MARILLA STREET LANDFILL
BUFFALO, NEW YORK
MISCELLANEOUS DEBRIS/ FINE REFUSE AREA, FINE REFUSE AREA RAILROAD FILL AREA CLOSURE PLAN

LTV Steel Company
Cleveland, Ohio

August 1988
Project: 0848-10-1

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15532

Engineering Report

[redacted] 64

MALCOLM
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ENVIRONMENTAL ENGINEERS, SCIENTISTS & PLANNERS

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1.0 INTRODUCTION

1.1 SITE DESCRIPTION

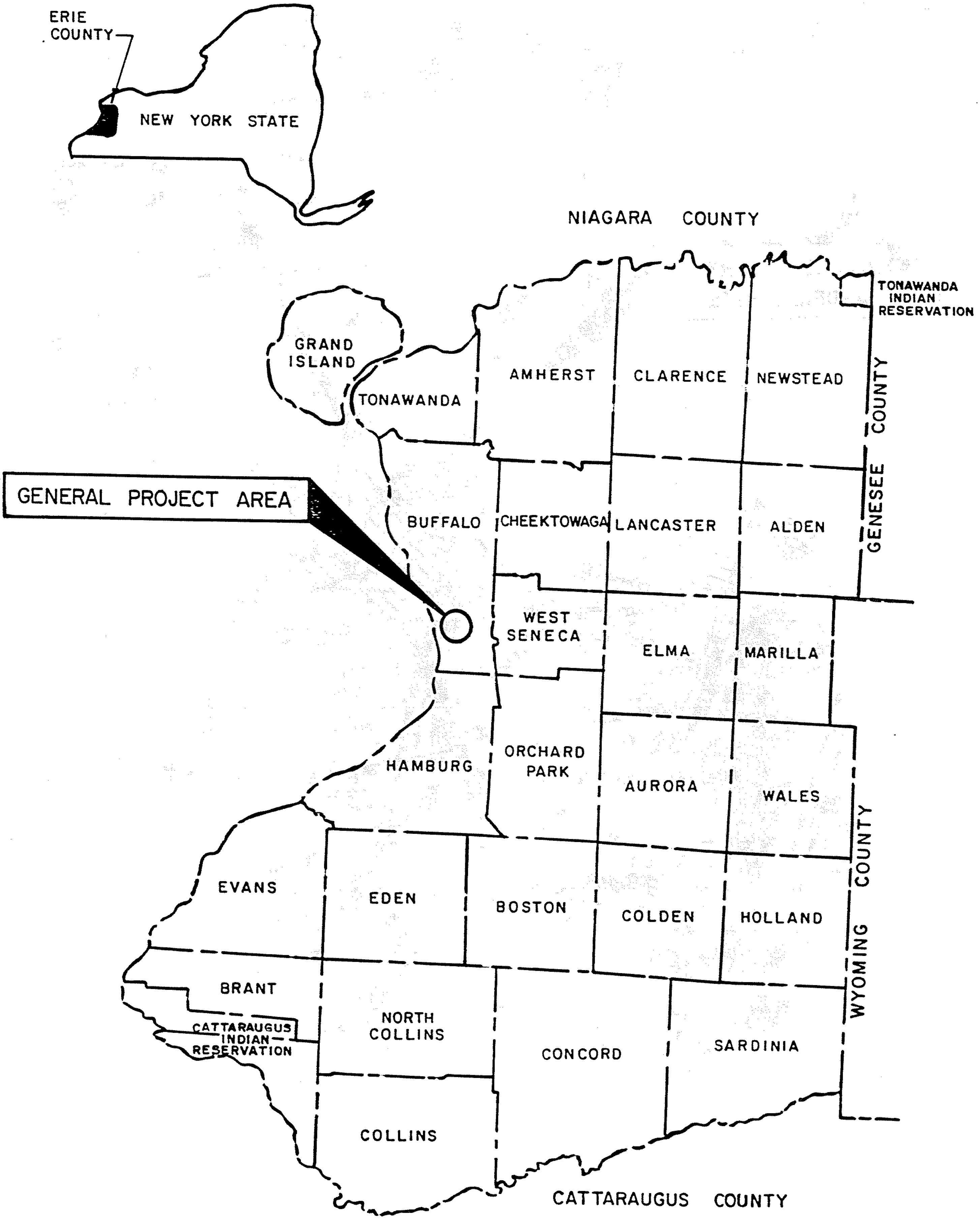
The Marilla Street Landfill site, which is currently owned by LTV Steel Company, has been in operation since 1930. Regional and Vicinity maps illustrating the location of the approximately 100-acre parcel (approximately 80 acres of which have been used as a landfill) are presented as Figures 1-1 and 1-2, respectively. An aerial photo of the site is presented as Figure 1-3 and a Wind Rose is presented as Figure 4. The site is bordered on the south by the South Park Recreational Facilities, on the west by the Penn-Central Railroad and on the north and east by the Baltimore and Ohio Railroad. Hopkins Street, Marilla Street and the South Buffalo Railroad segregate the site into several fill areas.

1.2 SITE BACKGROUND

A variety of wastes have been disposed of at the site including: slag, precipitator dust, clarifier sludge, railroad ties, checker bricks, scrap wood, tool scale, blast furnace dust, BOF brick and construction debris. The landfill was operated as an above-grade fill operation with minimal segregation of wastes prior to the effective date (viz. November, 1980) of the Resource Conservation and Recovery Act (RCRA). In November 1980, Basic Oxygen Furnace (BOF) precipitator dust generated at the Buffalo District Plant was classified as an "EP Toxic" hazardous waste due to lead leachability and therefore, was placed in a segregated fill area (see Figure 2 for location) from November, 1980 until steel making operations were suspended at the Buffalo Plant in June/July 1981. A RCRA Part A permit application was filed for the BOF Dust Area in mid-November, 1980 and a revised Part A was filed in November 1985 (see Appendix A).

The landfill site has been used primarily for material reclamation and disposal of construction debris since the plant shutdown. All wastes disposed of at the landfill site after November 1980 were kept segregated.

