SUMMARY REPORT
JULY, 1980
ANNUAL MEETING SFWMD/FPL
GROUND WATER MONITORING PROGRAM
TURKEY POINT, FLORIDA
FLORIDA POWER & LIGHT COMPANY

JOB NO. 04598-047-26
July 9, 1980

Dames & Moore

BOCA RATON, FLORIDA

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JULY 1980

ANNUAL MEETING SFWMD/FPL

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TURKEY POINT, FLORIDA

FLORIDA POWER & LIGHT COMPANY

1.0 INTRODUCTION

This handout, the first in the annual format discussed at our meeting in July 1979, presents the results of the Ground Water Monitoring and the Interceptor Ditch Programs required in compliance with the February 2, 1972 legal agreement between Florida Power & Light (FP&L), and the South Florida Water Management District (SFWMD). Specifically, this handout addresses the data collected between July 1979 and June 1980 in relative perspective with historical data which are available from April 1972.

This first annual handout was preceded by a series of seven semi-annual handouts, issued alternately in January and July, beginning in July 1976. The semi-annual handout series was preceded by 17 status handouts which were issued quarterly. (January, April, July and October).

In addition to the quarterly and more recent semi-annual handouts a summary report was submitted in March 1976 dealing with the G-Series wells used in the monitoring program. This summary report dealt with the initial four years of monitoring data.

The Ground Water Monitoring Program consists of periodic monitoring of ground water level, temperature and conductivity in 19 wells. The locations of these wells is shown on Figures 1 and 2. A description of the monitoring program, technique, logistics, and equipment is contained in Appendix E.

2.0 DATA REVIEW

RAINFALL

The rainfall pattern for the past 12 months shows a marked departure from the typical patterns displayed in the past. The departure is illustrated by the absence of a well defined wet/dry season and relative deficiencies in rainfall (see Figure 3). Total precipitation at Structures S-20 and S-20F were 31.55 and 26.39 inches, respectively.

Peak rainfall for the wet season occurred in September 1979 which marked a return to the conventional wet season peak as opposed to the late heavy rains that extended into October during the same monitoring period in 1978. Typically, October has represented the start of the dry season. However, it should be noted that an increase over previous seasonal levels of rainfall occurred during the months of November 1979 through March 1980 at Structures 20 and 20F with totals of 10.79 inches and 7.59 inches respectively. December displayed the peak of this five-month period with 3.65 inches recorded at Structure 20.

The months of February and March 1980 prove to be seasonally in line with historical data and marked the end of the conventional dry season period. Relatively low levels of rainfall were recorded during the months of April and May. The peak level recorded during these months (3.76 inches at Structure 20 in April) is comparable to the previous rainfall recorded at this station during the dry season month of

December 1979. These variances from the seasonal pattern have become common in recent monitoring periods and are taken into consideration when evaluating the cooling canal system.

SURFACE WATER LEVELS

Water levels in the Levee 31 Borrow Canal and Canal 32 along pumping Line C were impacted by variations in the circulating pump operation during the past 12-month monitoring period and displayed minimal seasonal fluctuation (Figure 4). This seasonal pattern can be directly attributed to the absence of a distinct wet/dry season. Whereas in the past the difference in the wet and dry season water levels has been observed to have a range of two feet, the maximum range recorded during this monitoring period was 1.1 feet in the Levee 31 Borrow Canal. The highest water levels occurred during the peak wet season months of September and October, which also coincides with the increased magnitude of the tidal cycle as effected by the occurrence of the fall equinox.

The observed water levels began a slow downward trend in November but due to sustained sporadic rainfall throughout the dry season relatively constant levels were maintained into the end of the dry season. During the period between July 1979 and March 1980 the canals maintained an average head difference of 0.49 feet. The lowest levels recorded occurred during the months of April and May, during which time the level of the Levee 31 Borrow Canal fell below that of Canal 32.

These low levels coincide with the heaviest pumping of the interceptor ditch for this monitoring period.

The beginning of the wet season in April is directly reflected by an increase of 0.5 feet in the Levee 31 Borrow Canal. The canals maintained an average head difference of 0.29 feet and displayed a normal seasonal fluctual pattern in response to rainfall for the remainder of the monitoring period.

GROUND WATER LEVELS

Ground water levels over the past 12-month period have exhibited fluctuating trends which follow historical patterns and directly reflect the effects of the extended wet and shortened dry seasonal periods (see Time History Data, Appendix A). Most wells throughout the system exhibited maximum water levels during the October/November period in response to the peak wet season rains that occurred in September of 1979. The high range for the season is represented by the levels in October in wells L-1 and G-35 displaying ground-water elevations of 2.34 and 1.30 feet MSL respectively. It should also be noted that the peak wet season ground water levels for this monitoring period are slightly higher than have been recorded in recent years.

Typical low water levels ranged from 0.15 Ft. MSL in April 1980 at well L-2, near Levee 31E, to 0.02 Ft. MSL in April at well G-28 along Tallahassee Road. These low levels represent declines of approximately 2.05 feet and 0.80 feet, respectively, from the October high water levels.

At this site the normal range of water levels from wet season to dry season is about two feet. The normal value has been exceeded along Tallahassee Road. The range measured this season in the L-wells is typically 1.61 feet.

GROUND WATER TEMPERATURES

The range of ground water temperatures for the past 12 months is represented on Figures 5 through 12. These figures show the extremes of temperatures for the period July 1979 through June 1980 as compared to the historical envelope of temperatures for indicator wells L-2, L-3, L-5, G-6, G-14, G-27, G-28 and G-35.

In general, temperatures in the L-Series were normal and within the historical range of temperatures. The L-Series wells displayed higher than normal temperatures at depths generally above -20 Ft. MSL. For instance, well L-2 ground water temperatures were as much as 1.4 C above all previous temperatures at depths less than -22 Ft. MSL. These excursions occurred during the period of March and April. Ground water temperatures at the shallower depths reflect the temperatures in the Levee 31E Borrow Canal.

Ground water temperatures in the G-Series indicator wells were generally within the historical range of temperatures. Well G-6 experienced an excursion of approximately 0.2 C in November above the previous range. Also well G-35 showed a slight increase in temperature in approximately the upper 30

feet. Other G-Series indicator wells showed no significant excursions from the historical envelopes.

The temperature time-history data (Appendix A) reveals increases in temperature in most ID-, L- and X-Series wells. However, the temperature increases were followed by declines in April, May and June. These declines brought temperatures back to levels similiar to those observed at the onset of the monitoring period. Ground water temperatures in the G-Series wells showed no significant increases over the past 12 months.

Ground water temperatures were generally highest in the months of March, April and May. The lowest temperatures generally occurred during October and November. These trends probably reflect climatic conditions when cooler precipitation recharges the aquifer and ground water temperatures decline during the wet season.

GROUND WATER CHLORINITIES

The range of ground water chlorinities for the past 12 months is represented on Figures 13 through 20. These figures show the chlorinity extremes for the period of July 1979 through June 1980 as compared to the historical envelope of chlorinities for indicator wells L-2, L-3, L-5, G-6, G-14, G-27, G-28 and G-35.

Chlorinities in wells L-2, L-3 and L-5 showed increases above the historical range during early 1980. Well L-2 showed approximately a 3.3 ppt increase in chlorinity in January at depth over the historical high. Smaller excursions were

displayed at depth by both wells L-3 and L-5. These wells showed a maximum increase of approximately 0.8 ppt chlorinity over the previous extreme of the historical envelope curve. Both extremes occurred in July 1979.

In the G-Series wells west of the cooling canal system, only well G-27 experienced historical high chlorinities below -24 Ft. MSL. Chlorinities increased to approximately 15.3 ppt below -28 Ft. MSL during January 1980 in well G-27.

Wells G-28 and G-35 showed historical low chlorinities in January 1980 and June 1979, respectively. At the base of well G-28 chlorinities dropped to approximately 5.8 ppt, approximately 1.5 ppt below the previous historical low. Well G-35 chlorinities dropped over 3.7 ppt below the previous historical low chlorinity at the base of the well.

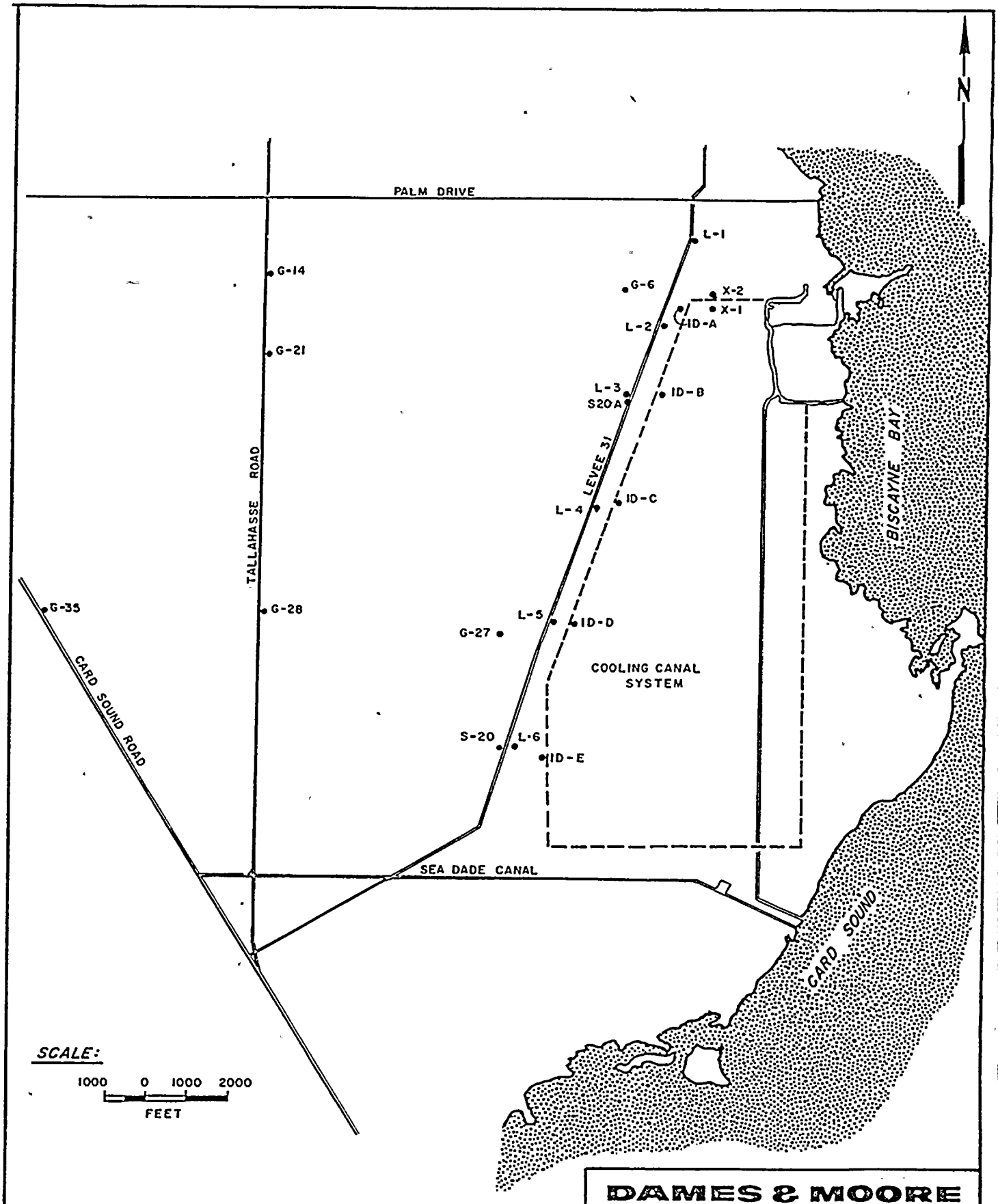
The chlorinity time-history data (Appendix A) generally shows increases in chlorinity in ID-, L- and X-Series wells. The chlorinities increase through April or May, then generally drop sharply to below July 1979 levels. The chlorinities in the G-Series wells remained relatively constant. Well G-28 experienced a decline in chlorinity of approximately 1.0 ppt. Chlorinities in the ID- and L-Series wells peaked during early 1980 while the G-Series wells reached the lowest chlorinity levels for the monitoring period during the same time period.

3.0 SUMMARY

During the past 12 months, the typical wet/dry season climatic pattern usually observed in South Florida has not been as pronounced at Turkey Point. A drier than normal wet season was followed by a slightly wetter than normal dry season. Total precipitation for the period appears to be below normal.

Temperatures and chlorinities in the G-Series wells west of the cooling canal system were generally within the historical ranges. No short or long-term trends were observed which indicates that the cooling canal system is not having a significant effect on ground water to the west.

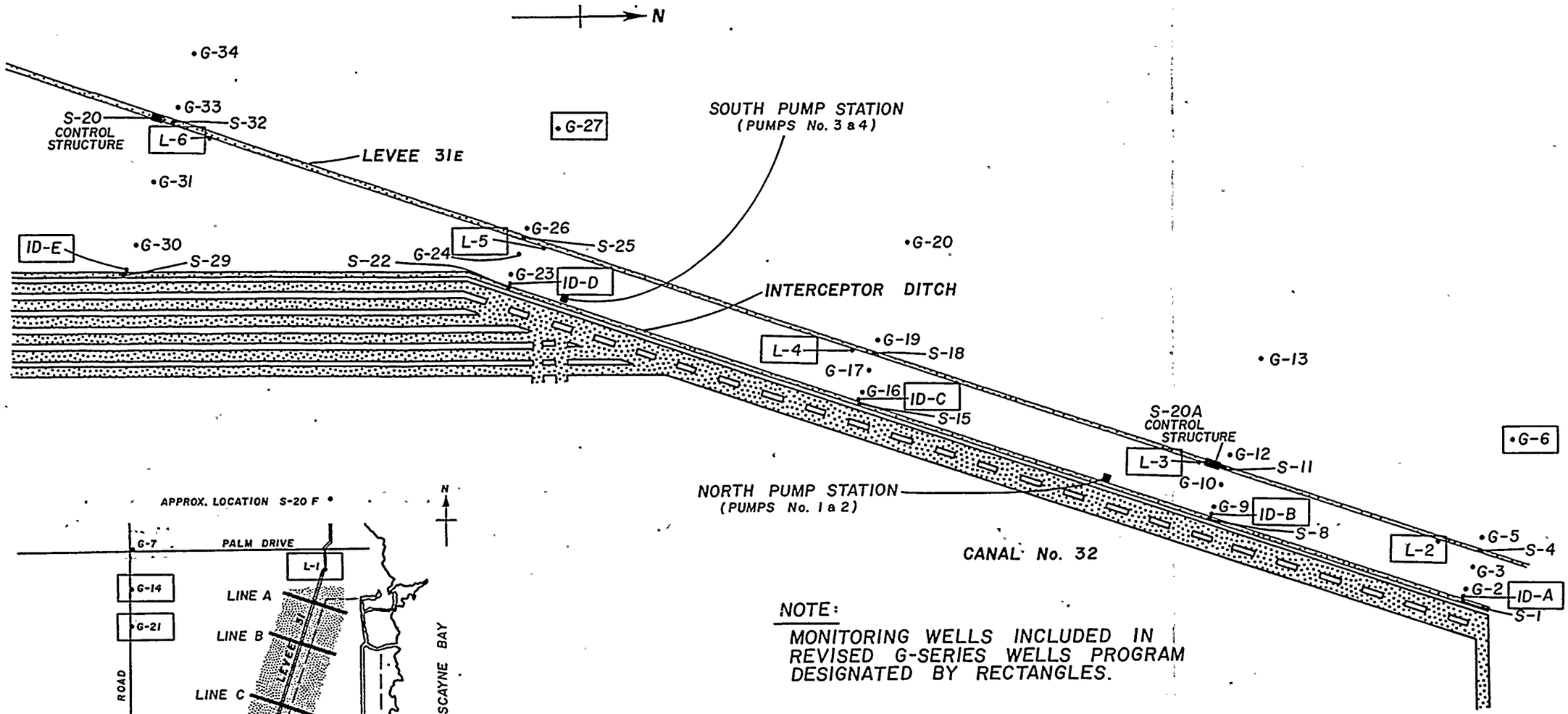
In the L-, ID- and X-Series wells, temperatures and chlorinities appear to have increased in the past few years. It is felt that these increases are due to abnormal precipitation patterns necessitating changes in Interceptor Ditch pumping schedules through the past three years. Previously, Interceptor Ditch pumping was necessary only during the dry season. However, in the past three years, precipitation has been low during the wet season. As a result the Interceptor Ditch has been pumped during portions of those wet season periods in addition to portions of the dry season. The onset of the 1980 wet season has generally shown decreases in temperature and chlorinity in the ID-, L- and X-Series wells to 1979 wet season levels.

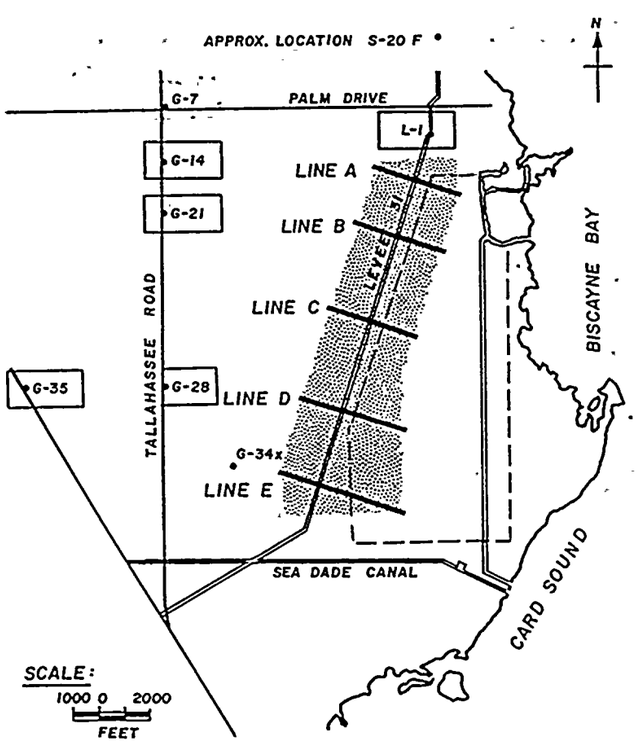


DAMES & MOORE

WELL LOCATIONS
CURRENT MONITORING PROGRAM

0459804726(7/80) FIGURE 1





NOTE:

MONITORING WELLS INCLUDED IN REVISED G-SERIES WELLS PROGRAM DESIGNATED BY RECTANGLES.

SCALE

2000' 0 1000'

FEET

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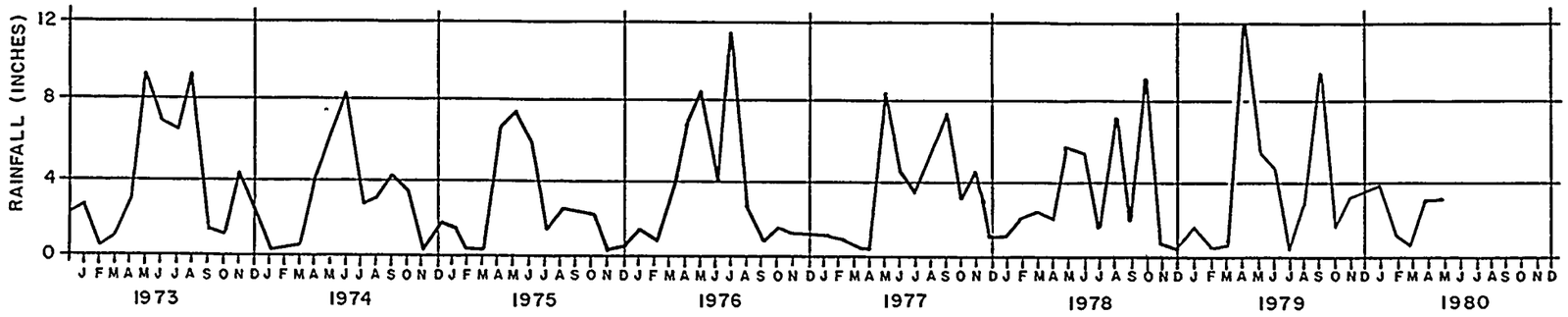
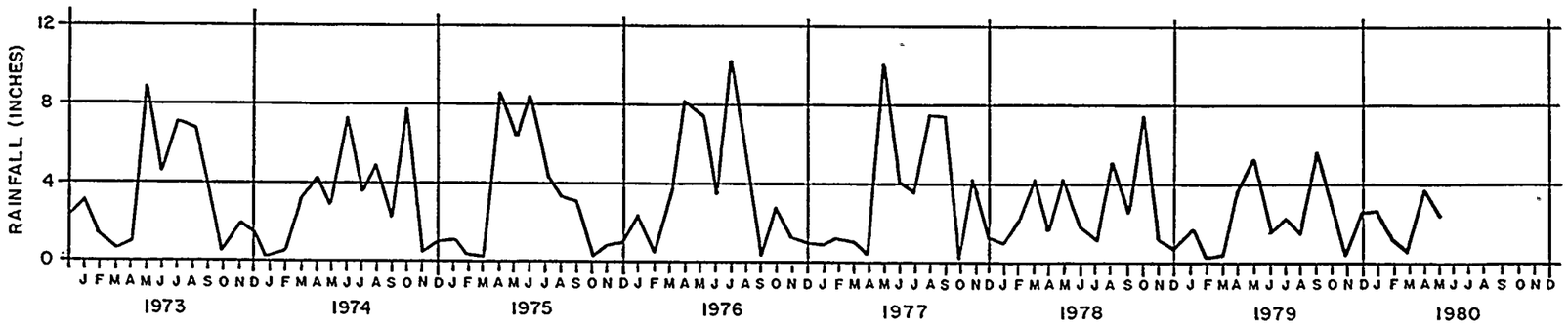
PLOT PLAN

0459804726(1/79) FIGURE 2



STRUCTURE 20



STRUCTURE 20F

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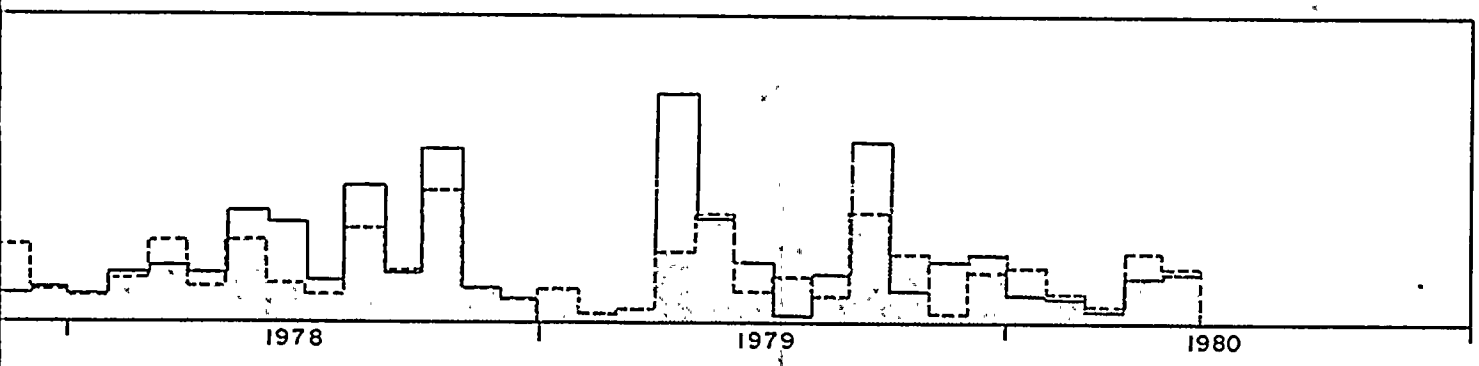
YEARLY RAINFALL
TURKEY POINT, FLORIDA

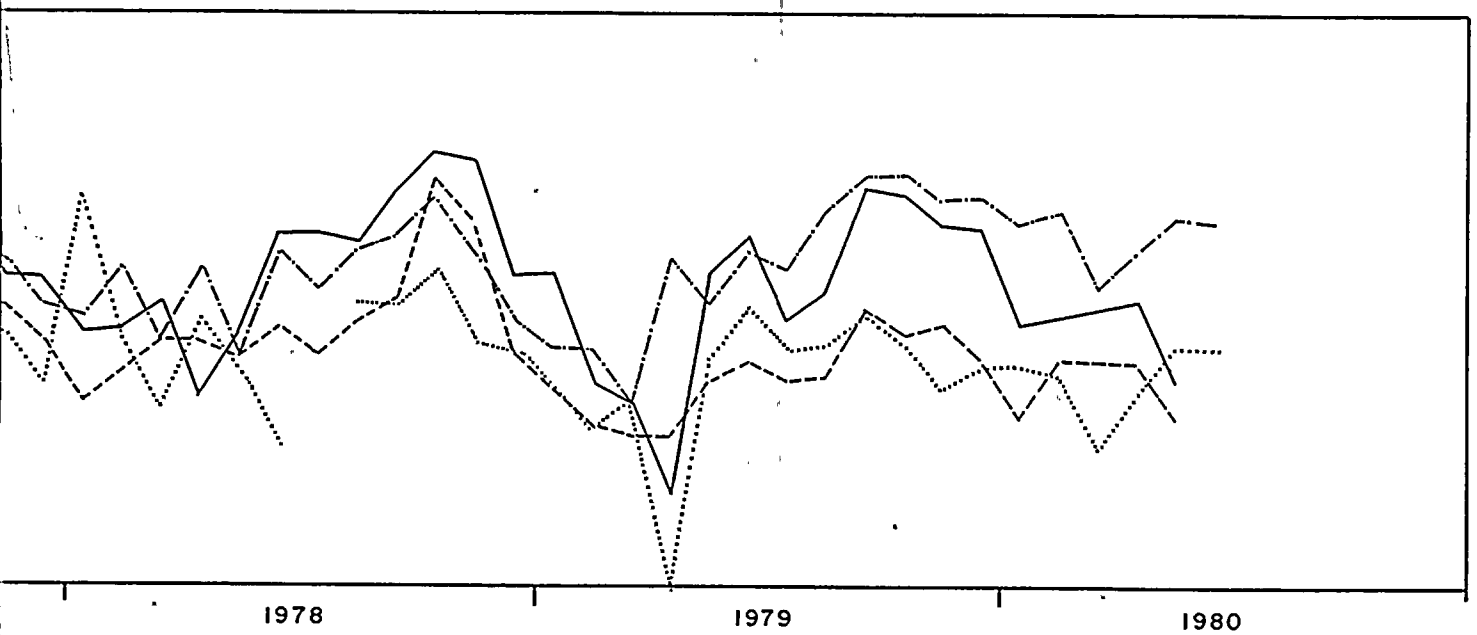
0459804726(7/79) FIGURE 3



STRUCTURE 20 AND
STRUCTURE 20 F

20

20F



SURFACE WATER LEVELS

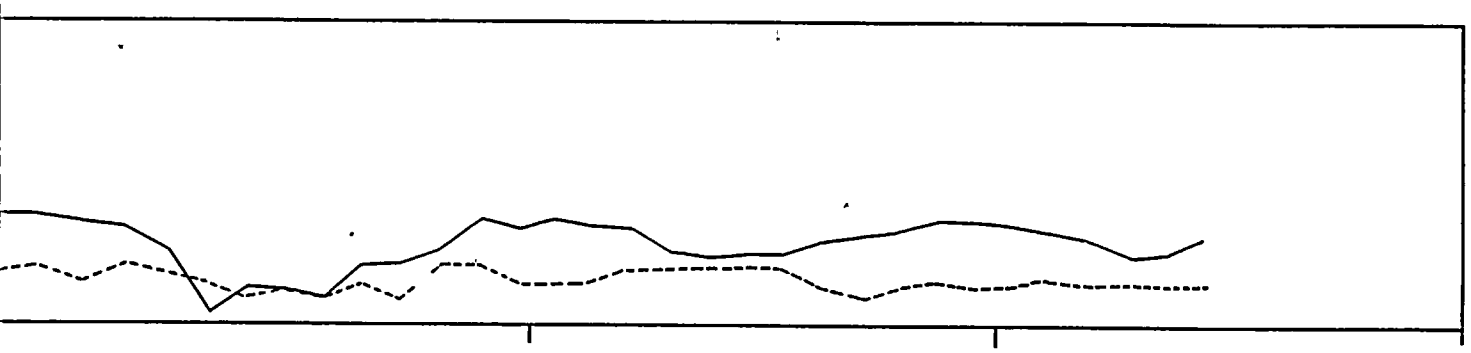
L-31

C-32

GROUND WATER LEVELS

G-28

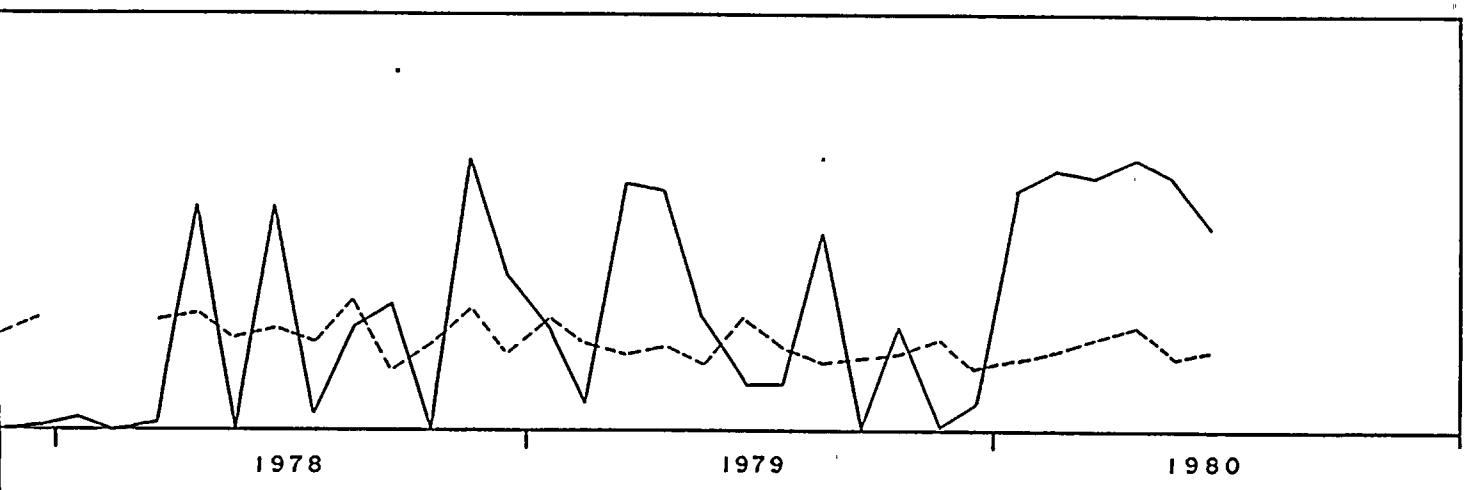
L-3



TEMPERATURE

L-3 (AT -17.5 FT)

G-28 (AT -50.0 FT)



CHLORINITY VALUES

L-3 (AT -17.5 FT.)

G-28 (AT -50.0 FT.)

TIME HISTORY:

RAINFALL, WATER LEVELS AND
GROUND-WATER TEMPERATURE
AND CHLORINITY

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FIGURE 4

0459804726(11/79)

GROUND WATER LEVELS IN FEET (MSL)

-1 0 1 2 3

CHLORINITY (ppt)

0 5 10 15 20

TEMPERATURE (C°)

22 26 30 32 36 40

SURFACE WATER LEVELS IN FEET (MSL)

