



Golder Associates

CONSULTING GEOTECHNICAL AND MINING ENGINEERS

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THERMAL

E/84/445

April 12th, 1984

British Columbia Hydro
and Power Authority
555 West Hastings Street
Vancouver, B.C.
V6B 4T6

ATTENTION: Mr. W.E. Meeks, P. Eng.

Re: Hat Creek Project
Ground Water Hydrographs

FILE: 604H-90500	
THERMAL ENGINEERING DEPARTMENT	
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DEPT. MGR.	
MEAGER CREEK	
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RETURN ORIGINAL TO CENTRAL FILES A.S.A.P.	

Dear Sir:

Further to our letter of March 14th, 1984, and subsequent telephone conversation, we have prepared a short final report summarizing the ground water level monitoring program to date at Hat Creek. The report includes an assessment of the ground water level monitoring results and attached updated computer plotted hydrographs.

1.0 INTRODUCTION

Assessment of ground water level hydrographs prepared from data gathered between 1977 and 1982 was presented in Golder Associates report entitled "Hat Creek Project Geotechnical and Hydrogeological Update, Fall 1982", submitted to B.C. Hydro. Subsequently, a reduced monitoring schedule was proposed for those piezometers located in the immediate vicinity of the pit; the proposed monitoring schedule was detailed in our letter dated February 14th, 1983, reference E/83/198. The present report is intended as an addendum to the 1982 report and covers the results of ground water level monitoring subsequently carried out by B.C. Hydro up to January 1984.

2.0 ASSESSMENT OF GROUND WATER LEVEL MONITORING (1982 - 1984)

The following assessment of ground water hydrographs is concentrated on those piezometers that have continued to show long term changes in piezometric levels. Conclusions derived from an assessment of short term ground water level fluctuations remain unchanged from the 1982 update report.

Examination of the individual ground water hydrographs indicates that there are still a number of piezometers that have not stabilized with the in situ ground water pressures. The table below details those piezometers that have recorded the greatest change in piezometric level since 1982.

604H-MIII

Piezometer Number	Piezometric Level Change (m)	Lithology
RH 77-48-1	+1.31	Siltstone (Tcu)
RH 77-61A-2	-13.65	Claystone (Tcl)
RH 77-62-1	-14.92	Claystone (Tcl)
RH 77-63-1	+11.36	Claystone (Tcl)
RH 78-70-1	+12.07	Siltstone (Tcu)
RH 78-75-1	+1.21	Coal
DDH 76-141-1	-1.30	Siltstone/Sandstone (Tcl)
DDH 76-143-1	-1.49	Siltstone/Sandstone (Tcl)
DDH 76-150-1	-11.49	Claystone/Sandstone (Tcl)
DDH 76-161-1	-9.55	Siltstone/Sandstone (Tcl)
DDH 77-840-1	+9.13(?)	Tuffaceous Sandstone
DDH 78-867-1	-2.97	Clayey Siltstone (Tcu)

NOTE: Tcl - Coldwater Formation; Tcu - Medicine Creek Formation

These piezometers are generally installed in very low permeability bedrock (hydraulic conductivity less than 10^{-11} m/sec). Piezometer RH 77-48-1 however, appears to be completed in more permeable (10^{-7} m/sec) siltstone and may be recording higher piezometric levels due to increased precipitation during the monitoring period. The ground water level recorded in piezometer DDH 77-840-1 rose 9.13 m between July 1983 and January 1984. During the previous six years of monitoring, ground water levels in this piezometer fluctuated by approximately 1 m. The recent "rise" in ground water levels is thus attributed to reading inaccuracy rather than increased ground water levels.

The 1982 update report noted that piezometer DDH 76-150-1, completed within the siltstone, sandstone, conglomerate unit (Tcl) of the Coldwater Formation, was recording an anomalously low piezometric elevation of approximately 795 m (i.e. below the level of Hat Creek). The piezometric elevation appeared to be approaching stabilization some 4 years after carrying out a falling head permeability test. During subsequent monitoring, the ground water level in this piezometer has shown an increased rate of decline and shows no sign of stabilizing. Piezometer RH 77-61A-2, 100 m distant from DDH 76-150-1, is recording declining ground water levels similar to those recorded in DDH 76-150-1. The piezometric elevations of these two piezometers are now approximately 65 to 75 m below neighbouring piezometers completed within similar materials [siltstone, sandstone, conglomerate (Tcl)], but at different horizons. As indicated in the 1982 update report, it is considered possible that burning of the coal at outcrop within the geological past may have resulted in unloading of the underlying material leading to an expansion of the material and decrease in pore water pressure. Due to the low hydraulic conductivity of the bedrock, the reduced piezometric pressures developed on unloading have not yet come into equilibrium with the neighbouring piezometers set in more permeable parts of the rock sequence.

The 1982 update report indicated that a number of piezometers in the Houth Meadows area responded to the pump testing of well PW1 during July 1981. Subsequently, during autumn 1981, some piezometers in the Houth Meadows area, completed in limestone or surficial deposits, showed only a partial recovery, while others continued to decline. Subsequent monitoring during 1983 and early 1984 indicates that all of the piezometers affected by the pump test did not recover fully and have shown a continual decline in ground water levels since 1982. The decline in ground water levels in those piezometers affected (DDH 76-813-1, DDH 77-829-1, DDH 77-831-1, DDH 77-834-1, DDH 77-835-1 and DDH 77-835-2) has generally been less than 1 m. The incomplete recovery of these piezometers following pump testing reflects a slow rate of recharge to both the limestones and the surficial granular deposits. The continuing decline in ground water levels in the Houth Meadows area since 1981/82 is probably the result of removal of ground water from storage associated with the continued natural discharge of well OW4 and limited natural recharge to both the limestone and surficial deposits.

As you know, it is Golder Associates intention to continue reading some of the piezometers at Hat Creek periodically because of their unique scientific interest. We will keep you informed of any interesting changes.

We hope this report provides you with the information you require. Should you have any questions, please do not hesitate to contact me.

Yours very truly,

GOLDER ASSOCIATES



G.E. Rawlings, P. Eng.

GER/sek
832-1516



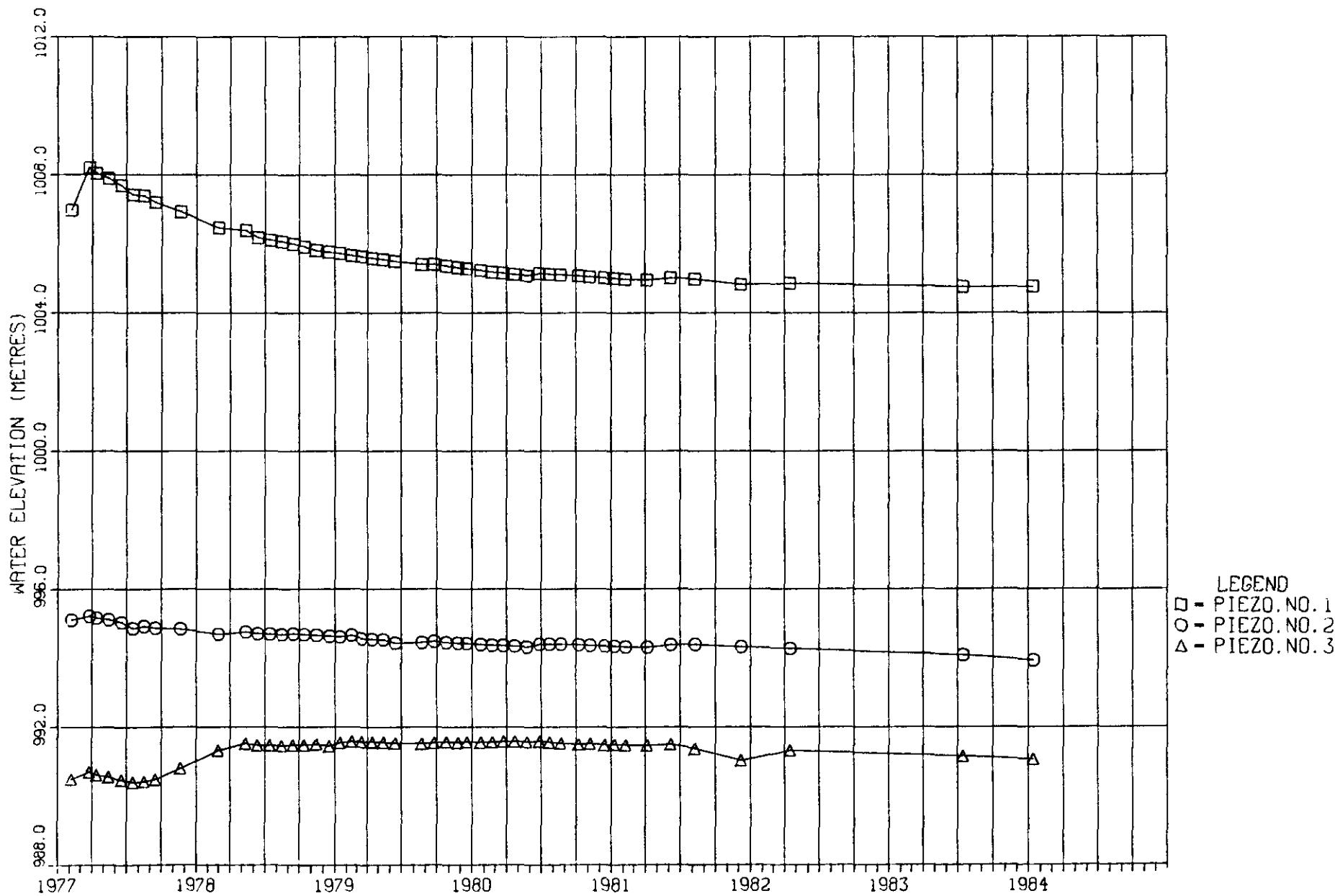
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HAT CREEK PROJECT
GROUND WATER HYDROGRAPHS
1977 - 1984

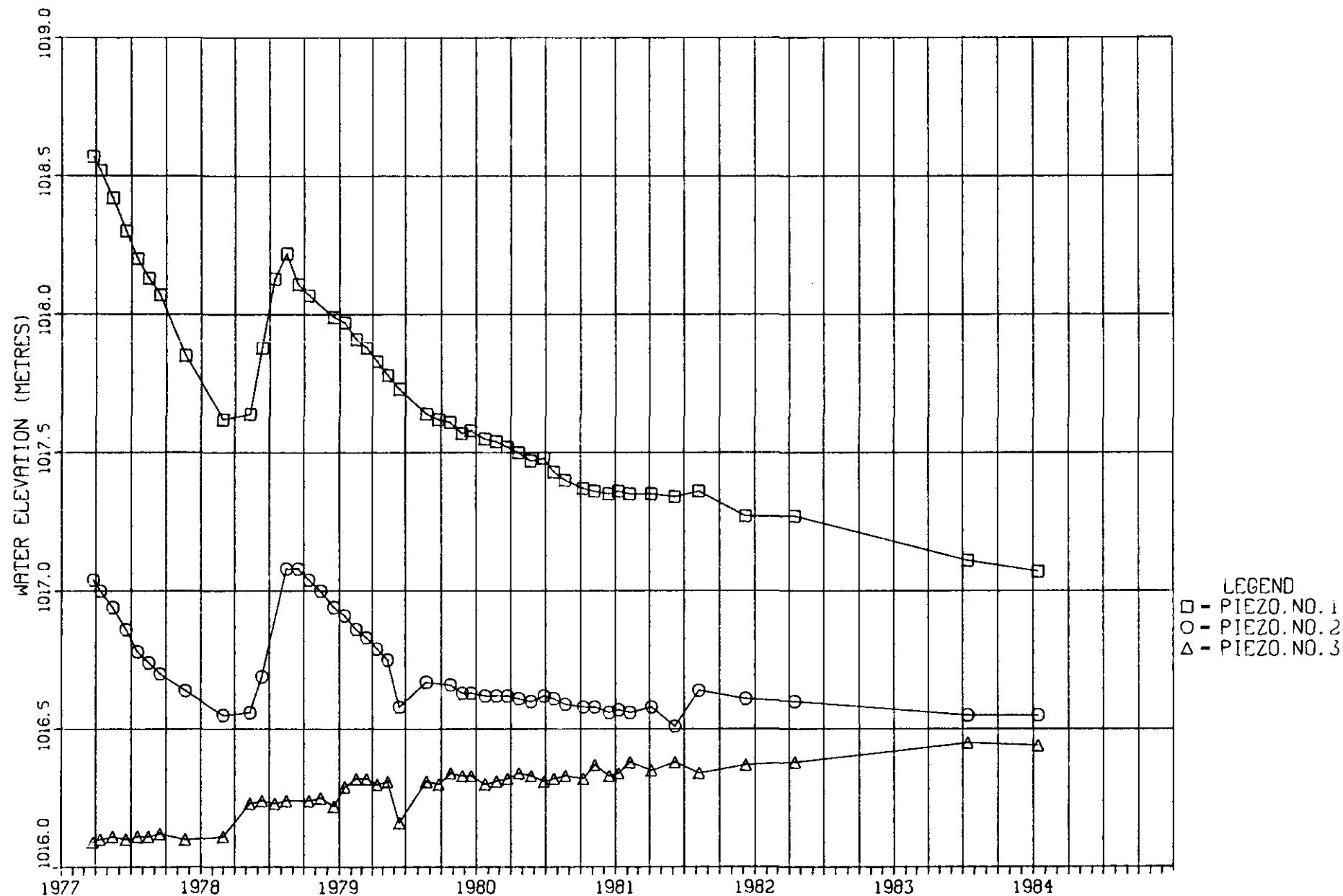
April, 1984

832-1516

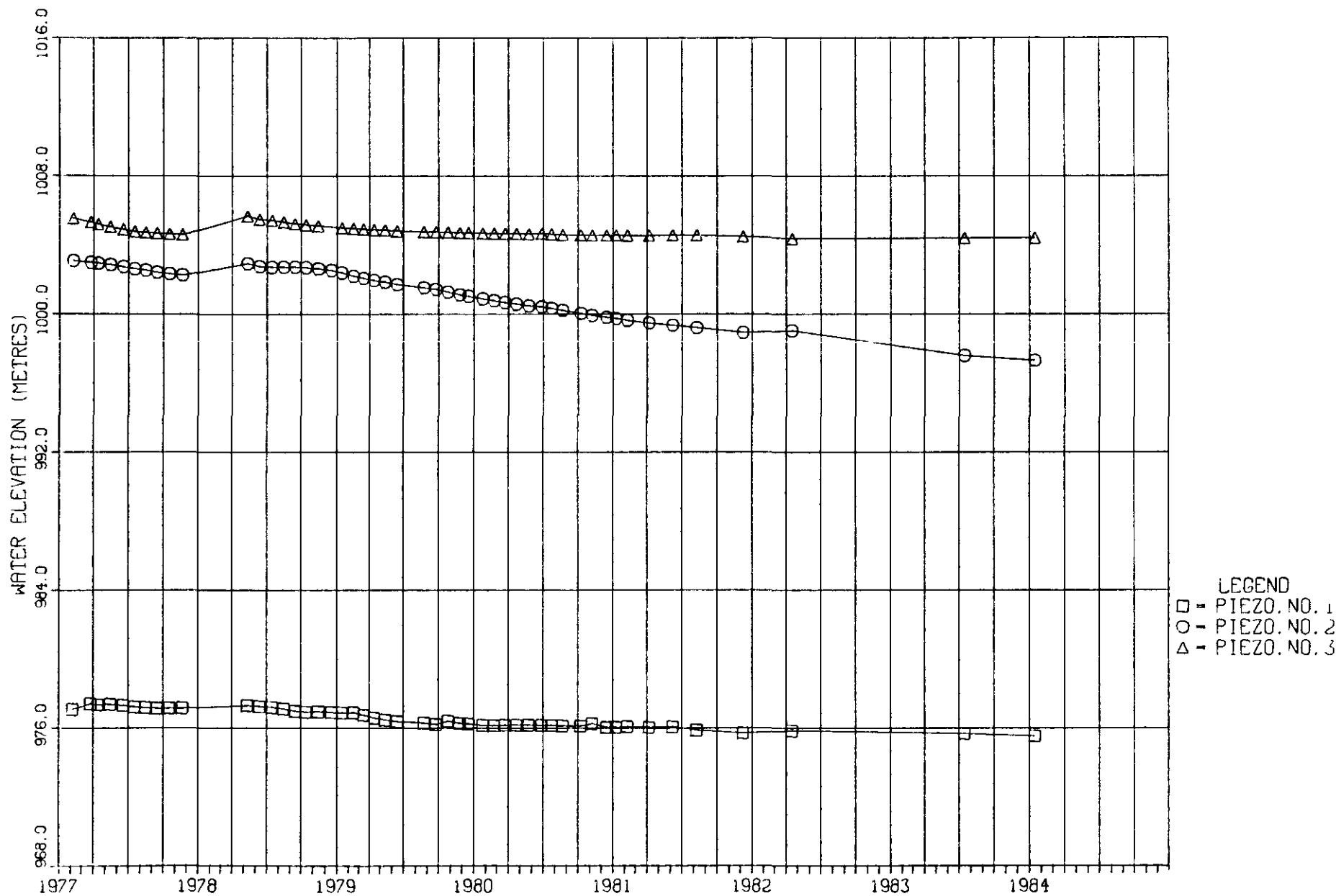
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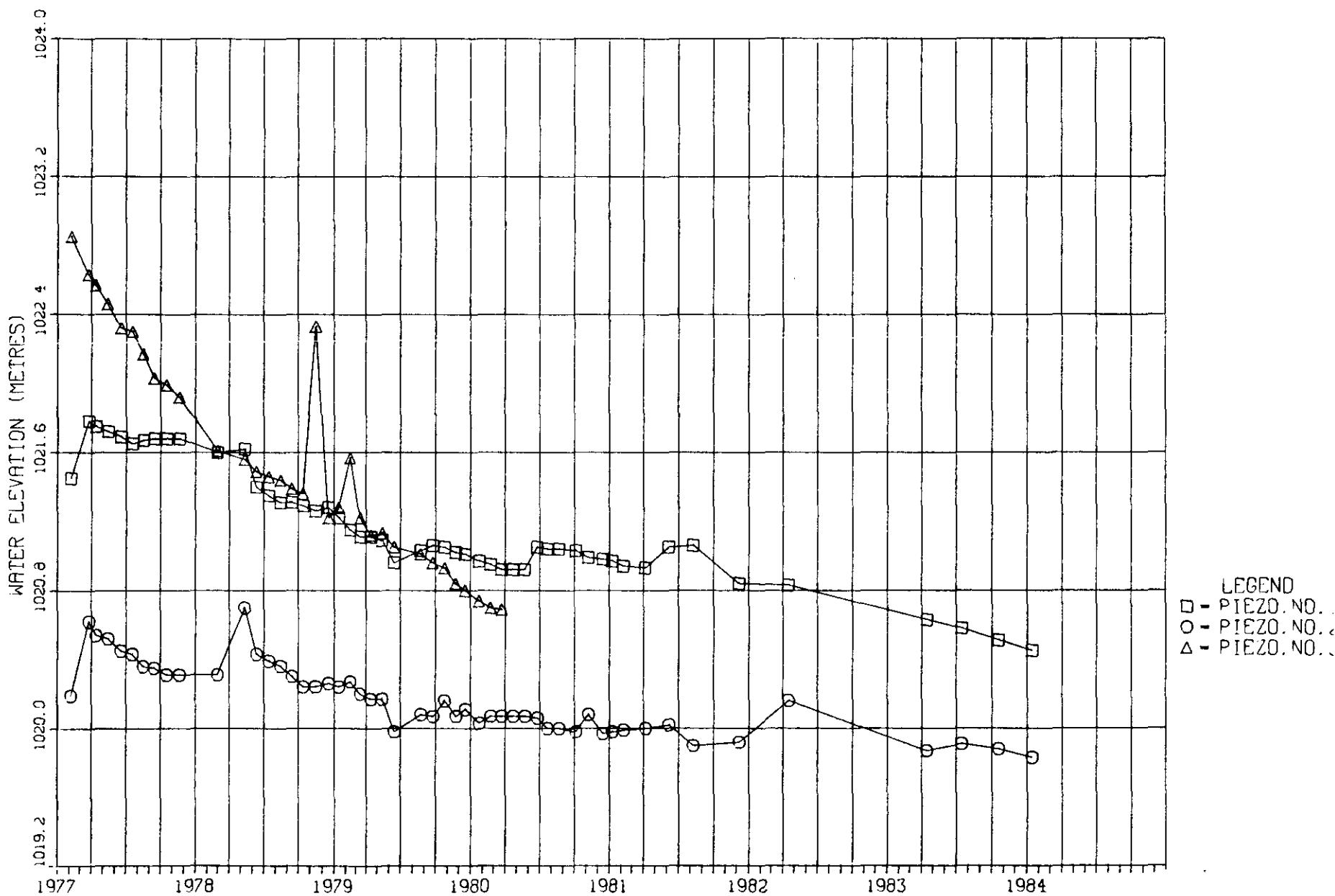
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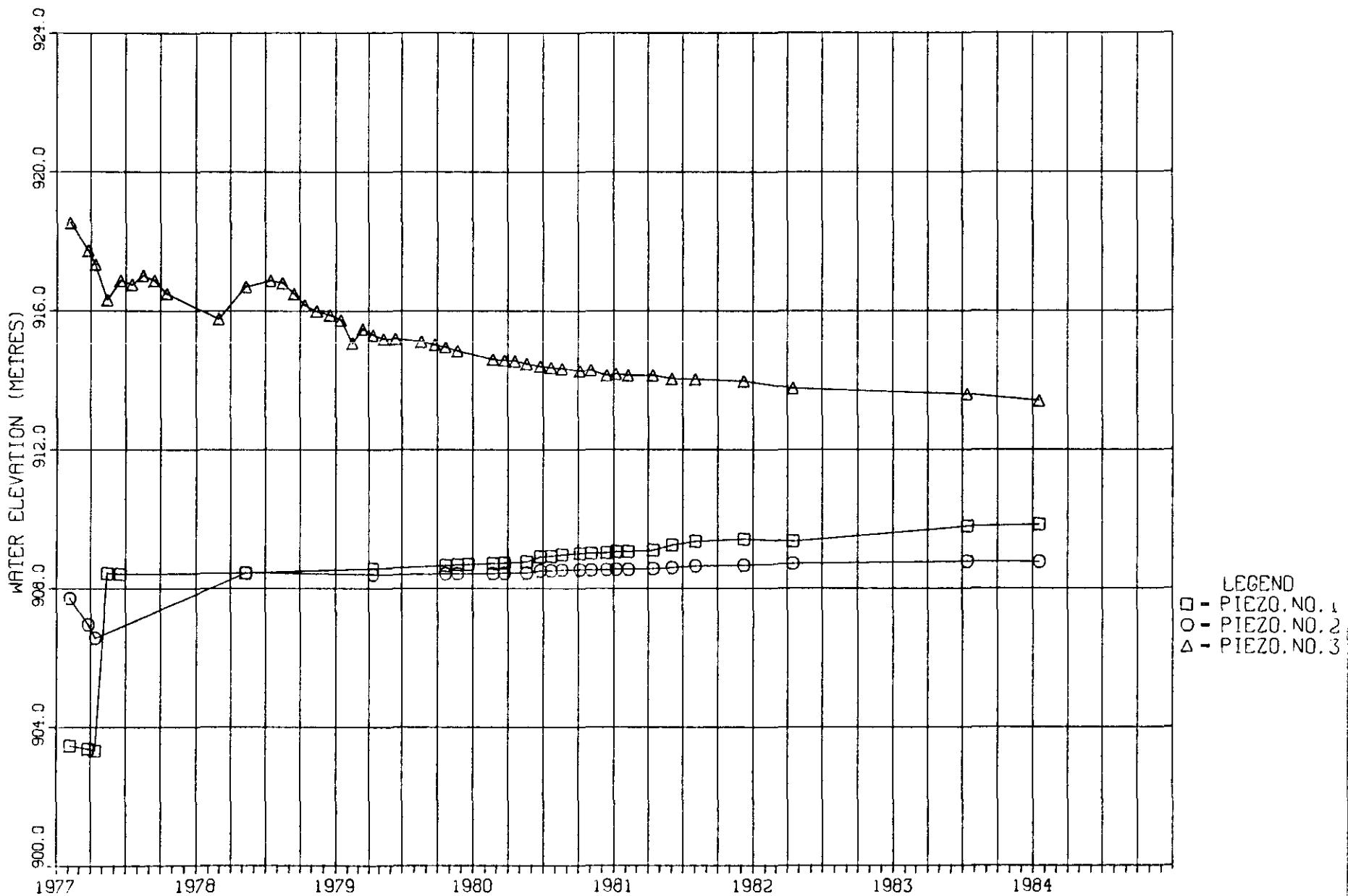
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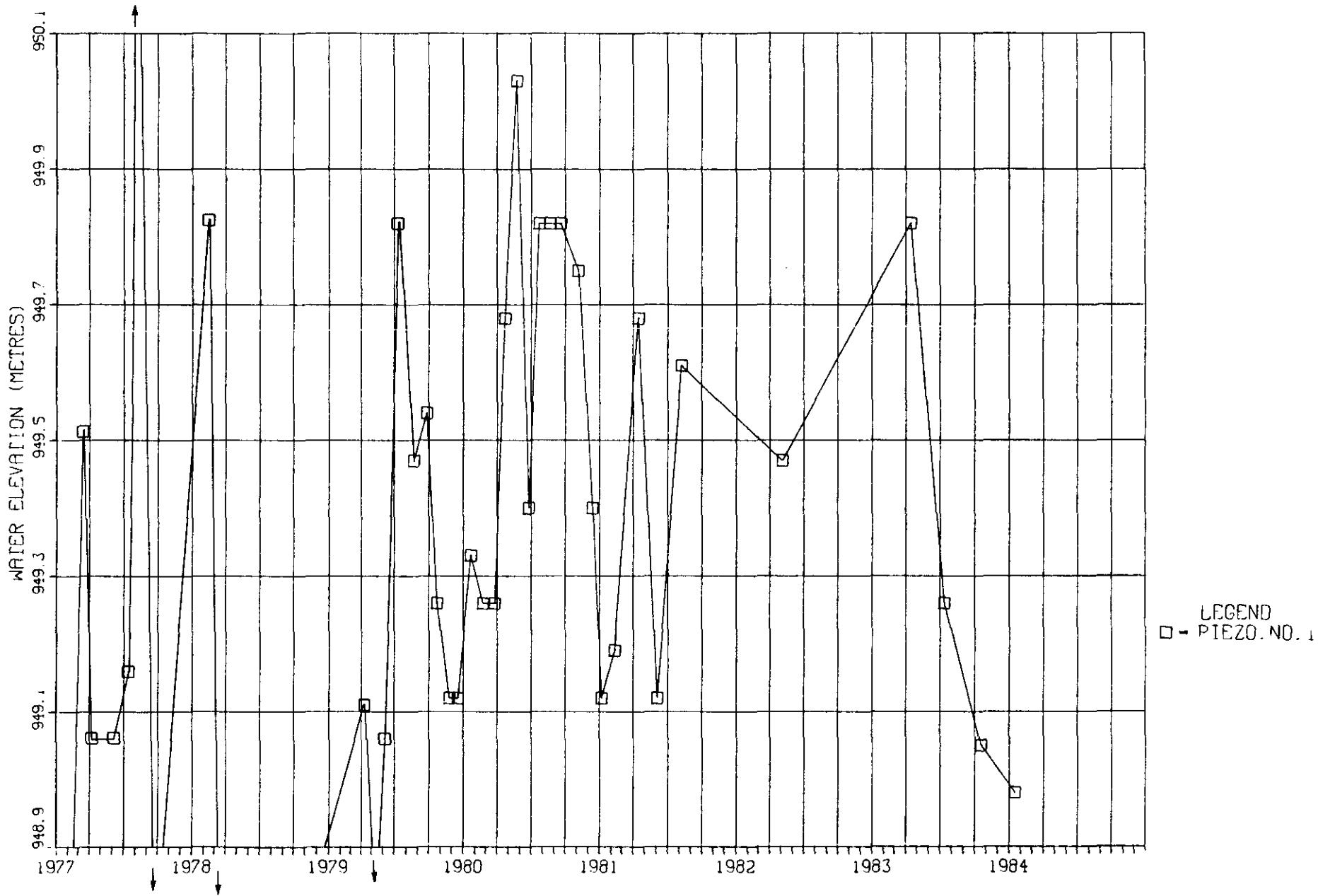
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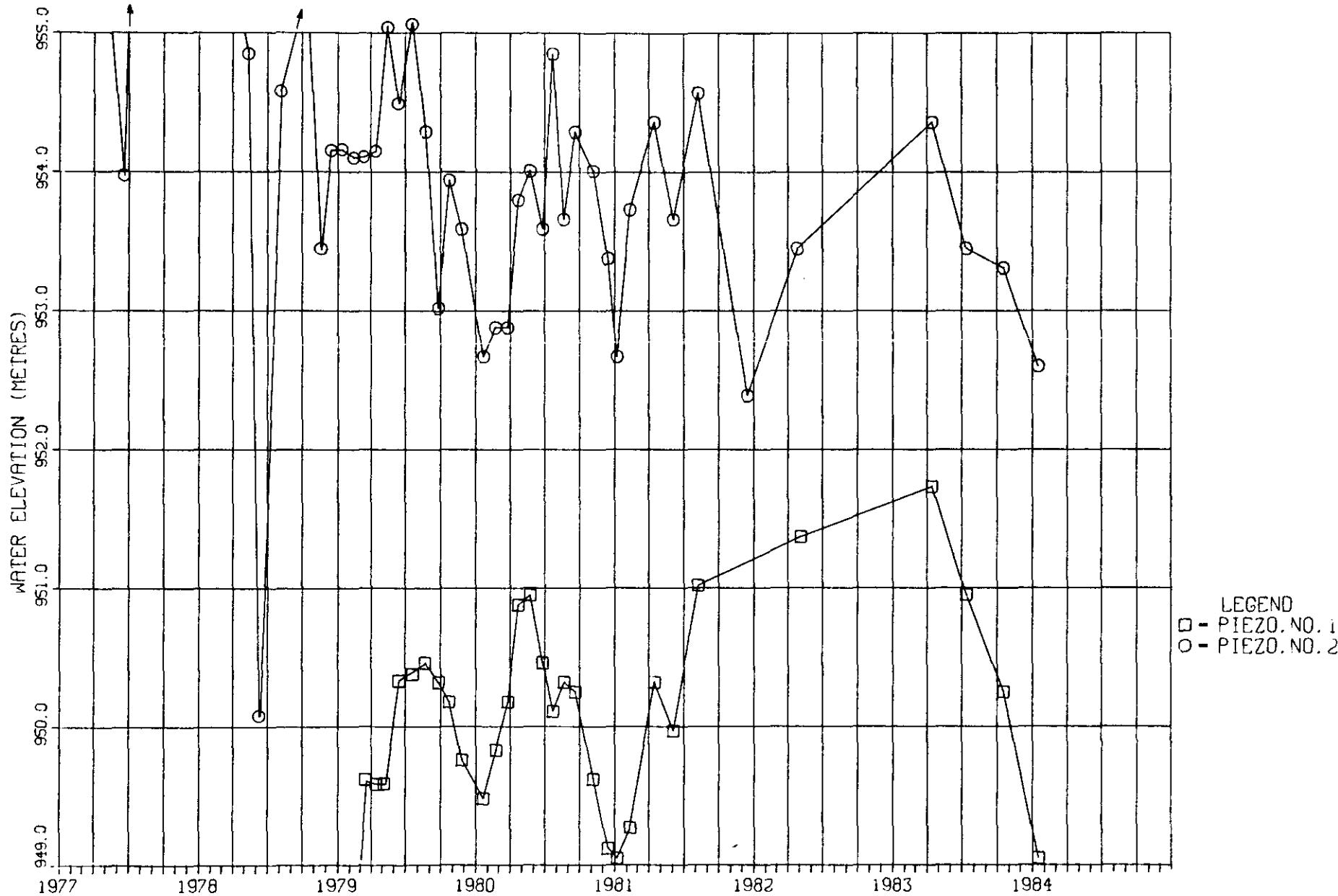
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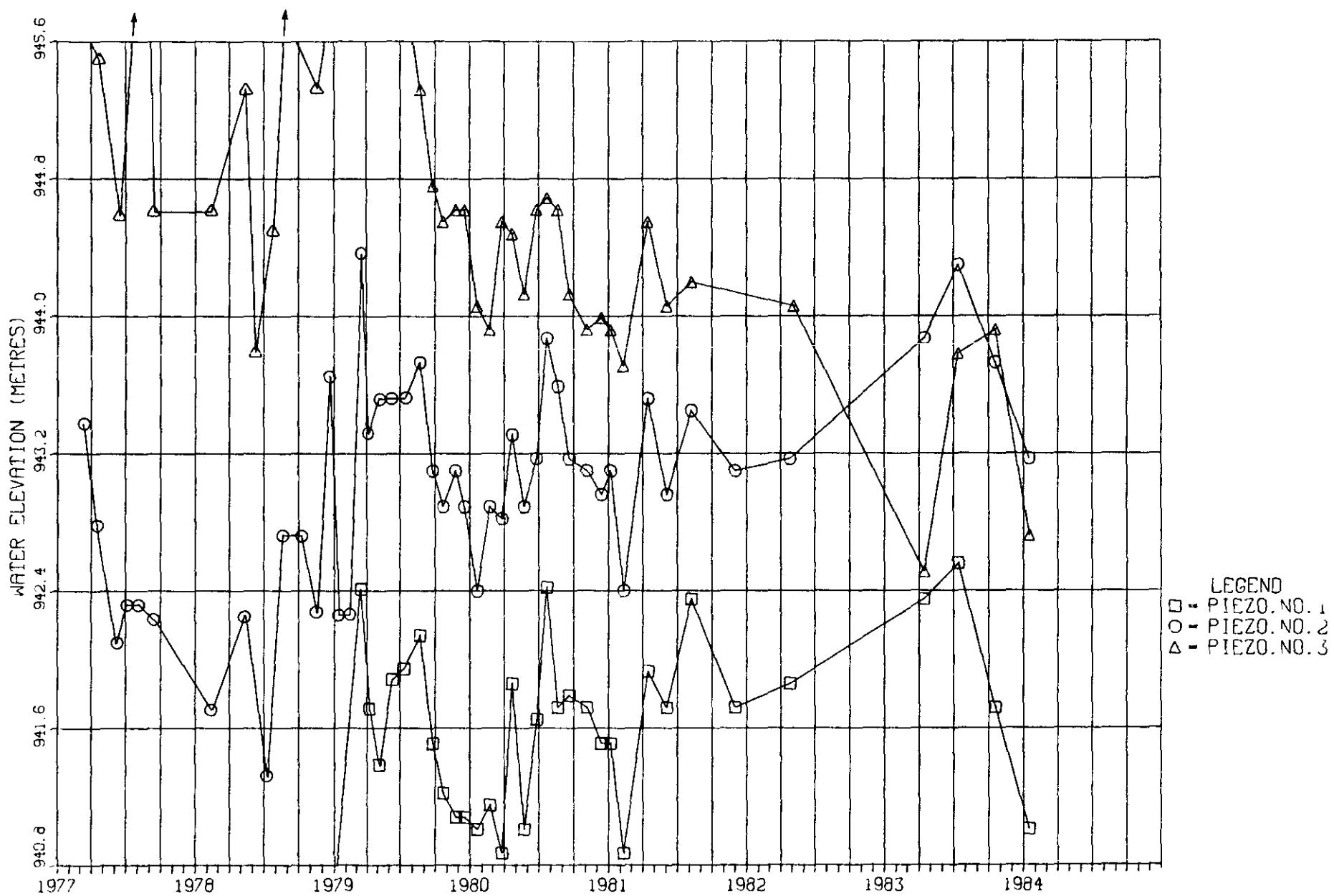
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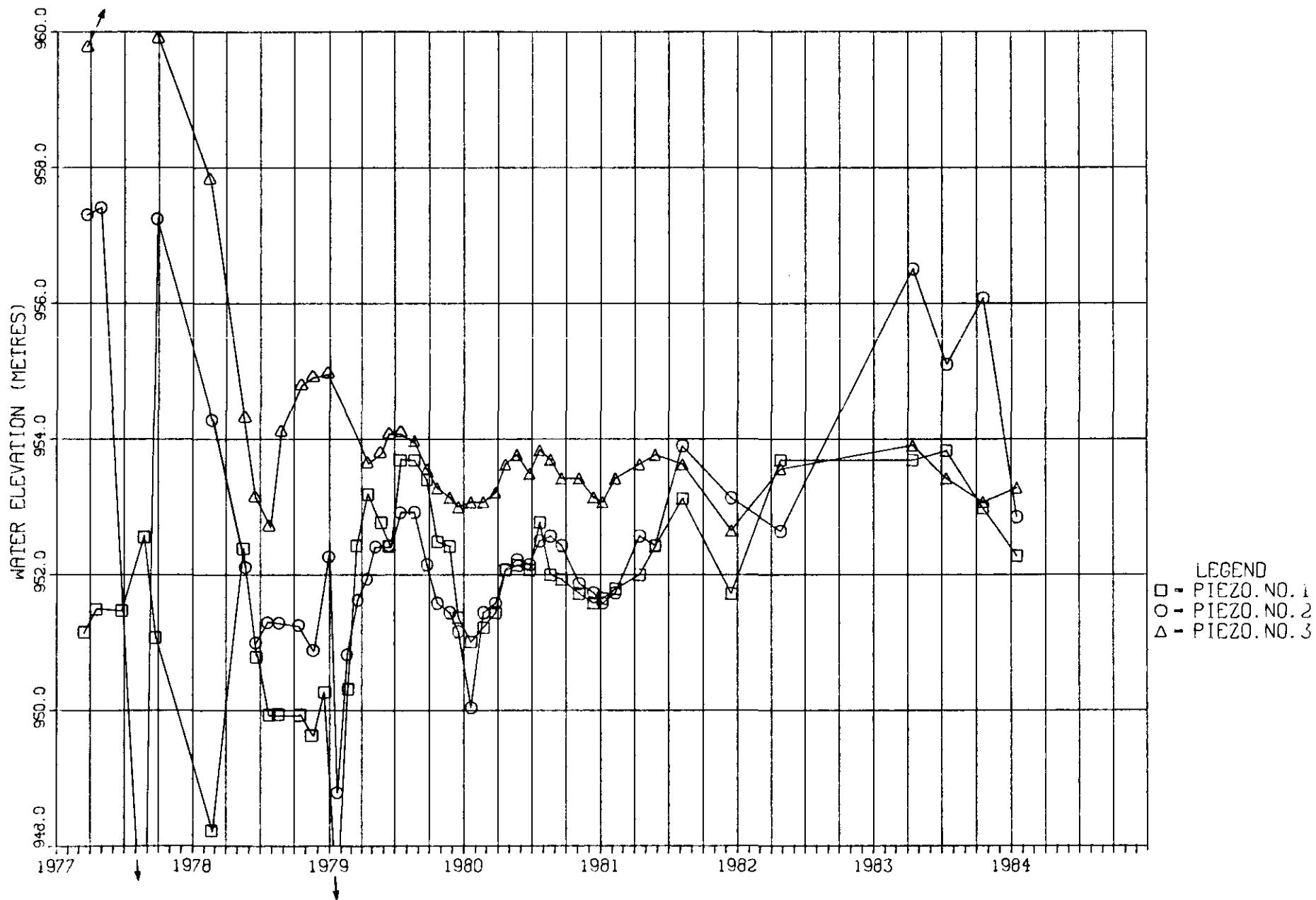
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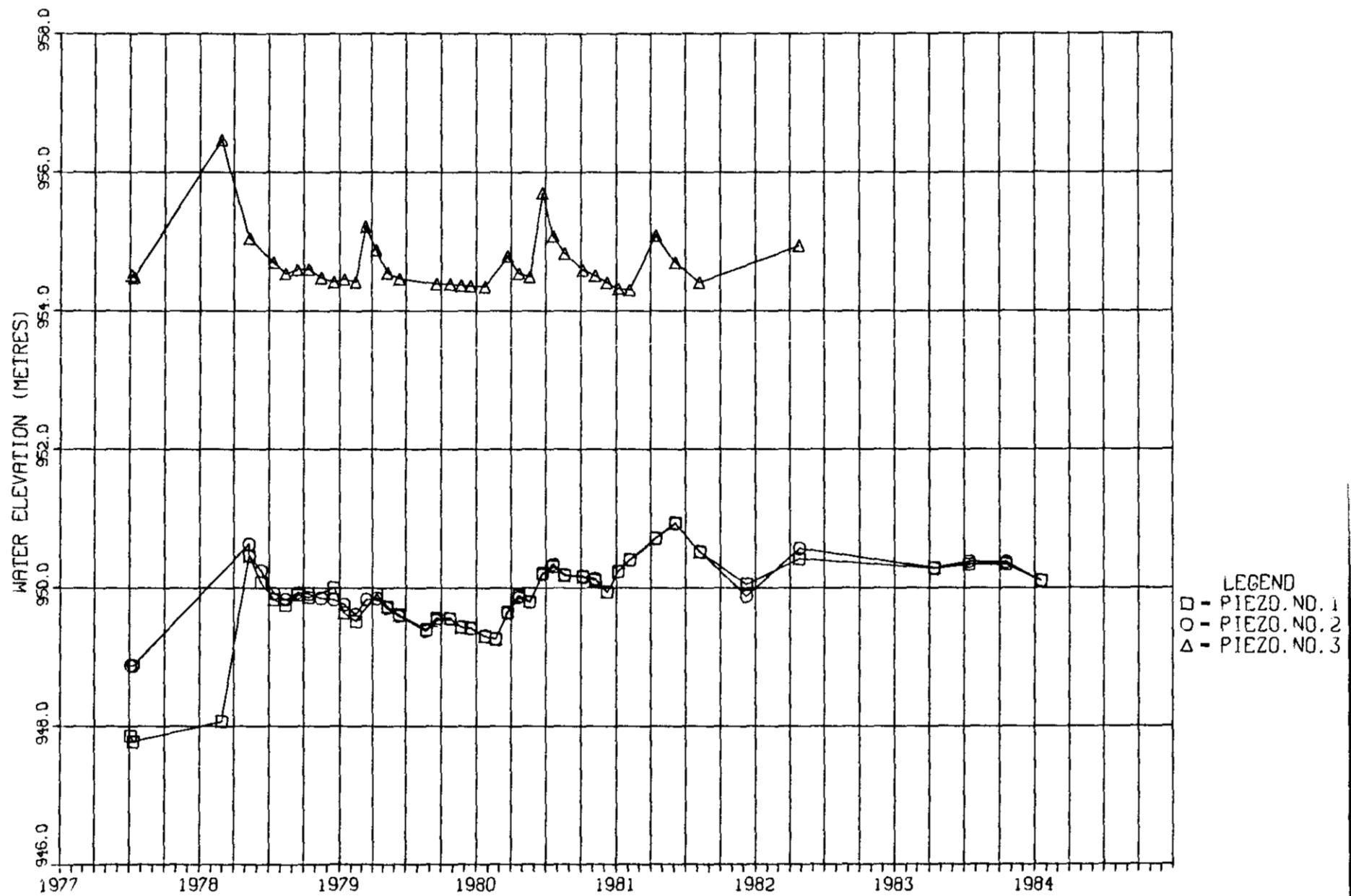
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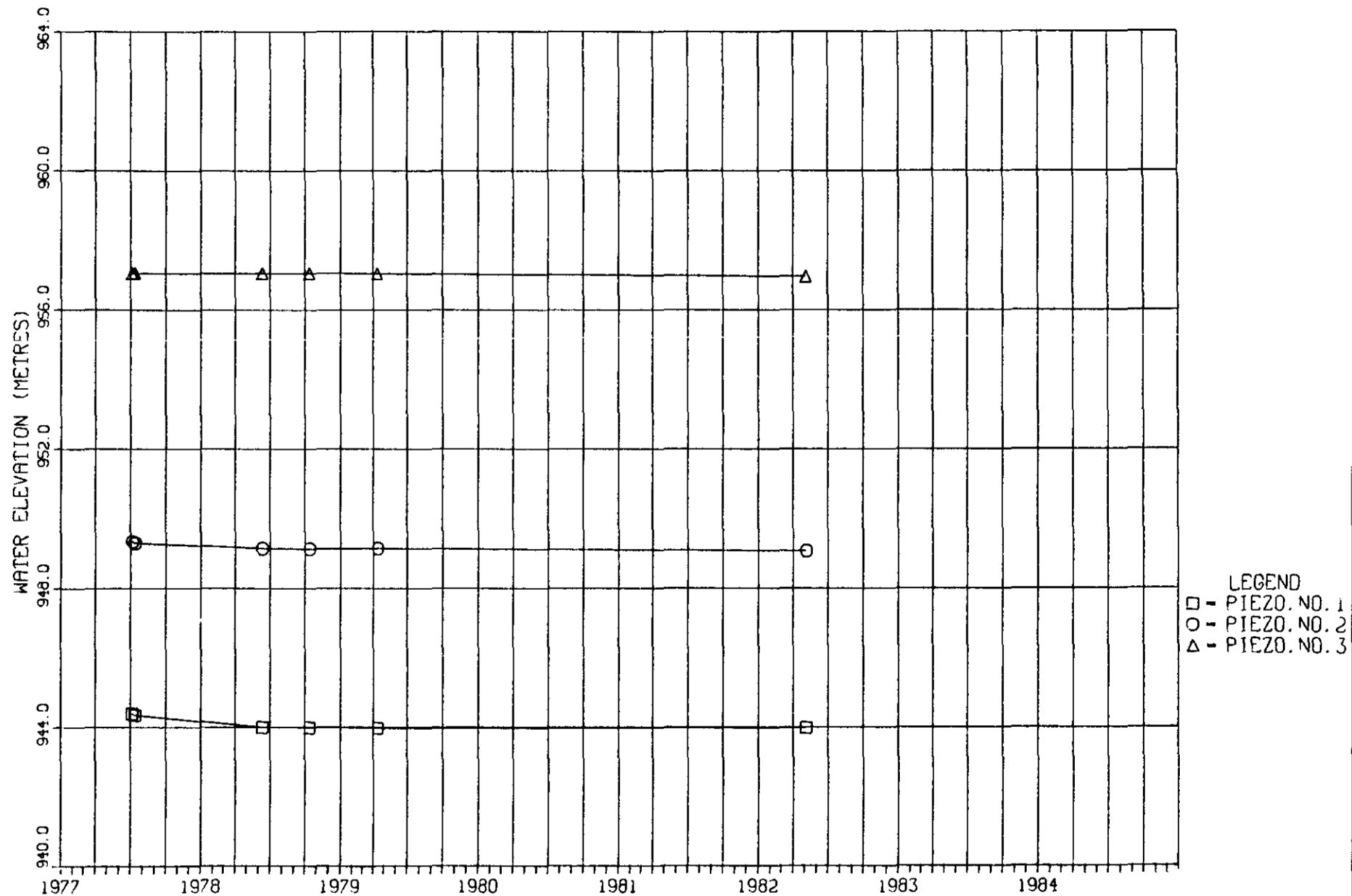
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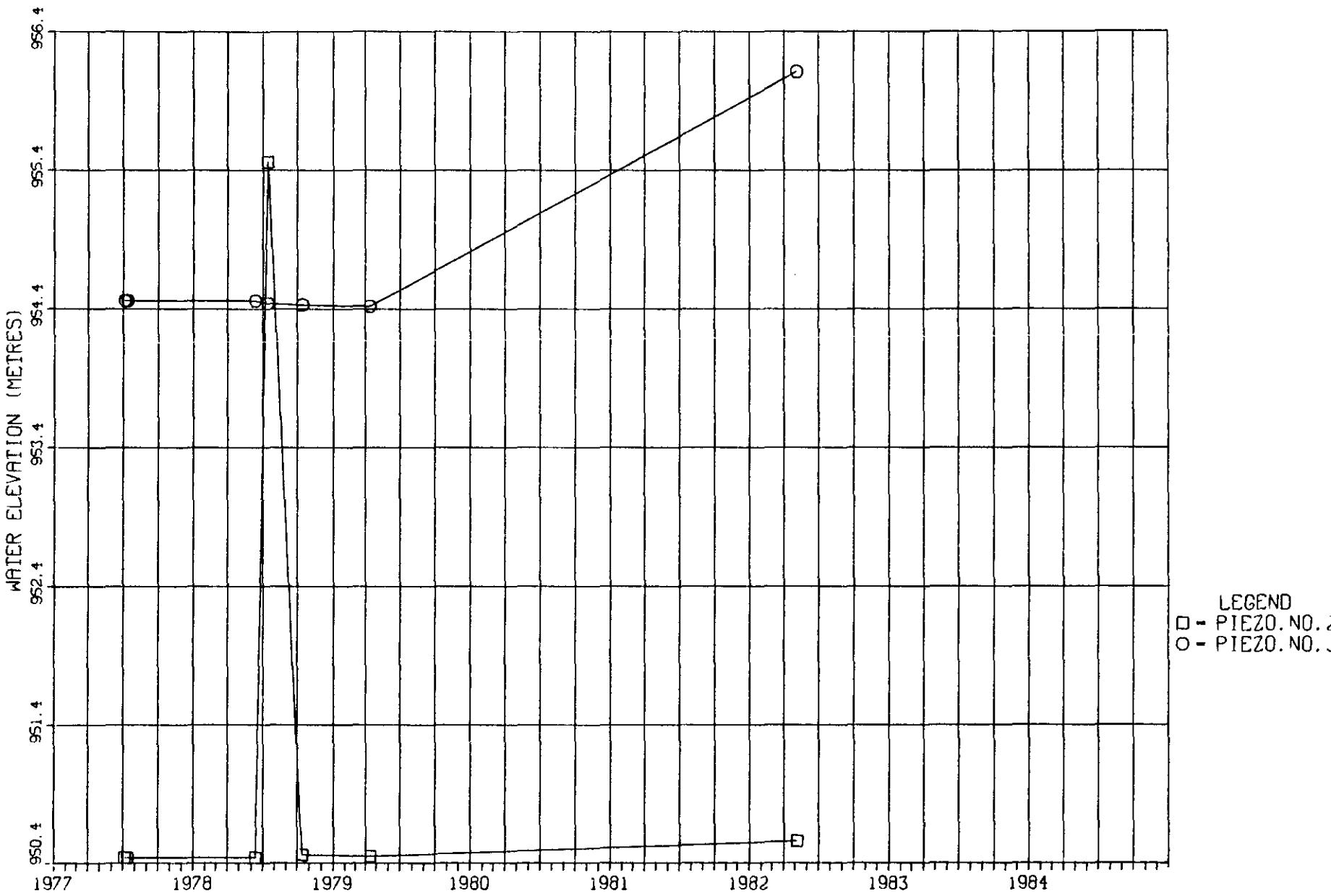
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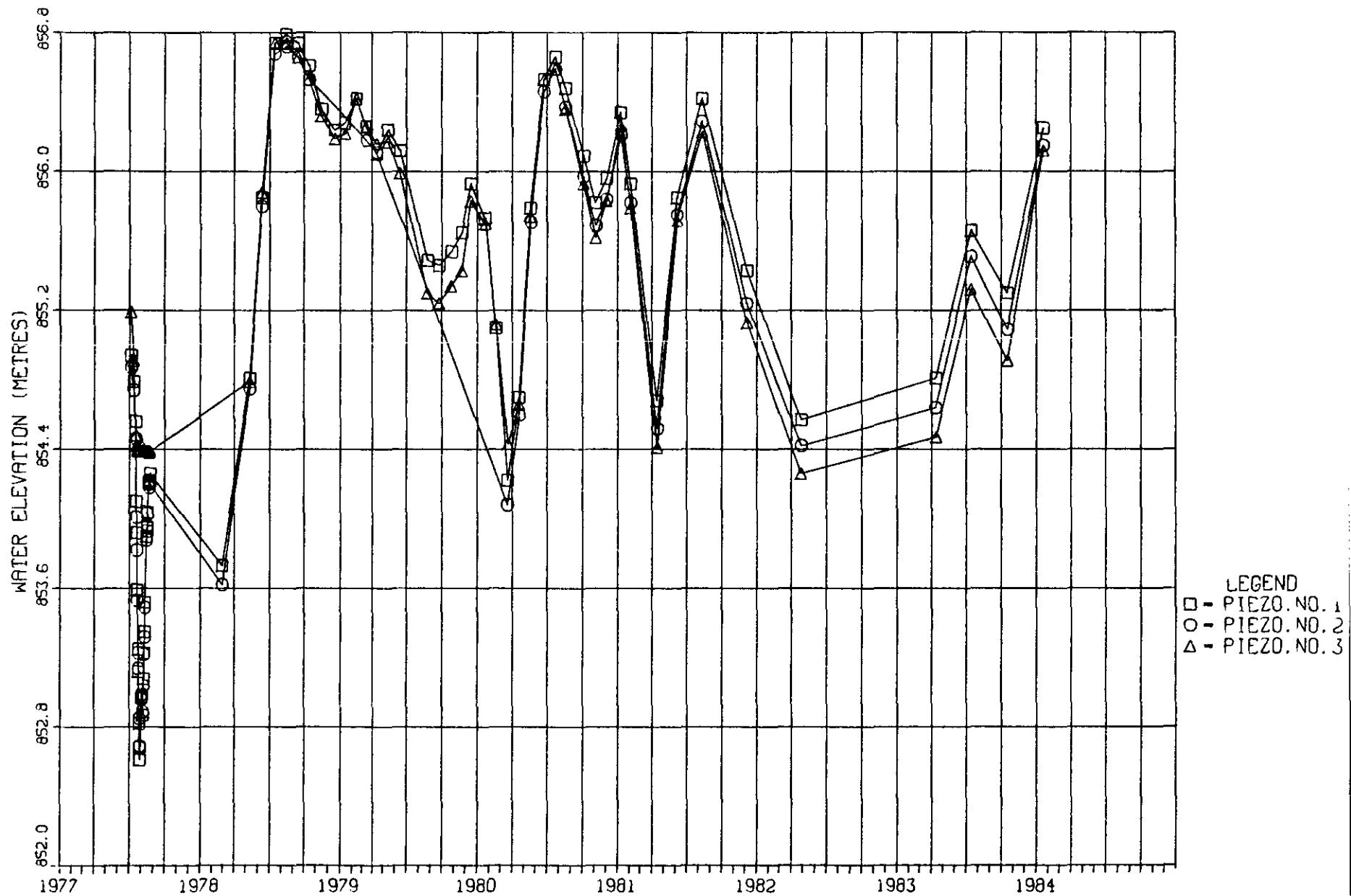
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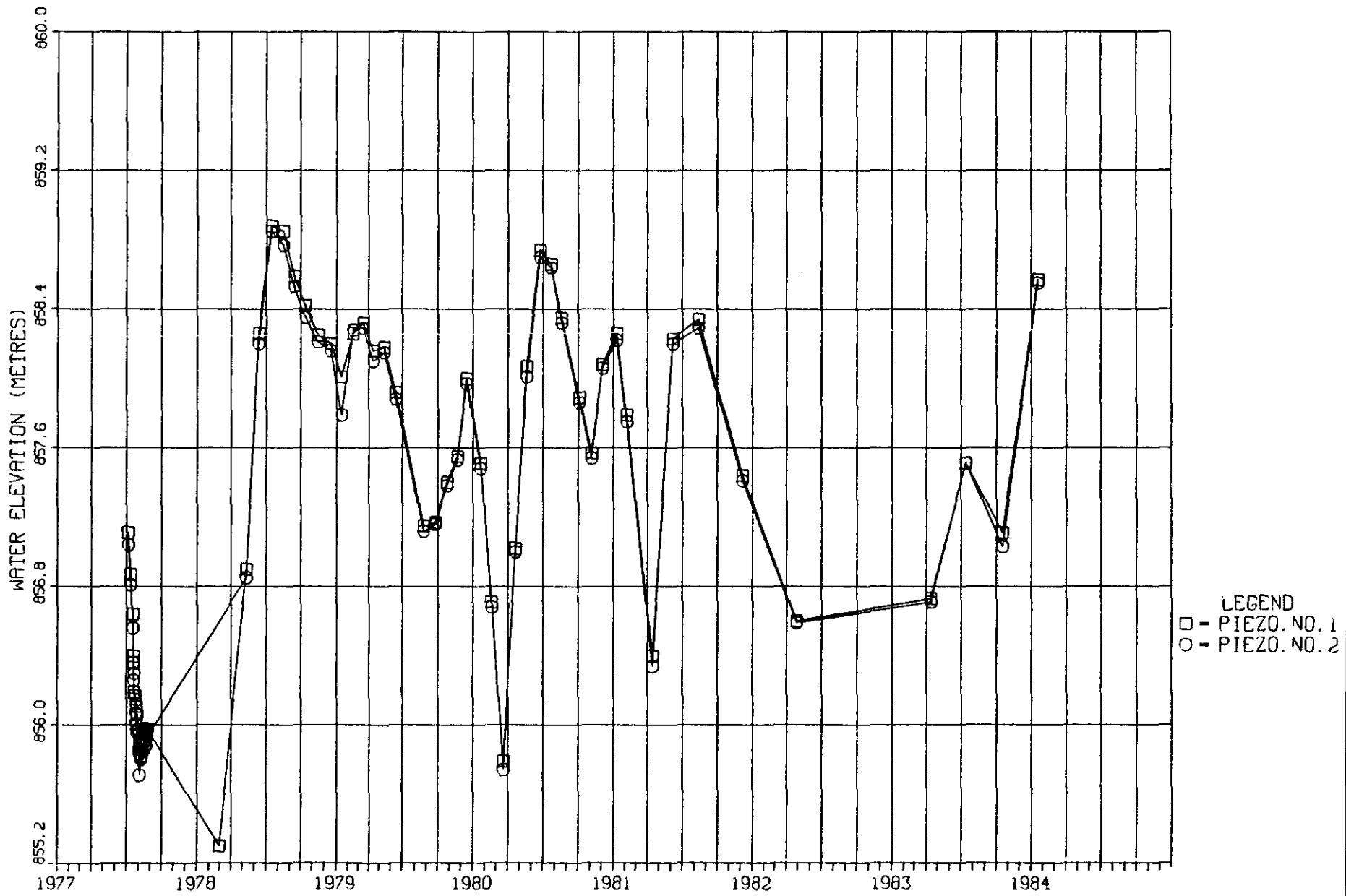