FIGURE 1-1



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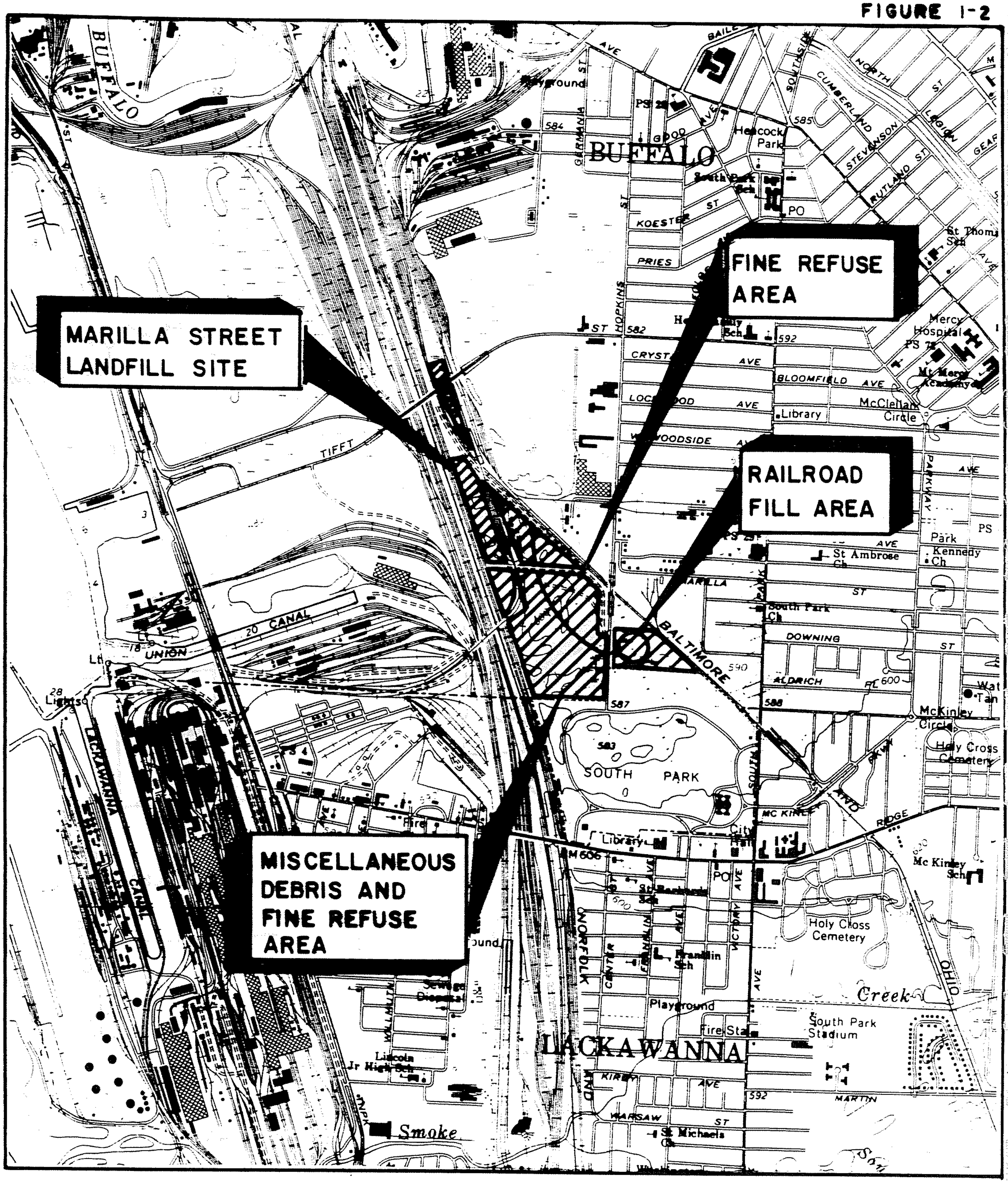
LANDFILL CLOSURE PLAN
REGIONAL MAP

LTV STEEL
JUNE, 1988

FIGURE 1-2



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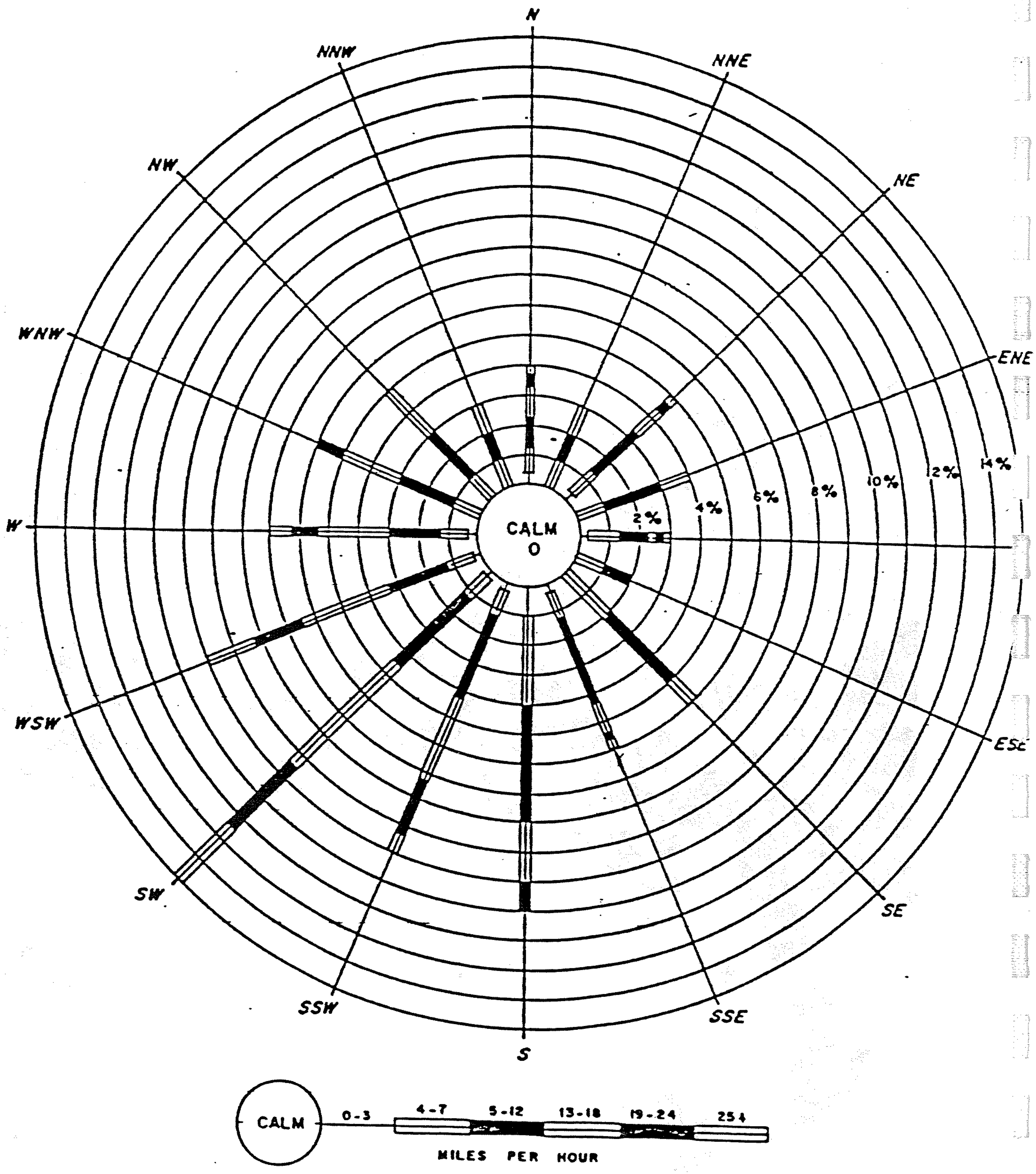
BUFFALO, NEW YORK
LTV STEEL CO.
LANDFILL CLOSURE PLAN
VICINITY MAP
JUNE 1988

FIGURE I-3

AERIAL PHOTOGRAPH OF
MARILLA STREET LANDFILL SITE

LTV STEEL COMPANY SEPTEMBER 1985

FIGURE 1-4



MEAN SPEED: 12 MPH

PREVAILING
DIRECTION: SOUTHWEST

MAXIMUM SPEED: 91 MPH

DATA - SOURCE: NOAA, DECENNIAL CENSUS O
UNITED STATES CLIMATE,
SUMMARY OF HOURLY
OBSERVATIONS, BUFFALO.

BUFFALO, NEW YORK
LTV STEEL CO.