0 1 2 3

MONTHLY RAINFALL IN INCHES

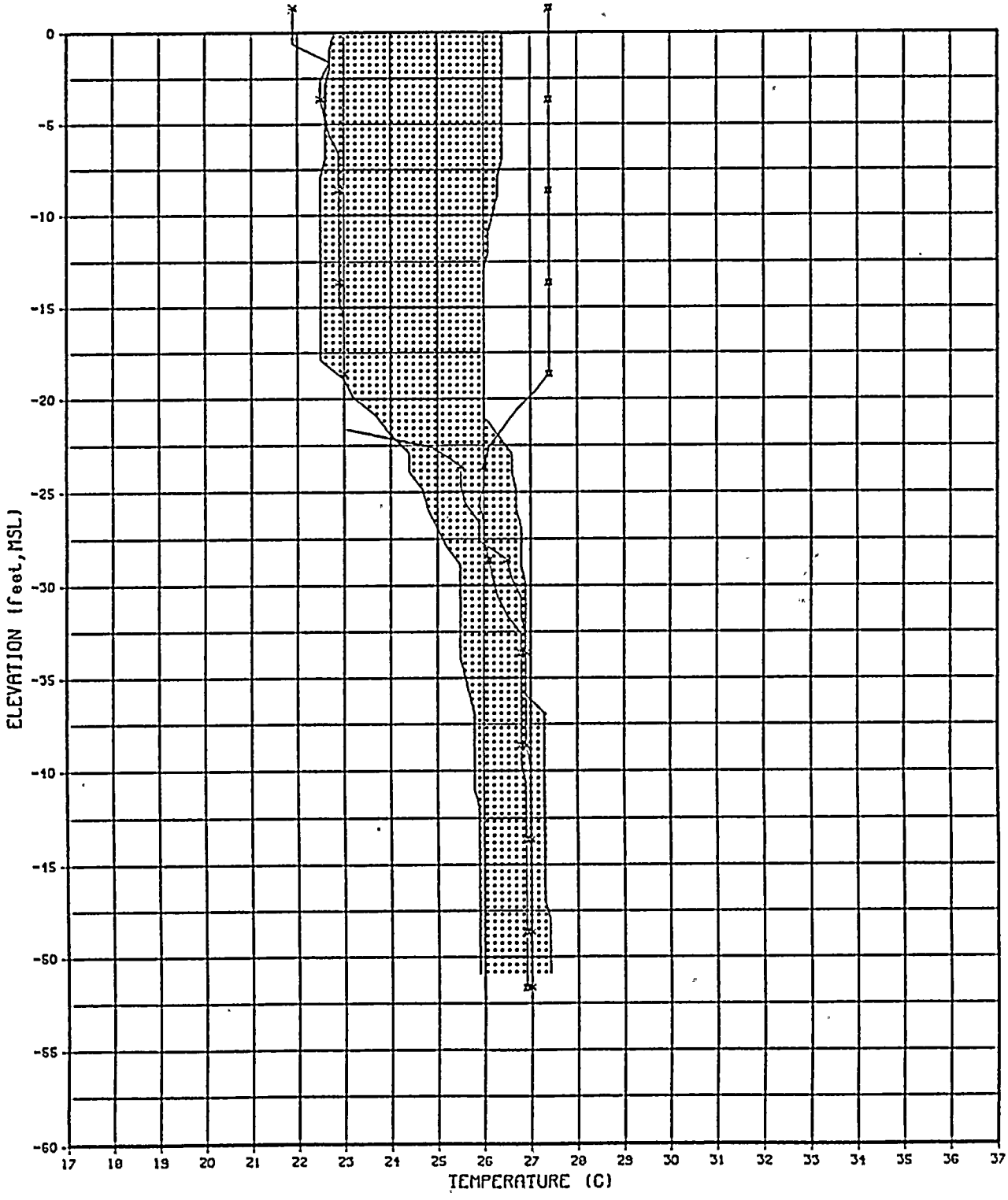
0 4 8 12 16

1974

1975

1976

1977



LEGEND

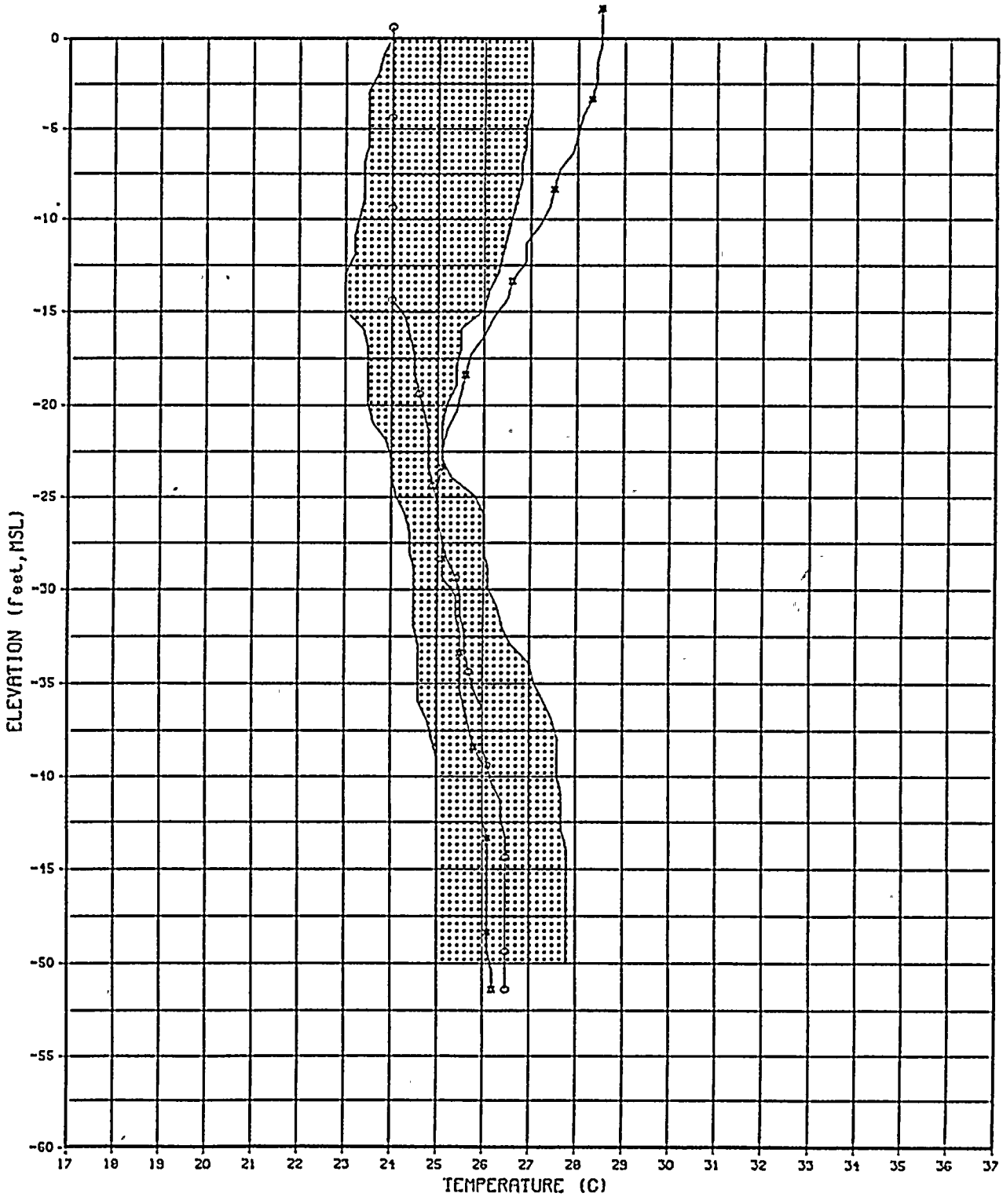
× MAR-80

¤ OCT-79

DAMES AND MOORE

EXTREMES OF TEMPERATURE
FOR JULY 79 - JUNE 80
WELL NUMBER L-2

0459804726 (7/80) FIGURE 5



LEGEND

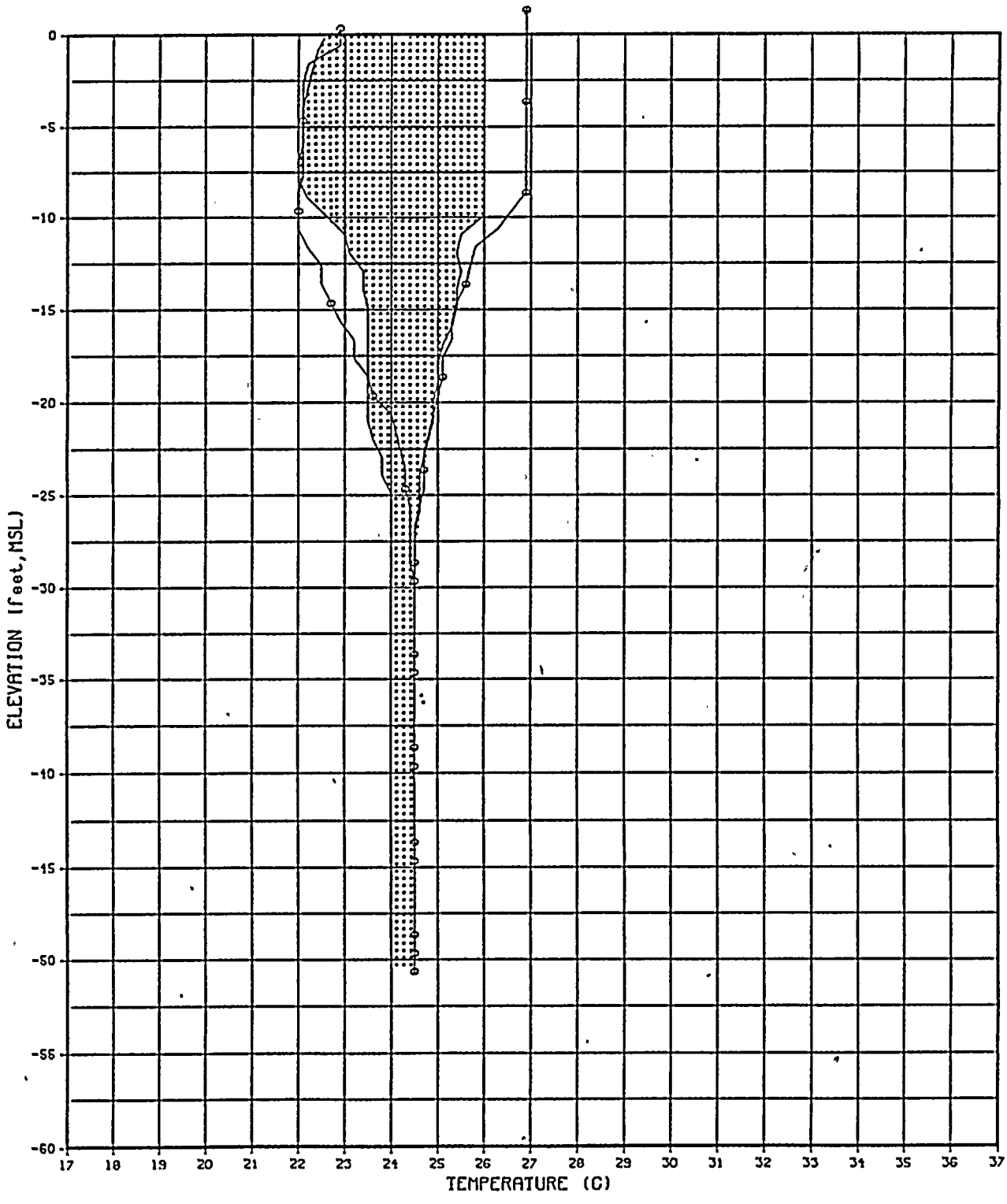
o APR-80

x OCT-79

DAMES AND MOORE

EXTREMES OF TEMPERATURE
FOR JULY 79 - JUNE 80
WELL NUMBER L-3

0459804726 (7/80) FIGURE 6



LEGEND

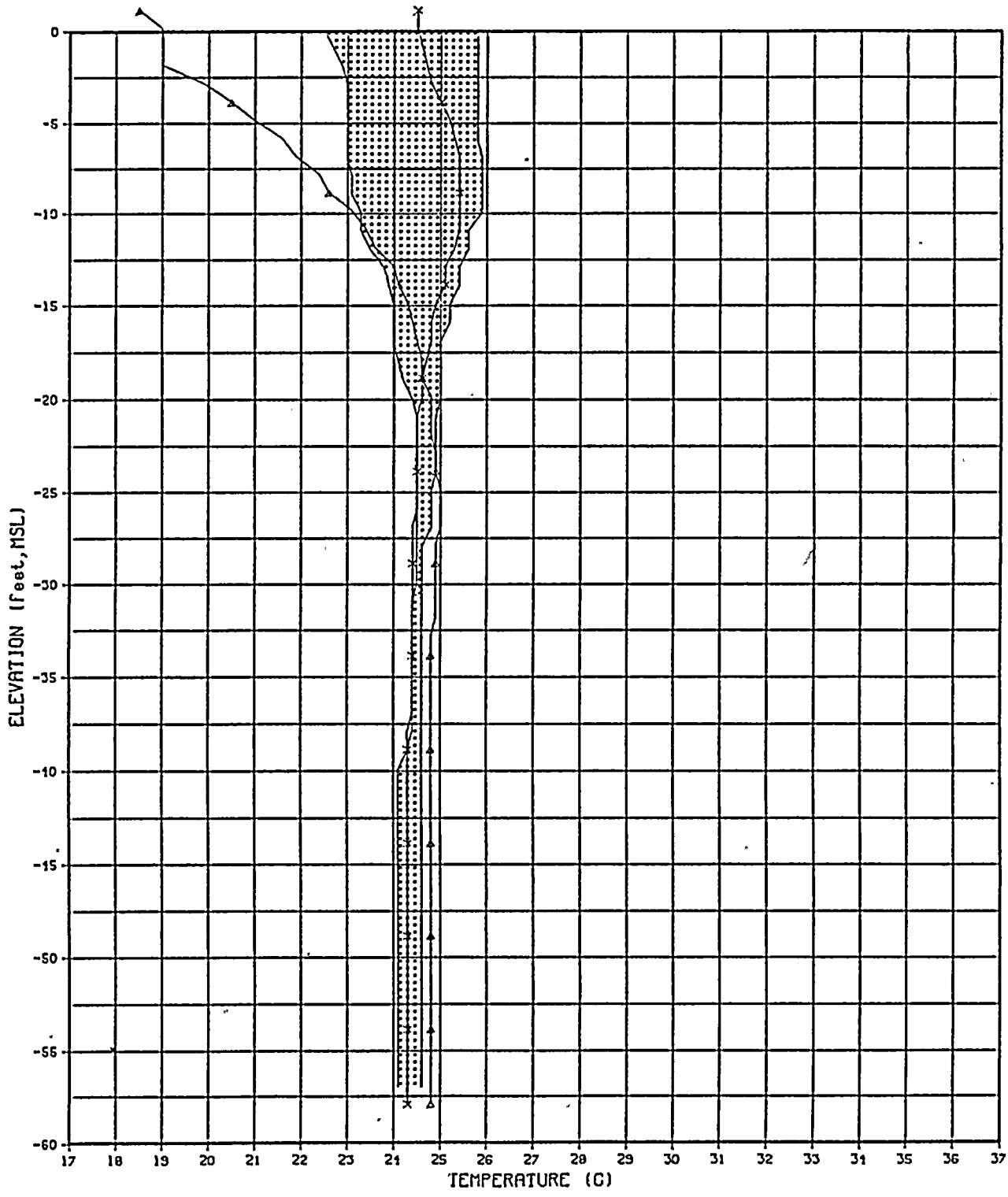
○ APR-80

● NOV-79

DAMES AND MOORE

EXTREMES OF TEMPERATURE
FOR JULY 79 - JUNE 80
WELL NUMBER L-5

0459804726 (7/80) FIGURE 7



LEGEND

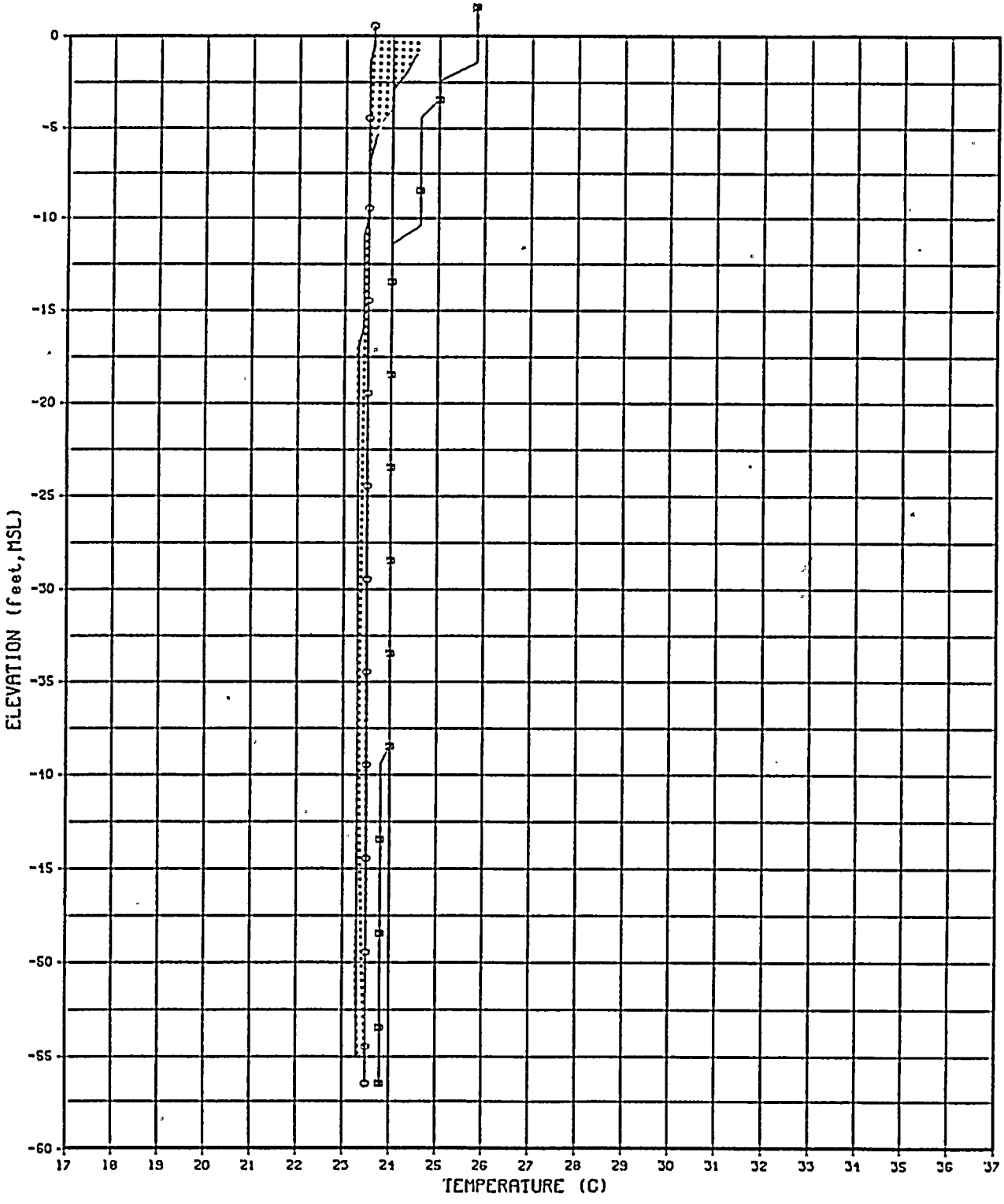
△ MAR-80

× NOV-79

DAMES AND MOORE

EXTREMES OF TEMPERATURE
FOR JULY 79 - JUNE 80
WELL NUMBER G-6

0459804726 (7/80) FIGURE 8



LEGEND

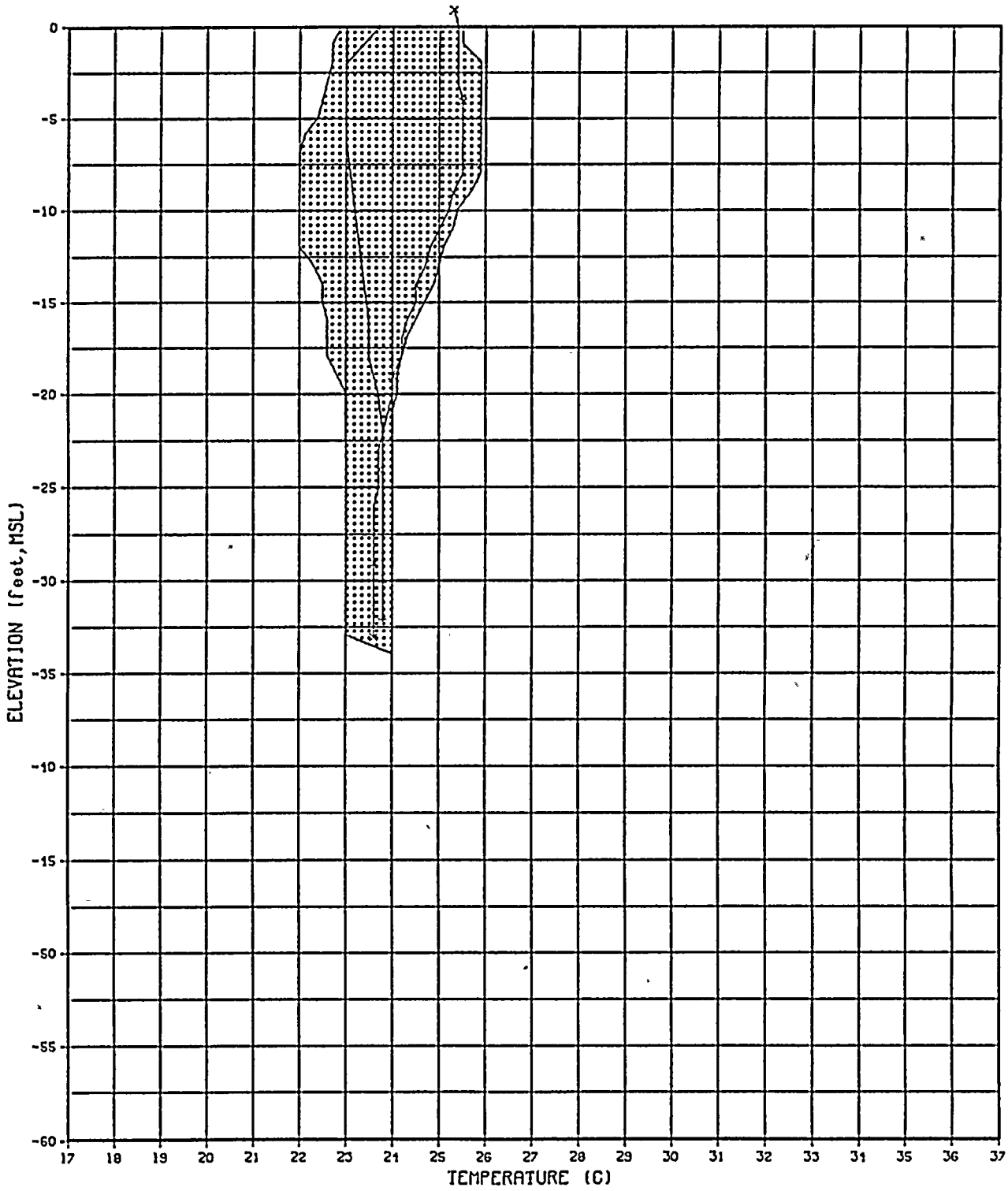
○ APR-80

▫ JUN-80

DAMES AND MOORE

EXTREMES OF TEMPERATURE
FOR JULY 79 - JUNE 80
WELL NUMBER G-14

0459804726 (7/80) FIGURE 9



LEGEND

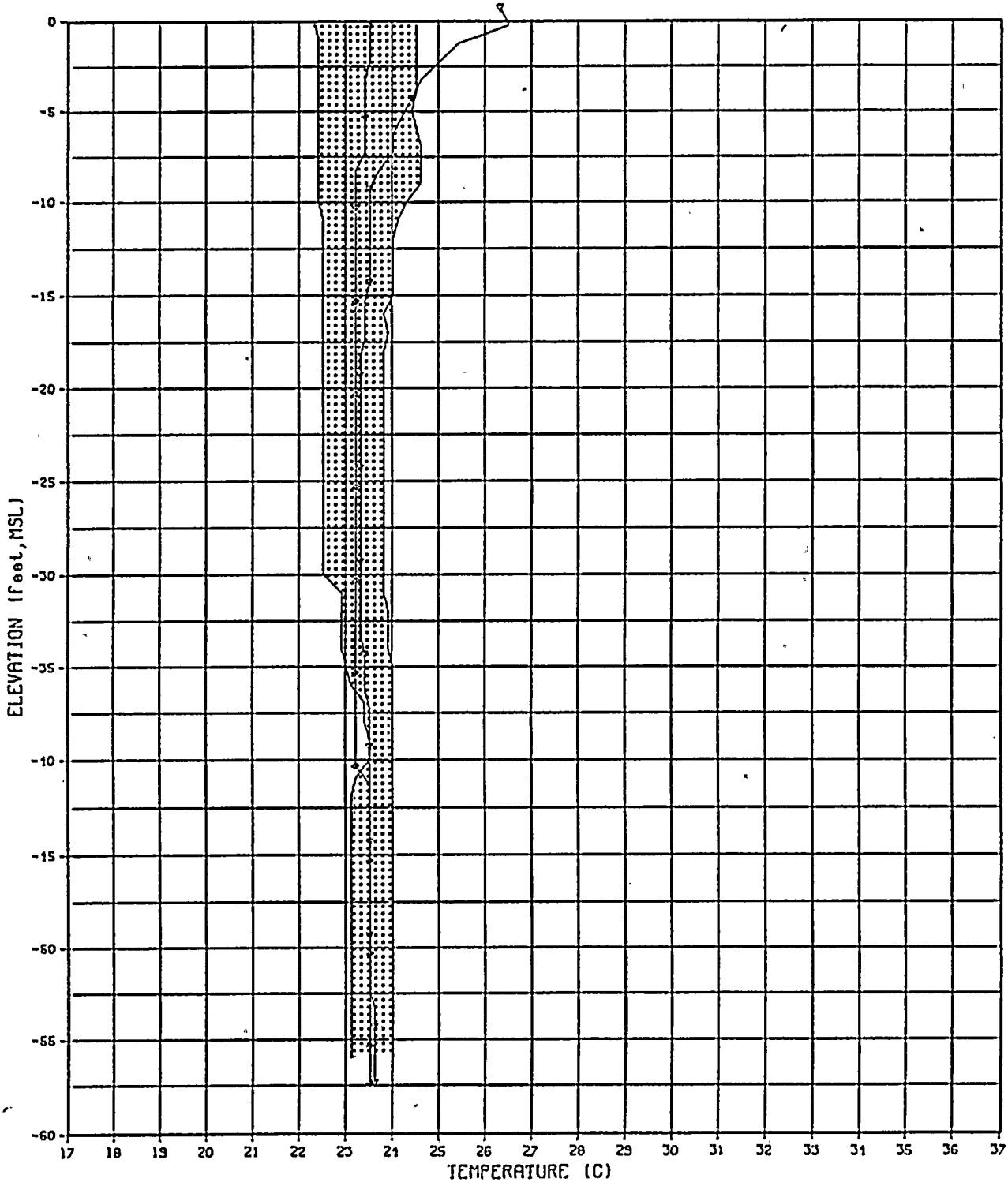
+ MAY-80

× NOV-79

DAMES AND MOORE

EXTREMES OF TEMPERATURE
FOR JULY 79 - JUNE 80
WELL NUMBER G-27

0459804726 (7/80) FIGURE 10



LEGEND

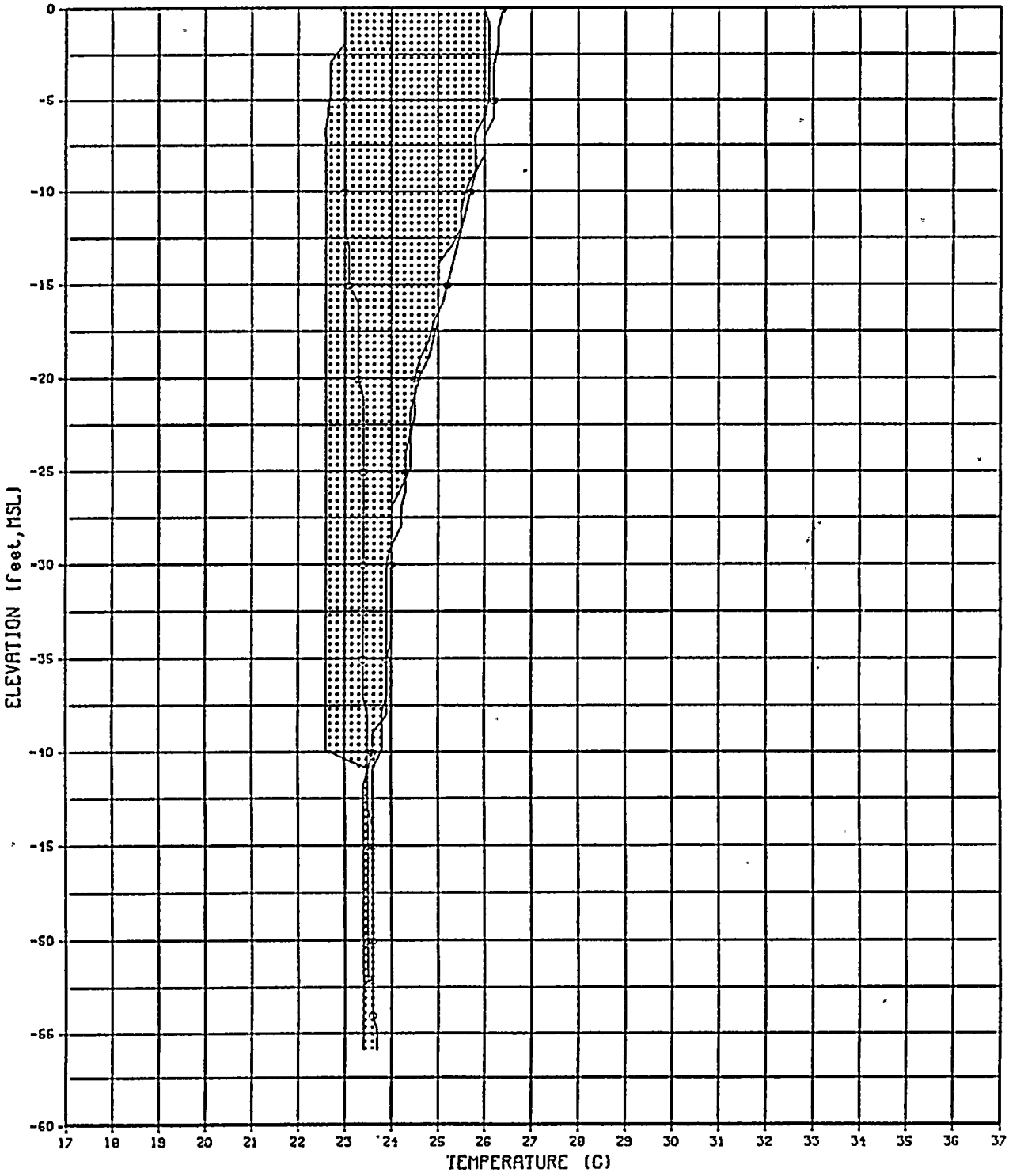
◆ MAY-80

▽ JUL-79

DAMES AND MOORE

EXTREMES OF TEMPERATURE
FOR JULY 79 - JUNE 80
WELL NUMBER G-28

0459804726 (7/80) FIGURE 11



LEGEND

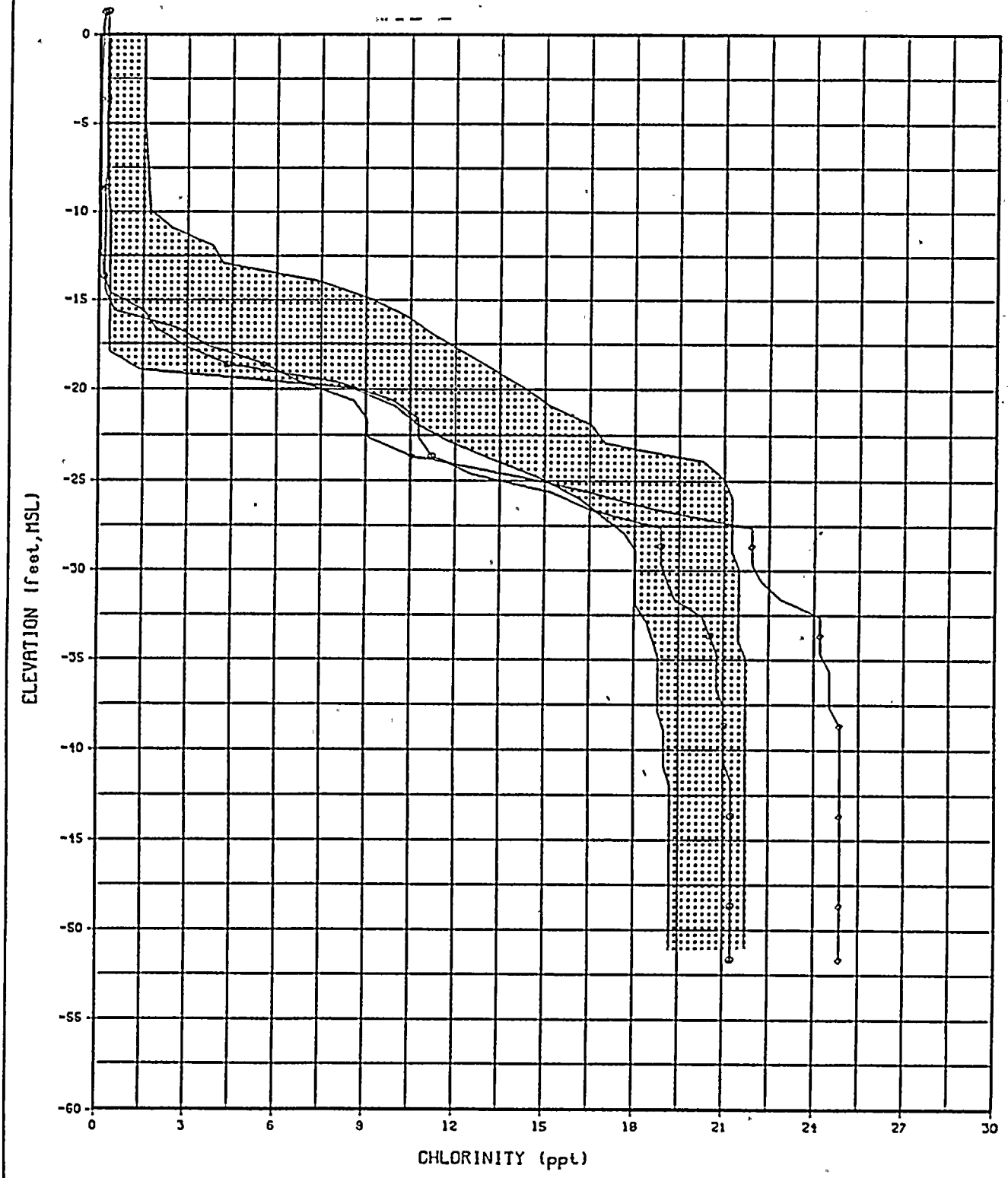
○ APR-80

○ NOV-79

DAMES AND MOORE

EXTREMES OF TEMPERATURE
FOR JULY 79 - JUNE 80
WELL NUMBER G-35

0459804726 (7/80) FIGURE 12



LEGEND

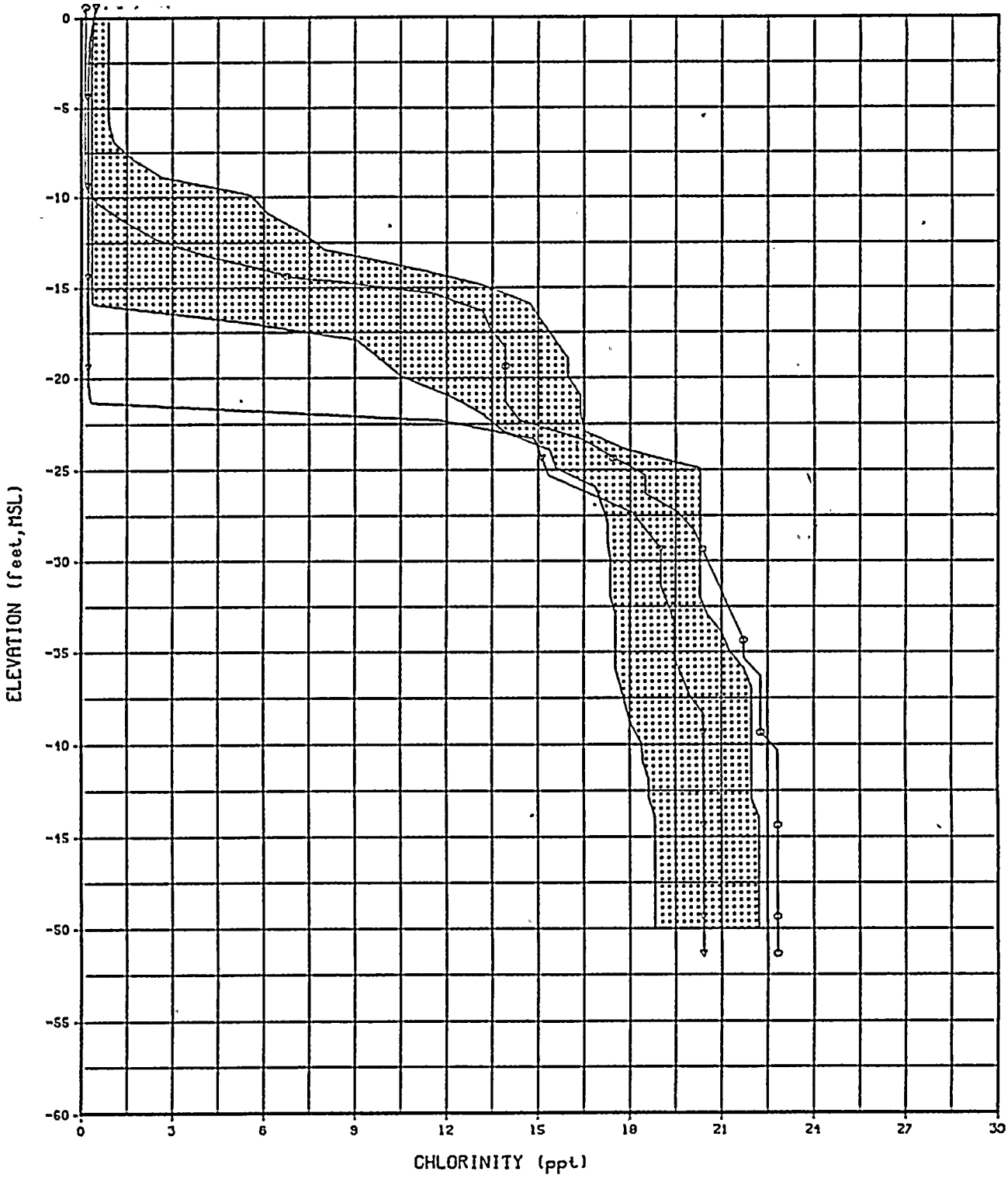
NOV-79

JAN-80

DAMES AND MOORE

EXTREMES OF CHLORINITY
FOR JULY 79 - JUNE 80
WELL NUMBER L-2

0459804726 (7/80) FIGURE 13



LEGEND

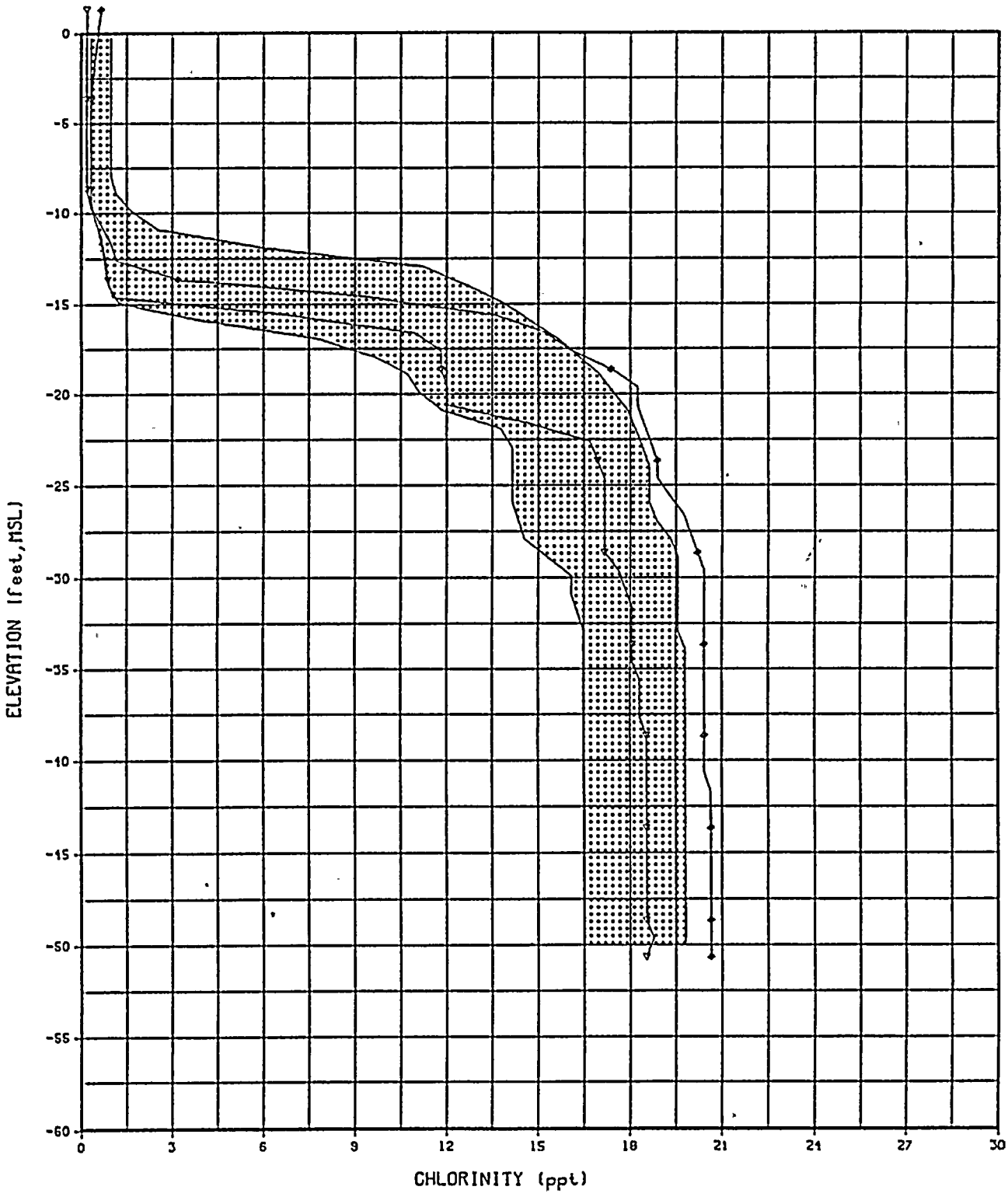
▽ JUL-79

○ APR-80

DAMES AND MOORE

EXTREMES OF CHLORINITY
FOR JULY 79 - JUNE 80