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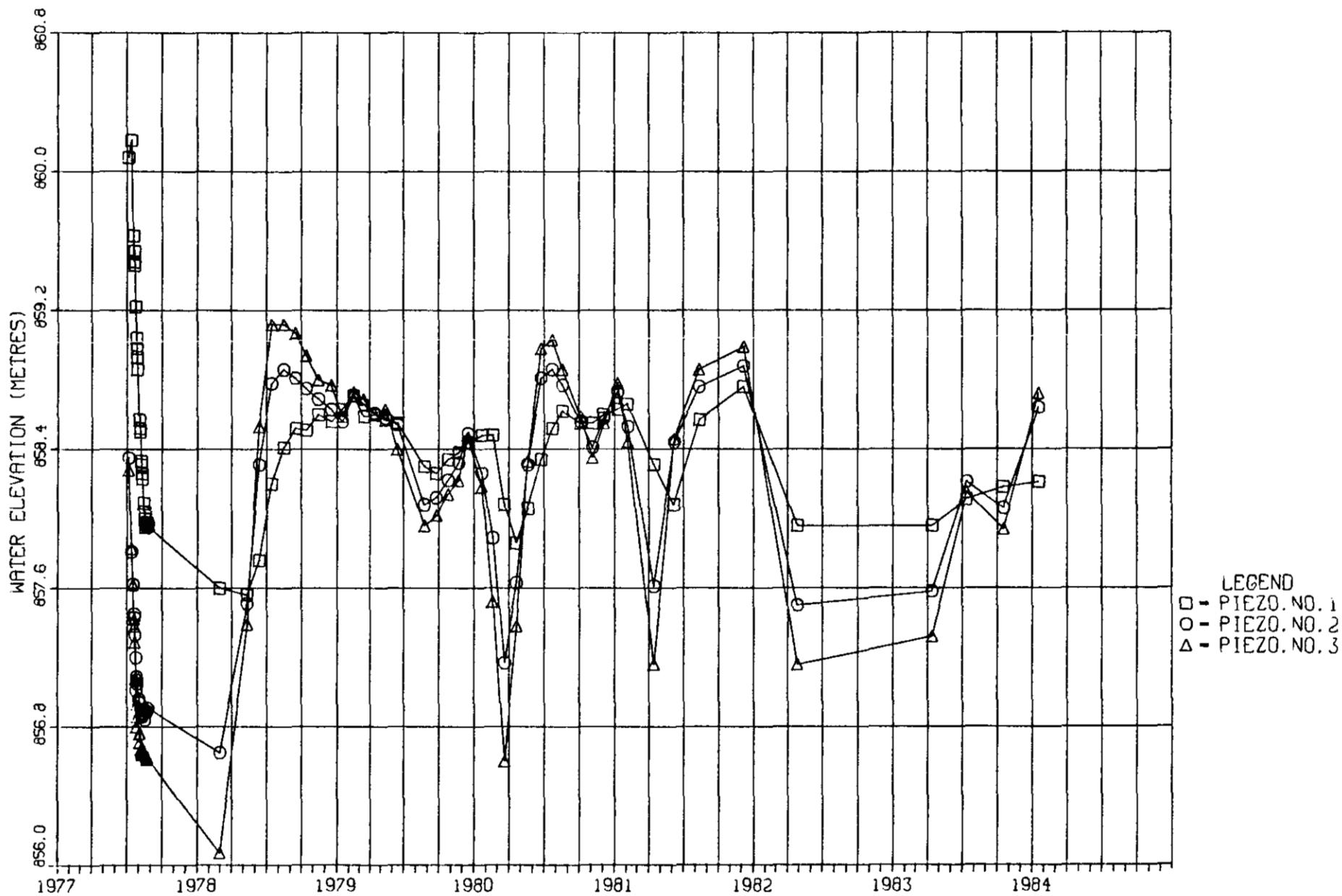


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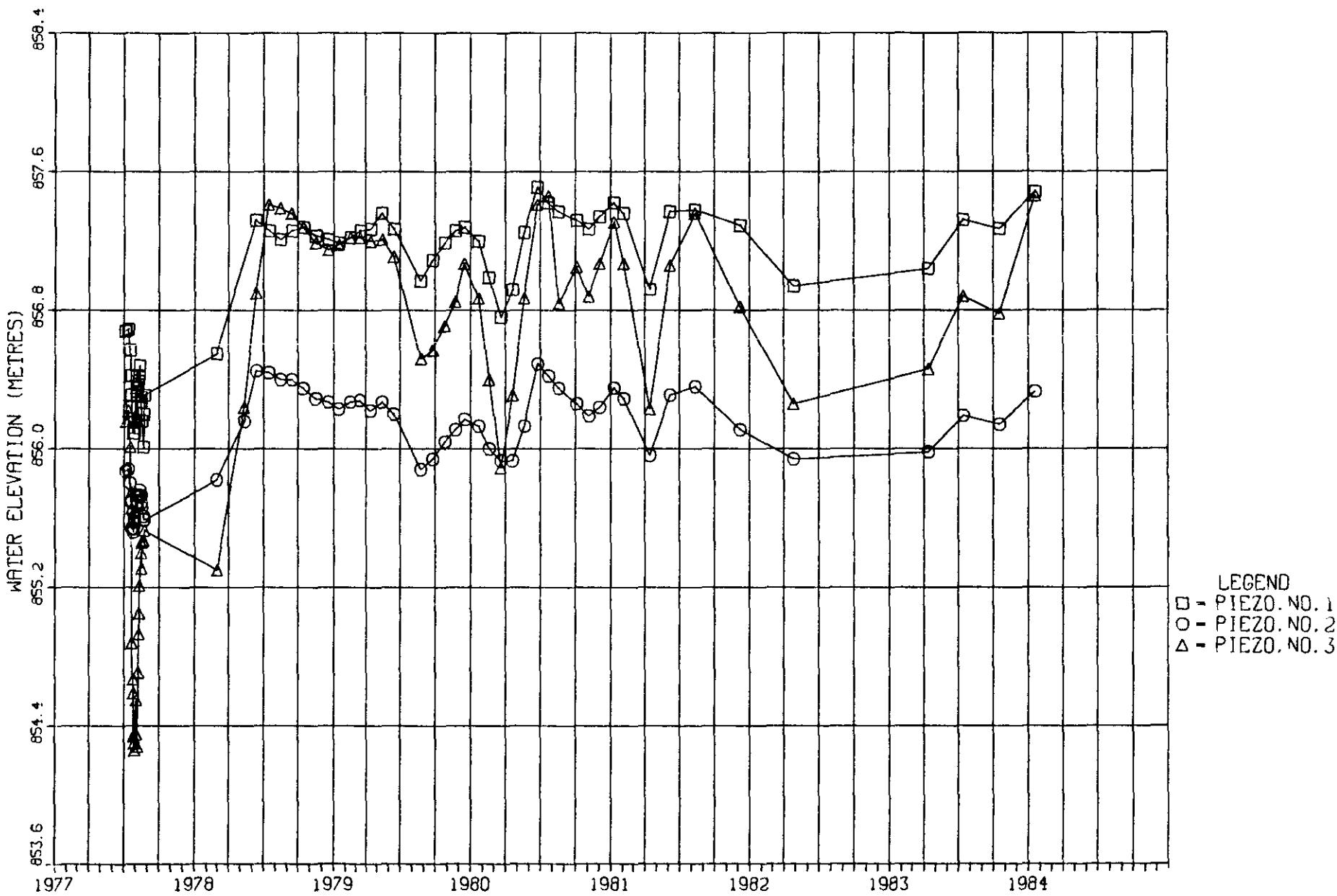
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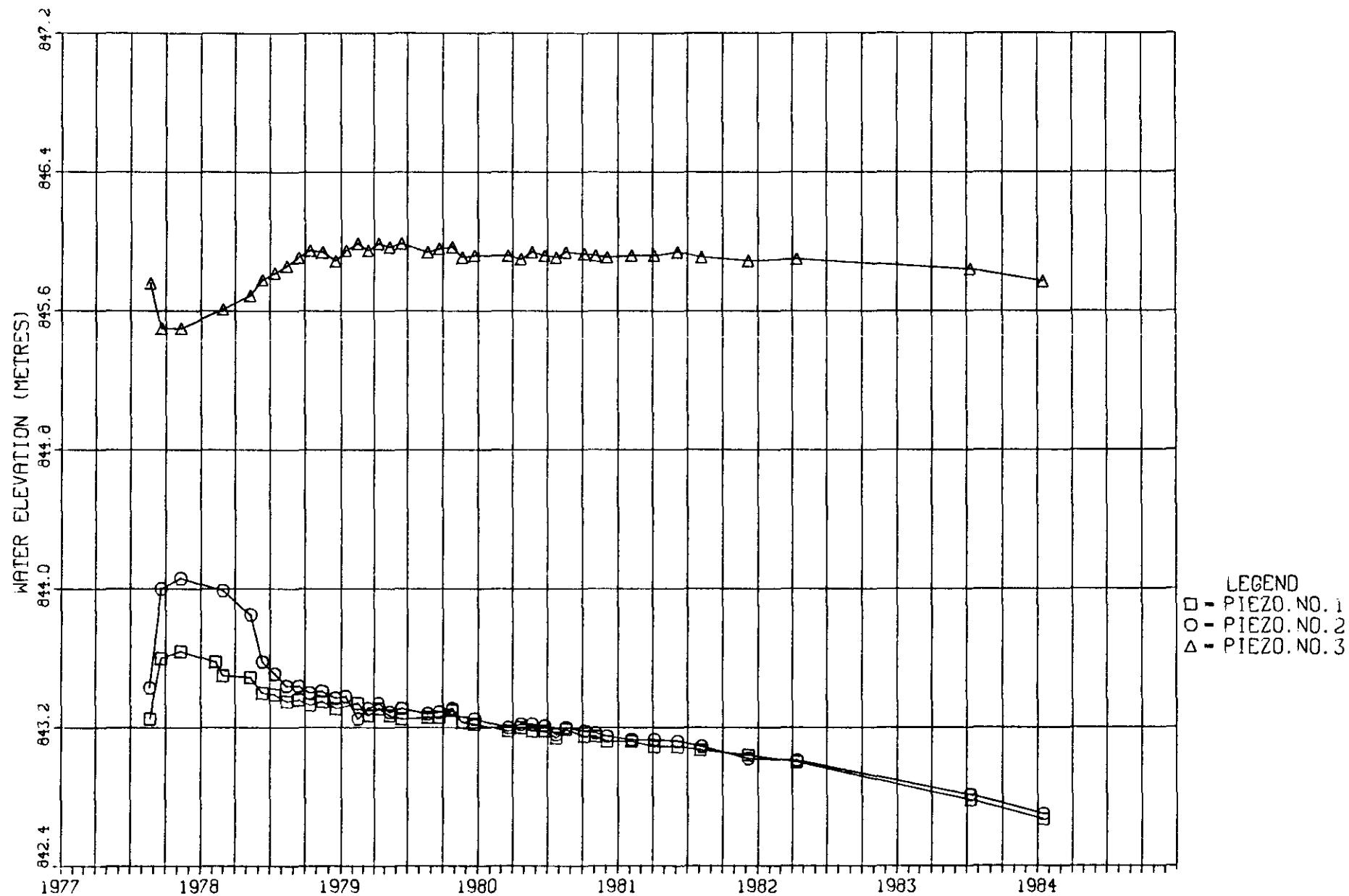
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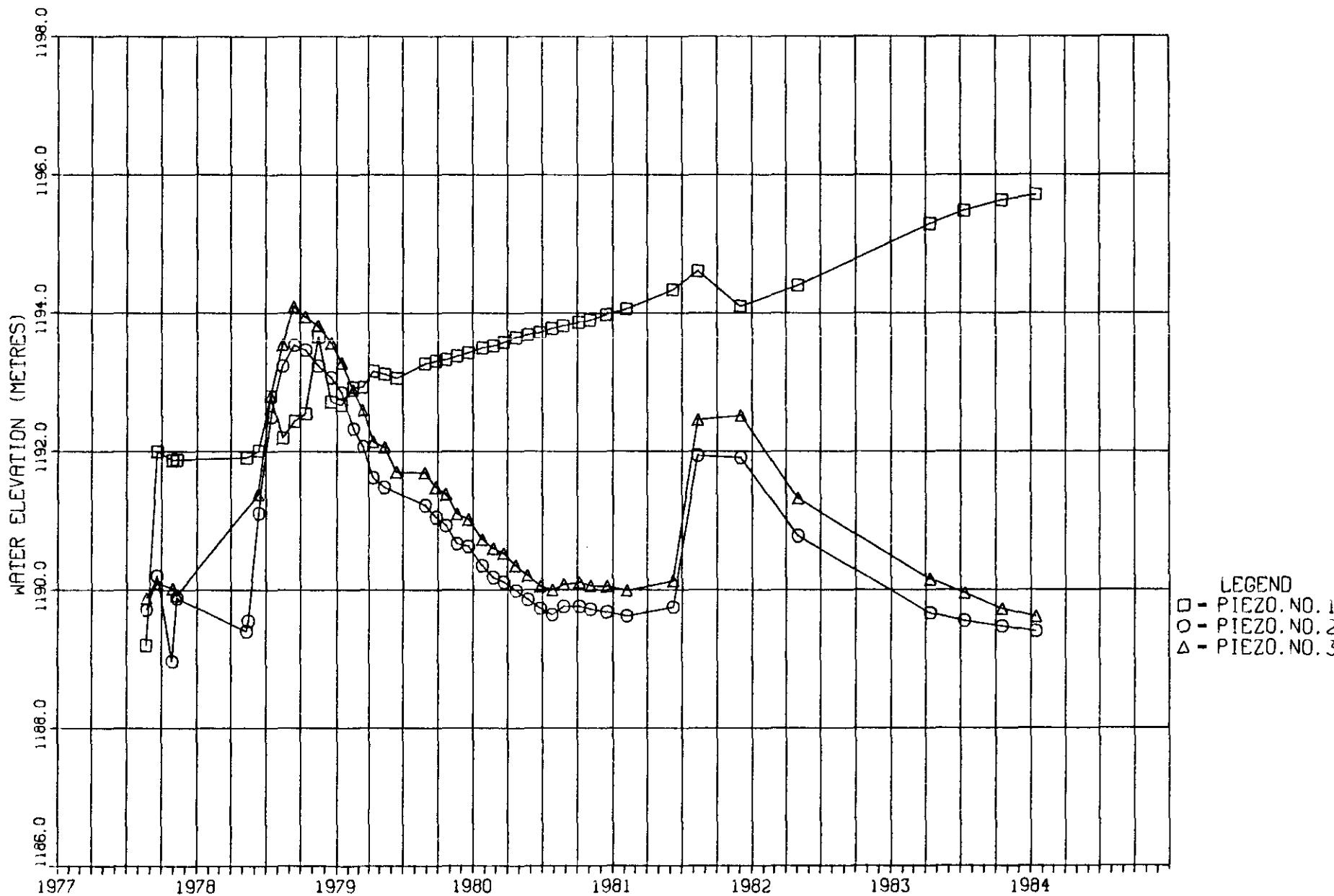
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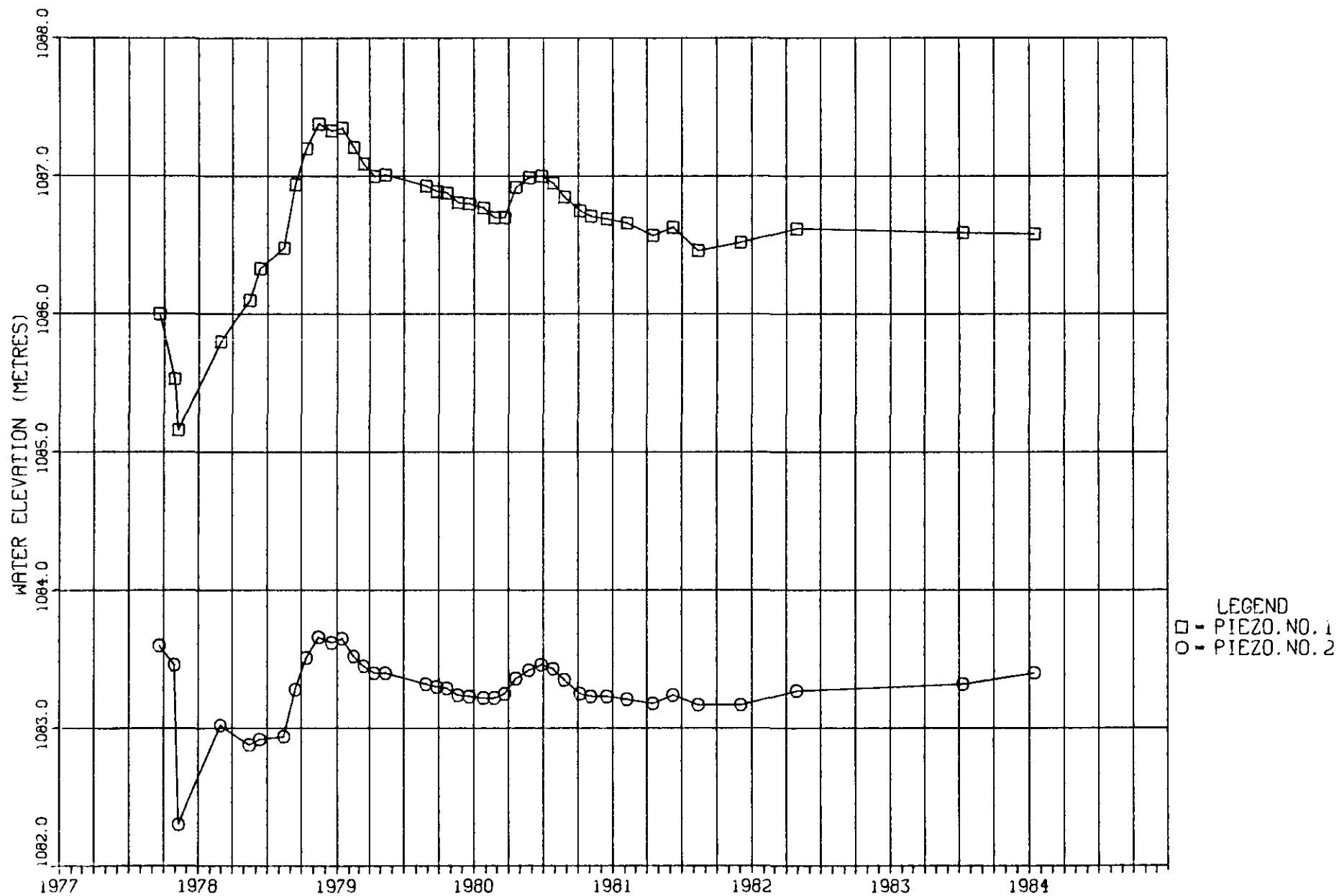
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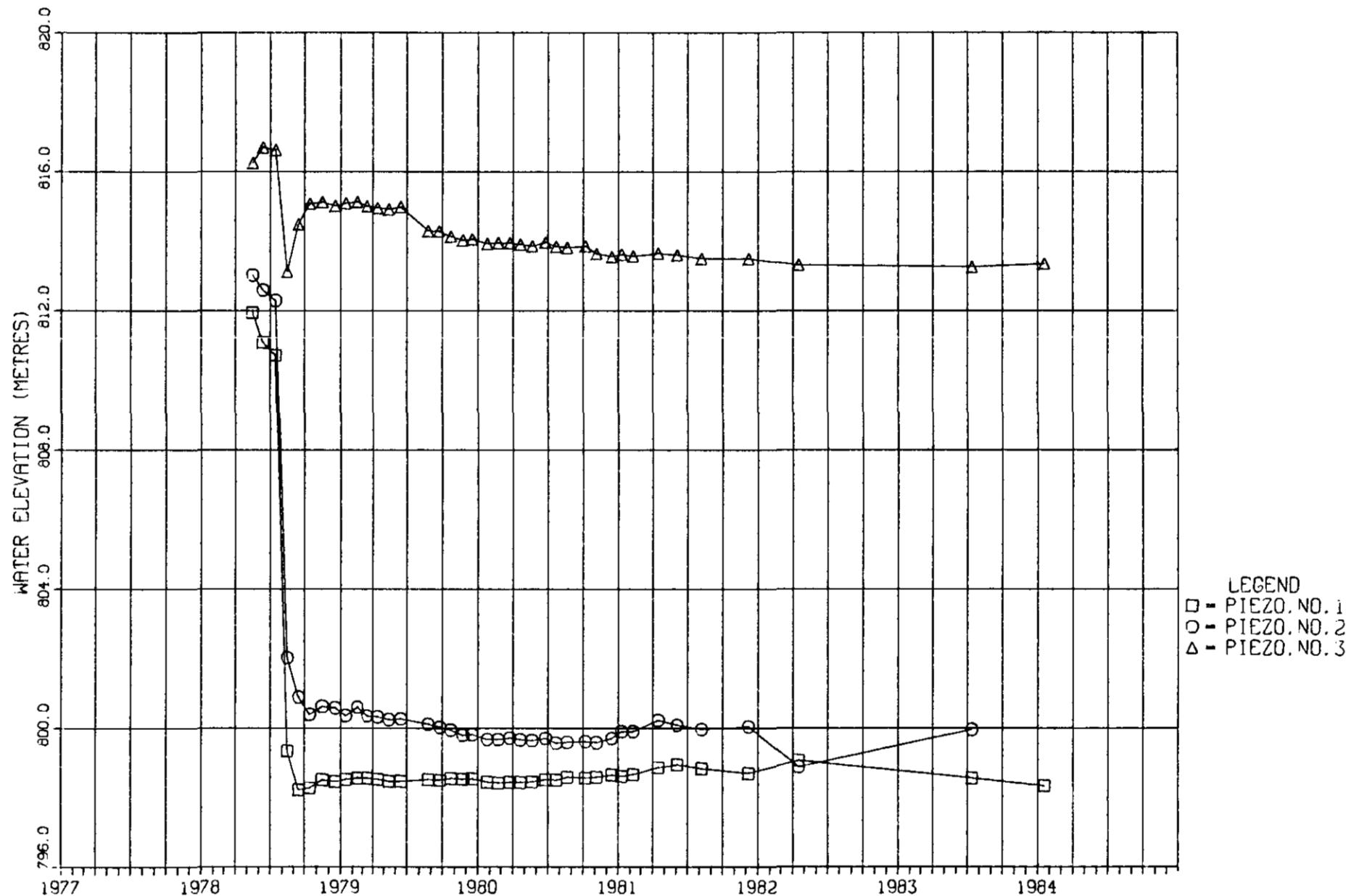
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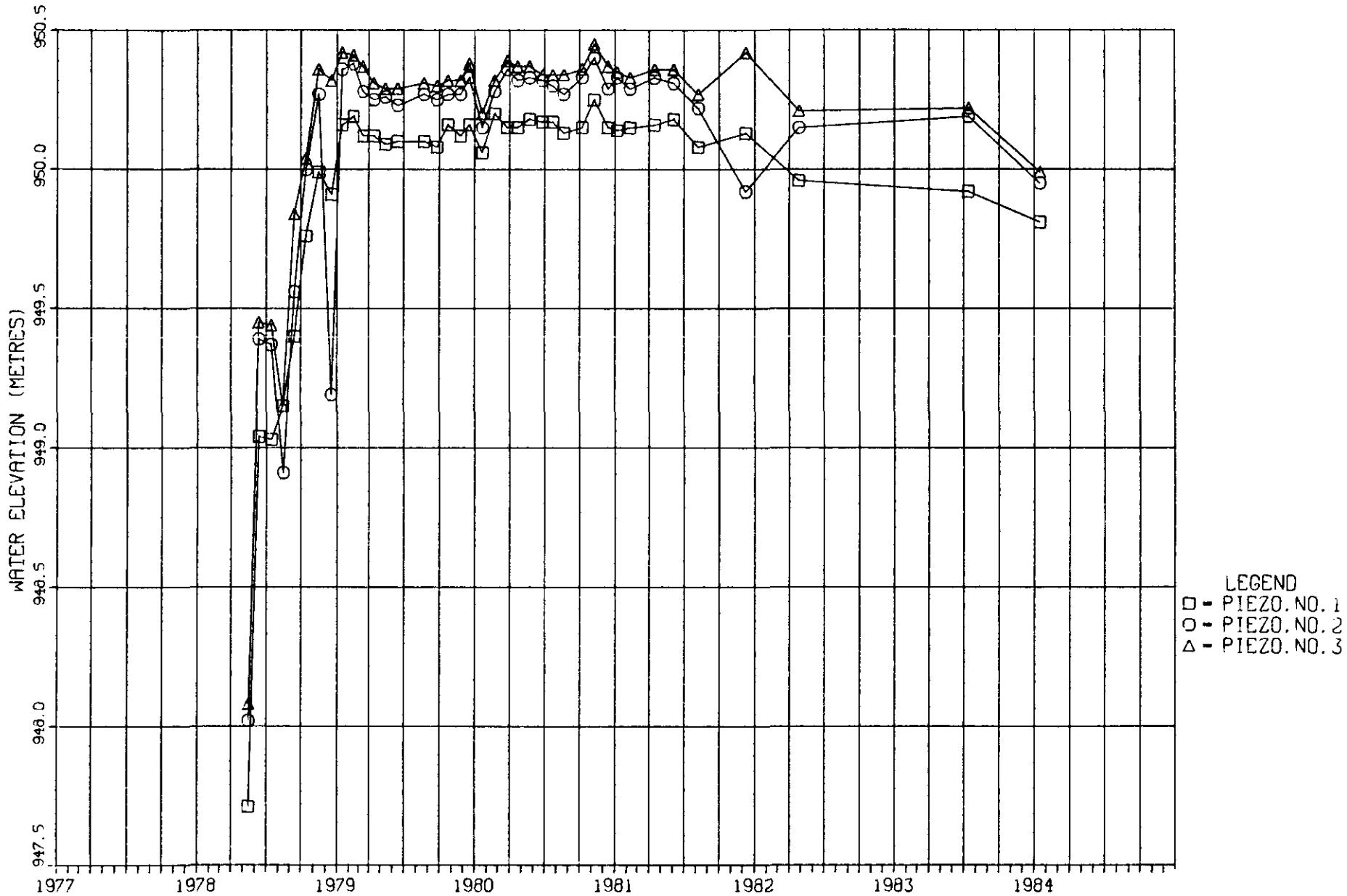
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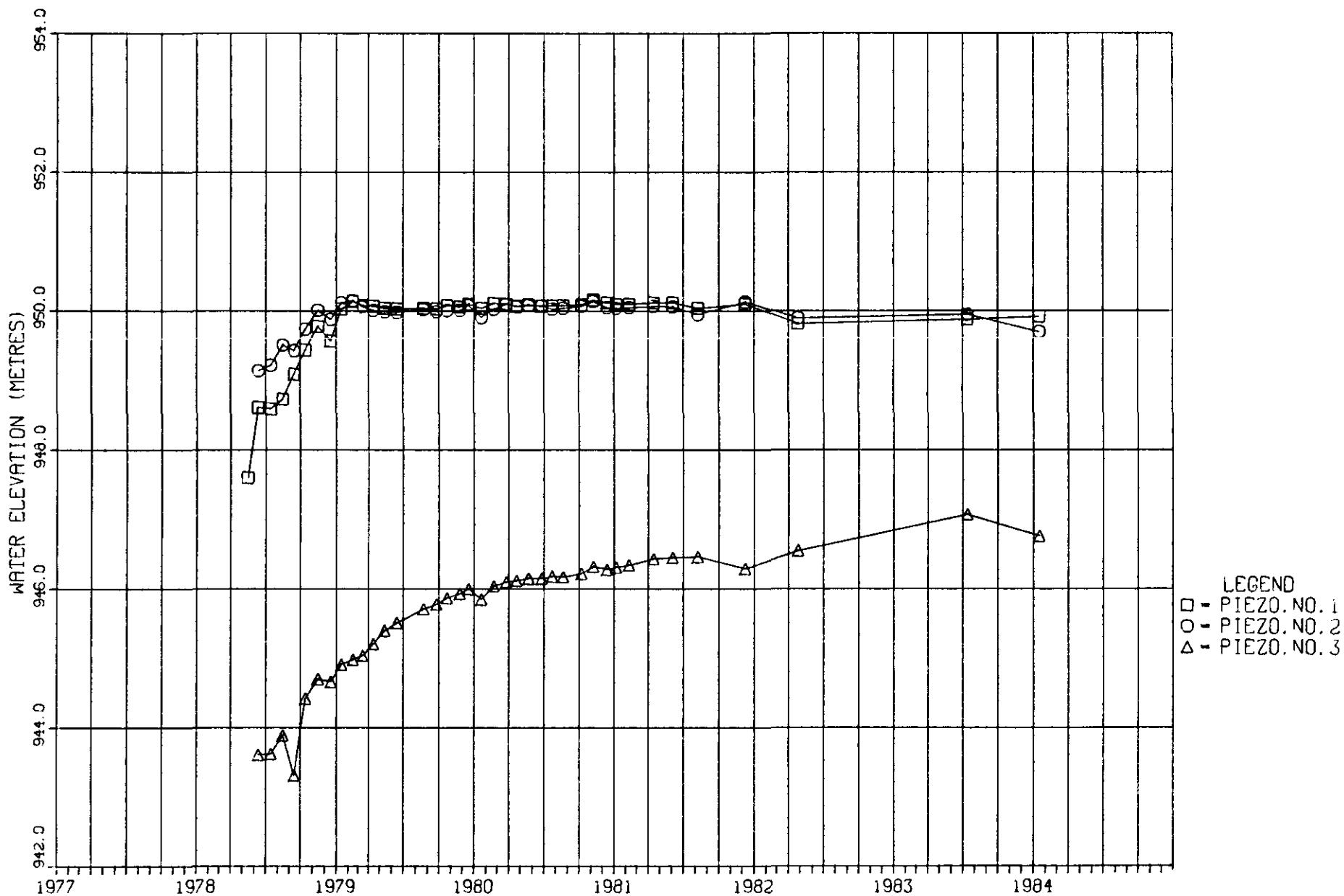
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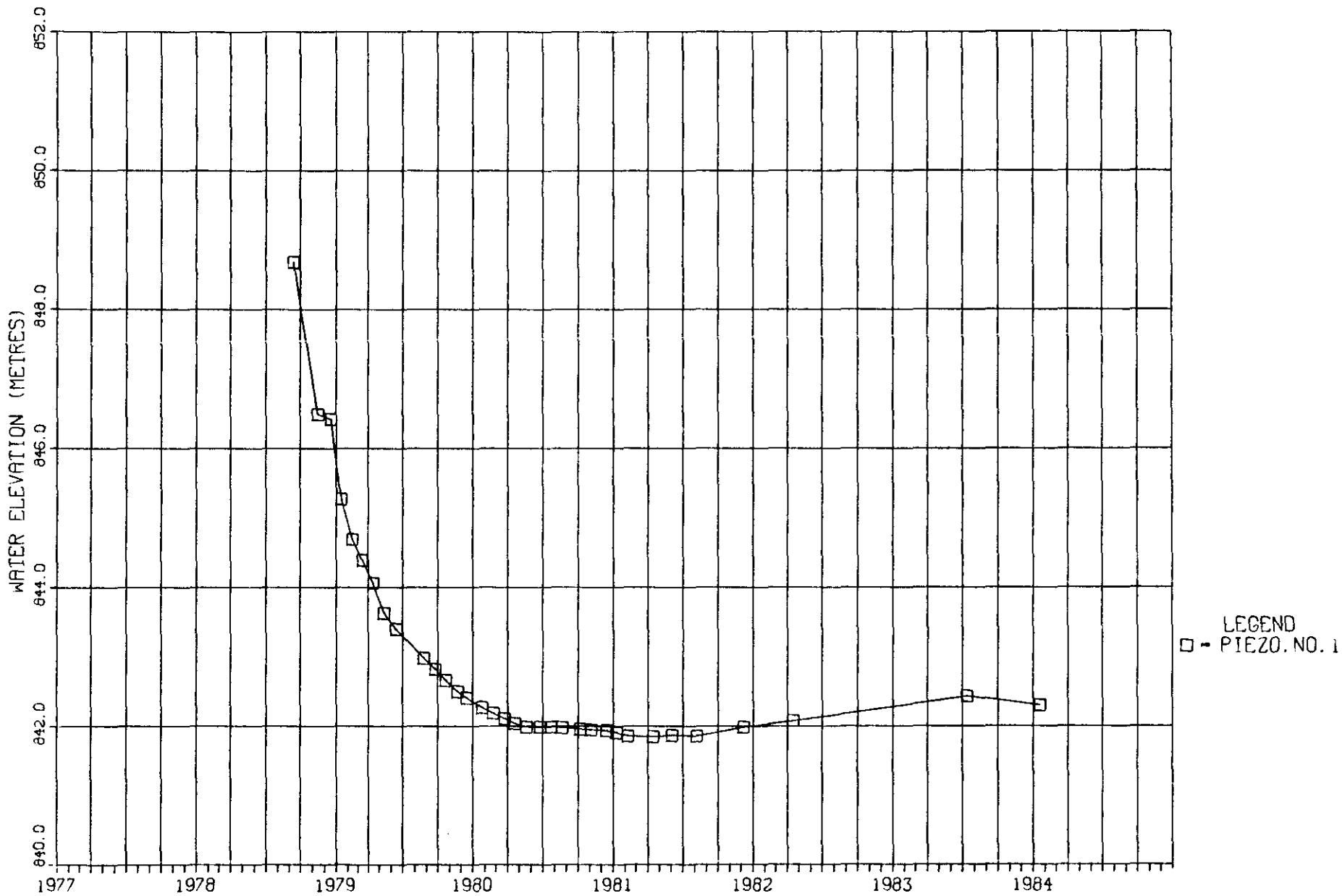
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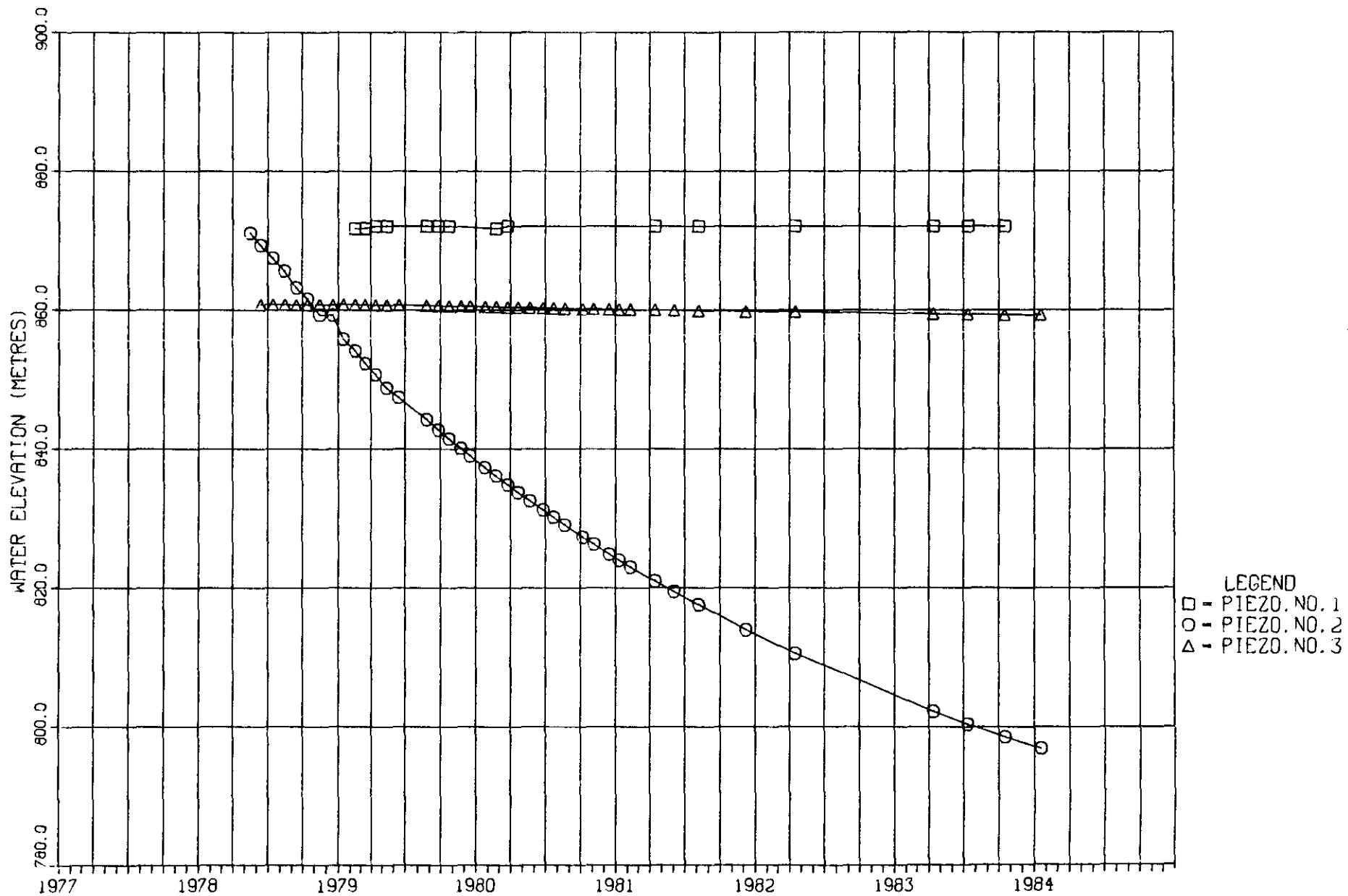
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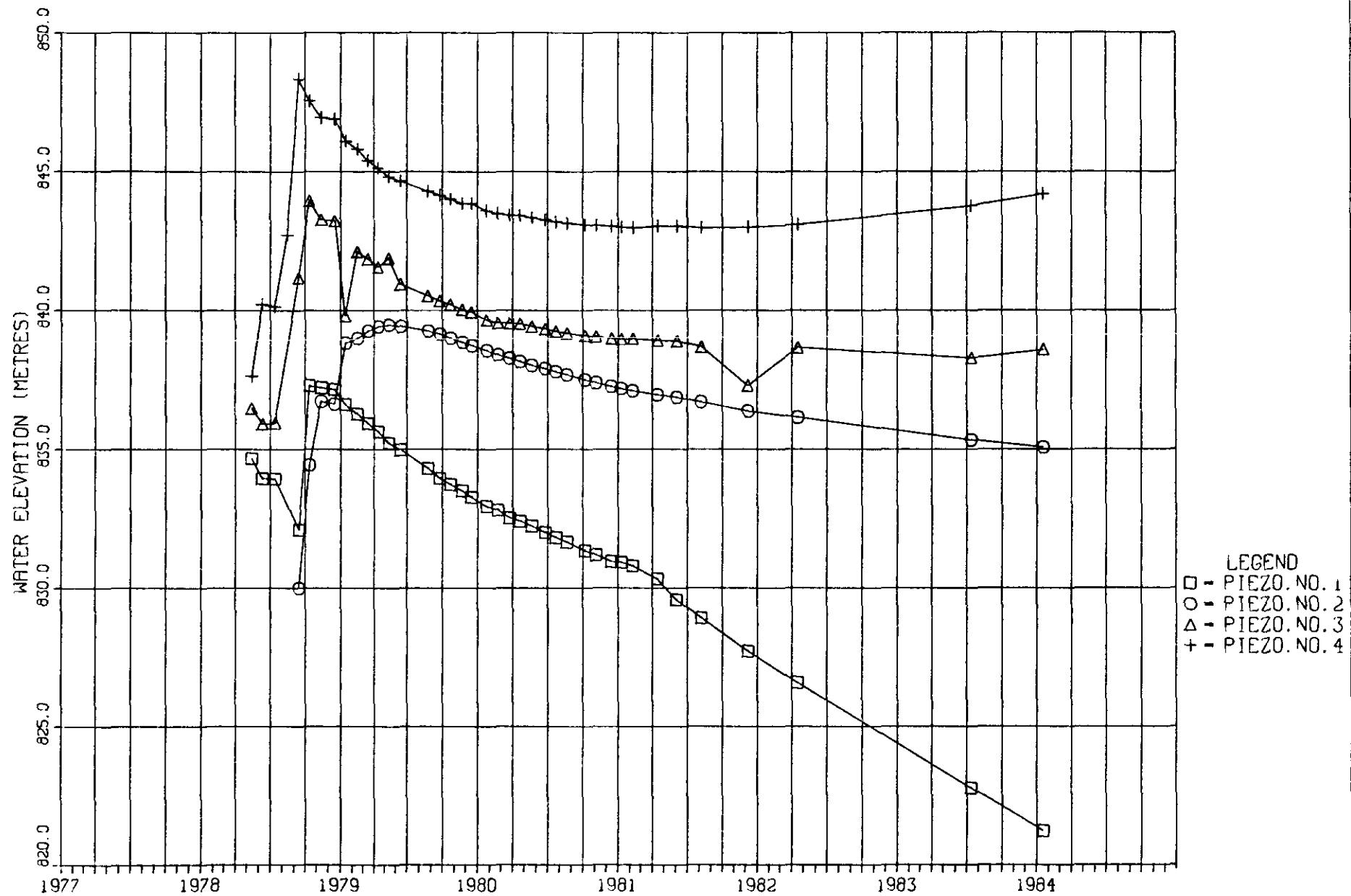
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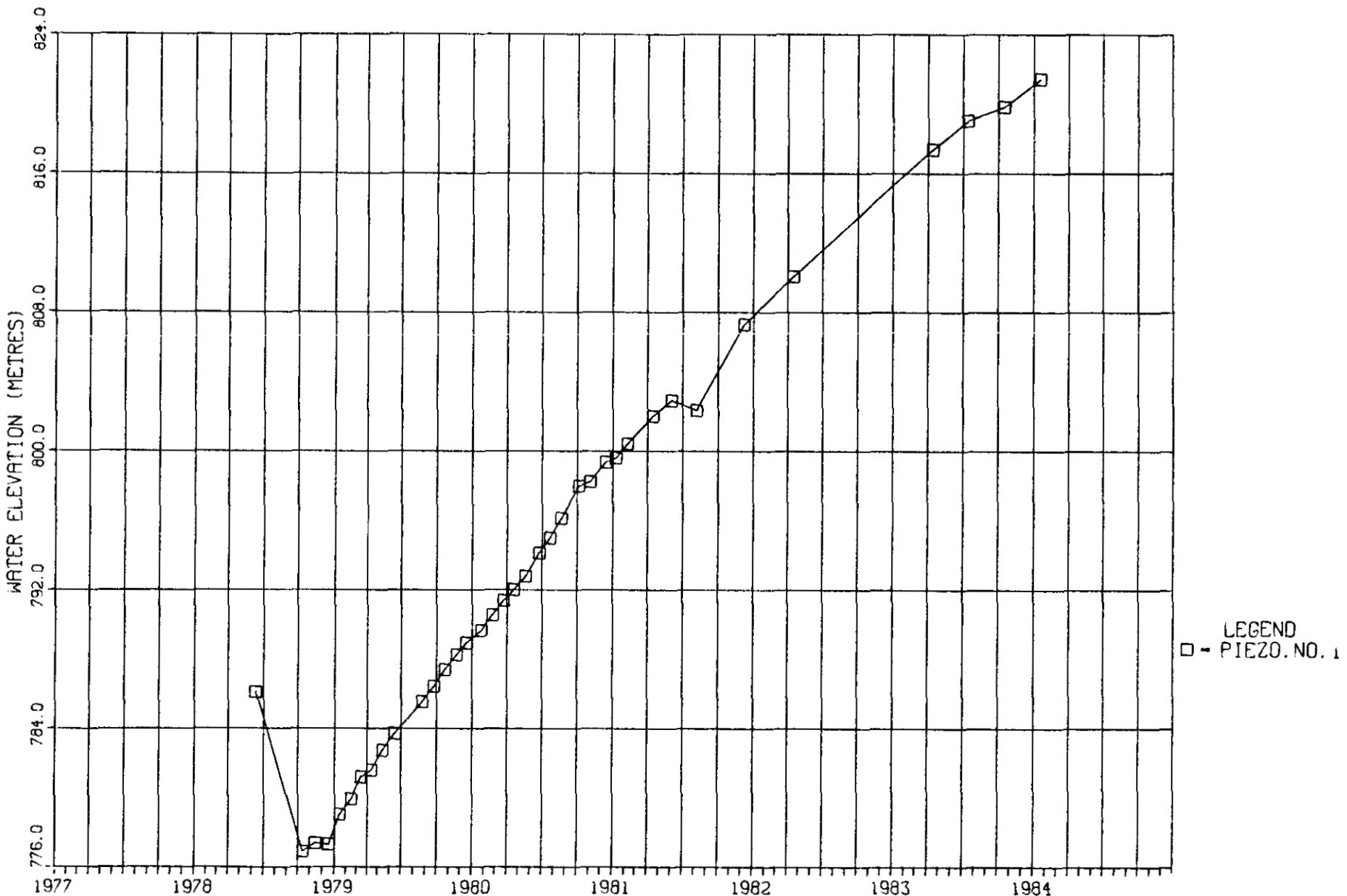
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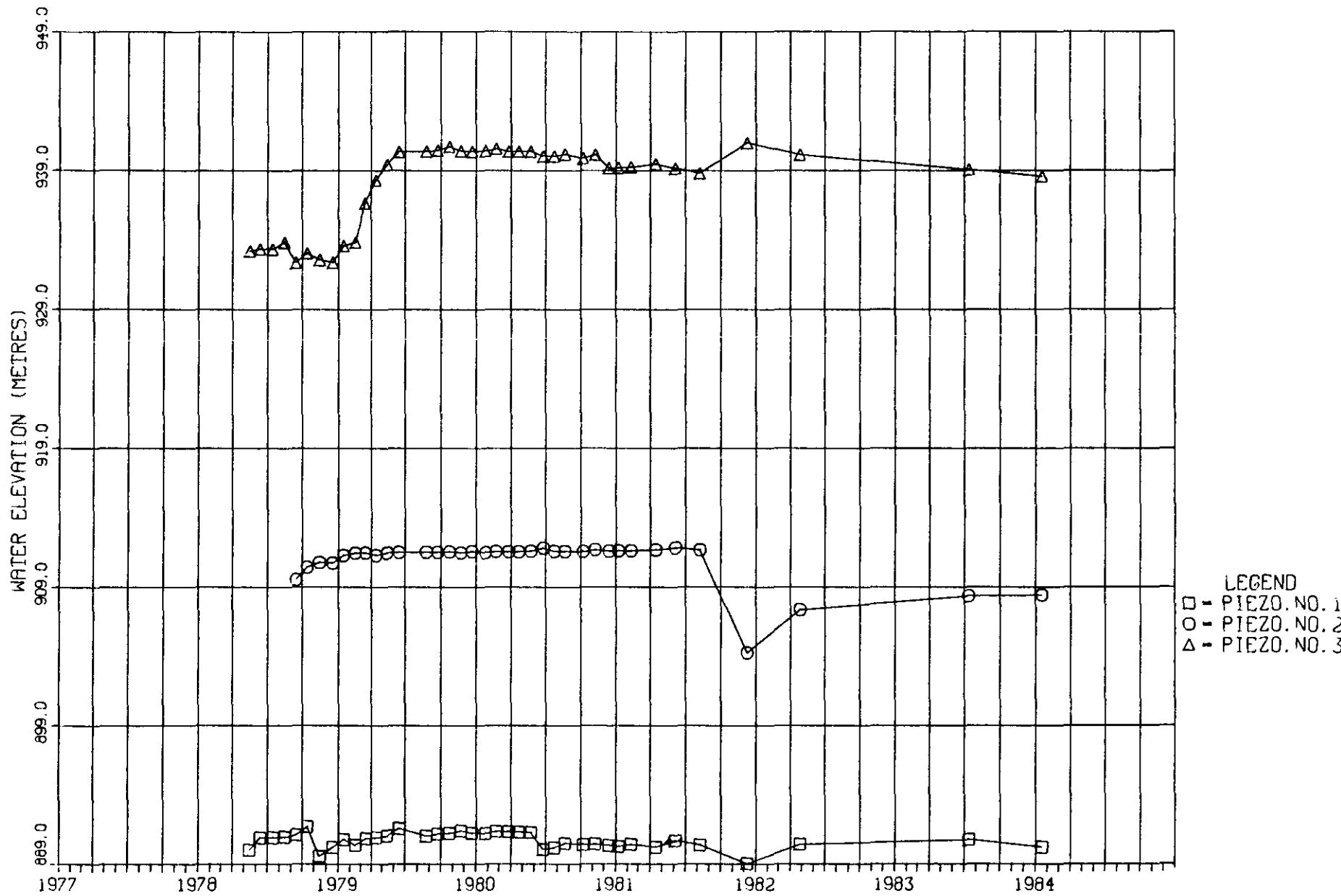
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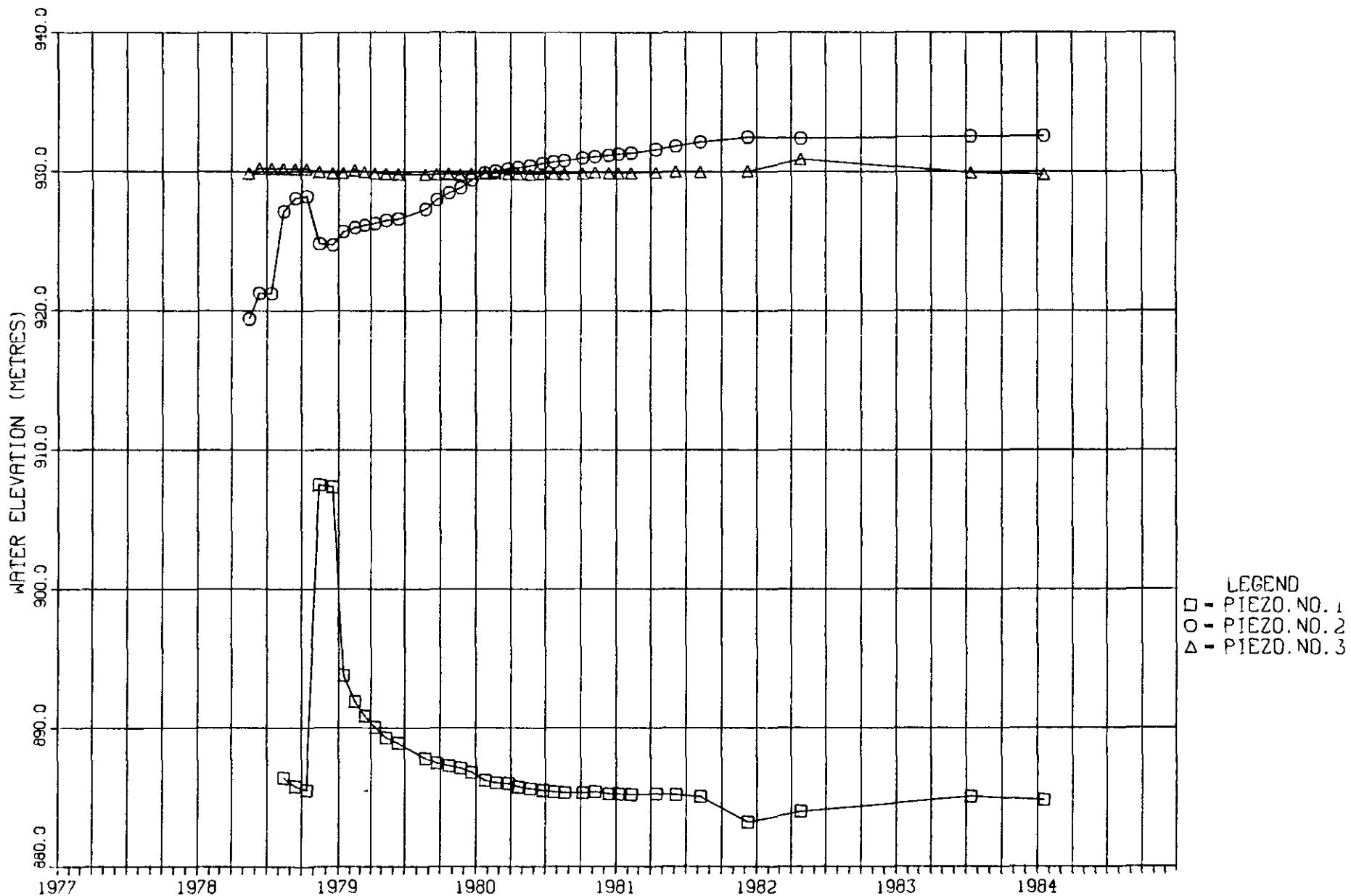
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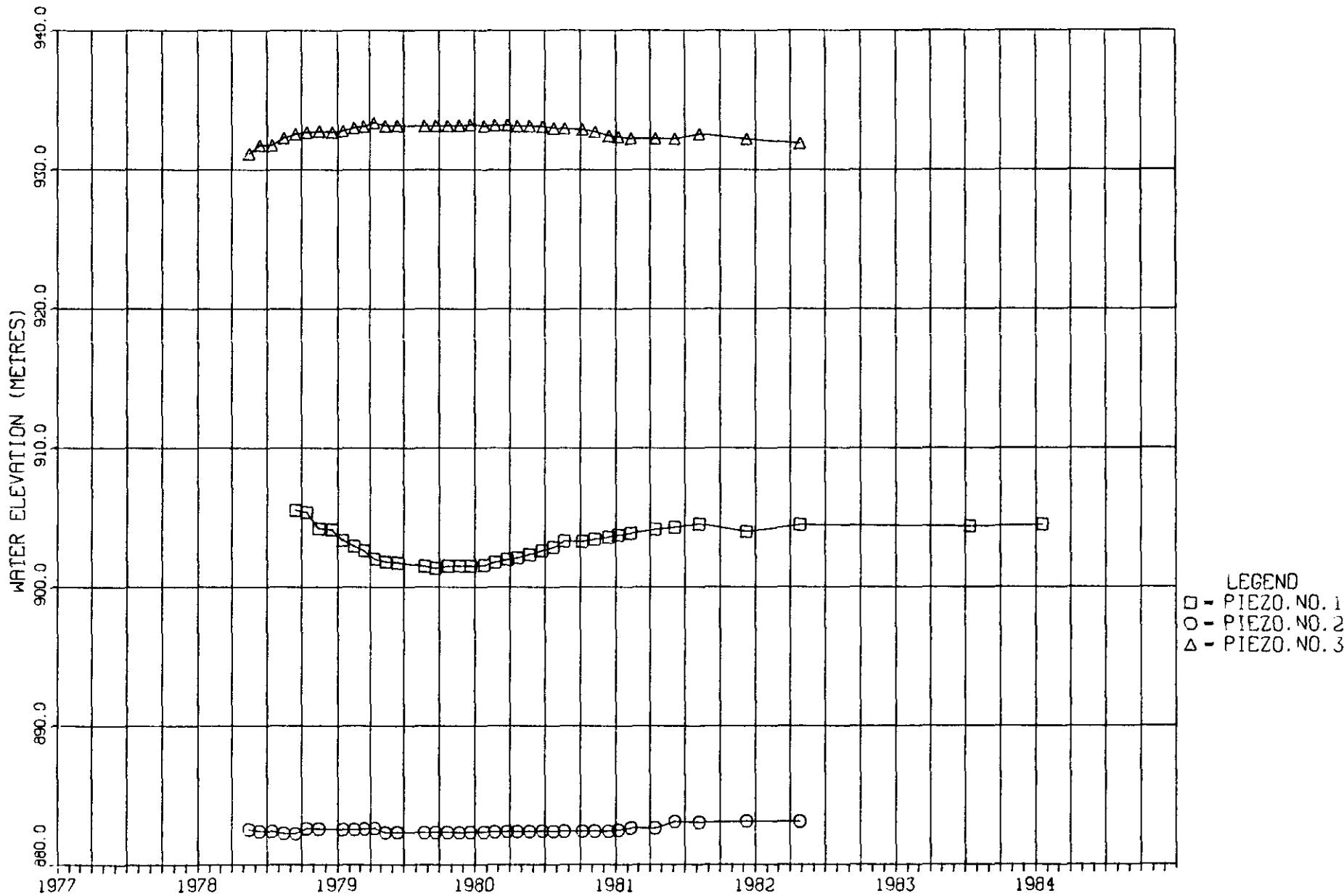
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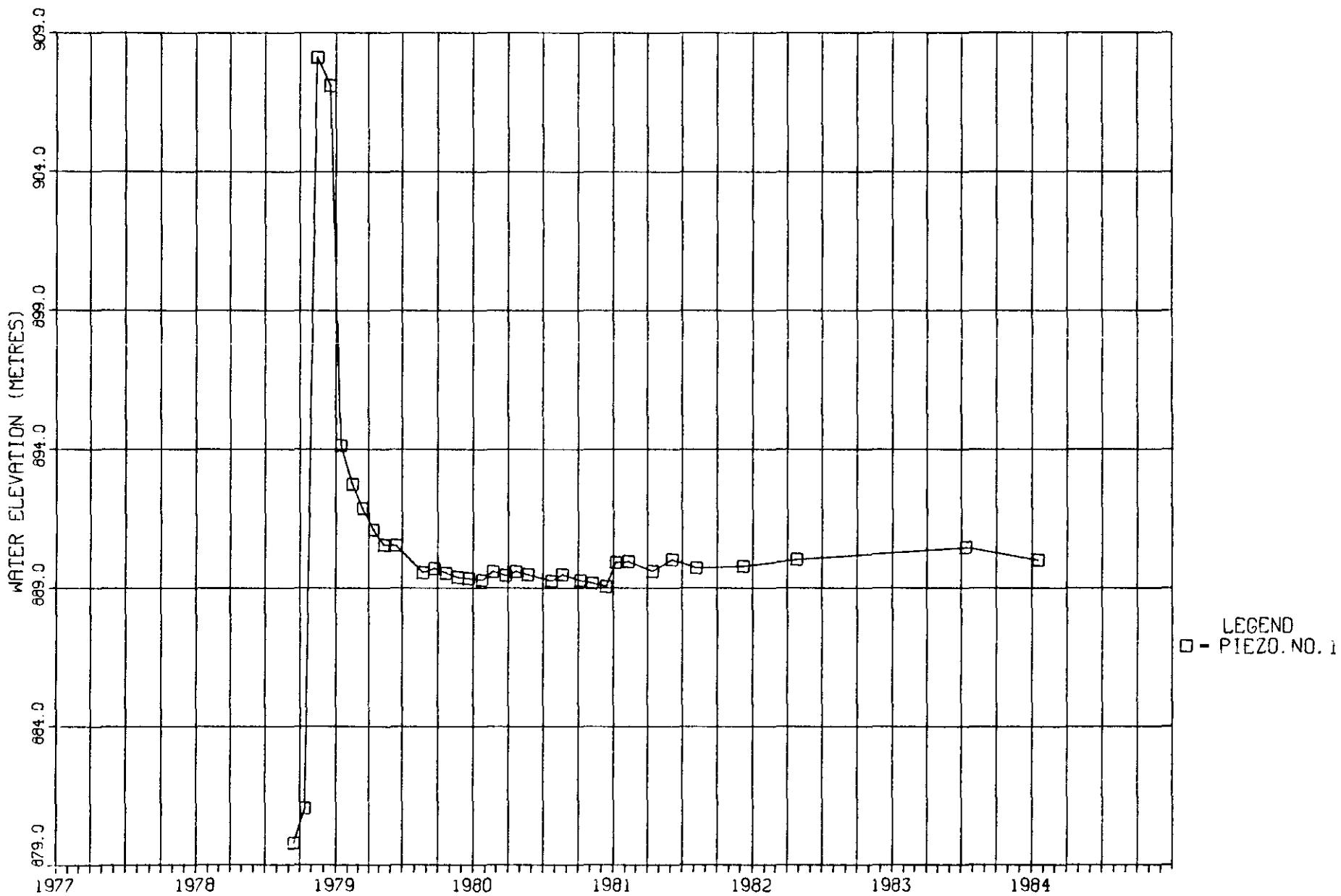
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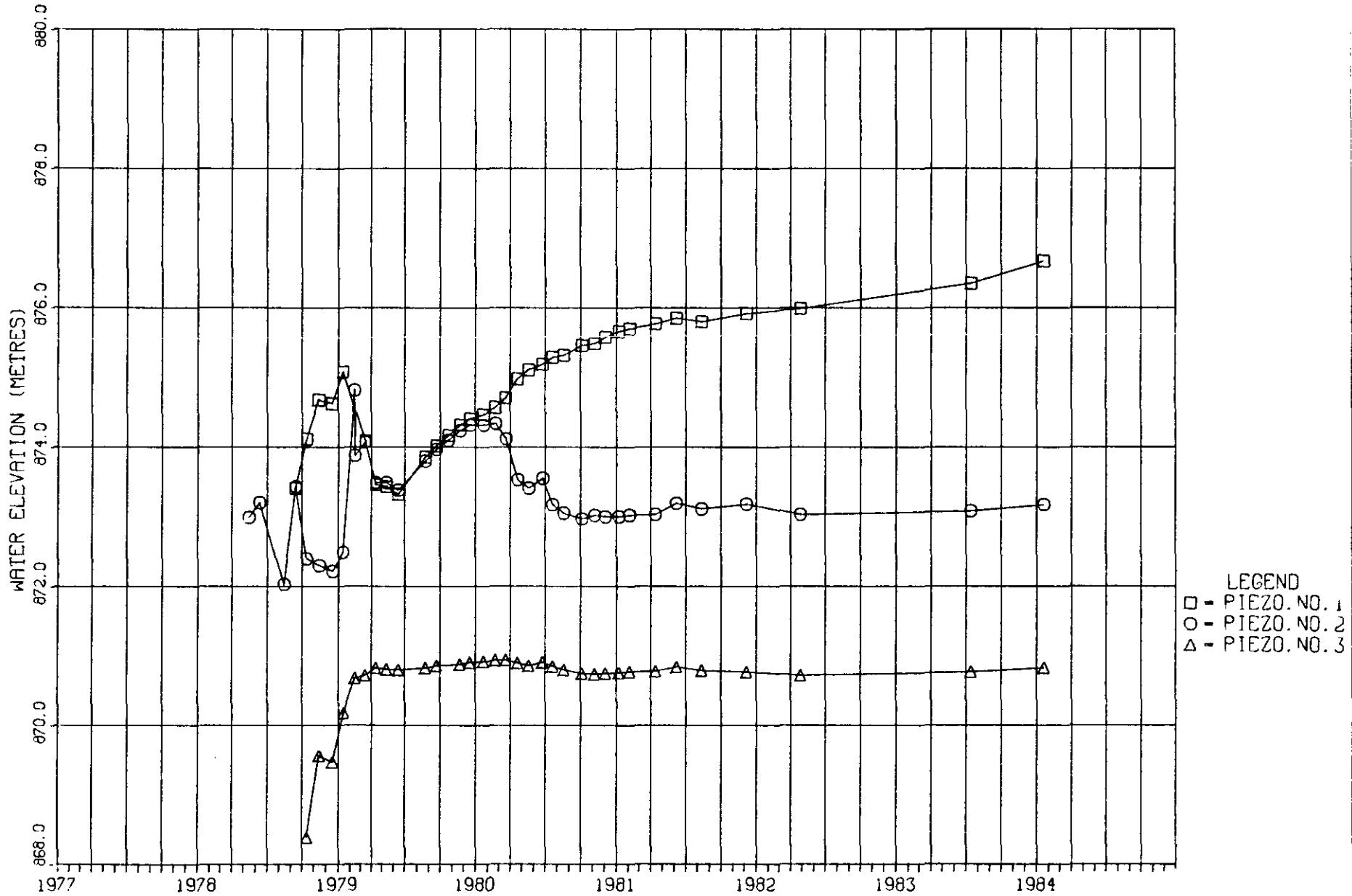
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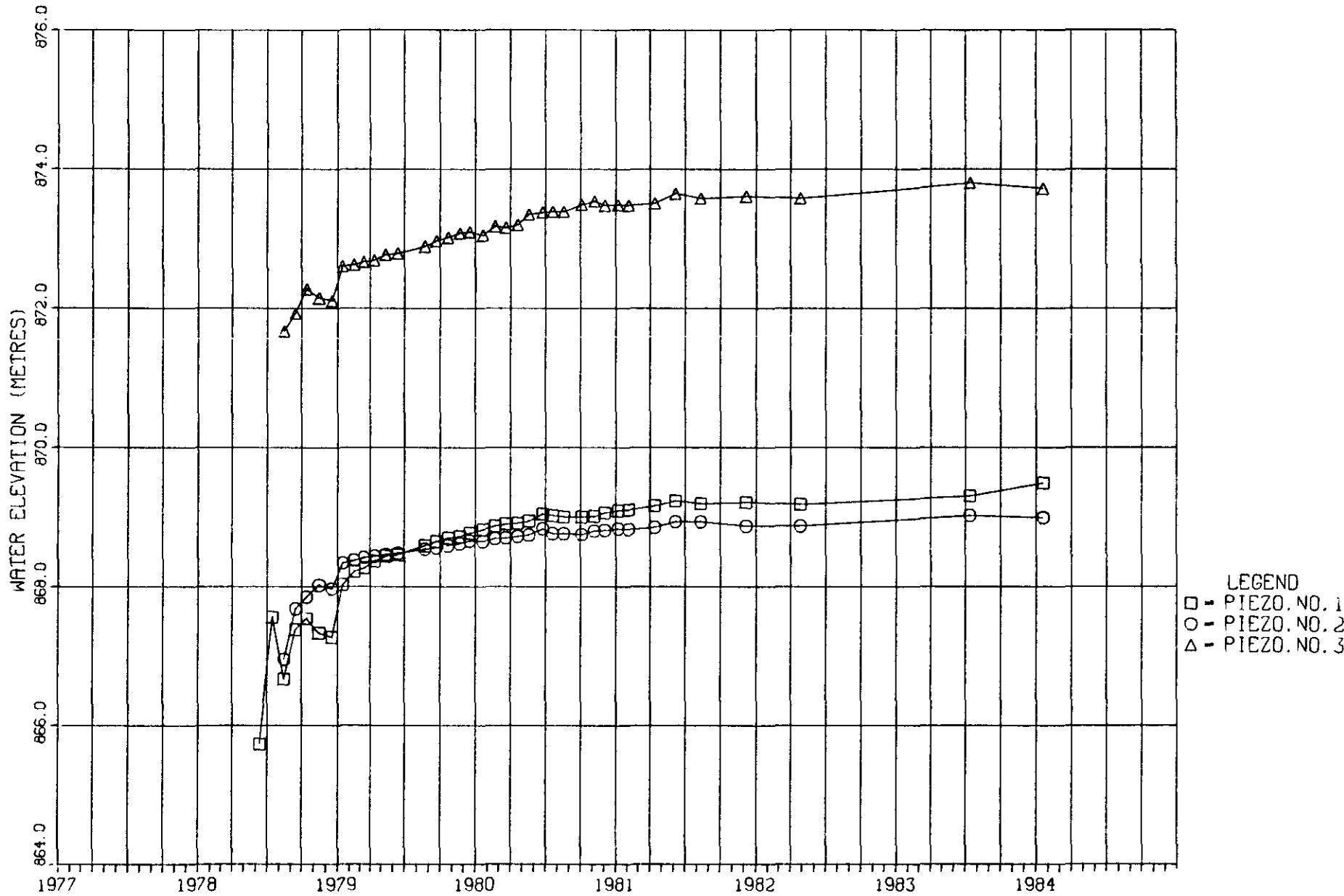
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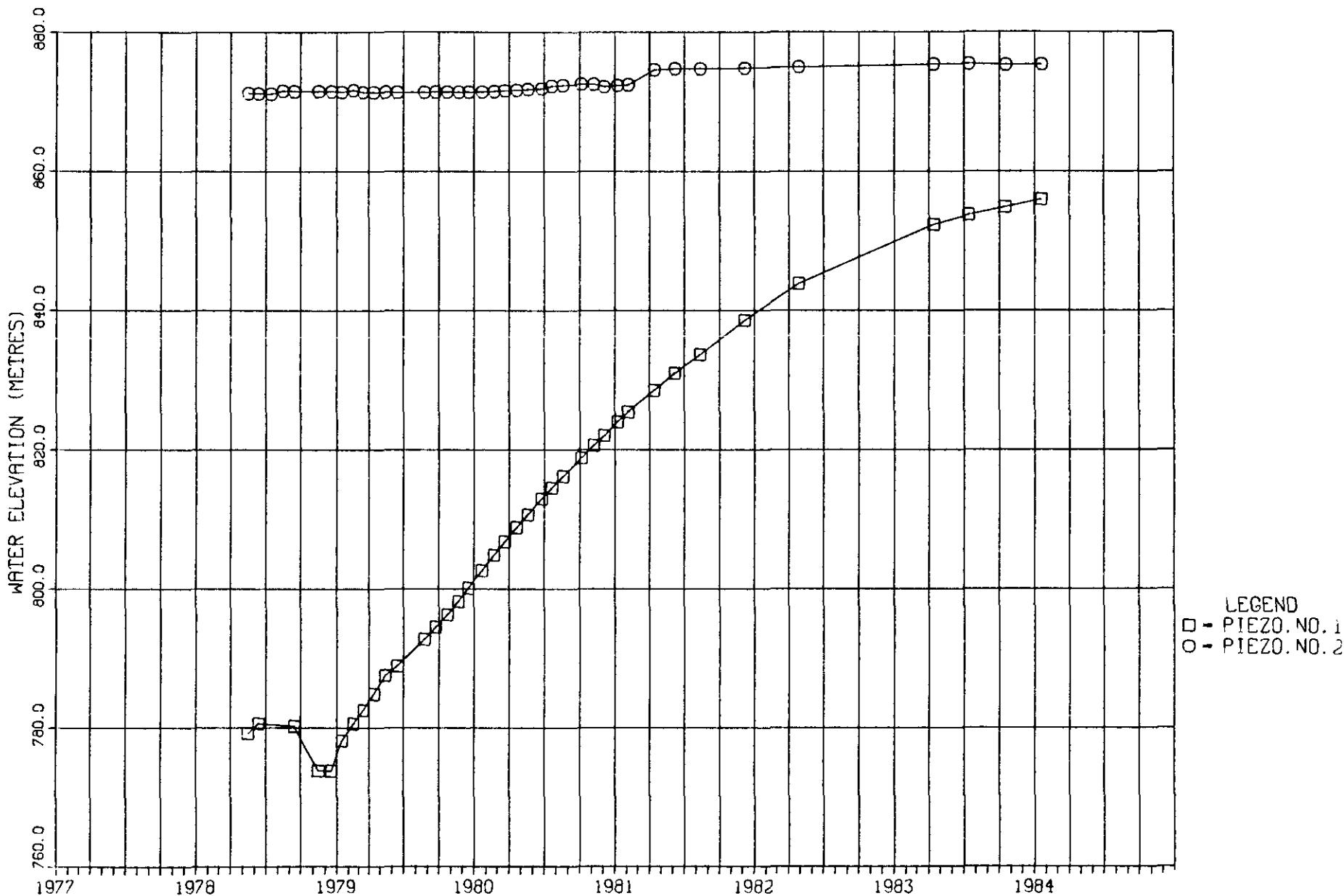
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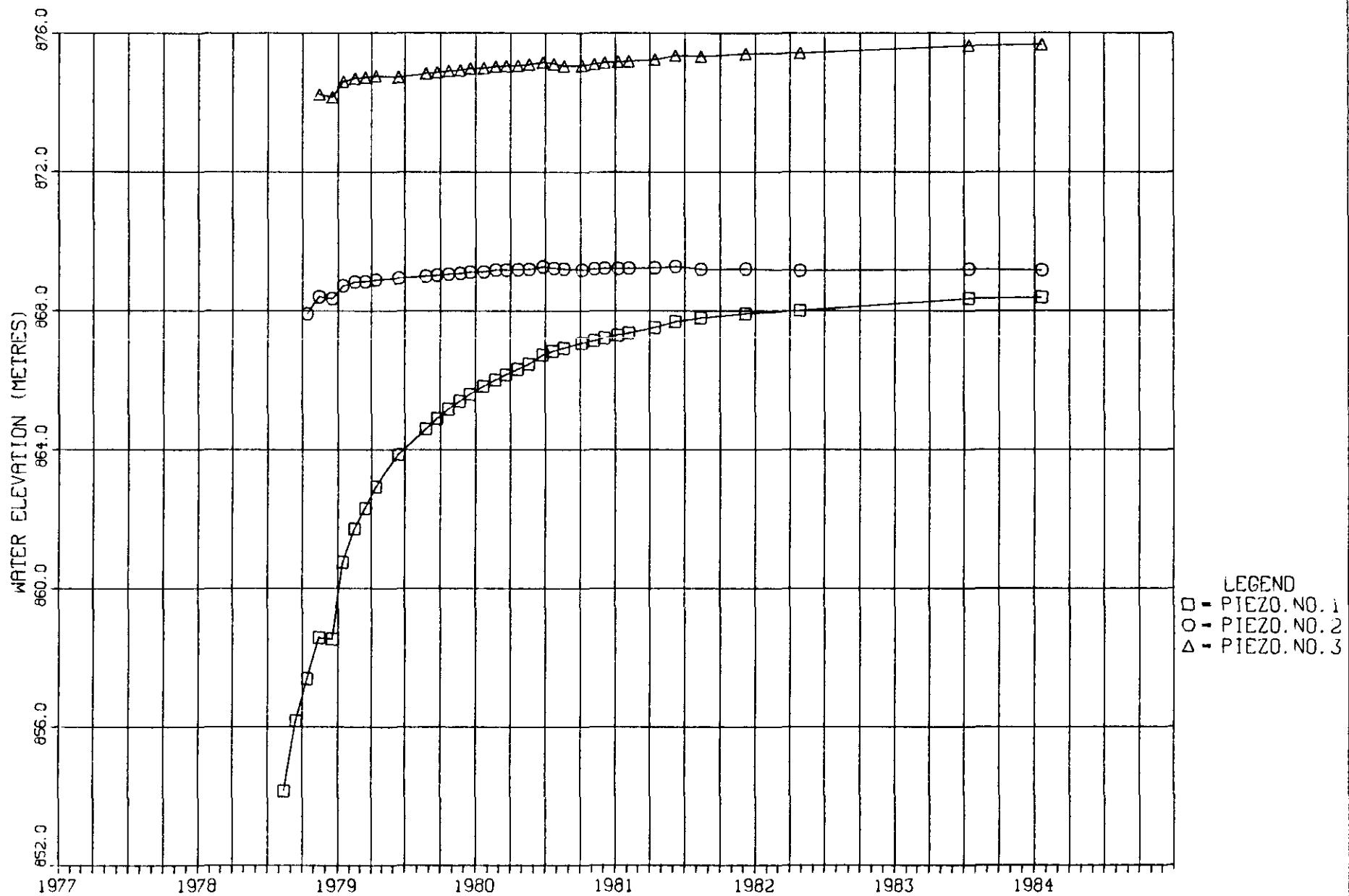
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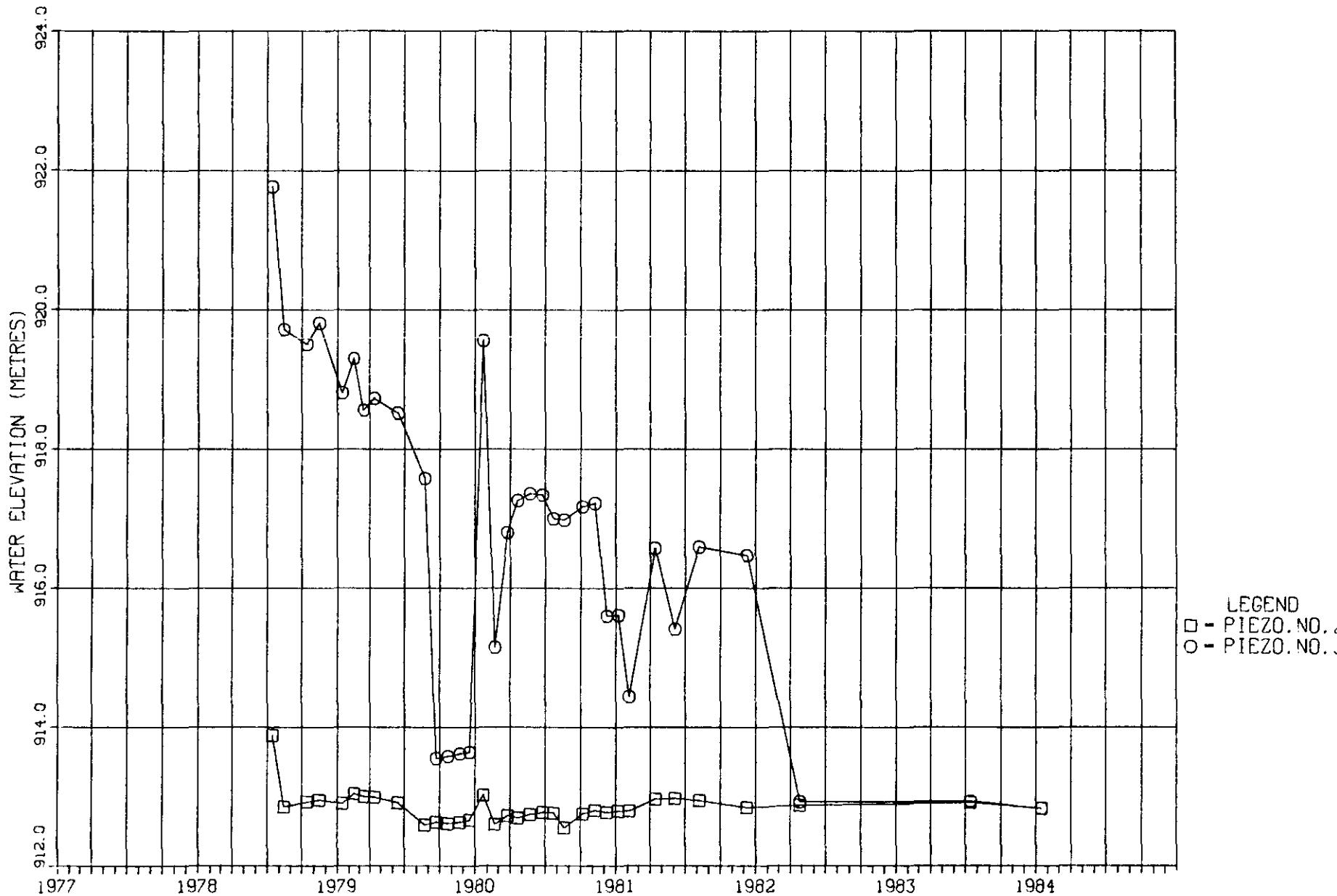
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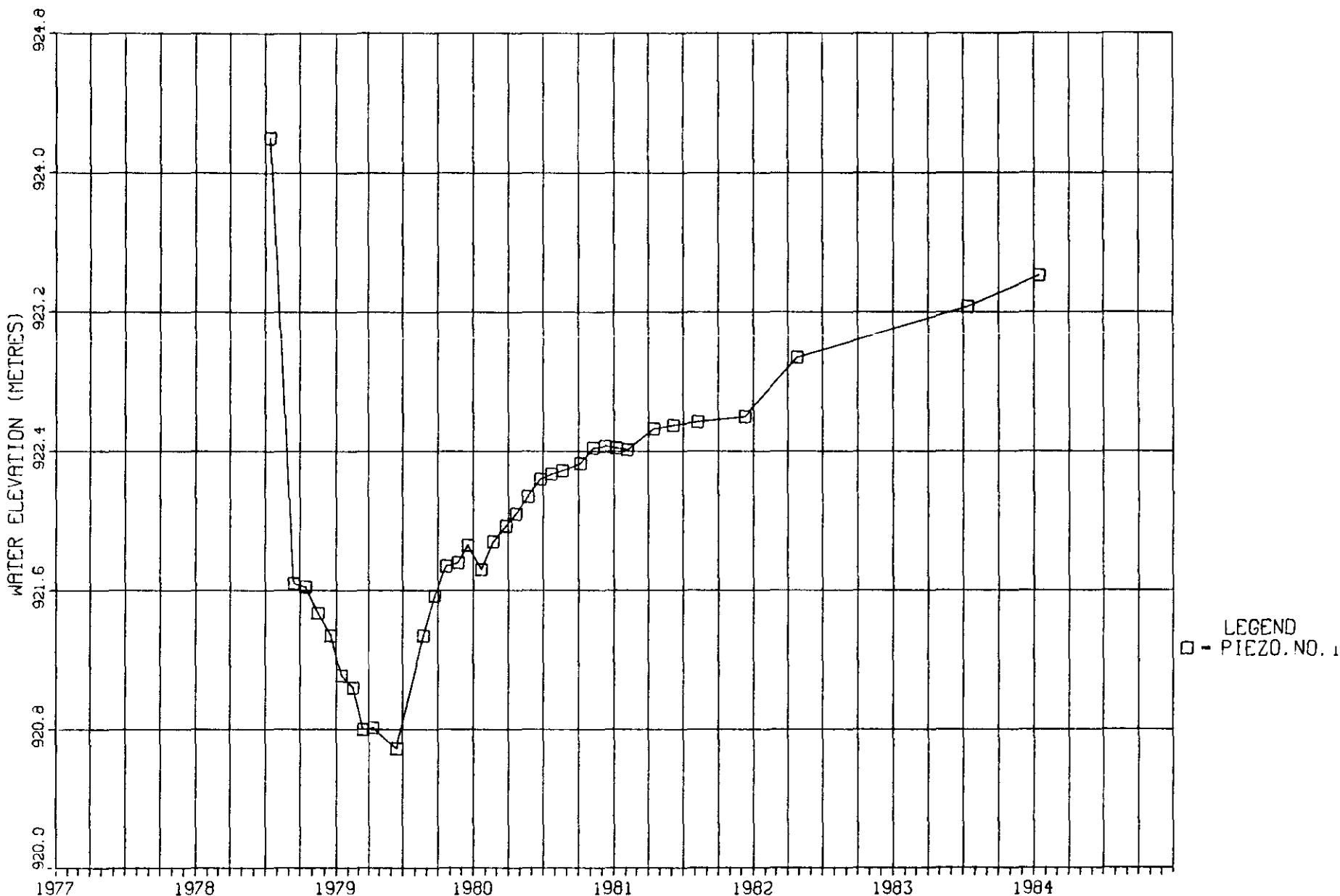
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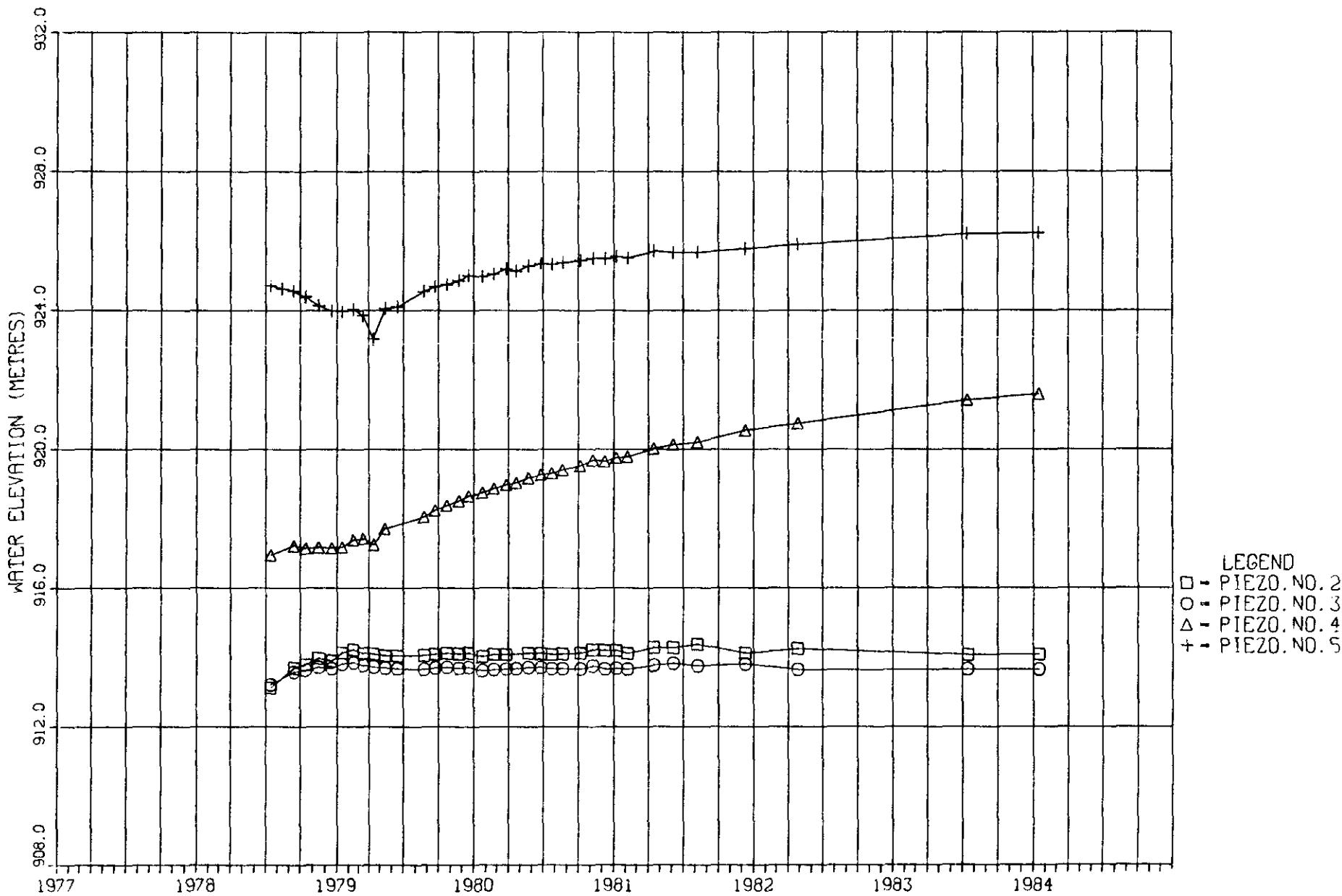
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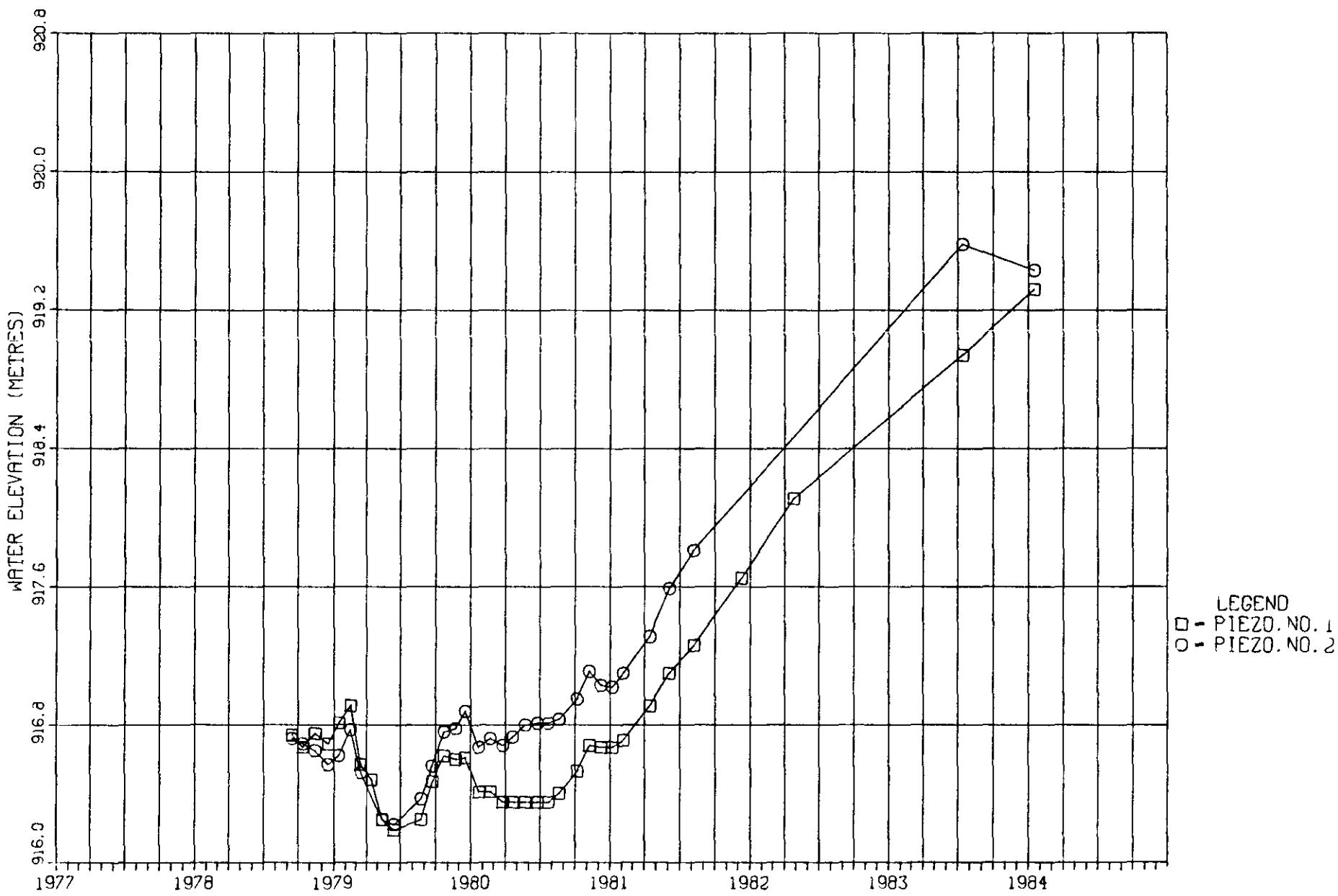