MARILLA STREET LANDFILL
MISCELLANEOUS DEBRIS/FINE REFUSE, FINE REFUSE AND RAILROAD FILL AREA
ANNUAL WINDROSE
JUNE 1988

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1.3 LANDFILL CHARACTERISTICS

The landfill site has been segregated into five fill areas based on information obtained from borings and from conversations with LTV personnel familiar with previous landfill operations. The five areas are shown on Sheet 17 and discussed below:

- Miscellaneous Debris/Fine Refuse Area - The Miscellaneous Debris and Fine Refuse Area consists primarily of a mixture of plant construction debris, railroad ties, bricks, minus minus fines (viz. BOF slag less than 1/4 inch in size), minus fines (viz. BOF slag 1/4-inch to 5/8-inch in size), BOF slag, and blast furnace slag. As indicated on Sheet 17, the volume of waste in this area has been estimated to be 1,550,000 cubic yards.

- Fine Refuse Area - The Fine Refuse Area consists primarily of a mixture of minus minus fines, minus fines, BOF slag and blast furnace slag. As indicated on Sheet 17, the volume of waste in this area was estimated to be 712,000 cubic yards in 1985. 31,300 cubic yards of material have been mined and removed since that time.

- Railroad Fill Area - The Railroad Fill Area consists primarily of slag deposited during construction of a railroad on the east side of Hopkins Road. As indicated on Sheet 17, the volume of waste in this area has been estimated to be 14,500 cubic yards.

- Clarifier Sludge Area - The Clarifier Sludge Area consists primarily of a mixture of clarifier sludge (viz. sludge generated by the plant's wastewater treatment system), BOF slag, and blast furnace slag. The slag was used to prevent the sludge from being dispersed by the wind. As indicated on Sheet 17, the total volume of waste in the Clarifier Sludge Area has been estimated to be 531,000 cubic yards which includes the rubble/slag used in the construction of the railroad berm.

- BOF Dust Area - The BOF (Basic Oxygen Furnace) Dust Area consists of a mixture of BOF dust and BOF slag. The slag was used to prevent the dust particles from being dispersed by the wind. LTV personnel estimate that approximately 6000 tons of BOF dust, which is considered an "EP Toxic" characteristic hazardous waste due to lead leachability, were disposed of in the BOF Dust Area from November, 1980 until June/July 1981. As indicated on Sheet 8, the total volume of wastes (slag and dust) in the BOF Dust Area has been estimated to be 136,600 cubic yards. The BOF Dust Area also contains approximately 33,300 cubic yards of rubble/slag used in the construction of the railroad berm and the western retaining berm.

1.4 ESTABLISHMENT OF A BENCHMARK

A surveying benchmark will be established and maintained on the site. In addition, the property boundaries will be certified by a land surveyor licensed to practice in New York State, prior to commencement of closure activities.

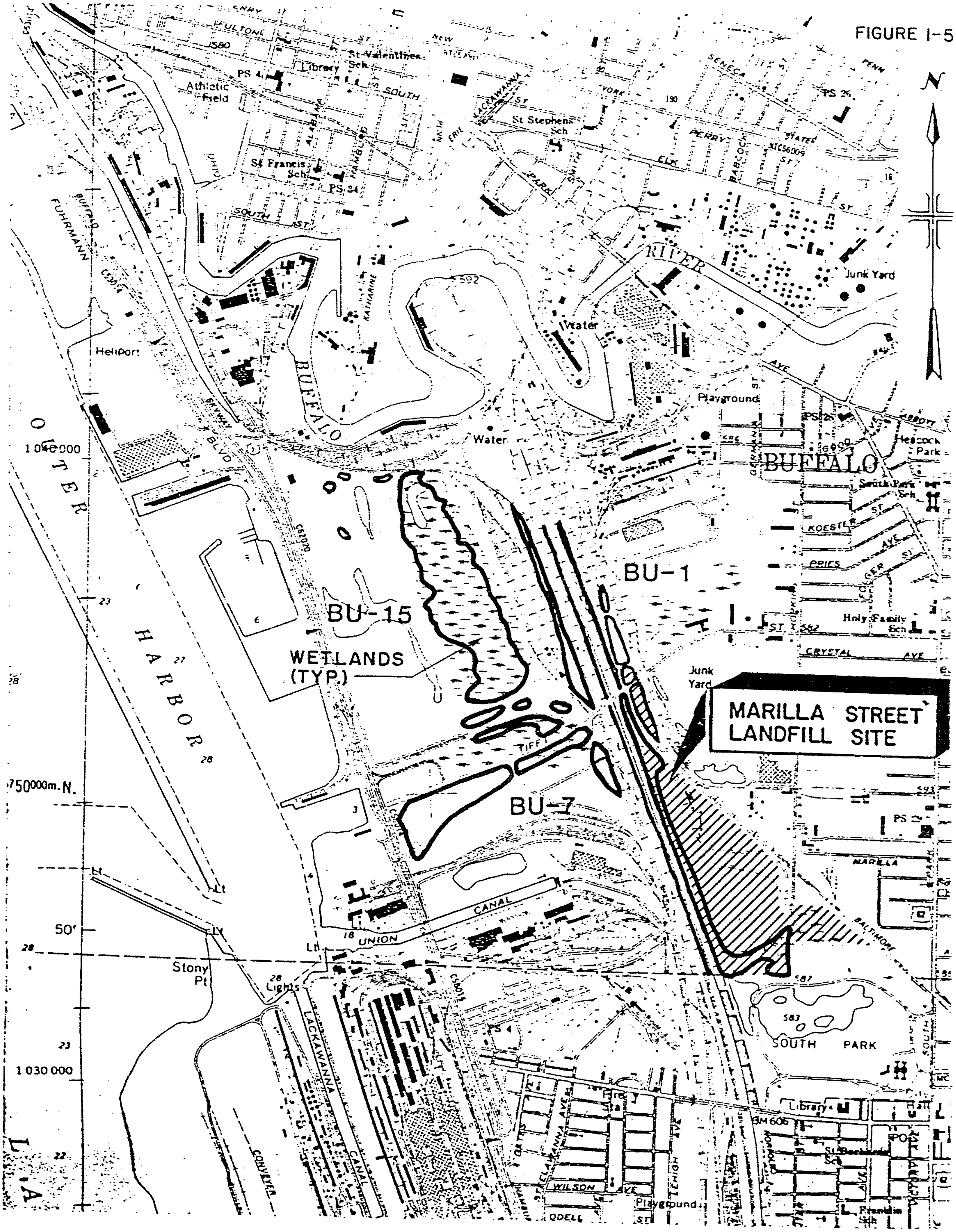
1.5 WETLANDS PERMITS

Several of the ponds and drainage ditches located on and in the vicinity of the site may be considered designated wetlands by the NYSDEC (see Figure 1-5). Special permits will be obtained before the initiation of any work in these areas.