WELL NUMBER L-3

0459804726 (7/80) FIGURE 14



LEGEND

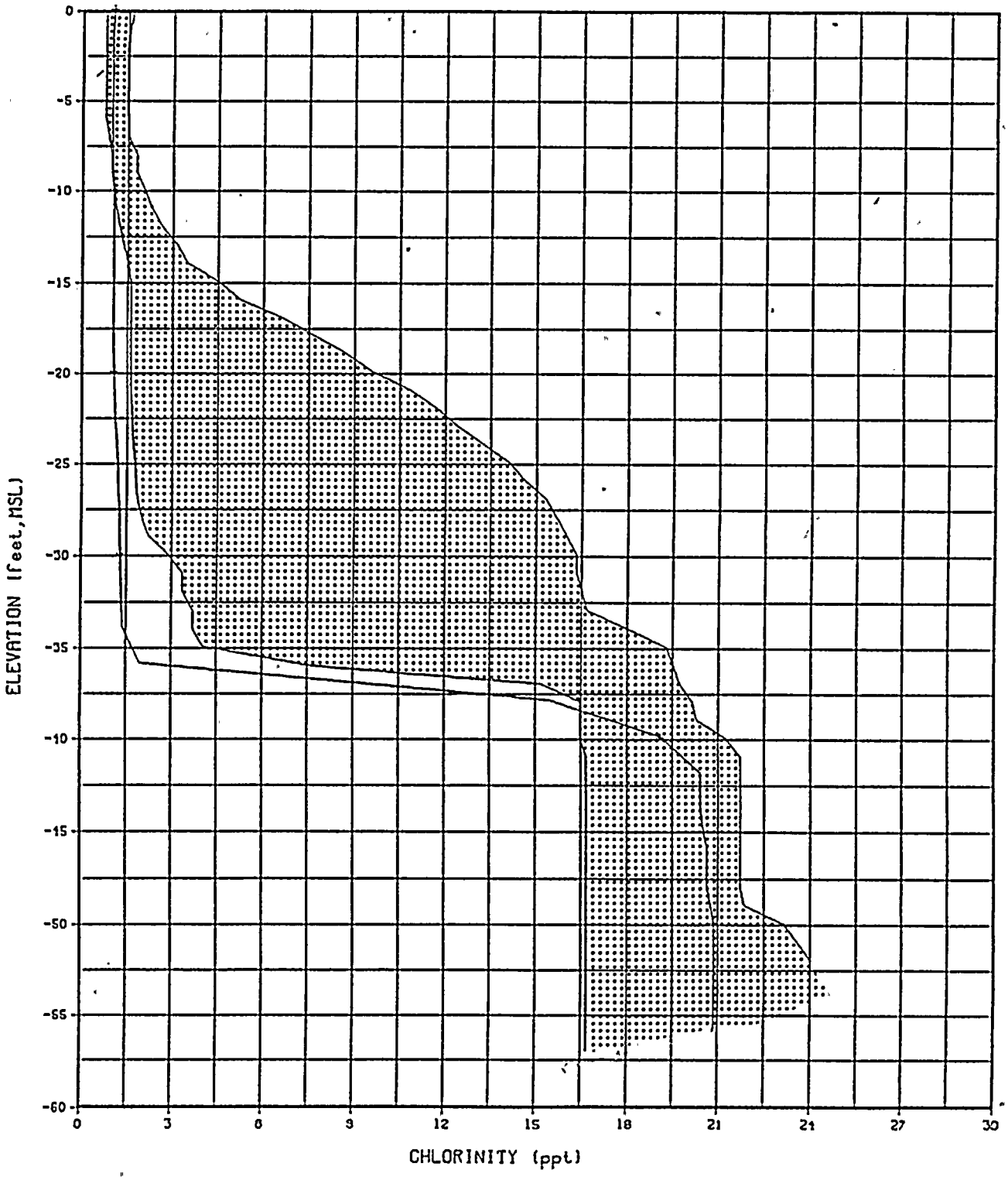
▽ JUL-79

• MAY-80

DAMES AND MOORE

EXTREMES OF CHLORINITY
FOR JULY 79 - JUNE 80
WELL NUMBER L-5

0459804726 (7/80) FIGURE 15



LEGEND

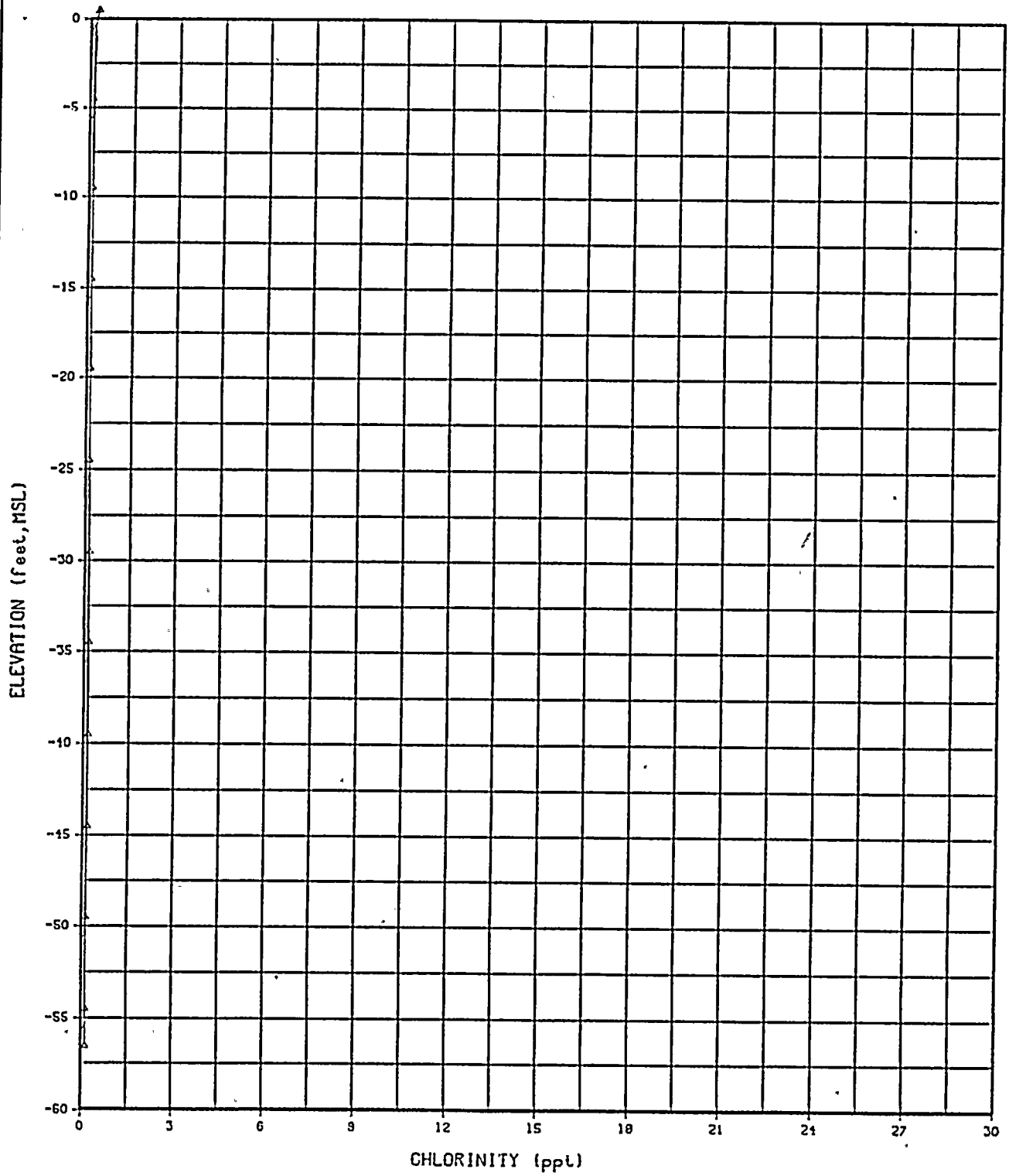
+ MAY-80

+ MAY-80

DAMES AND MOORE

EXTREMES OF CHLORINITY
FOR JULY 79 - JUNE 80
WELL NUMBER G-6

0459804726 (7/80) FIGURE 16



LEGEND

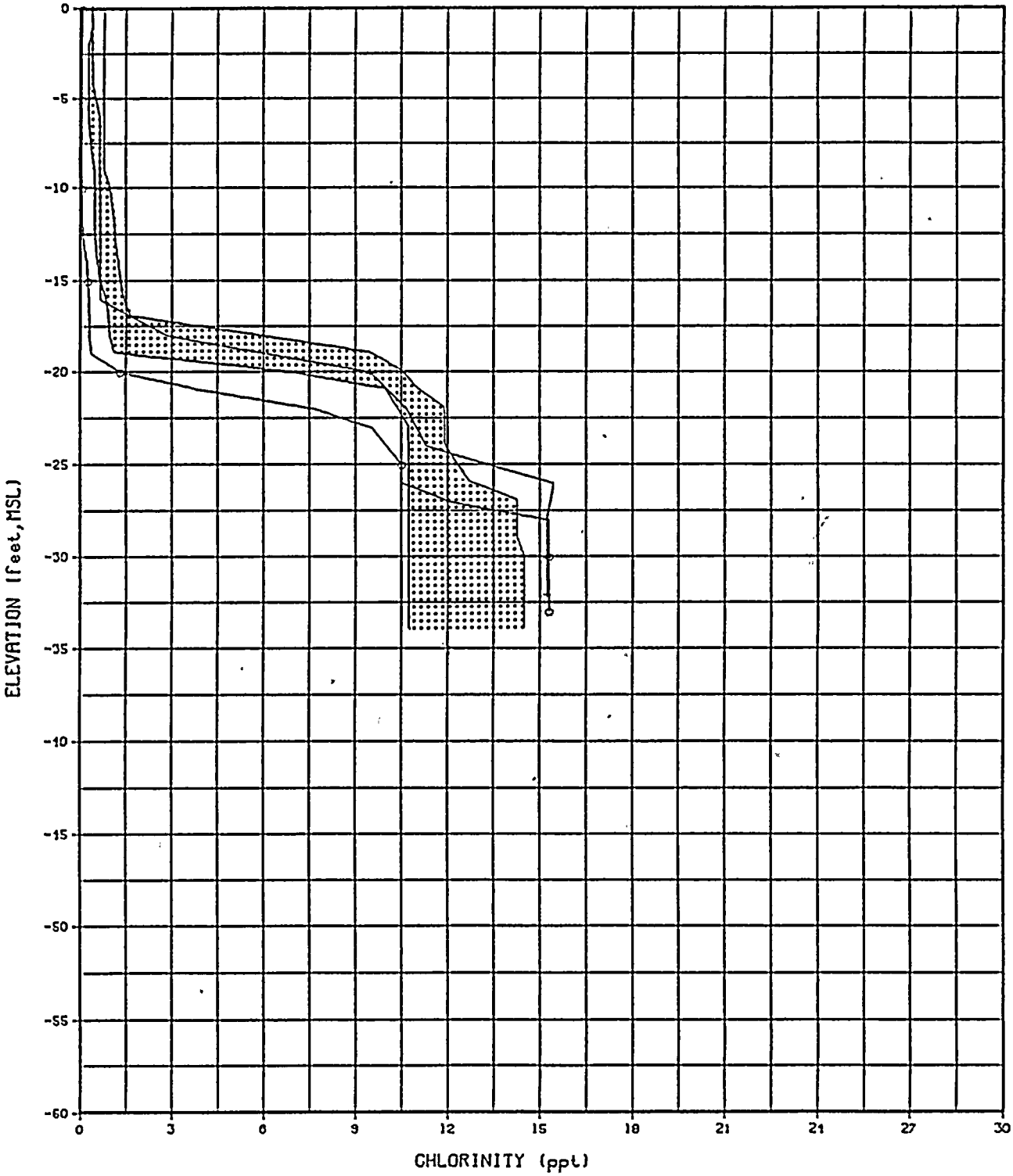
◇ JAN-80

△ AUG-79

DAMES AND MOORE

EXTREMES OF CHLORINITY
FOR JULY 79 - JUNE 80
WELL NUMBER G-14

0459801726 (7/80) FIGURE 17



LEGEND

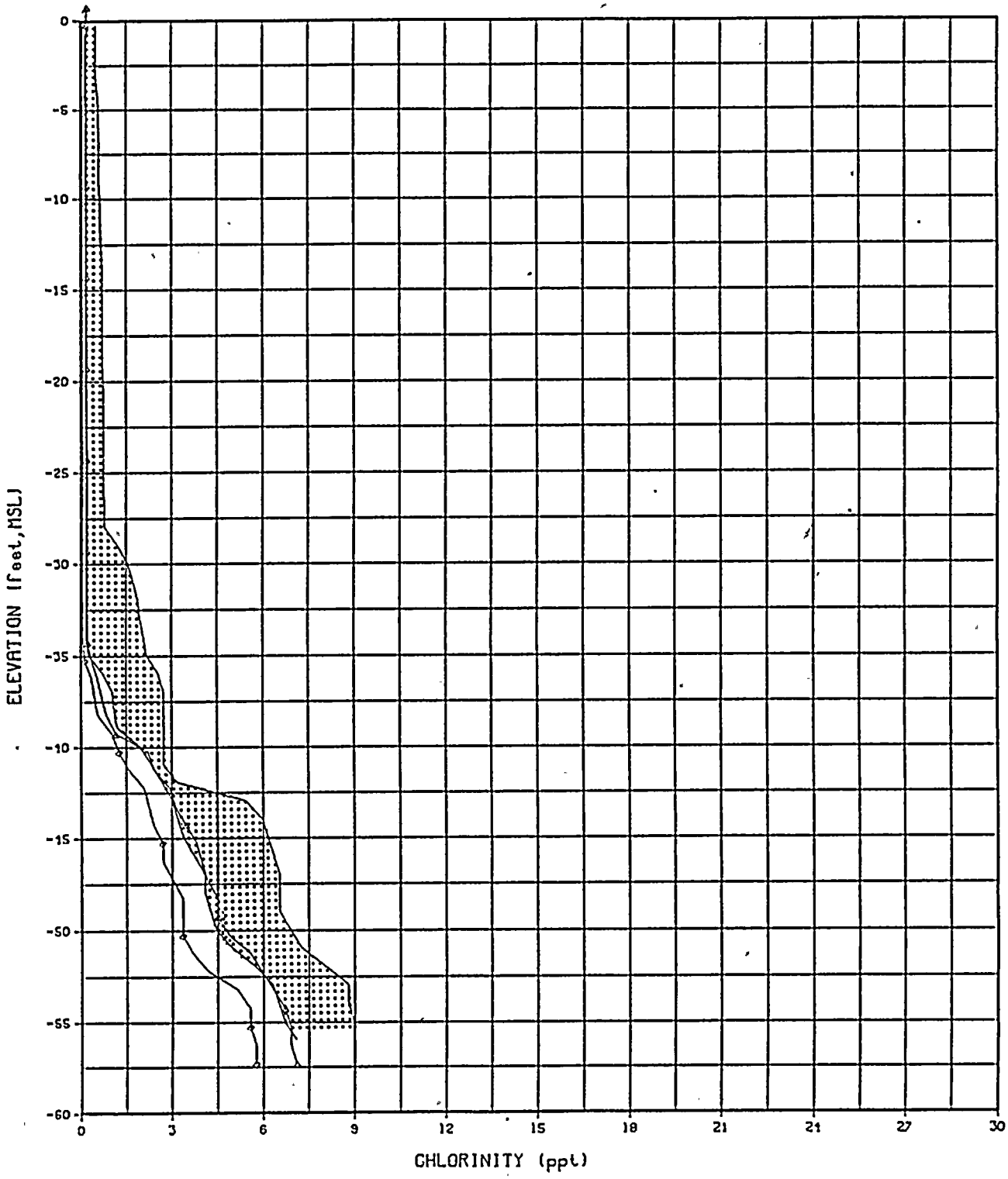
° JAN-80

+ MAY-80

DAMES AND MOORE

EXTREMES OF CHLORINITY
FOR JULY 79 - JUNE 80
WELL NUMBER G-27

0459804726 (7/80) FIGURE 18



LEGEND

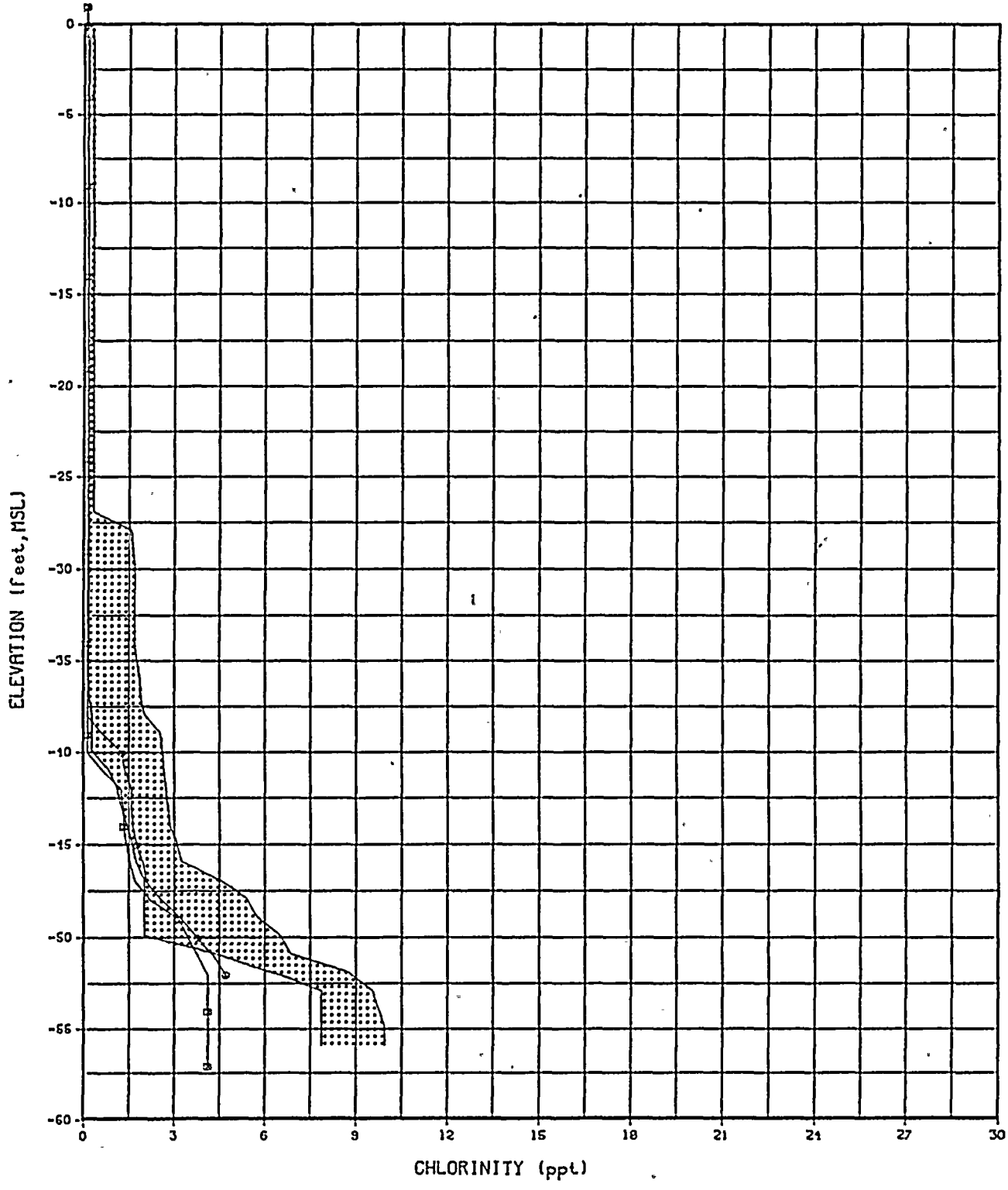
◦ JAN-80

△ AUG-79

DAMES AND MOORE

EXTREMES OF CHLORINITY
FOR JULY 79 - JUNE 80
WELL NUMBER G-28

0459804726 (7/80) FIGURE 19



LEGEND

▪ JUN-80

◦ NOV-79

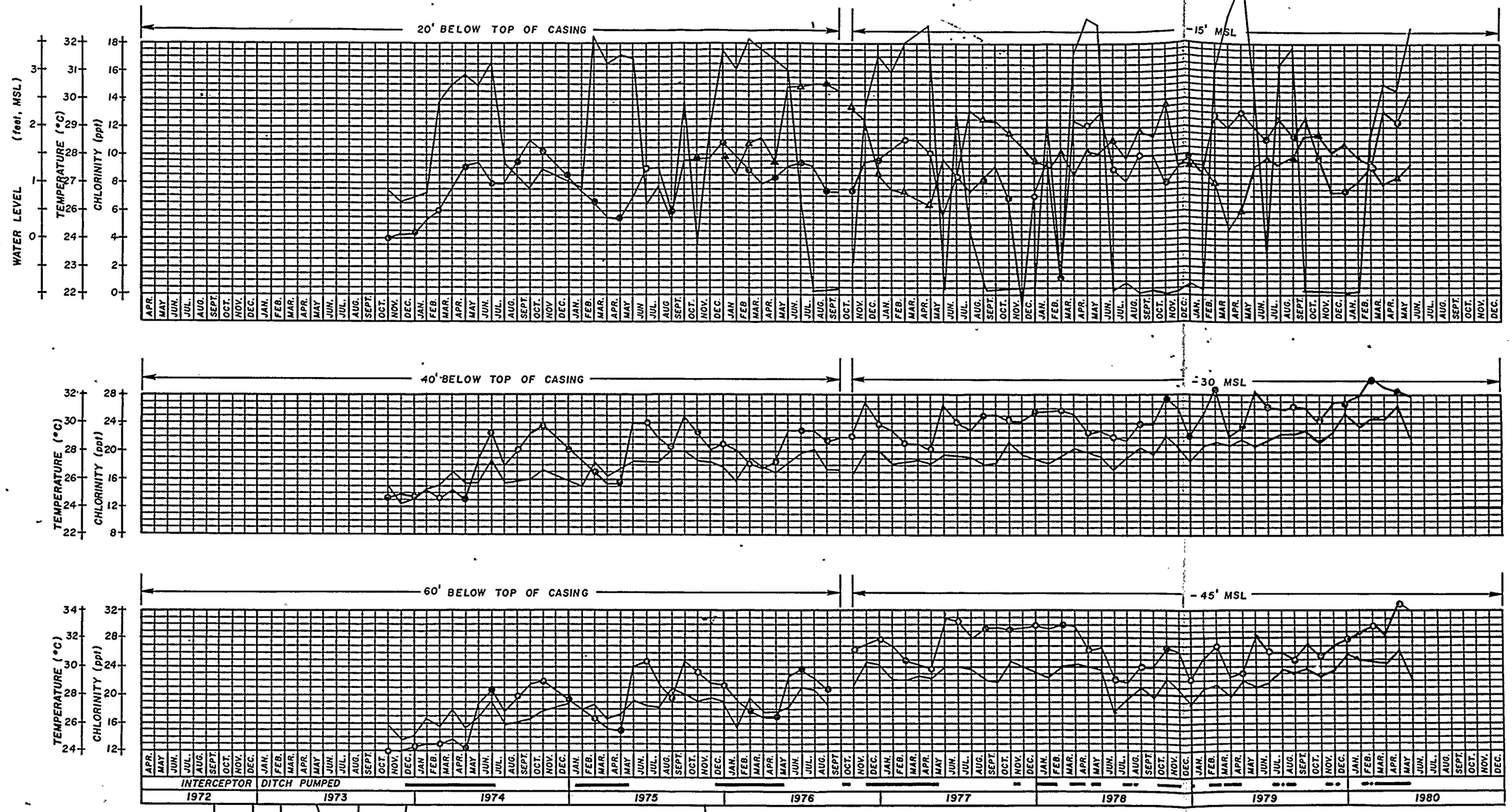
DAMES AND MOORE

EXTREMES OF CHLORINITY
FOR JULY 79 - JUNE 80
WELL NUMBER G-35

0459804726 (7/80) FIGURE 20

APPENDIX A

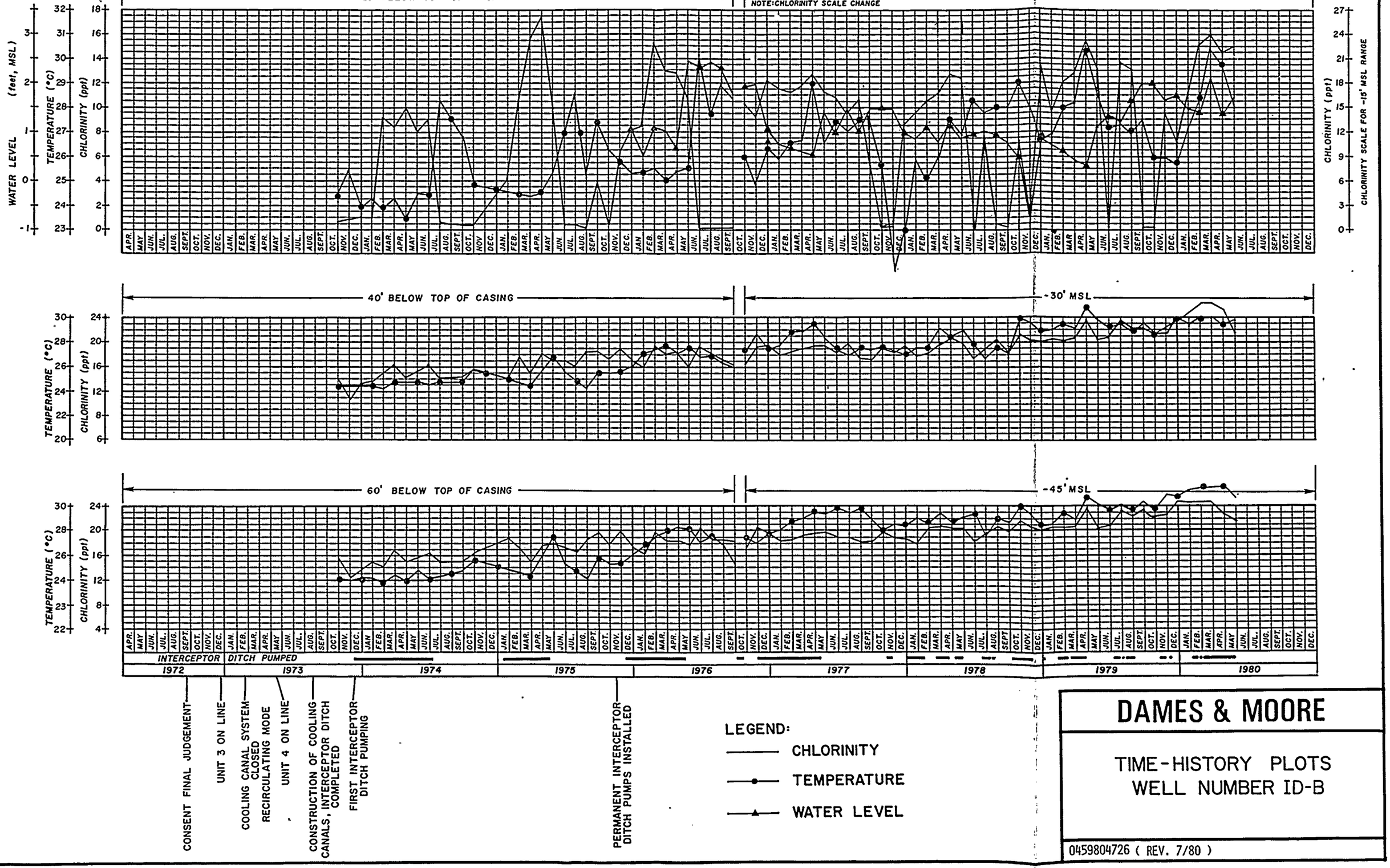
TIME-HISTORY DATA



DAMES & MOORE

TIME-HISTORY PLOTS
WELL NUMBER ID-A

0459804726 (REV. 7/80)



DAMES & MOORE

TIME-HISTORY PLOTS
WELL NUMBER ID-B

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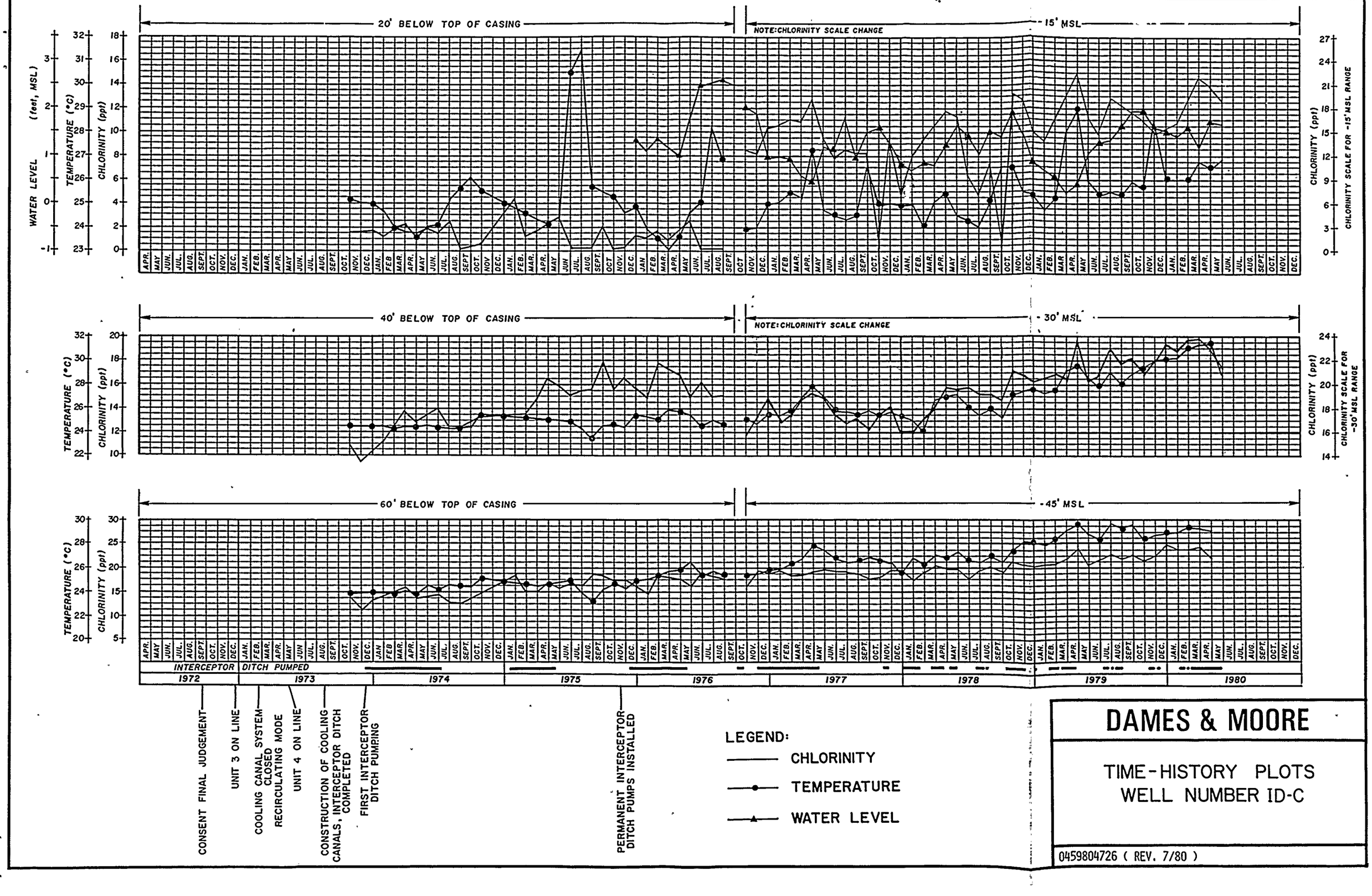

DAMES & MOORE

TIME-HISTORY PLOTS
WELL NUMBER ID-C

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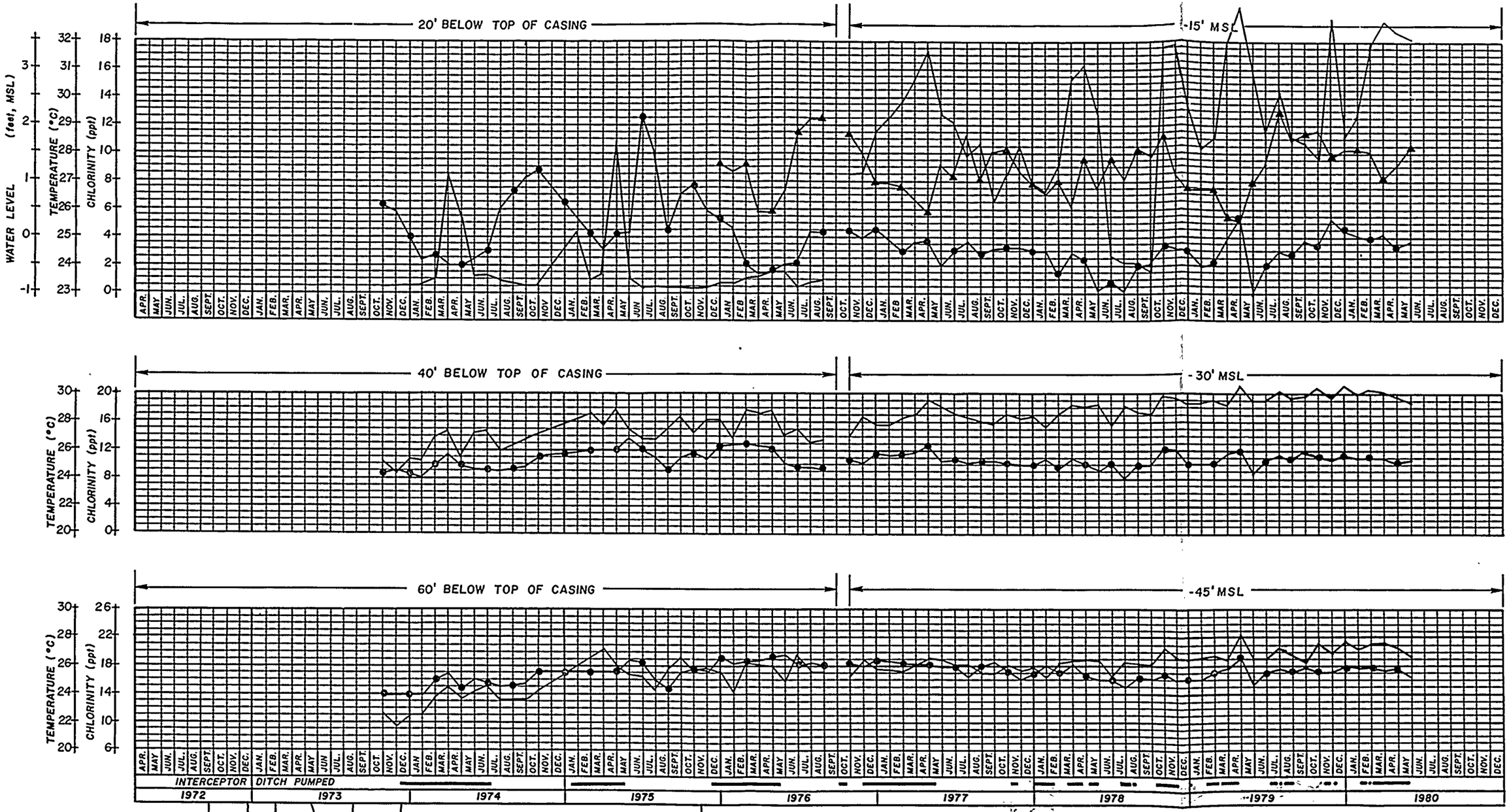
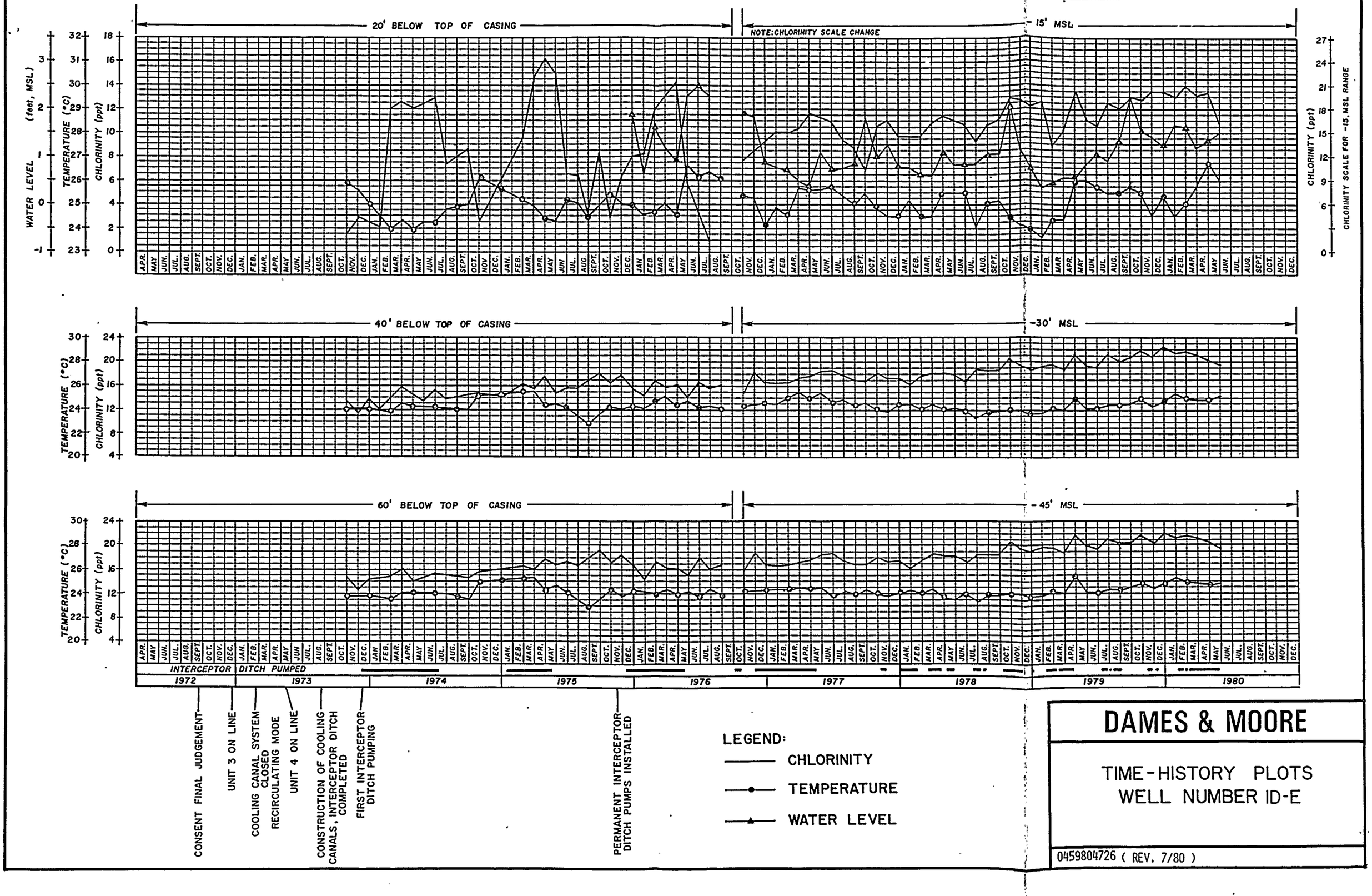


DAMES & MOORE

TIME-HISTORY PLOTS
WELL NUMBER ID-D

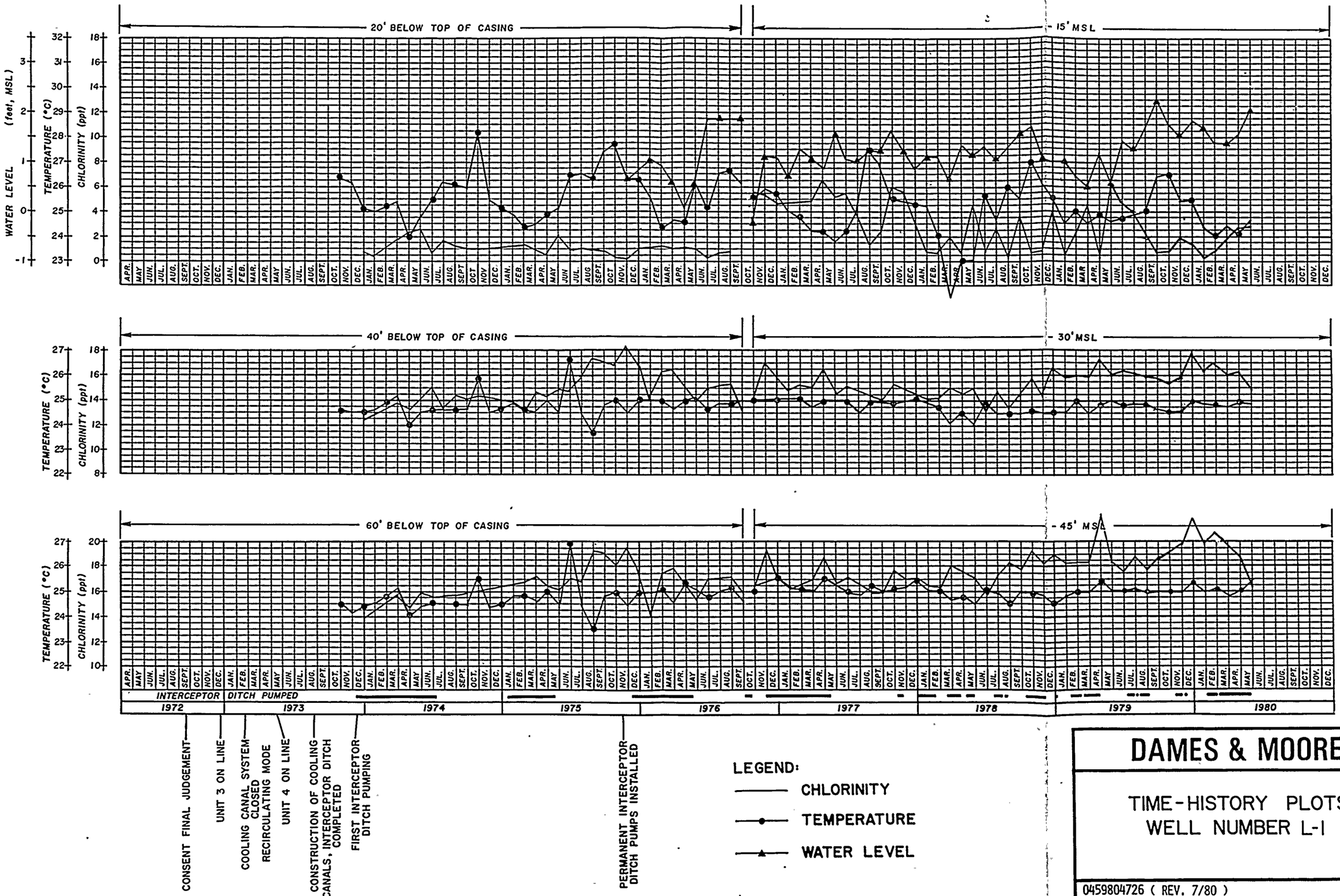
0459804726 (REV. 7/80)



DAMES & MOORE

TIME-HISTORY PLOTS
WELL NUMBER ID-E

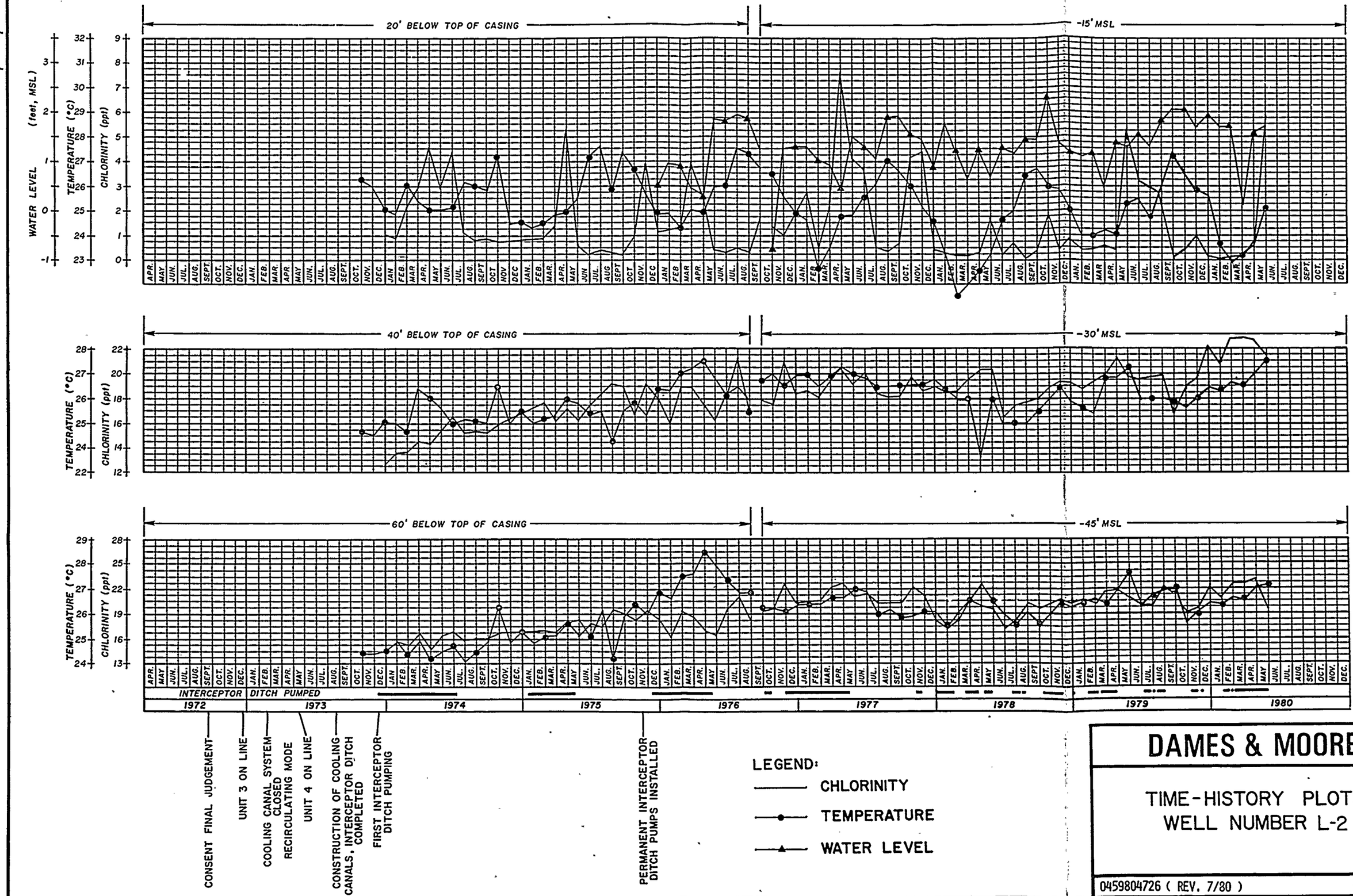
0459804726 (REV. 7/80)