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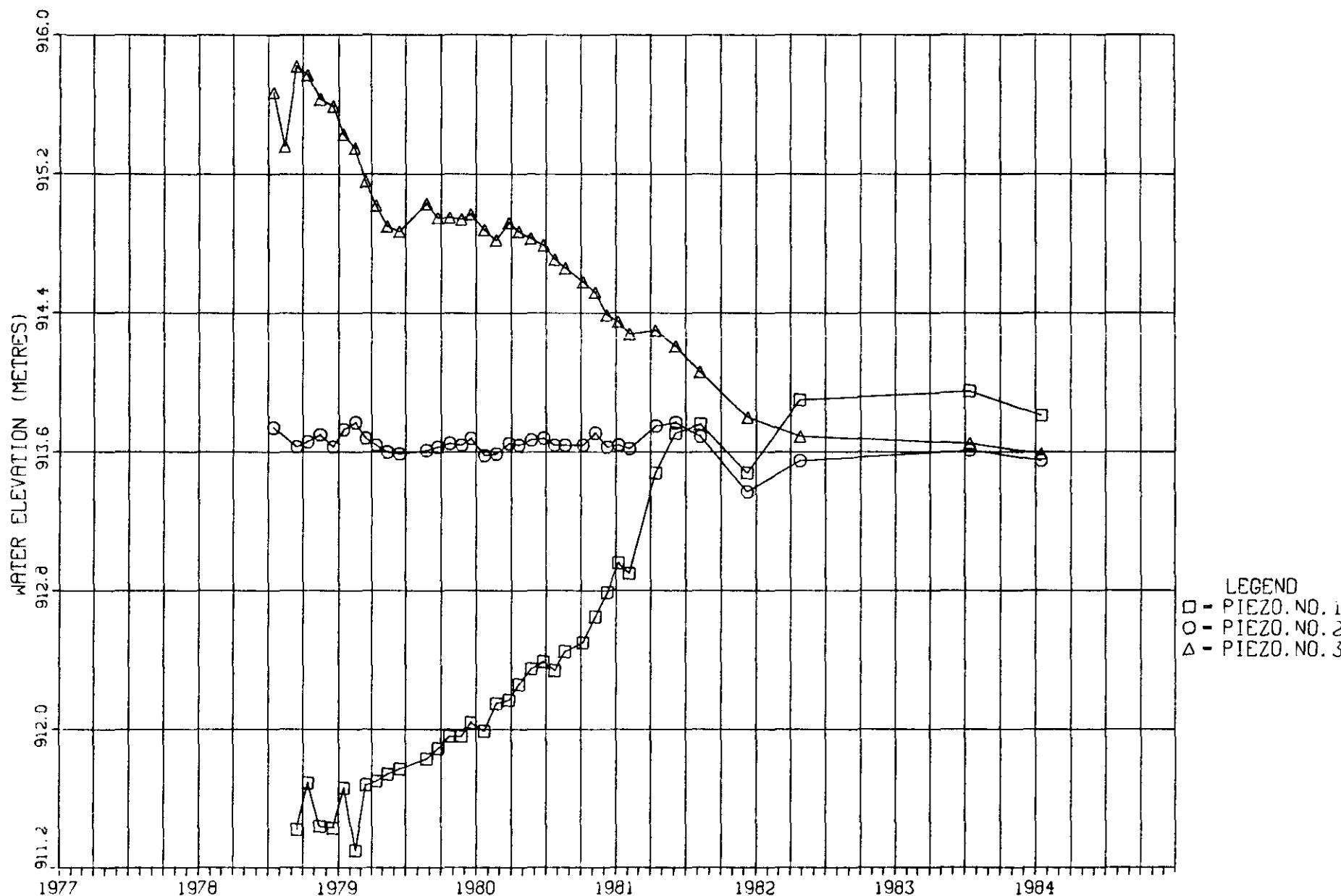
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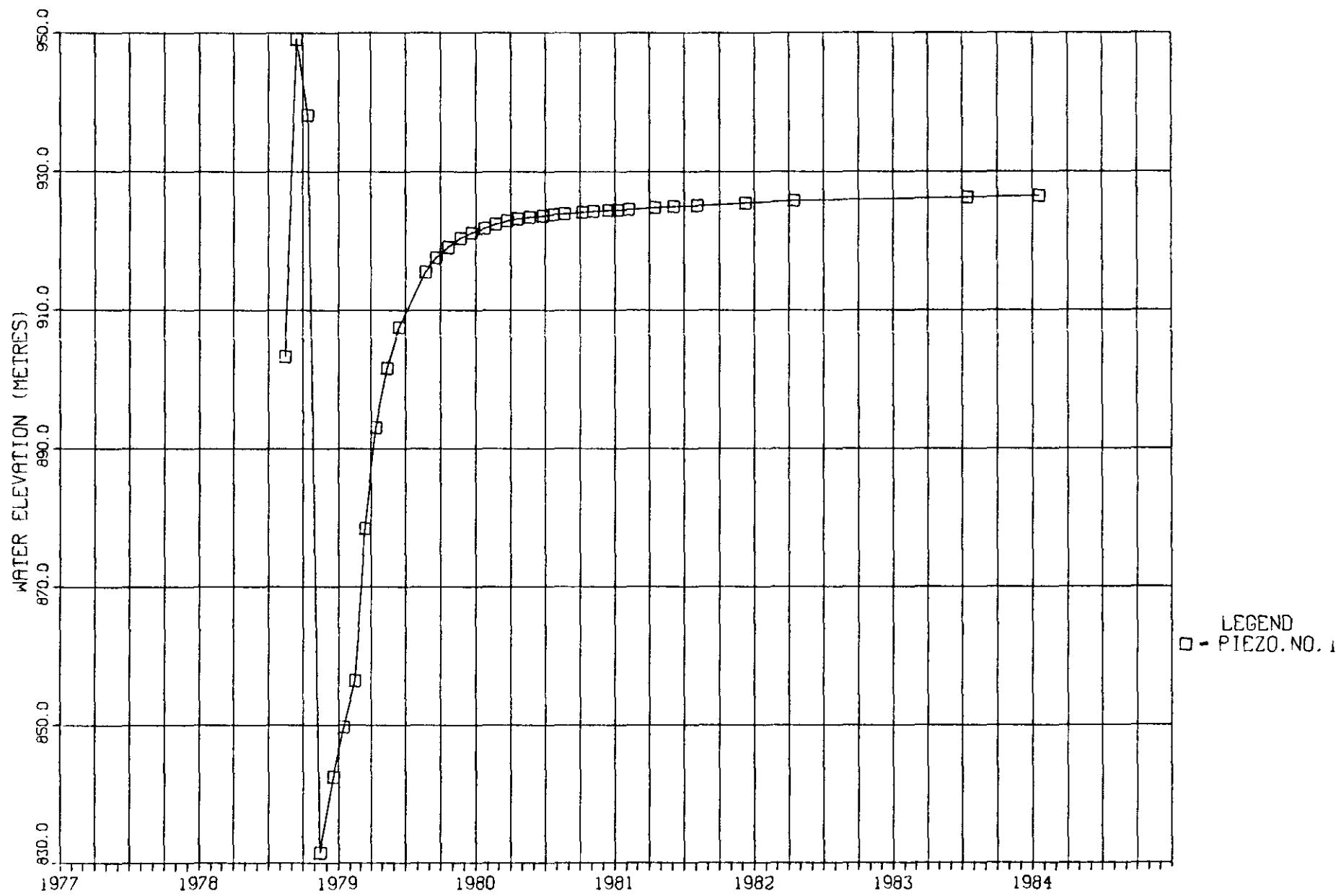
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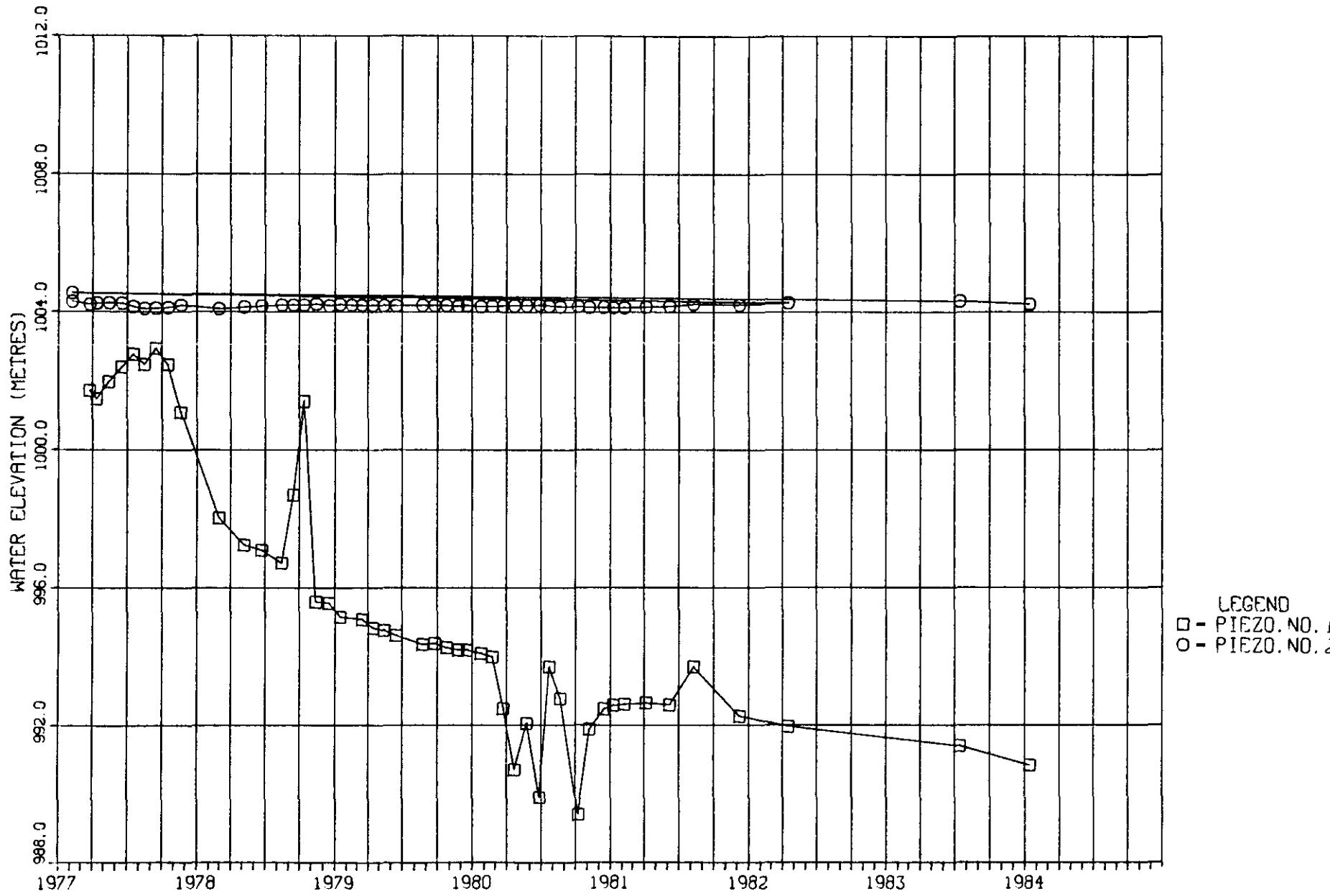