1.6 PURPOSE AND SCOPE

This project was initiated to develop an approvable closure/post-closure plan for the Miscellaneous Debris/Fine Refuse Area, the Fine Refuse Area and the Railroad Fill Area of the Marilla Street Landfill in accordance with Title 6 of the New York Code of Rules and Regulations (6NYCRR), Part 360. Separate closure/post-closure plans were prepared for the BOF Dust (in accordance with 6NYCRR, Part 373), Sludge Clarifier (in accordance with 6NYCRR, Part 360) Areas. The project objectives pertaining to closure of the Miscellaneous Debris/Fine Refuse Area, Fine Refuse Area and Railroad Fill Areas include:

FIGURE I-5



MALCOLM PIRNIE

WETLANDS MAP

LTV STEEL CO. SEPT. 1985

- segregation, to the extent possible, of the Miscellaneous Debris/Fine Refuse Area, Fine Refuse Area and Railroad Fill Areas from the remaining portions of the landfill site;
- covering these areas in accordance with 6NYCRR, Part 360; and
- minimizing post-closure care and monitoring costs.

The engineering report, prepared in accordance with 6NYCRR, Part 360, includes a summary of the hydrogeologic conditions of the site, a summary of the field investigations completed at the site, a description of the closure plan, a routine post-closure maintenance plan, a preliminary ground and surface water monitoring plan, and a summary of closure cost estimates. Although a routine post-closure ground and surface water monitoring program has been developed for the site and is presented in Section 4.0, the program may require revision once the closure and post-closure plans for the BOF Dust, and Clarifier Sludge Areas are completed and approved.

2.0 FIELD INVESTIGATIONS

2.1 TOPOGRAPHIC SURVEY

An aerial photograph of the site was taken on April 18, 1985 by McIntosh and McIntosh, Inc. (Licensed Land Surveyors) of Lockport, New York (see Figure 3). This aerial photograph was used by McIntosh to develop a topographic map with 5-foot contours (see Sheet 1) for the site.

2.2 BORINGS/MONITORING WELLS

A total of thirty-four (34) borings have been completed on and in the vicinity of the site. Twenty-three (23) of these borings were completed as monitoring wells; however, four of those wells were abandoned due to vandalism. The boring logs and monitoring well details are included as Appendix B. Each of the wells is constructed of two-inch diameter PVC casing with a two-foot length of machine-slotted well screen.

The first boring program at the site was initiated in July 1979 as detailed in the September 1984, Malcolm Pirnie, Inc. report entitled "Marilla Street Landfill Investigation, Phase I - Hydrogeologic Investigation Update" (Reference 1). Five (5) soil borings were completed and nine (9) ground water monitoring wells (viz. 5 deep - A series and 4 shallow - B series) were installed at the five (5) soil boring locations under the direction of URS Engineers. As part of the 1984 Malcolm Pirnie investigation, Wells 1A and 1B were abandoned due to vandalism and Wells 4A and 4B were replaced with a new deep (viz. 4A) well. The report presents boring logs along with an evaluation of ground water flow directions and quality data collected in July and August 1979 and in July 1982.

A second boring program was initiated in June 1985 as detailed in the September 1985, Malcolm Pirnie, Inc. report entitled "Marilla Street Landfill, Conceptual Site Closure Plan (Reference 2). Fourteen (14) borings were performed with two of the borings completed as monitoring wells (viz. 7A and 8B). The report also presented a summary of ground water flow directions and quality data collected on July 23, 1985.

A third boring program was initiated in September 1985 as detailed in the November 1985, Malcolm Pirnie, Inc. report entitled "Closure Plan for the Marilla Street Landfill BOF Dust Area". This investigation focused on the BOF Dust Area with a total of eight (8) new shallow wells installed (viz. 3B, 4B, 7B, 9B, 10B, 11B, 12B and 13B). Monitoring Well 14B was installed in July 1986.

Ground water flow directions and quality data are generated on a quarterly basis for the entire site (in accordance with 6NYCRR, Part 360) and specifically for the BOF Dust Area (in accordance with 6NYCRR Part 373). The two most recent quarterly monitoring reports dated March and June 1988 are presented as Appendices C and D, respectively.

2.3 HYDROGEOLOGY

Based upon site investigations, the general geology of the Marilla Street Landfill has been determined. The site geology from the surface to bedrock is as follows:

- Fill:	0' to greater than 20'
- Topsoil:	0' to 2'
- Sandy-silt:	0' to 15'
- Clayey-silt:	7' to greater than 18'
- Glacial till:	1' to 2'
- Shale bedrock	

Depths to bedrock range from over 25 feet on the east side of the site to less than 14 feet at the northwest corner of the site. A geologic fence diagram illustrating site geology is attached as Sheet 16.

Since cover material has not been applied to the site, the permeability of the surface material is a function of the type of material deposited and the degree of compaction. Five in-situ permeability tests (i.e. field percolation tests) were performed on the surface fill material including one in the BOF Dust Area. The results of these tests indicate that the permeability of the landfill surface ranges from 1.60×10^{-3} to 1.19×10^{-4} cm/sec and averages 4.85×10^{-4} cm/sec.

Bailer permeability tests were performed on monitoring wells 2A, 3A, 6A, 2B and 6B. The results of these tests are summarized in Table 2-1. As indicated in Table 2-1, the permeability of the deep saturated zone ranges between 5.16 x 10^{-6} and 7.8 x 10^{-5} cm/sec. Bailer permeability tests performed on Wells 4A and 5B were unsuccessful due to the rapid recovery of the wells.

Ground water at the landfill site exists in both perched and confined conditions. The perched ground water system occurs in the sandy-silt deposits and/or the topsoil and fill materials which overlie the clayey=silt layer. Based on bailer permeability tests conducted on monitoring wells 2B and 6B, the permeability of the saturated zone is between 3.17 x 10^{-5} and 6.86 x 10^{-5} cm/sec. A ground water isopotential map illustrating the general direction of ground water flow in both the deep and shallow ground water systems based on average ground water elevations is presented as Sheet 15. The direction of flow in the shallow ground water system appears to be toward the west pond, with South Park Lake suspected to be the recharge area. The confined ground water system occurs in the bedrock and to a lesser extent in the immediate overburden beneath the site. Bailer permeability tests performed on wells completed in the immediate overburden indicate that the permeability of this clayey-silt layer ranges between 5.16 x 10^{-6} and 7.80 x 10^{-5} cm/sec. These permeabilities suggest that wells completed in the overburden would not yield sufficient quantities of water to be considered an aquifer.

Direction of ground water flow in the confined ground water system is normal to isopotential contours and moves from points of higher elevation to points of lower elevation. As illustrated on Sheet 15, the general direction of ground water flow in the confined ground water system in the vicinity of the site is toward Lake Erie to the west. This is consistent with previous determinations of the direction of ground water flow in the confined ground water system.

TABLE 2-1

LTV STEEL COMPANY
MARILLA STREET LANDFILL

BAILER PERMEABILITY TEST RESULTS

WELL NO.	PERMEABILITY(1) (cm/sec)
2A	1.69×10^{-5}
3A	7.80×10^{-5}
4A	ND(2)
6A	5.16×10^{-5}
2B	6.86×10^{-5}
5B	ND(2)
6B	3.17×10^{-5}

NOTES:

(1) Based on bailer permeability tests performed in field on 8/23/84.

(2) No Data. Wells recovered too quickly to complete bailer permeability test.

3.0 MISCELLANEOUS DEBRIS/FINE REFUSE, FINE REFUSE AND RAILROAD FILL AREA CLOSURE PLAN

3.1 GENERAL

This closure plan was prepared in accordance with the requirements of Title 6 of the New York Code of Rules and Regulations (6NYCRR), Part 360, and the New York State Department of Environmental Conservation Solid Waste Management Facility Guidelines. The existing site topography of the Miscellaneous Debris/Fine Refuse, Fine Refuse and Railroad Fill Areas is shown on Sheets 1-4. The final grading plan is shown on Sheets 6-9. A maximum thirty-three percent (33%) slope will be maintained over the landfill. All cut and fill calculations are presented in Appendix E.