DAMES & MOORE

TIME-HISTORY PLOTS
WELL NUMBER L-1

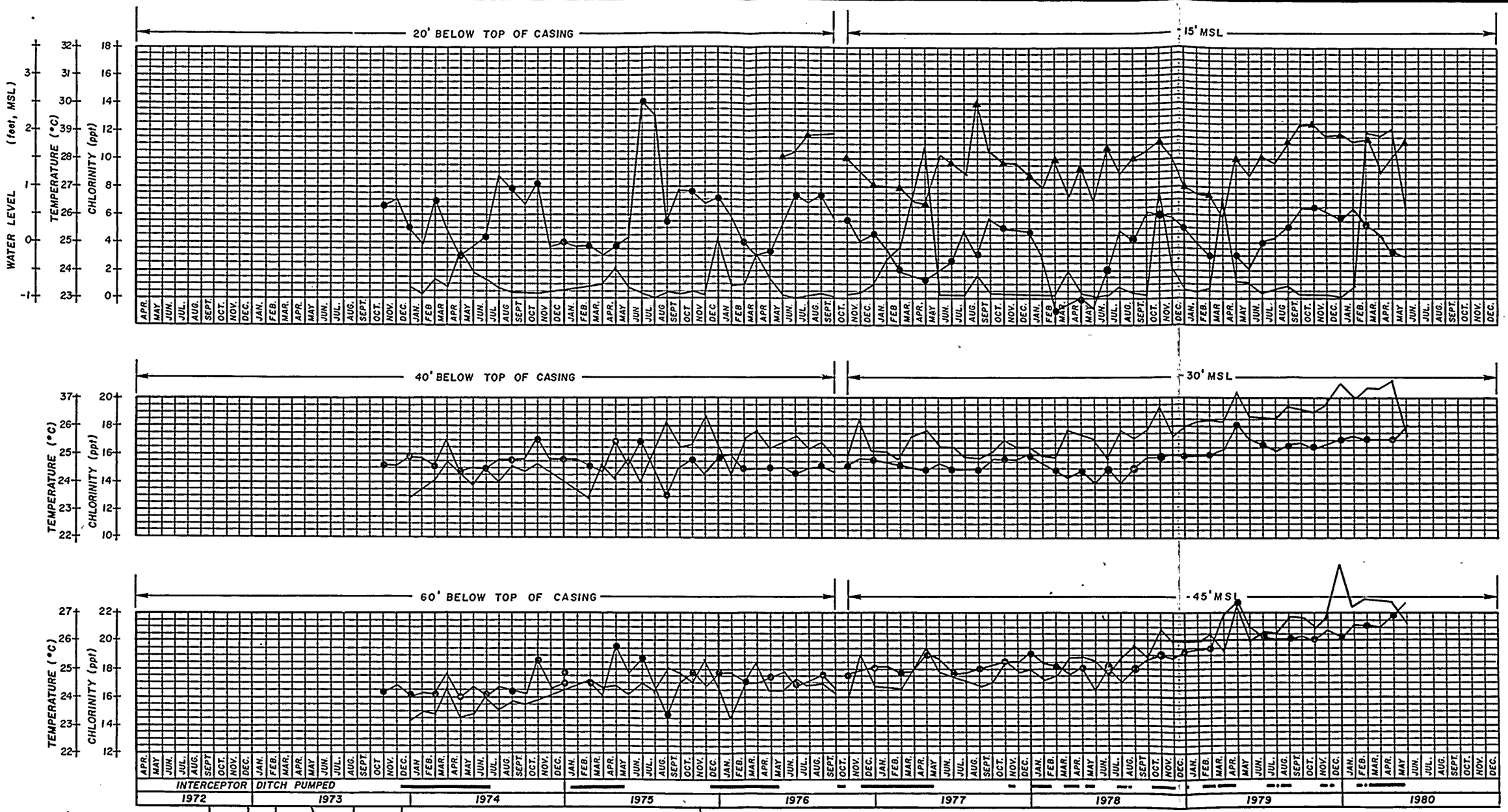
0459804726 (REV. 7/80)



DAMES & MOORE

TIME-HISTORY PLOTS
WELL NUMBER L-2

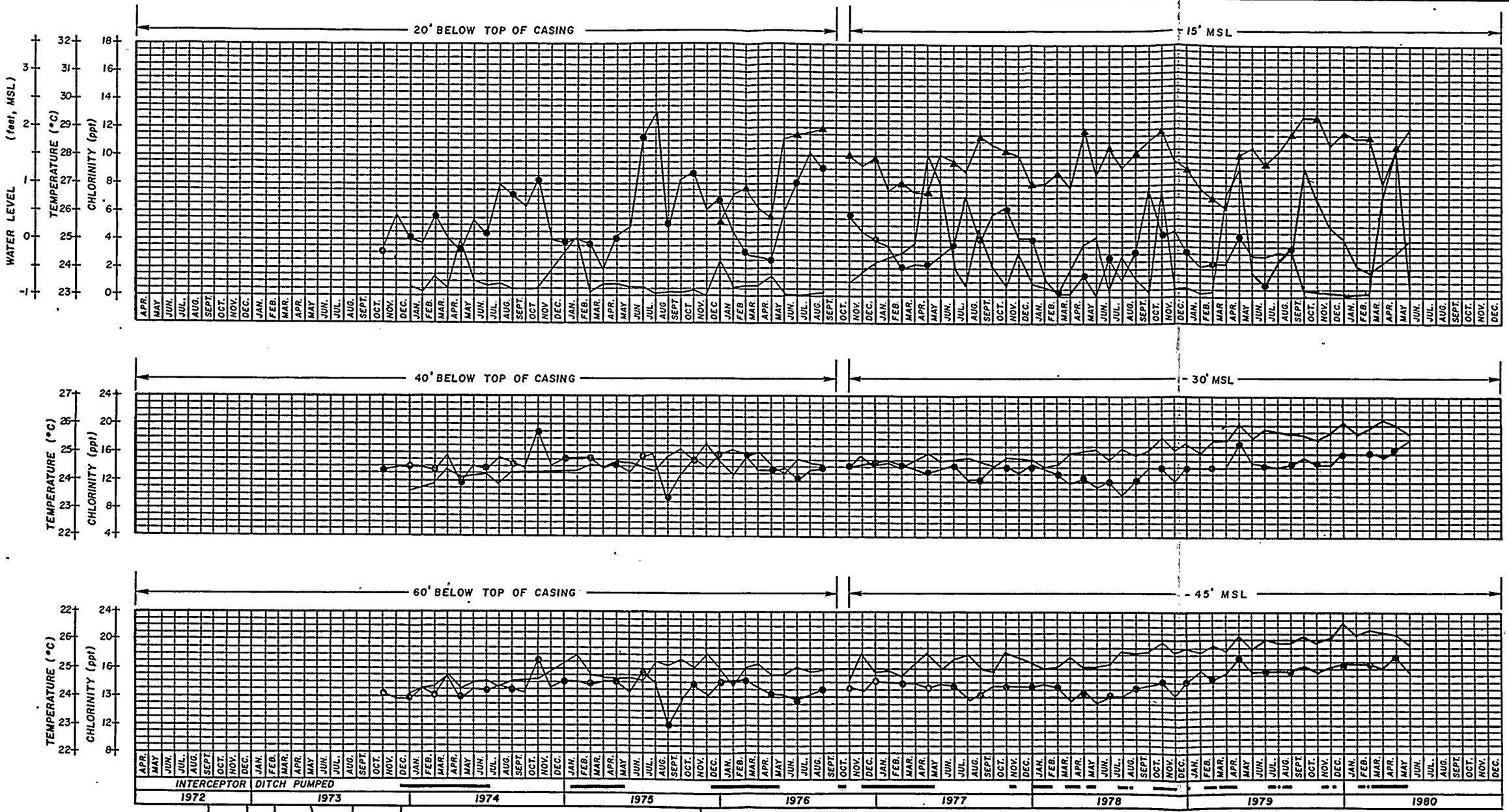
0459804726 (REV. 7/80)



DAMES & MOORE

TIME-HISTORY PLOTS
WELL NUMBER L-3

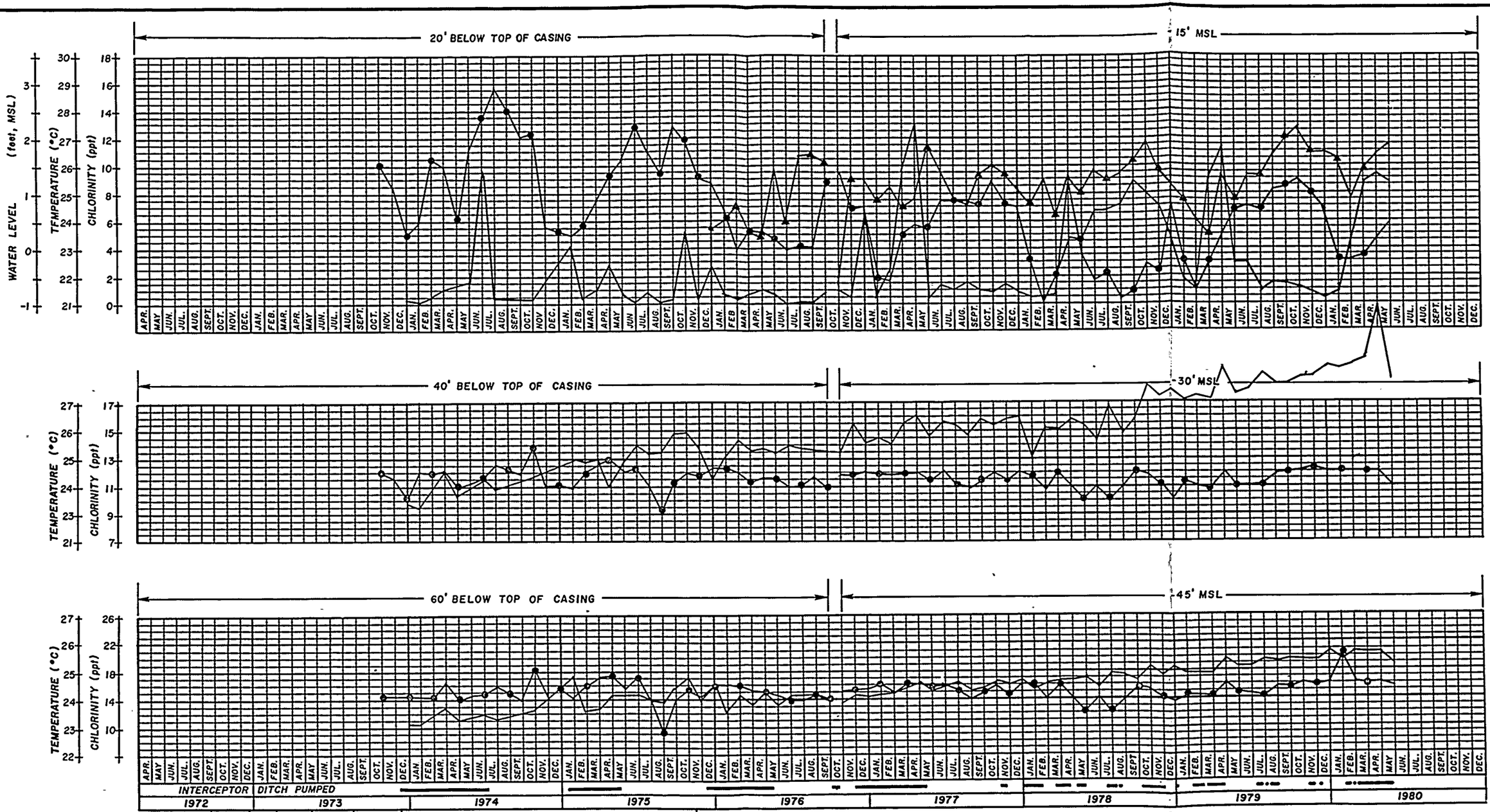
0459804726 (REV. 7/80)



DAMES & MOORE

TIME-HISTORY PLOTS
WELL NUMBER L-4

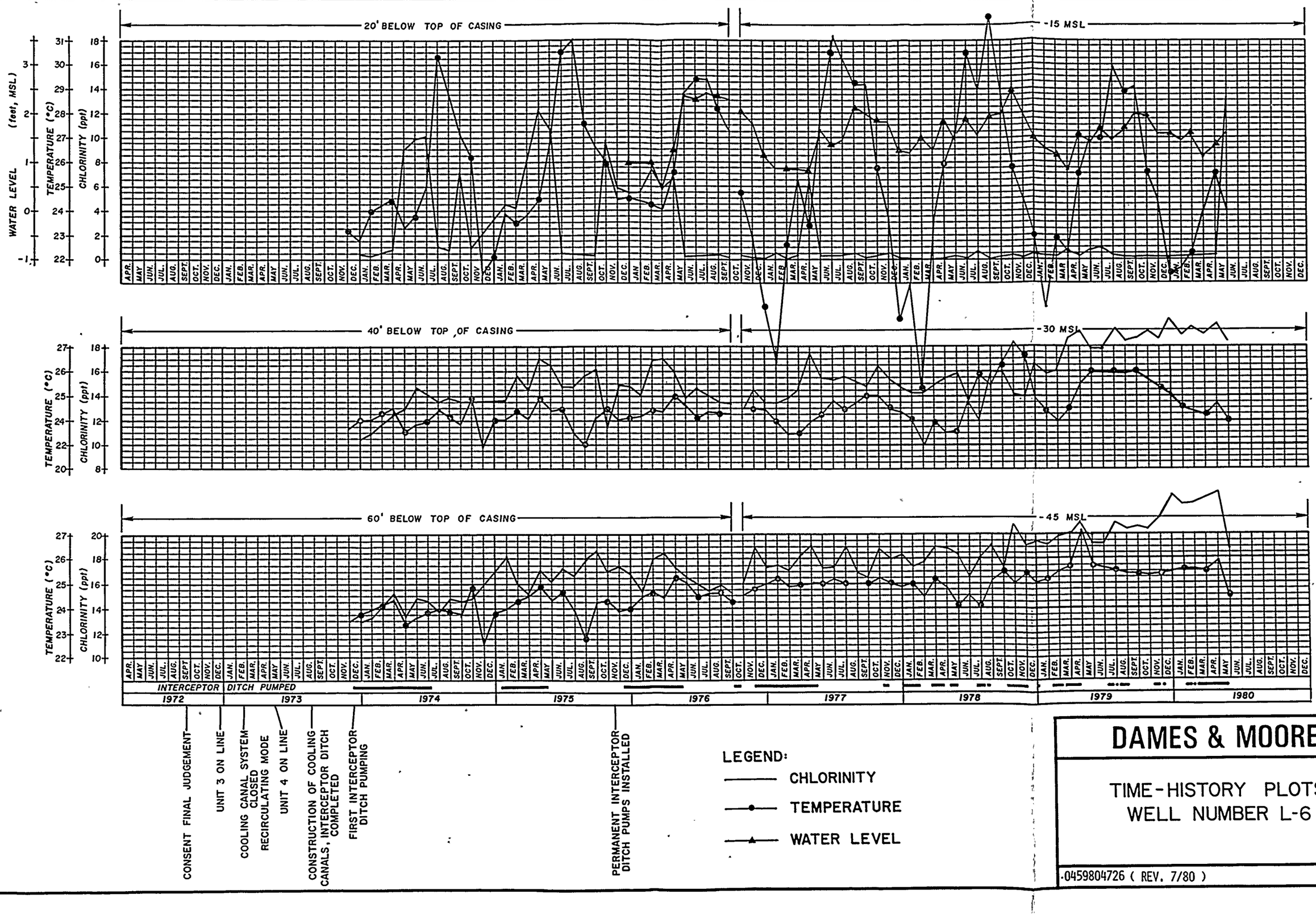
0459804726 (REV. 7/80)



DAMES & MOORE

TIME-HISTORY PLOTS
WELL NUMBER L-5

0459804726 (REV. 7/80)



DAMES & MOORE

TIME-HISTORY PLOTS
WELL NUMBER L-6

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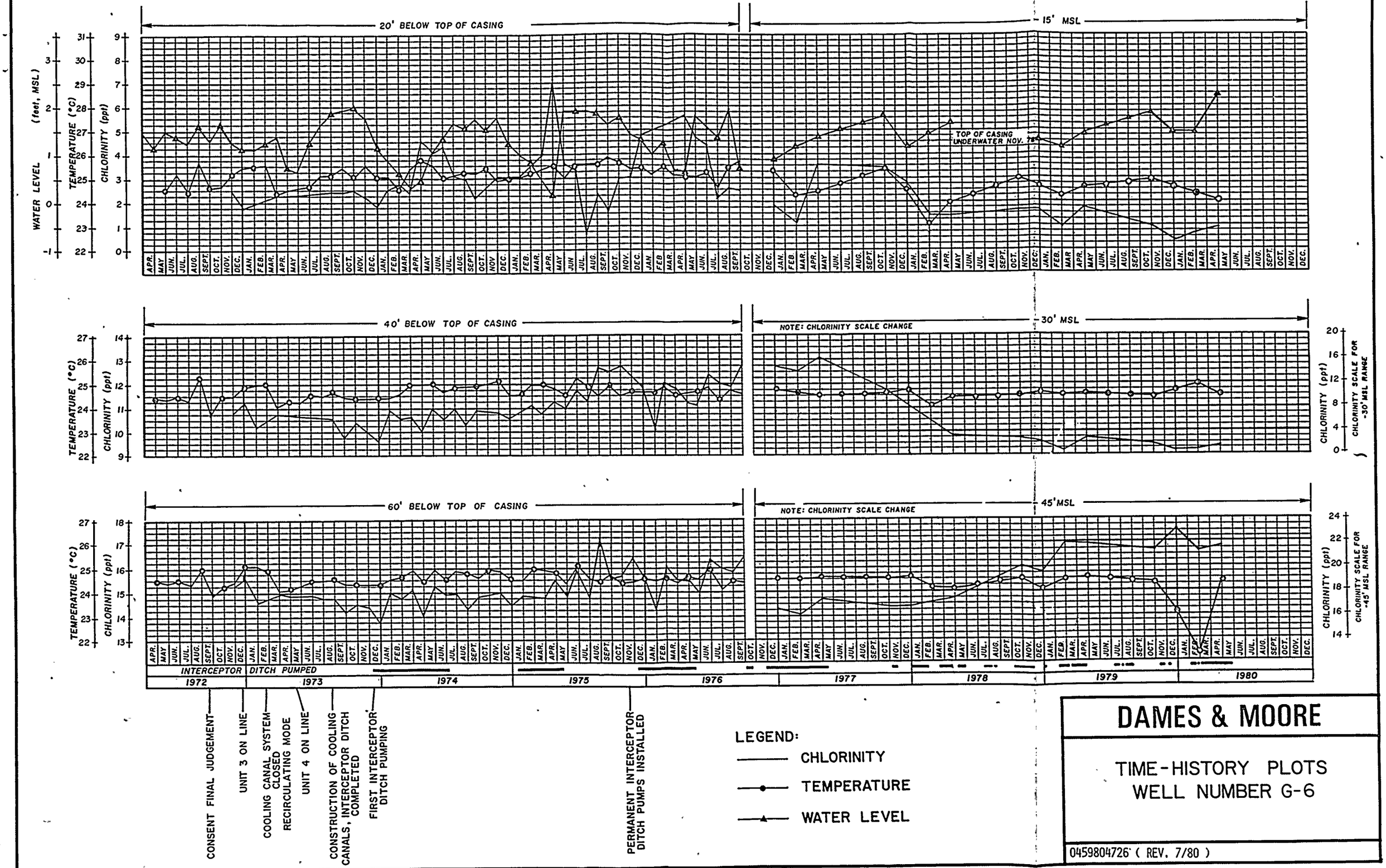
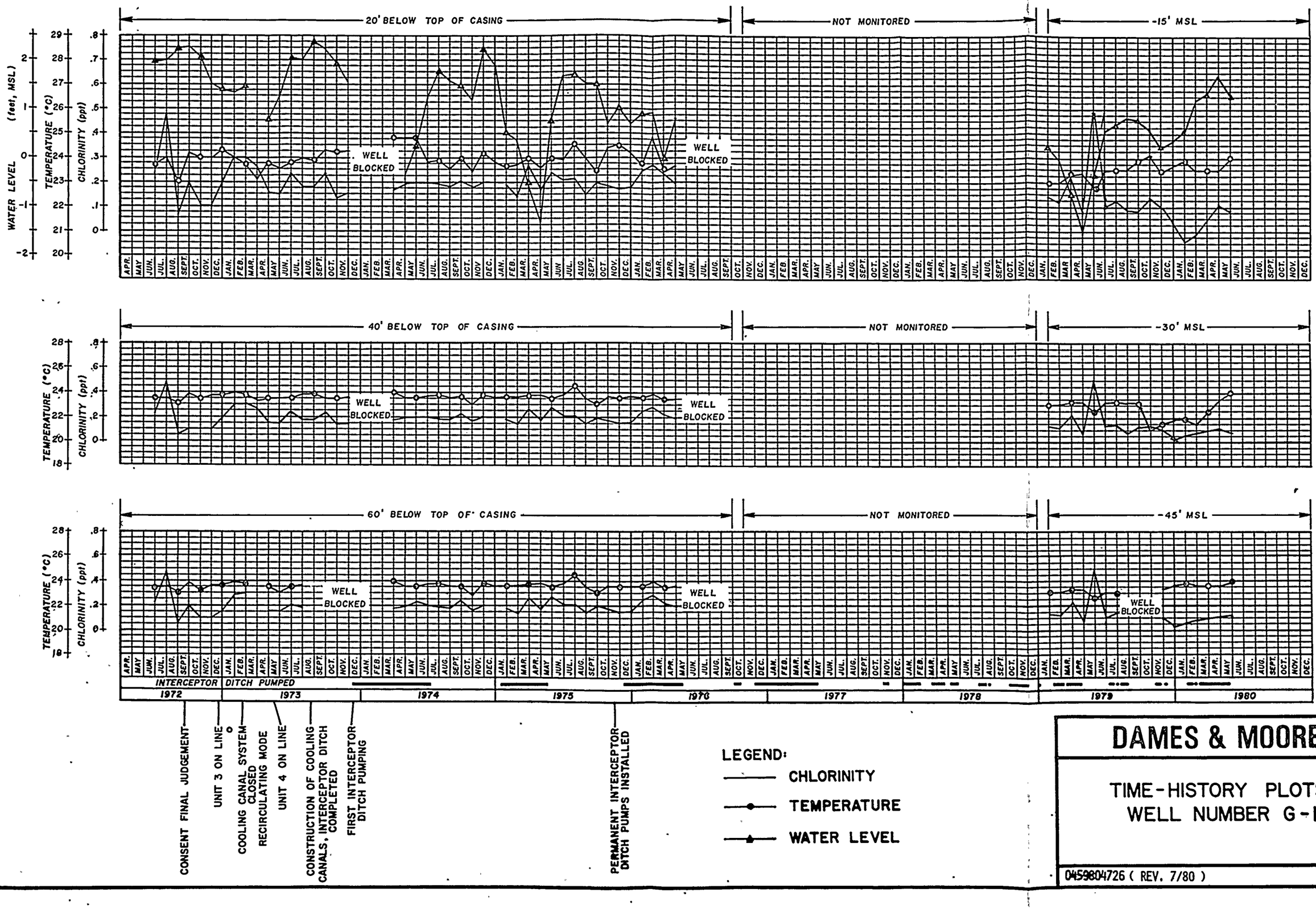


DAMES & MOORE

TIME-HISTORY PLOTS WELL NUMBER G-6

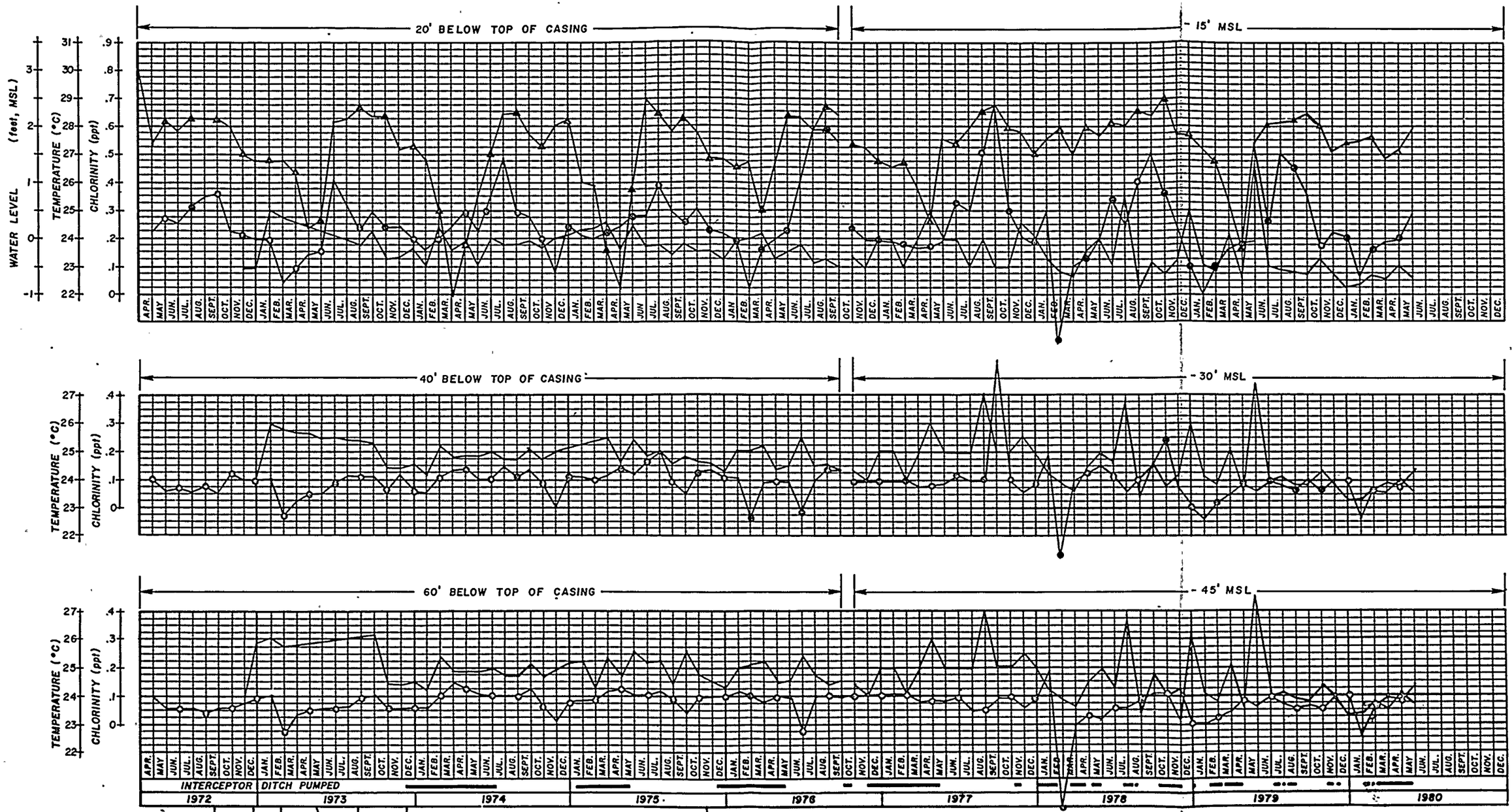
0459804726 (REV. 7/80)



DAMES & MOORE

TIME-HISTORY PLOTS
WELL NUMBER G-14

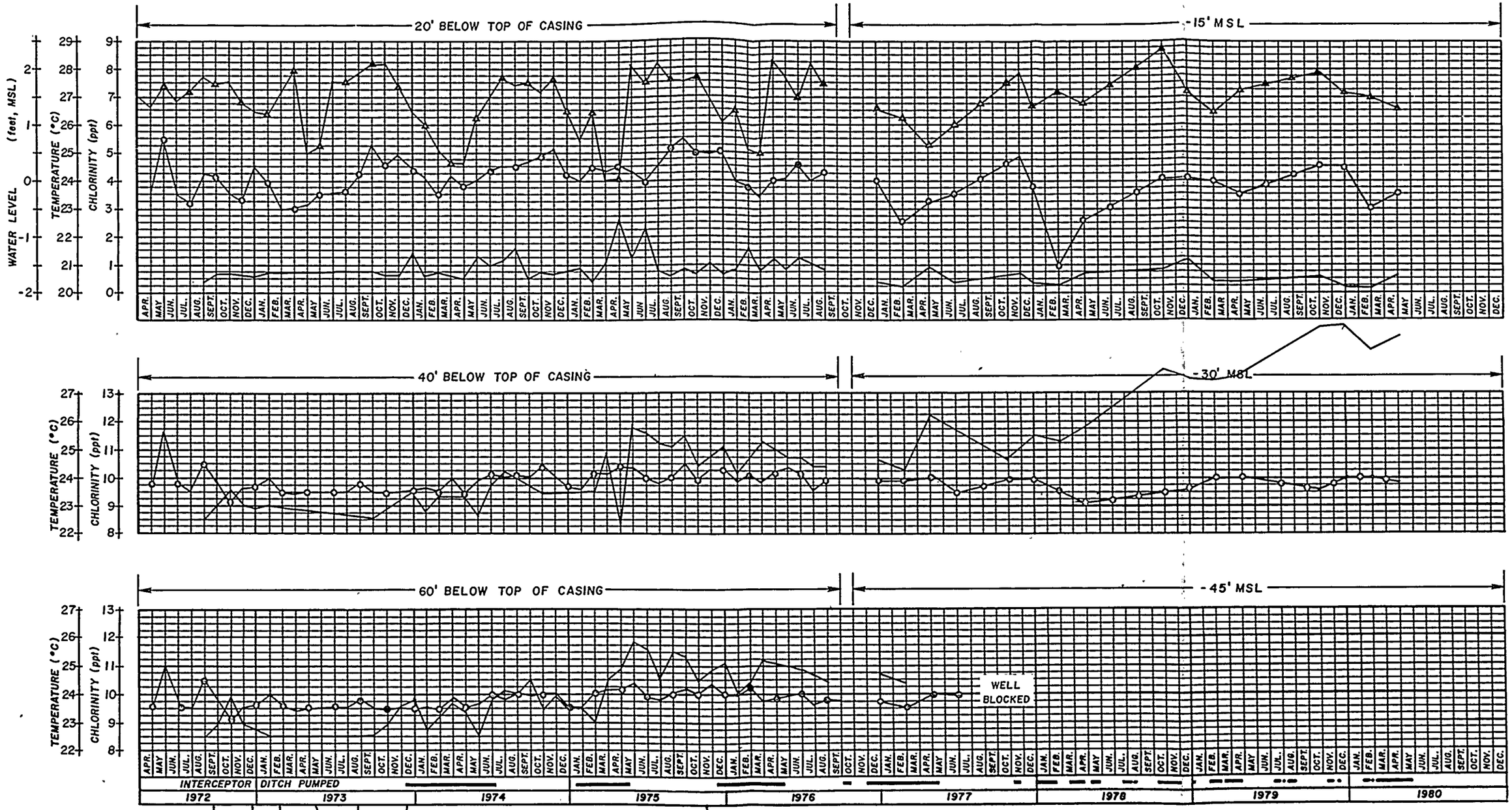
0459804726 (REV. 7/80)



DAMES & MOORE

TIME-HISTORY PLOTS
WELL NUMBER G-21

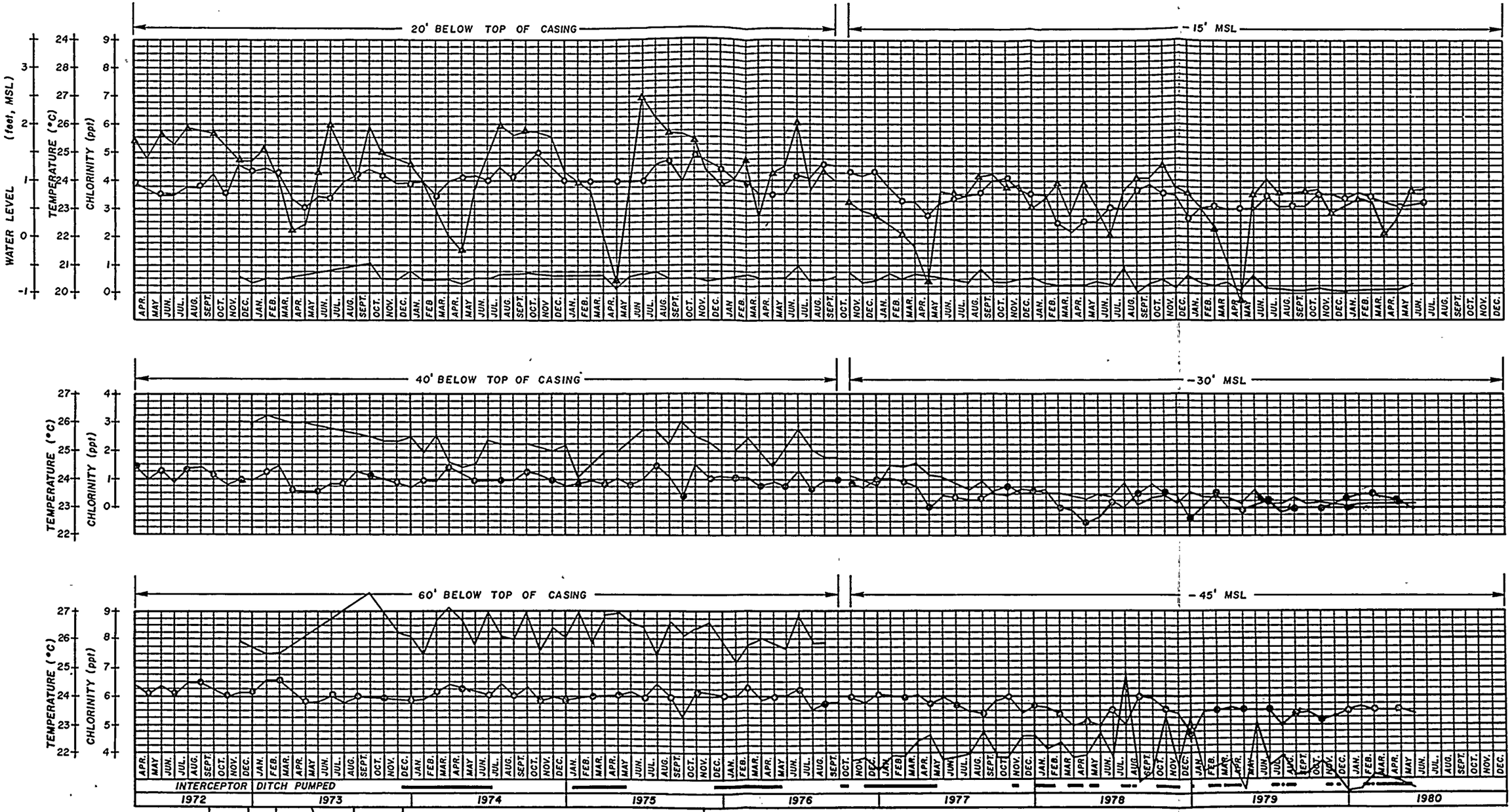
0459804726 (REV. 7/80)



DAMES & MOORE

TIME-HISTORY PLOTS
WELL NUMBER G-27

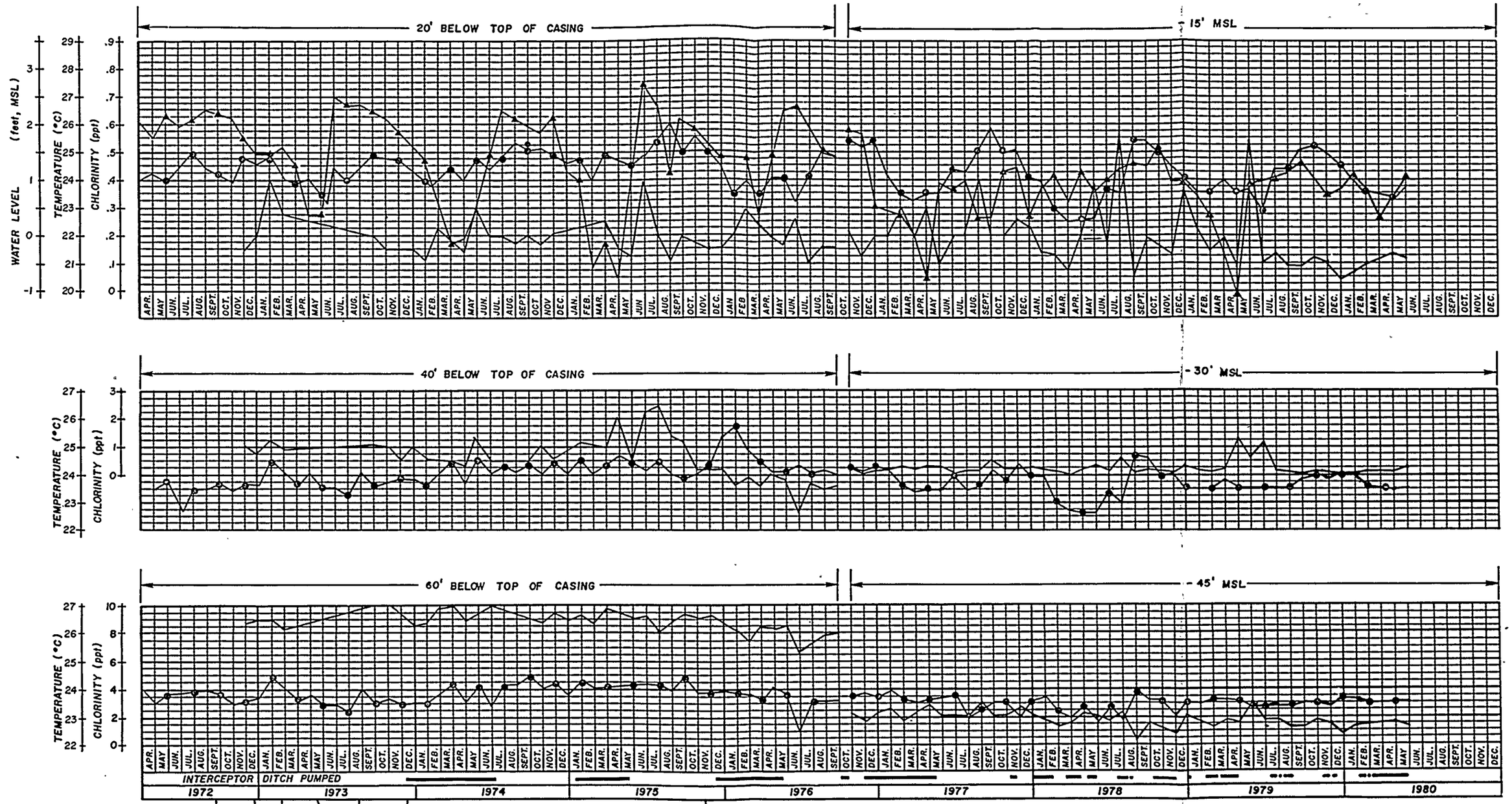
0459804726 (REV. 7/80)