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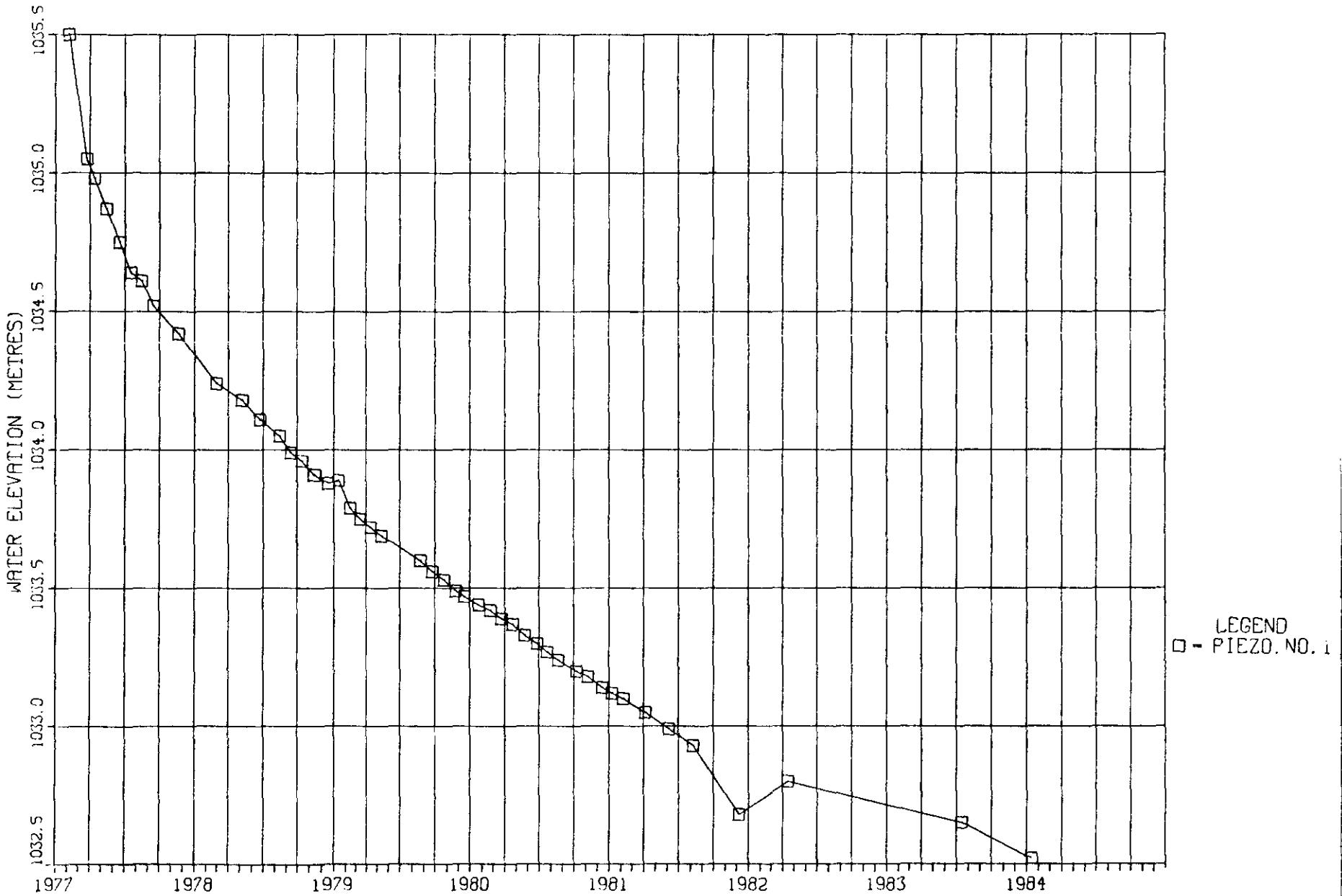
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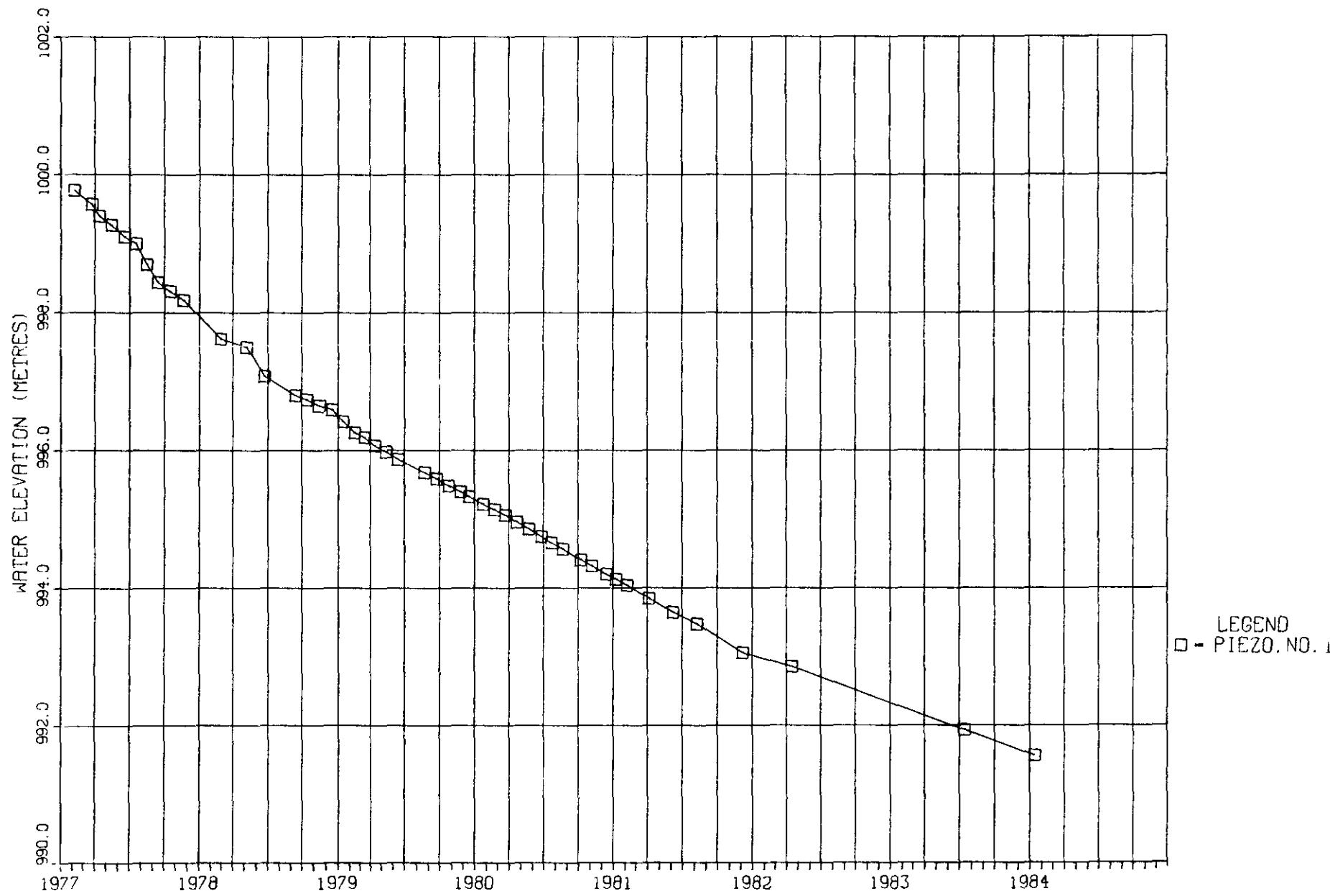
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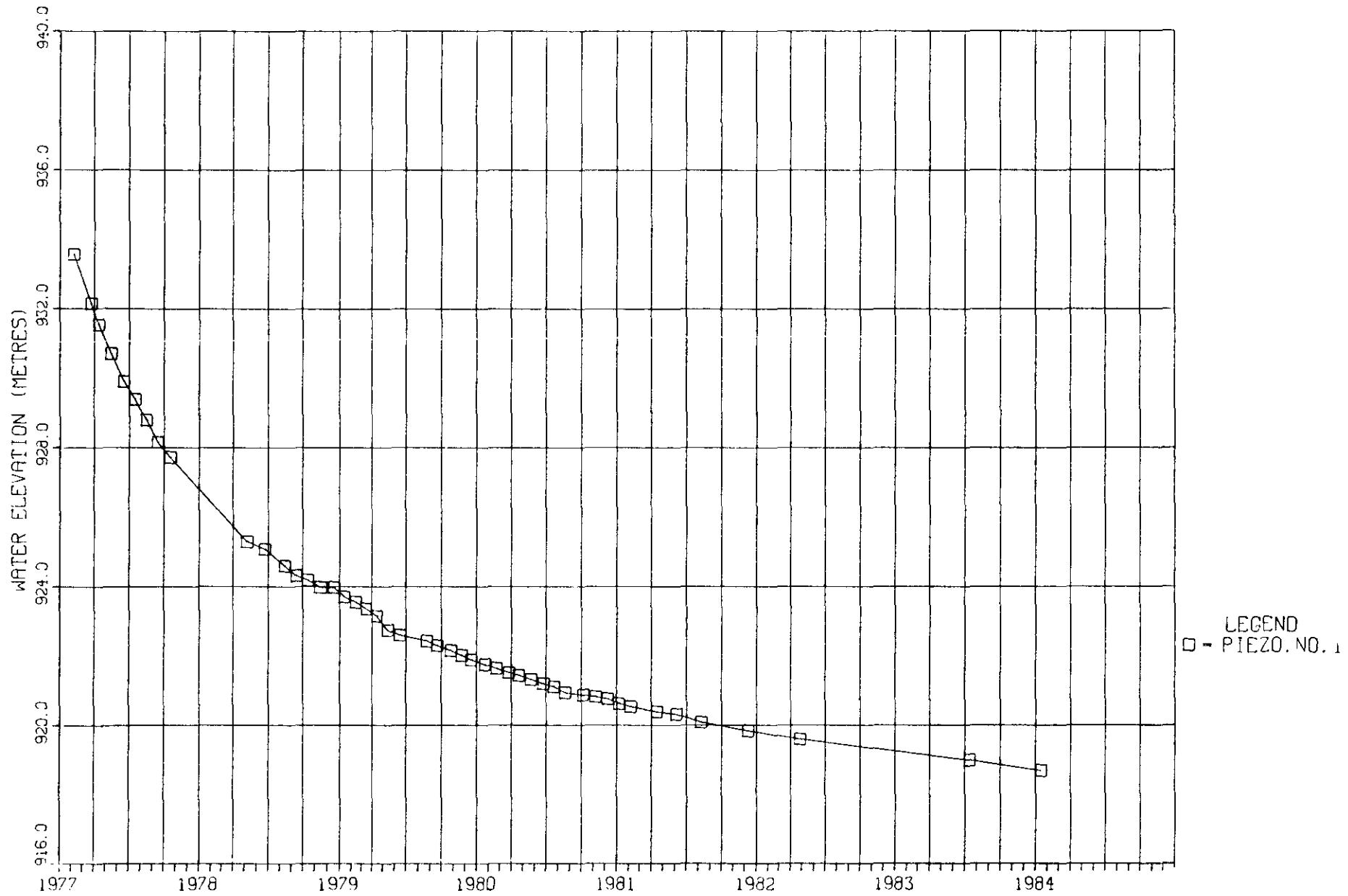
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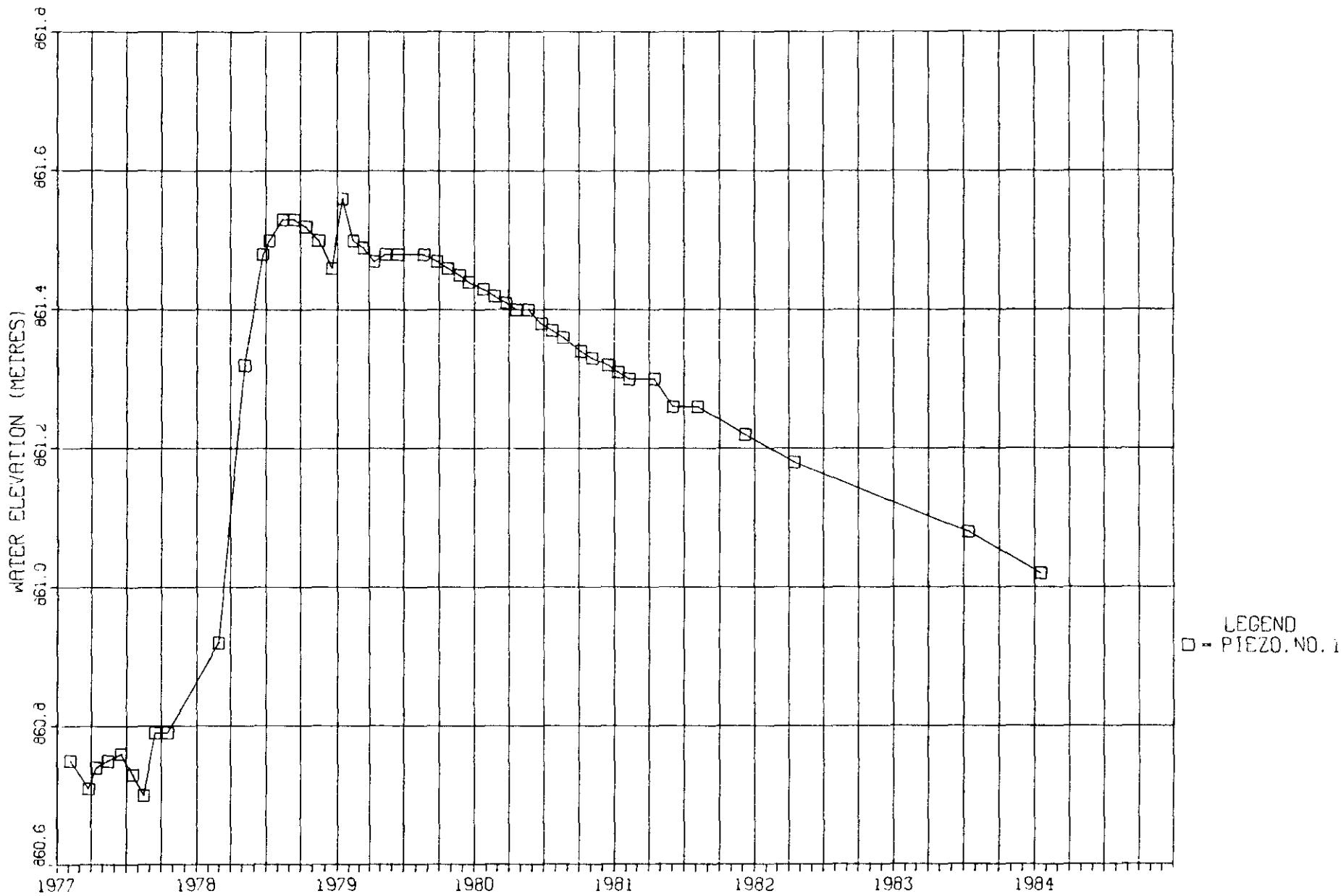
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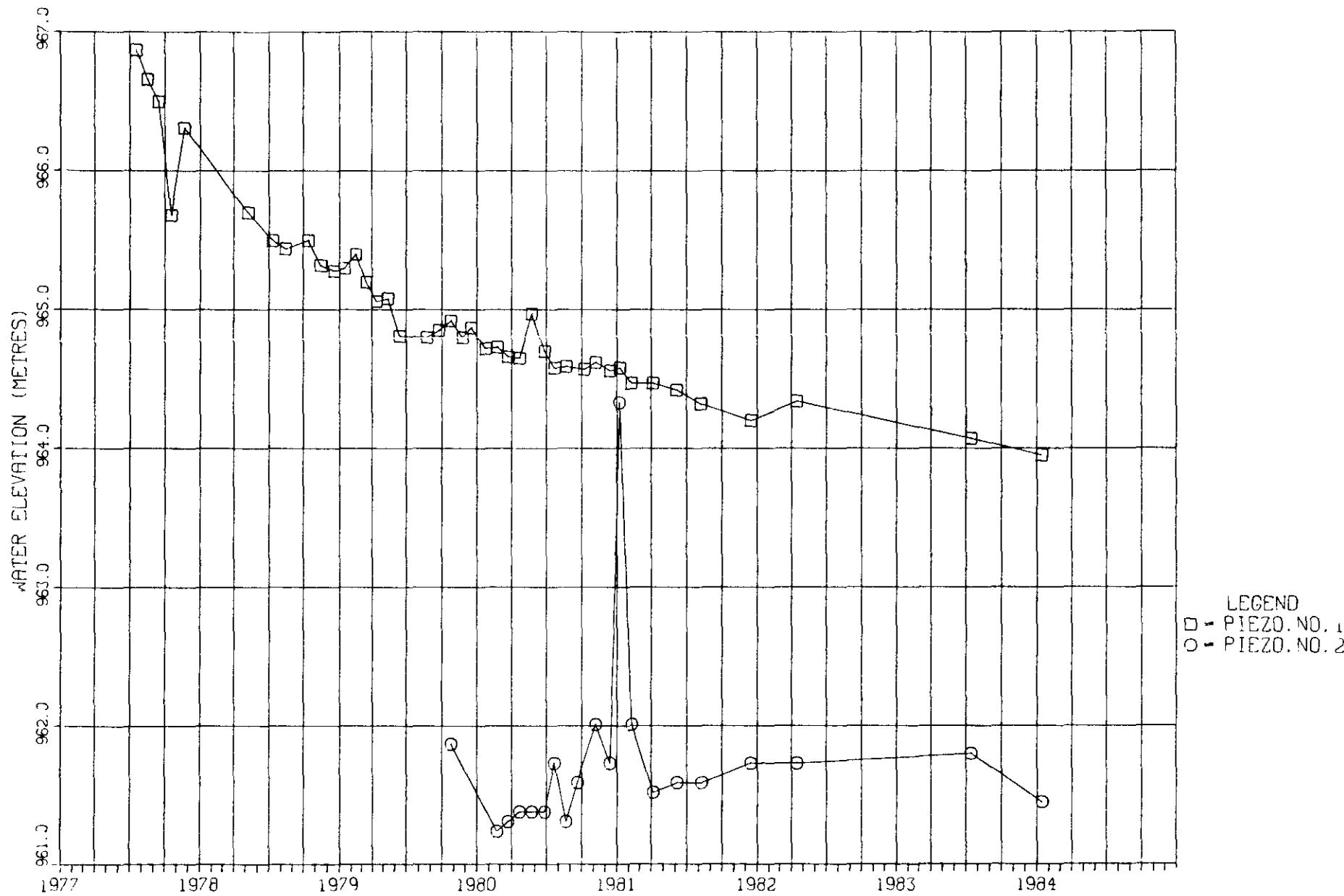
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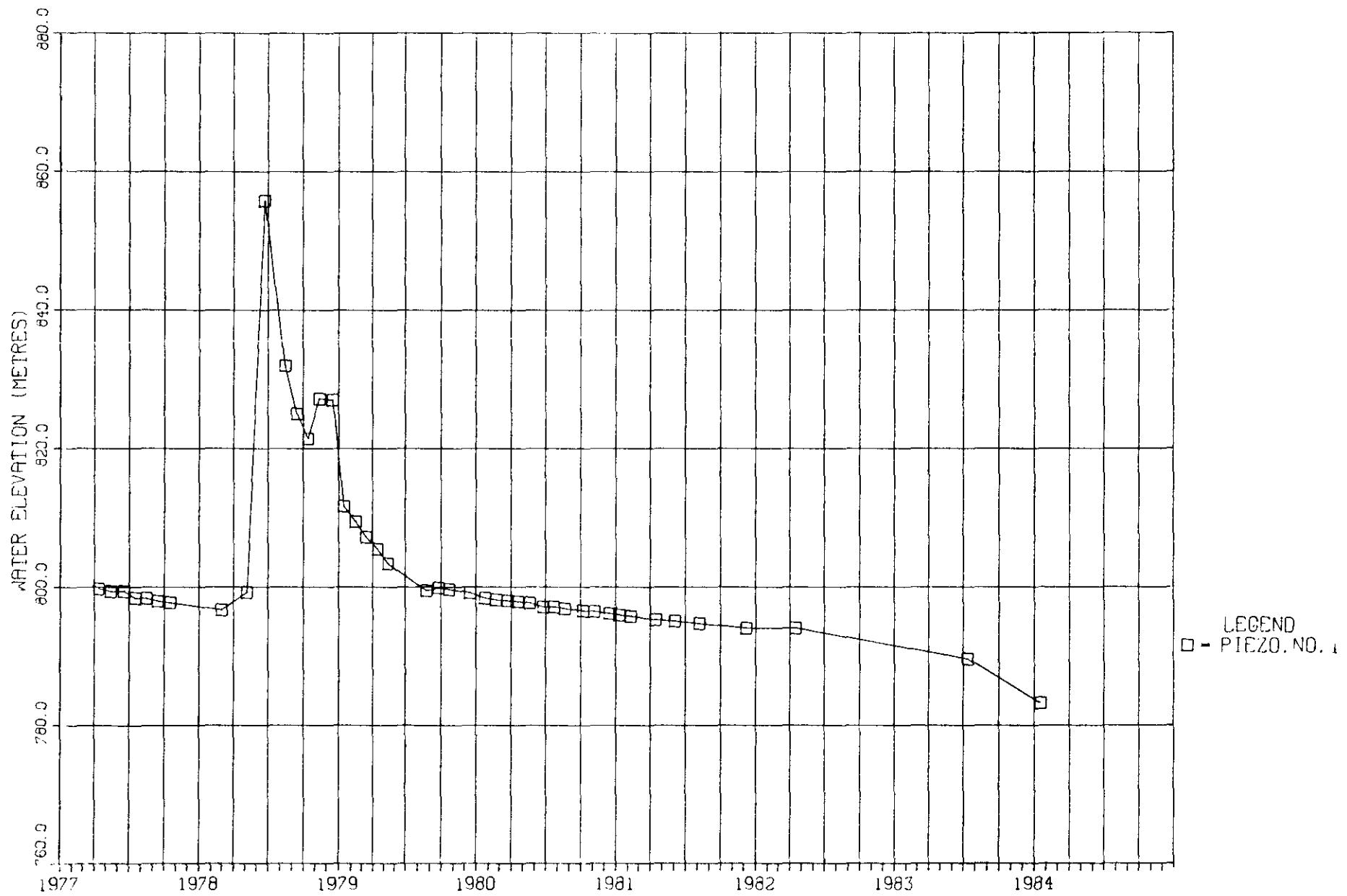
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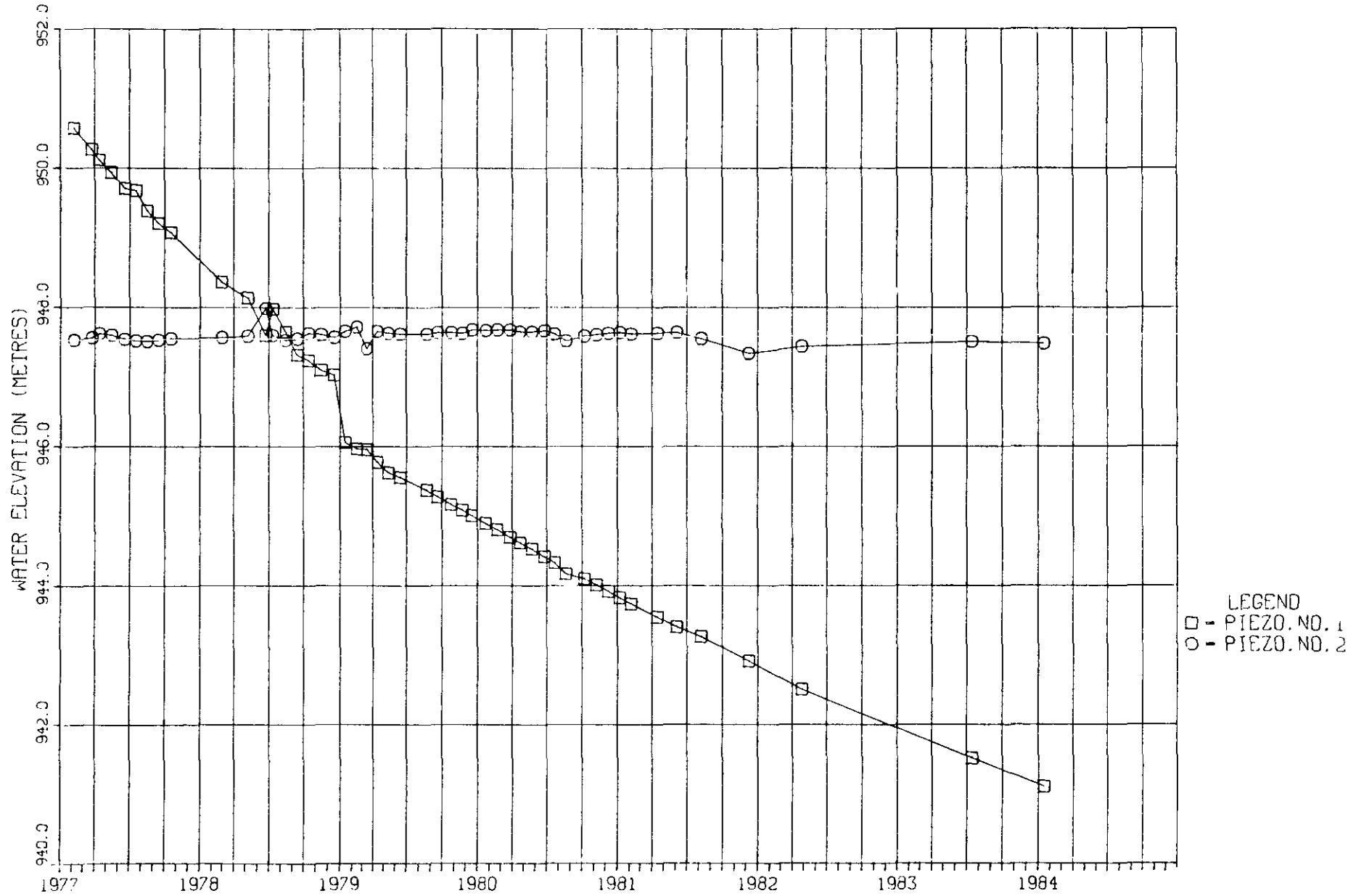
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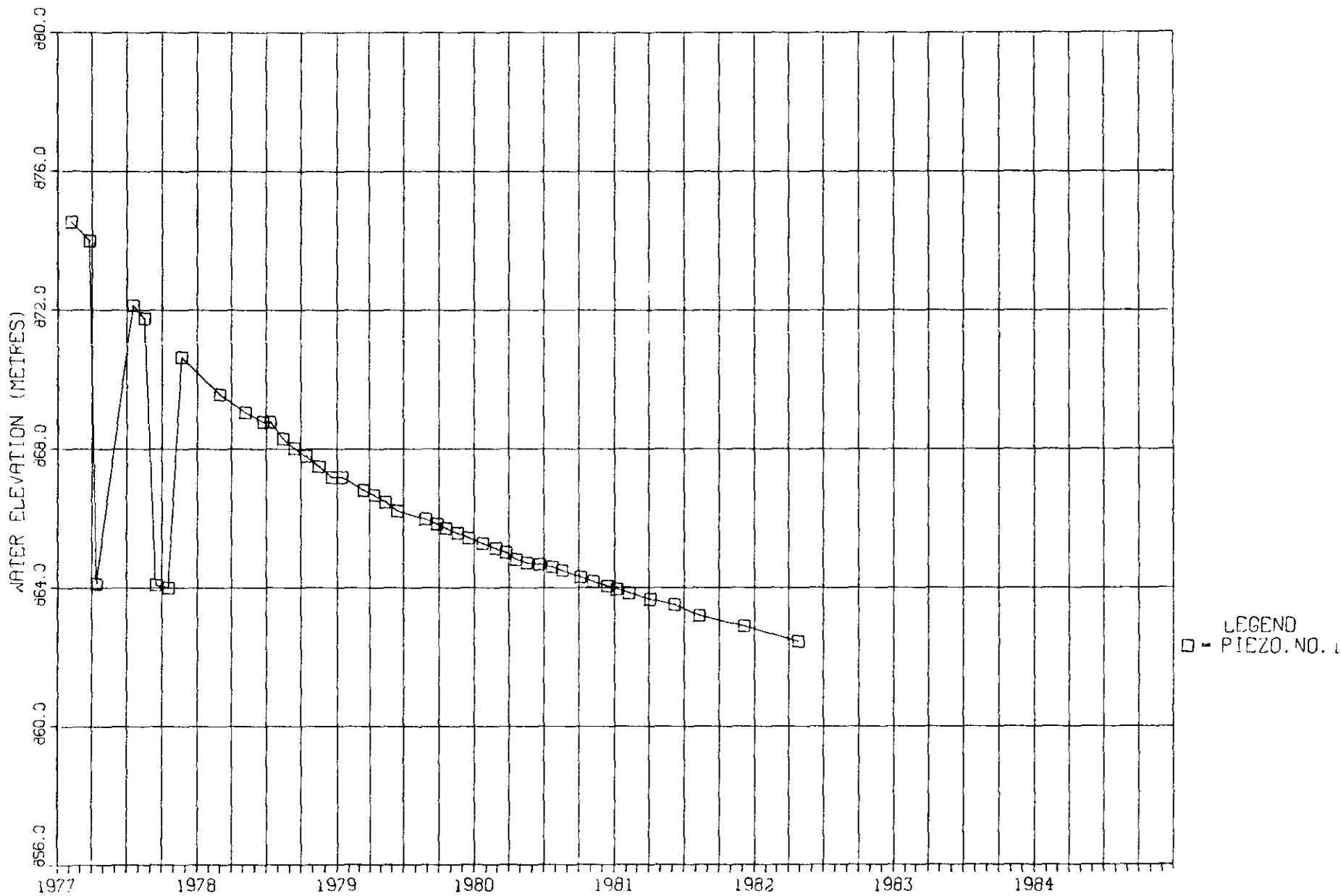
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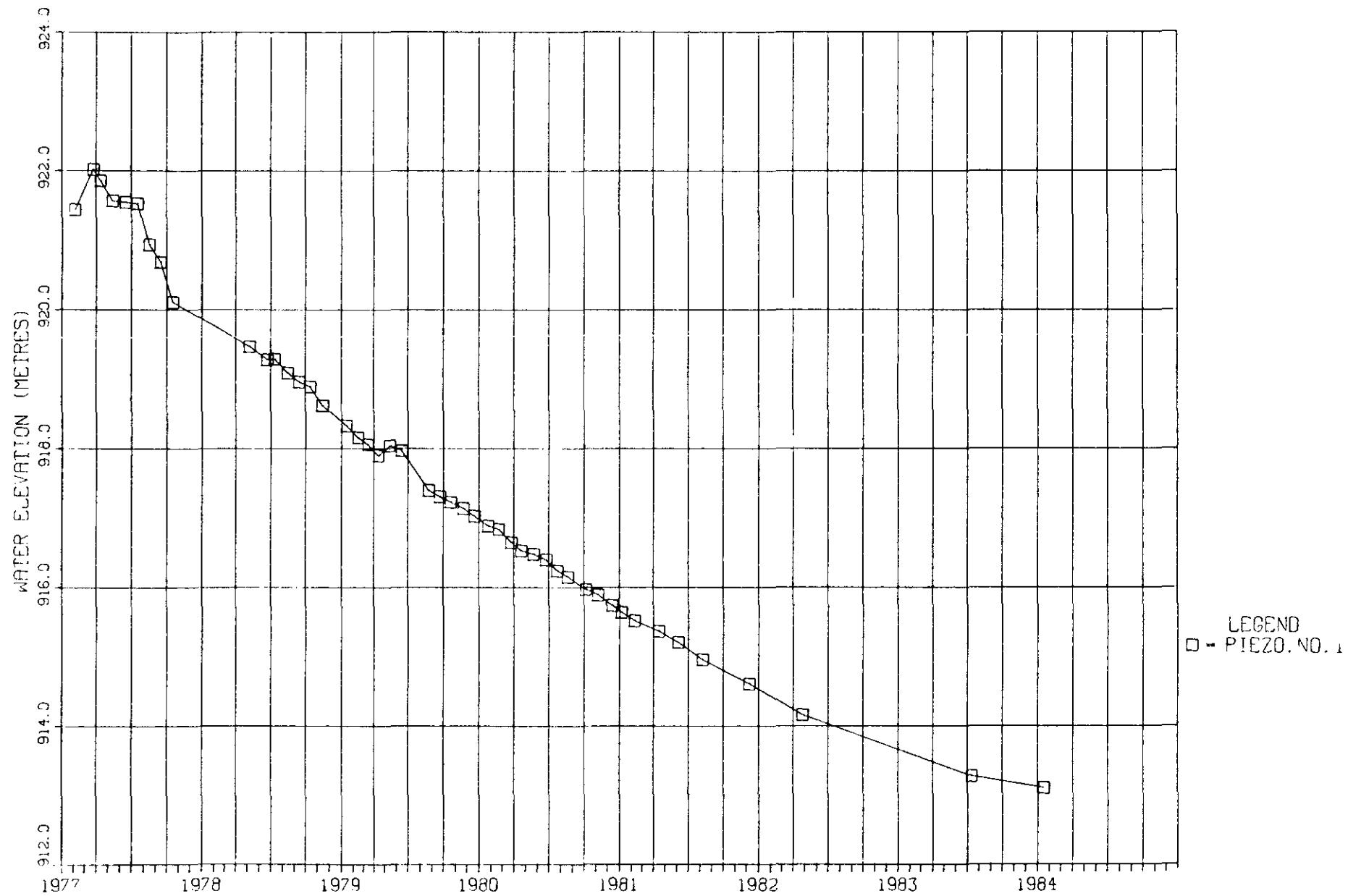
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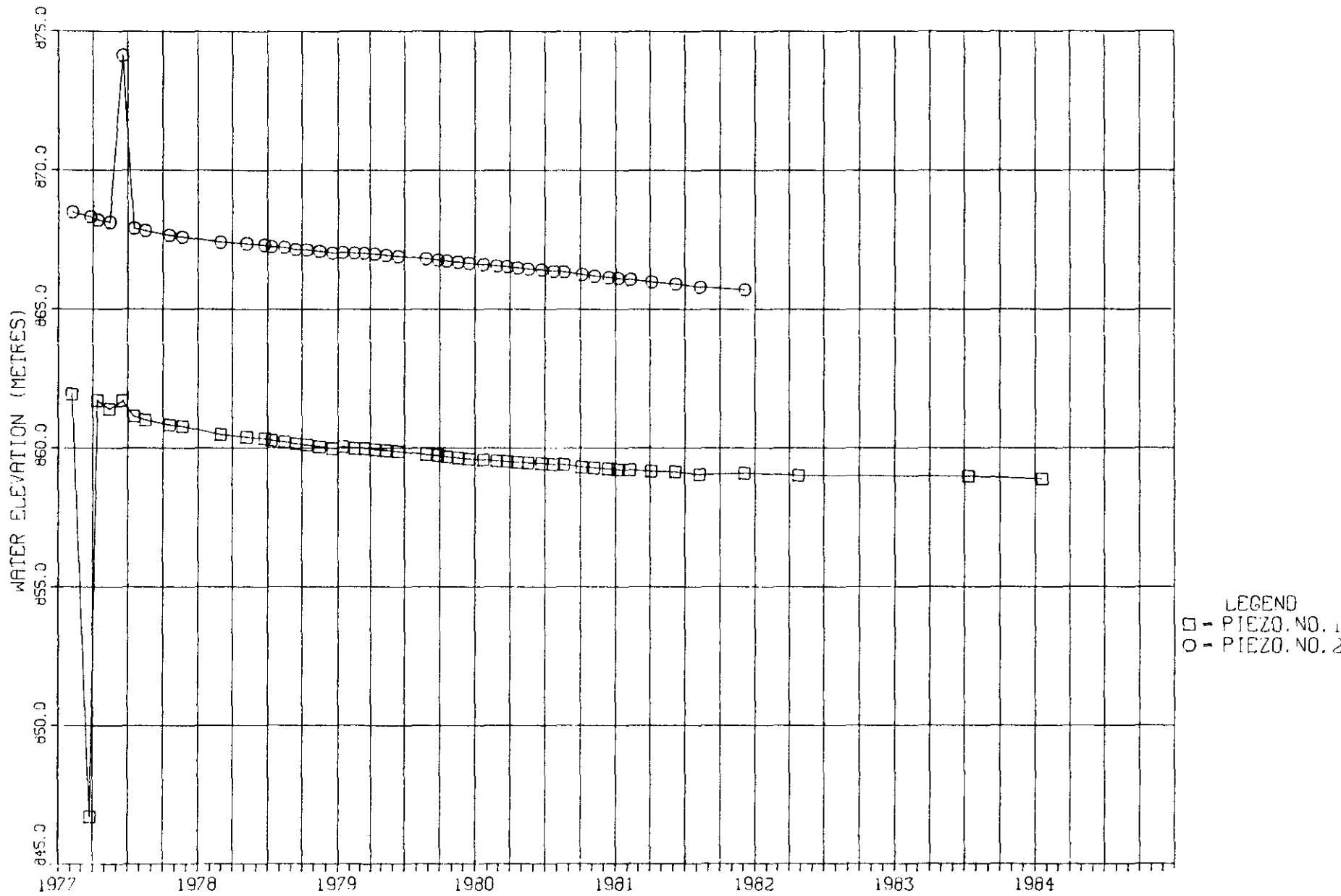
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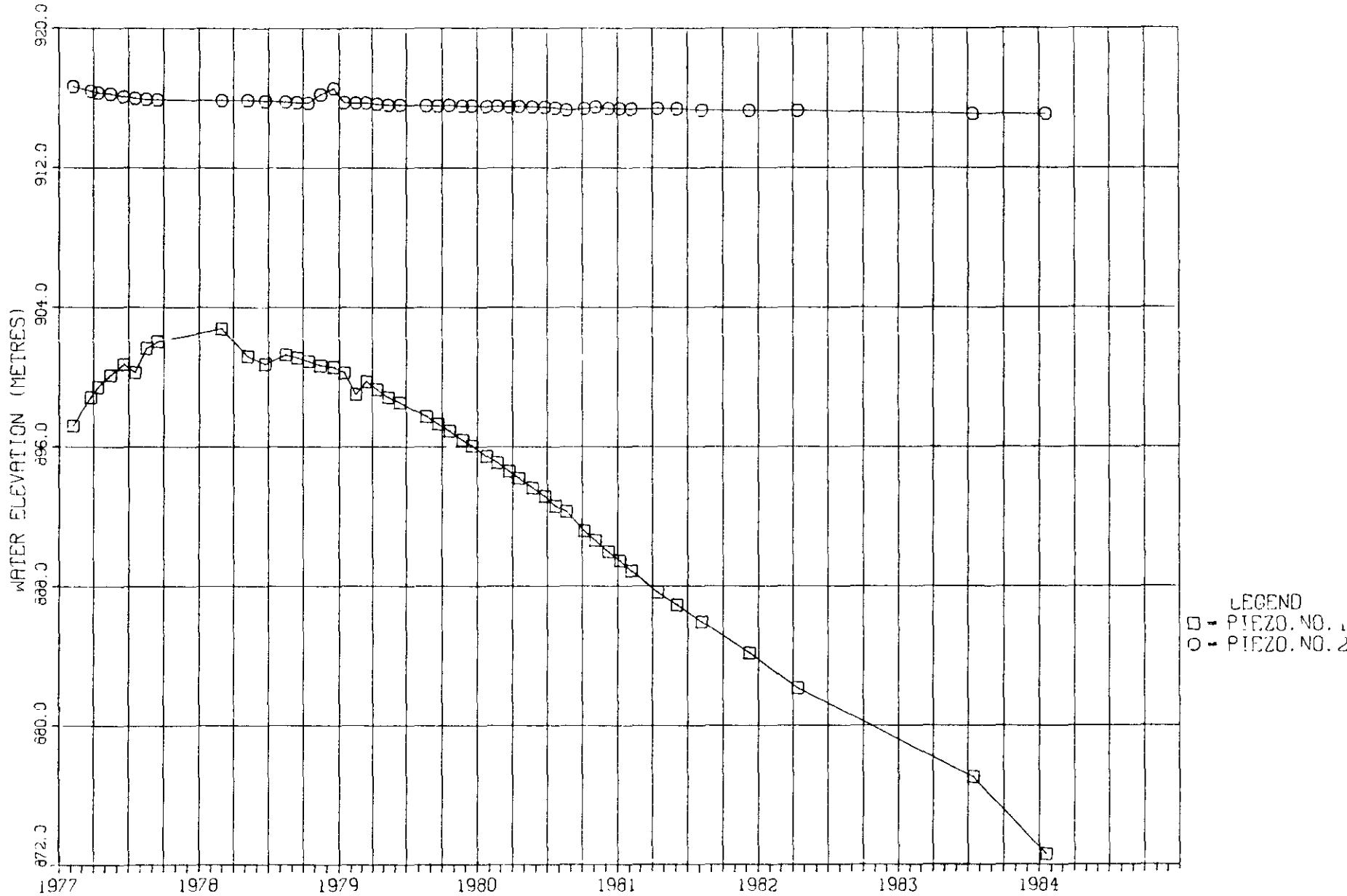
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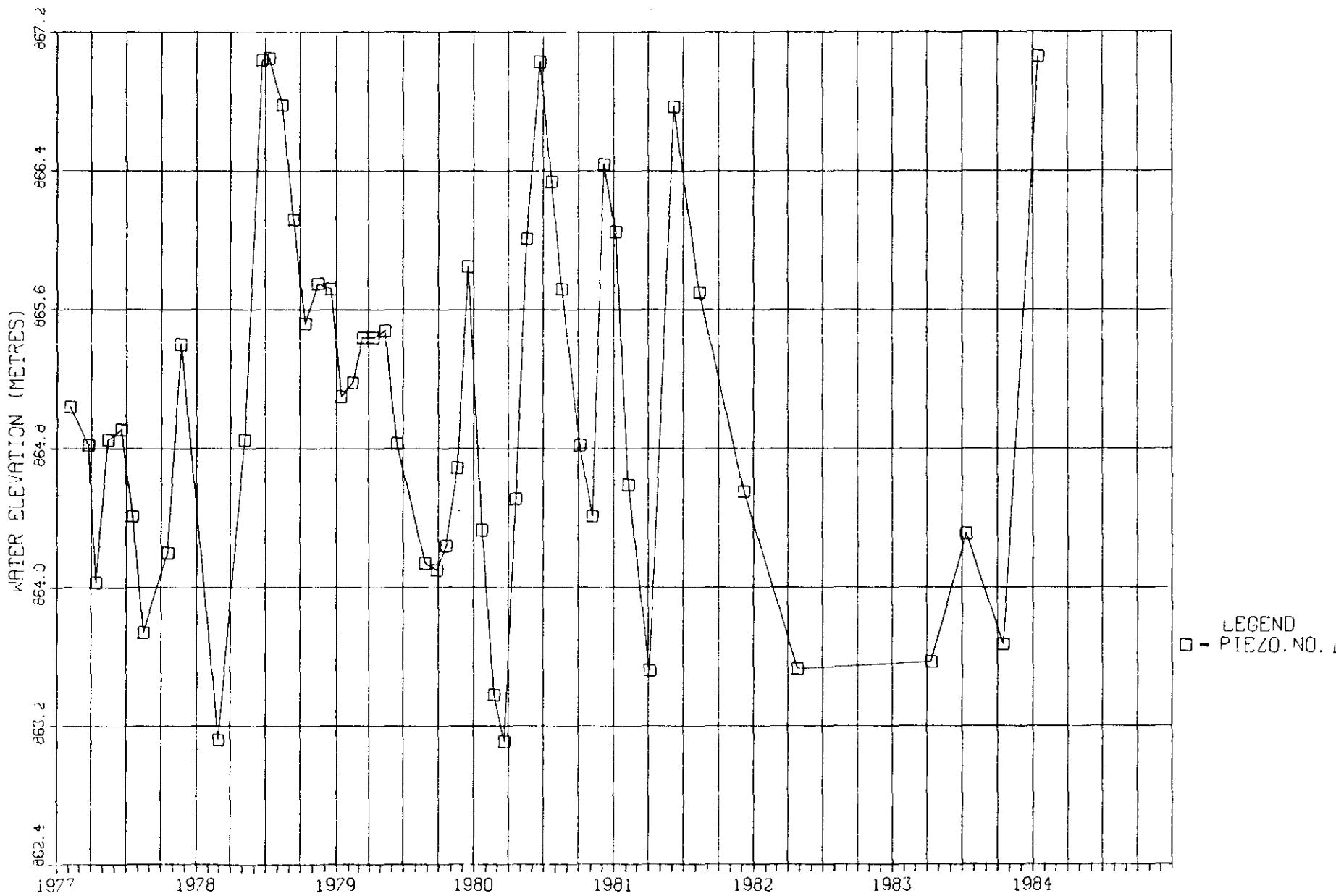
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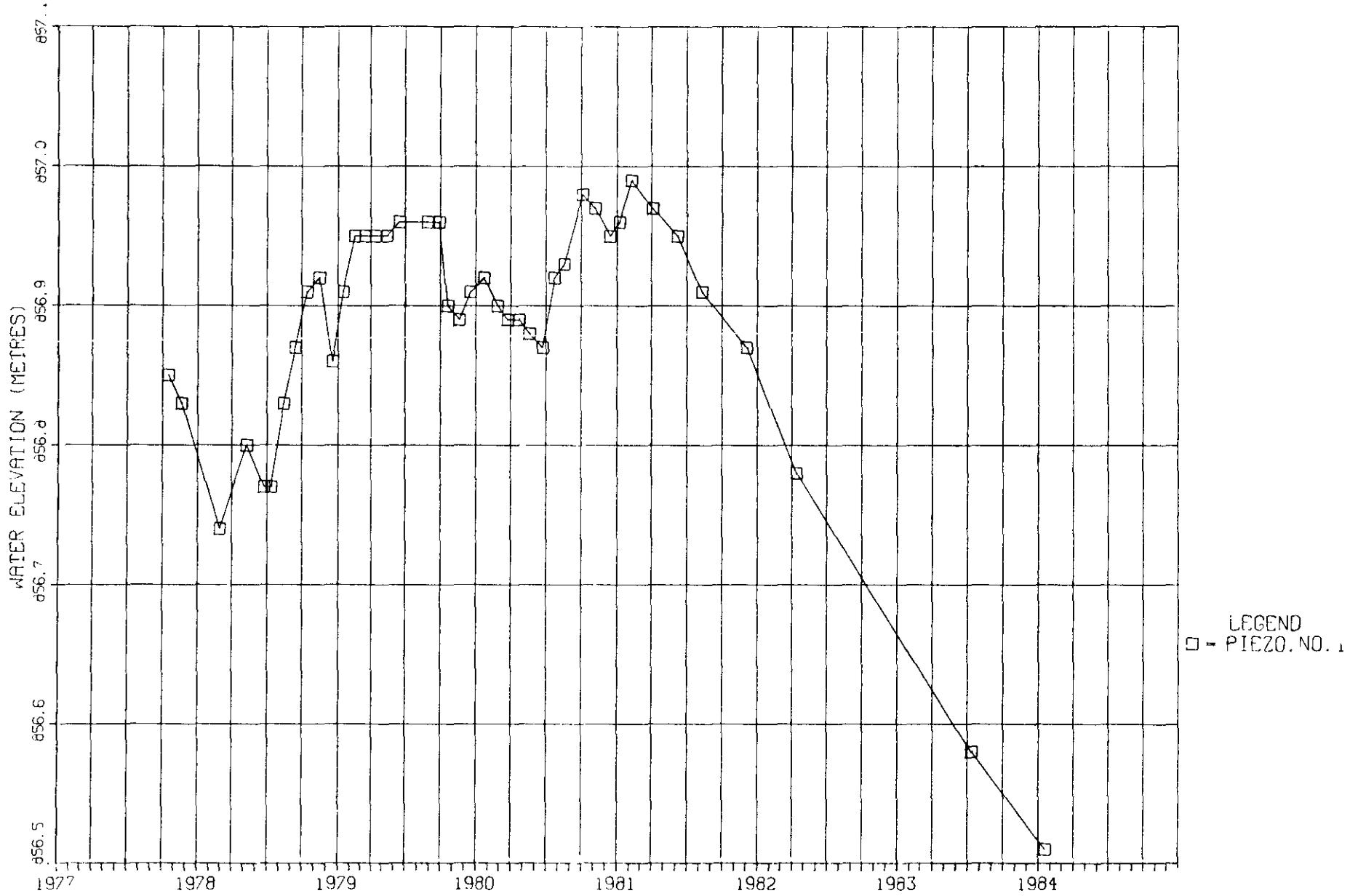
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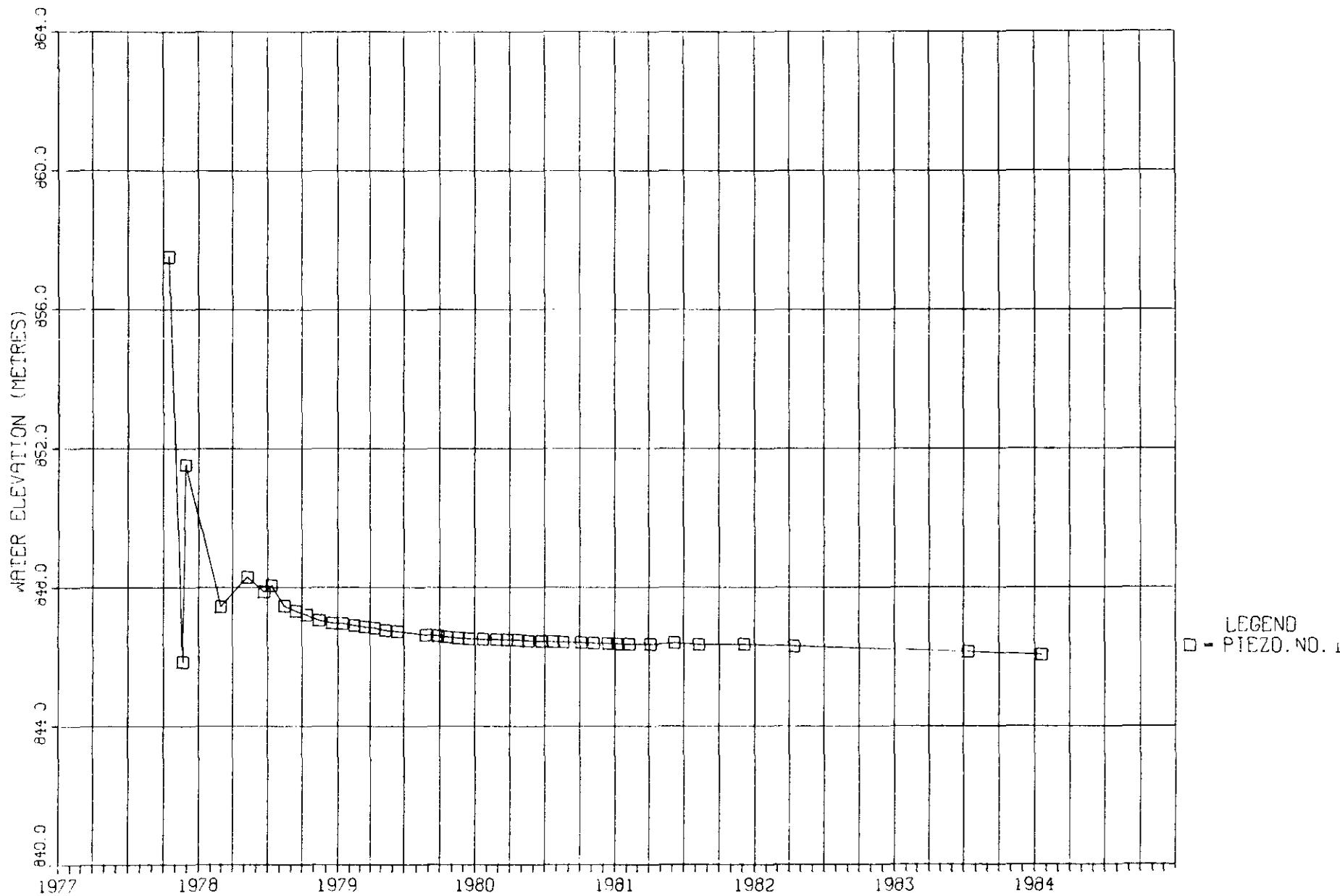
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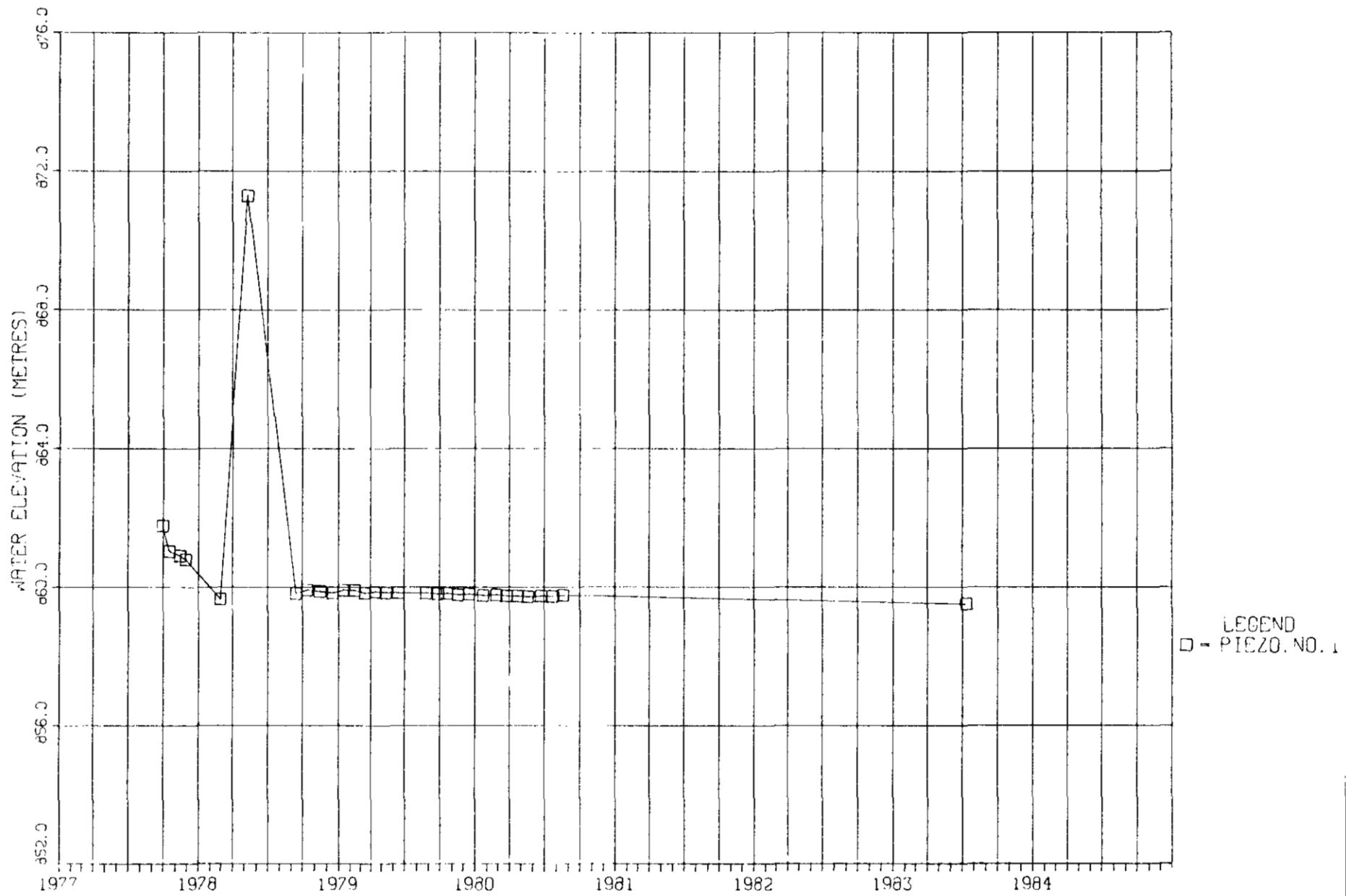
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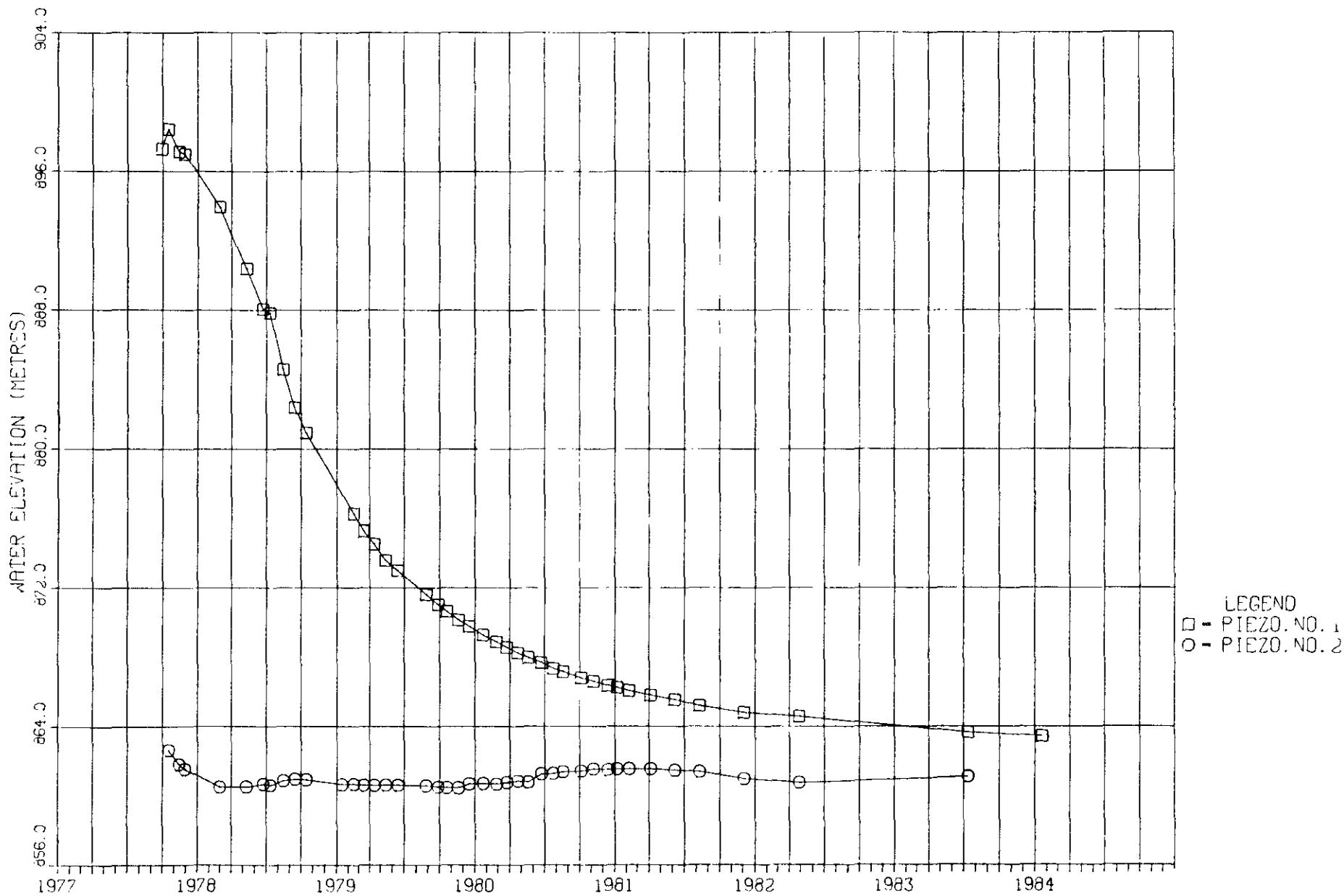
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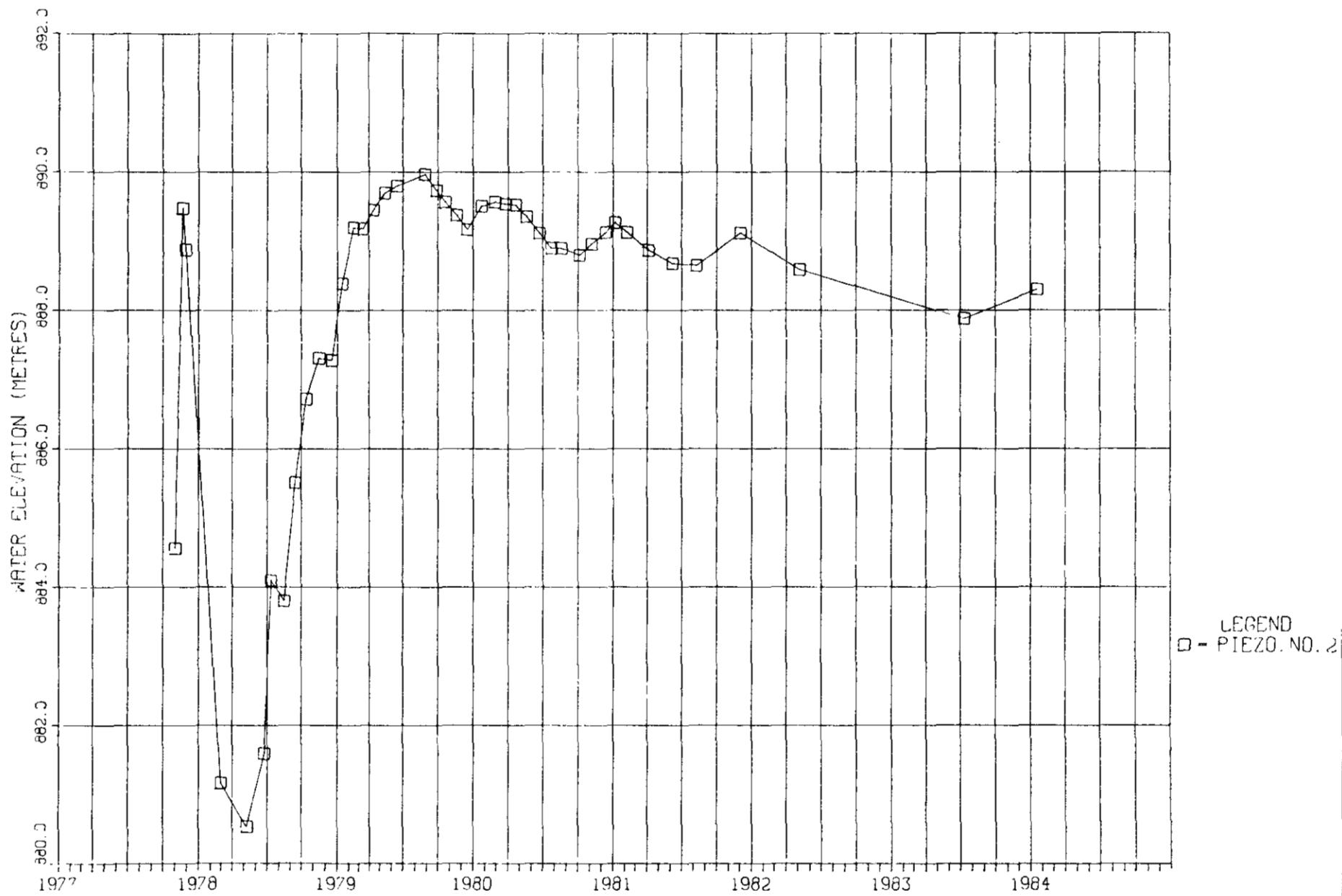
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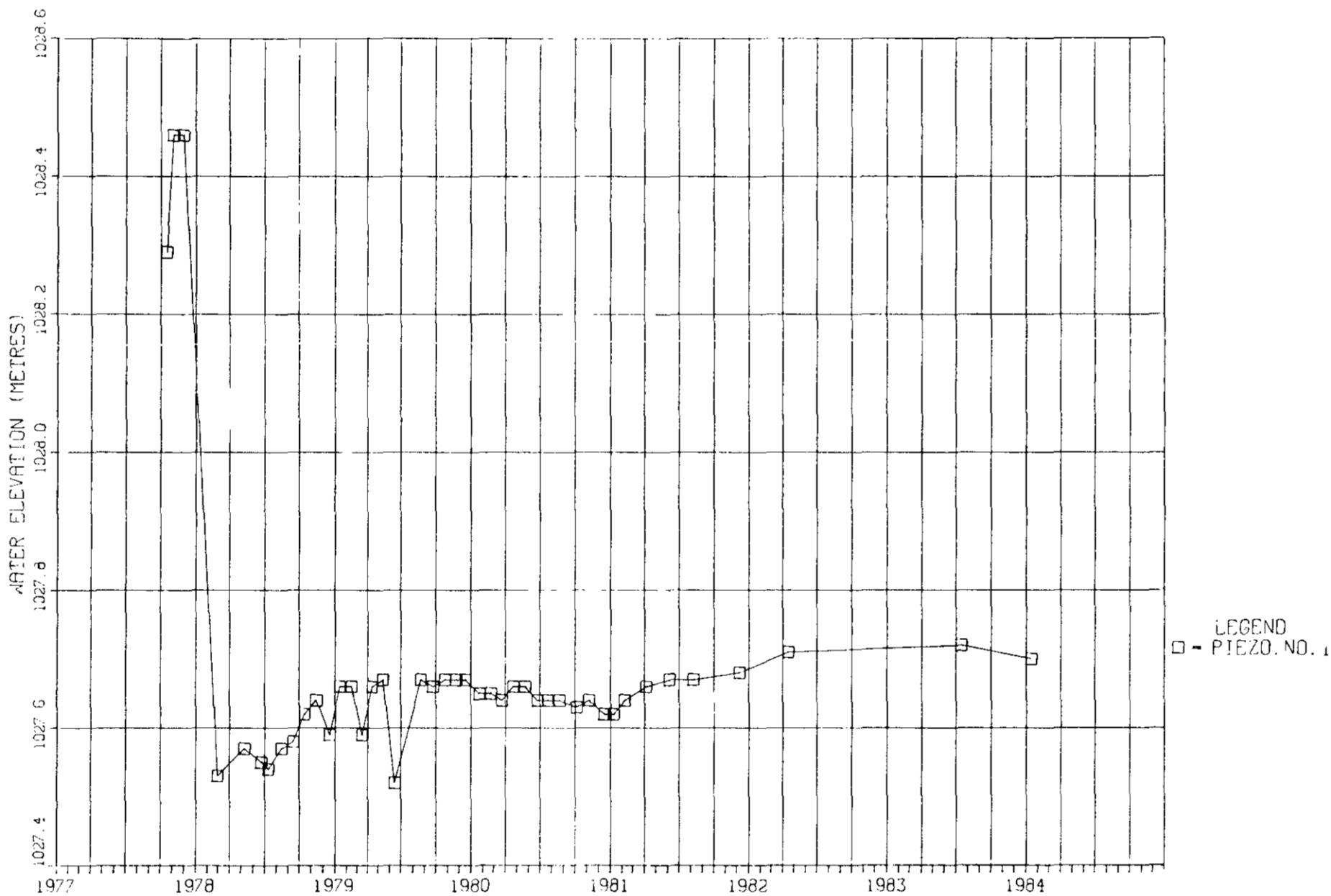
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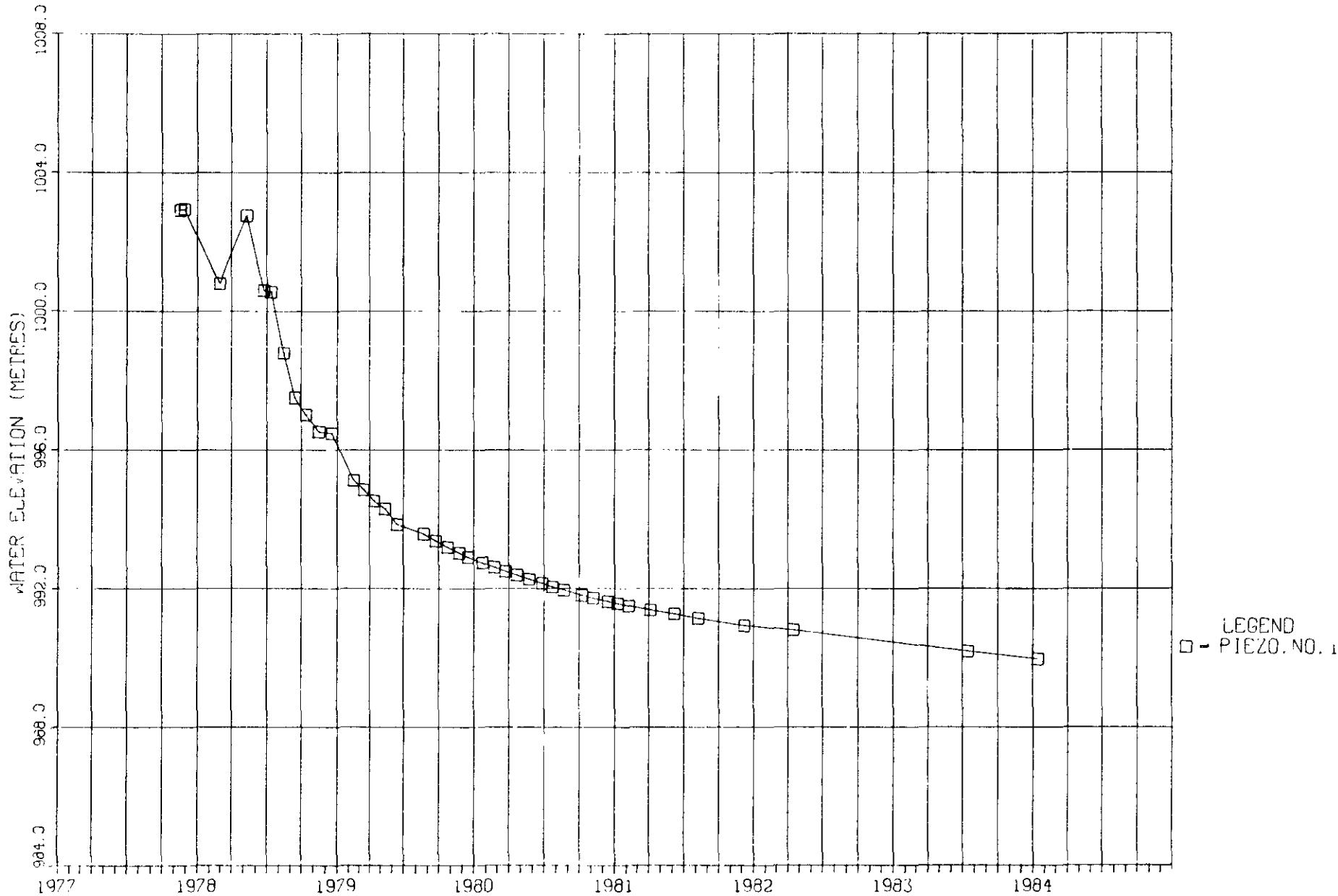
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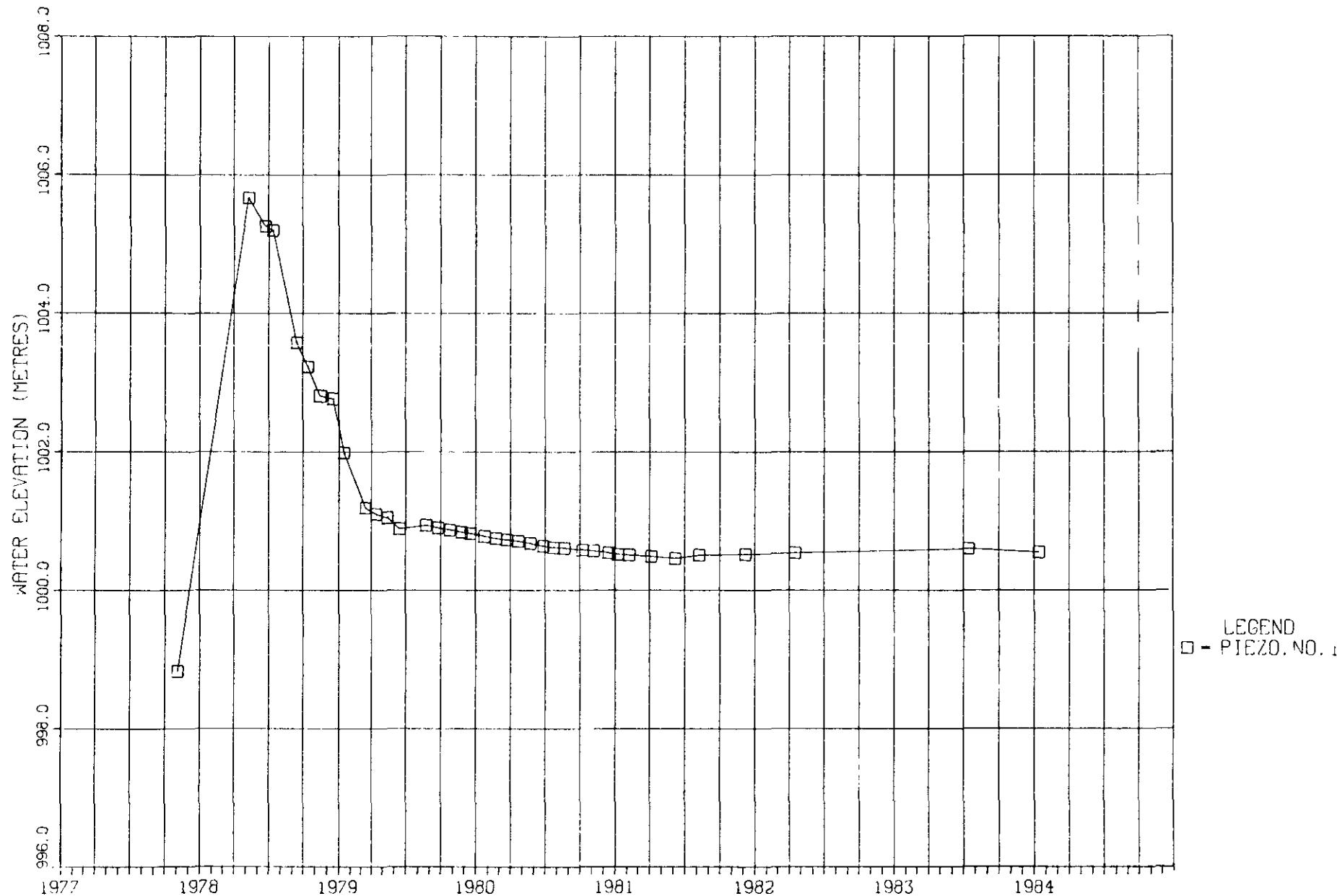
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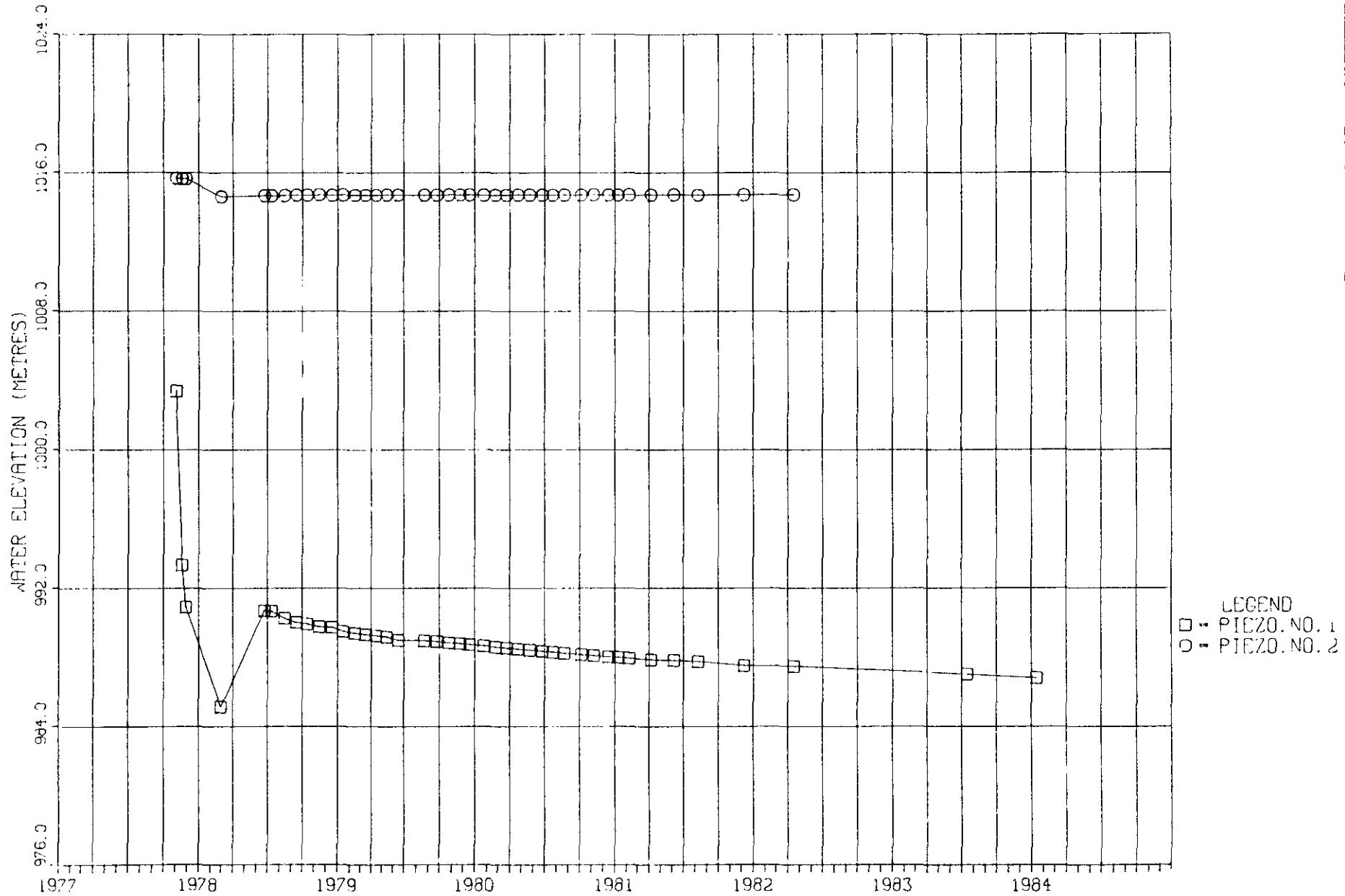
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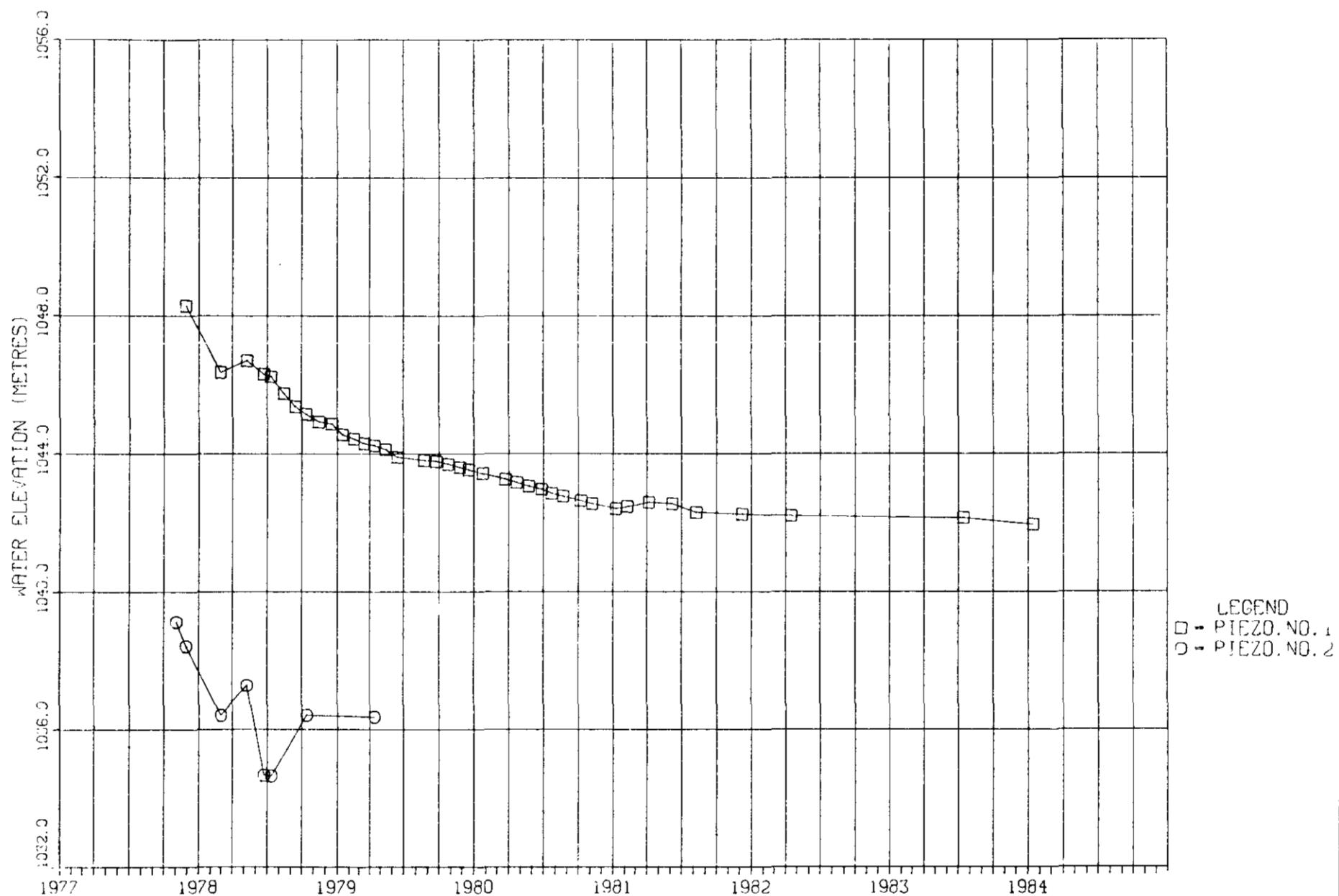
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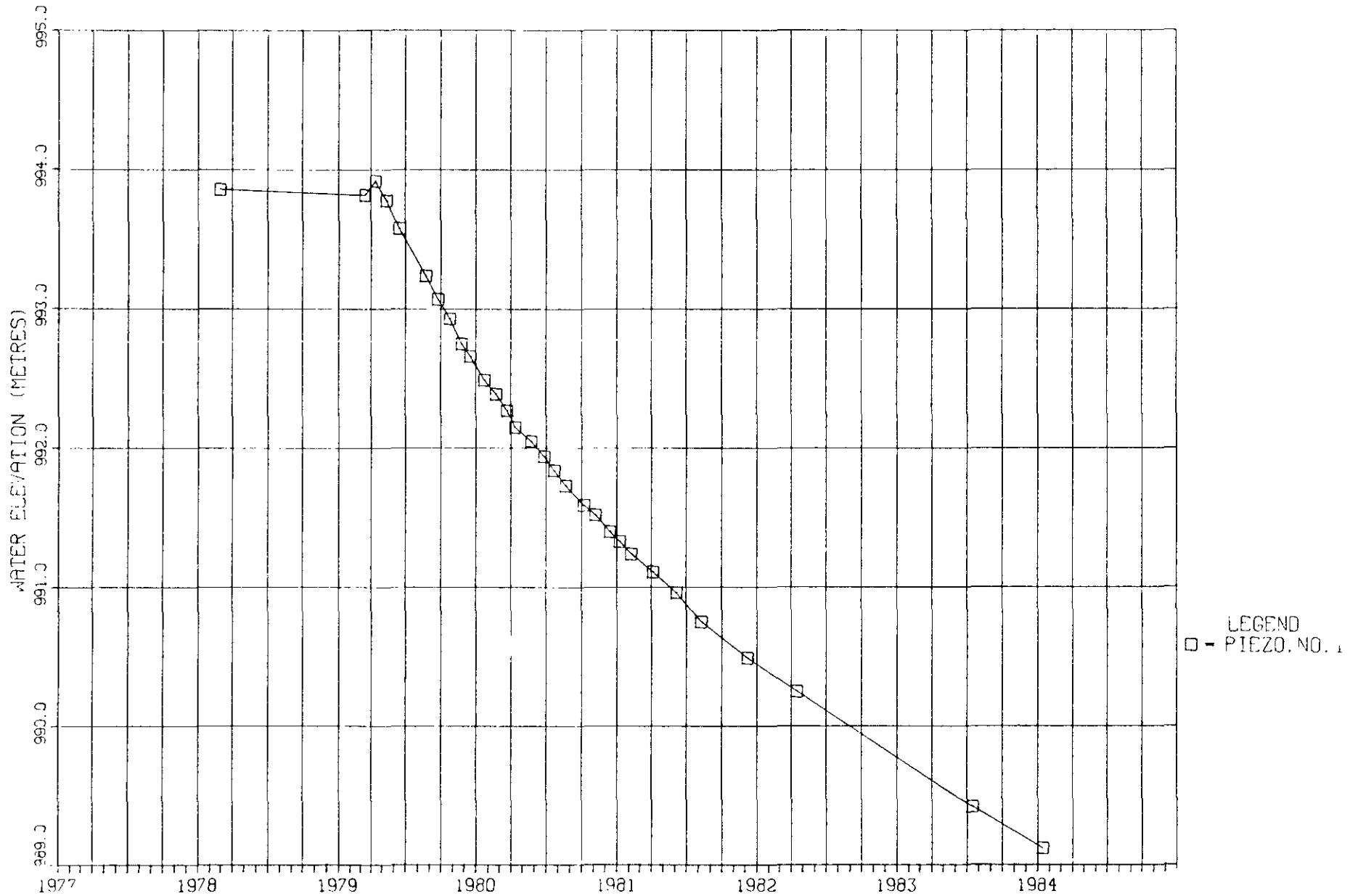
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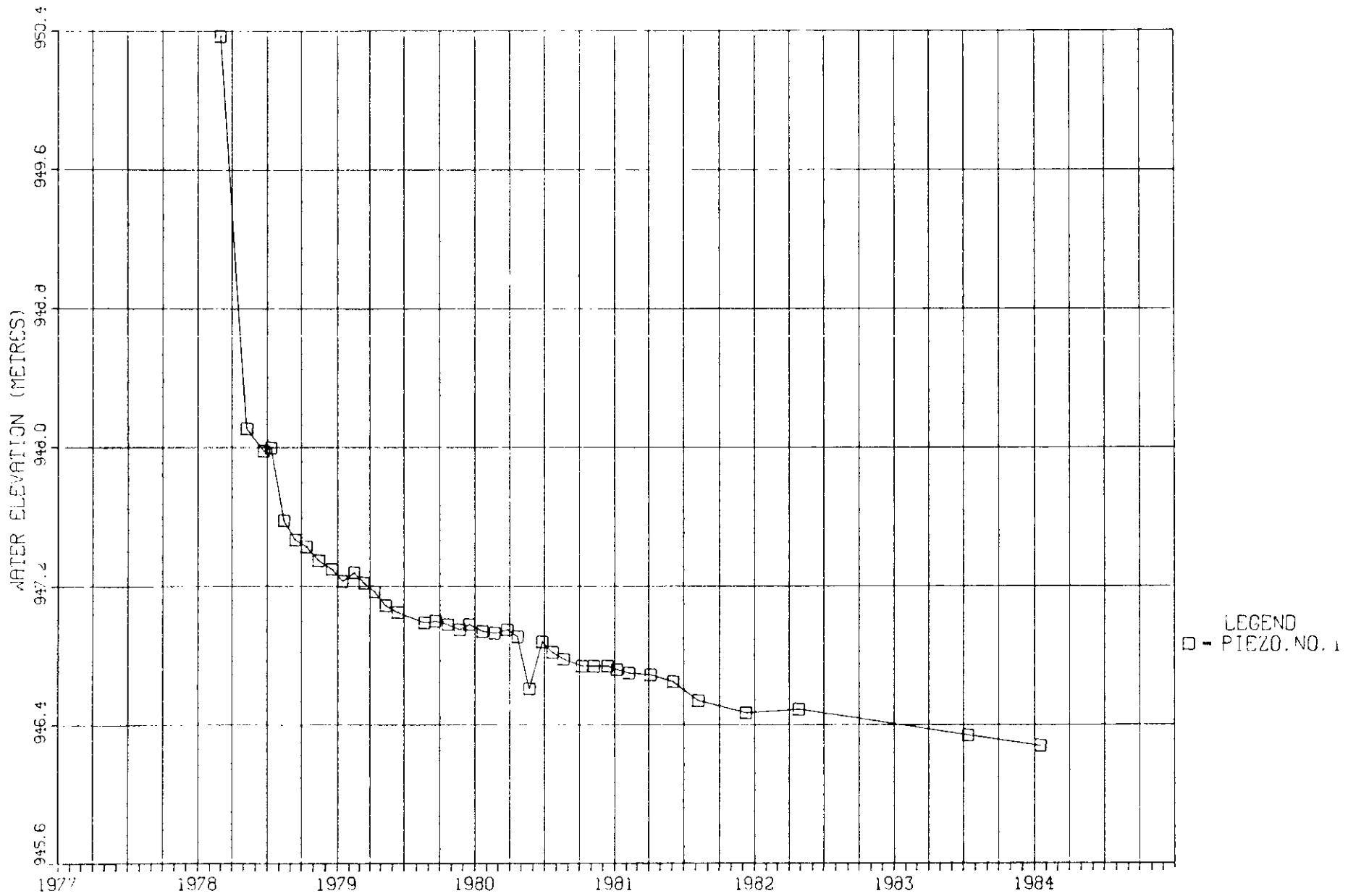
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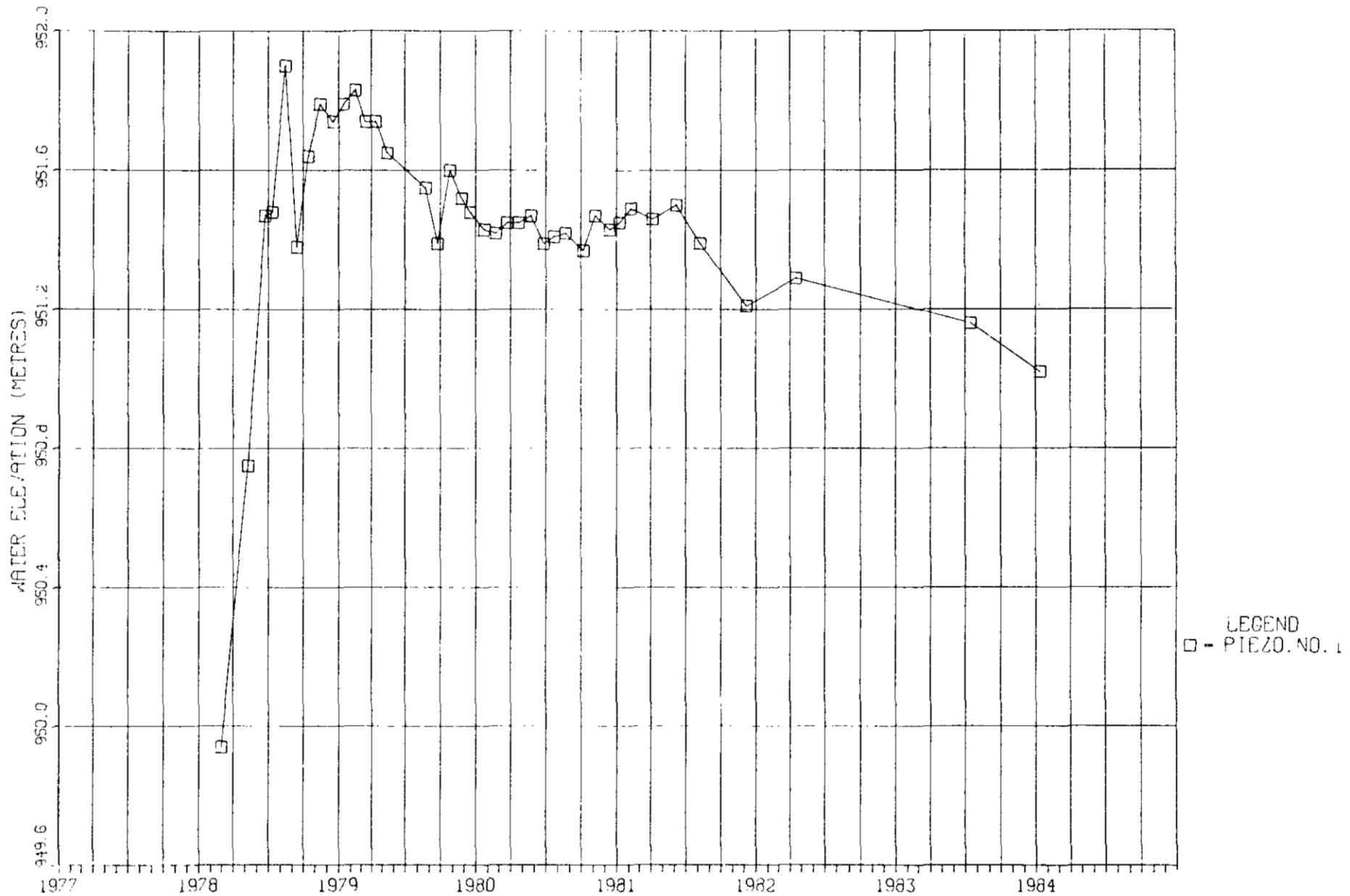
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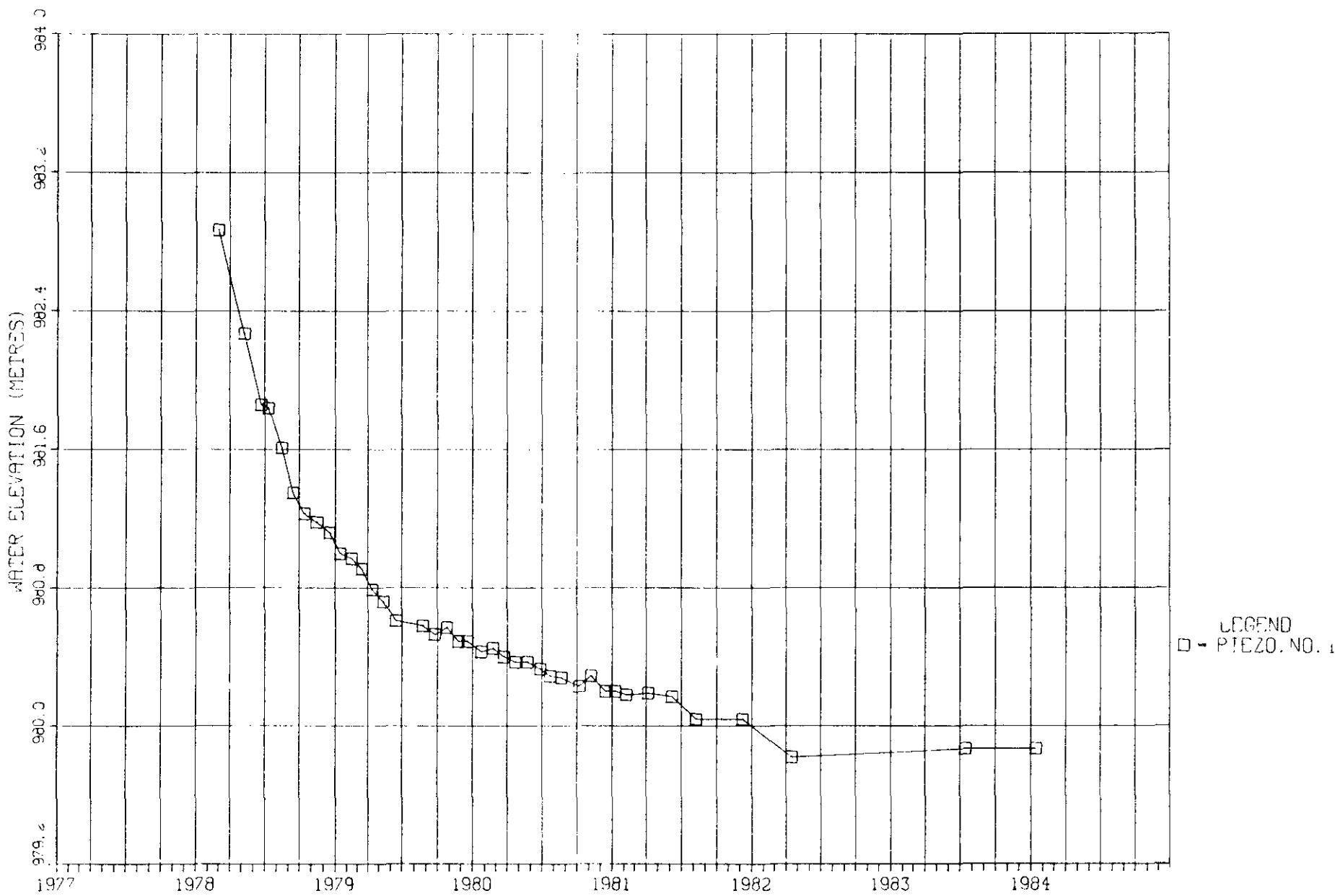
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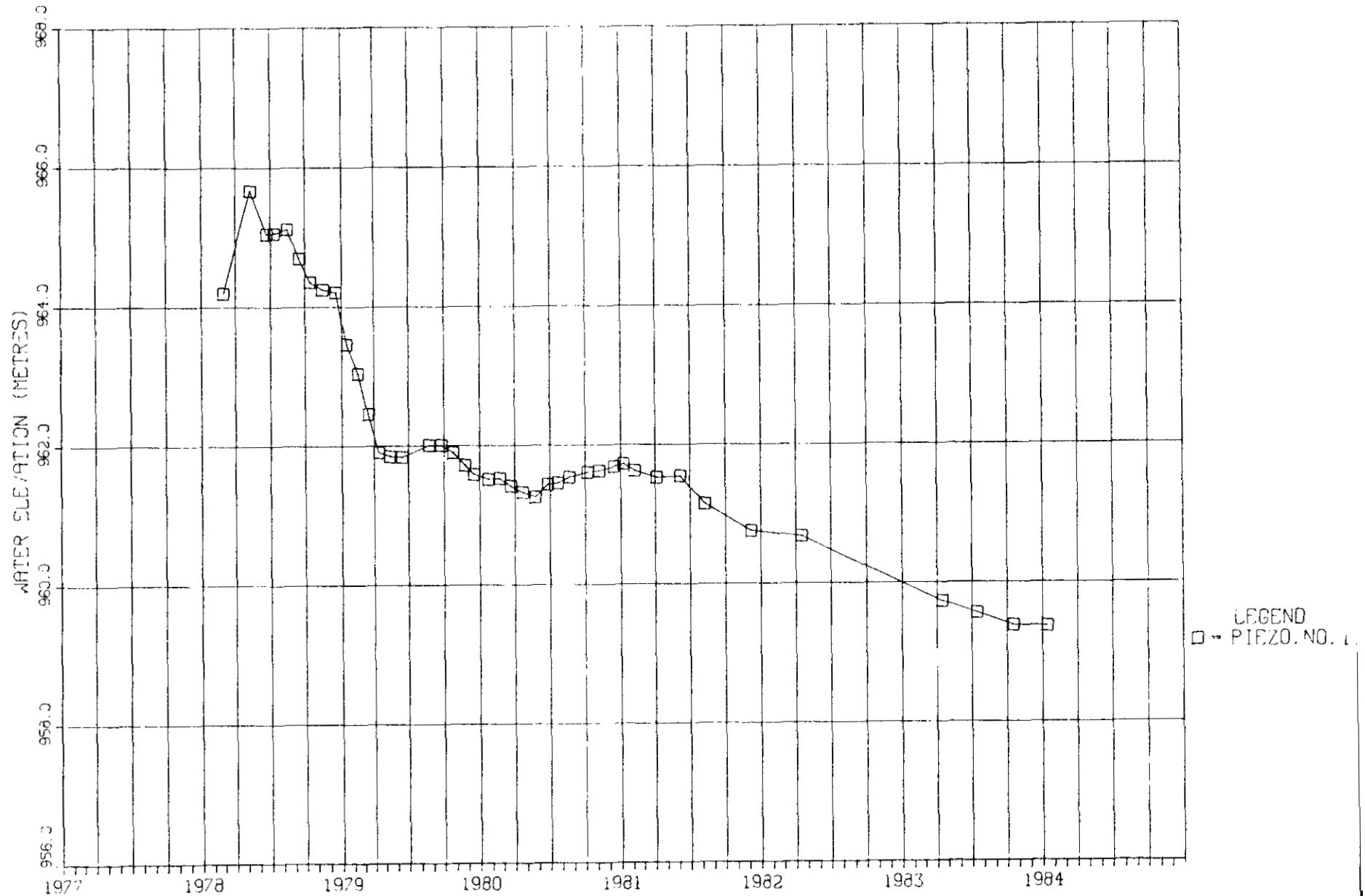
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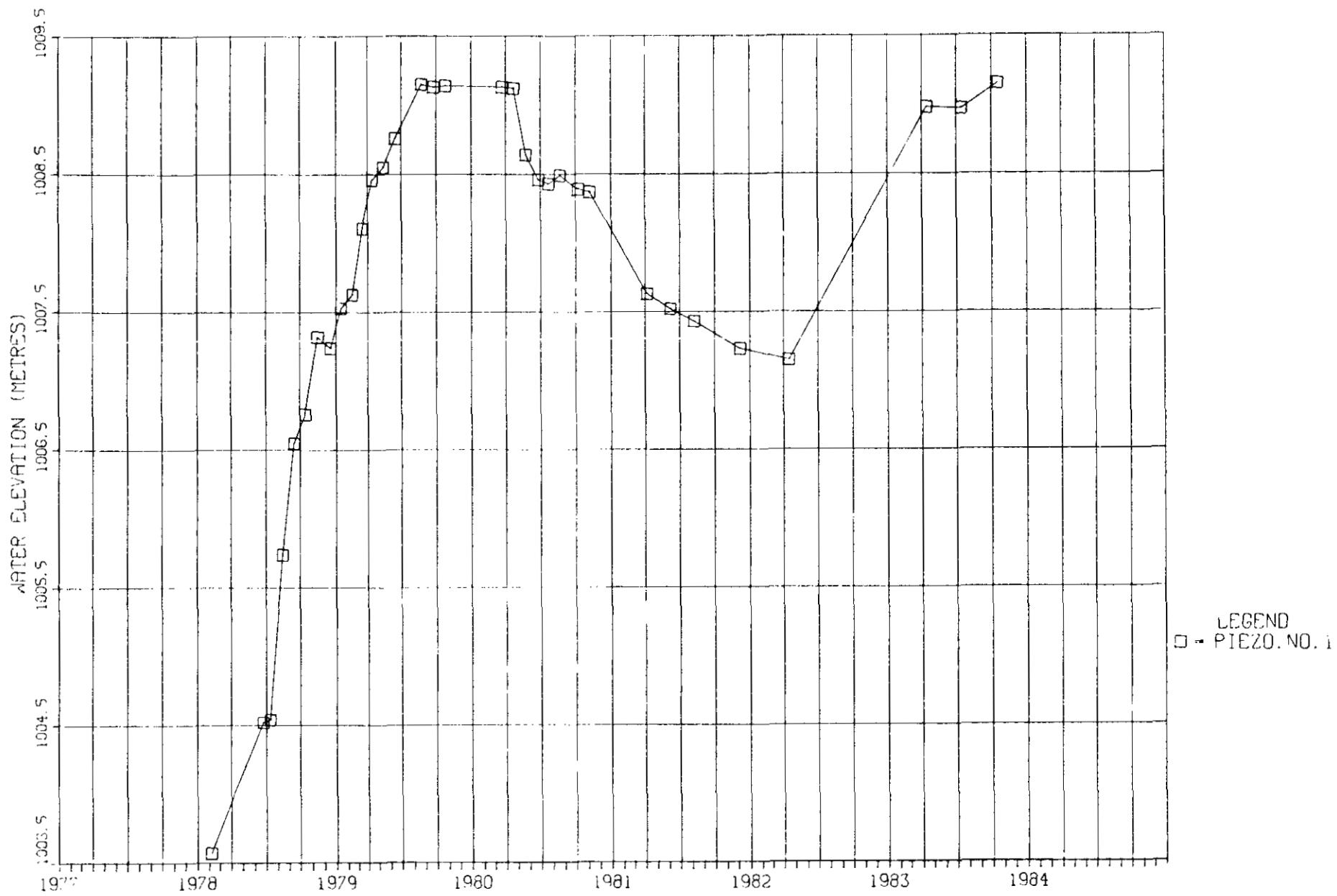
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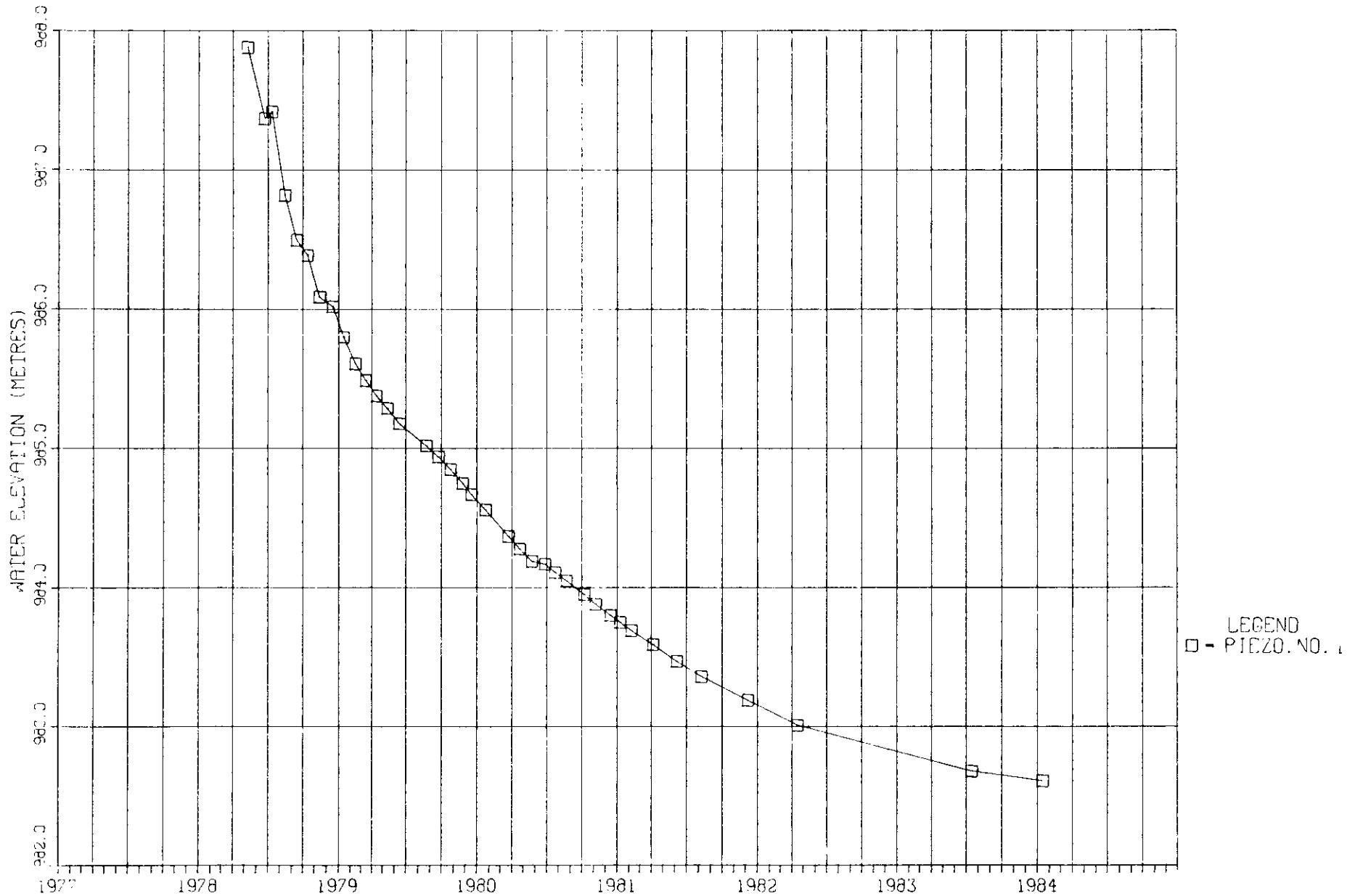
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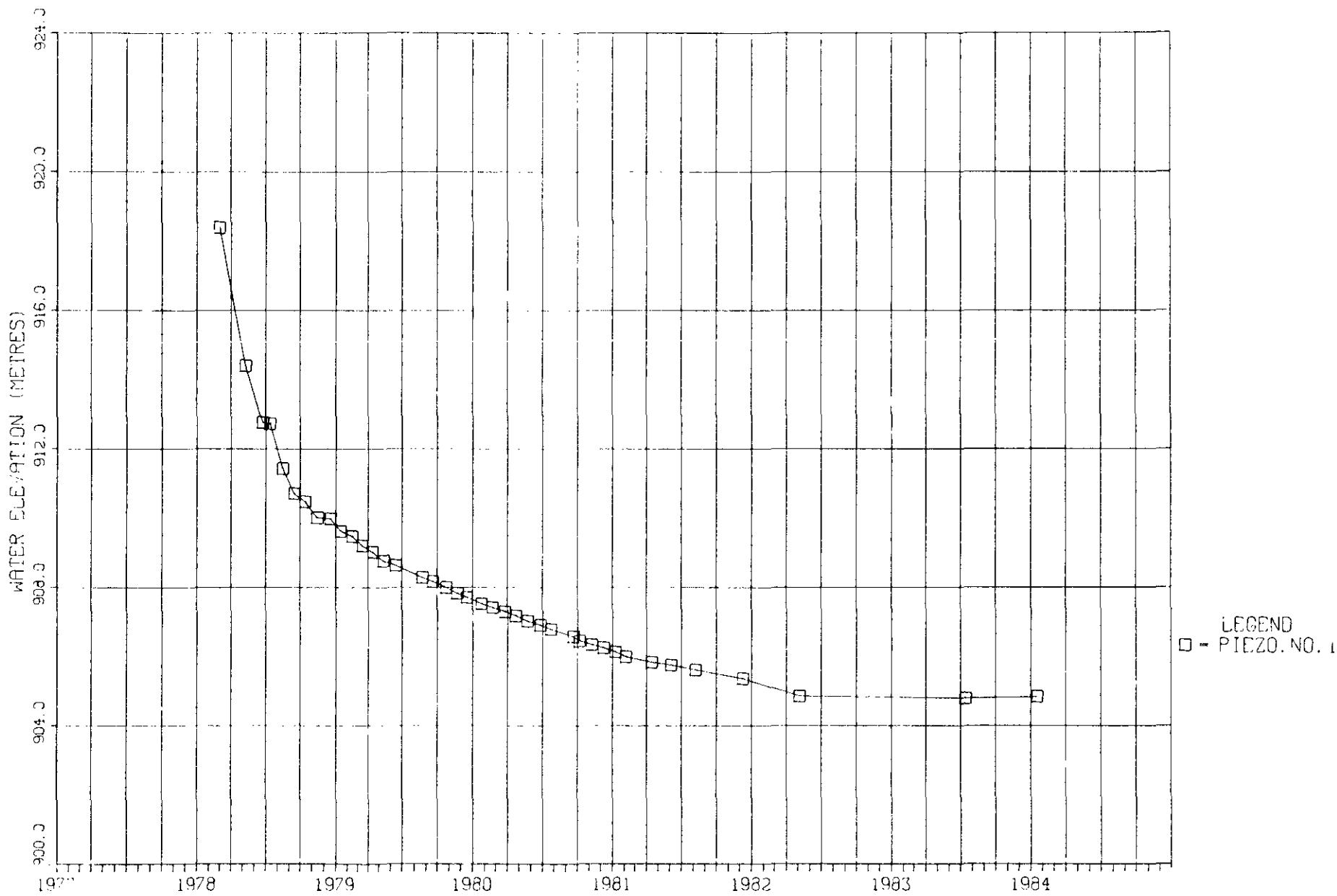
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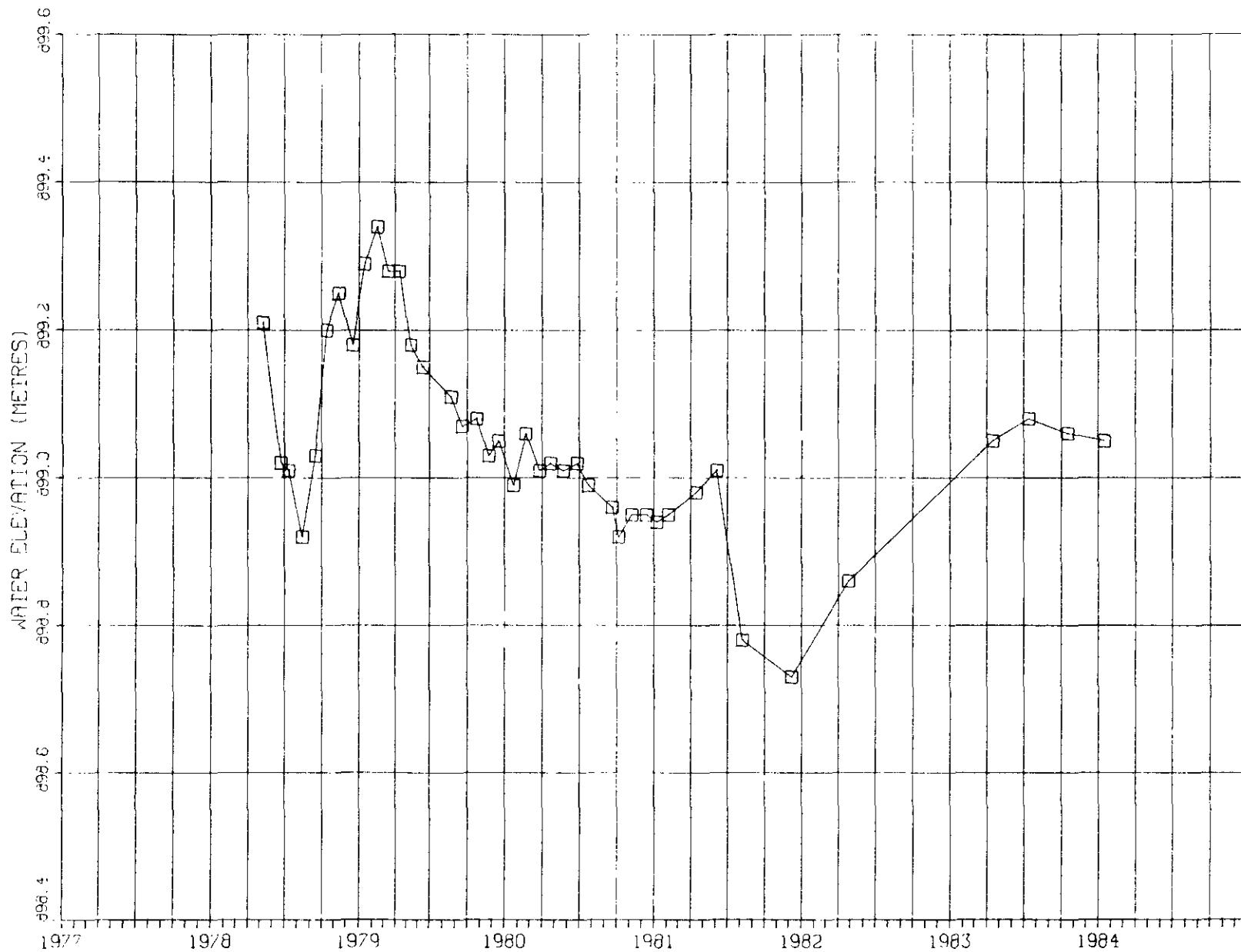
HAT CREEK WATER LEVEL MONITORING - OBSERVATION WELL NO. DDH-77-258