3.2 FINAL COVER

Final cover will be installed over the entire 60-acre area as described herein. A typical cross-section of the final cover is shown on Sheets 6-9.

The final cover will consist of an 18-inch thick barrier layer of soil having a maximum permeability of 1.0×10^{-7} cm/sec placed over the graded fill material. Installation of the final cover will be completed under a competitively-bid contract. The contractor will obtain the soil from an off-site source. The barrier layer soil will be placed in three lifts, each lift being compacted to a 6-inch thickness, for a total compacted thickness of 18 inches. Quality assurance and control procedures are described in Section 3.10.

A 12-inch thick layer of topsoil will be placed over the compacted barrier layer. The topsoil will support a vegetative layer as described in Section 3.4 while providing sufficient thickness to prevent root penetration into the barrier layer. A drainage layer was not included in the cap design because the steep slopes will promote runoff, minimizing the need for drainage. In addition, with steeper slopes, experience has indicated that drainage layers will tend to dry out the topsoil cover, thereby promoting reduced vegetative growth, increased erosion and increased long-term maintenance requirements.

3.3 FINAL GRADES

Final grades will be achieved through grading of the fill material to the maximum extent possible. Final grades will provide positive drainage of the entire landfill area. Maintenance terraces ten (10) feet in width and with cross slopes of 2% minimum will be constructed at each 20-foot vertical change in elevation. Maintenance terraces are necessary to minimize erosion due to surface water runoff and provide improved accessibility for site maintenance.

Approximately 343,000 cubic yards of material will require grading to achieve desired grades (see Appendix E). Final grades (without the 2-1/2-foot thick final cap) are shown on the final grading plan provided as Sheets 6-9.

3.4 VEGETATIVE GROWTH

The landfill will be seeded and fertilized immediately following final grading. The entire surface of the landfill area will be seeded with 150 lbs/acre of seed conforming to the following mix (by weight):

- Creeping Red Fescue	40%
- Perennial Rye Grass	40%
- Crown Vetch	20%

In addition, the following species will be sowed specifically in the drainage ditches to help prevent ditch erosion:

- Tall Fescue (Kentucky 31)	20 lbs/acre
- Creeping Red Fescue	20 lbs/acre
- Red Top	4 lbs/acre
- Empire Birdsfoot Trefoil	8 lbs/acre
- Garrison Creeping Foxtail	10 lbs/acre

This mixture was chosen due to the species tolerance to wetness, adaptability to climate and resistance to erosion. The selected species have a continuous rather than a clump form of growth. Birdsfoot Trefoil is a legume, a plant which fixes nitrogen and helps the grasses thrive. Garrison Foxtail is especially adapted for vigorous growth in wet and seepage areas.

In addition to the seed mixtures listed above, one bushel per acre of oats or rye seed will be sowed over the entire area, including drainage ditches, to provide a quick shade cover and to prevent erosion during turf establishment. As an aid to turf establishment, seeded areas will be fertilized with 20 pounds per 1000 square feet of 10-10-10 fertilizer and covered with a hay or straw mulch to prevent erosion during initial establishment.

3.5 SURFACE WATER CONTROL

A surface water control system will be constructed to prevent the severe erosion and damage caused by storms. Drainage ditches along the perimeter of the Miscellaneous Debris/Fine Refuse, Fine Refuse and Railroad Fill Areas will be constructed to convey surface runoff to existing natural drainage. The surface water control system is shown on the final grading plan presented as Sheets 6-9.

Ditches will be constructed to a depth of two feet with a minimum bottom slope of 0.5% and a maximum side slope of 1:1. All drainage ditches located on the Miscellaneous Debris/Fine Refuse, Fine Refuse and Railroad Fill areas will be constructed over 18 inches of compacted cover material which is consistent with the proposed final cover for the site. All remaining drainage ditches will be constructed in existing material.

Ditches crossing maintenance terraces will be filled entirely with crushed stones to permit vehicles to drive across the ditch while still providing surface drainage across the terrace. A vegetative cover, as described in Section 3.4 of this Closure Plan, will be established in the drainage ditches with slopes less than 5% to prevent surface soil erosion and ditch washout. In addition, all ditches with bottom slopes in excess of 5% will be lined with crushed stones and/or a synthetic anti-erosion matting as an aid to turf establishment and to prevent soil and vegetative washout during periods of high rainfall. The drainage ditches have the capacity to handle a 25-year, 24-hour rainfall event (see Appendix H). The ditch invert elevations shown on Sheets 6-9 are approximate; the final elevations will be determined by actual field conditions.

3.6 LEACHATE COLLECTION/TREATMENT

A leachate collection/treatment system, per se, will not be developed for the site for the following reasons:

- The quantity of leachate generated by the Miscellaneous Debris/Fine Refuse, Fine Refuse and Railroad Fill Areas after the surface has been covered will be greatly reduced.
- Most of the leachate which is generated by the Miscellaneous Debris/Fine Refuse, Fine Refuse and Railroad Fill Areas and the entire site will continue to be intercepted by the perimeter drainage ditches.

- The Miscellaneous Debris/Fine Refuse, Fine Refuse and Railroad Fill Areas have not been determined to have a significant impact on the ground water quality in the vicinity of the site.

- There are several other solid waste disposal sites in the vicinity of the Marilla Street Landfill which could be affecting both ground water systems present beneath the BOF Dust Area.

- There are no known drinking water wells located between the Miscellaneous Debris/Fine Refuse, Fine Refuse and Railroad Fill Areas and Lake Erie. Furthermore, the existence of public water supplies and the poor overall ground water quality of the area indicate that ground water in the area will not be a future source of drinking water.

3.7 Schedule for Closure

Closure of the Miscellaneous Debris/Fine Refuse, Fine Refuse and Railroad Fill Areas will be initiated upon approval of closure plan by the NYSDEC. As shown in Table 3-1, it is estimated that one (1) to three (3) full construction seasons will be required for closure.

3.8 GAS CONTROL

The decomposition of the solid wastes contained in a sanitary landfill produces various gases, methane being the gas of most concern. The build-up and migration of methane gas must be controlled to prevent fire and explosion hazards. Gas control is typically accomplished through the installation of a gas venting system. Due to the inert nature of the waste materials disposed in the Miscellaneous Debris/Fine Refuse, Fine Refuse and Railroad Fill Areas, a gas venting system is not considered necessary; however, the gas venting system is being proposed in response to NYSDEC requests.

A passive gas venting system consisting of 63 PVC pipes (approximately 6 inches in diameter) will be installed to facilitate gas migration through the final cap. The gas vents will be installed during placement of the final cover. The locations of the gas vents are shown on Sheets 6-9, and a detail is presented on Sheet 14. The vent pipes will be installed vertically in the cap extending 2'-0" below the cap and protruding 3'-0" above final grade at approximately 200-foot spacing across the site. Gas vents will be terminated with a 180 degree return bend and a bird and insect screen. The pipes will be filled with gravel and will be perforated to allow gas to move freely into the pipe and vent to atmosphere. In addition, the gas vents will be installed in a crushed stone envelope to minimize soil migration which could block the vents and render them ineffective.