DAMES & MOORE

TIME-HISTORY PLOTS
WELL NUMBER G-28

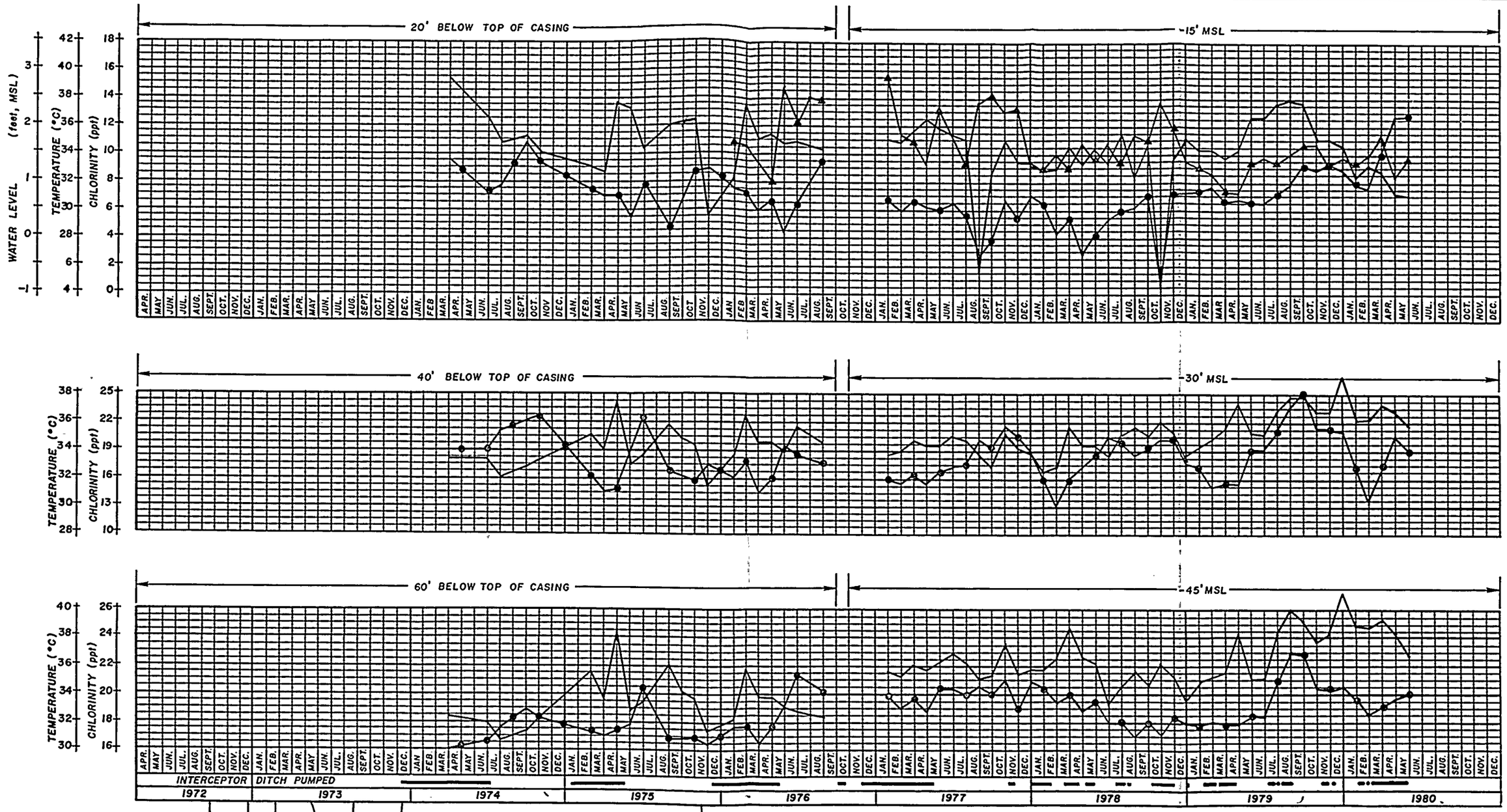
0459804726 (REV. 7/80)



DAMES & MOORE

TIME-HISTORY PLOTS
WELL NUMBER G-35

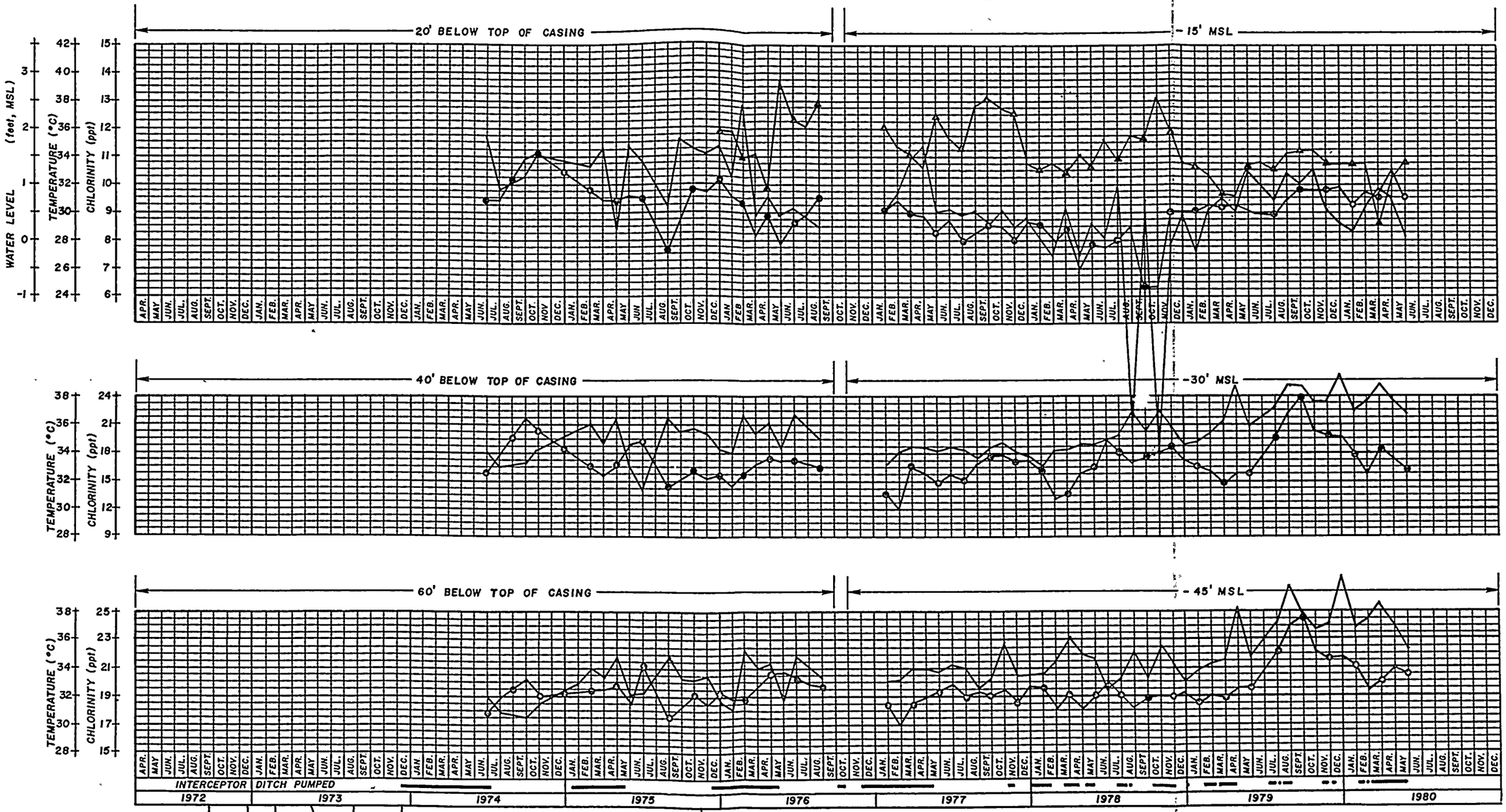
0459804726 (REV. 7/80)



DAMES & MOORE

TIME-HISTORY PLOTS
WELL NUMBER X-1

0459804726 (REV. 7/80)



DAMES & MOORE

TIME-HISTORY PLOTS
WELL NUMBER X-2

0459804726 (REV. 7/80)

APPENDIX B

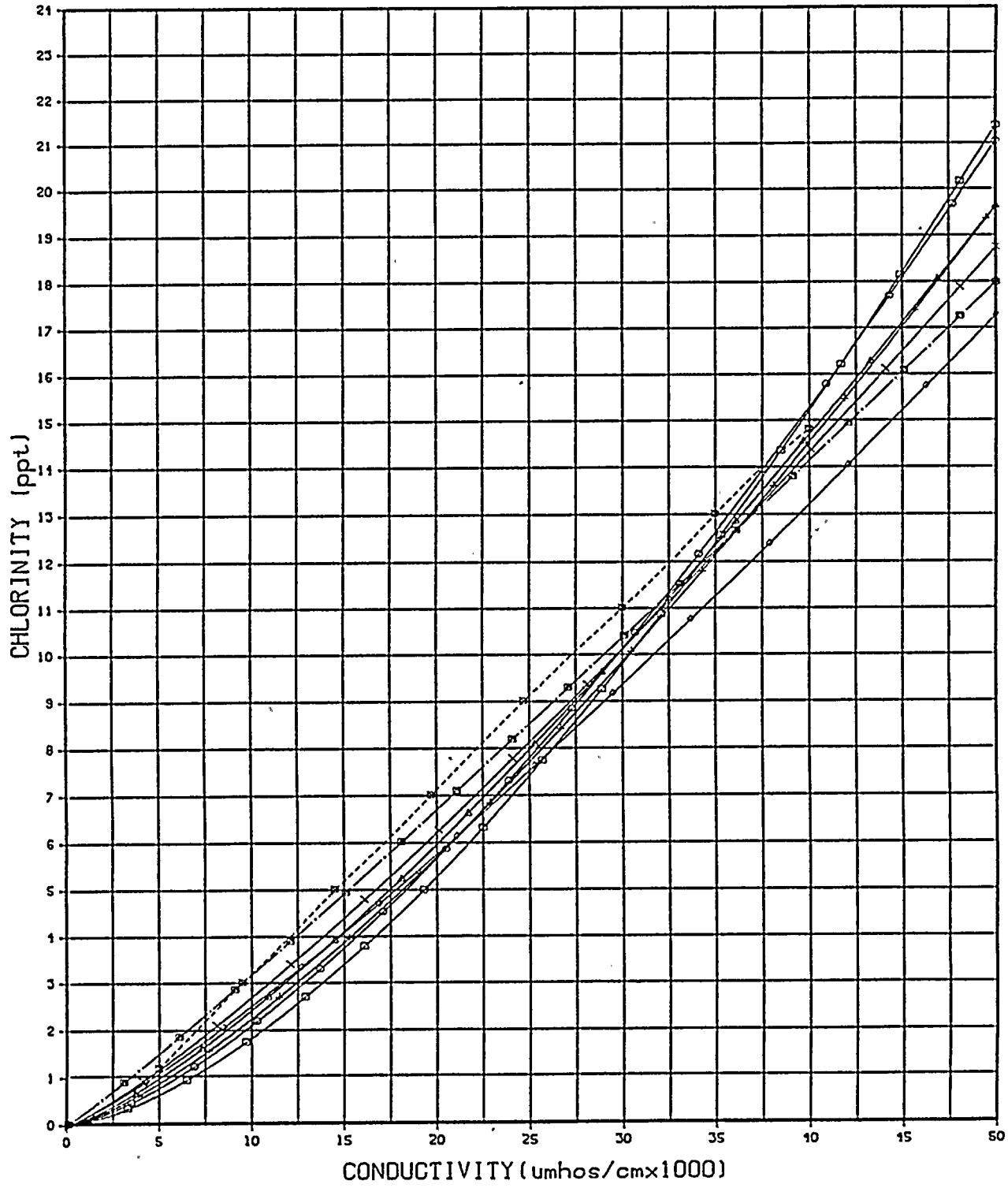
CONDUCTIVITY-CHLORINITY

CALIBRATIONS

APPENDIX B

CONDUCTIVITY-CHLORINITY CALIBRATIONS

The following figures present graphically the conductivity-chlorinity relationship for the ground water samples collected during the July 1979-June 1980 monitoring period as determined by Laboratory analyses. A discussion of the procedures for developing these relationships is presented in Appendix E.



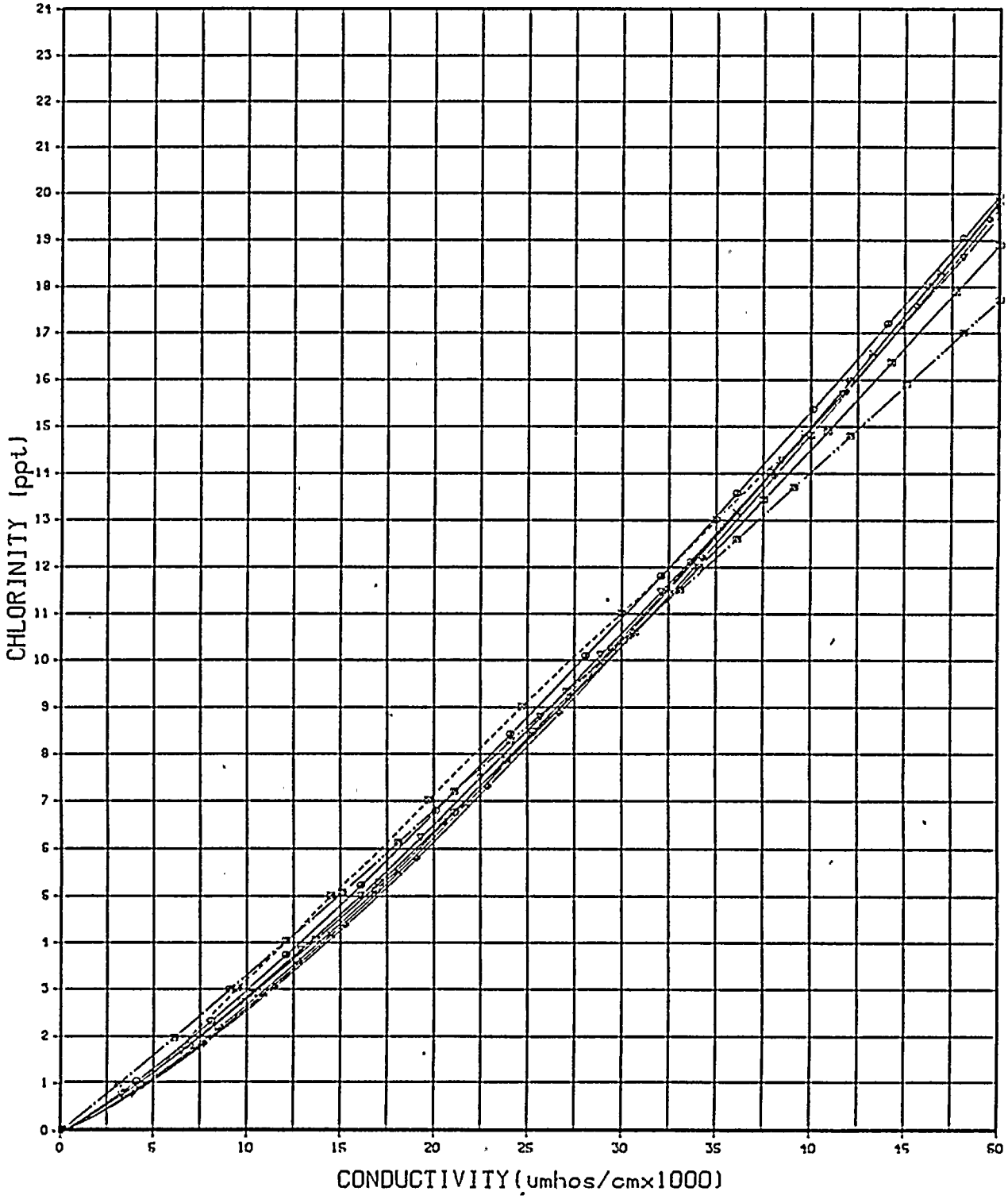
LEGEND

- HISTORICAL
- JANUARY, 1980
- FEBRUARY, 1980
- MARCH, 1980
- USGS
- APRIL, 1980
- MAY, 1980
- JUNE, 1980

DAMES AND MOORE

CONDUCTIVITY-CHLORINITY RELATIONSHIPS G-SERIES WELLS

0459804726 (7/80) FIGURE B-1



LEGEND

- HISTORICAL
- USGS
- JULY, 1979
- OCTOBER, 1979
- AUGUST, 1979
- NOVEMBER, 1979
- SEPTEMBER, 1979
- DECEMBER, 1979

DAMES AND MOORE

CONDUCTIVITY-CHLORINITY RELATIONSHIPS G-SERIES WELLS

0459804726 (7/80) FIGURE B-2

APPENDIX C

INTERCEPTOR DITCH OPERATION

APPENDIX C

INTERCEPTOR DITCH OPERATION

The Interceptor Ditch Program consisted of construction of a ditch along the western edge of the cooling canal system and the installation of pumping facilities. The ditch and associated structures were established to control inland seepage of cooling canal water. This is accomplished by pumping water from the ditch during periods when a natural seaward ground water gradient does not exist. Operation of the pumping stations and requirements are presented in the Ground Water Monitoring and Interceptor Ditch Operation Procedures Manual dated May 6, 1976.

Surface water elevations are monitored at staff gages located in Levee 31E Borrow Canal, Cooling Canal 32, and the Interceptor Ditch. These staff gages are located at five positions in each of these canals relative to Lines A, B, C, D and E as shown on the inset, Figure 2. Water elevations are recorded twice a month during non-pumping periods (usually June through November) and once a week during potential pumping periods (December through May), except when the pumps are operating. When pumping occurs, water elevations are recorded at least twice a week.

Pumping of the Interceptor Ditch for the wet season began July 11, 1979 (Figure C-1). Lines A, B and C were pumped until July 17 with Lines A and B continuing until July 22. Lines A and B were pumped intermittently from July 30 to August 3;

August 7 to August 14; August 17 to August 22; and again on August 30 and 31.

Pumping of the Interceptor Ditch for the dry season began February 5, 1980. Lines A and B were pumped continuously through February with the exception of February 26 when a power failure caused the pumps to briefly shut down. Lines A and B continued puming throughout March and were joined by Line C on March 14 and by Lines D and E on March 17. All lines continued pumping until April 19, 1980. Lines A, B, C, D and E were pumped intermittently from April 20 to April 25; April 29 to May 6; and again from May 7 to May 9, 1980. All lines began pumping again on May 12. Lines D and E were shut down May 20 while Lines A, B and C continued pumping until May 25, 1980.

This completed the pumping program for the monitoring period from July 1979 to June 1980. A historic record of Interceptor Ditch pumping from the inception of the program in August 1973 is depicted graphically on the Time-History plots in Appendix A of this report.

APPENDIX D

VARIATIONS FROM HISTORICAL ENVELOPE CURVES

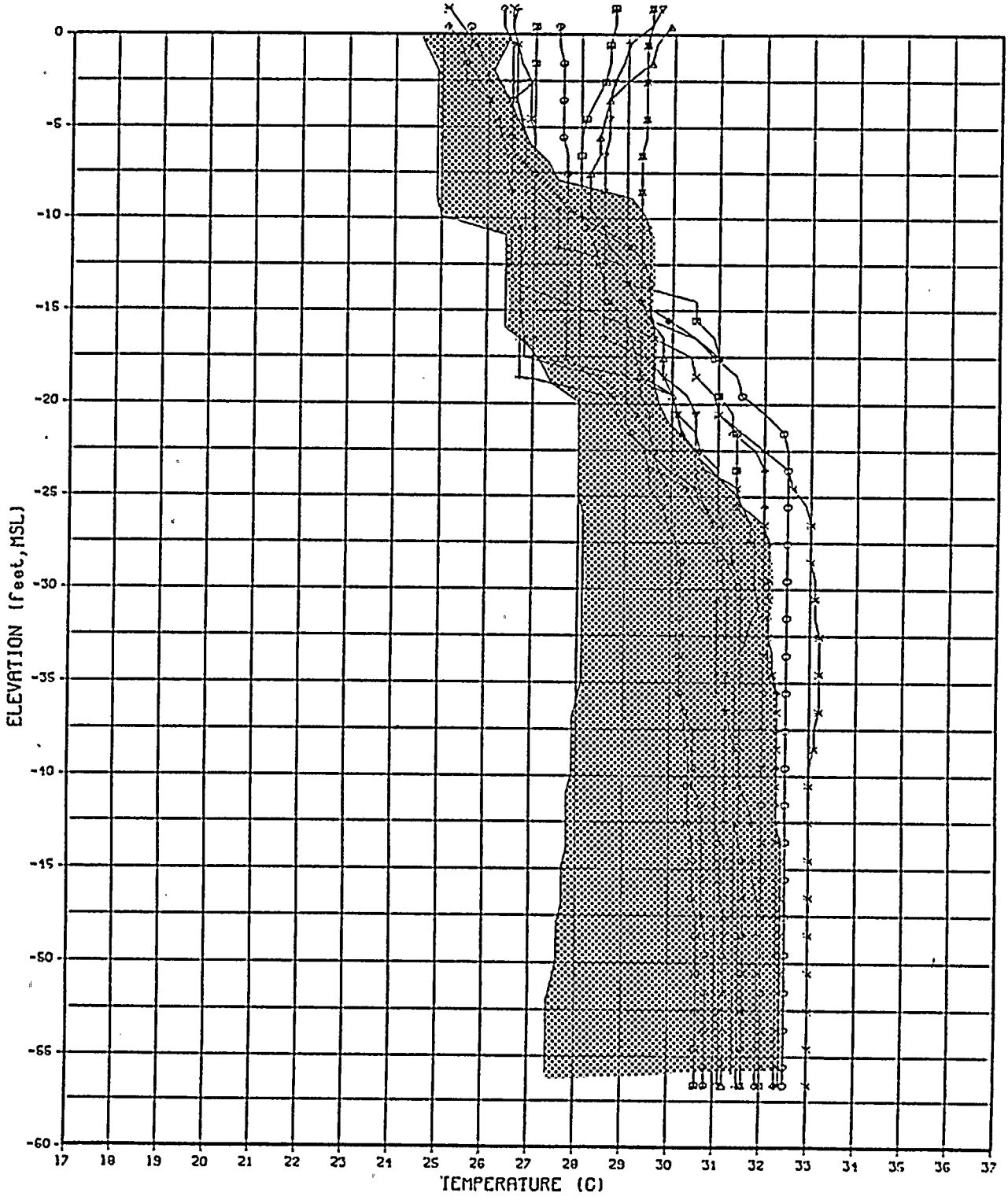
APPENDIX D

VARIATIONS FROM HISTORICAL ENVELOPE CURVES

Historical envelope curves have been prepared which show the historical ranges of temperature and chlorinity profiles. The historical base for envelope curves is from November 1976 through June 1979.

This appendix contains plots of the historical envelope curves for each well having excursions from that envelope during the July 1979 through June 1980 monitoring period. The shaded area on each plot is the historical envelope while temperature and chlorinity excursions are shown as profile lines.

The excursions presented in the following figures are similar to those for indicator wells presented in Section 2.0 of the report. The reader is referred to Sections 2.0 and 3.0 for a summary of the results of the July 1979-June 1980 monitoring program.



LEGEND

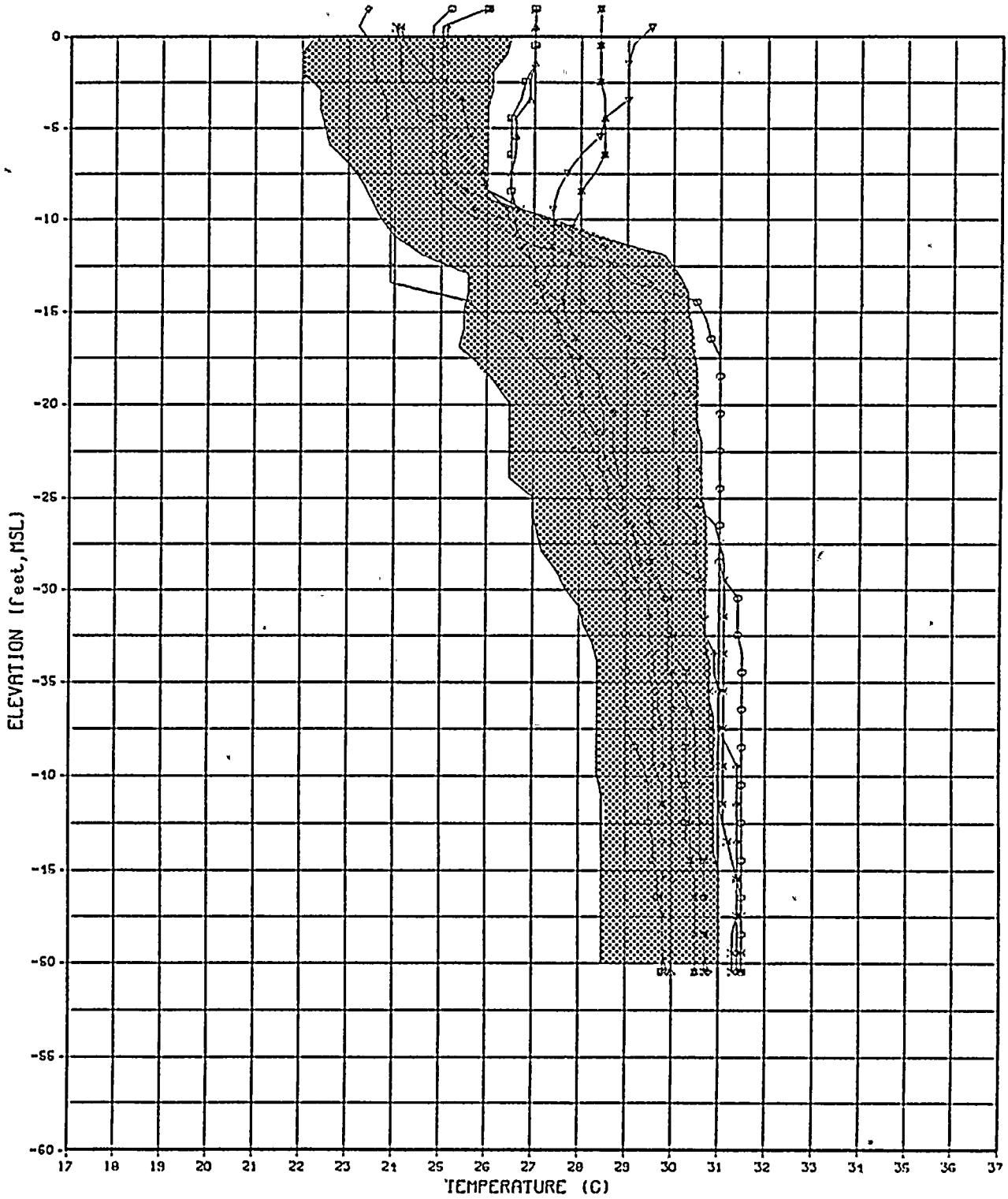
APR-80	AUG-79	DEC-79	FEB-80
JAN-80	JUL-79	JUN-80	MAR-80
MAY-80	NOV-79	OCT-79	SEP-79

DAMES AND MOORE

EXCURSIONS FROM TEMPERATURE ENVELOPE FOR JULY 79 - JUNE 80

WELL NUMBER ID-A

0459804726 (7/80)



LEGEND

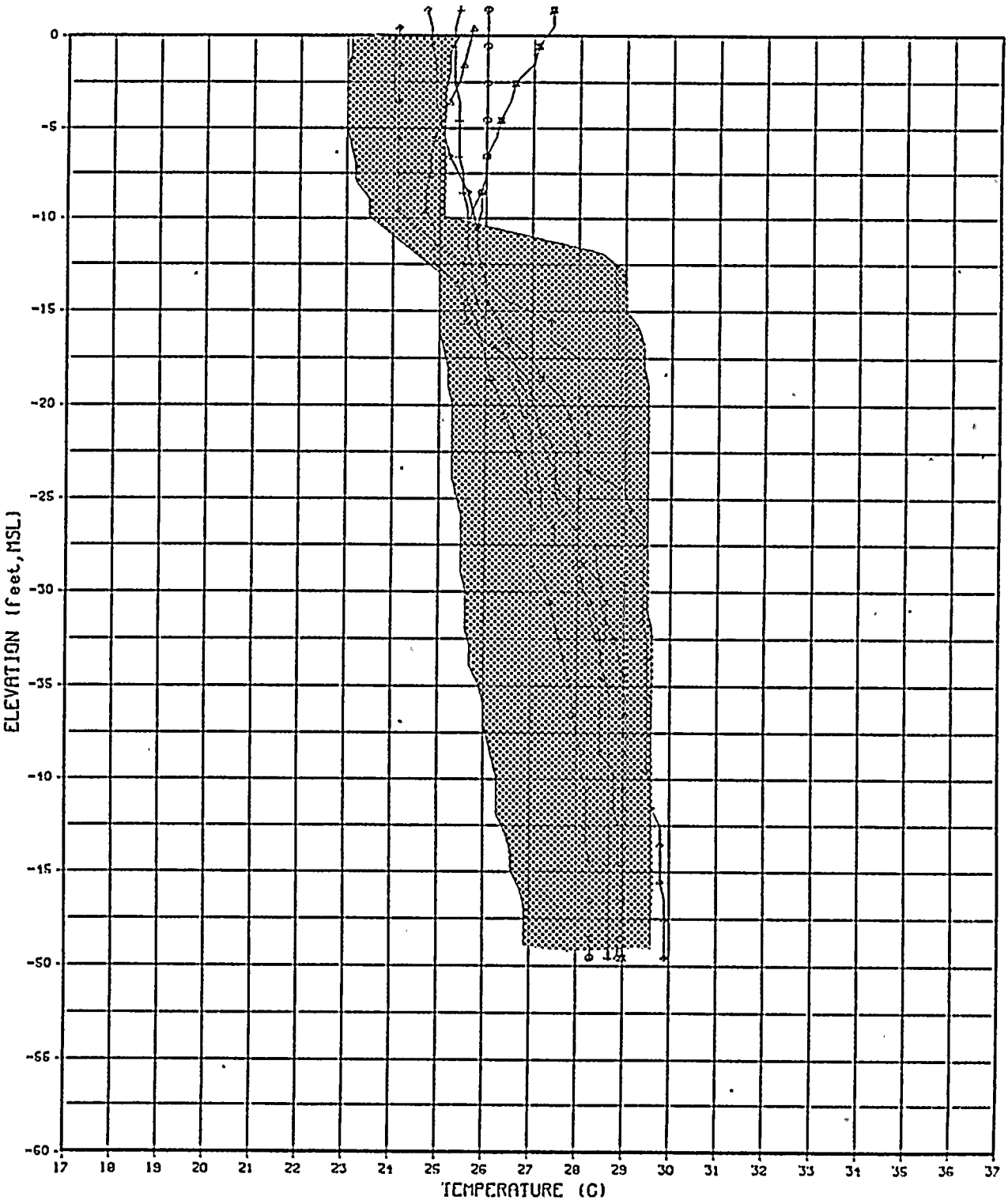
APR-Y	AUG-79	FEB-80	JAN-80
JUL-79	JUN-80	MAR-80	MAY-80
OCT-79	SEP-79		

DAMES AND MOORE

EXCURSIONS FROM TEMPERATURE ENVELOPE FOR JULY 79 - JUNE 80

WELL NUMBER ID-B

0459804726 (7/80)



LEGEND

△ AUG-79 + DEC-79 ◇ JAN-80 ◆ MAY-80

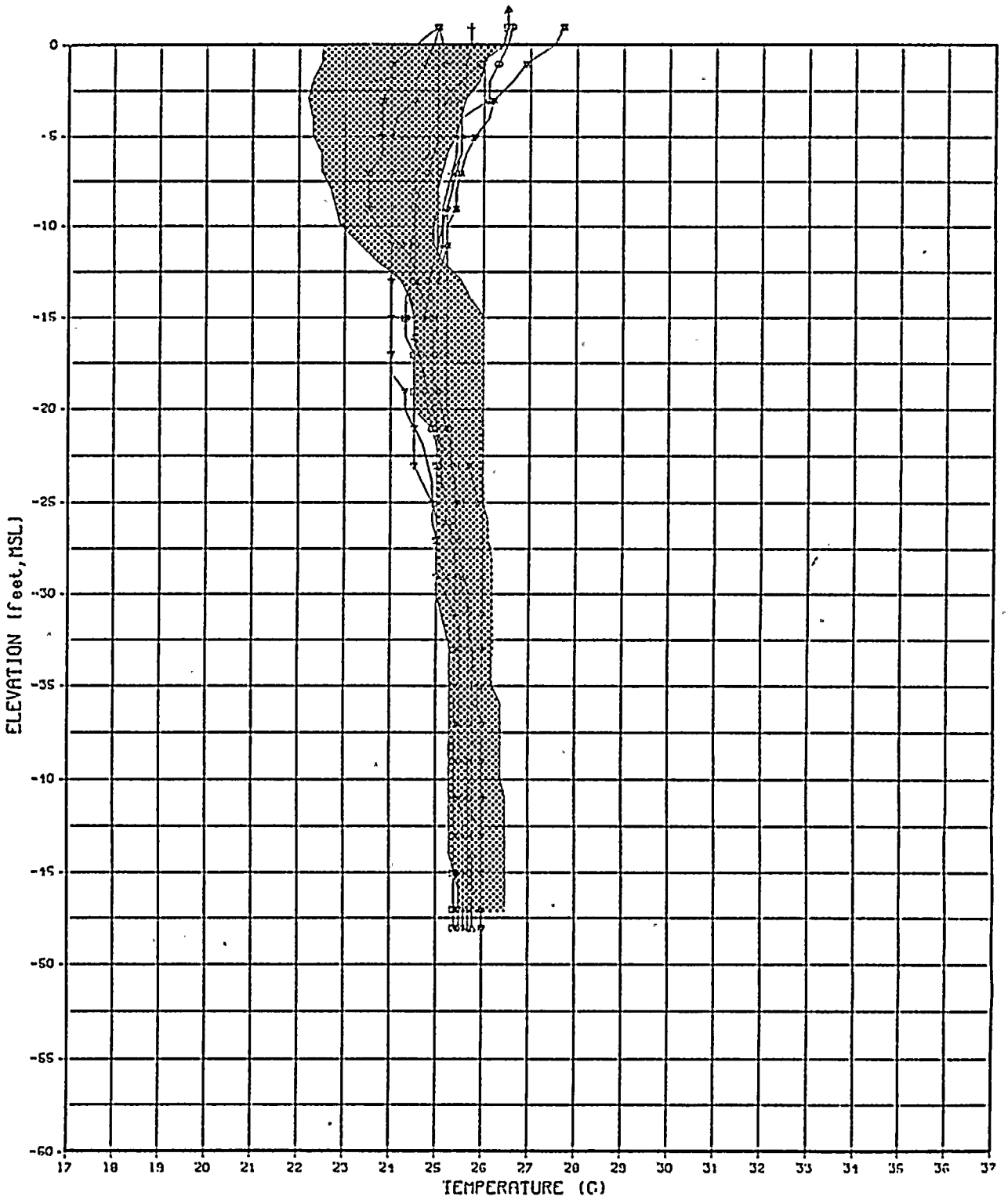
⊕ NOV-79 ⊠ OCT-79

DAMES AND MOORE

EXCURSIONS FROM TEMPERATURE ENVELOPE FOR JULY 79 - JUNE 80

WELL NUMBER 10-C

0459804726 (7/80)



LEGEND

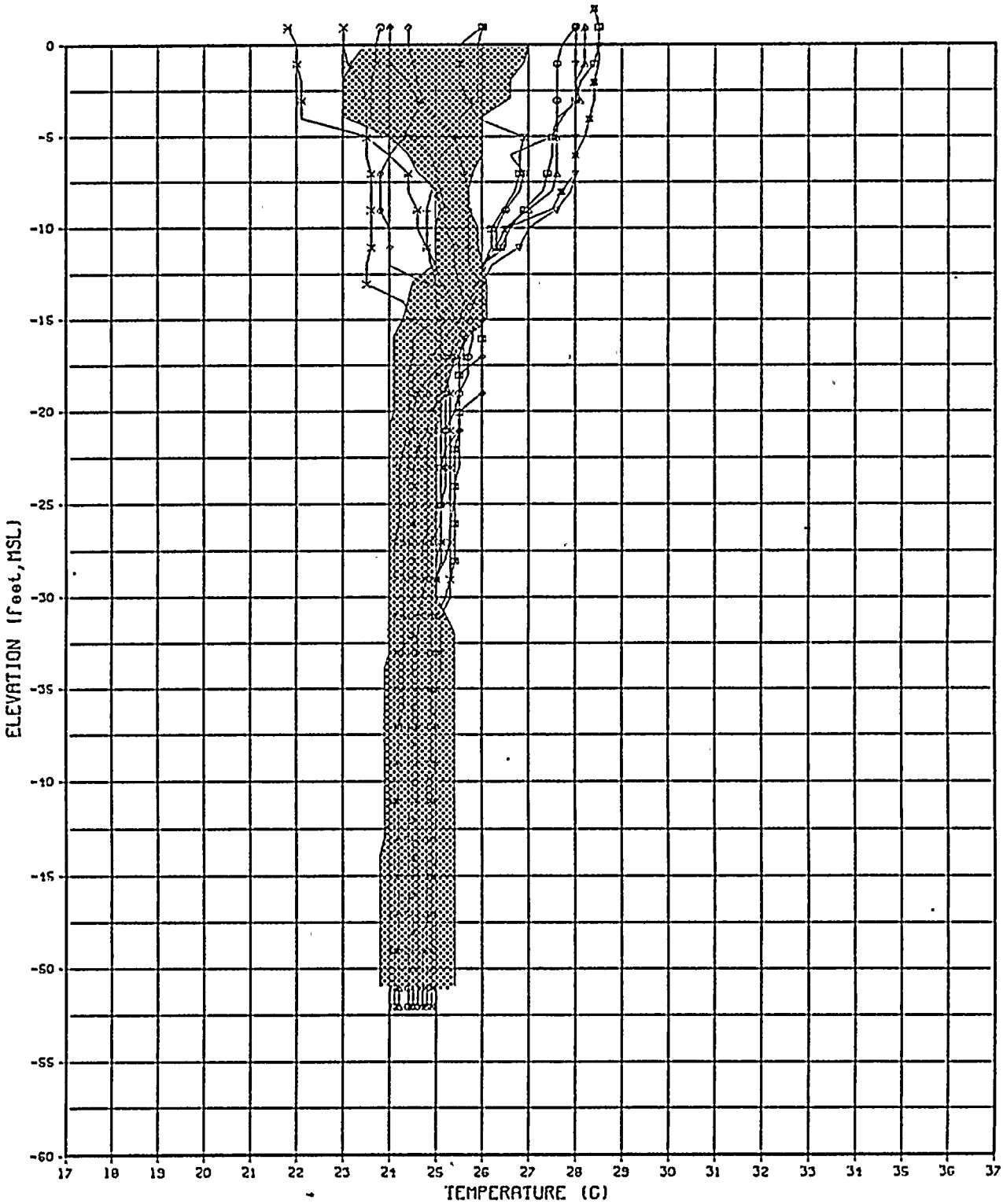
AUG-79	DEC-79	JAN-80	JUL-79
JUN-80	NOV-79	OCT-79	SEP-79

DAMES AND MOORE

EXCURSIONS FROM TEMPERATURE ENVELOPE FOR JULY 79 - JUNE 80

WELL NUMBER ID-D

0459804726 (7/80)



LEGEND

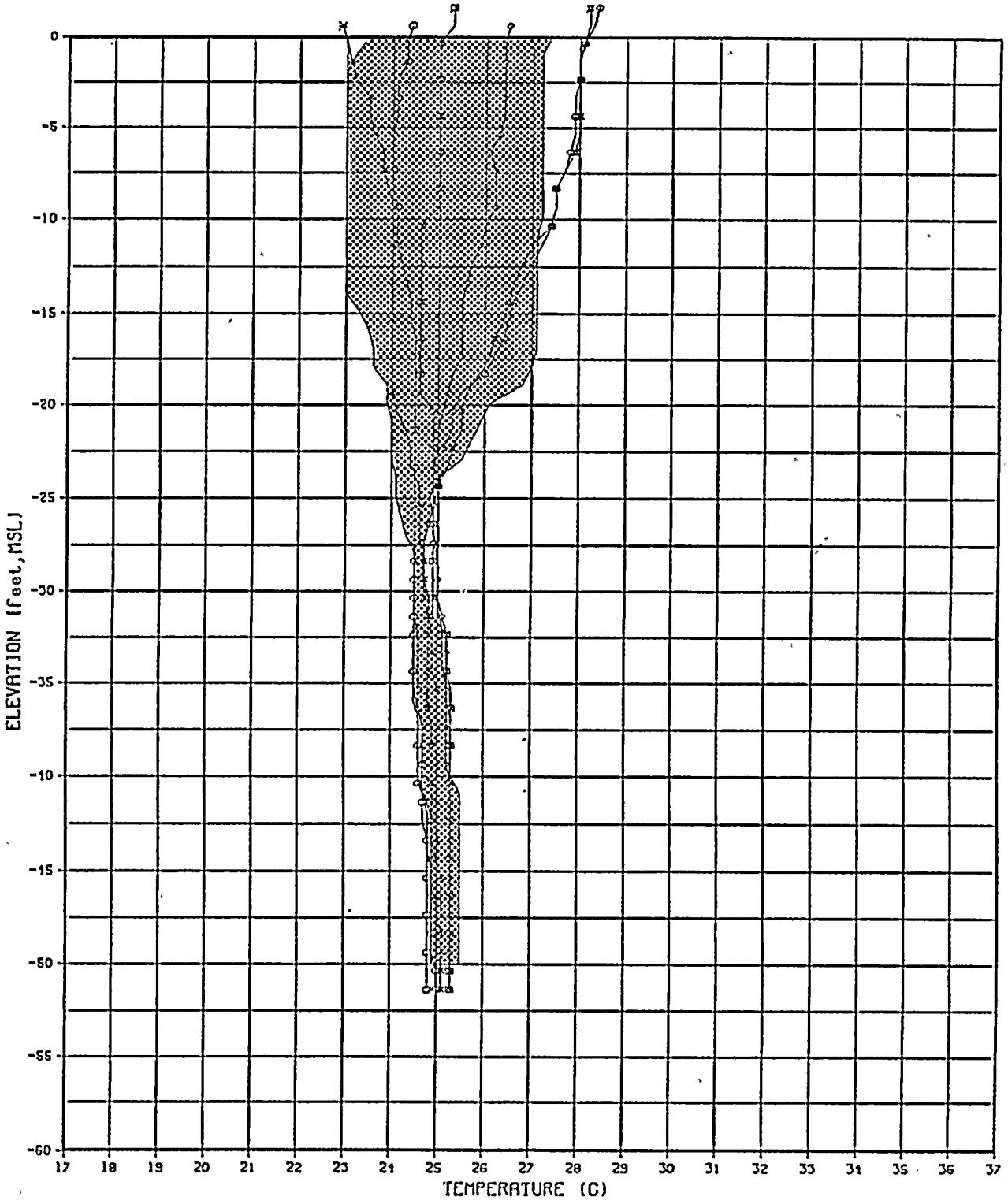
APR-80	AUG-79	DEC-79	FEB-80
JAN-80	JUL-79	JUN-80	MAR-80
MAY-80	NOV-79	OCT-79	SEP-79