HAT CREEK WATER LEVEL MONITORING - OBSERVATION WELL NO. DDH-78-261

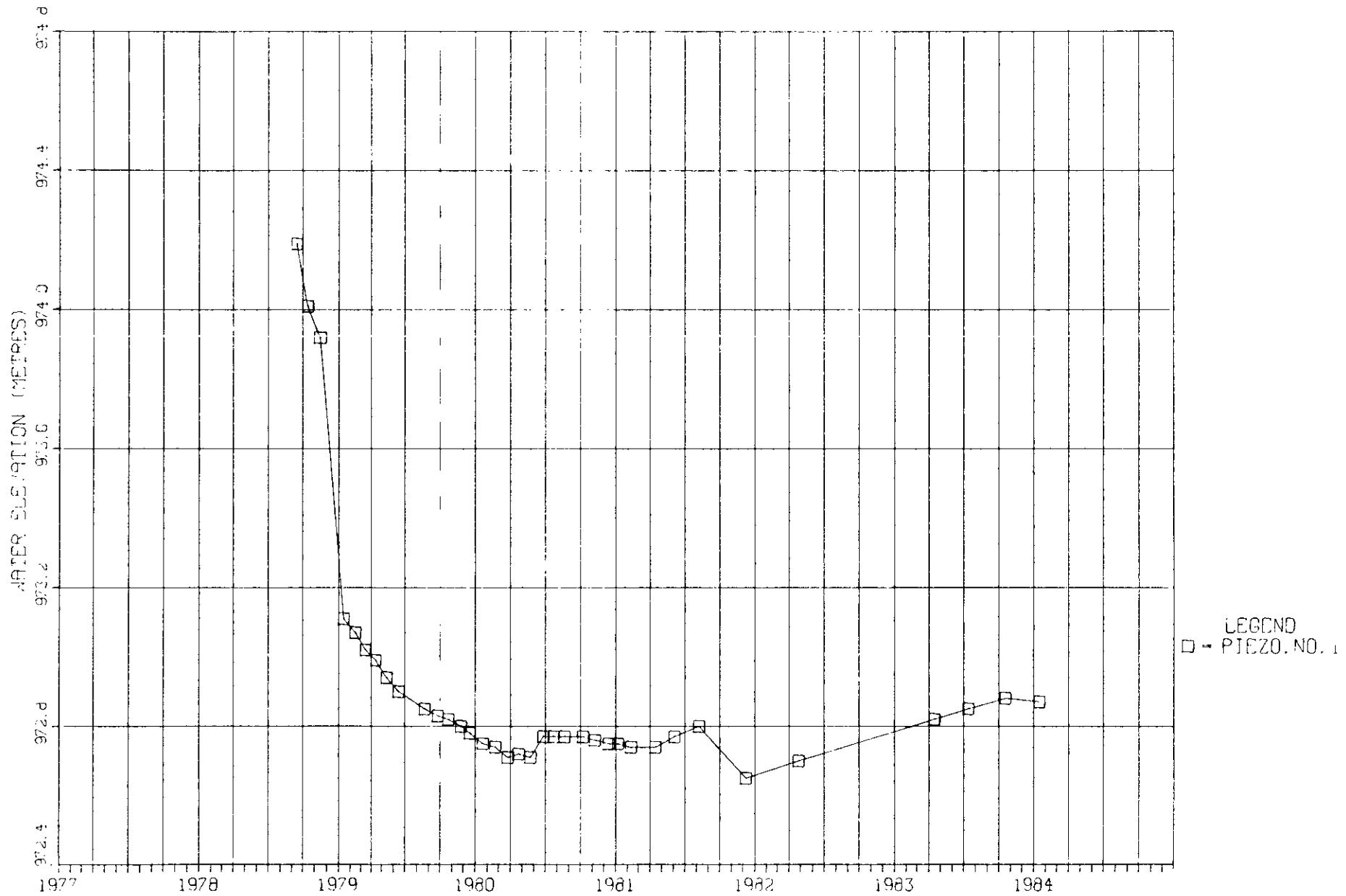


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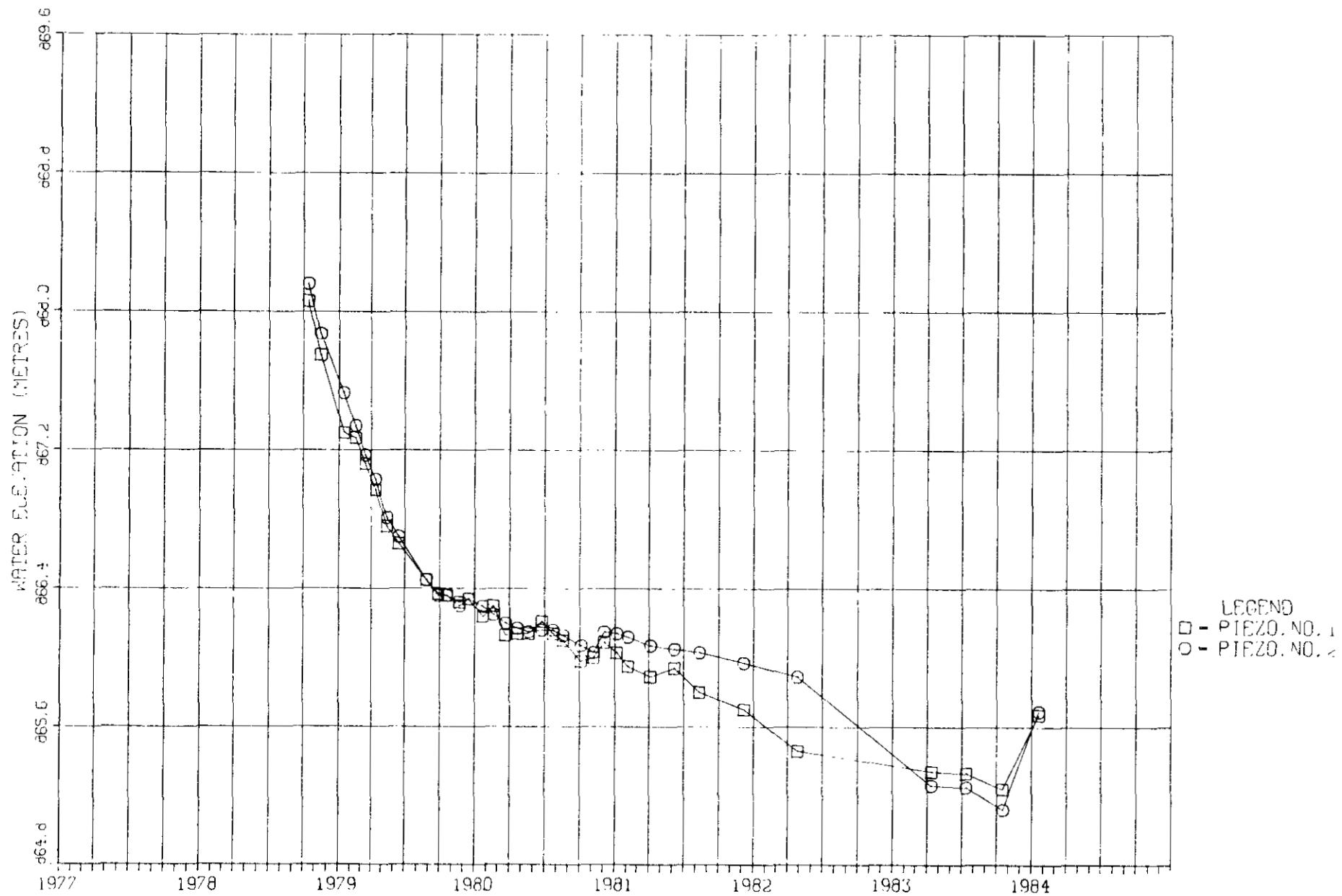