TABLE 3-1

LTV STEEL COMPANY
MARILLA STREET LANDFILL

MISCELLANEOUS DEBRIS/FINE REFUSE, FINE REFUSE AND RAILROAD FILL AREAS

CLOSURE SCHEDULE

MILESTONE	Estimated Number of Months to Accomplish Milestones For Each Area**
Regulatory Approval of Closure/ Post-Closure Plan	-
Preparation of Bid Documents/ Specifications	2
Solicit Bids	2
Selection of Contractor	0.5
Execute Contract	0.5
Complete Construction*	4
TOTAL	9

* Construction can only be accomplished during the construction season when climatic conditions are favorable.

** Due to the size of each area, it is estimated that one full construction season will be required for each area; however, if the work is separated into 2 or 3 contracts with separate contractors, the work could be completed in one construction season.

3.9 ACCESS CONTROL

There is a single access road from Hopkins Road onto the landfill site. The road has an existing gate to prevent entry to the landfills on the west side of Hopkins Road, by unauthorized persons. Existing topography will minimize access from the southern and northern boundaries for the Miscellaneous Debris/ Fine Refuse and Fine Refuse areas. A fence will be installed along Hopkins Road and "NO TREASPASSING" signs will be posted.

Existing topography on the north, east and south boundaries will minimize access to the Railroad Fill area. A fence with a gate will be installed along Hopkins Road (the western boundary of the landfill) and "NO TREASPASSING" signs will be posted around the entire landfill. The gates will be equipped with locks and appropriate warning signs.

3.10 Quality Assurance/Quality Control

To assure that the final cover of the landfill will meet the requirements set forth herein, the following quality assurance/ quality control measures will be adhered to:

- Final cover material will consist of the following gradation:

Sieve Size Designation	Minimum Percent Passing by Weight
3 inches	100
No. 4	85
No. 200	50
.002 mm	25

- Cover material will be tested in accordance with the following quality control:
  - Grain size and moisture content every 1000 yd^3
  - Liquid limit and plasticity index every 5000 yd^3
  - Moisture density curve every 5000 yd^3
  - Recompacted permeability every 5000 yd^3;
- Cover material will be placed in three 6-inch maximum (after compaction) lifts;
- Cover material will be compacted to 90-95% of Modified Proctor Density;

- The cap thickness will be controlled via before and after survey, the before survey will be performed after the final grading is complete;
- One falling-head in-situ permeability test will be performed per acre, per lift of completed cap;
- One Shelby tube sample will be collected per five (5) acres, per lift, of completed cap for performance of an undisturbed triaxial permeability test in the laboratory;
- Nine (9) nuclear densitometer tests will be performed per acre per lift of completed cap;
- All drainage ditches on the disposal area will be constructed with a minimum of 18 inches of recompacted cover material between the bottom of the ditch and the fill materials; and
- All landfill closure construction will be performed under the supervision of, and certified by, a Registered Professional Engineer.

4.0 POST-CLOSURE ACTIVITIES

The following information is submitted in accordance with the requirements for landfill post-closure activities as contained in 6NYCRR Part 360 and New York State Solid Waste Management Facility Guidelines.

4.1 POST-CLOSURE PERIOD

Post-closure activities for the Miscellaneous Debris/ Fine Refuse, Fine Refuse and Railroad Fill Areas will extend over a period of thirty (30) years.

4.2 GROUND AND SURFACE WATER QUALITY MONITORING

The ground and surface water monitoring program that was implemented in 1985 will be continued until the entire site is closed. A proposed post-closure ground and surface water monitoring program for the entire site (6NYCRR, Part 360 Areas) has been developed and outlined below; however, this plan may require modification once the closure/post-closure plan for the Clarifier Sludge and BOF Dust Areas are approved by the NYSDEC. The ground water monitoring wells and surface water locations which are currently used and are planned for future use as routine monitoring locations are shown on Sheet 15.

4.2.1 Routine Surface Water Quality Monitoring

All surface water drainage from the Miscellaneous Debris/Fine Refuse, Fine Refuse and Railroad Fill Areas will discharge to the adjacent drainage ditches, as shown on Sheets 6-9. Water samples will be collected from the West Pond on a quarterly basis. Each sample will be analyzed for the parameters listed in Table 4-1. This list will be reviewed annually and, when justified by previous analytical results, LTV Steel will submit proposed additions or deletions to the NYSDEC for review and approval.

4.2.2 Routine Ground Water Quality Monitoring

The routine monitoring program will consist of collecting samples from the ground water monitoring wells on a quarterly basis. Ground water samples for the routine ground water monitoring program will be taken from wells 2A, 2B, 3A, 4A, 4B, 5A, 5B, 6A, 6B, 7A and 7B. Ground water surface elevations will be measured in all the wells. Samples will be analyzed for the parameters listed

TABLE 4-1

LTV STEEL COMPANY
MARILLA STREET LANDFILL

PROPOSED PARAMETERS FOR ROUTINE SURFACE GROUND WATER QUALITY MONITORING(1)(3)

PARAMETER	QUARTERLY	ANNUAL
Alkalinity		X
Ammonia		X
BOD_5		X
Chloride	X	
Nitrate		X
Sulfate	X	
COD		X
Color		X
Hardness		X
Odor		X
pH(2)	X	
Eh(2)	X	
Specific Conductivity(2)	X	
Static Water Level(2)	X	
TDS	X	
TKN		X
TOC	X	
Total Coliform		X
Turbidity	X	
Temperature	X	
Arsenic		X
Boron		X
Cadmium		X
Lead	X	
Chromium	X	
Mercury		X
Aluminum		X
Chromium (Hexavalent)		X
Calcium		X
Iron	X	
Manganese	X	
Sodium		X
Total Phenols	X	
Priority Pollutant Series		X

NOTES:

1. Both total and soluble metals will be measured. All samples for soluble metals analysis will be filtered in the field prior to preservation. No other samples will be filtered. Both total and soluble analyses will be performed on metals.

2. To be field measured.

3. The list of parameters will be reviewed on an annual basis and adjusted as necessary following review and approval by NYSDEC.

in Table 4-1. This list is a result of a review of current ground water quality data and will be reviewed annually. When justified by previous analytical results, the LTV Steel will submit proposed additions or deletions to the NYSDEC for review and approval.

4.2.3 Sample Collection

Surface water samples will be collected via manual grabs. Ground water samples will be collected using teflon bailers. The primary consideration in ground water sampling is to obtain a representative sample of the ground water body by guarding against mixing the sample with stagnant (standing) water in the well casing. In a non-pumping well, there will be little or no vertical mixing of the water and stratification will occur. The well water in the screened section will mix with the ground water due to normal flow patterns, but the well water above the screened section will remain isolated and become stagnant. Persons sampling should realize that stagnant water may contain foreign material inadvertently or deliberately introduced from the surface, resulting in unrepresentative data and misleading interpretation of the same.

To safeguard against collecting non-representative samples, the following steps will be taken during sampling:

Step 1. Measure distance from top of casing to water surface using graduated string with weight attached or electronic water level measuring device. Record this measurement.

Step 2. Measure distance to bottom of well using string with weight attached. Record this measurement.

Step 3. Determine the volume of water in the well. Evacuate three well volumes prior to sampling. If the well is pumped or bailed dry before 3 volumes are discharged and it does not recharge itself in a reasonable length of time, allow it to fill back up and collect the sample. This may require the well to be left overnight.