DAMES AND MOORE

EXCURSIONS FROM TEMPERATURE ENVELOPE FOR JULY 79 - JUNE 80

WELL NUMBER 10-E

0459804726 (7/80)



LEGEND

APR-80 JAN-80 JUN-80 MAR-80

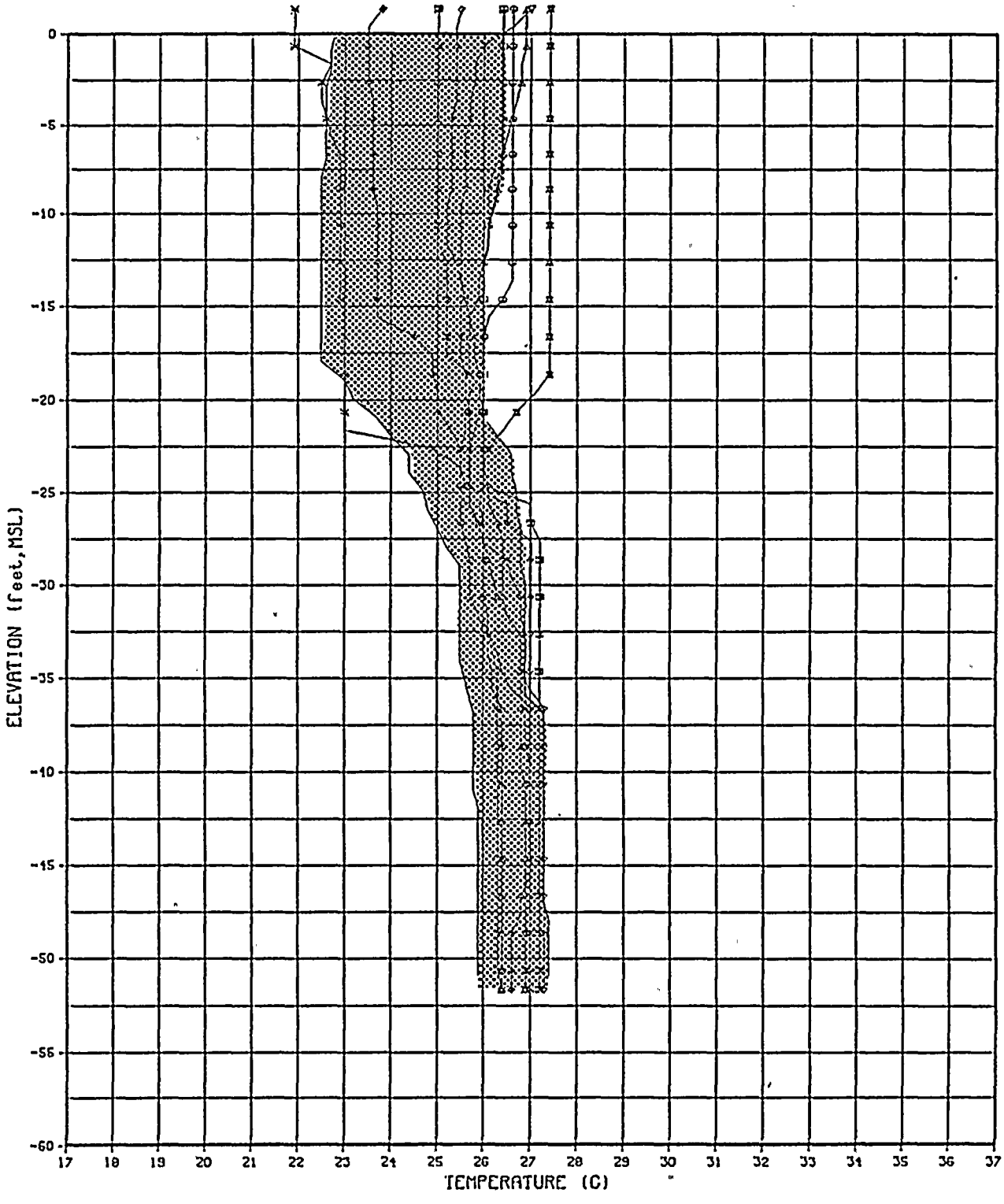
NOV-79 OCT-79

DAMES AND MOORE

EXCURSIONS FROM TEMPERATURE ENVELOPE FOR JULY 79 - JUNE 80

WELL NUMBER L-1

0459804726 (7/80)



LEGEND

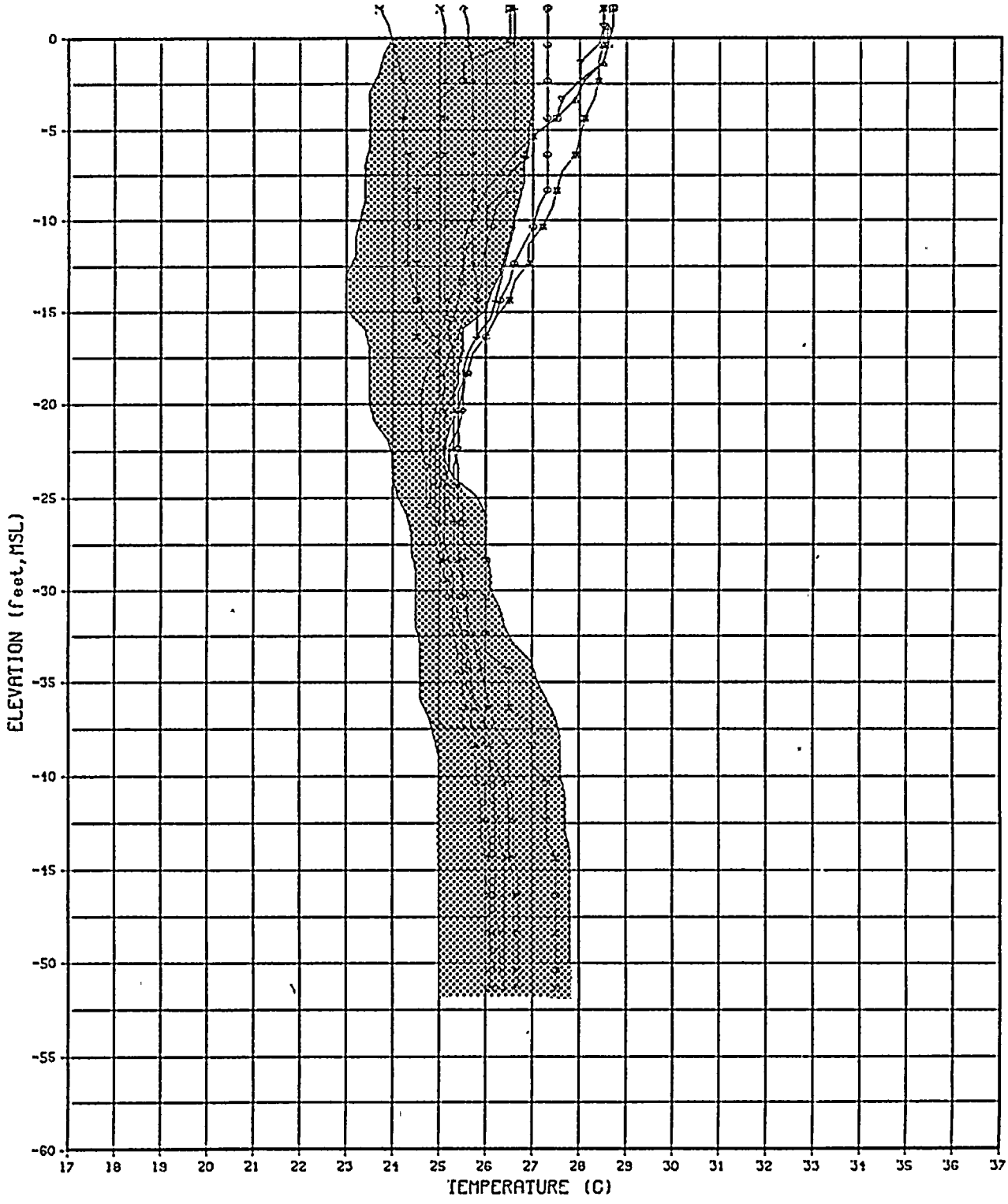
△ AUG-79	◇ JAN-80	▽ JUL-79	▫ JUN-80
× MAR-80	◆ MAY-80	○ NOV-79	⧈ OCT-79
▣ SEP-79			

DAMES AND MOORE

EXCURSIONS FROM TEMPERATURE ENVELOPE FOR JULY 79 - JUNE 80

WELL NUMBER L-2

0459804726 (7/80)



LEGEND

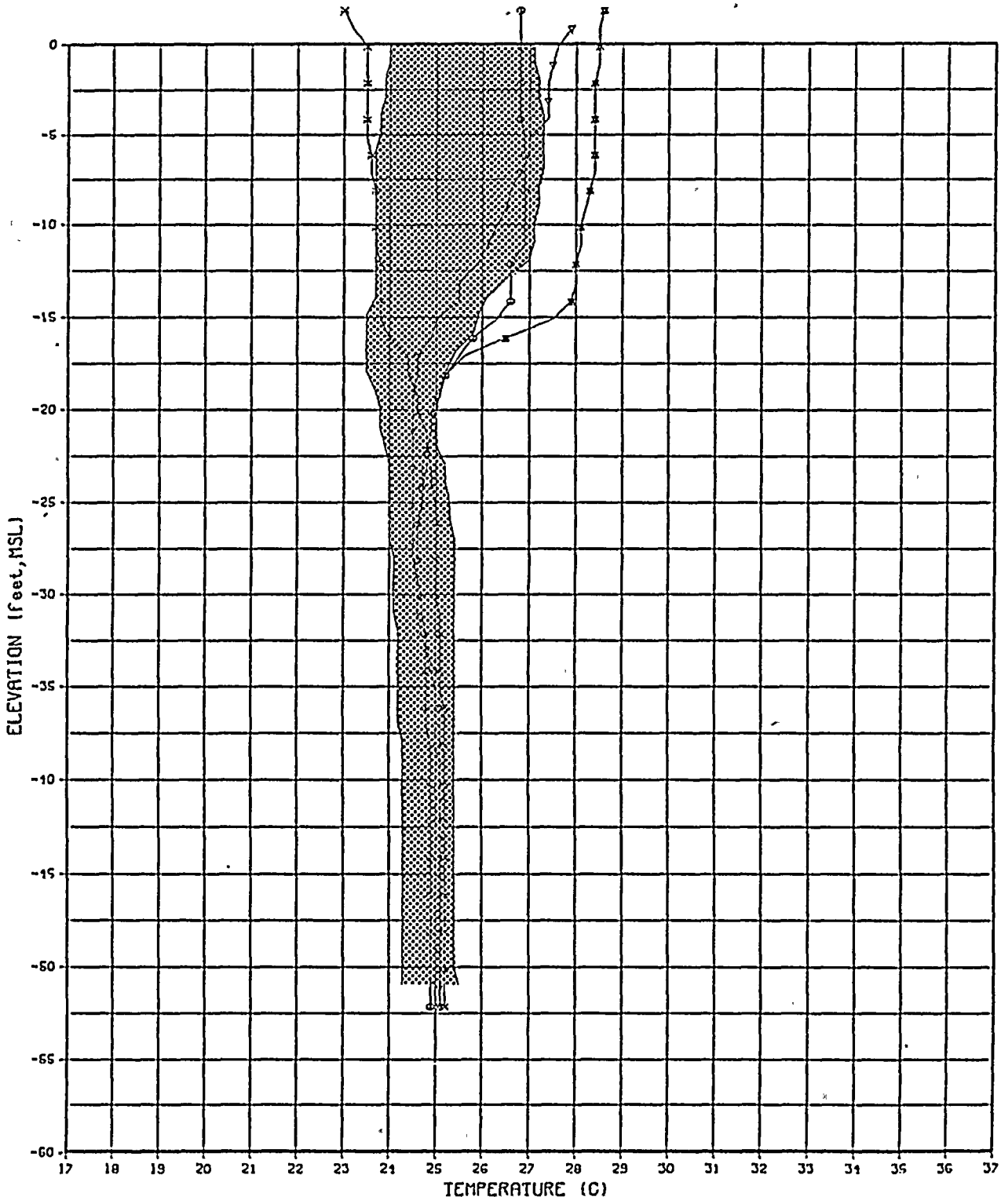
△ AUG-79	+ DEC-79	× FEB-80	◇ JAN-80
▽ JUL-79	⊠ JUN-80	⋋ MAR-80	⊛ NOV-79
⊡ OCT-79	⊞ SEP-79		

DAMES AND MOORE

EXCURSIONS FROM TEMPERATURE ENVELOPE FOR JULY 79 - JUNE 80

WELL NUMBER L-3

0459804726 (7/80)



LEGEND

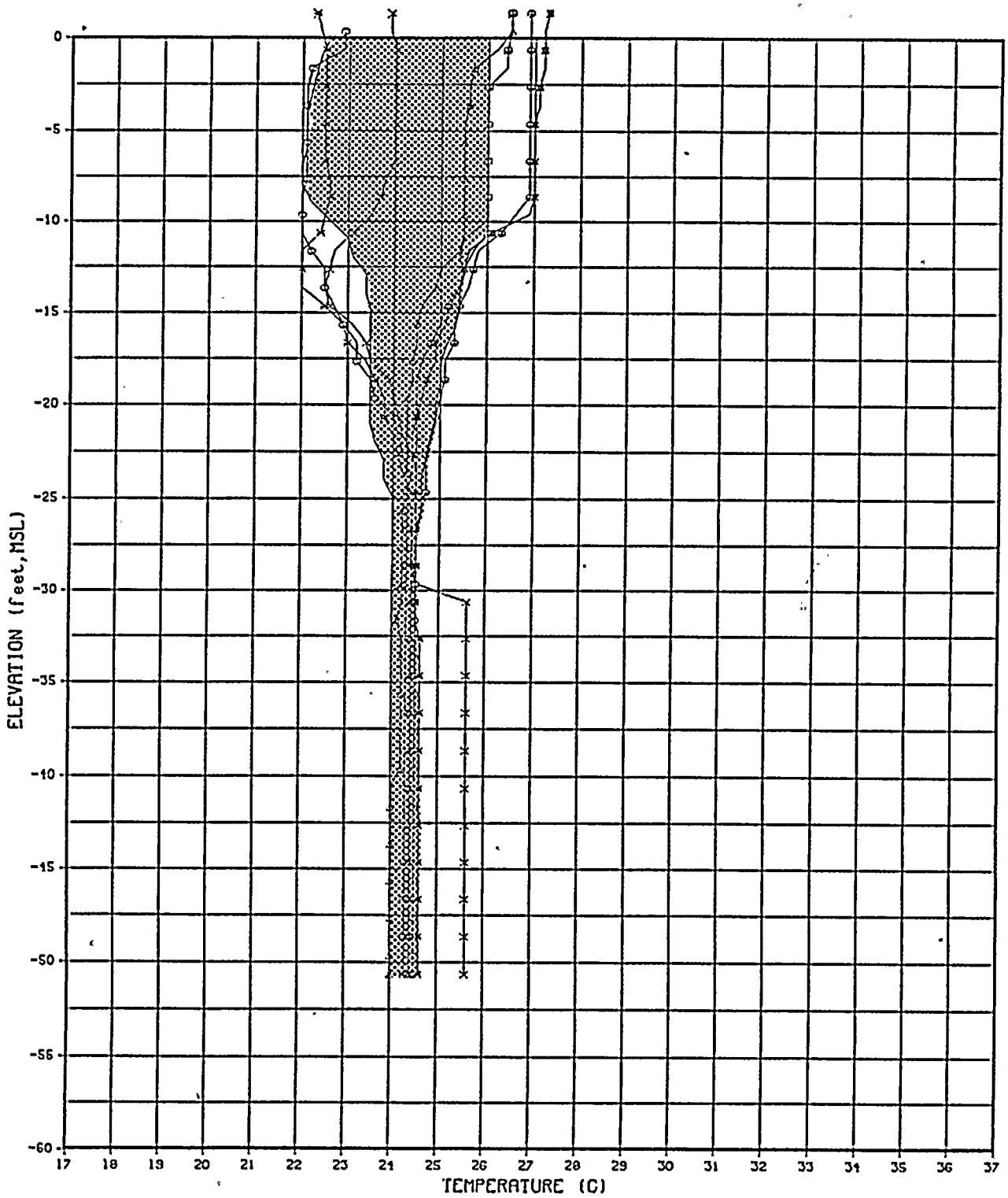
▽ JUL-79 × MAR-80 ○ NOV-79 ▫ OCT-79

DAMES AND MOORE

EXCURSIONS FROM TEMPERATURE ENVELOPE FOR JULY 79 - JUNE 80

WELL NUMBER L-4

0459804726 (7/80)



LEGEND

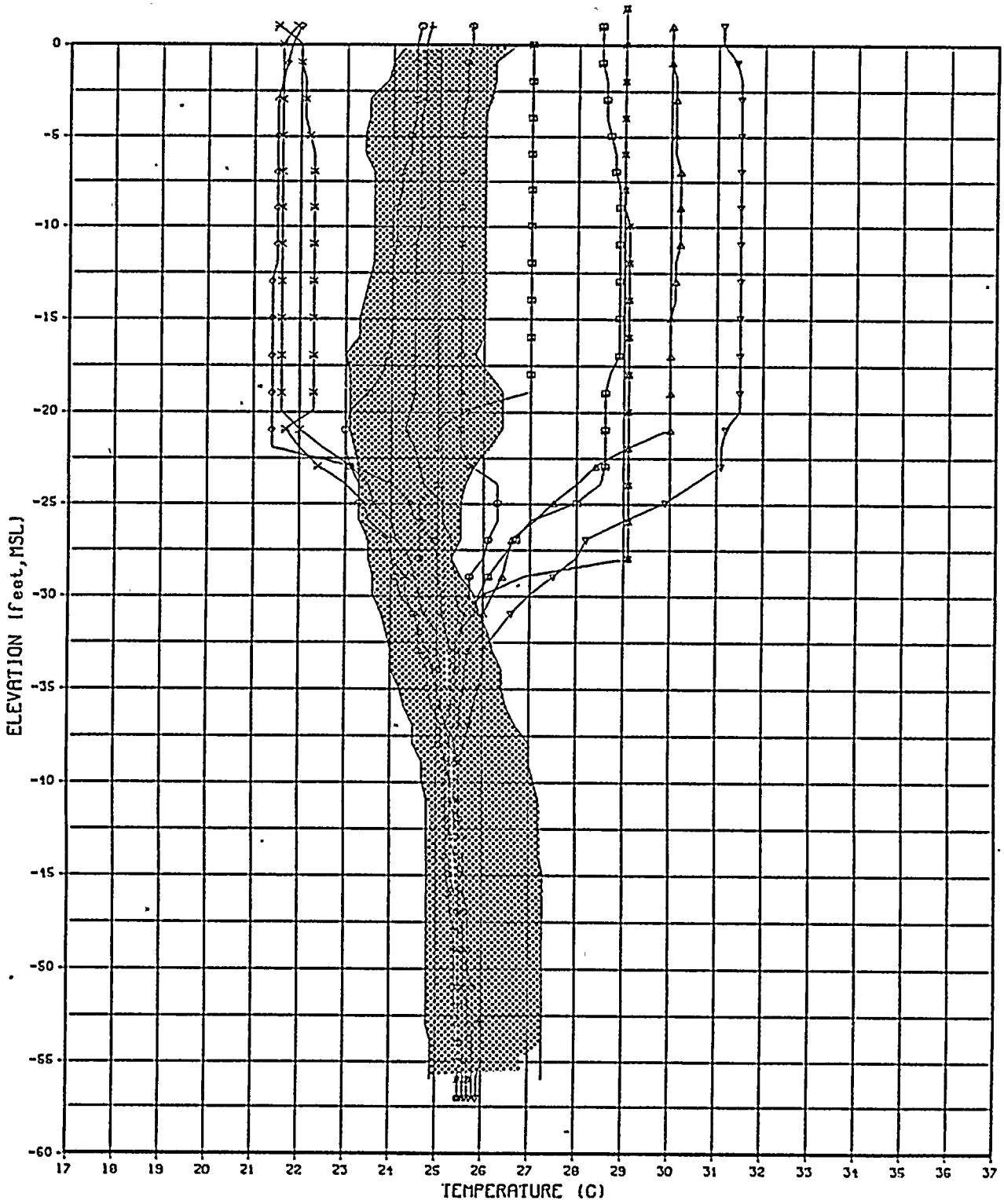
○ APR-80	△ AUG-79	× FEB-80	✳ MAR-80
⊙ NOV-79	⊠ OCT-79	⊟ SEP-79	

DAMES AND MOORE

EXCURSIONS FROM TEMPERATURE ENVELOPE FOR JULY 79 - JUNE 80

WELL NUMBER L-5

0459804726 (7/80)



LEGEND

APR-80	AUG-79	DEC-79	FEB-80
JAN-80	JUL-79	JUN-80	MAR-80
NOV-79	OCT-79	SEP-79	

DAMES AND MOORE

EXCURSIONS FROM TEMPERATURE ENVELOPE FOR JULY 79 - JUNE 80

WELL NUMBER L-6

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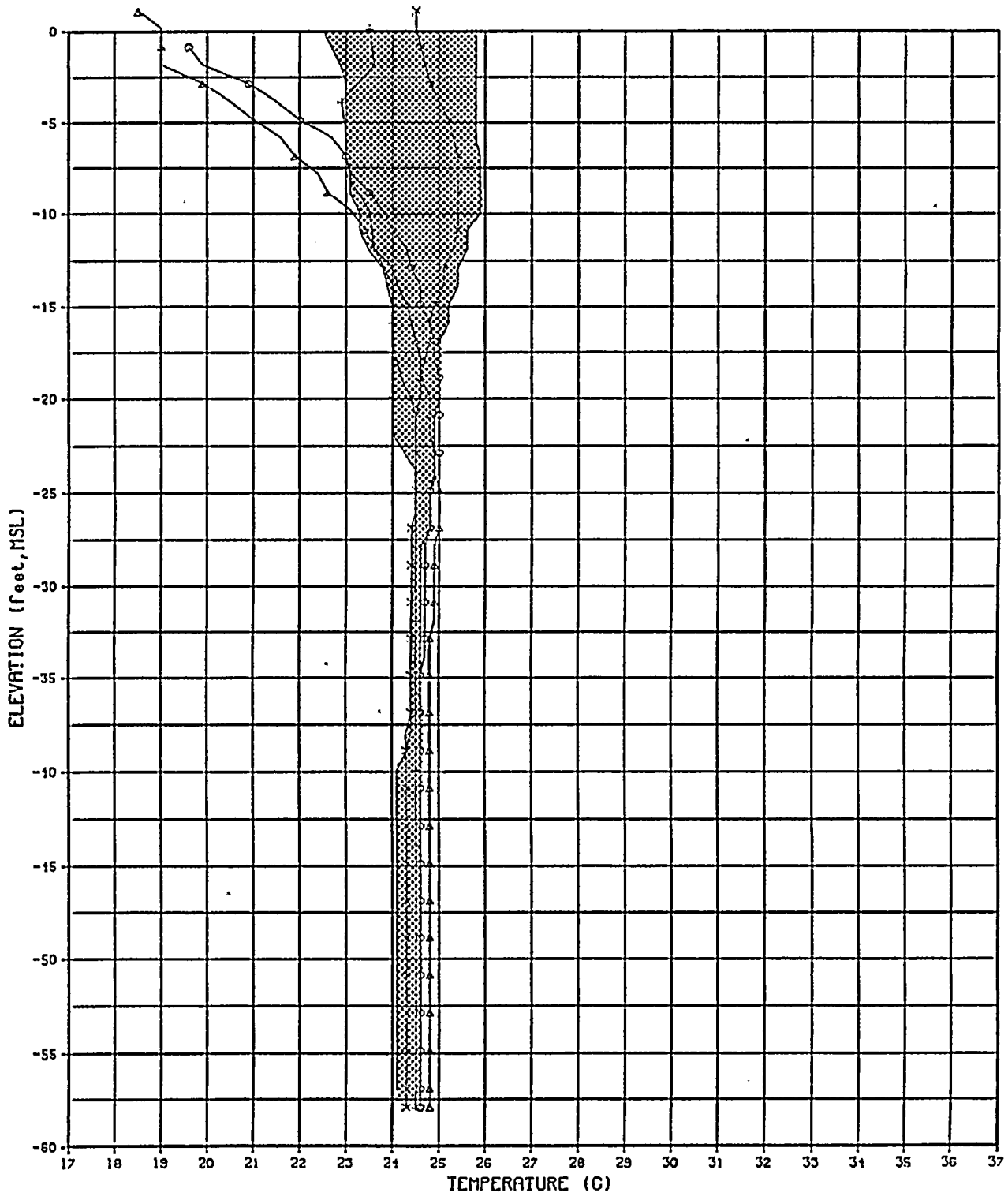


LEGEND

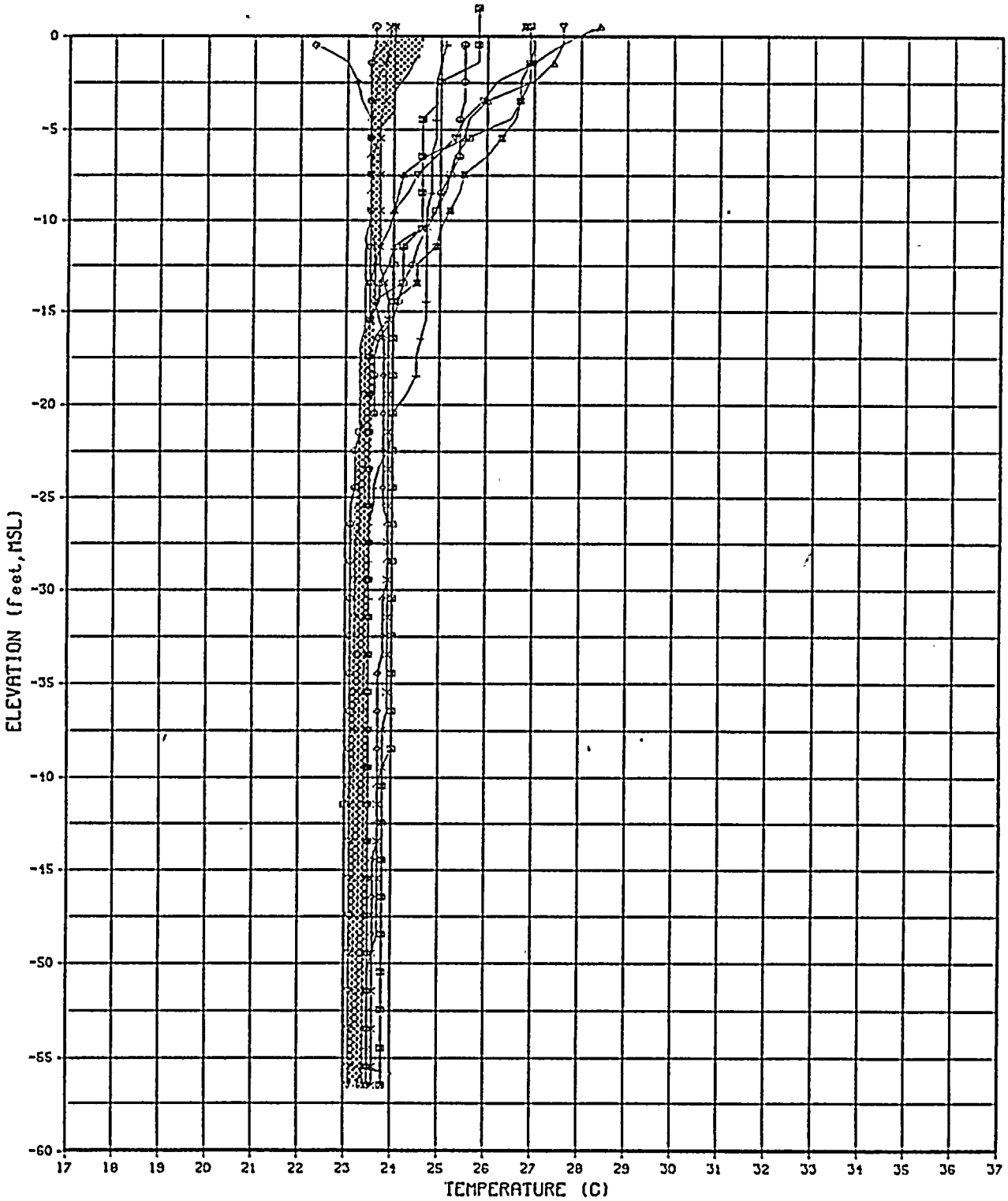
○ JAN-80 △ MAR-80 + MAY-80 × NOV-79

DAMES AND MOORE

EXCURSIONS FROM TEMPERATURE ENVELOPE FOR JULY 79 - JUNE 80

WELL NUMBER G-6

0459804726 (7/80)



LEGEND

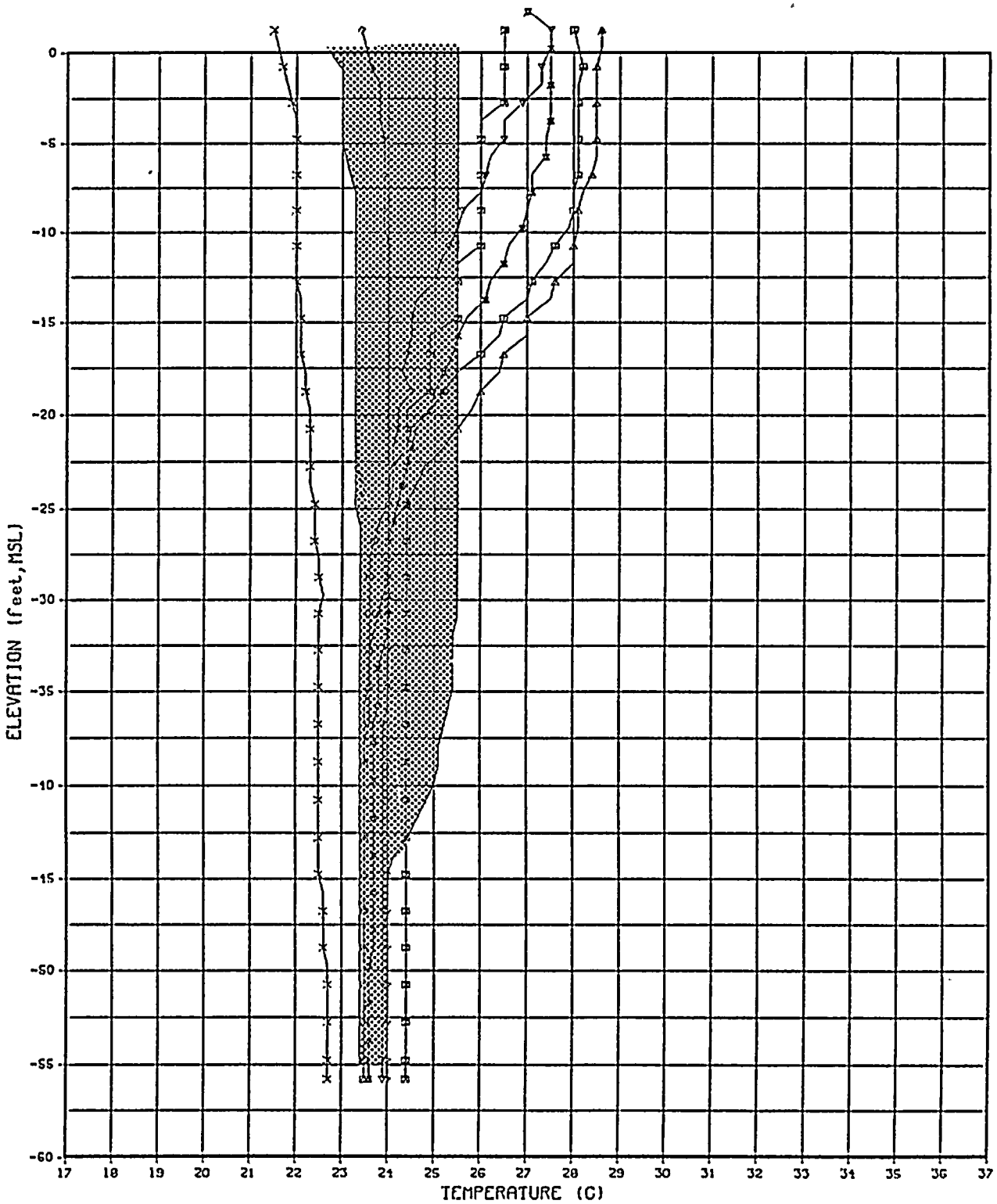
APR-80	AUG-79	DEC-79	FEB-80
JAN-80	JUL-79	JUN-80	MAR-80
MAY-80	NOV-79	OCT-79	SEP-79

DAMES AND MOORE

EXCURSIONS FROM TEMPERATURE ENVELOPE FOR JULY 79 - JUNE 80

WELL NUMBER G-14

0459804726 (7/80)



LEGEND

△ AUG-79 × FEB-80 ◇ JAN-80 ▽ JUL-79

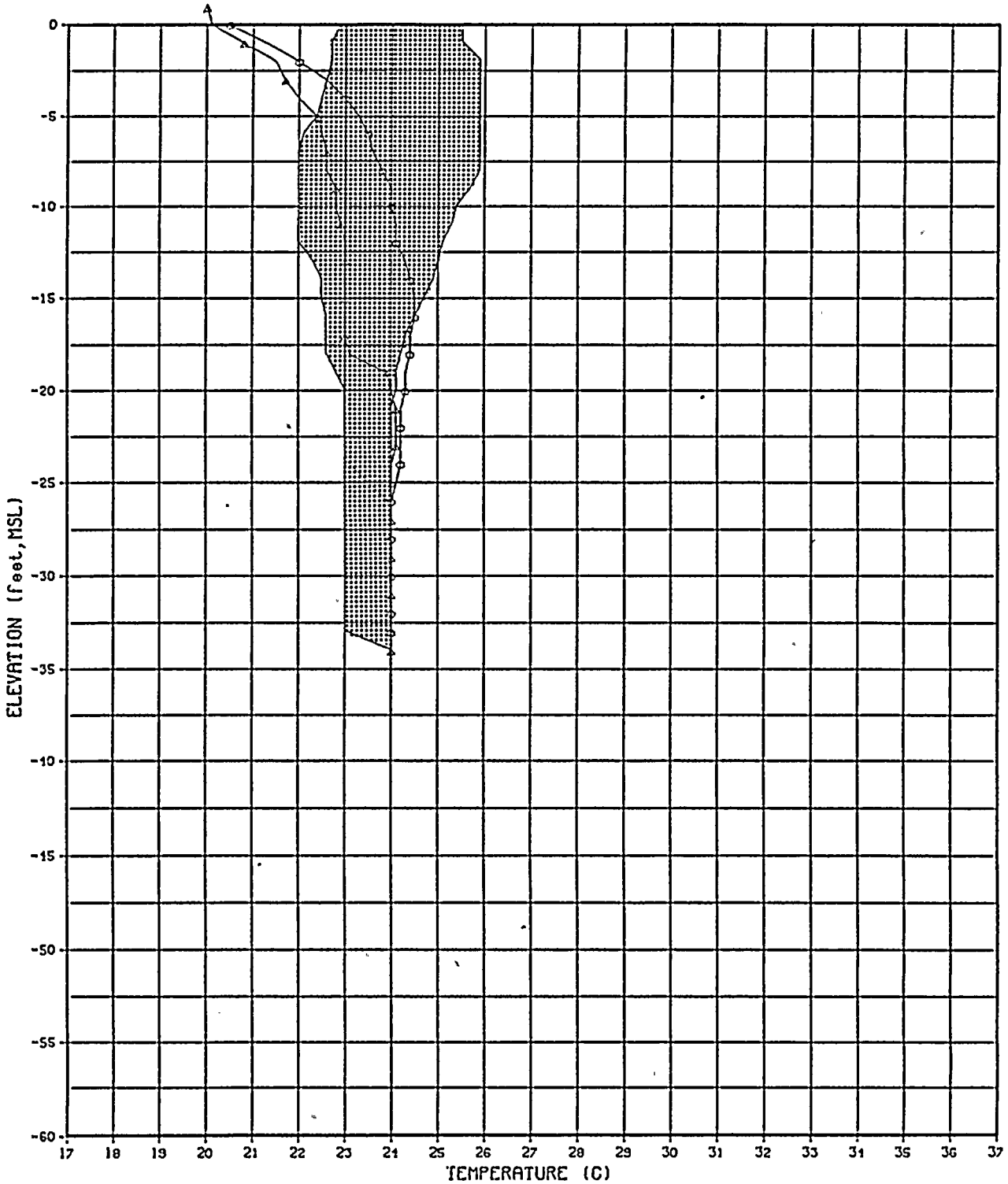
⊠ JUN-80 ⊠ OCT-79 ⊡ SEP-79

DAMES AND MOORE

EXCURSIONS FROM TEMPERATURE ENVELOPE FOR JULY 79 - JUNE 80

WELL NUMBER G-21

0459804726 (7/80)



LEGEND

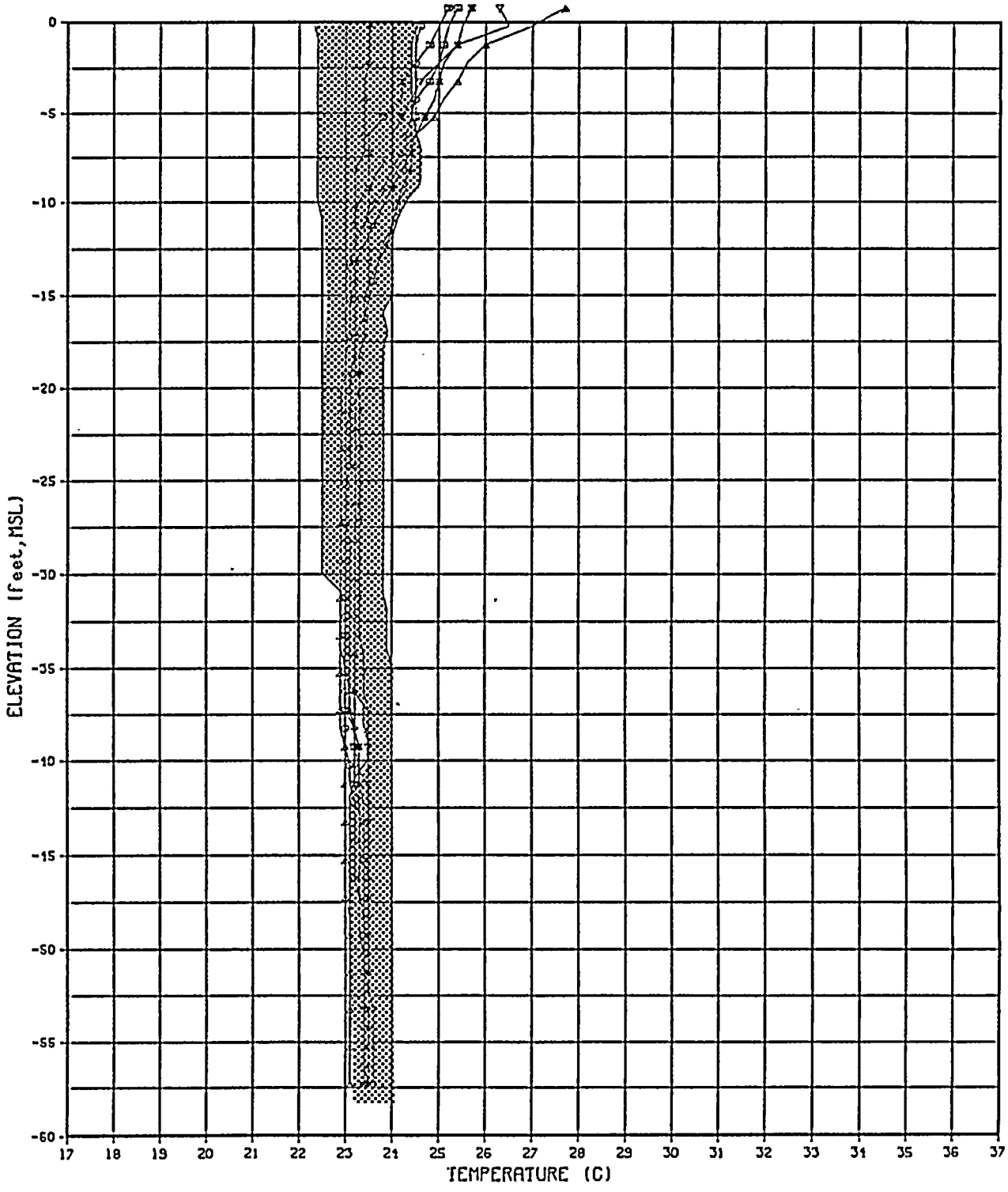
○ JAN-80 △ MAR-80

DAMES AND MOORE

EXCURSIONS FROM TEMPERATURE ENVELOPE FOR JULY 79 - JUNE 80

WELL NUMBER G-27

0459804726 (7/80)