LEGEND
□ - PIEZO NO. 1

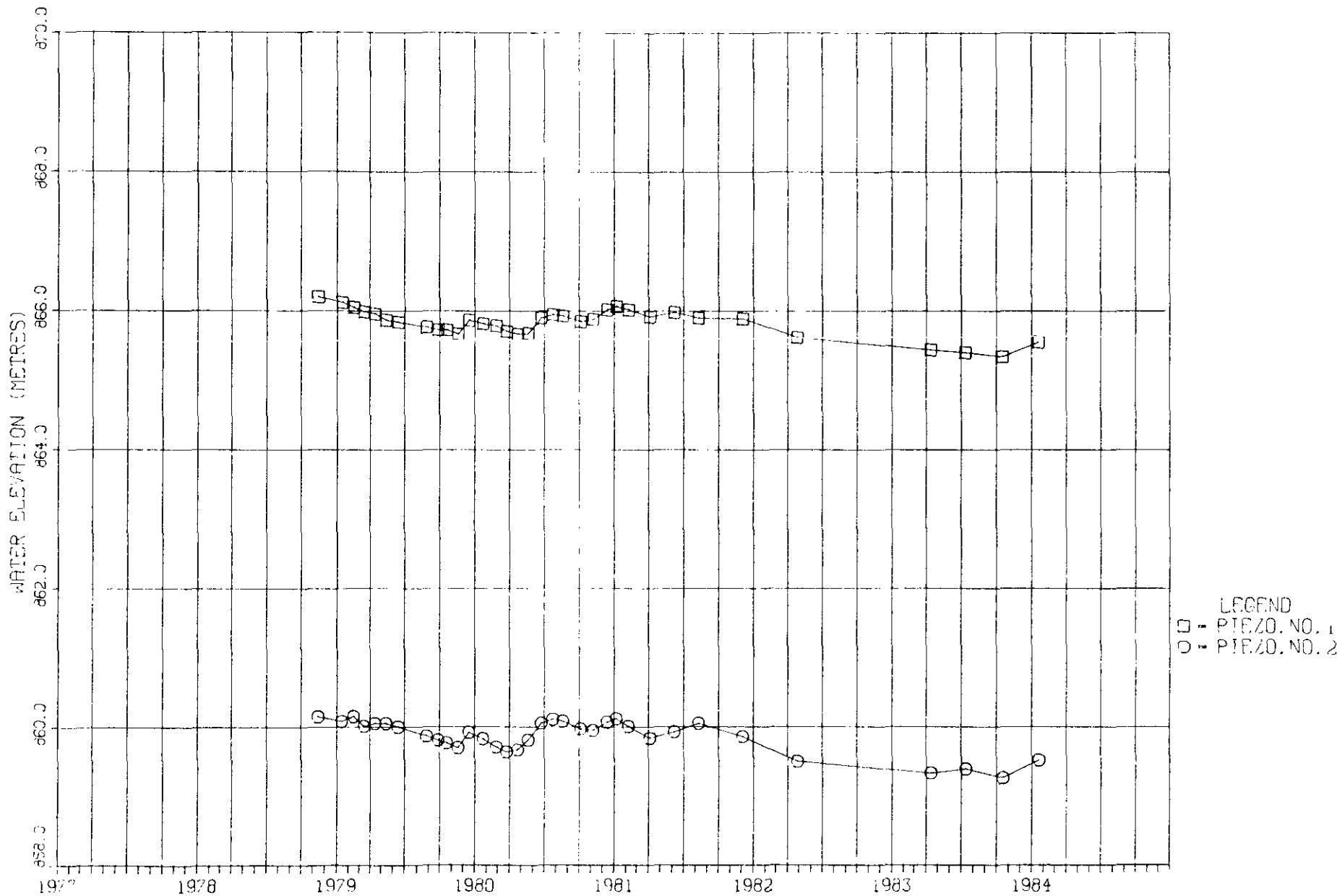
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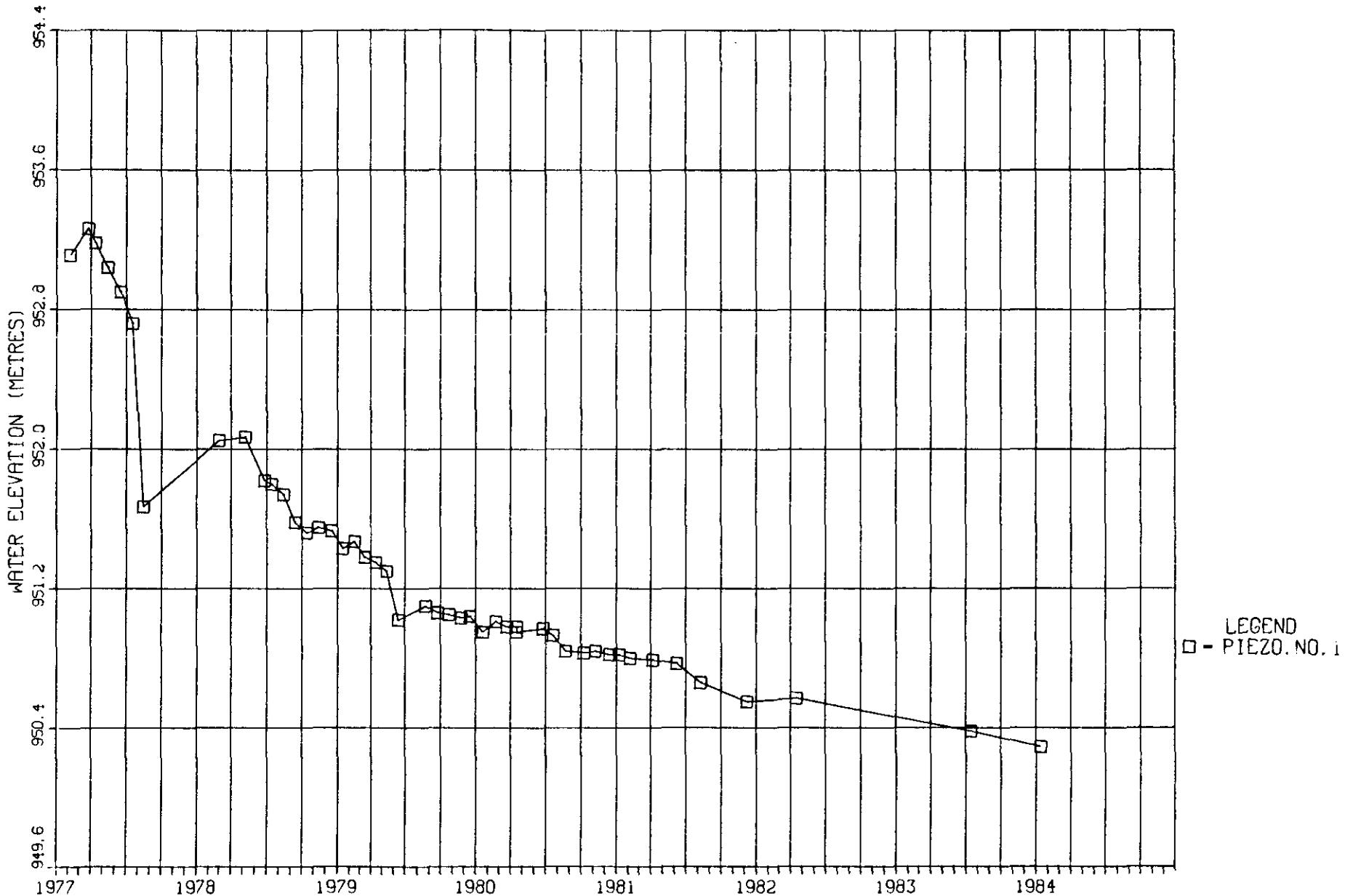
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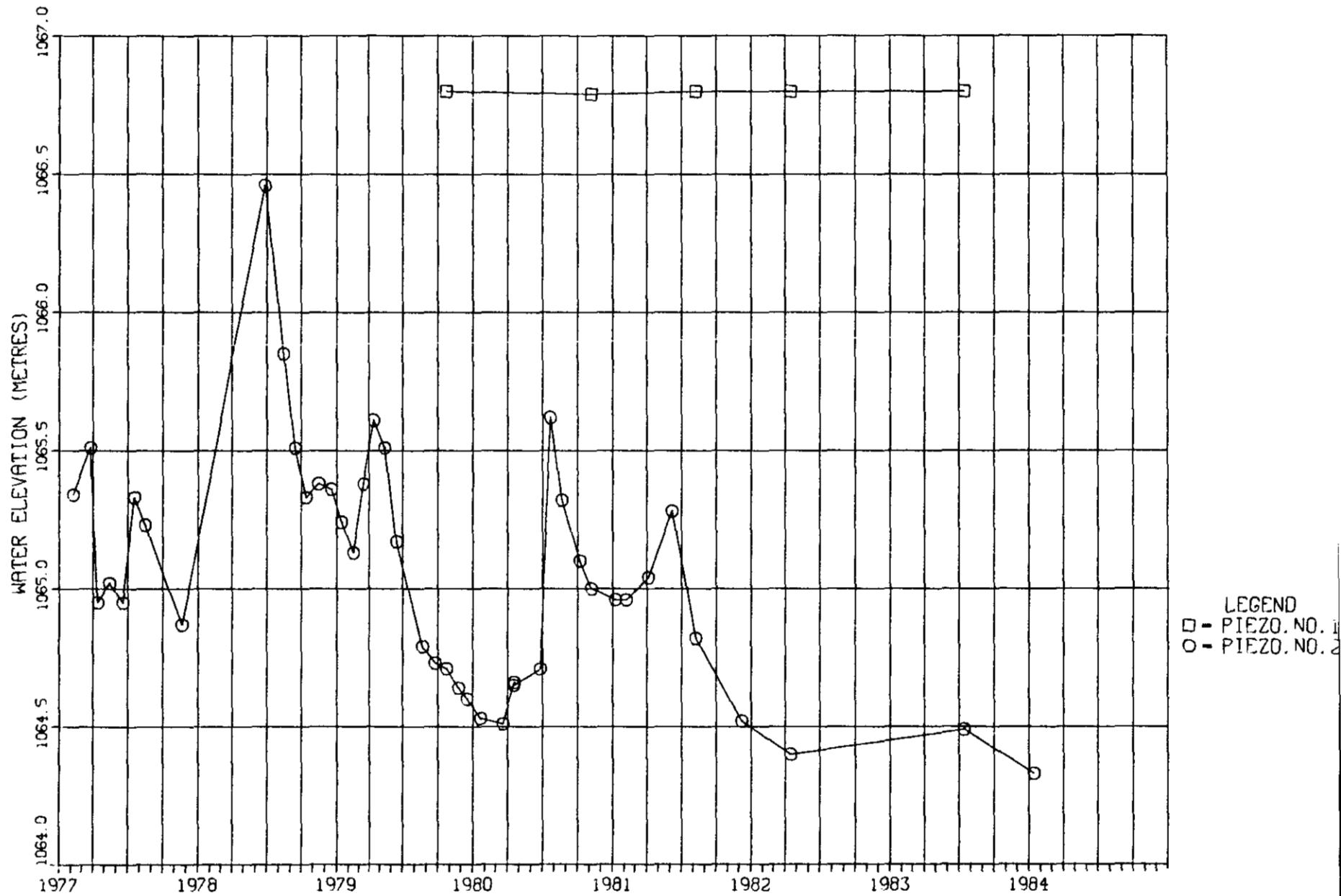
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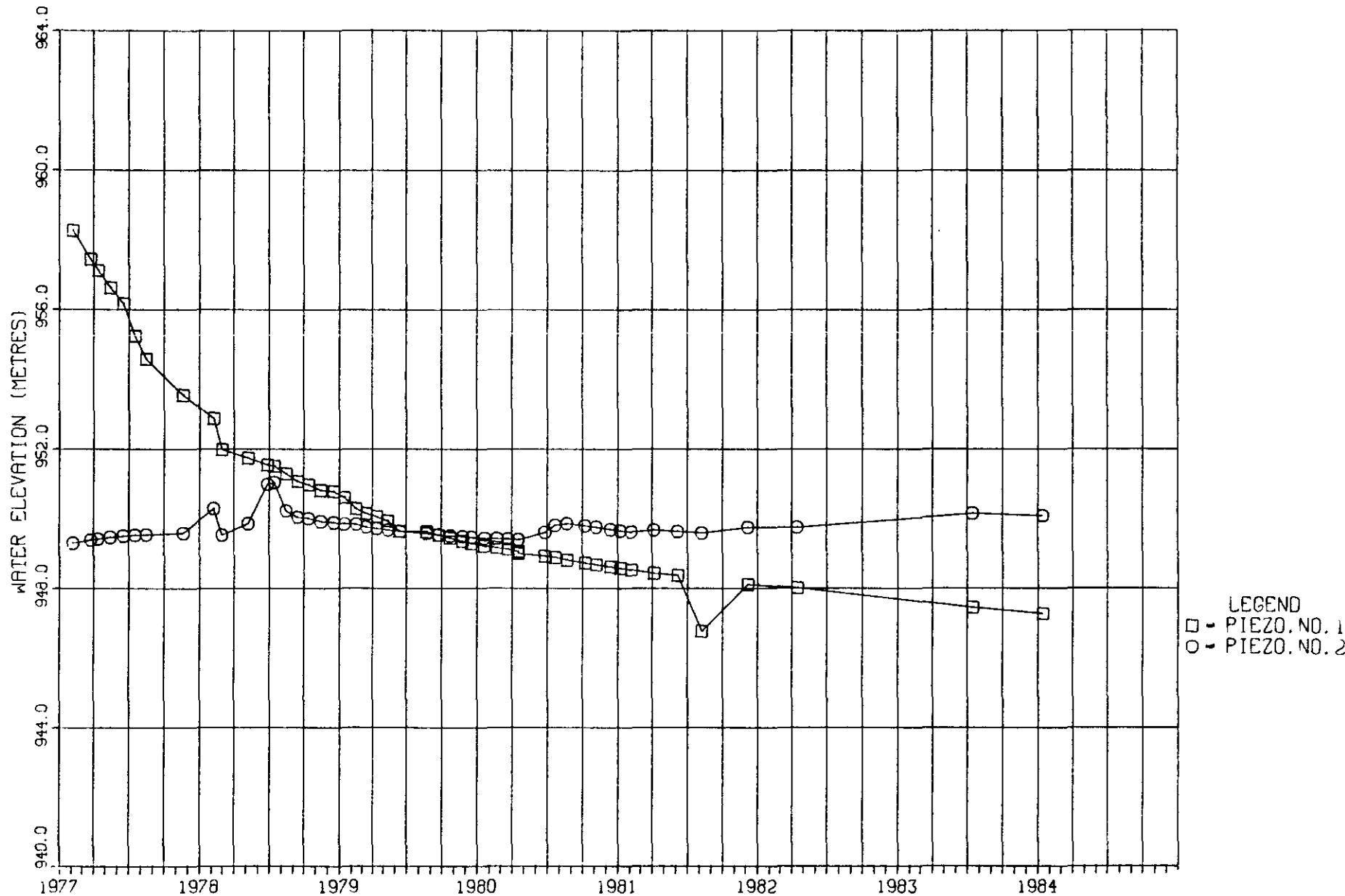
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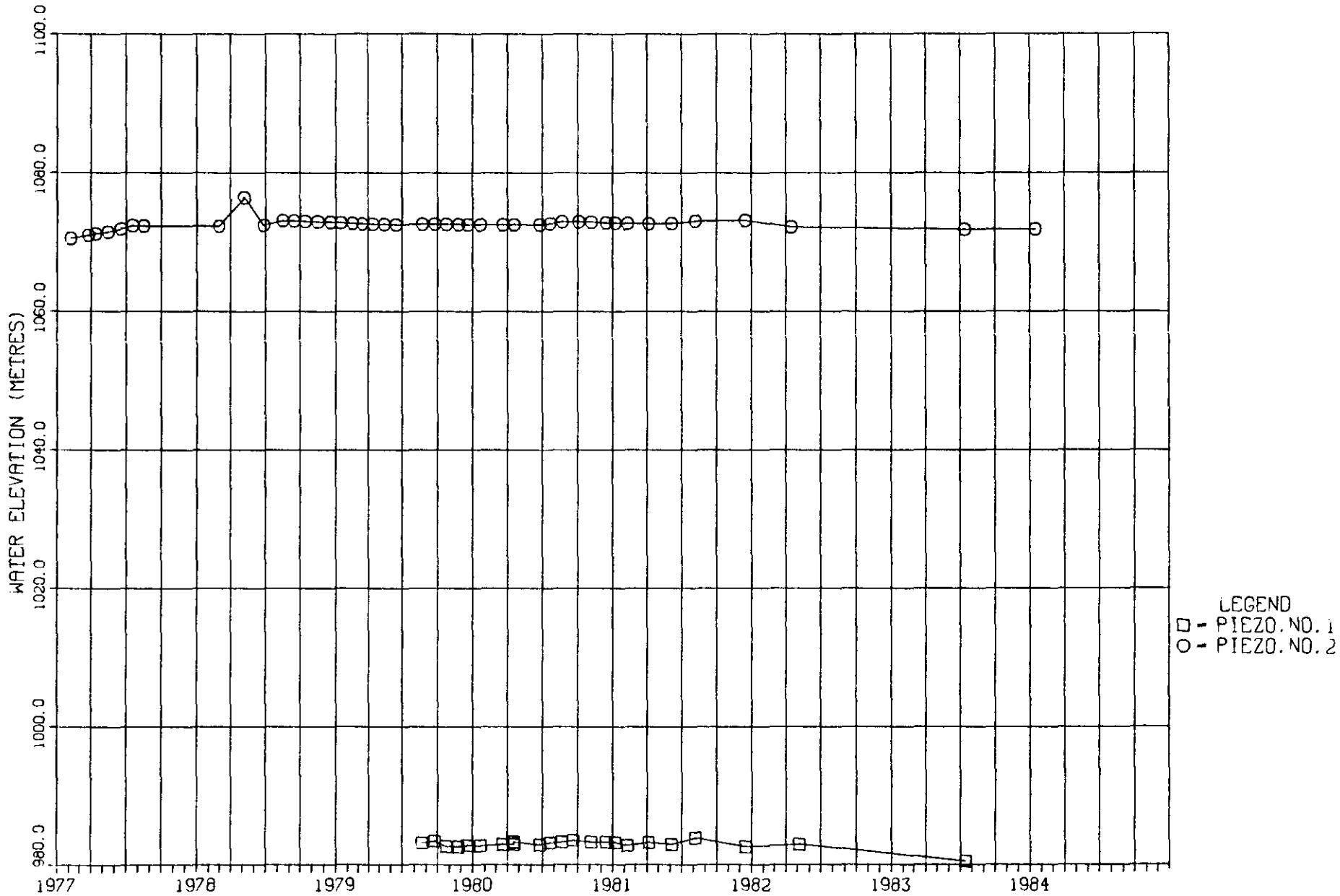
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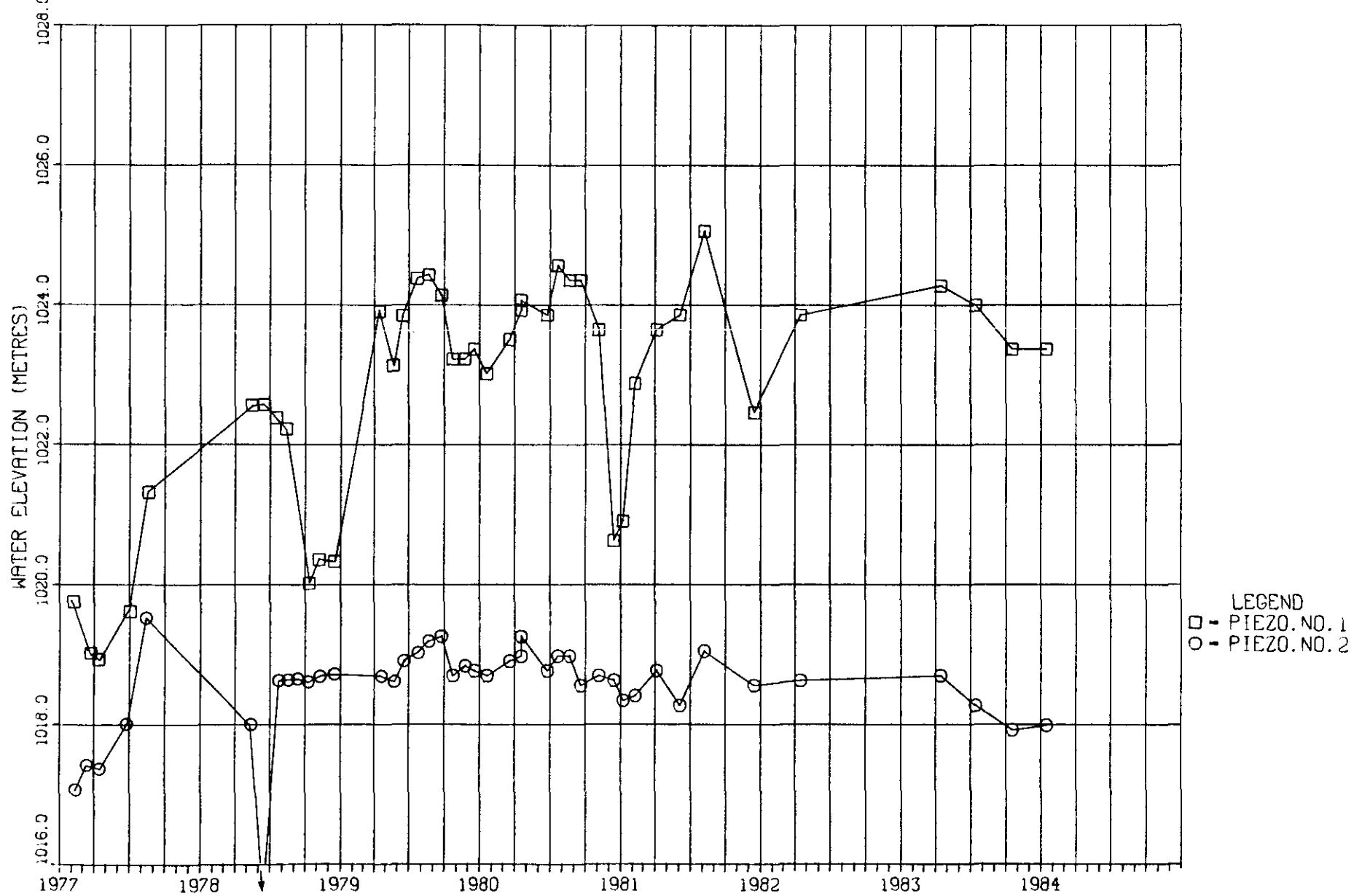
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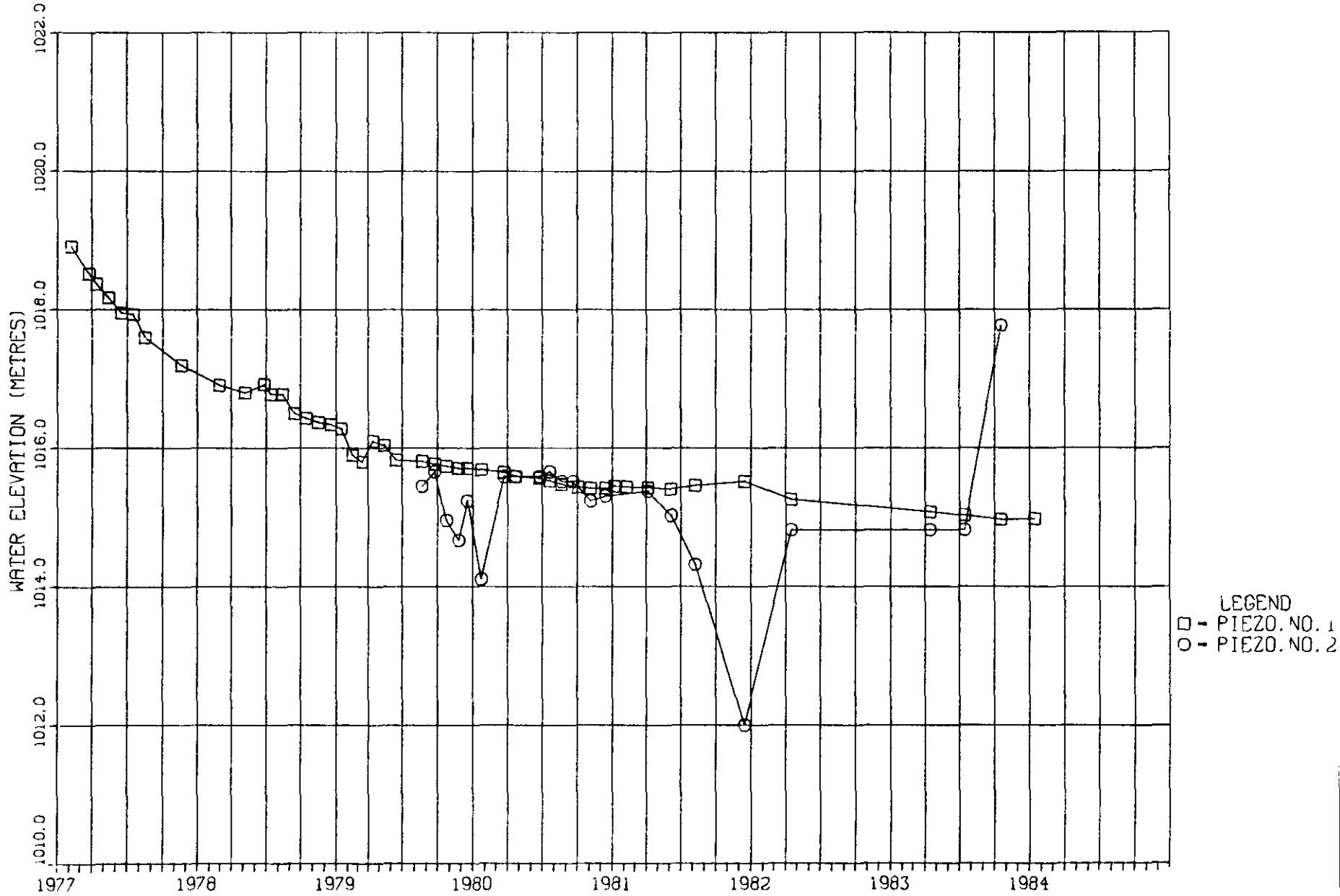
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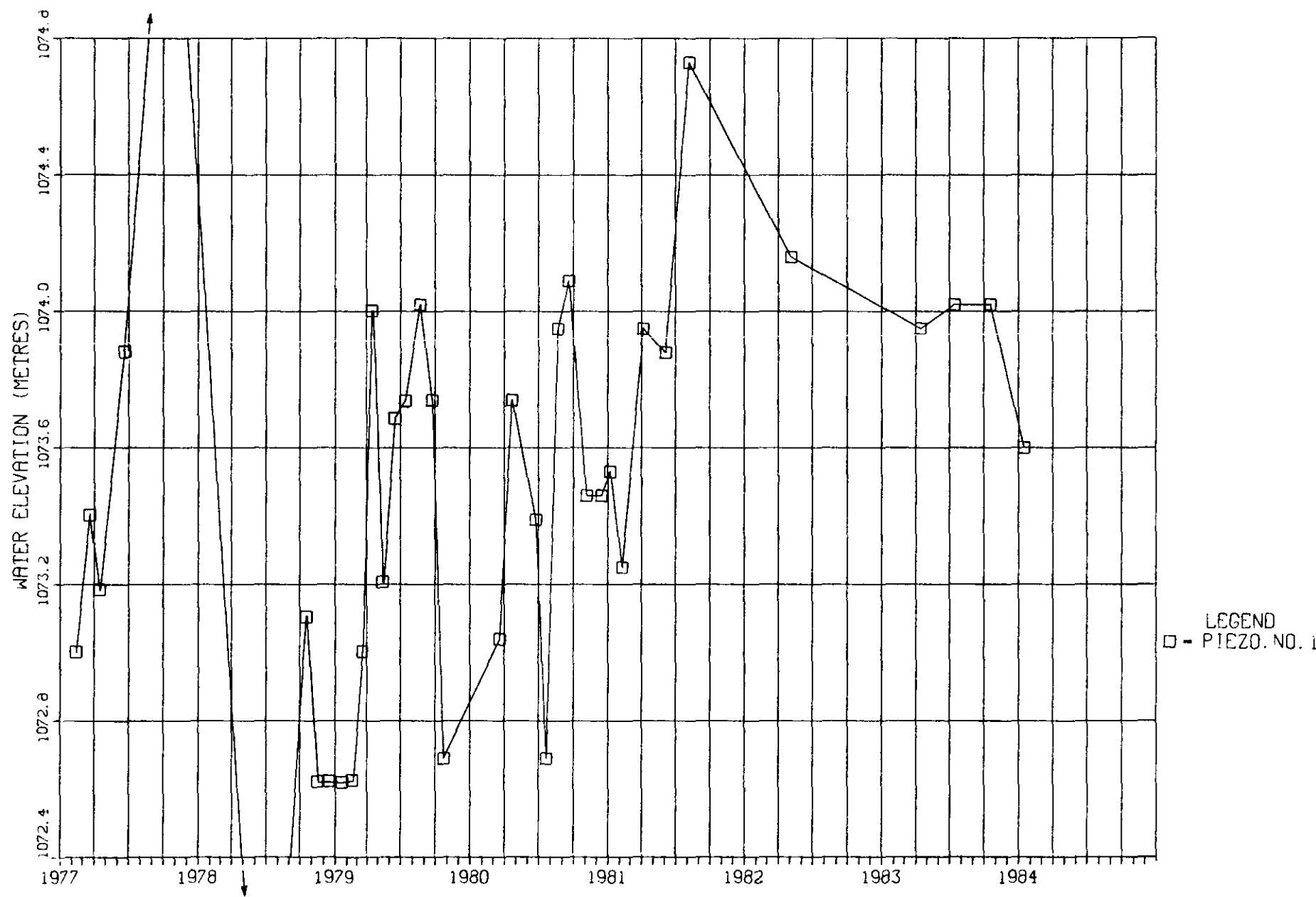
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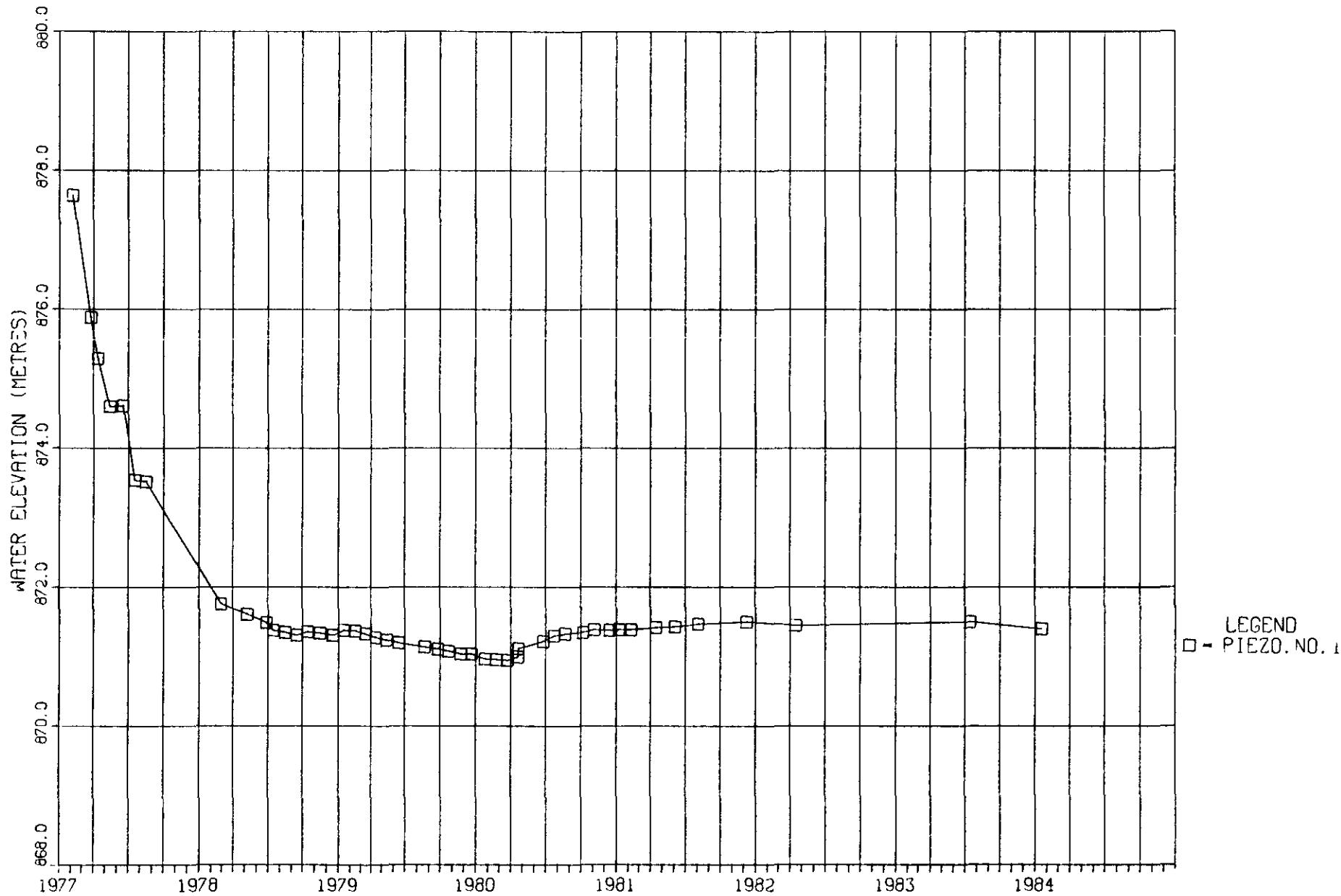
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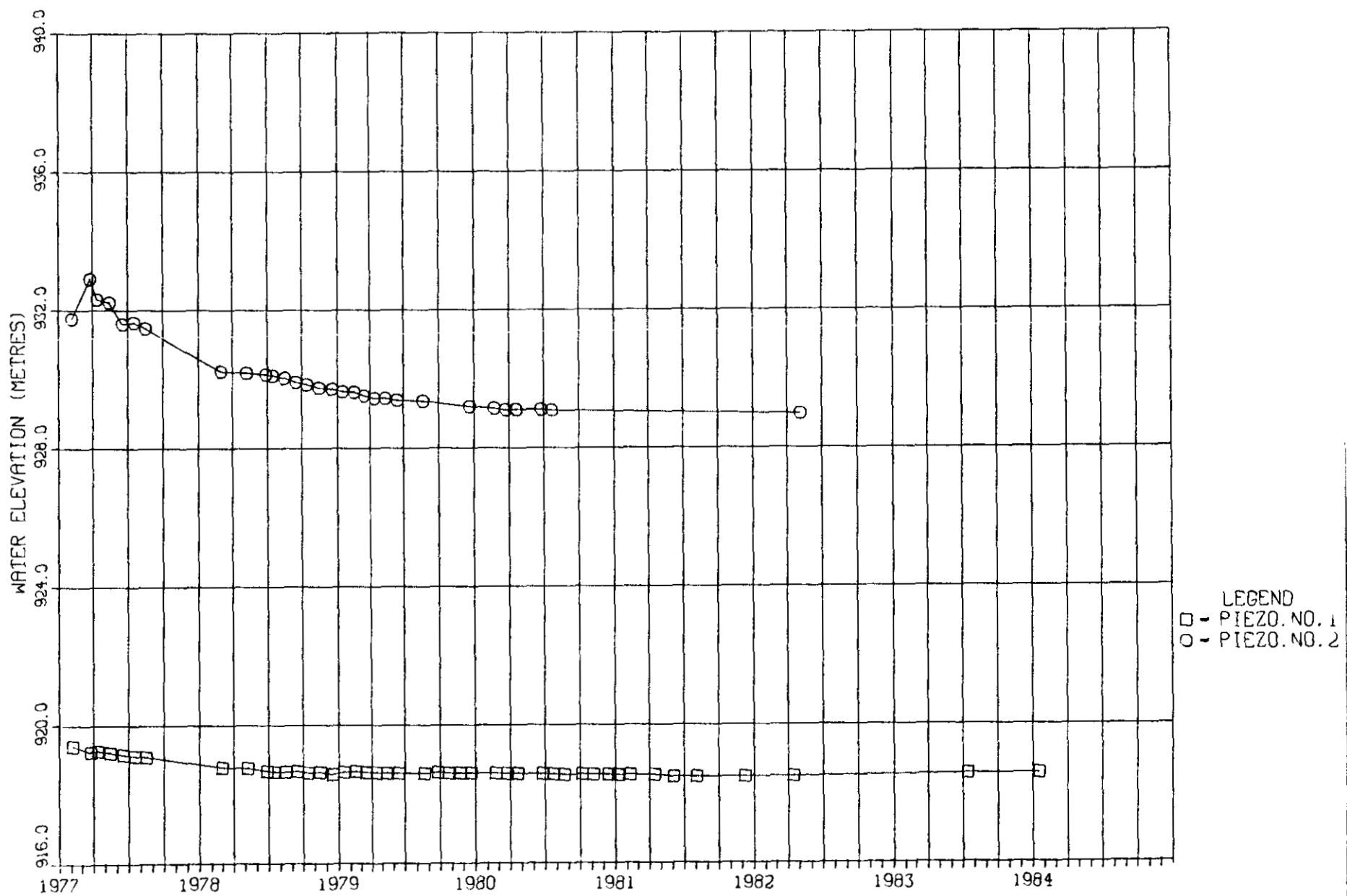
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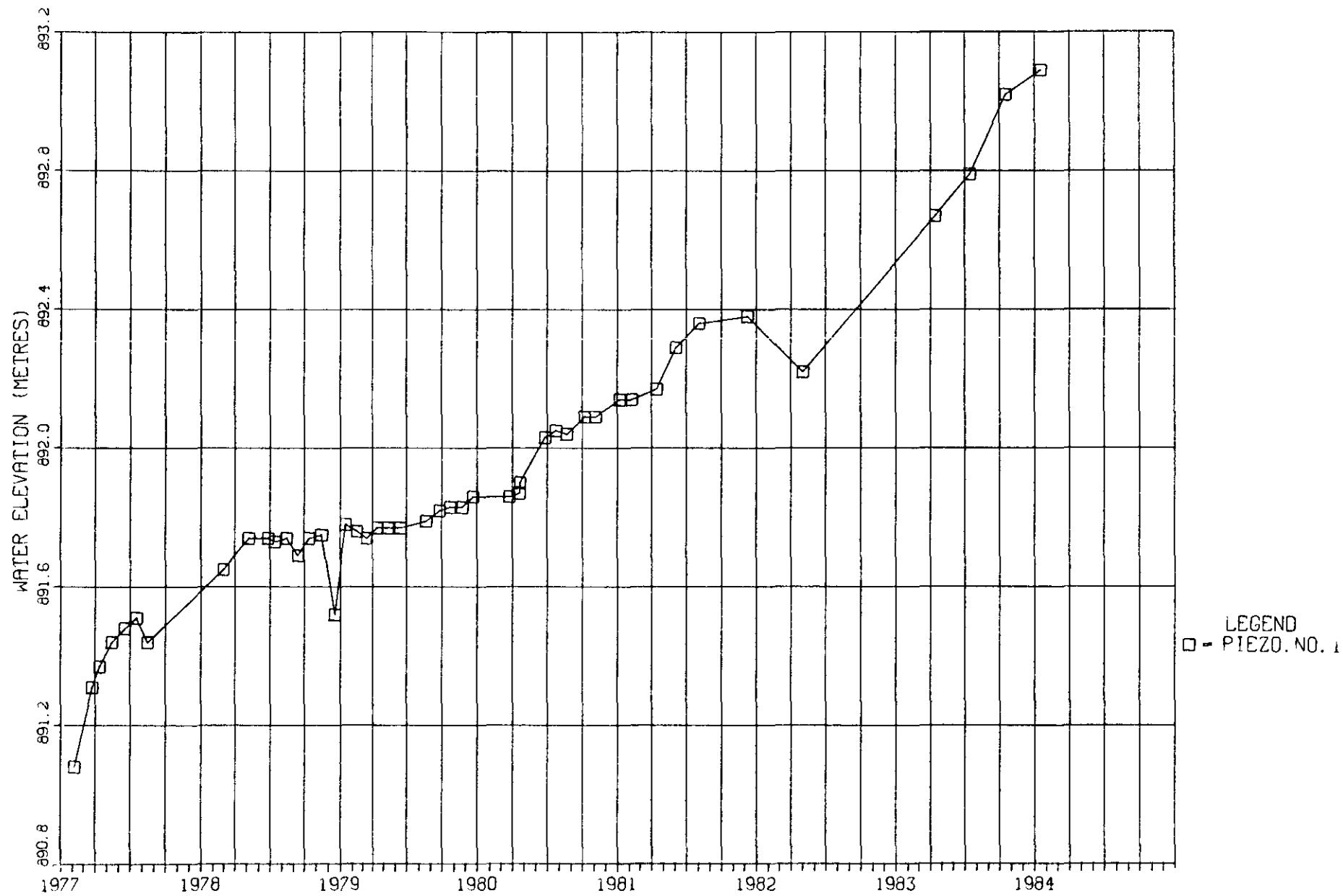
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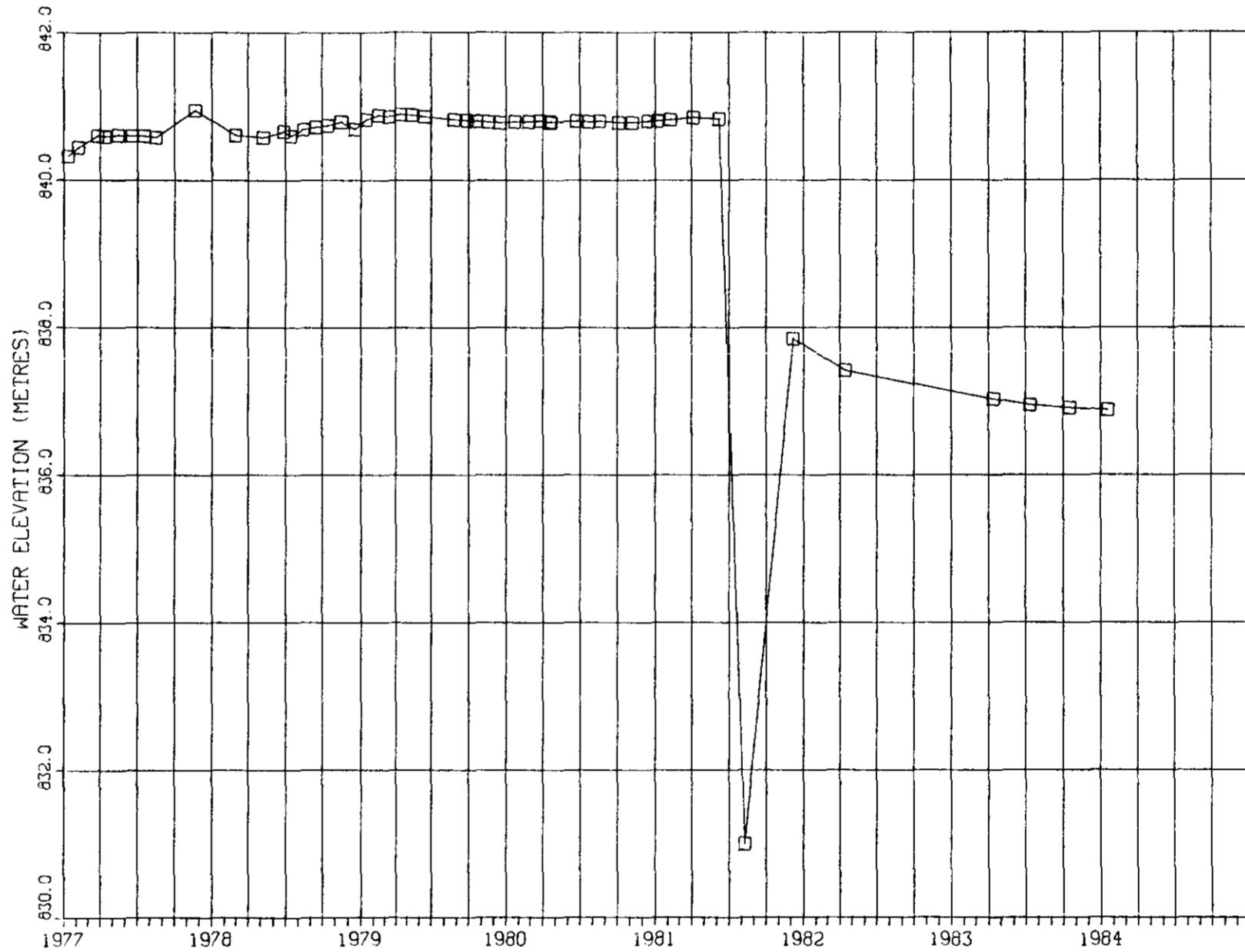
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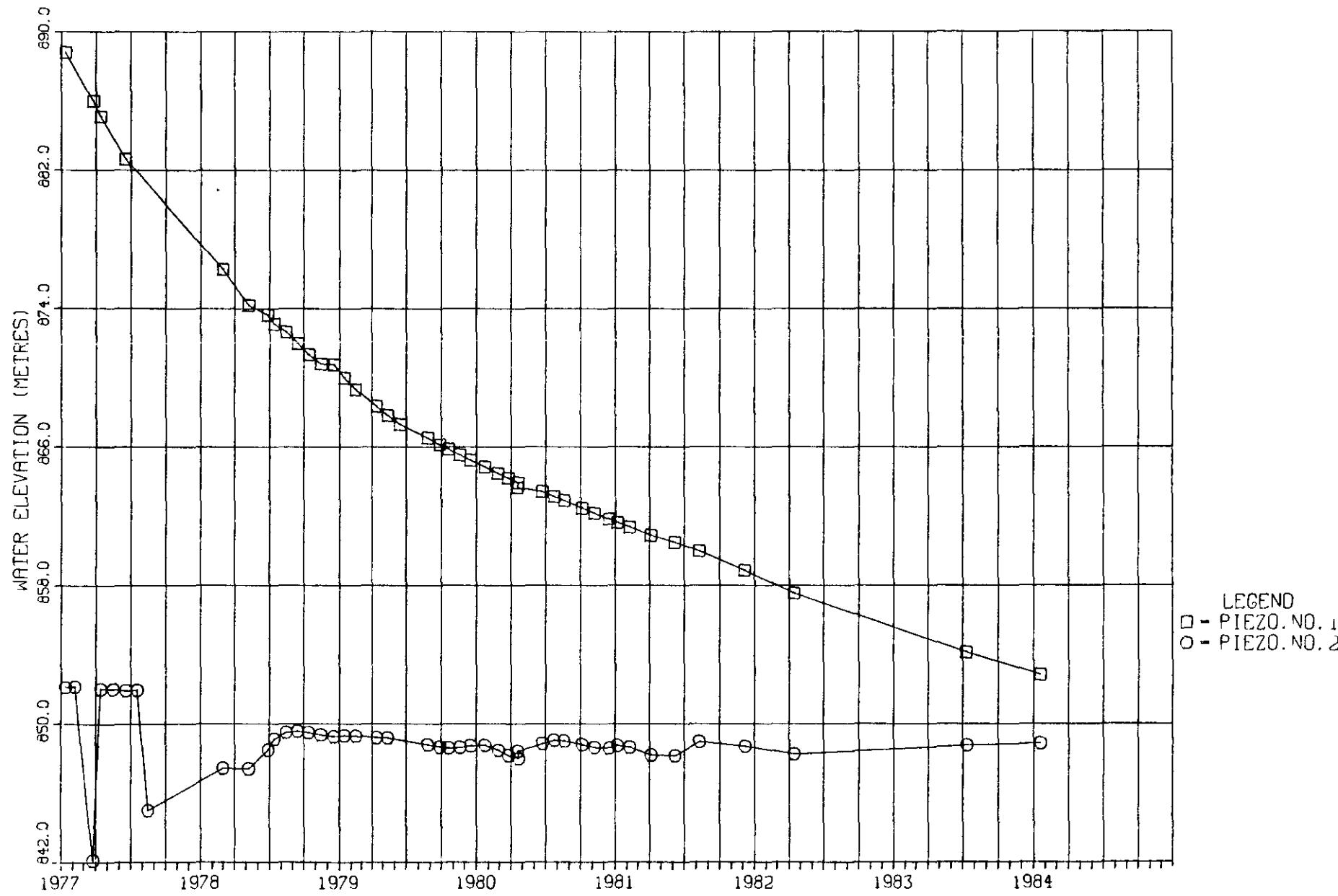


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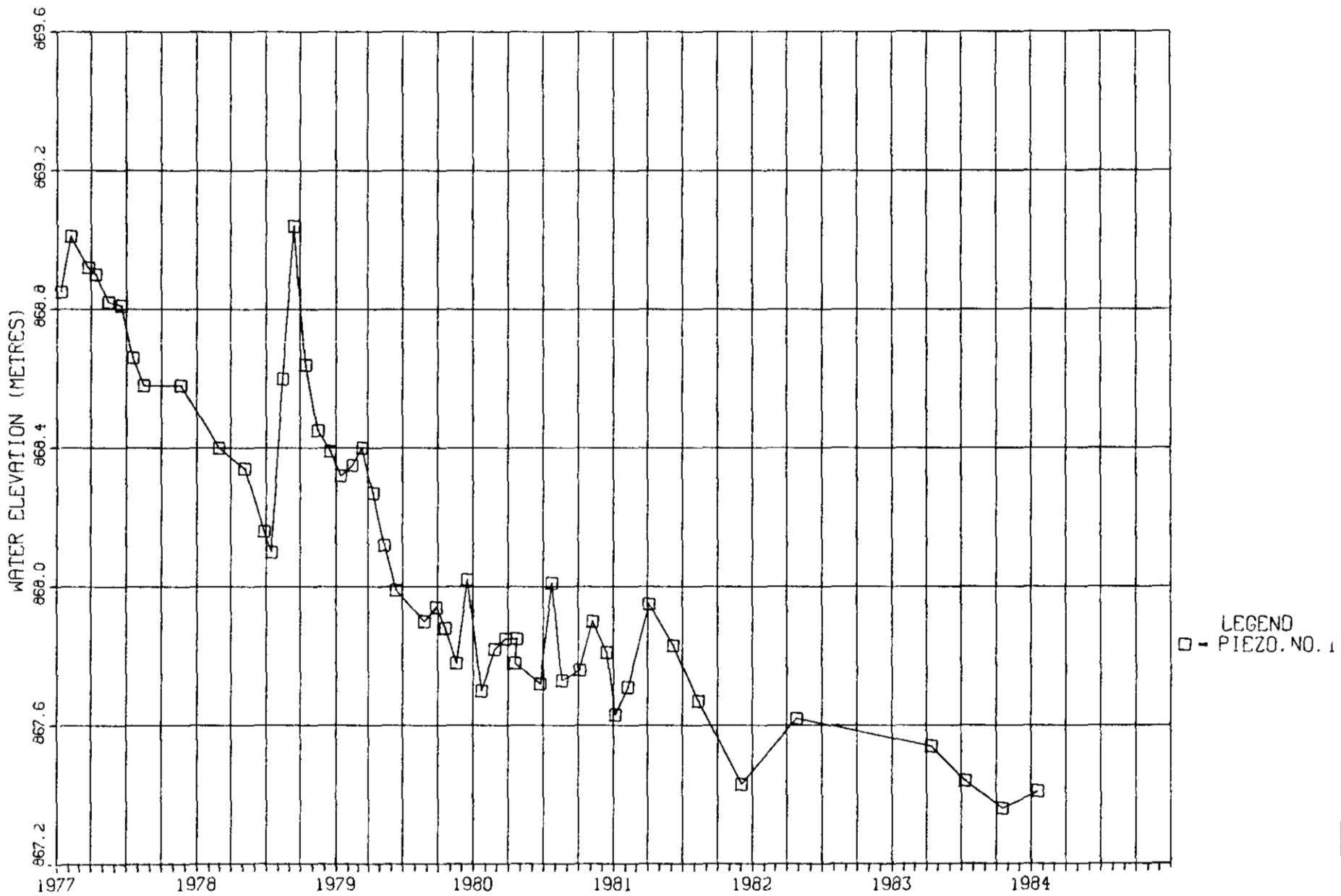