Step 4. If significant amounts of silt are present in the well, attempts will be made to remove as much as possible from the well prior to sample collection. This may require pumping or bailing the well several times. In the event the silt cannot be removed, the well will be redeveloped. Care will be taken during sample collection not to disturb the sediments in the bottom of the well.

Step 5. The sample should be taken as soon as sufficient recharge to the well occurs. A dedicated Teflon hand bailer will be used for sample collection. A bailing pump will not be used for sample collection to prevent cross-contamination of the wells.

Step 6. Prior to collecting the sample, the bailer will be cleaned using the following procedure:

1. Wash bailer in detergent and water.
2. Rinse with tap water.
3. Rinse again using distilled water.

Step 7. Lower the bailer into the well to collect sample. Note the depth at which the sample was collected.

Step 8. Pour sample into the appropriate bottle taking extreme caution to prevent any contamination of the sample.

Step 9. Repeat Steps 1-9 at each of the specified monitoring locations.

Step 10. The bailing pump, if used for well evacuation, will be cleaned prior to reuse to prevent cross contamination of wells. Pump cleaning procedure will be as follows:

1) Wipe exterior of hose and/or other wetted parts with clean paper towel and rinse with tap water.

2) Pump approximately one-half gallon of detergent water through pump and hose, then rinse by pumping one to two gallons of tap water. Allow to drain prior to use.

4.2.4 Recording of Sampling Data

Monitoring results will be submitted to the Erie County Health Department and NYSDEC within 30 days of the sampling date. The information to be recorded and submitted will include the following:

- Location of sample collection point;
- Identity of person performing the sampling, including a chain of custody record;
- Weather conditions at the time of sample collection;
- Method of collection;
- Relevant well features (i.e. depth of sampling, location of water table prior to bailing);

- Time and date of sampling;
- Method of sample preservation;
- Name and address of analytical laboratory performing analysis; and
- Visual sample characteristics (i.e. color, sediment, presence of oil, turbidity, etc.).

4.2.5 Chain of Custody

The chain of custody records will be maintained by the field sampler for each sample, from the time that the sample is withdrawn until it is delivered to the laboratory or transferred to an authorized custodian. The records outlined in Subsection 4.2.4 of this report will be attached to the sample container. When the information has been recorded, the sample container will be sealed, containing the regulatory agency's designation, date and sampler's signature.

4.2.6 Sample Containers

Samples will be collected in containers as specified in Appendix F. Glass and plastic sample containers will be utilized. EPA-approved procedures for cleaning sample containers will be utilized. All containers will be rinsed with the sample prior to sampling. Blank samples will be collected in containers with preservatives in the event it is necessary to determine if the containers were contaminated. Following collection of the sample, all containers will remain full to maintain anaerobic conditions prior to analysis.

4.2.7 Sample Preservation

In order to maintain the integrity of the samples collected, EPA-approved preservation methods for retarding the biological and chemical changes that take place in the container while the sample is being transported and awaiting analysis will be employed. The techniques utilized generally include pH adjustment, chemical addition, and/or refrigeration. Preservation will take place as specified as Appendix F.

4.2.8 Analytical Methods

Laboratory analysis will take place within the time frame specified in Appendix F. Field blanks and laboratory blanks will be analyzed. The methods of analysis to be employed in the monitoring program will be conducted in accordance with the procedures described in one of the following texts and/or as outlined in Appendix F.

- Test Methods for Evaluating Solid Waste, United States Environmental Protection Agency, Office of Solid Waste and Emergency Response, (SW-846), Washington, D.C. 1986 or most recent date.
- Standard Methods for the Examination of Water and Wastewater, 16th Ed., APHA, 1985 or most recent update.
- Manual of Methods for Chemical Analysis of Water and Wastes, U.S. Environmental Protection Agency (EPA), EPA-600/4-79-020, March 1983 or most recent update.

4.3 Gas Control

A gas control program will not be required for the Miscellaneous Debris/Fine Refuse, Fine Refuse and Railroad Fill Areas. Any gas within the landfill will be vented to the atmosphere via the proposed gas vents (see Section 3.8).

4.4 Inspection and Maintenance

4.4.1 Site Inspections

LTV Steel will be responsible for site inspection and maintenance. The site will be inspected a minimum of four (4) times per year throughout the entire post-closure period. The landfill site will be inspected for:

- Integrity of structures;
- Visible debris, litter and waste;
- Loss of vegetative cover or growth of undesirable species;
- Integrity of drainage ditches including:
    - sediment build-up,
    - pooling or ponding,
    - slope integrity, and
    - overall adequacy of surface runoff collection system;
- Integrity of gas venting system;
- Condition of access roads, gates and fences;
- Integrity of ground water monitoring system;
- Integrity of landfill cap including:
    - erosion or settling of cap material,
    - leachate breakthroughs;

4.4.2 Cover Maintenance

Cover maintenance will be performed as necessary by LTV Steel over the 30-year post-closure care period. Any signs of erosion or other site maintenance problems detected during routine site inspections will be corrected as soon as possible. All eroded areas will be brought back to original grade according to the procedures described for constructing the final cover. All bare spots in the final cover will be reseeded and fertilized as necessary. Seed and fertilizer will be of the same type and quality as specified in Section 3.4 of the Closure Plans. Vegetative growth will be mowed as necessary. Any undesirable species will be removed if their presence is suspected to deteriorate the integrity of the final cover.

The need for cover repairs due to subsidence and/or settling will be determined based on an evaluation of whether the function of the final cover in the affected area has been impaired. Those areas where the function has been impaired will be repaired to ensure that the integrity of the final cover is maintained. These repair actions may include, but will not be limited to:

- strip and stockpile topsoil from the affected area;
- regrade the affected area in accordance with the grading plan (see Section 3.3);
- using clay or a bentonite-soil admixture, fill cracks and reestablish the recompacted low permeability soil layer to a depth of two feet at a maximum permeability of $1x10^{-7}$ cm/s, and;
- replace topsoil and revegetate affected area in accordance with Section 3.4 of this Closure Plan.

4.4.3 Maintenance of Site Structures

Maintenance of structures for surface water control, leachate control, ground water monitoring and access control will be performed by LTV Steel as necessary over the 30-year post-closure period.

All eroded areas in the drainage ditches will be repaired and regraded. Reseeding will be carried out using the recommended seed mixture given in Section 3.4 of this Plan. Sediment build-up in the ditches will be removed if it restricts flow in the ditch. Any other areas in the ditches where the cross-section or slope has been altered to the extent that flow does not occur as desired will be reworked and regraded as necessary.

Gas vents will be repaired or rebuilt to restore them to original design configuration shown on Sheet 14, Miscellaneous Sections and Details.

Monitoring wells which sustain damage or cannot provide representable ground water samples, for whatever reason, will be examined to determine whether the problem can be corrected. This will be facilitated by comparing data from previous monitoring activities to reveal the problem. In particular, attention should be given to:

- Signs of encrustation and corrosion;
- An exceptional increase in solids content (due to the breakdown of the screening arrangement); and
- An appreciable decrease in ground water elevation, perhaps the result of these problems.

Remedial action may involve some form of chemical treatment, screen removal and replacement or the installing a new monitoring well.