LEGEND

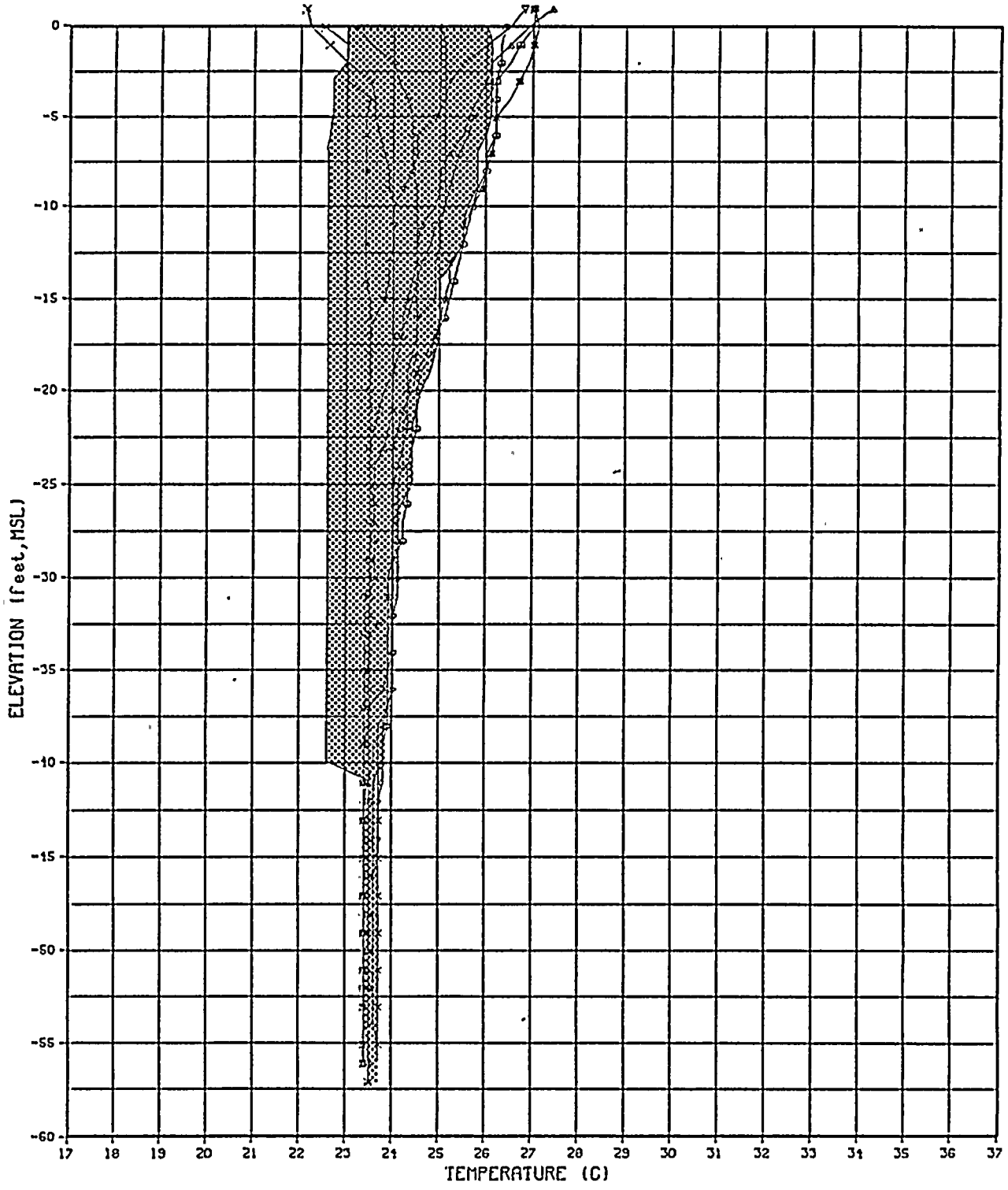
△ AUG-79	+ DEC-79	▽ JUL-79	▫ JUN-80
◆ MAY-80	○ NOV-79	✕ OCT-79	▫ SEP-79

DAMES AND MOORE

EXCURSIONS FROM TEMPERATURE ENVELOPE FOR JULY 79 - JUNE 80

WELL NUMBER G-28

0459804726 (7/80)



LEGEND

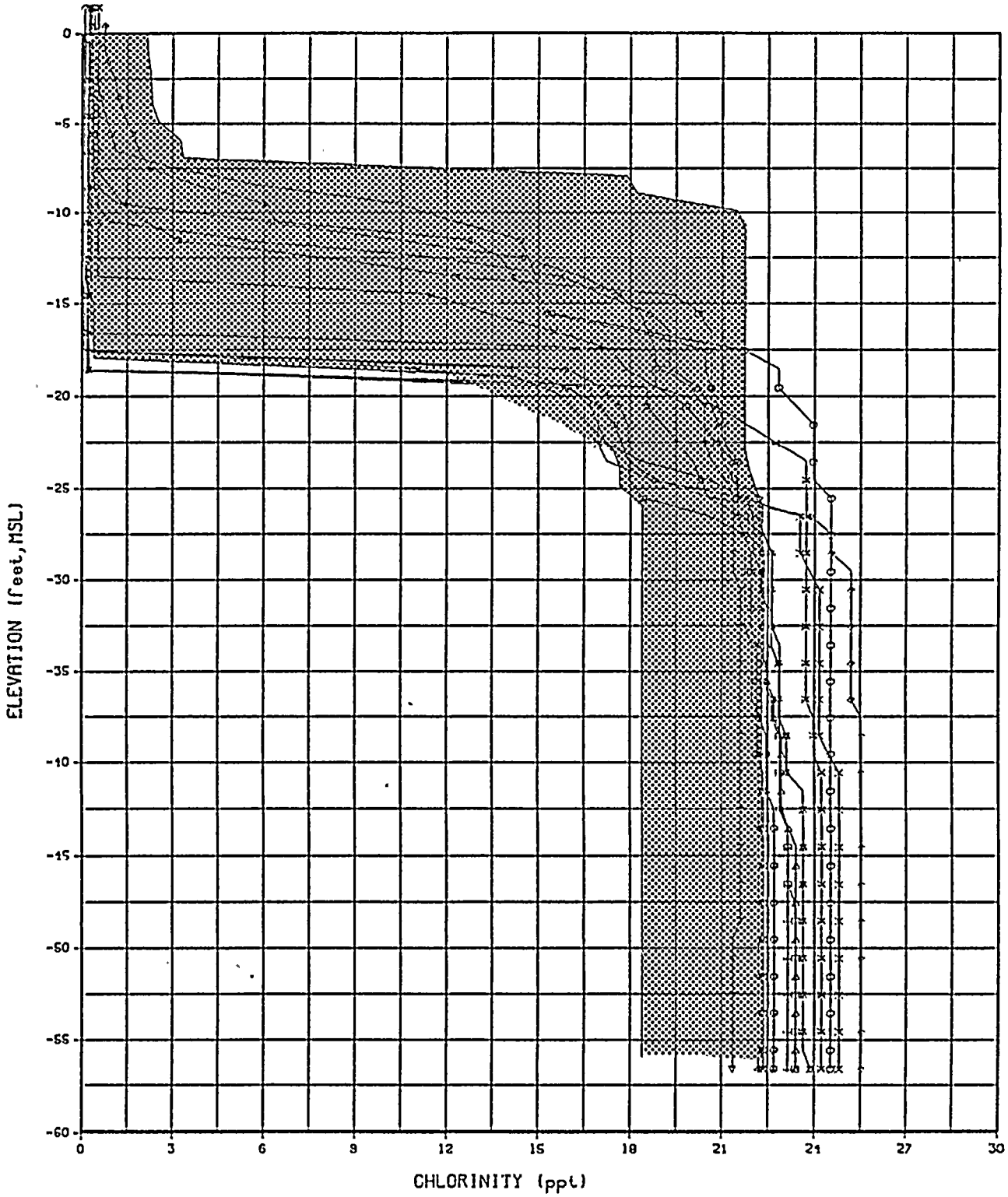
△ AUG-79	+ DEC-79	× FEB-80	◇ JAN-80
▽ JUL-79	* MAR-80	○ NOV-79	⧗ OCT-79
▣ SEP-79			

DAMES AND MOORE

EXCURSIONS FROM TEMPERATURE ENVELOPE FOR JULY 79 - JUNE 80

WELL NUMBER G-35

0459804726 (7/80)



LEGEND

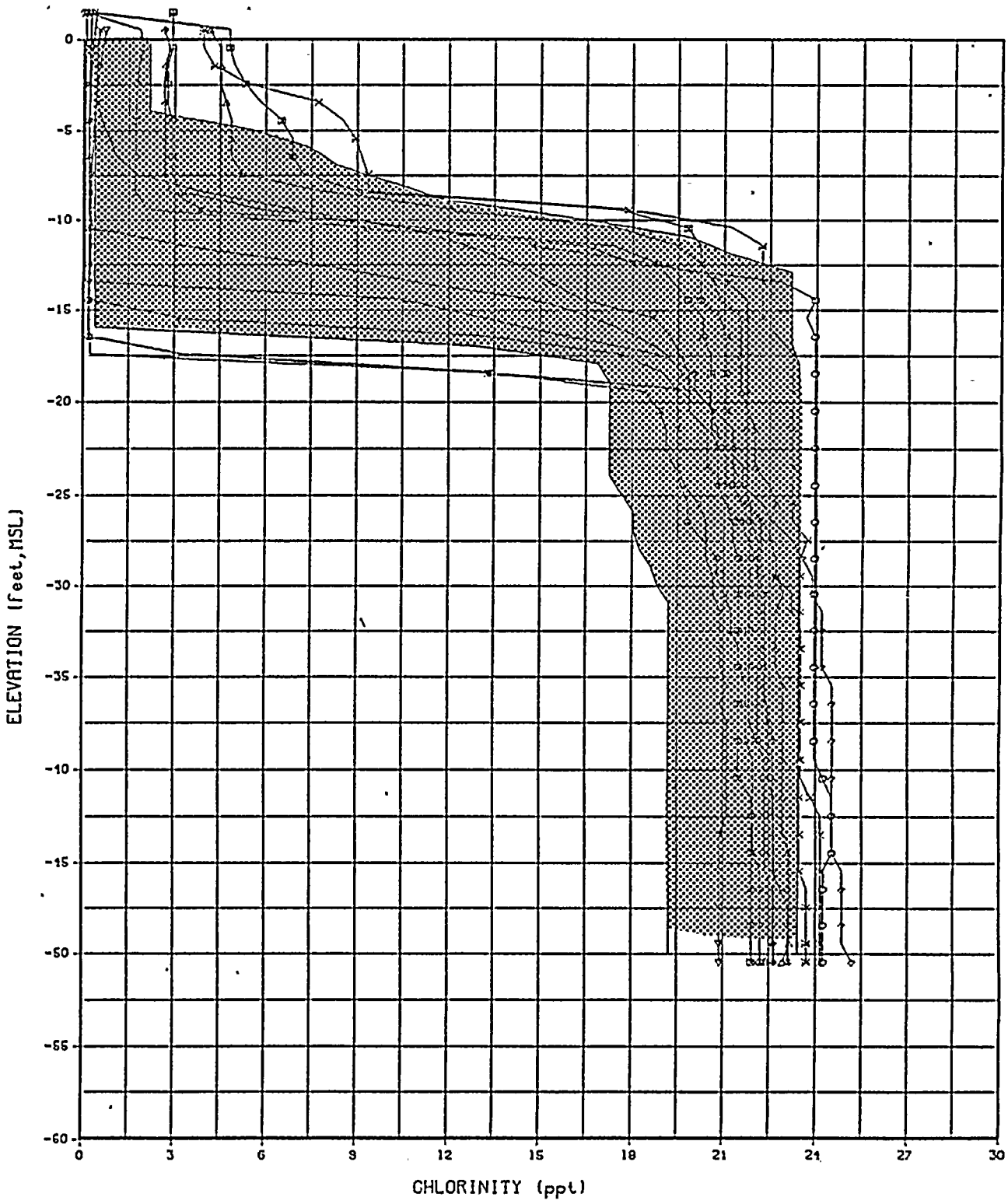
APR-80	AUG-79	DEC-79	FEB-80
JAN-80	JUL-79	JUN-80	MAR-80
MAY-80	NOV-79	OCT-79	SEP-79

DAMES AND MOORE

EXCURSIONS FROM CHLORINITY ENVELOPE FOR JULY 79 - JUNE 80

WELL NUMBER ID-A

0459804726 (7/80)



LEGEND

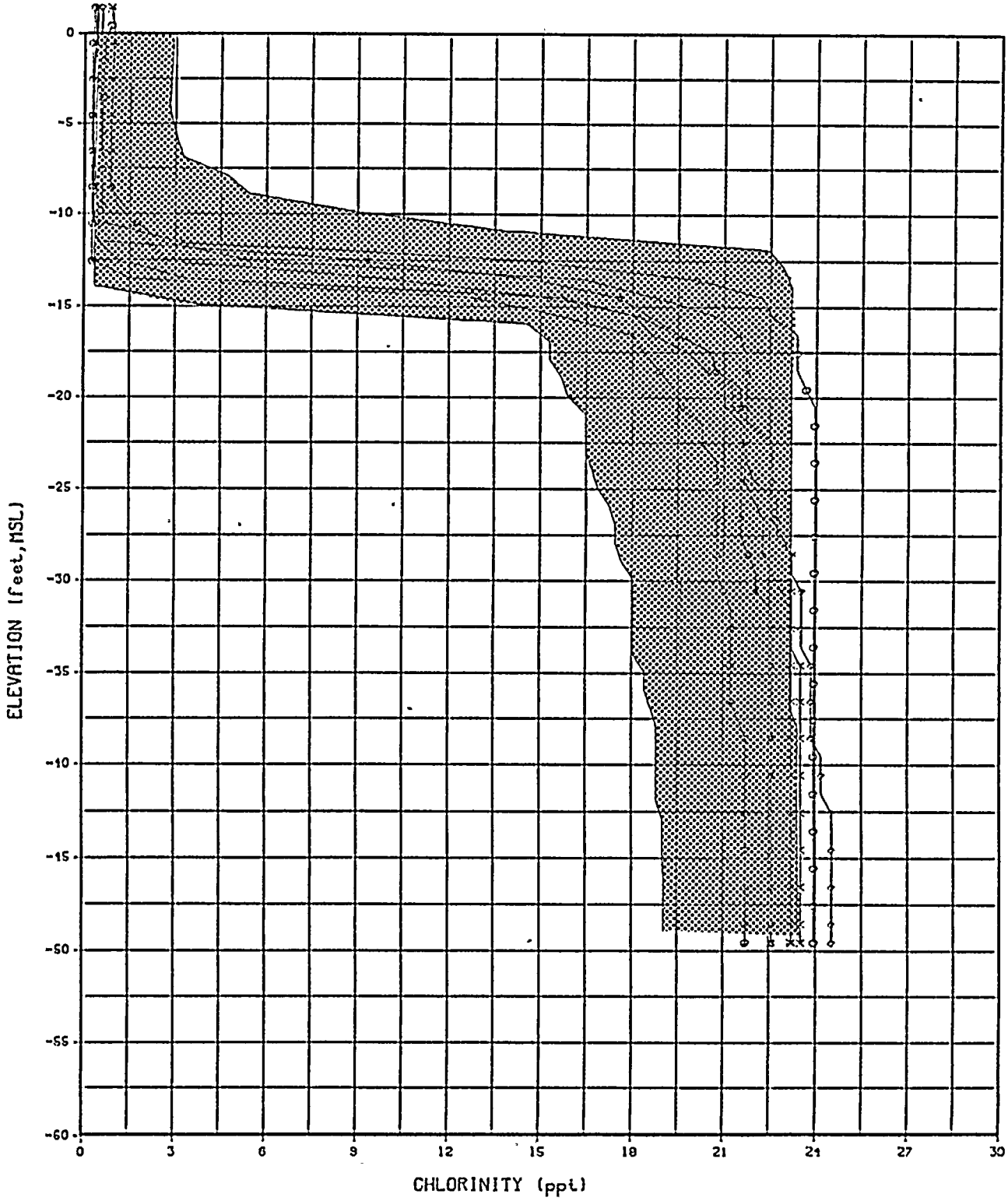
○ APR-Y	△ AUG-79	+ DEC-79	× FEB-80
◇ JAN-80	▽ JUL-79	⊞ JUN-80	✳ MAR-80
◆ MAY-80	⊙ NOV-79	⊠ OCT-79	⊡ SEP-79

DAMES AND MOORE

EXCURSIONS FROM CHLORINITY ENVELOPE FOR JULY 79 - JUNE 80

WELL NUMBER ID-B

0459804726 (7/80)



LEGEND

° APR-80 × FEB-80 ° JAN-80 × MAR-80

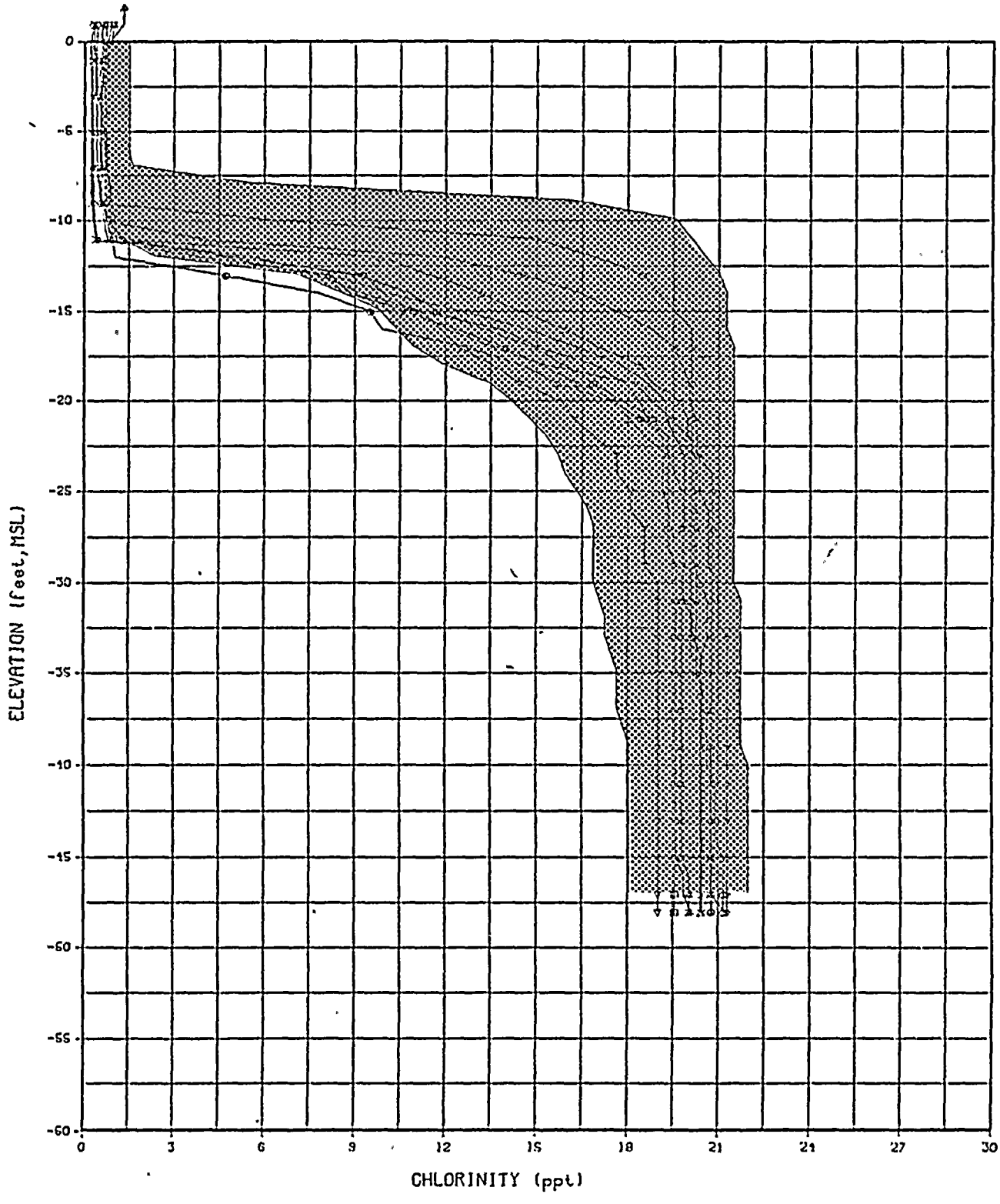
° NOV-79 ¤ OCT-79

DAMES AND MOORE

EXCURSIONS FROM CHLORINITY ENVELOPE FOR JULY 79 - JUNE 80

WELL NUMBER 10-C

0459804726 (7/80)



LEGEND

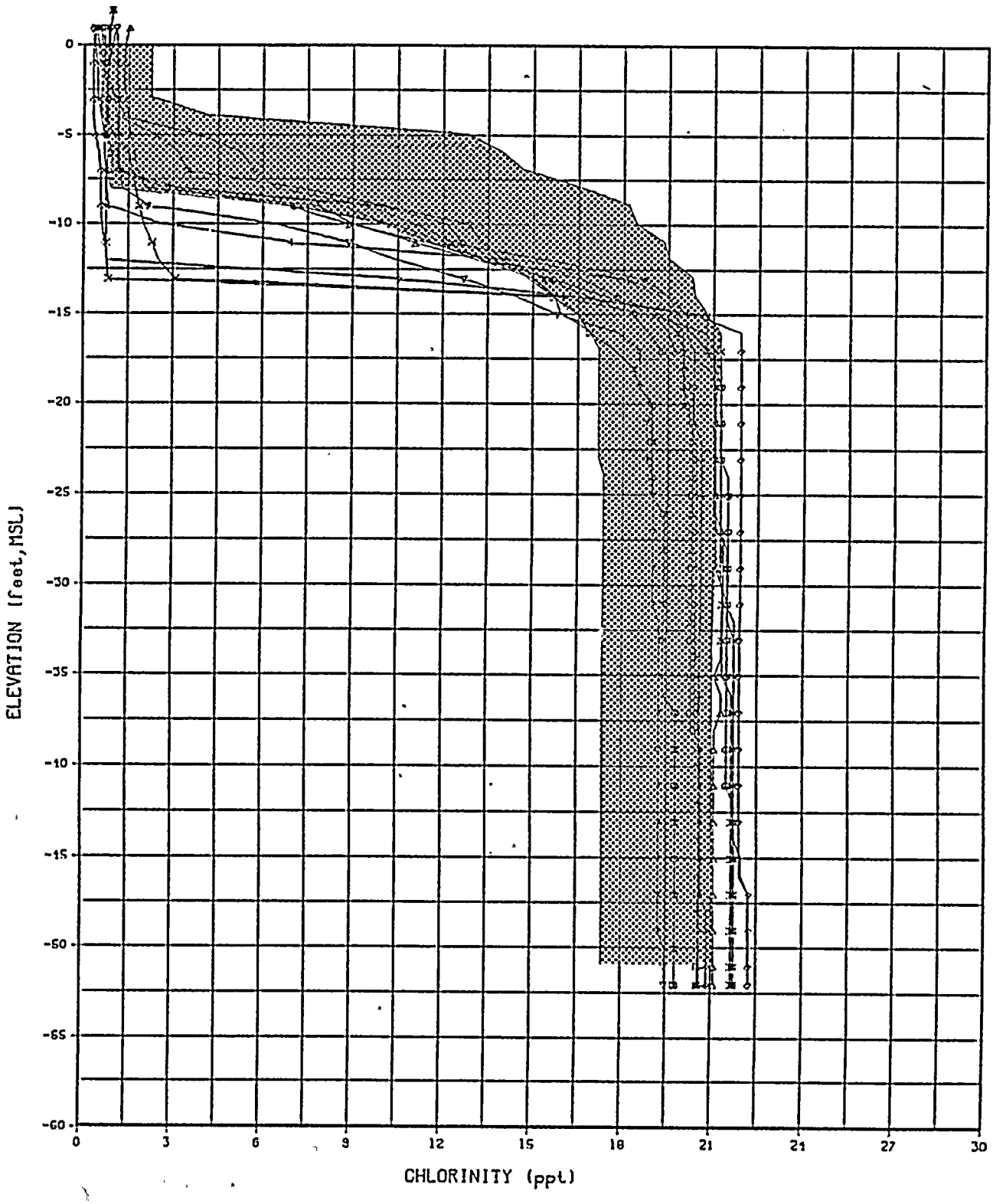
APR-80	AUG-79	DEC-79	FEB-80
JAN-80	JUL-79	MAR-80	NOV-79
OCT-79	SEP-79		

DAMES AND MOORE

EXCURSIONS FROM CHLORINITY ENVELOPE FOR JULY 79 - JUNE 80

WELL NUMBER ID-D

0459804726 (7/80)



LEGEND

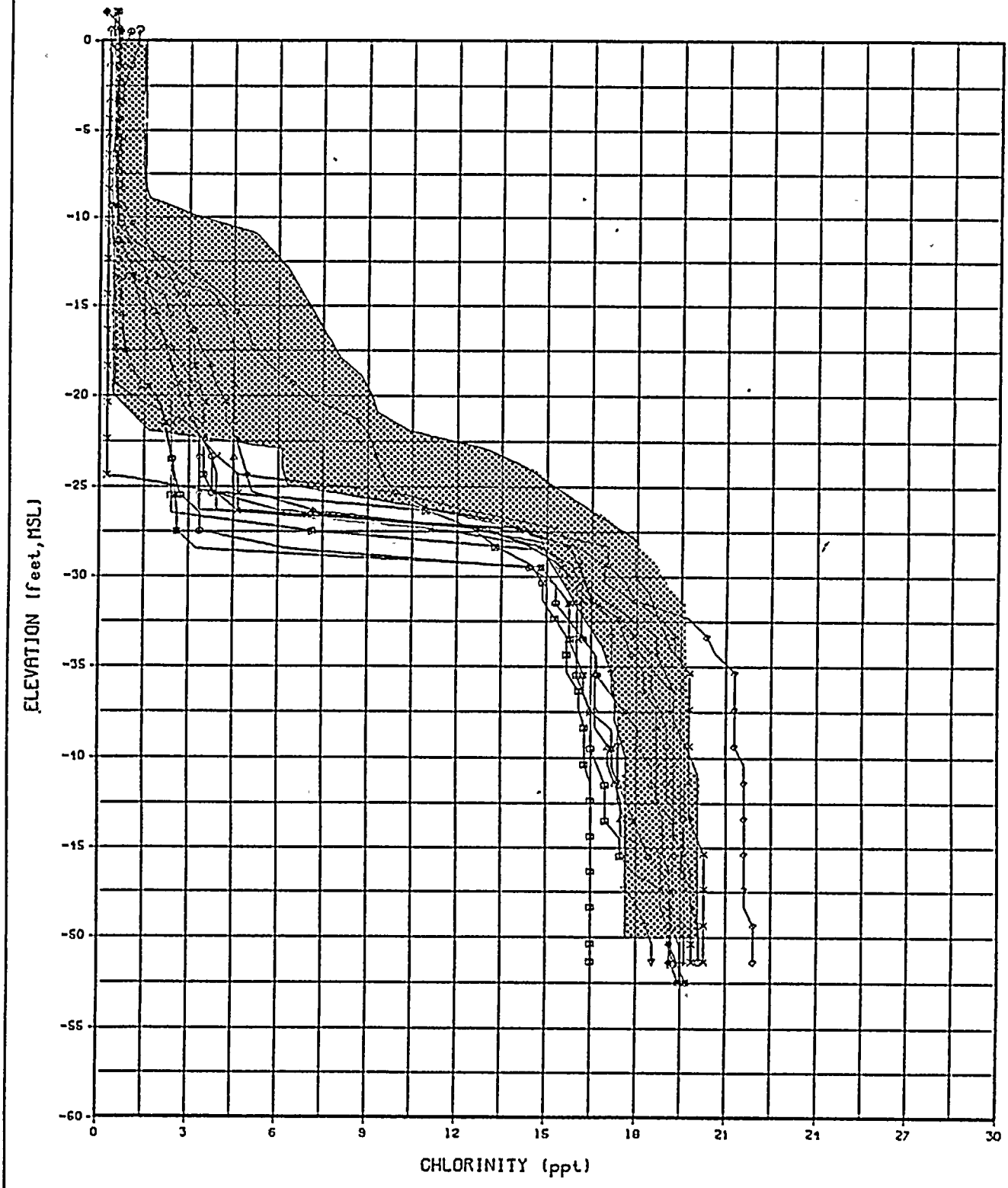
△ AUG-79	+ DEC-79	× FEB-80	○ JAN-80
▽ JUL-79	⊠ JUN-80	✳ MAR-80	◆ MAY-80
⊕ NOV-79	⊞ OCT-79	⊡ SEP-79	

DAMES AND MOORE

EXCURSIONS FROM CHLORINITY ENVELOPE FOR JULY 79 - JUNE 80

WELL NUMBER ID-E

0159804726 (7/80)



LEGEND

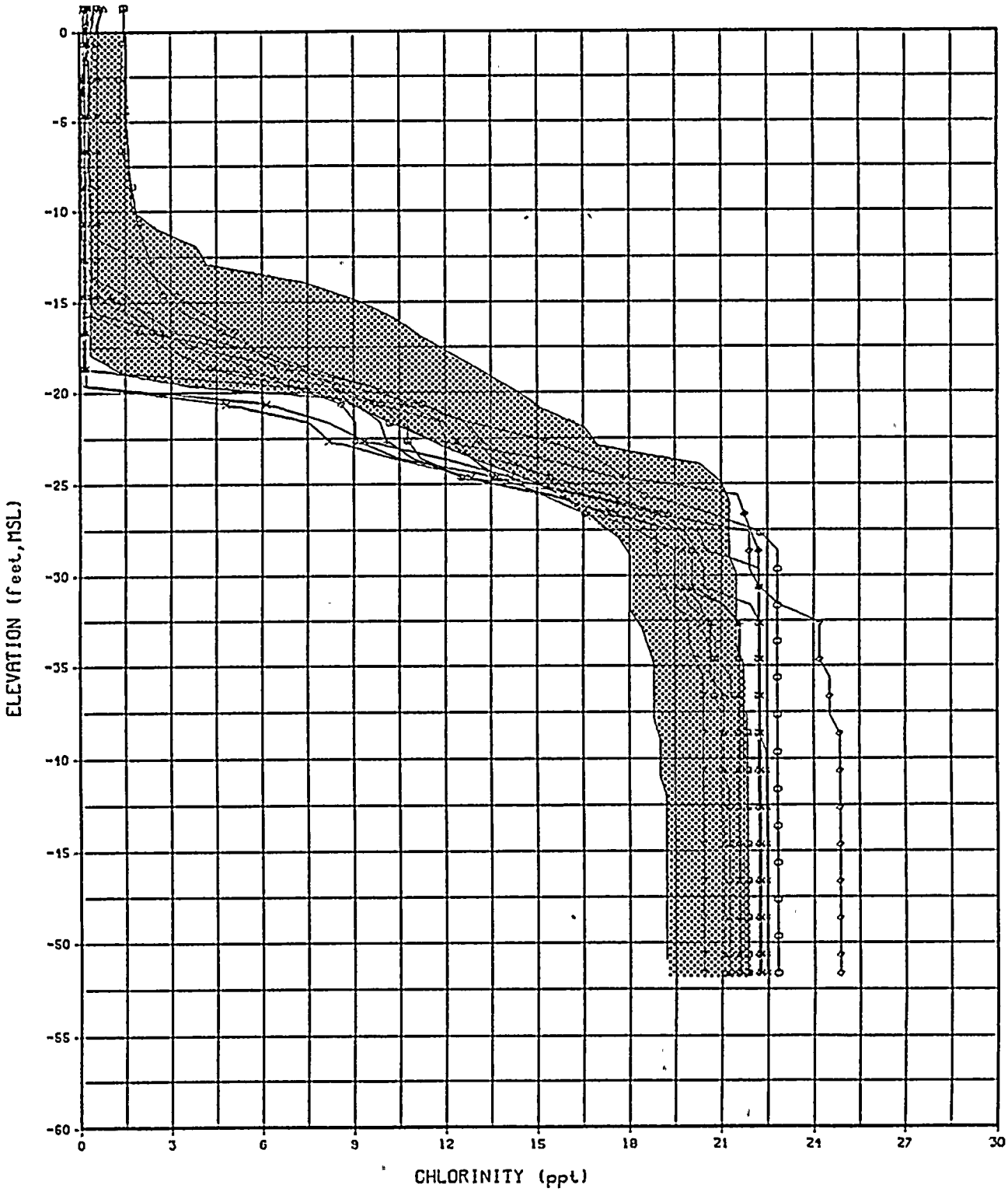
○ APR-80	△ AUG-79	+ DEC-79	× FEB-80
◇ JAN-80	▽ JUL-79	⊠ JUN-80	× MAR-80
(MAY-80	⊕ NOV-79	⊡ OCT-79	⊟ SEP-79

DAMES AND MOORE

EXCURSIONS FROM CHLORINITY ENVELOPE FOR JULY 79 - JUNE 80

WELL NUMBER L-1

0459804726 (7/80)



LEGEND

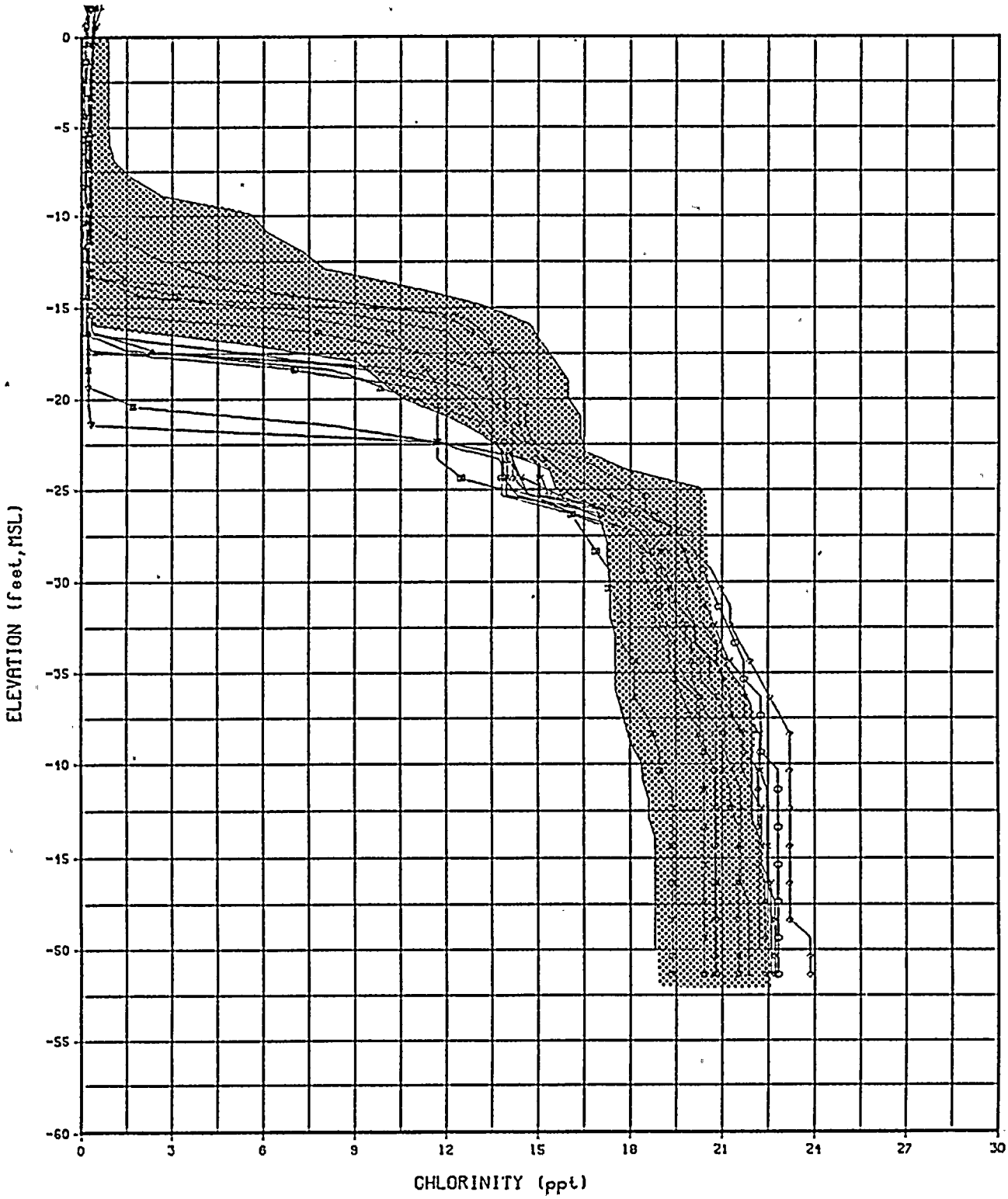
○ APR-80	△ AUG-79	+ DEC-79	× FEB-80
◇ JAN-80	▽ JUL-79	* MAR-80	◆ MAY-80
⊕ NOV-79	⊠ OCT-79	⊡ SEP-79	

DAMES AND MOORE

EXCURSIONS FROM CHLORINITY ENVELOPE FOR JULY 79 - JUNE 80

WELL NUMBER L-2

0459804726 (7/80)