LEGEND
□ - PIEZO NO. 1

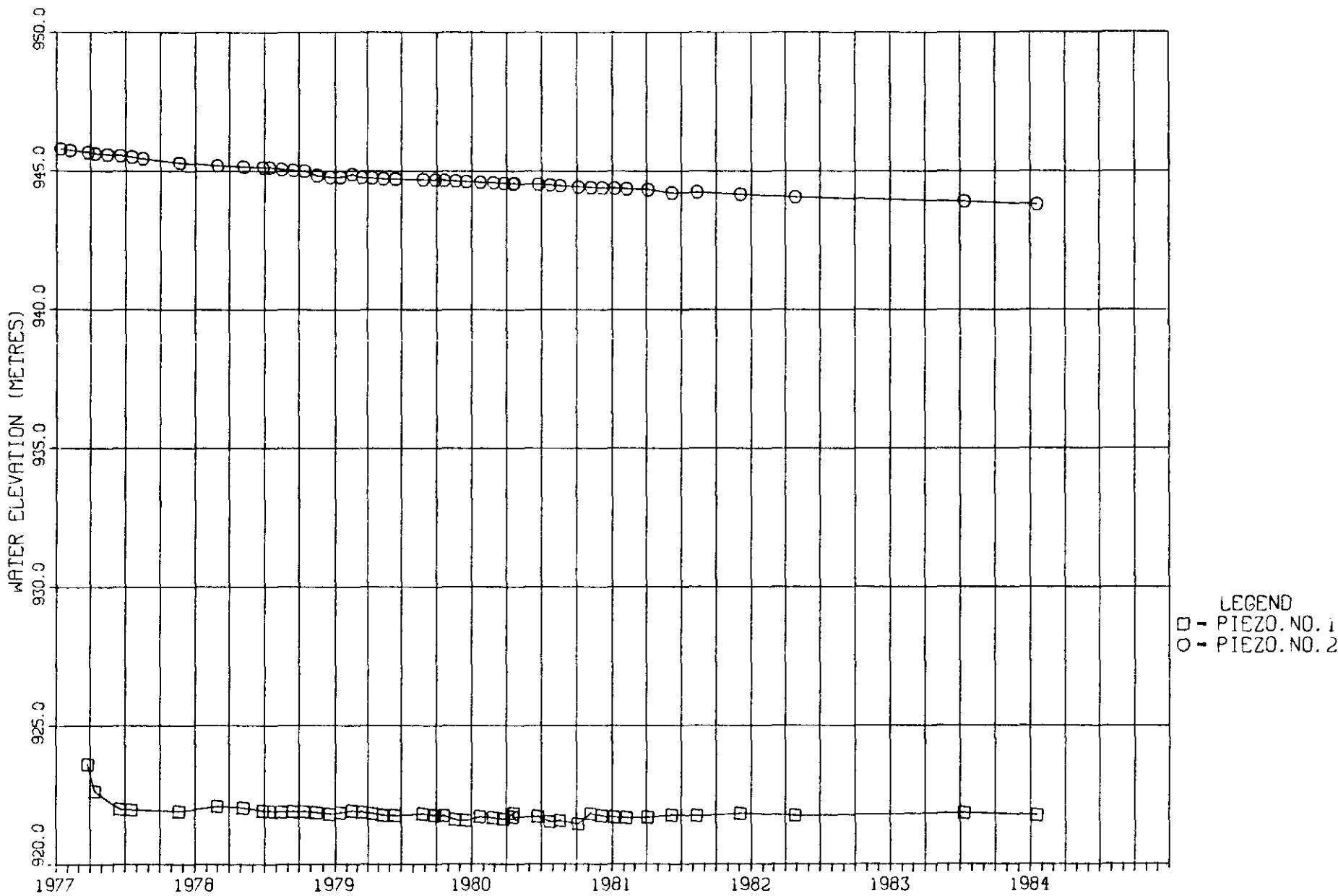
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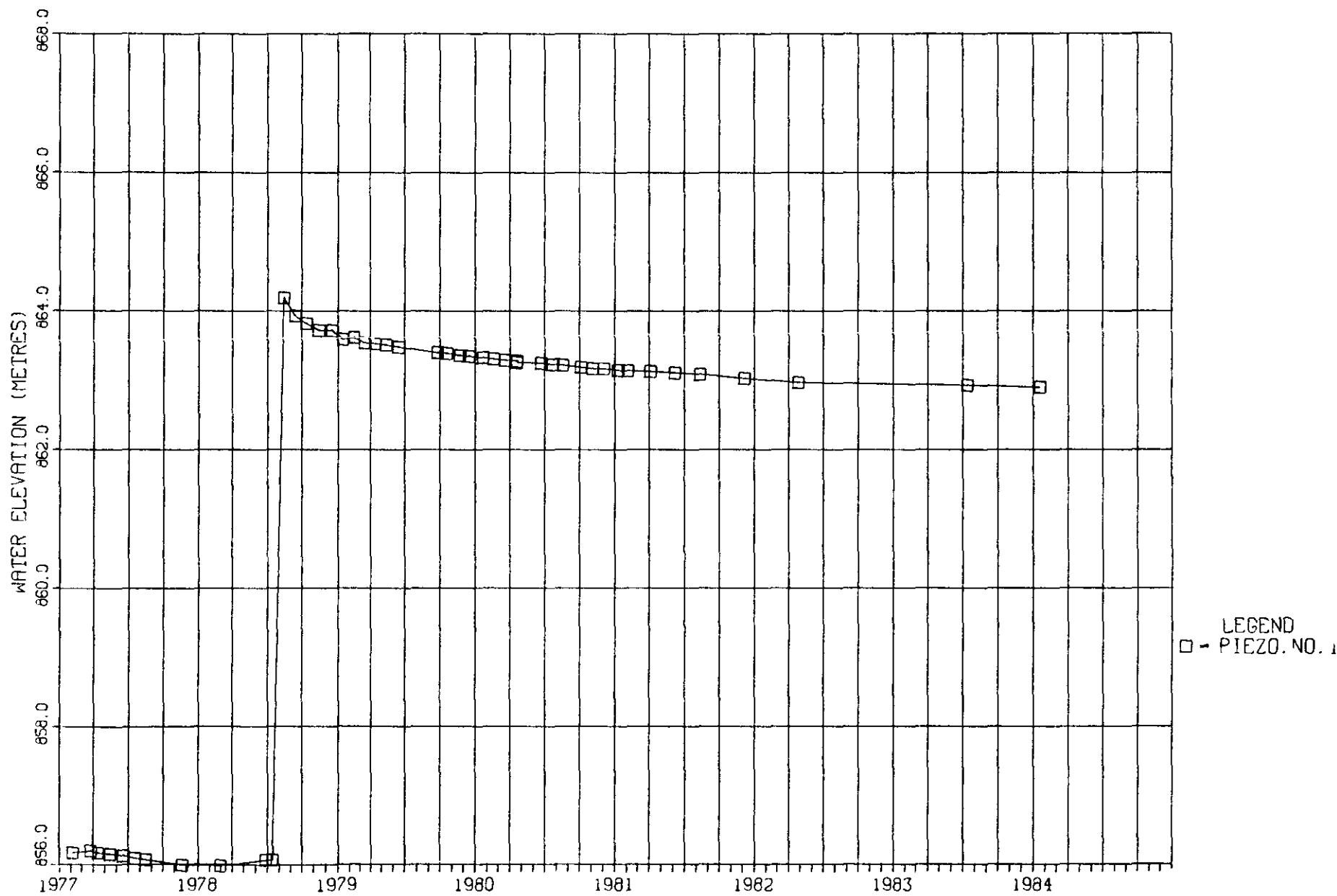
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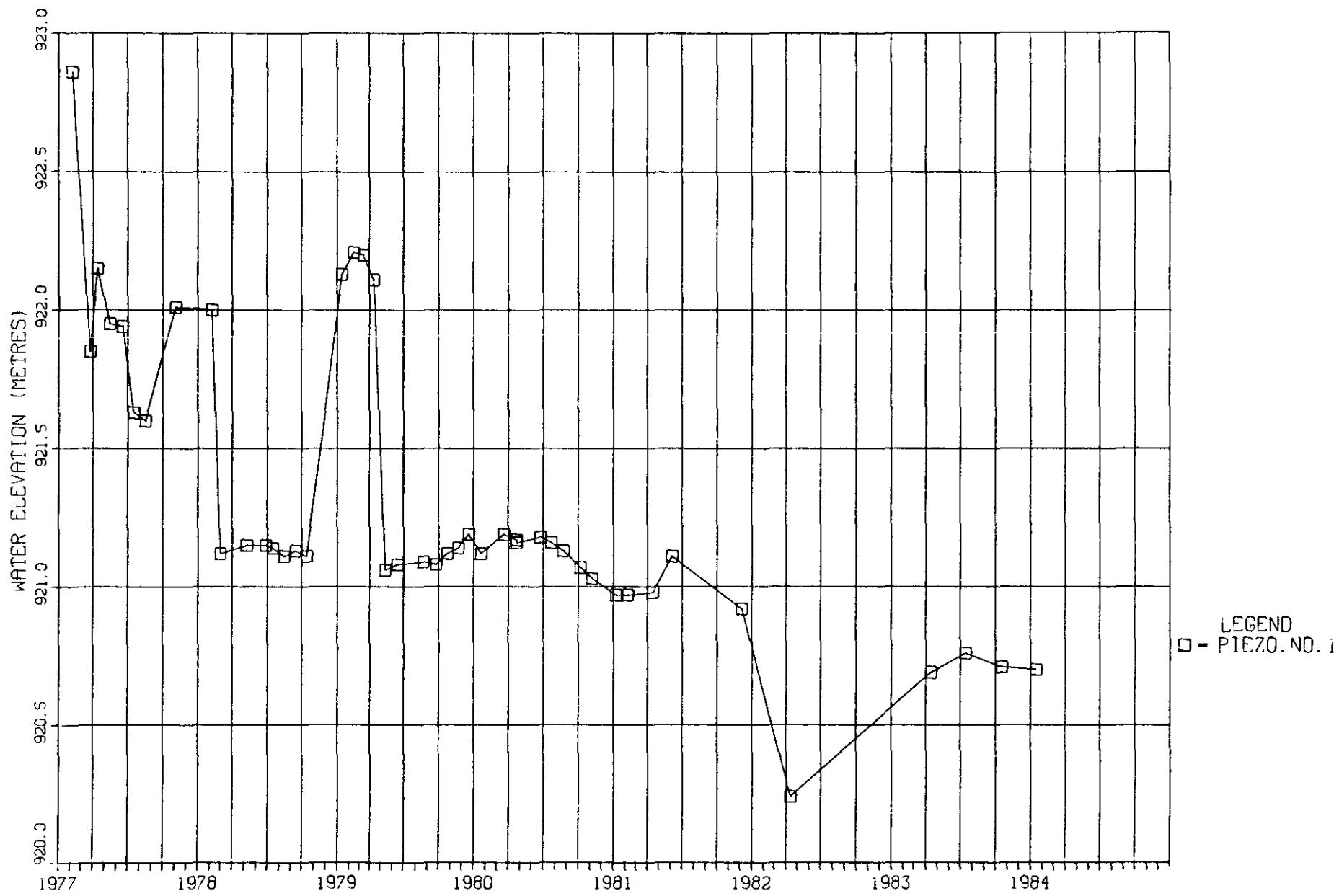
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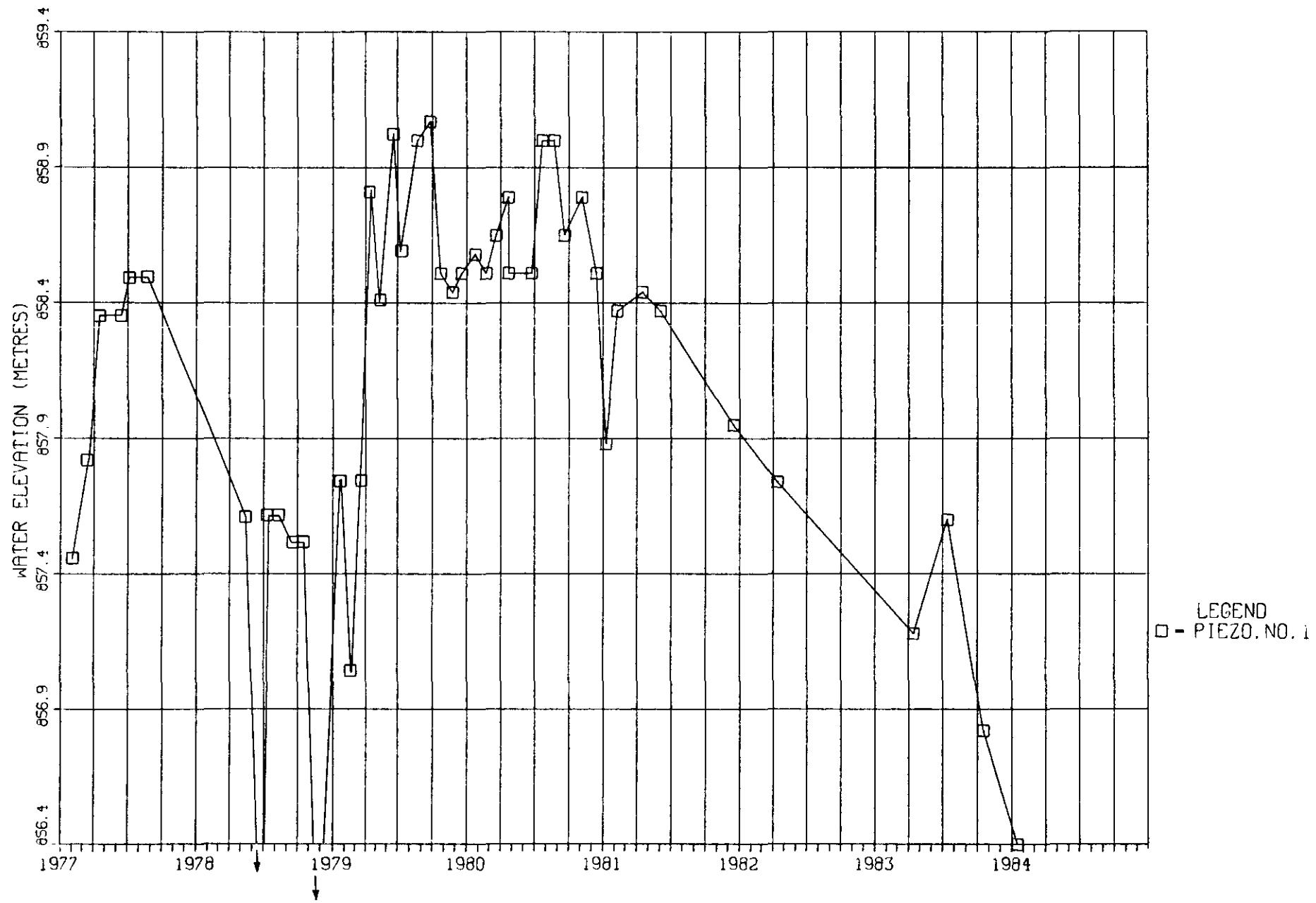
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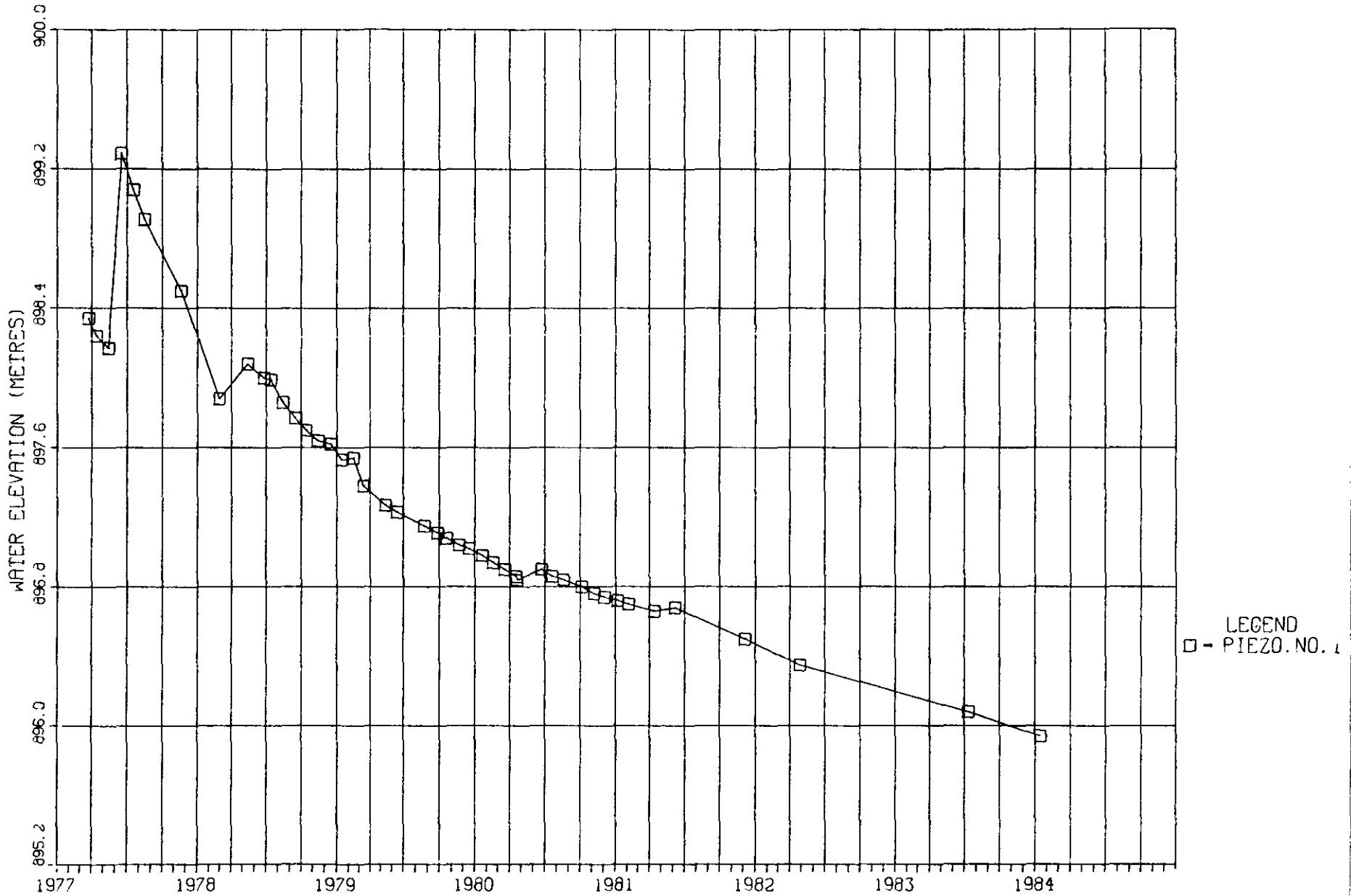
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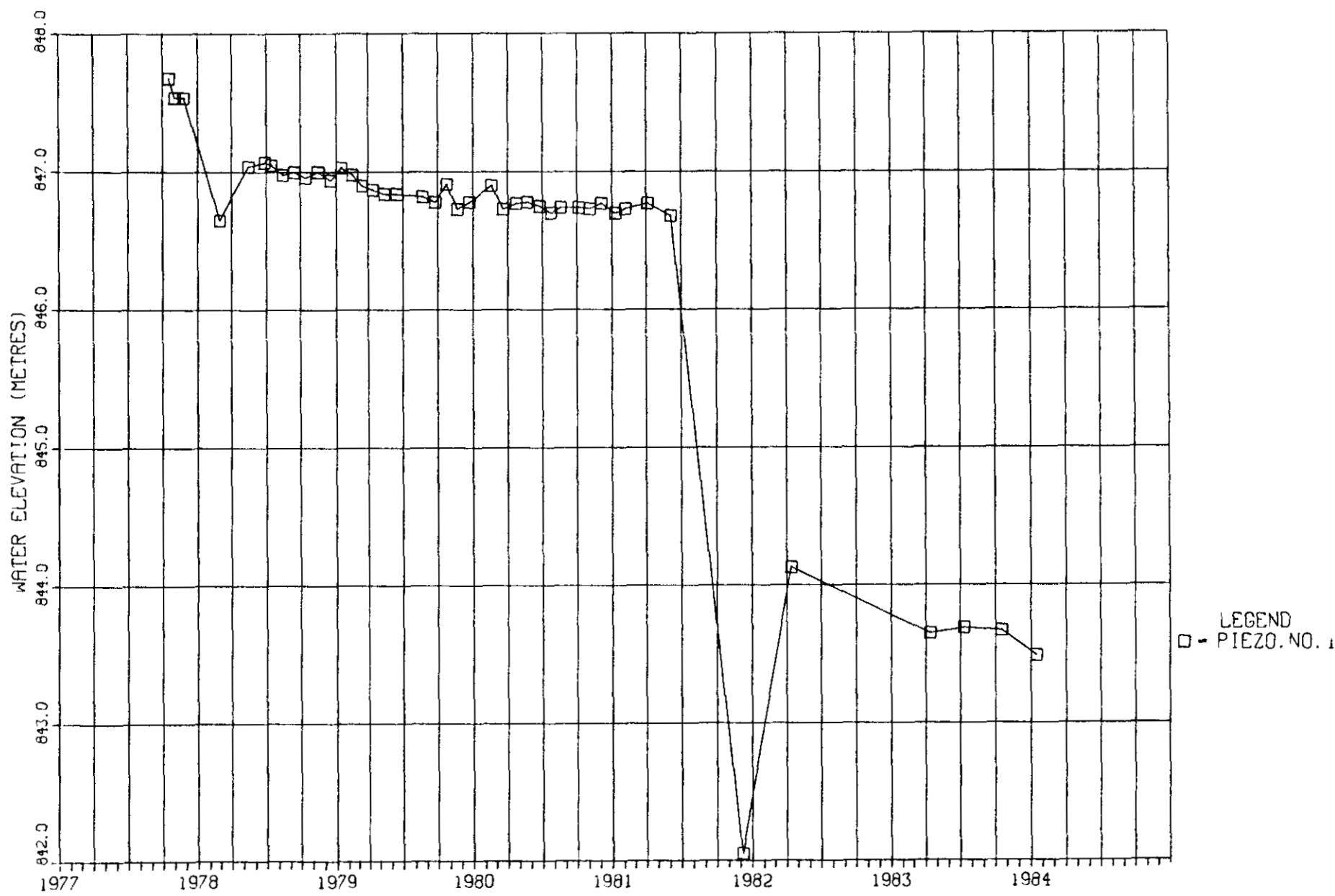
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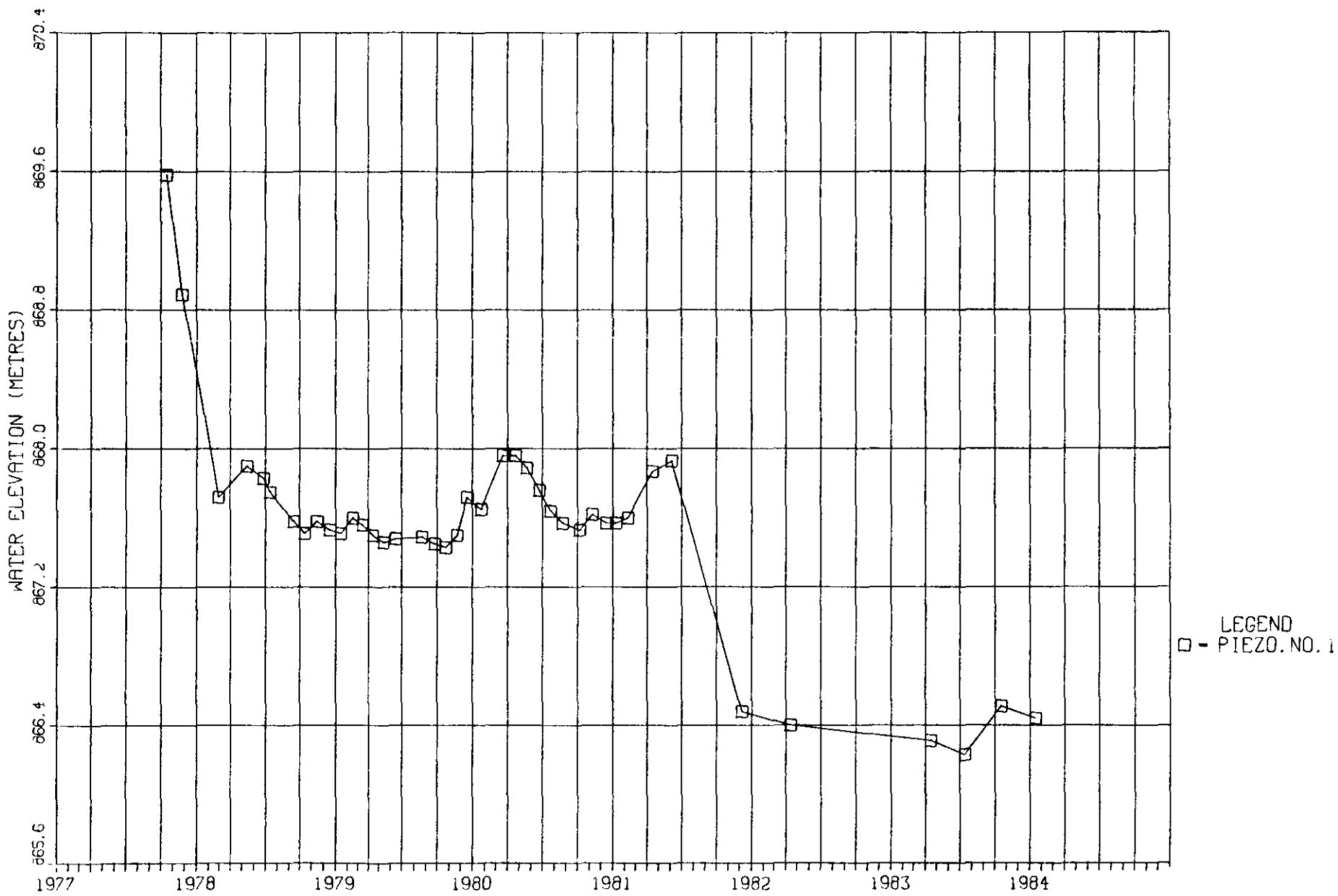
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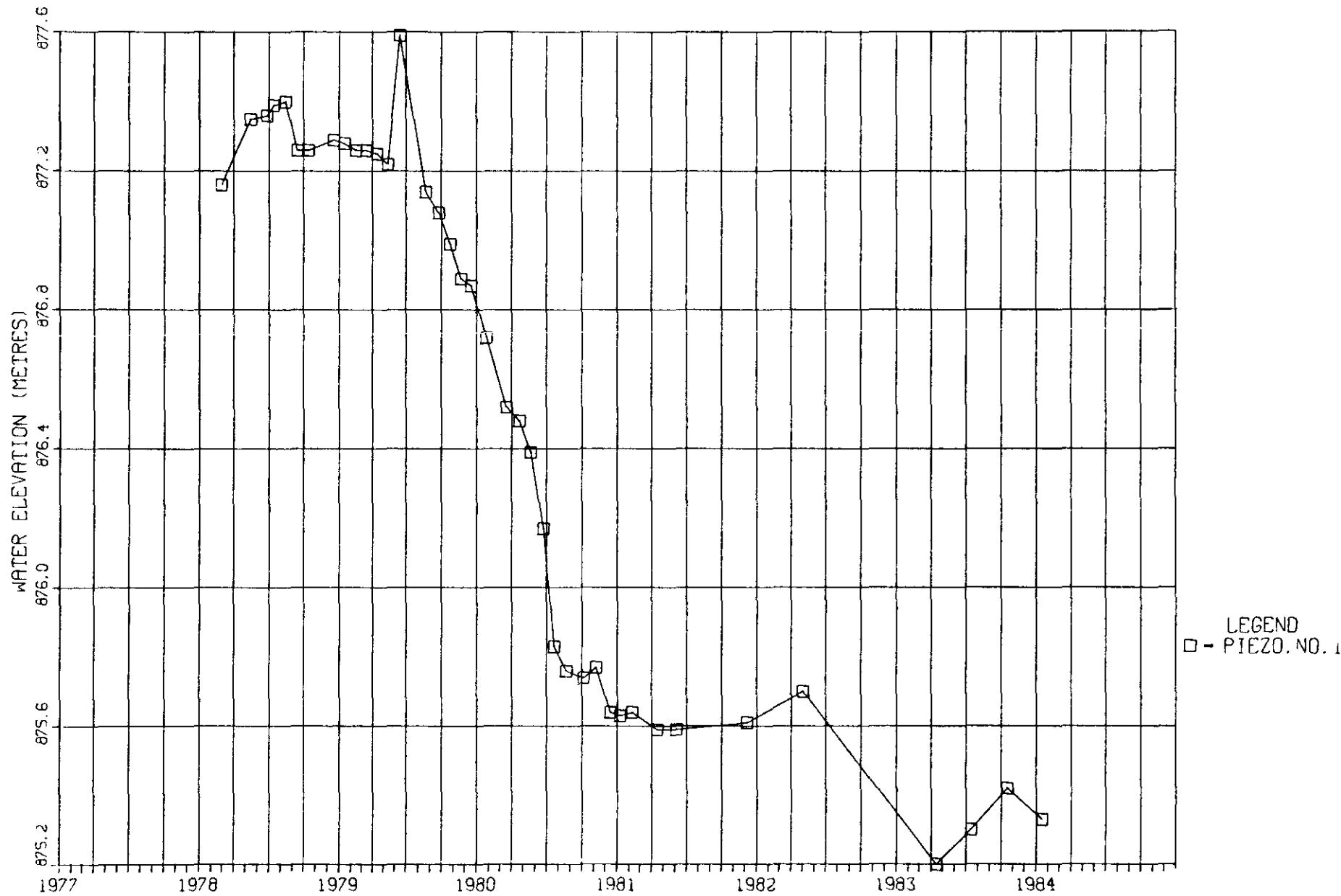
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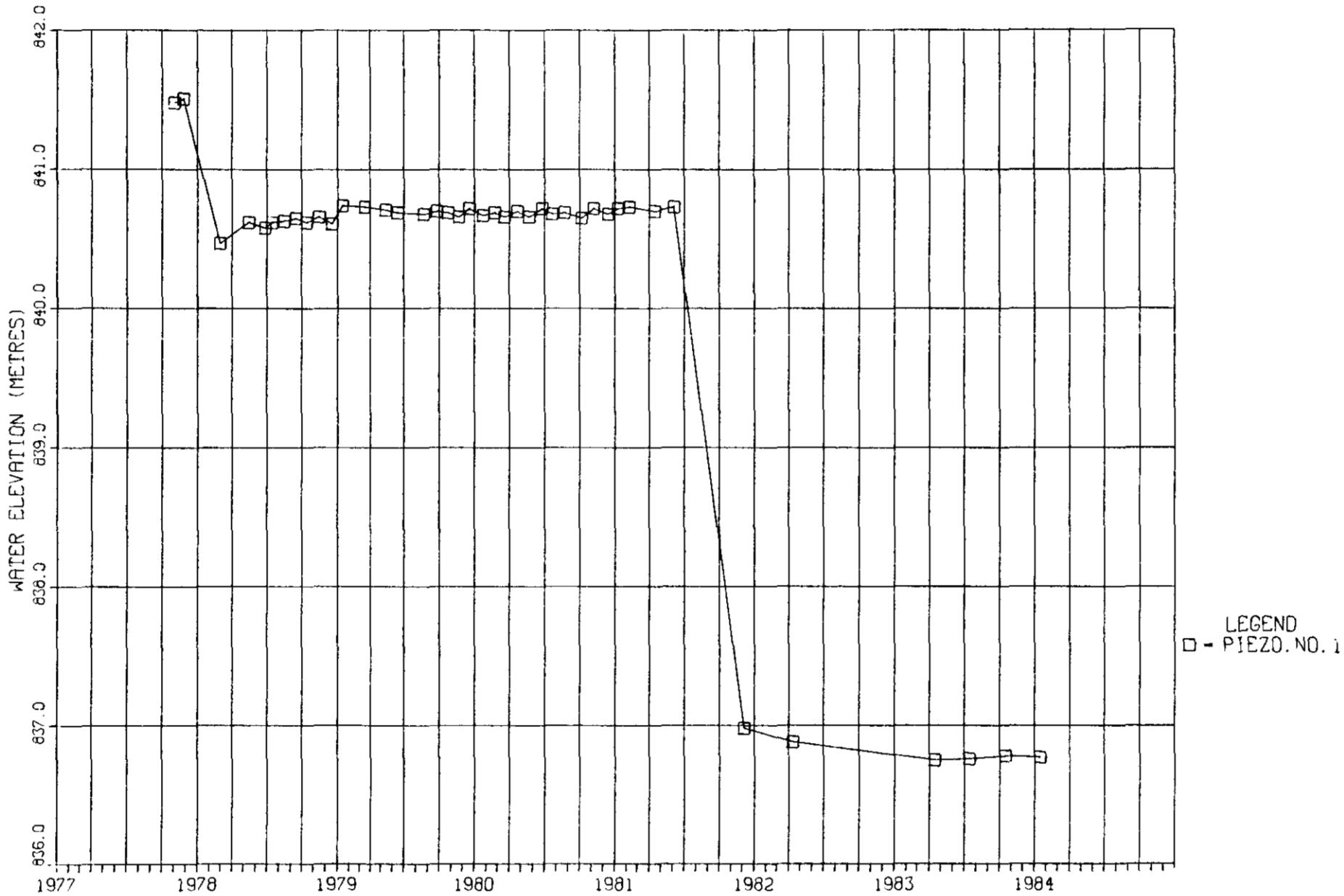
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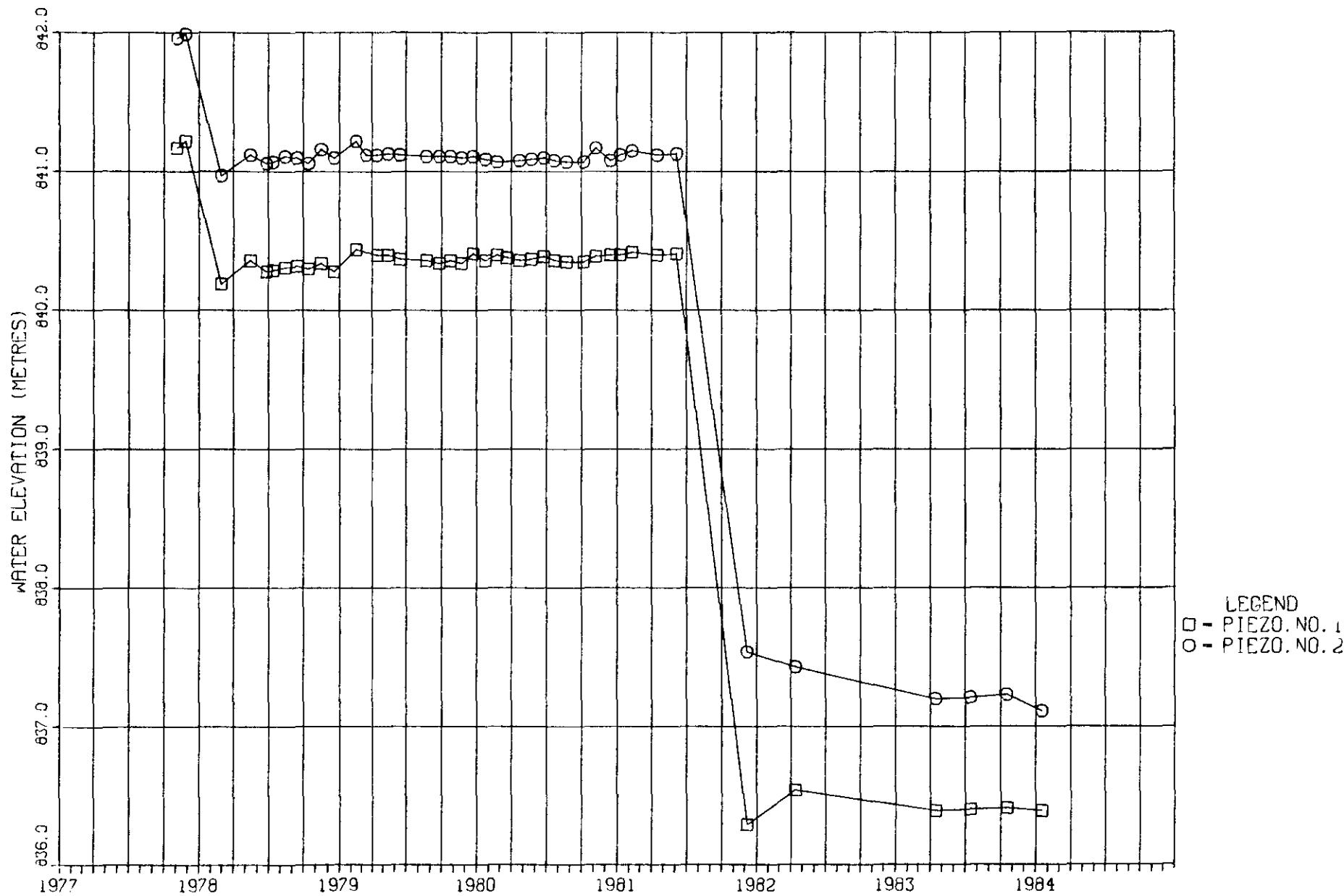
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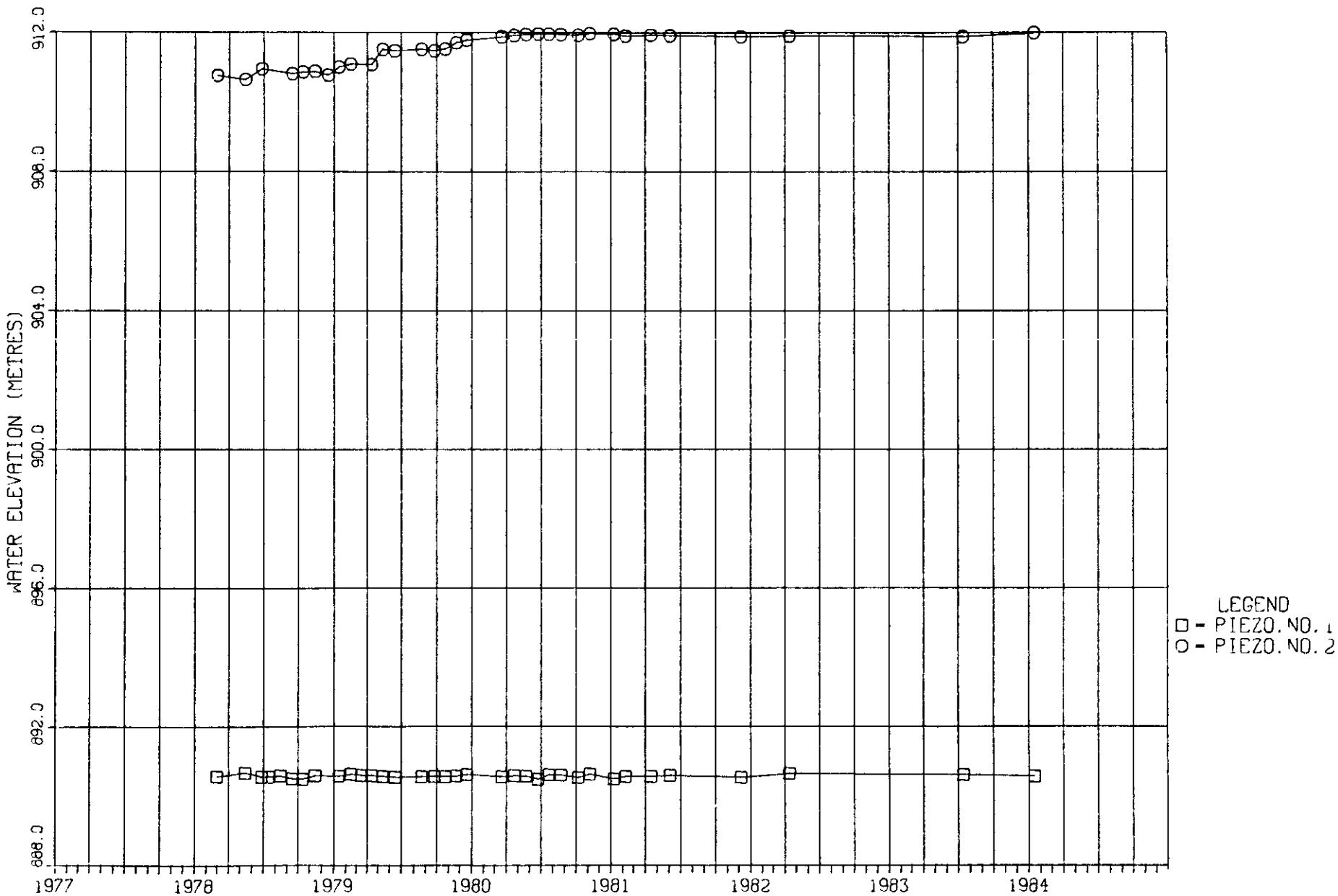
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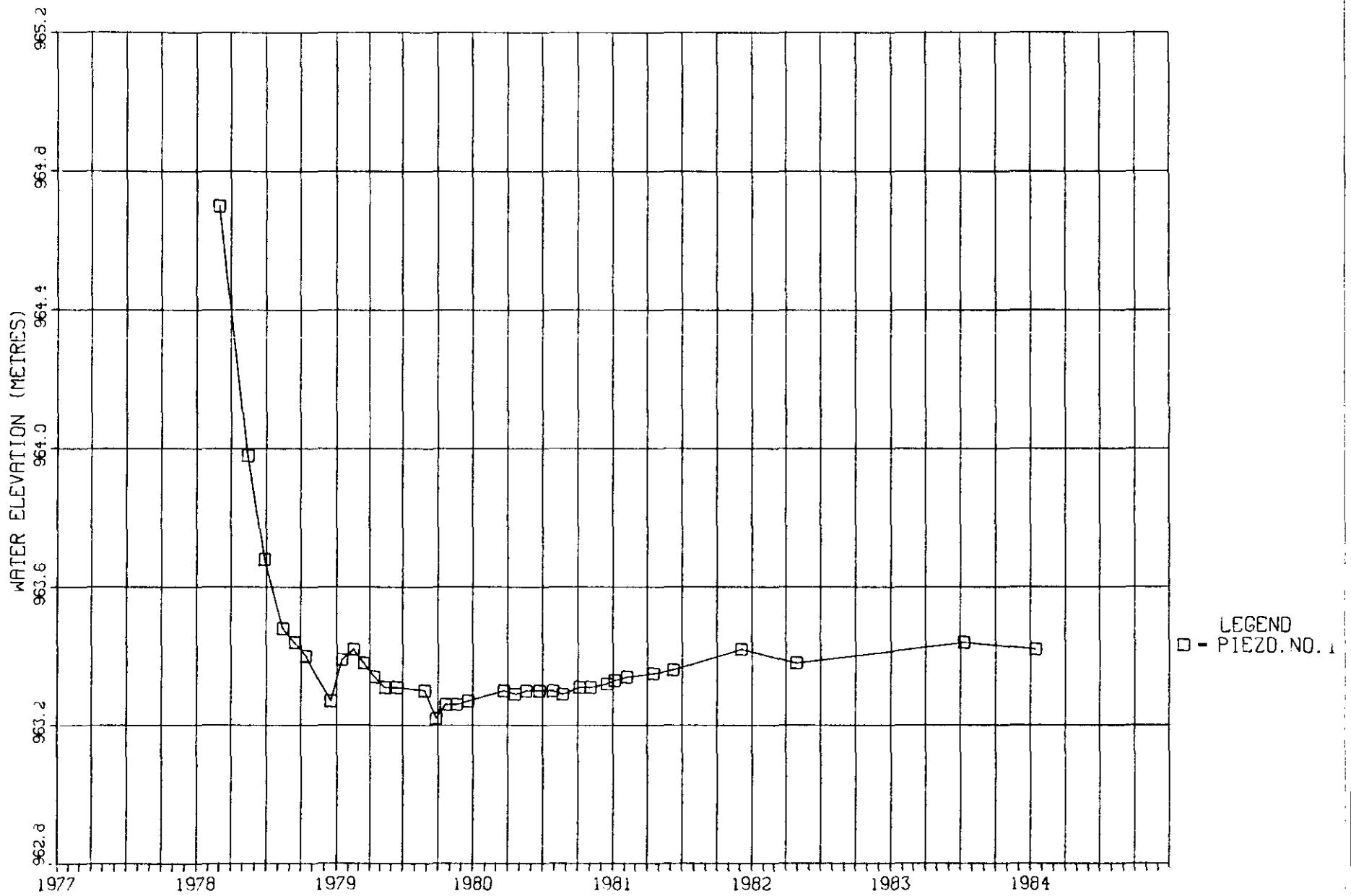
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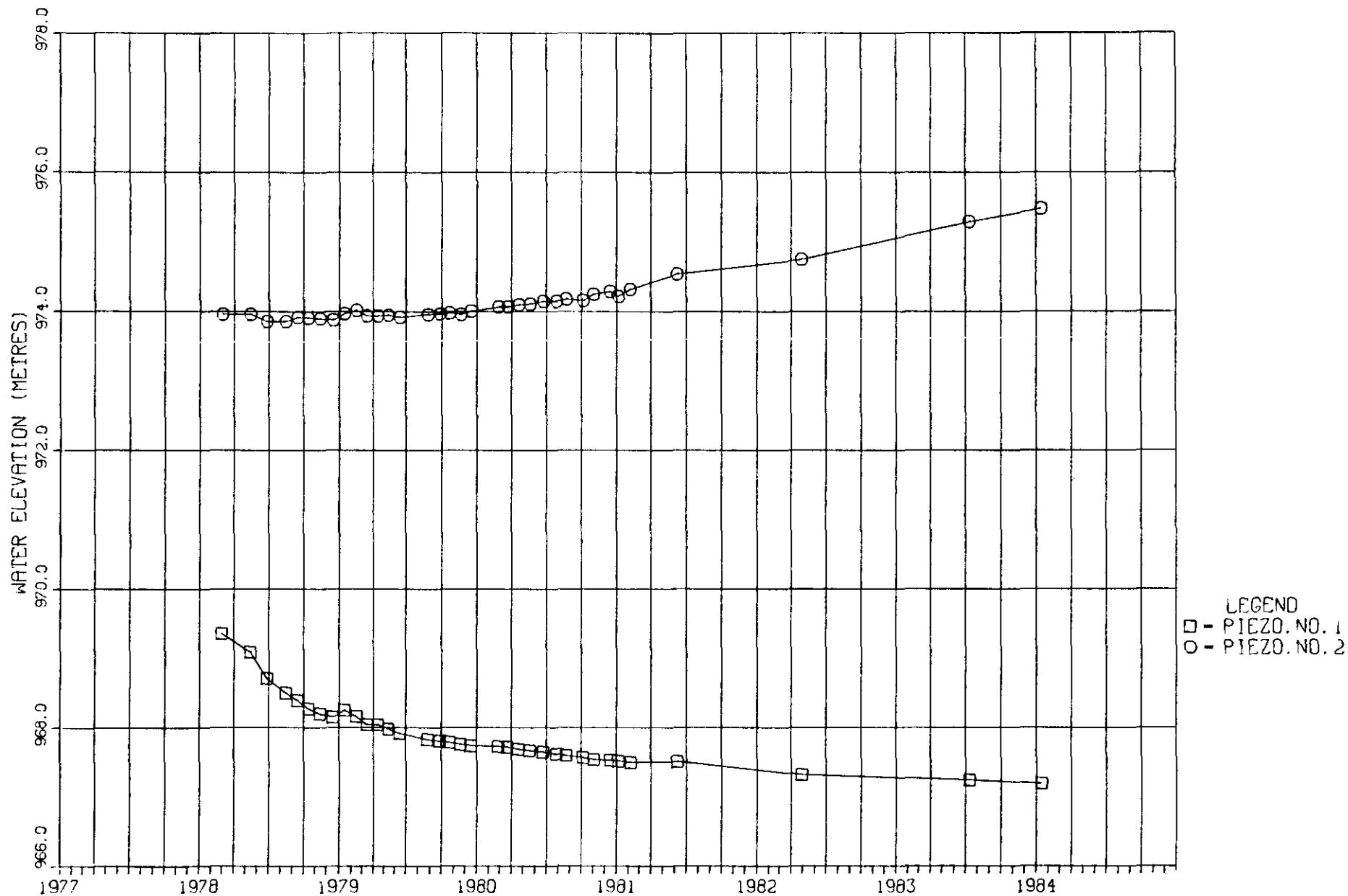
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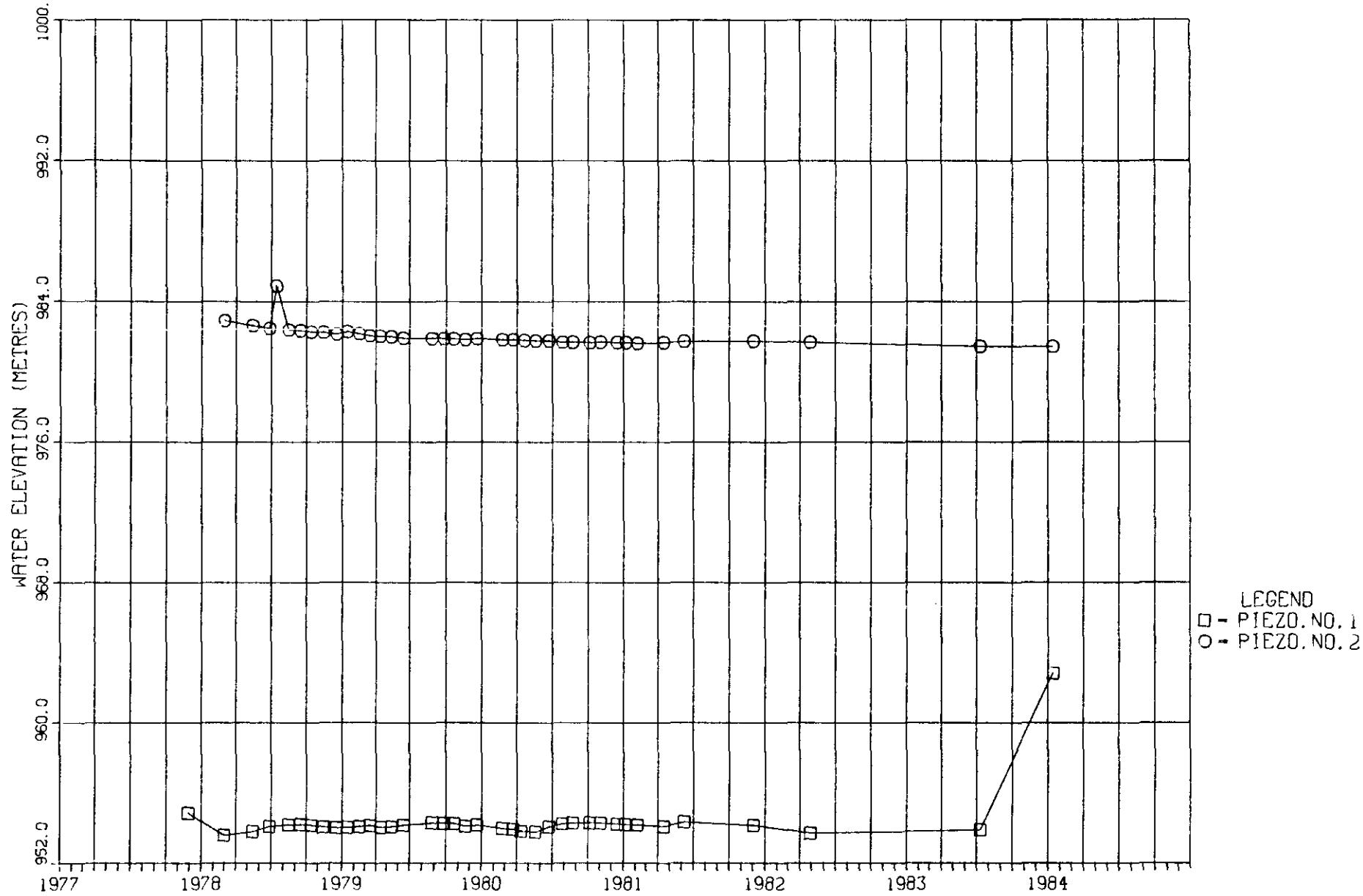
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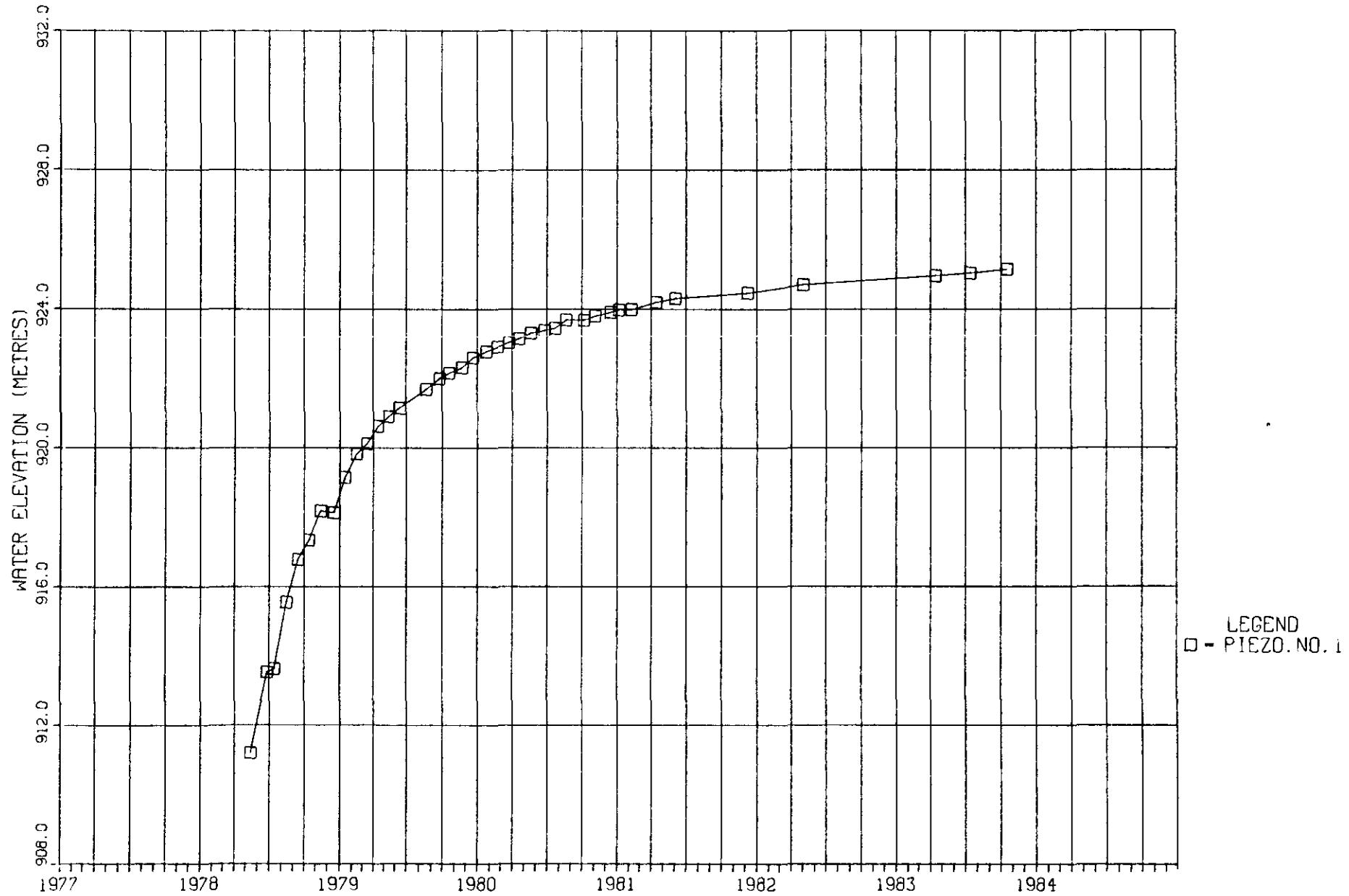
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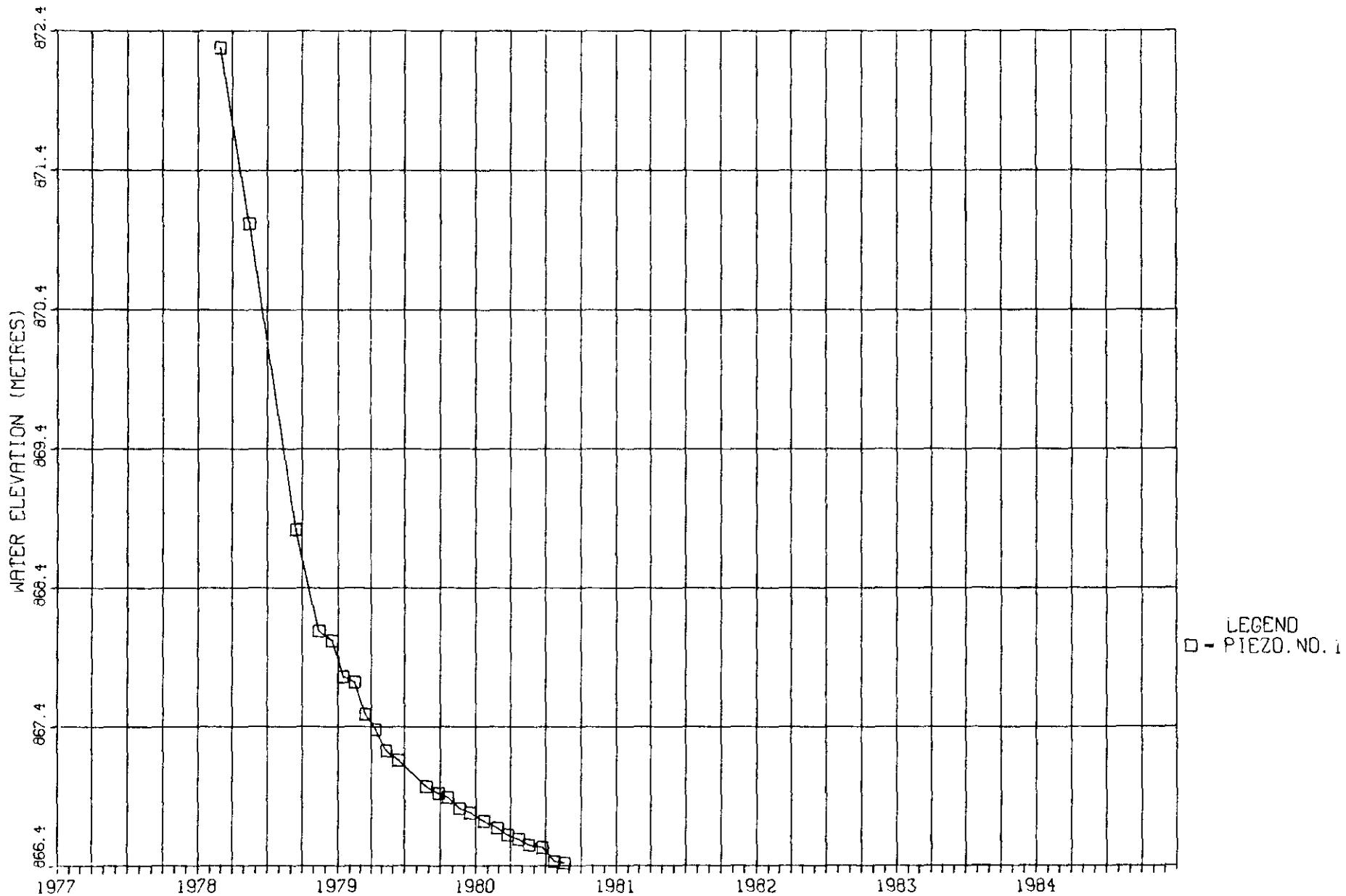
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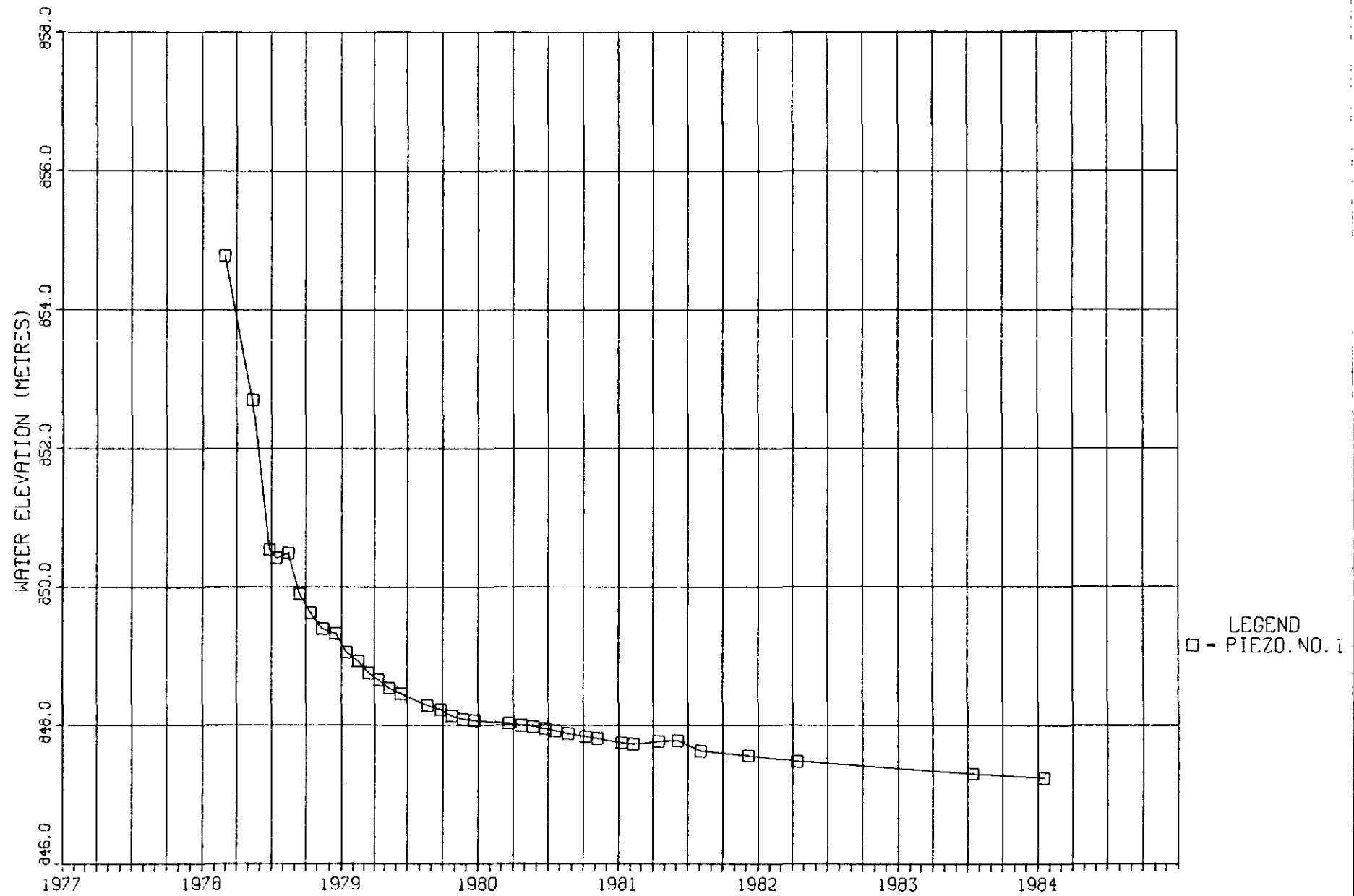
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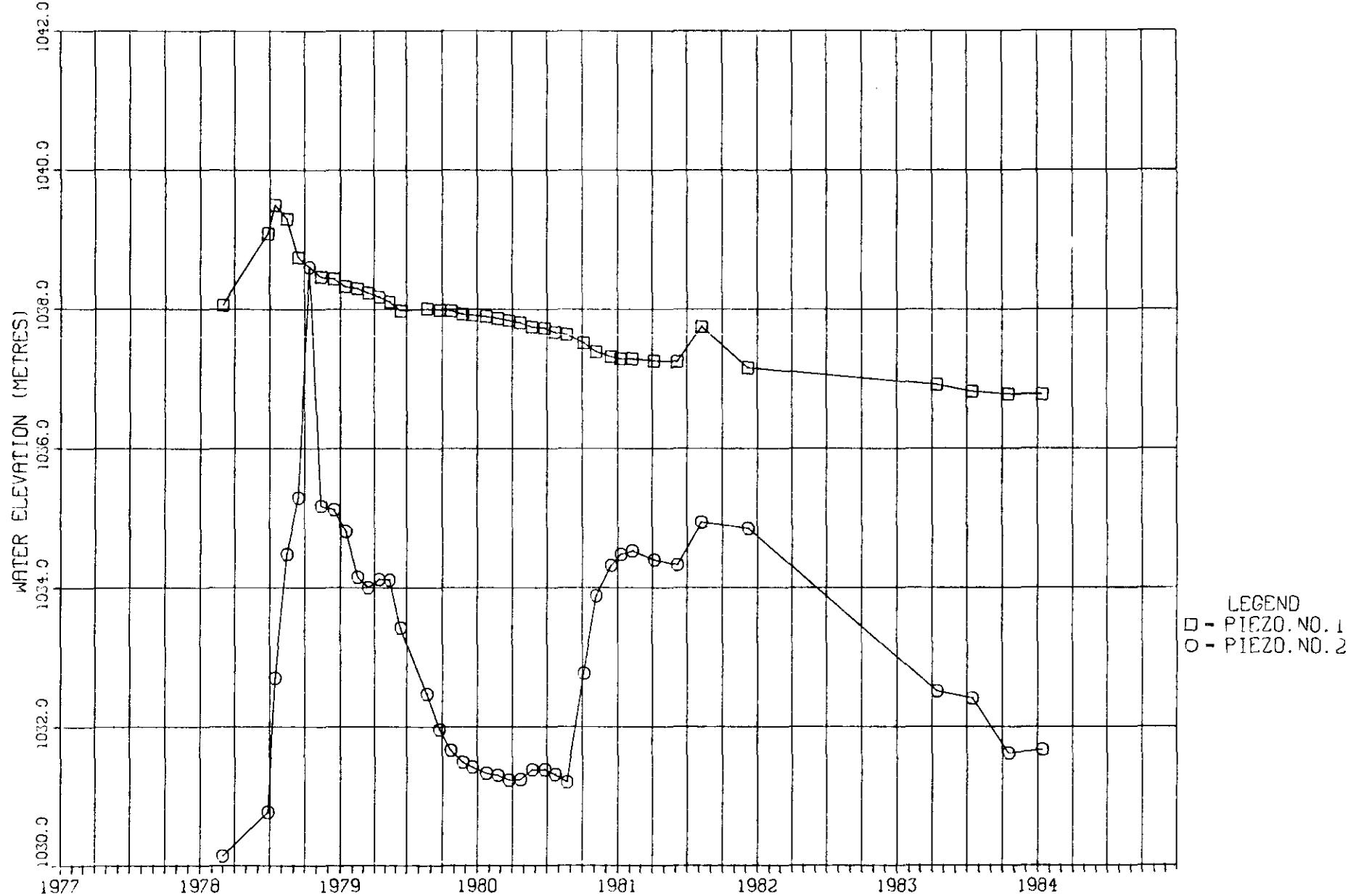
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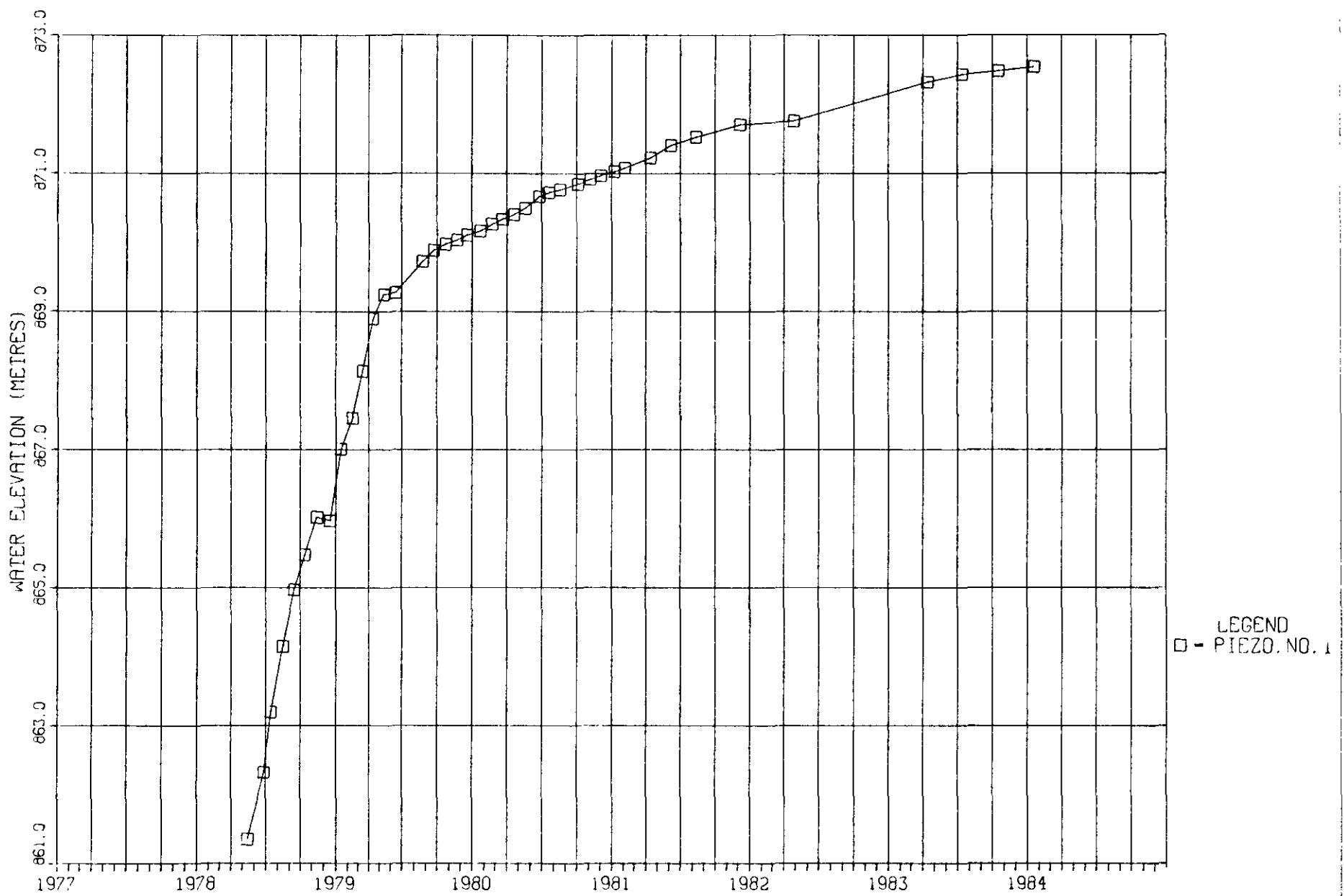
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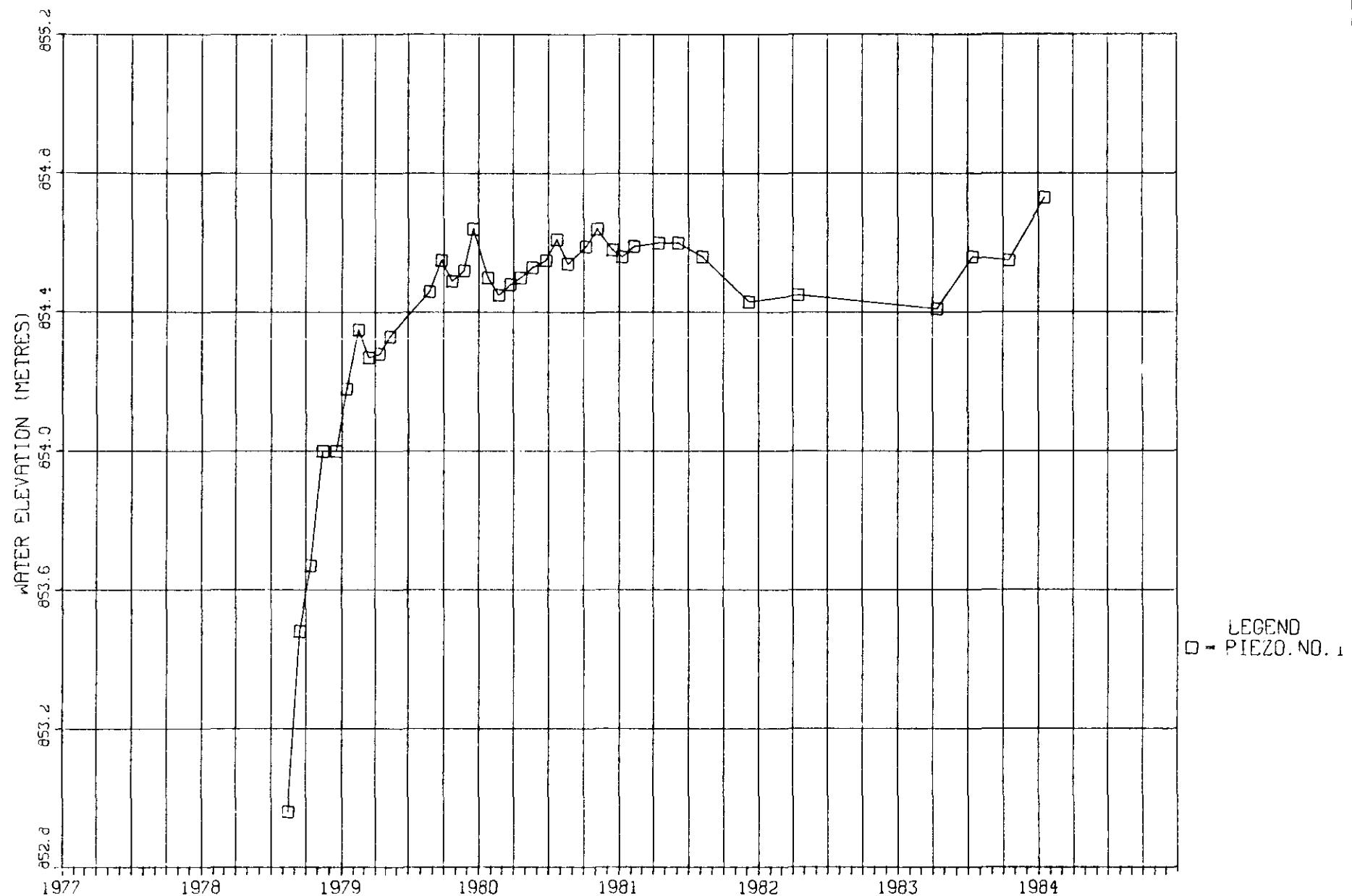
HAI CREEK WATER LEVEL MONITORING - OBSERVATION WELL NO. DDH-78-852



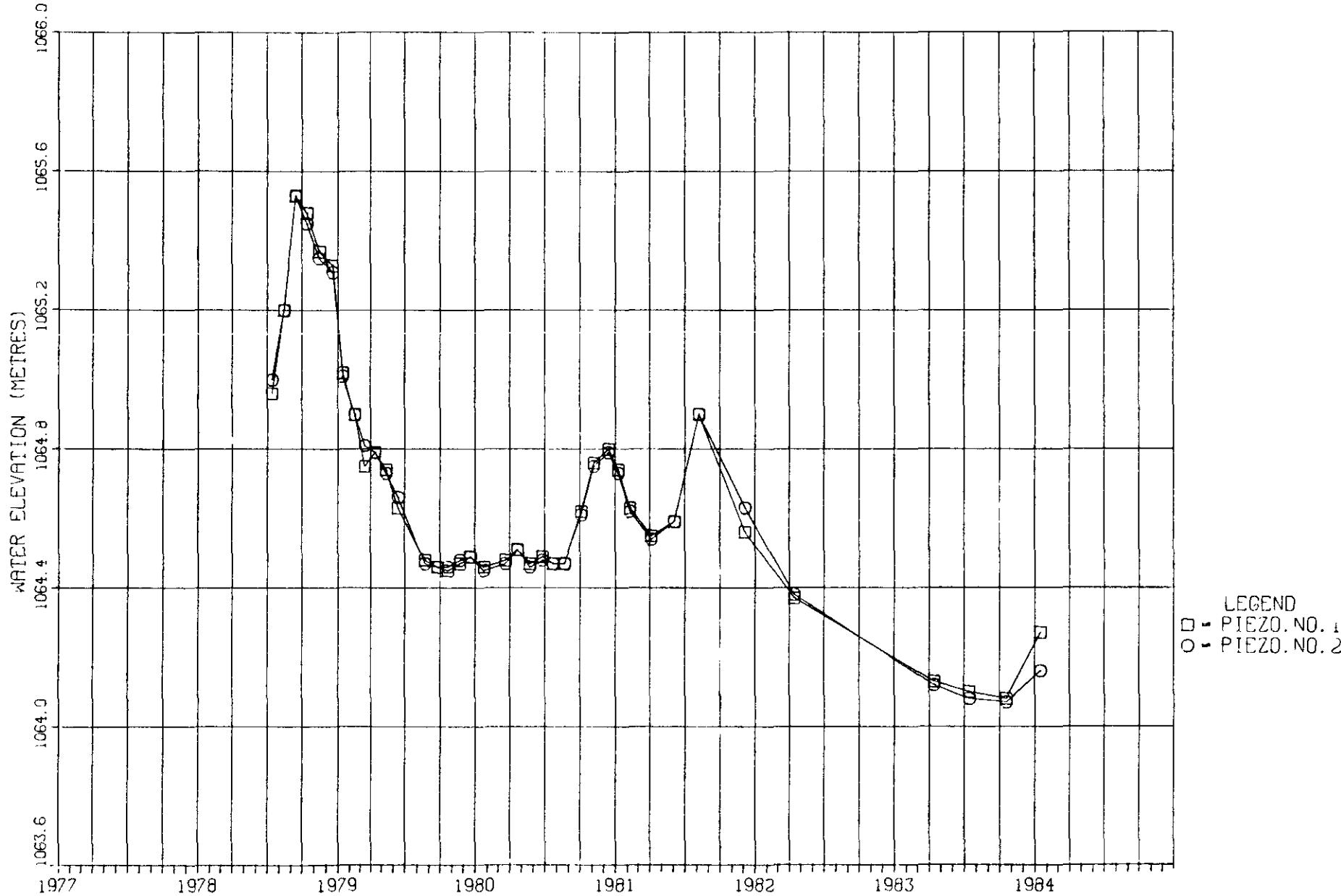
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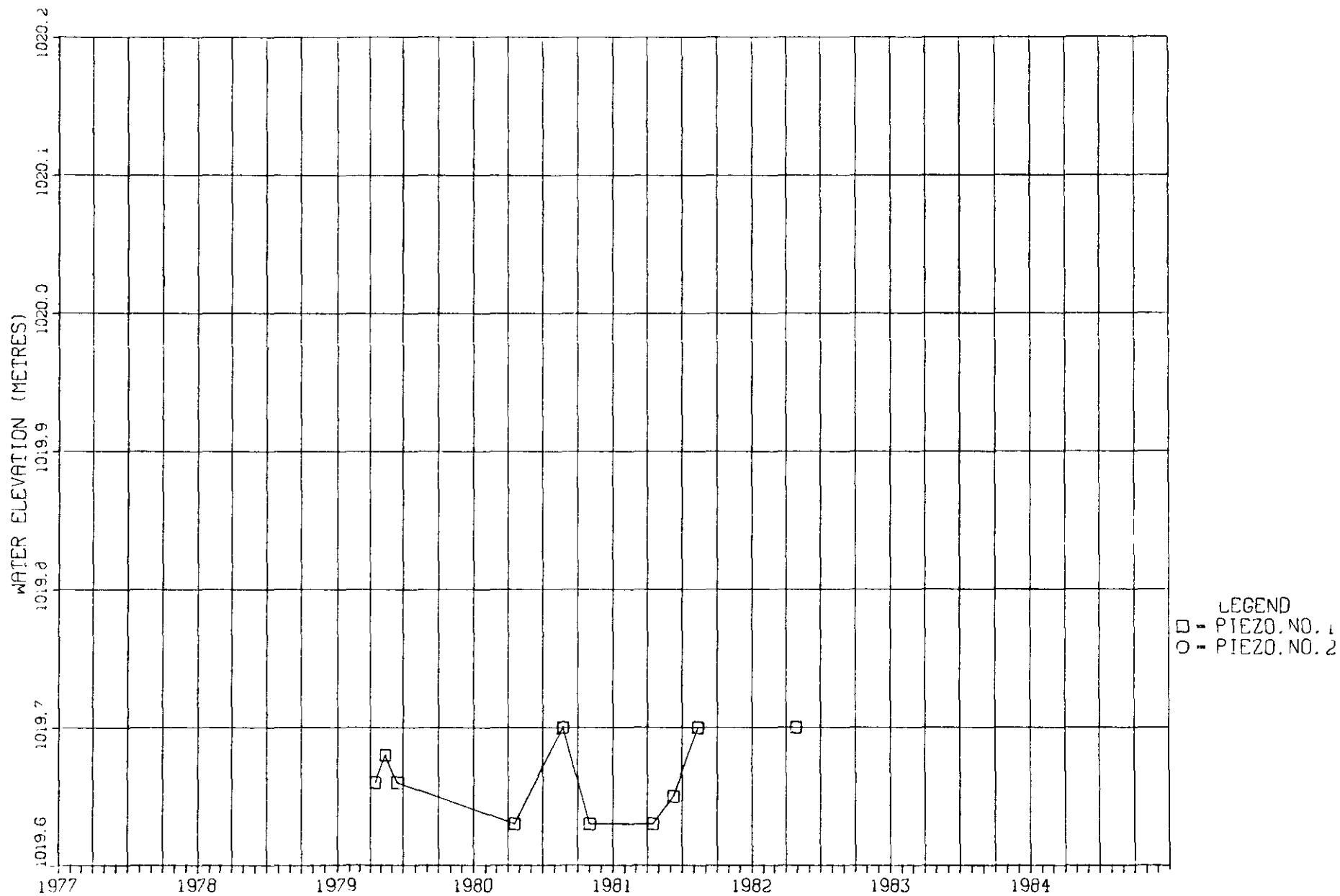
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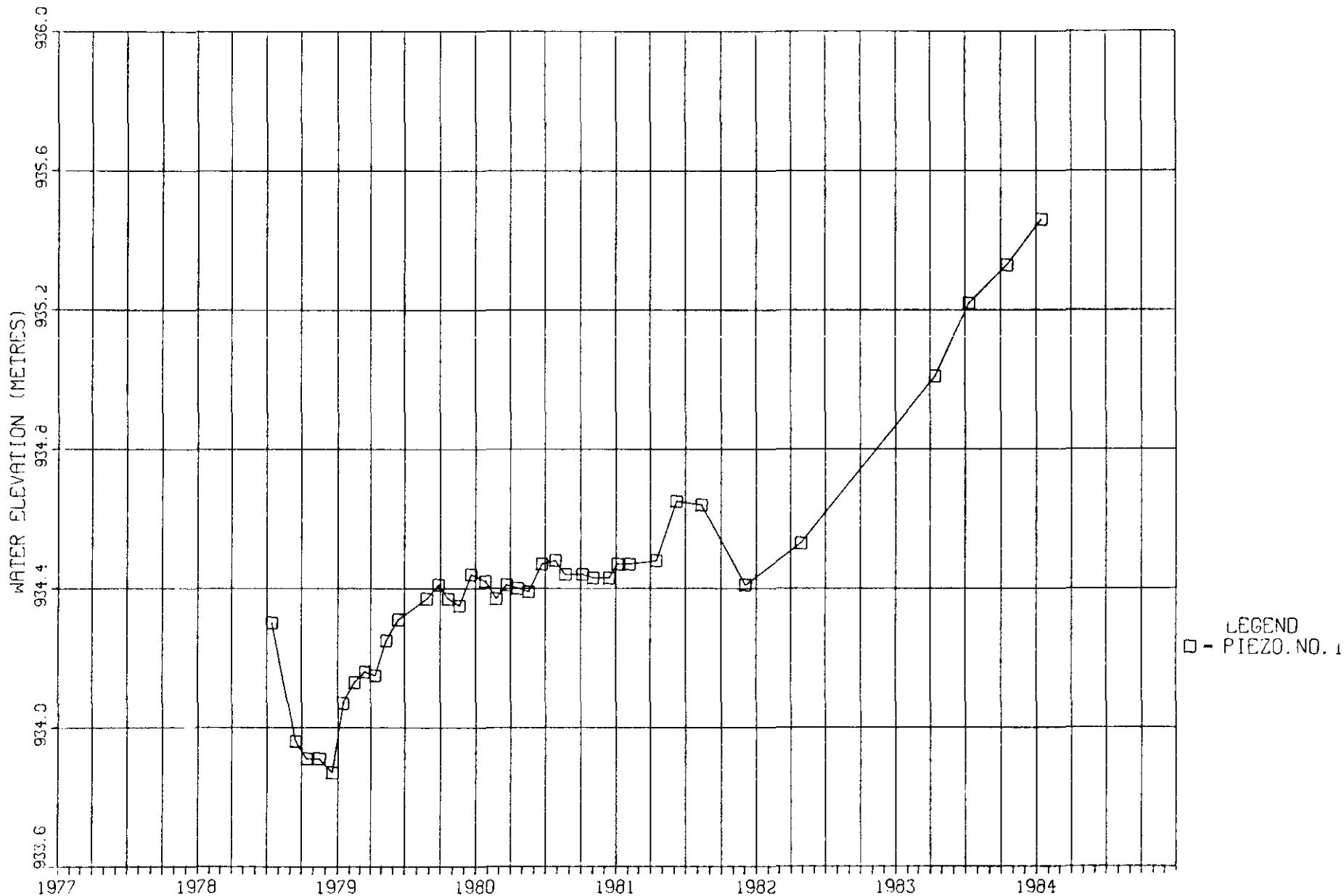


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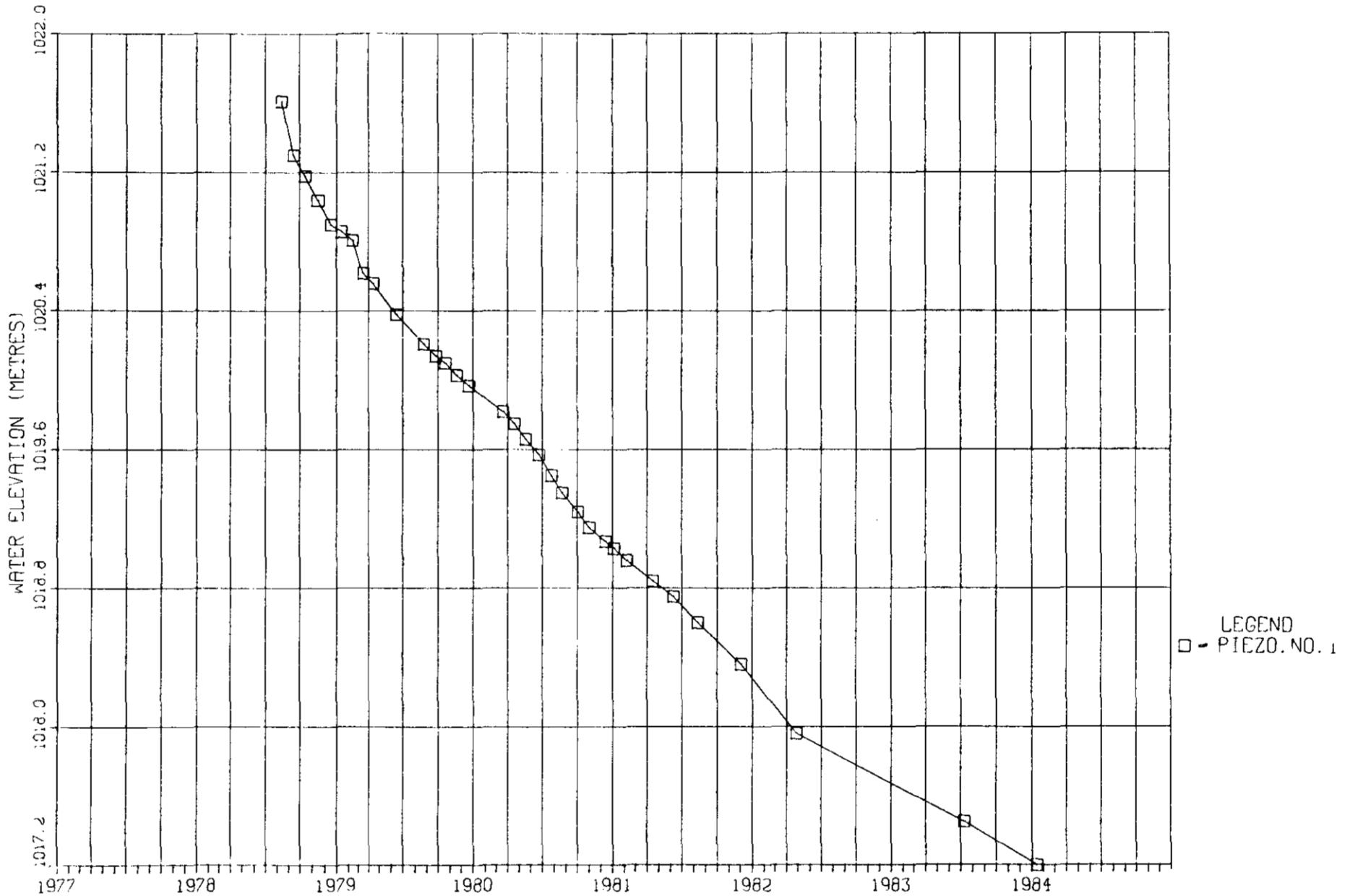


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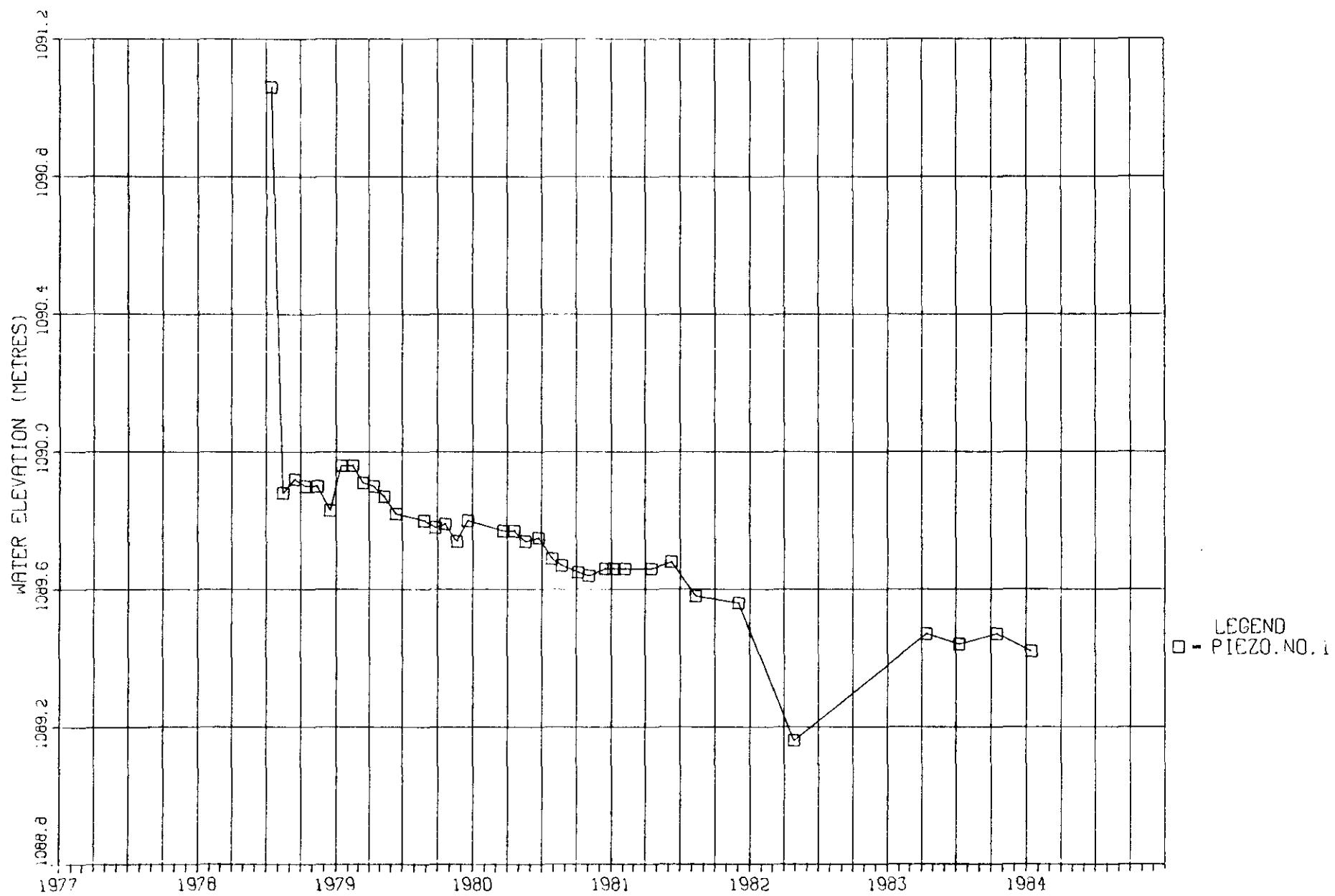
JR 6 16.JJ.26 THUR 29 MAR .984 08-5-1984 . SOS - EGS DISSPLA JER d.2



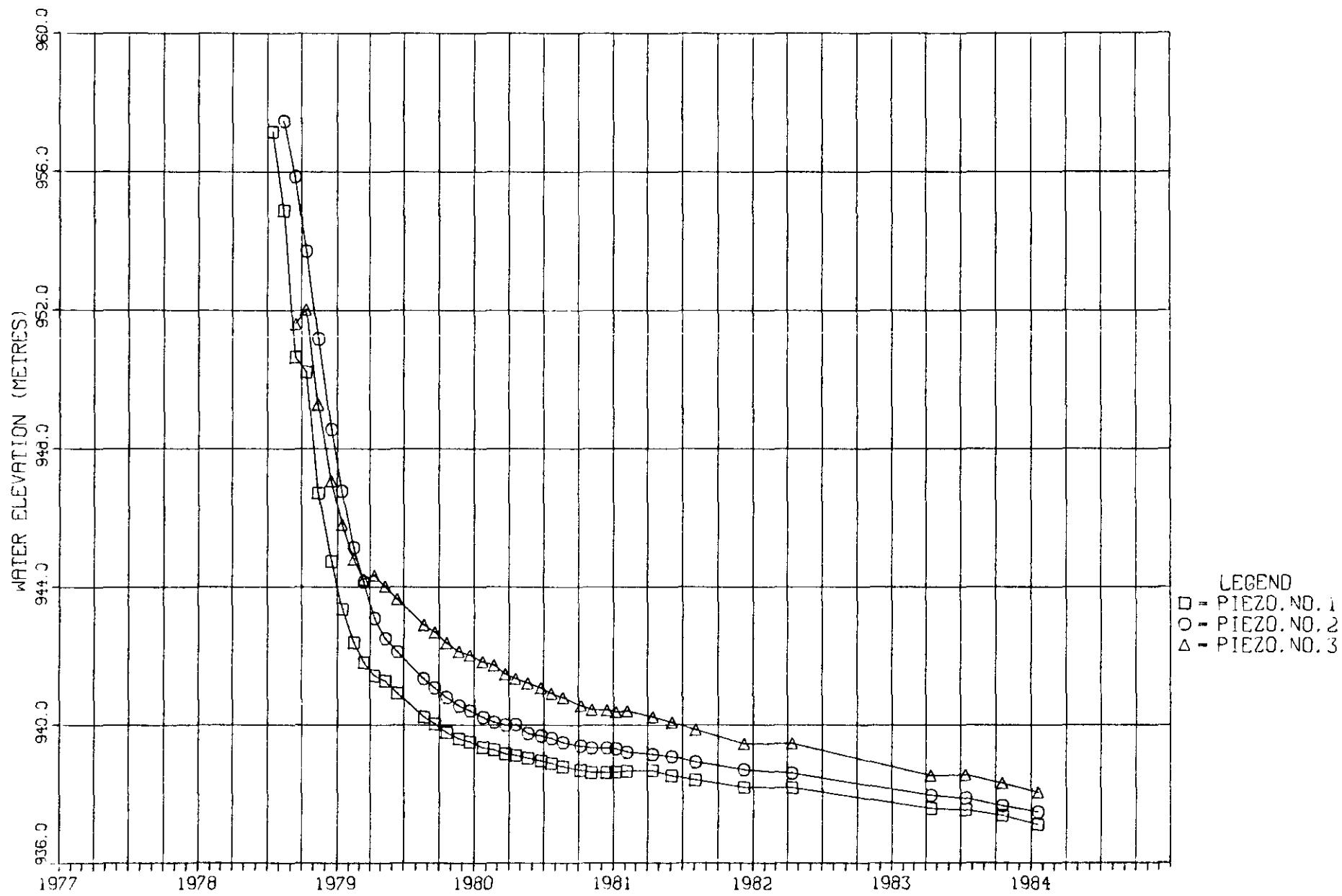
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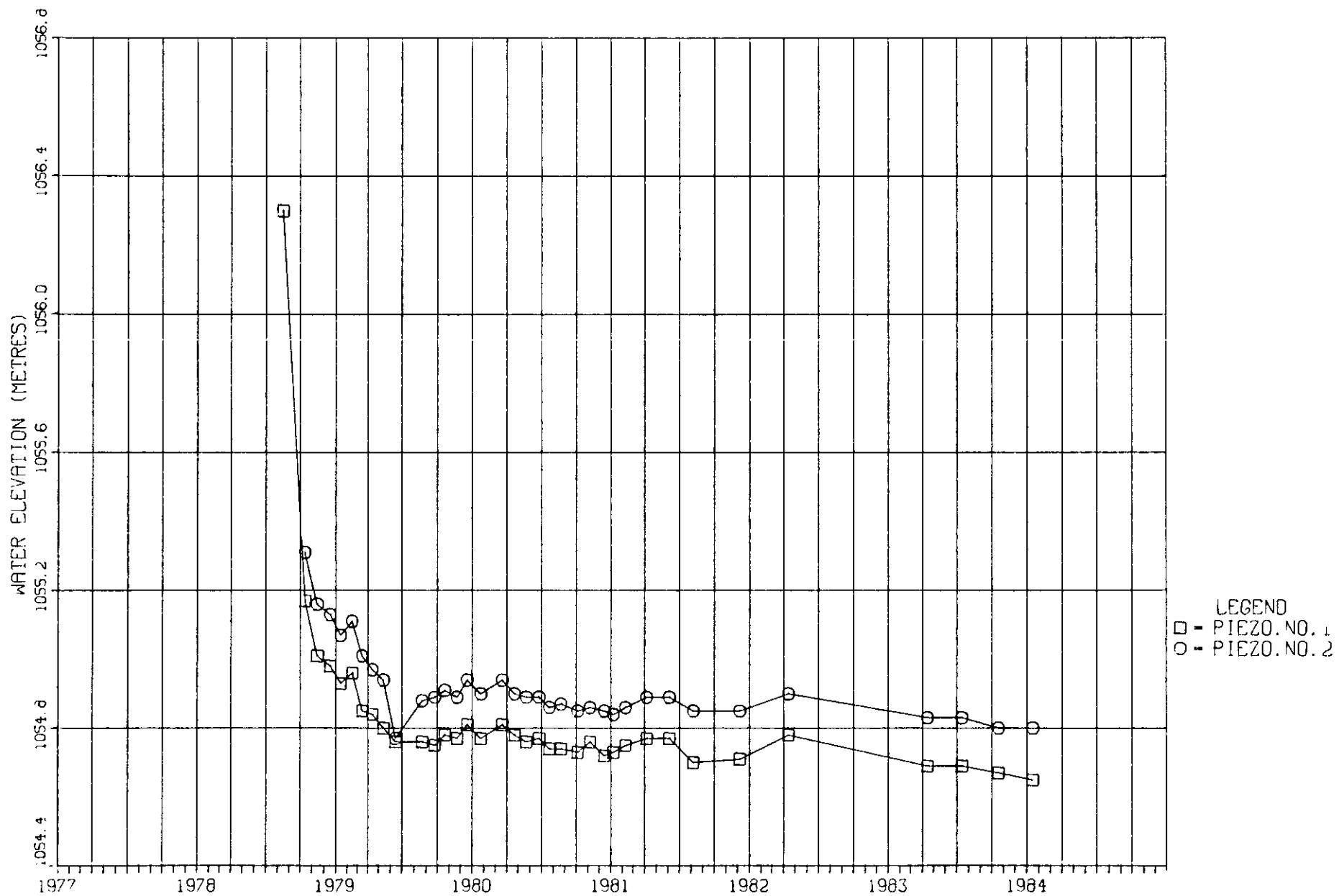
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HAT CREEK WATER LEVEL MONITORING - OBSERVATION WELL NO. DDH-78-865

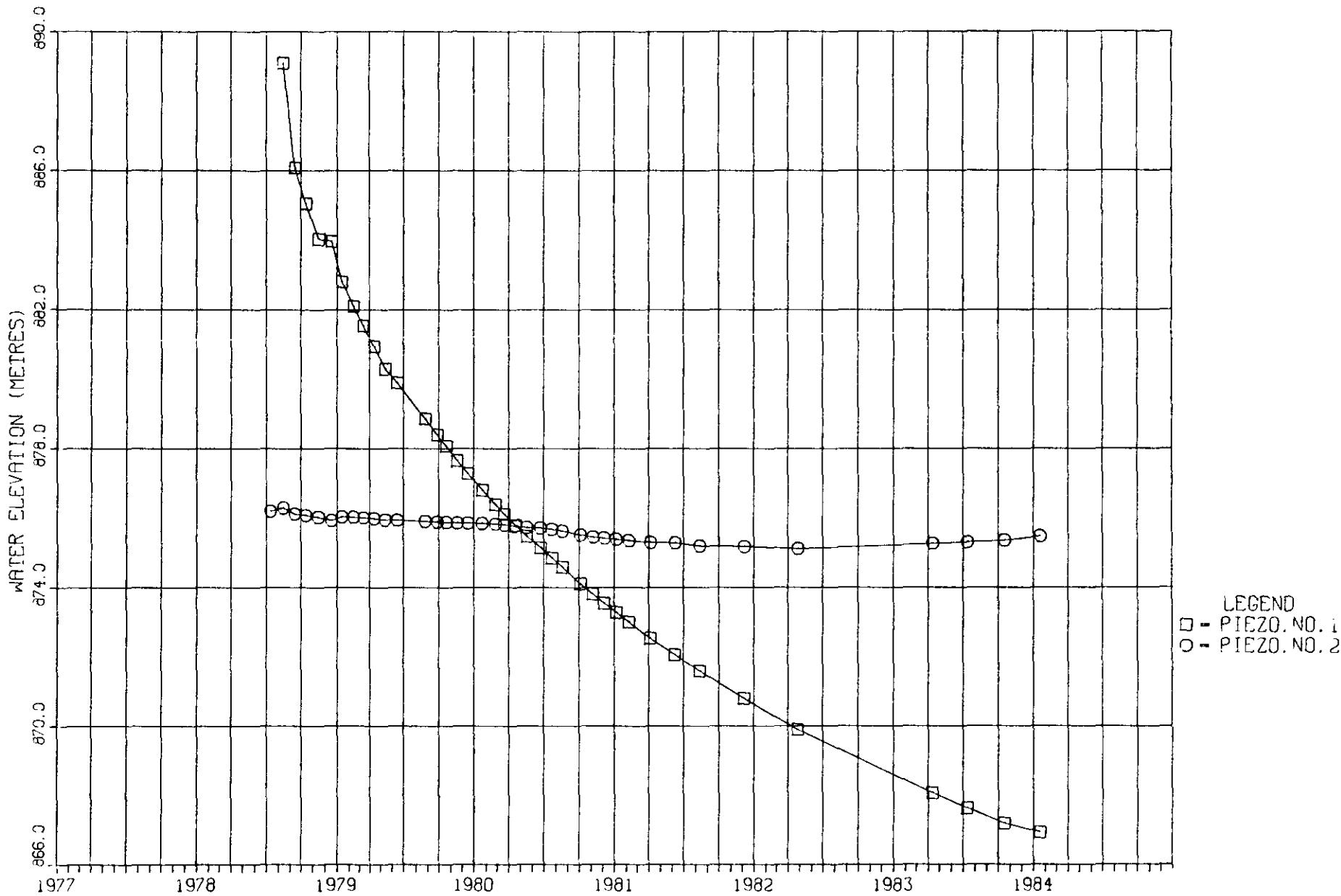


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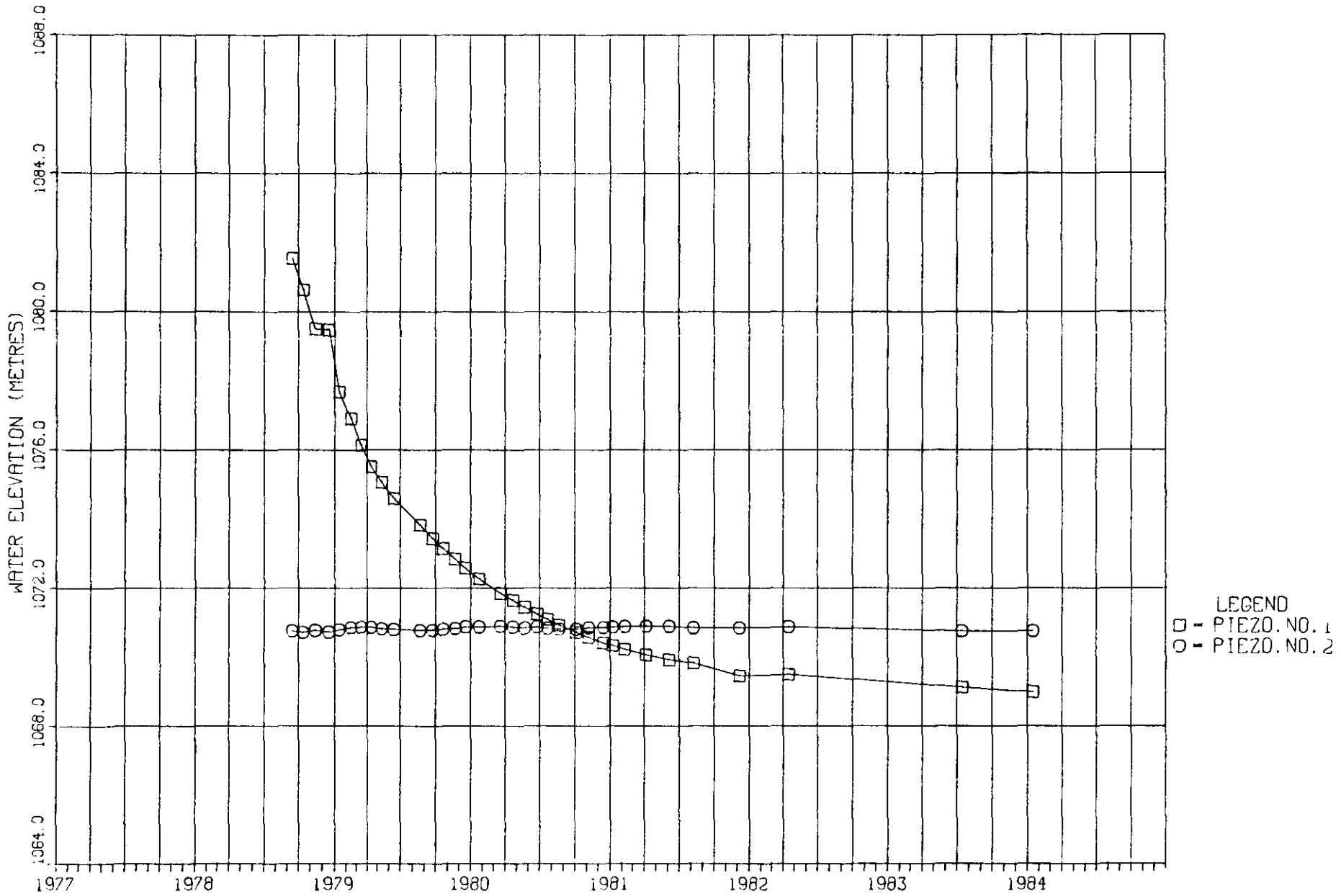


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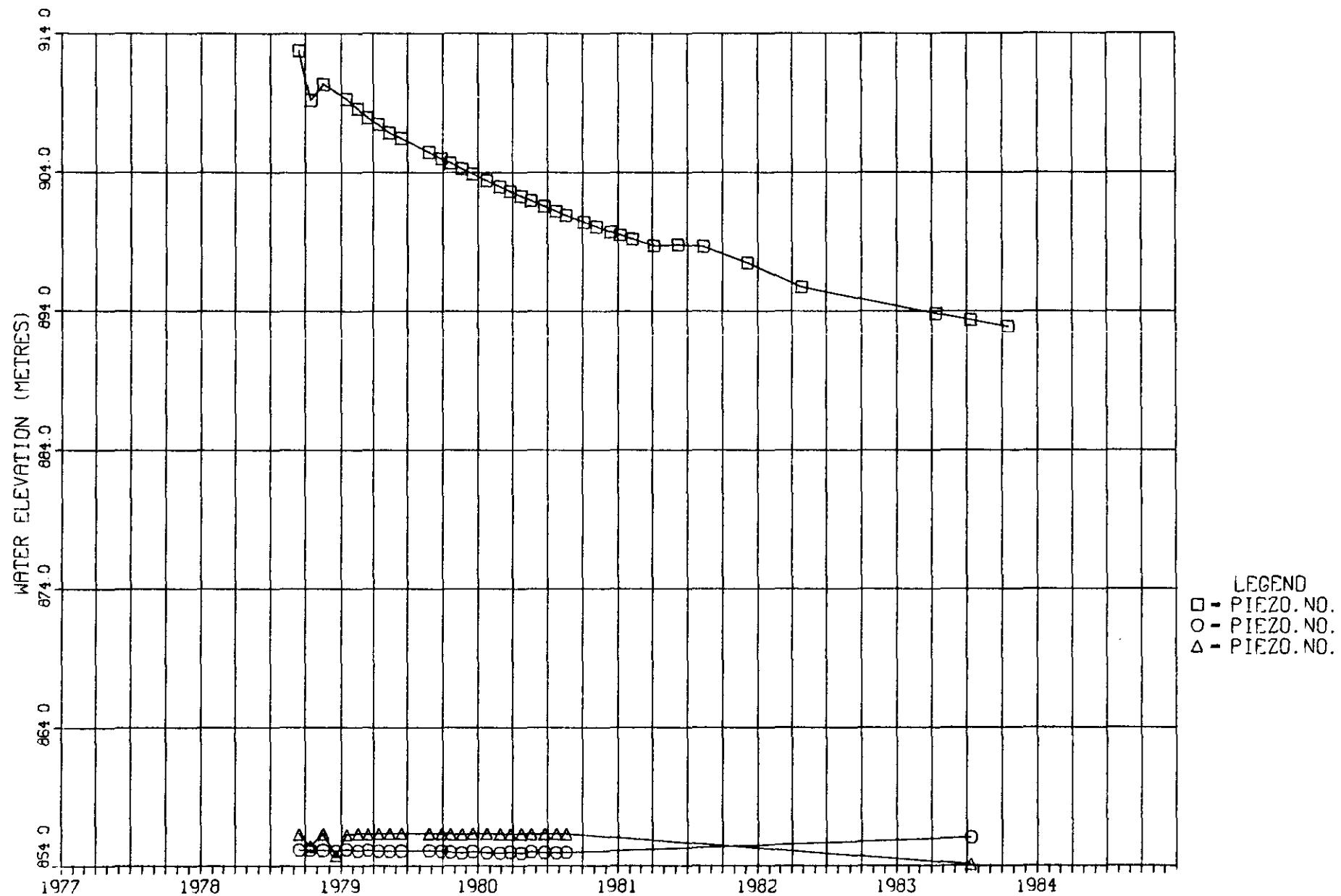
LJCT 6 1977.2.33 MHR 29 MAR. 1984 JOB-LVPROFSC . SCS - EKS DISSPLA VER 0.2



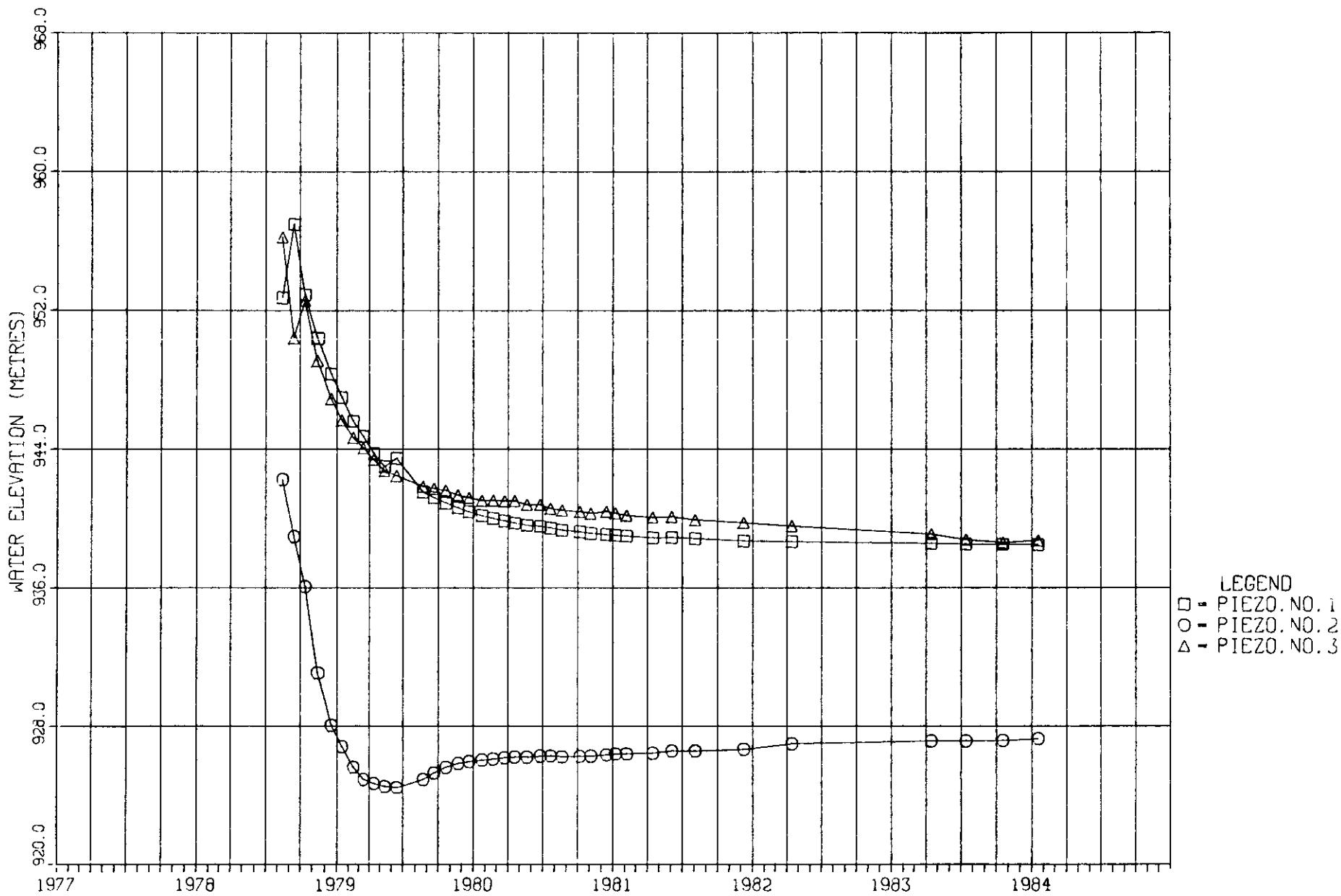
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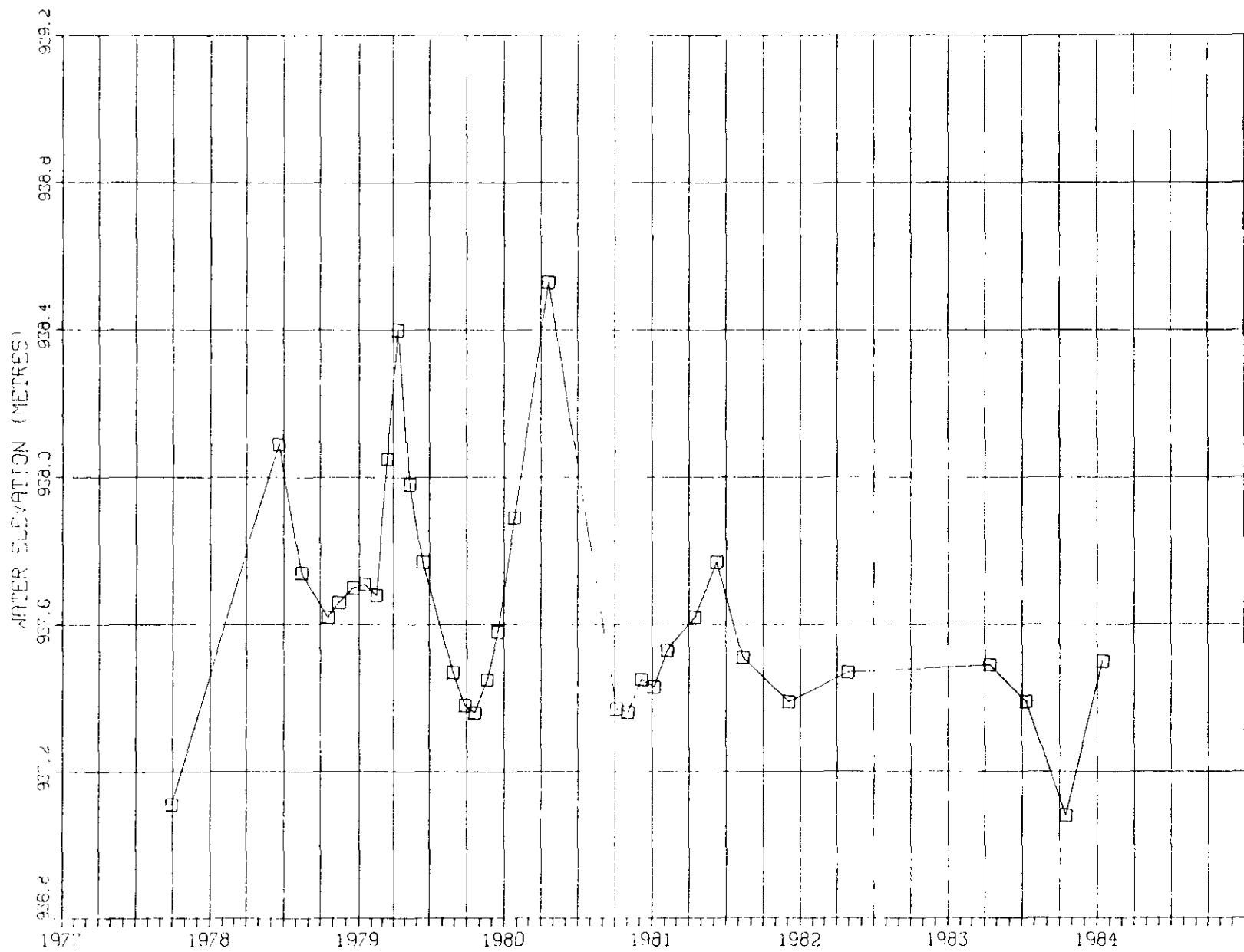
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HAT CREEK WATER LEVEL MONITORING - OBSERVATION WELL NO. DDH-78-871

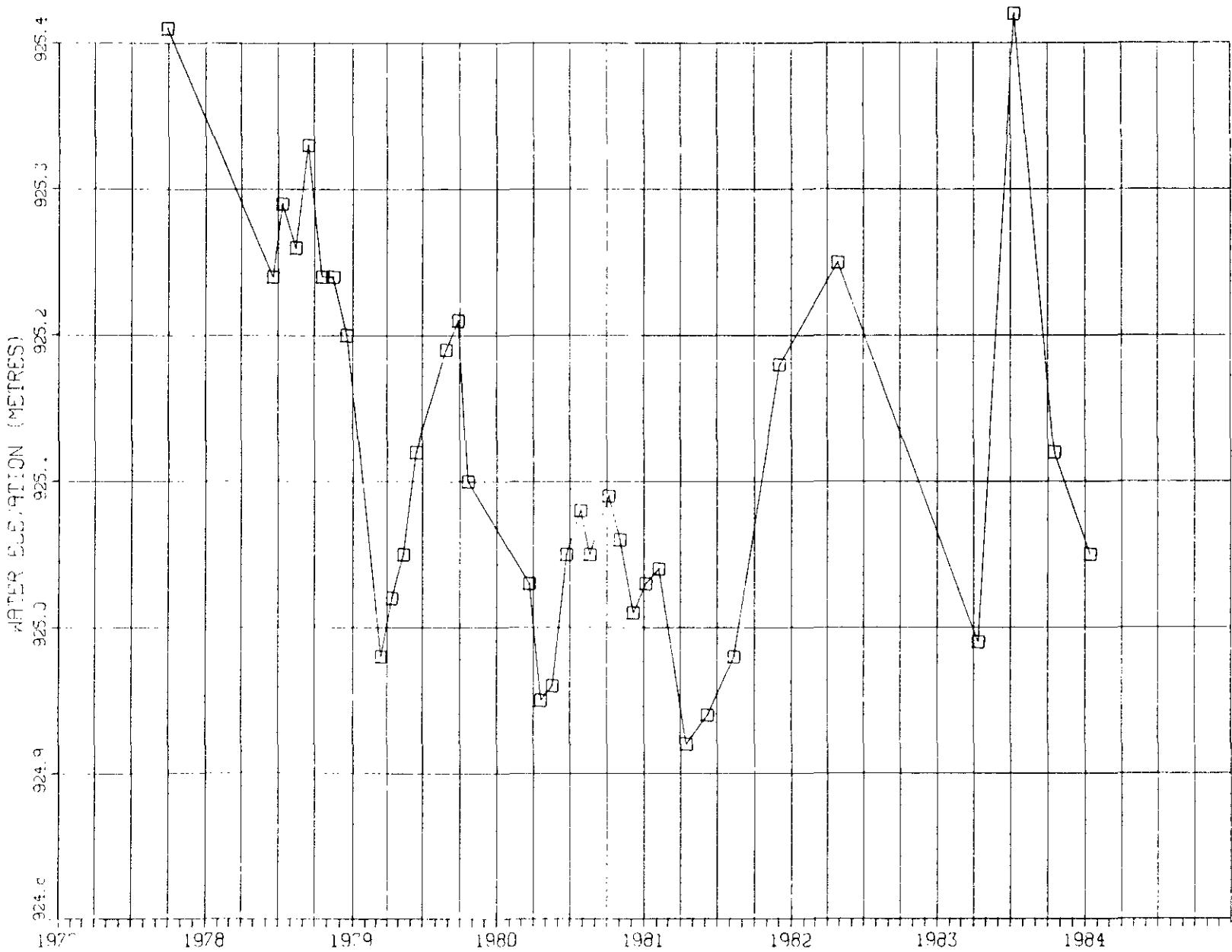


HAT CREEK WATER LEVEL MONITORING - OBSERVATION WELL NO. P-77-50



LEGEND
□ - PIEZO NO. 1

HAT CREEK WATER LEVEL MONITORING - OBSERVATION WELL NO.P-77-51



HAT CREEK WATER LEVEL MONITORING - OBSERVATION WELL NO. P-77-61