LEGEND

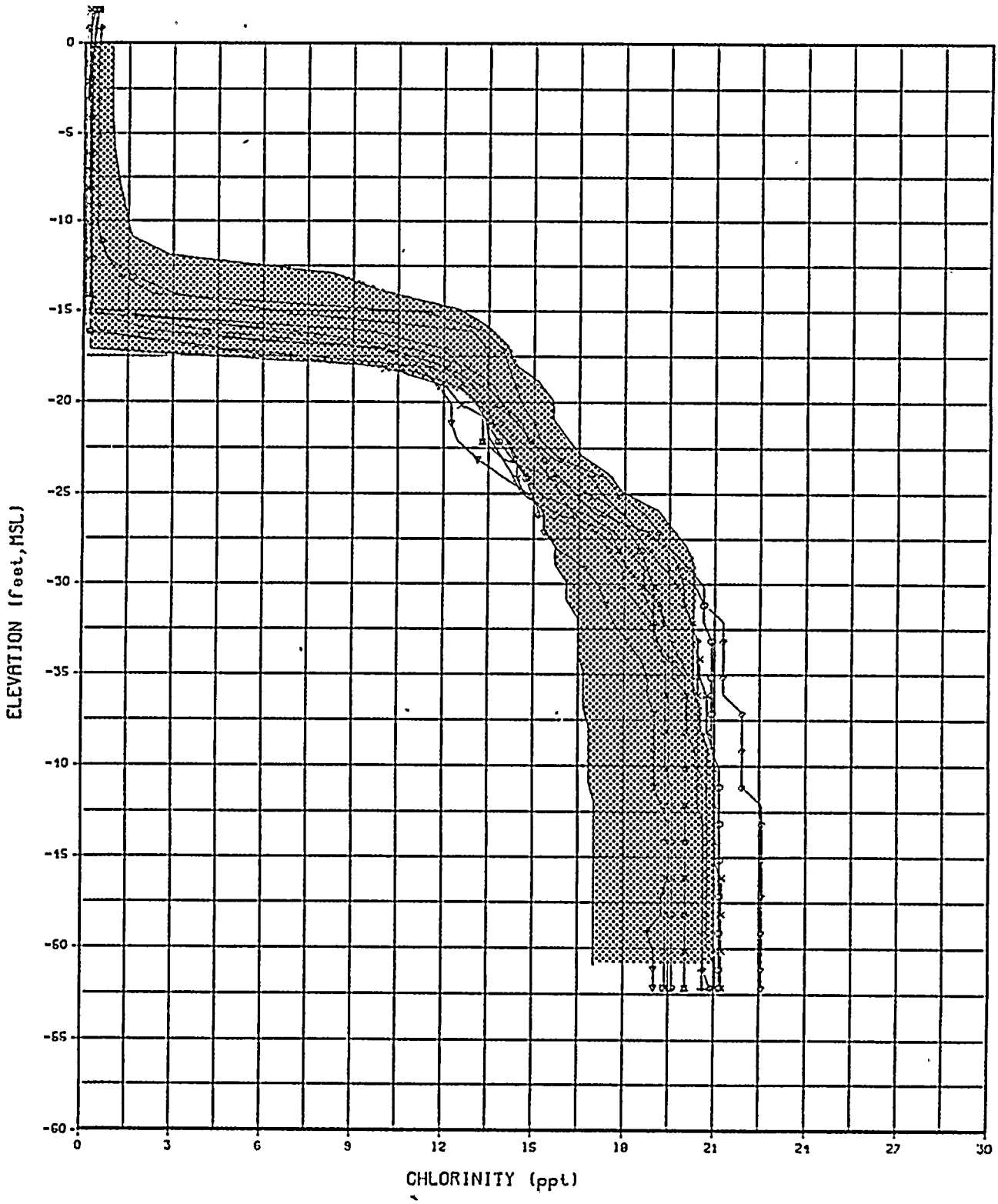
○ APR-80	△ AUG-79	+ DEC-79	× FEB-80
◇ JAN-80	▽ JUL-79	⊠ JUN-80	⋈ MAR-80
◆ MAY-80	⊙ NOV-79	⊡ OCT-79	⊞ SEP-79

DAMES AND MOORE

EXCURSIONS FROM CHLORINITY ENVELOPE FOR JULY 79 - JUNE 80

WELL NUMBER L-3

0459804726 (7/80)



LEGEND

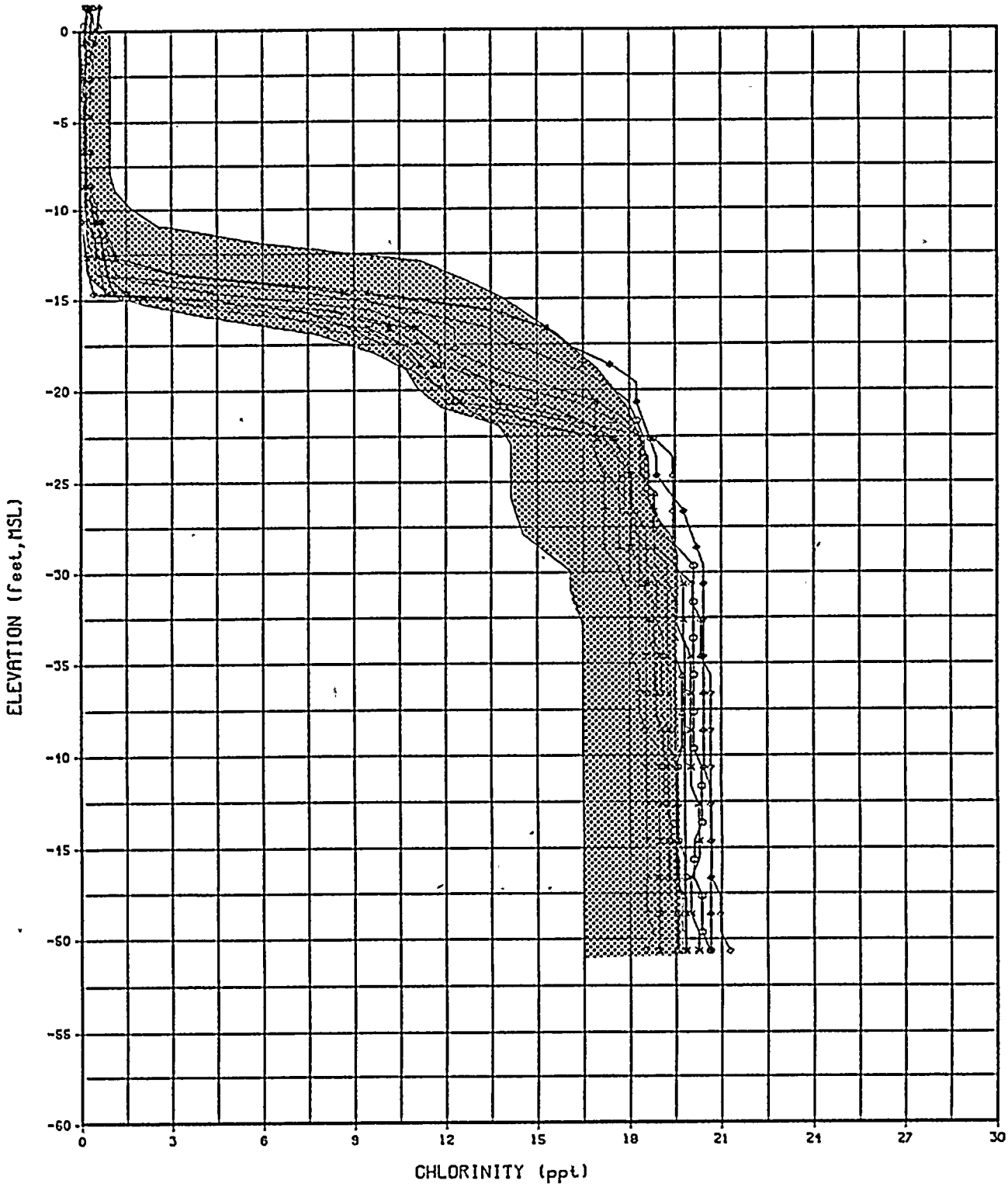
○ APR-80	+ DEC-79	× FEB-80	◇ JAN-80
▽ JUL-79	⊠ JUN-80	× MAR-80	◆ MAY-80
⊙ NOV-79	⊡ OCT-79		

DAMES AND MOORE

EXCURSIONS FROM CHLORINITY ENVELOPE FOR JULY 79 - JUNE 80

WELL NUMBER L-4

0459804726 (7/80)



LEGEND

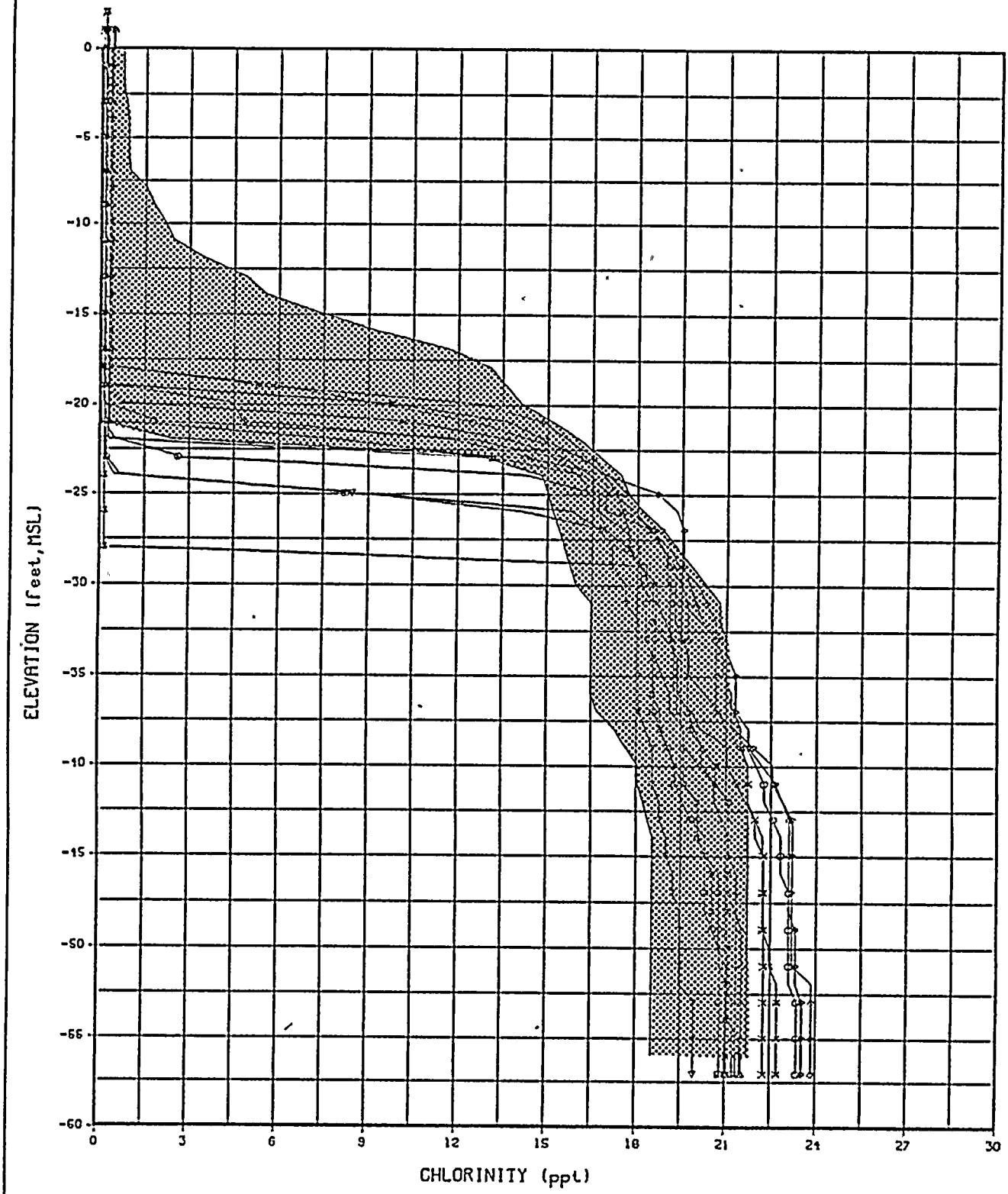
○ APR-80	△ AUG-79	+ DEC-79	× FEB-80
◇ JAN-80	▽ JUL-79	⊞ JUN-80	× MAR-80
• MAY-80	⊙ NOV-79	⊡ OCT-79	⊠ SEP-79

DAMES AND MOORE

EXCURSIONS FROM CHLORINITY ENVELOPE FOR JULY 79 - JUNE 80

WELL NUMBER L-5

0459804726 (7/80)



LEGEND

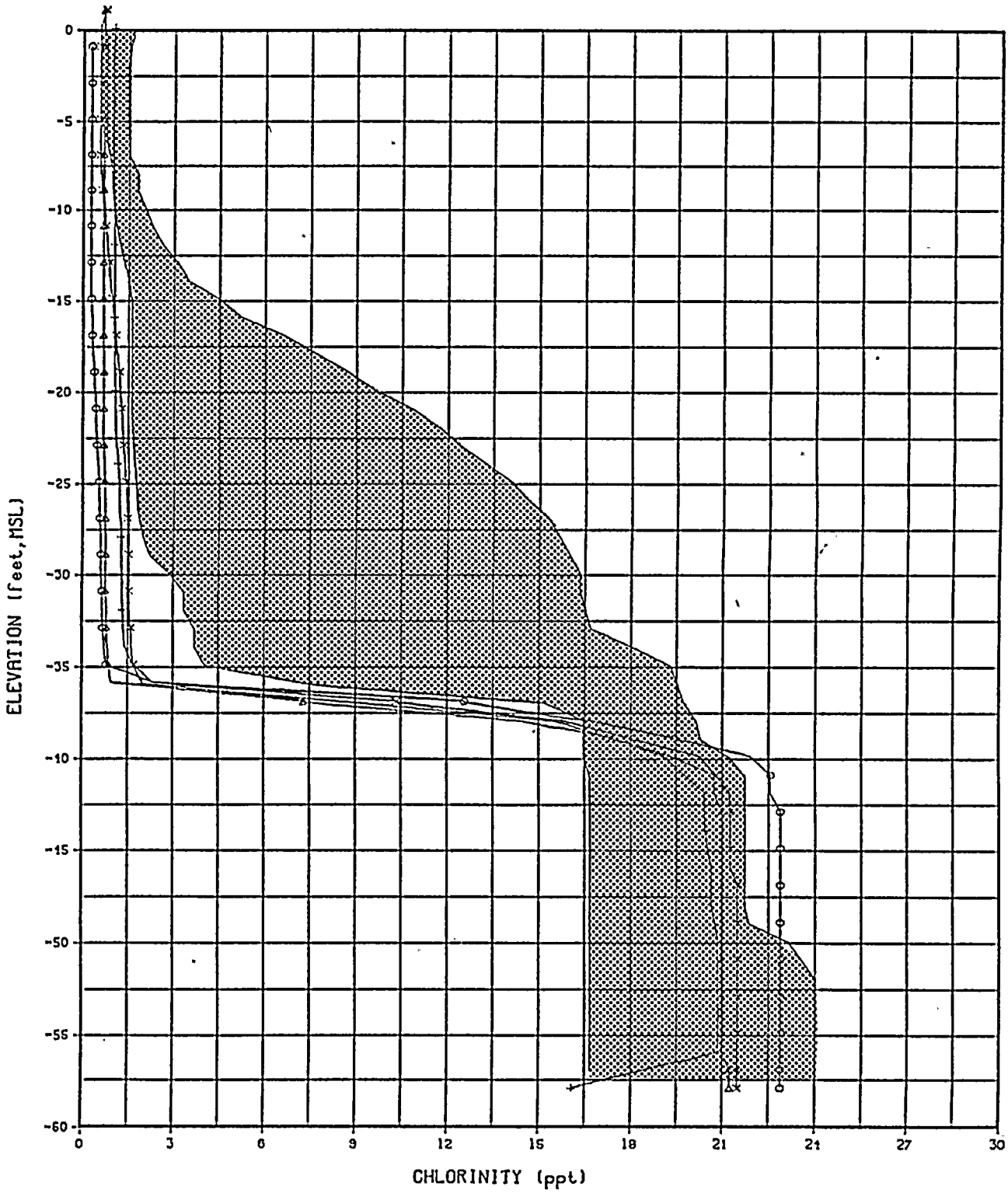
○ APR-80	△ AUG-79	+ DEC-79	× FEB-80
◇ JAN-80	▽ JUL-79	⊞ JUN-80	✕ MAR-80
◆ MAY-80	⊙ NOV-79	⊠ OCT-79	⊡ SEP-79

DAMES AND MOORE

EXCURSIONS FROM CHLORINITY ENVELOPE FOR JULY 79 - JUNE 80

WELL NUMBER L-6

0459804726 (7/80)



LEGEND

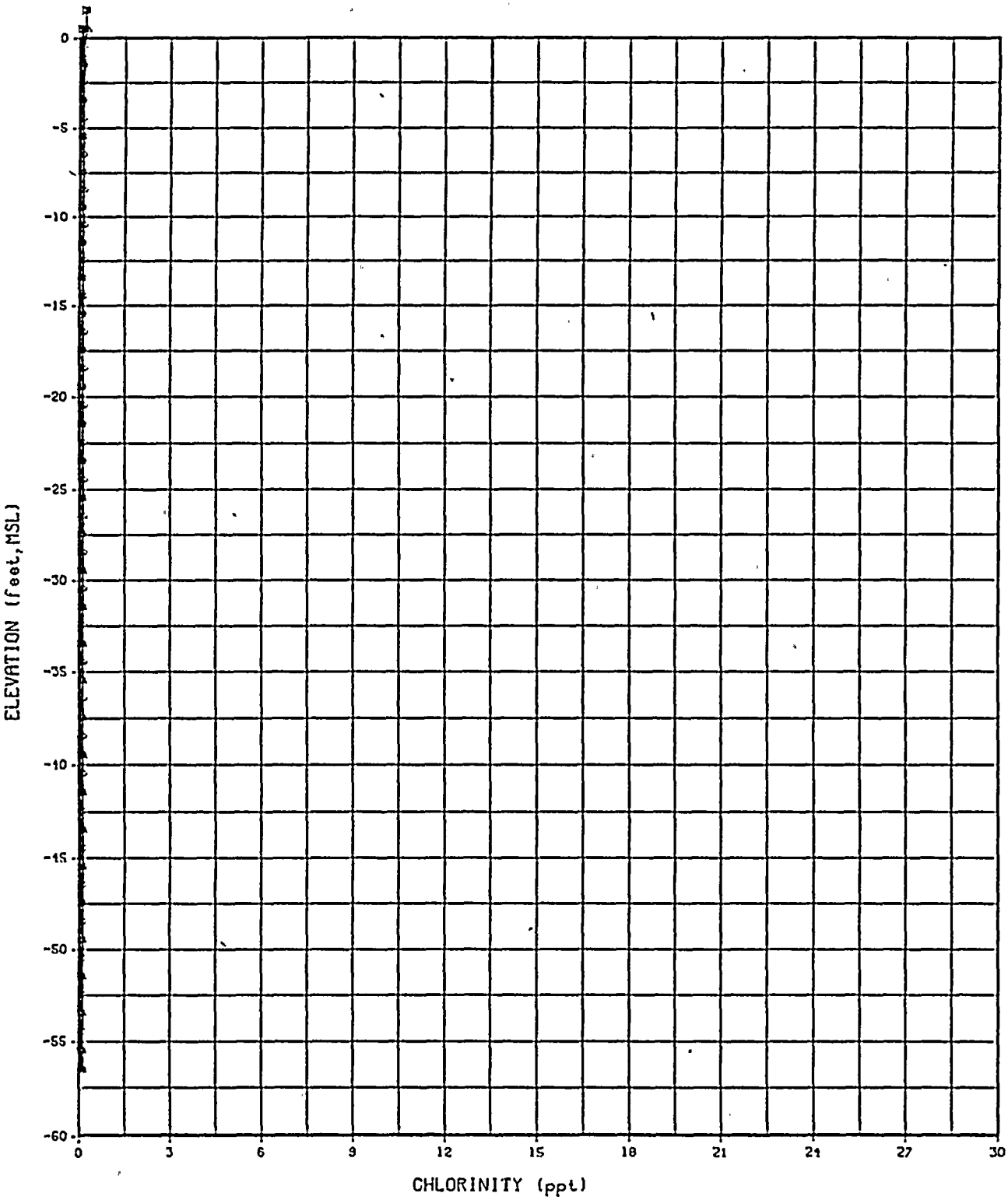
○ JAN-80 △ MAR-80 + MAY-80 × NOV-79

DAMES AND MOORE

EXCURSIONS FROM CHLORINITY ENVELOPE FOR JULY 79 - JUNE 80

WELL NUMBER G-6

0459804726 (7/80)



LEGEND

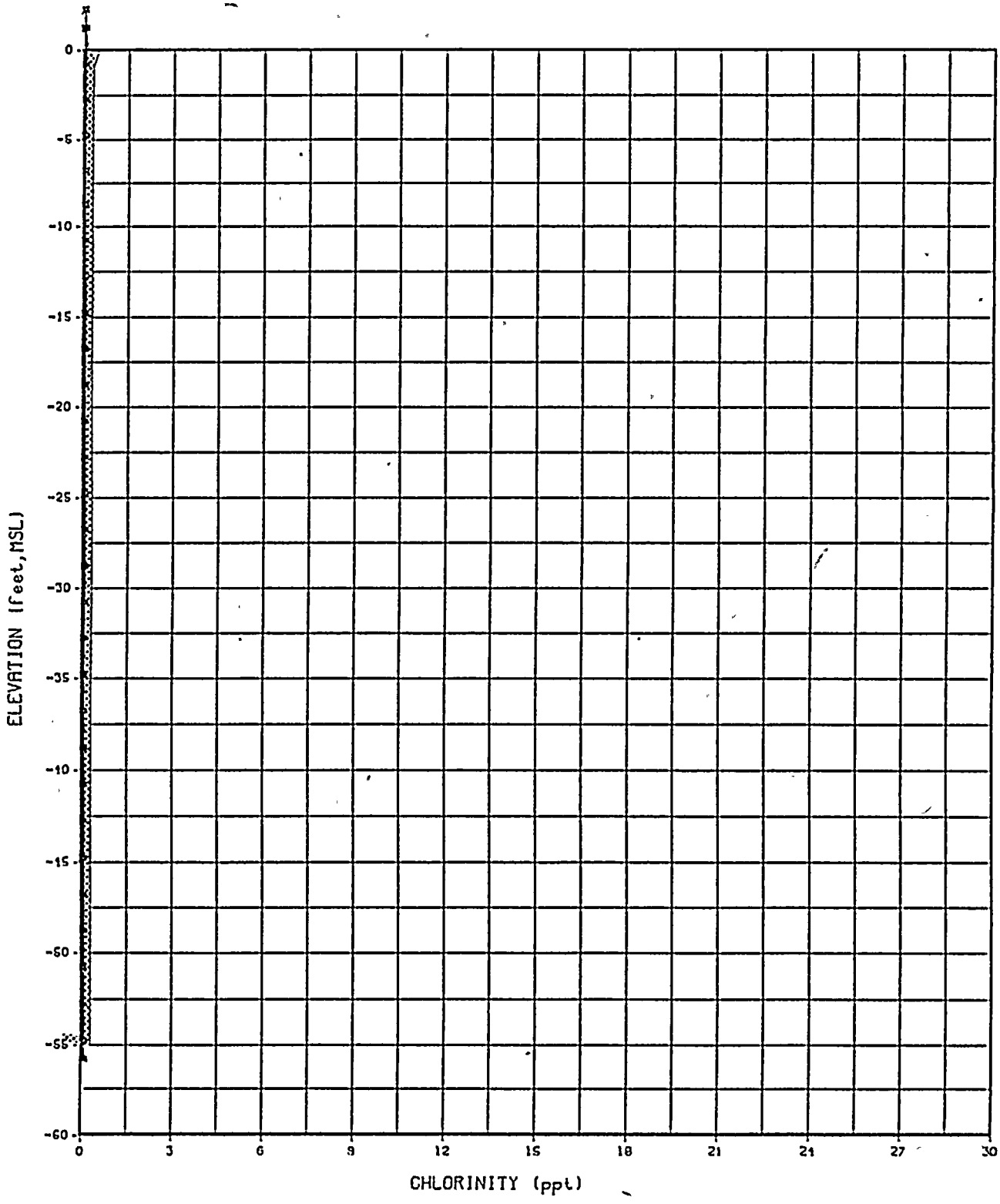
○ APR-80	△ AUG-79	+ DEC-79	× FEB-80
◇ JAN-80	▽ JUL-79	⊠ JUN-80	⋊ MAR-80
◆ MAY-80	● NOV-79	⊡ OCT-79	■ SEP-79

DAMES AND MOORE

EXCURSIONS FROM CHLORINITY ENVELOPE FOR JULY 79 - JUNE 80

WELL NUMBER G-14

0459804726 (7/80)



LEGEND

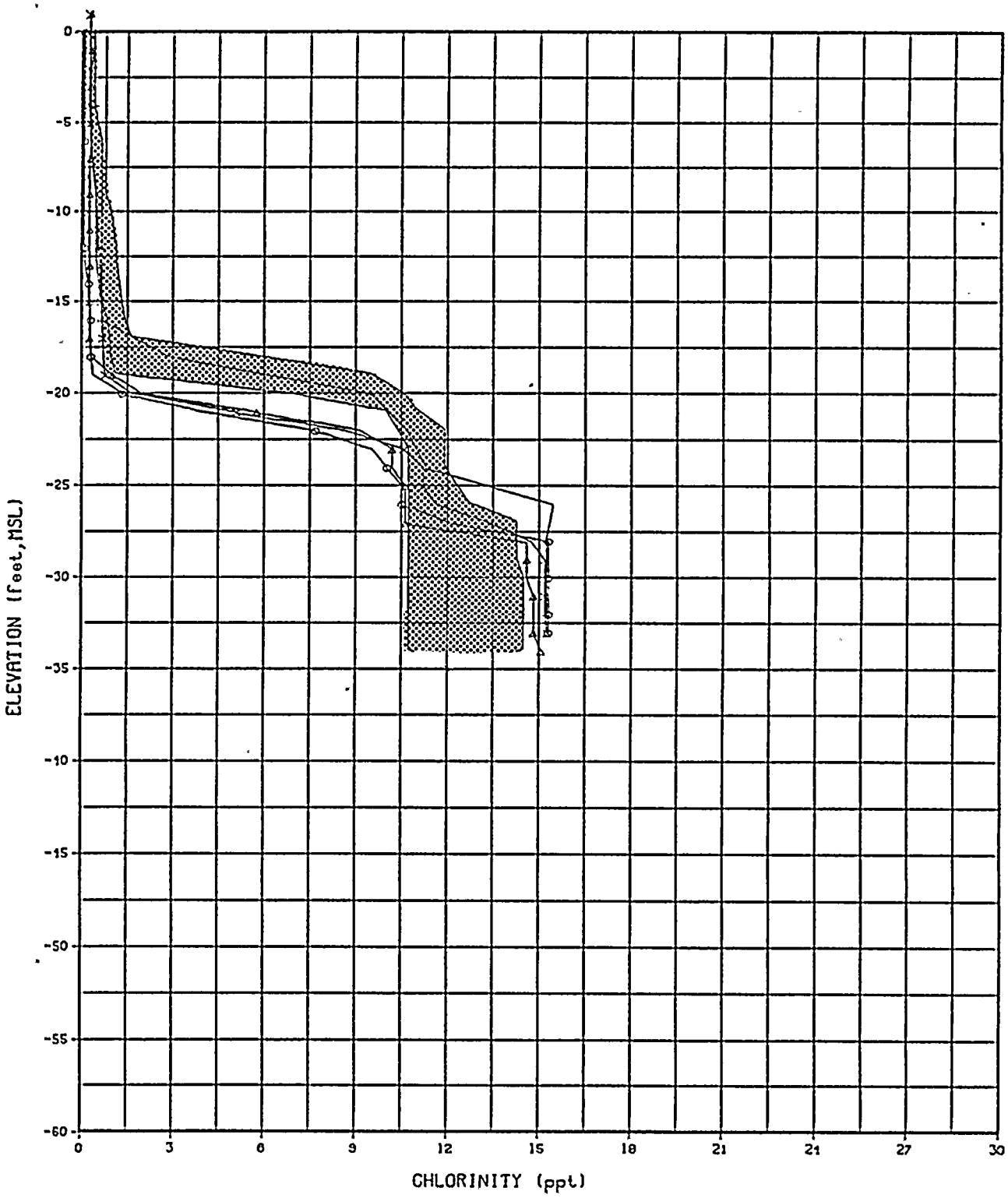
○ APR-80	△ AUG-79	+ DEC-79	× FEB-80
◇ JAN-80	▽ JUL-79	⊠ JUN-80	× MAR-80
⊠ OCT-79	⊠ SEP-79		

DAMES AND MOORE

EXCURSIONS FROM CHLORINITY ENVELOPE FOR JULY 79 - JUNE 80

WELL NUMBER G-21

0459804726 (7/80)



LEGEND

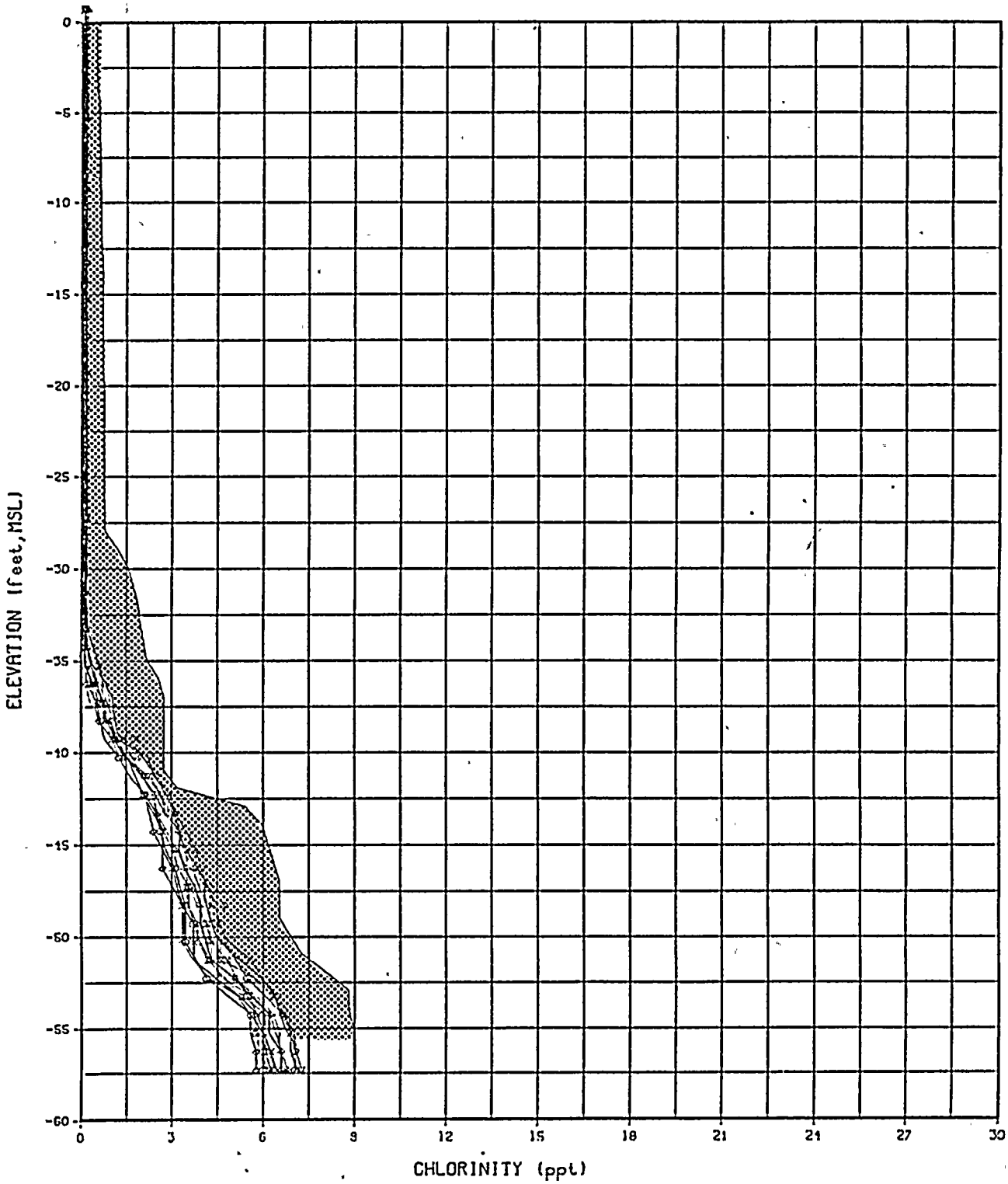
○ JAN-80 △ MAR-80 + MAY-80 × NOV-79

DAMES AND MOORE

EXCURSIONS FROM CHLORINITY ENVELOPE FOR JULY 79 - JUNE 80

WELL NUMBER G-27

0459804726 (7/80)



LEGEND

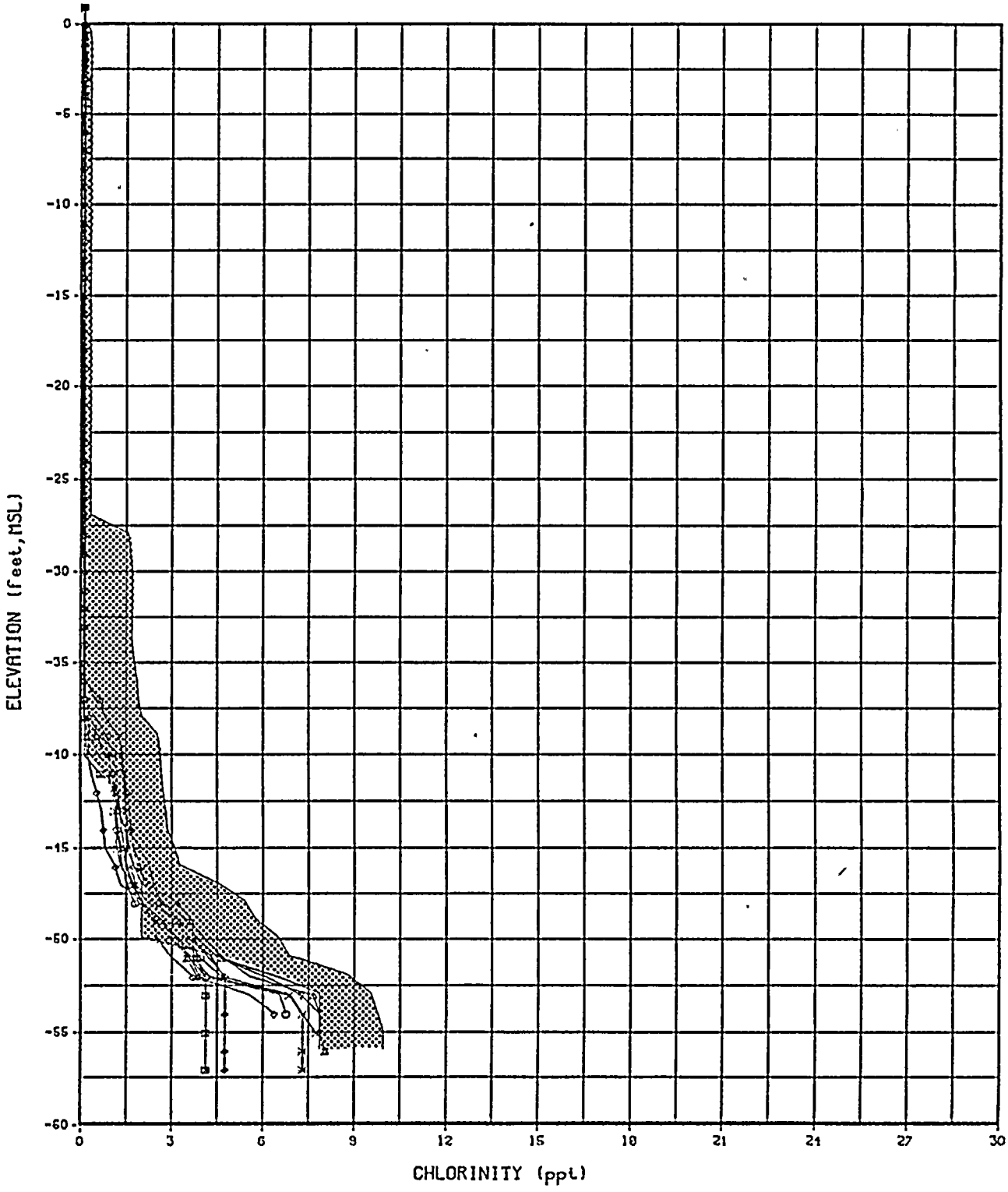
○ APR-80	△ AUG-79	+ DEC-79	× FEB-80
◇ JAN-80	▽ JUL-79	⊠ JUN-80	✳ MAR-80
◆ MAY-80	⊙ NOV-79	⊡ OCT-79	⊟ SEP-79

DAMES AND MOORE

EXCURSIONS FROM CHLORINITY ENVELOPE FOR JULY 79 - JUNE 80

WELL NUMBER G-28

0459804726 (7/80)



LEGEND

○ APR-80	△ AUG-79	+ DEC-79	× FEB-80
◇ JAN-80	▽ JUL-79	⊠ JUN-80	✕ MAR-80
◆ MAY-80	⊙ NOV-79	⊠ OCT-79	⊡ SEP-79

DAMES AND MOORE

EXCURSIONS FROM CHLORINITY ENVELOPE FOR JULY 79 - JUNE 80

WELL NUMBER G-35

0459804726 (7/80)

APPENDIX E

MONITORING PROGRAMS

APPENDIX E

MONITORING PROGRAMS

G-SERIES WELLS

The G-Series Wells Monitoring Program was initiated in April 1972 in compliance with the February 2, 1972, legal agreement between FP&L and the South Florida Water Management District (SFWMD). This monitoring program consisted of two separate but related projects:

1. The Ground Water Quality Monitoring Program and,
2. The Interceptor Ditch Program.

The original ground water monitoring program entailed 38 monitoring wells installed at 23 separate locations west of the cooling canal system and designated as the G-Series wells. Two piezometers, one 50 feet and one 20 feet deep, were installed at 15 of the 23 locations. The 20 feet deep piezometer was located approximately 10 feet north of the 50 feet piezometer.

Surface water and ground water elevations, ground water temperature, and conductivity were measured in each of these wells near the beginning of each month. For the 15 pairs of piezometers, ground water temperature and conductivity were measured at the bottom of the casing; in the composite wells, these parameters were measured at depths of 20, 40, and 60 feet below the top of the well casing. In addition, water samples were obtained to verify and to correlate the water conductivity data by titration for chlorinity. A regression analysis of

these data established the monthly relationship between conductivity and chlorinity, this relationship then being used to convert conductivity to chlorinity.

A revised ground water monitoring program was implemented in November 1976 following ratification of the third supplemental agreement between FP&L and SFWMD in September 1976. The revised program consisted of monitoring the ID-Series wells, the L-Series wells and Wells G-7, G-21, G-28 and G-35 near the beginning of each month. As from January 1979, Well G-14 was substituted for Well G-7 because of damage to the well by local farmers. The L-wells and ID-wells are described in a following section. Additionally, Wells G-6 and G-27 are monitored at the beginning of January, March, May, and November. Monitoring consists of measuring surface water and ground water elevation and ground water conductivity and temperature. Temperature and conductivity are measured at one-foot intervals for the entire well depth. One water sample is obtained from each well for analysis of the chlorinity.

L-, ID-, X-WELLS

FP&L installed 13 additional wells to aid in the determination of the effects of the cooling canal system on the ground water. Six wells were installed along Levee 31E Borrow Canal (L-wells), five along the Interceptor Ditch (ID-wells), and two north of the Feeder Canal (X-wells). These wells are composite wells extending to a depth of approximately 70 feet.

A flexible monitoring schedule was maintained for these wells. These wells were normally monitored at about two-week frequencies (near the beginning of the month when the G-Series wells were monitored and near the middle of the month). Temperature and conductivity measurements were initially made in these wells at five-feet intervals from the ground water surface to the bottom of the casing. However, since December 1975, temperature and conductivity measurements have been made at one-foot intervals.

As mentioned previously, the ID- and L-wells are now incorporated in the G-Series Wells Monitoring Program. These wells are monitored once a month. Similarly, the X-wells are monitored once a month.

MONITORING EQUIPMENT

The in-situ conductivity and temperature measurements are obtained with a Hydrolab TC-2 conductivity-temperature meter. Calibration of the field conductivity meters is done in the laboratory with saline solutions of known conductivity at the beginning and end of each day of measurements.

Water samples are obtained with a masterflex sampling pump.

The reader is referred to the March 31, 1976 G-Series Wells Summary Report for more detailed descriptions of monitoring equipment and calibration.

No new equipment was acquired during the period July 1979 through June 1980.

LABORATORY ANALYSES

The water samples collected during the monthly monitoring programs are titrated to determine chlorinity. The chlorinity was determined by titrating the water samples with silver nitrate, using a potassium chromate solution as the end point indicator; recently a mercuric nitrate has been substituted, as it provides a more readily identified end point. These titrations are performed at Florida Power & Light's laboratories at Turkey Point.

The chlorinity, once it is determined, is used to develop a relationship between conductivity and chlorinity content. Conductivity-chlorinity relationships are determined for each series of wells each month. The conductivity-chlorinity relationships developed for this monitoring period are shown in Appendix B.

The conductivity-chlorinity relationships are used to convert the appropriate monthly conductivity data to equivalent values of chlorinity.

The methodology used to determine the conductivity-chlorinity relationships is discussed in greater detail in the G-well summary report.

MONITORING PROGRAM LOGISTICS

Field data collection efforts have been conducted from the FP&L field laboratories at Turkey Point. All monitoring equipment is stored at these facilities. Instrument calibration

and most instrument maintenance have been handled at these facilities.

Transportation to the monitoring wells is dependent on well location. Some of the wells are located in swampy areas and are accessible only by helicopter. Since discontinuance of the E-Well Monitoring Program, a helicopter will be required onsite only during the months of January, March, May, and November for the revised ground-water monitoring programs. During the remaining months all the required wells can be reached by automobile.