The access road to the landfill site will be maintained in good condition so that routine inspections and required maintenance activities can be carried out. Gates will be kept in good repair to prevent unauthorized access onto the landfill site.

4.4.4 Contingency Plans

The objective of the contingency plan is to address events which occur outside the scope of the routine maintenance program. The contingency plan will be implemented following the discovery of a condition at the landfill which is not covered by the routine maintenance plan.

Natural occurrences such as storms, drought and subsidence should be considered "expected occurrences" and are addressed in the maintenance program and are not addressed in this contingency plan. Certain problems which cannot be reasonably expected to occur, such as earthquakes or war, are also not addressed in this contingency plan.

The following problems may not be reasonably expected to occur, yet may be discovered during a routine post-closure inspection and monitoring program:

- Leachate impacting ground or surface water quality;
- Failure of the final cover integrity which may be a result of or indicated by:
  - Waste protruding through the final cover,
  - Soil erosion or other drainage problems, and
  - Uncontrolled burrowing by pests; and
- Vegetative cover missing despite repeated efforts at revegetation.

The following guidelines are offered to determine when the contingency plan should be implemented and to determine possible corrective actions when responding to a contingency. All corrective actions, where appropriate, will be executed in a timely fashion after notifying the appropriate regulatory agencies.

In the event that ground water contamination may be occurring, approximately six months would be required to:

- compare the data qualitatively;
- perform a statistical evaluation of the data;
- notify the NYSDEC of the analytical and statistical results;
- prepare a work plan to determine the source and extent of the contamination; and
- receive NYSDEC approval of the work plan.

Time frames for executing the remainder of the contingency plan, including:

- implementing the work plan for determining the source and extent of the contamination;
- preparing a final report to submit to the NYSDEC;
- preparing a work plan for corrective action, and;
- implementing corrective actions

would be a function of the extent of the problem and the corrective measures required. An approximate schedule for carrying out the contingency plan would be included in the work plan for determining the source and extent of the contamination.

4.4.4.1 Ground or Surface Water Quality Degradation

Ground and surface water quality will be routinely monitored as indicated in Section 4.2. The results will be evaluated according to the procedure outlined in Figure 4-1. The decision tree serves as a guide for LTV Steel to determine if water quality degradation has occurred and to implement appropriate actions based on the results of this determination.

4.4.4.2 Vandalism

Vandalism will be reported to the local enforcement authorities. If vandals have gained entry to the landfill, appropriate measures will be taken to eliminate or restrict future access. Vandalism to monitoring wells will be repaired as appropriate. Damage caused by off-road vehicles will be repaired where the damage is determined to have compromised the integrity of the final cover or the functions of the gas vents, surface drainage system or leachate collection system.

4.4.4.3 Air Contamination

Methane gas venting to the atmosphere should not present a risk to human health due to the inert nature of the fill material.

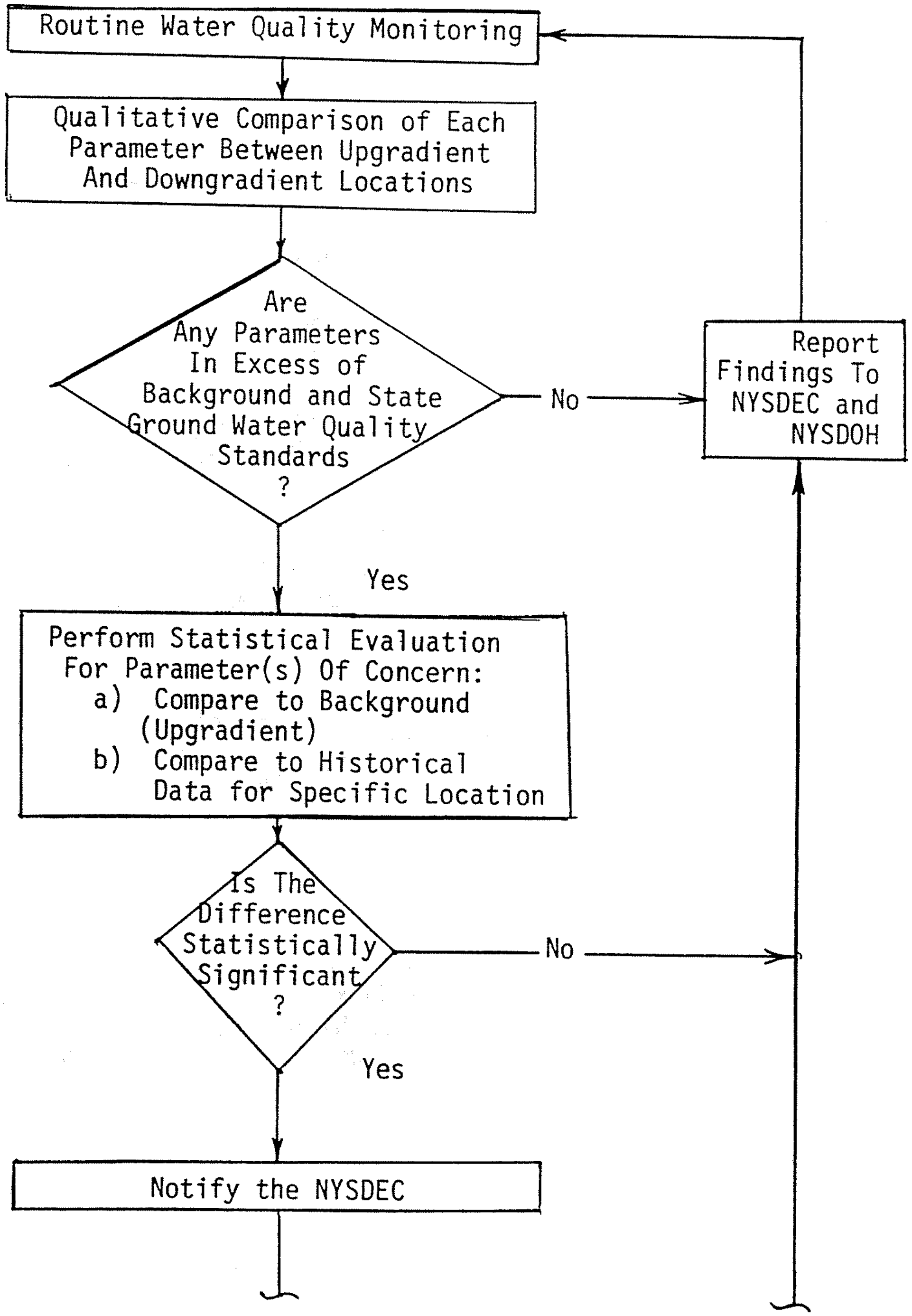
Should it be suspected that methane gas generation may be presenting a human health hazard, LTV Steel will notify the NYSDEC and New York State Department of Health. In the event that the NYSDOH determines a human health hazard is present, a work plan will be developed to determine if the venting system is functioning properly and to determine the appropriate response actions. Possible response actions include replacing portions of the venting system, adding new vents, or installing an active gas withdrawal system. Any proposed remedial actions would be approved through the NYSDEC prior to implementation.

4.4.4.4 Unauthorized Dumping or Disposal

Unauthorized dumping or waste disposal will be reported to the NYSDEC and local enforcement officials. Appropriate measures will be taken to determine the waste characteristics, containment requirements and the necessary removal

FIGURE 4 - 1

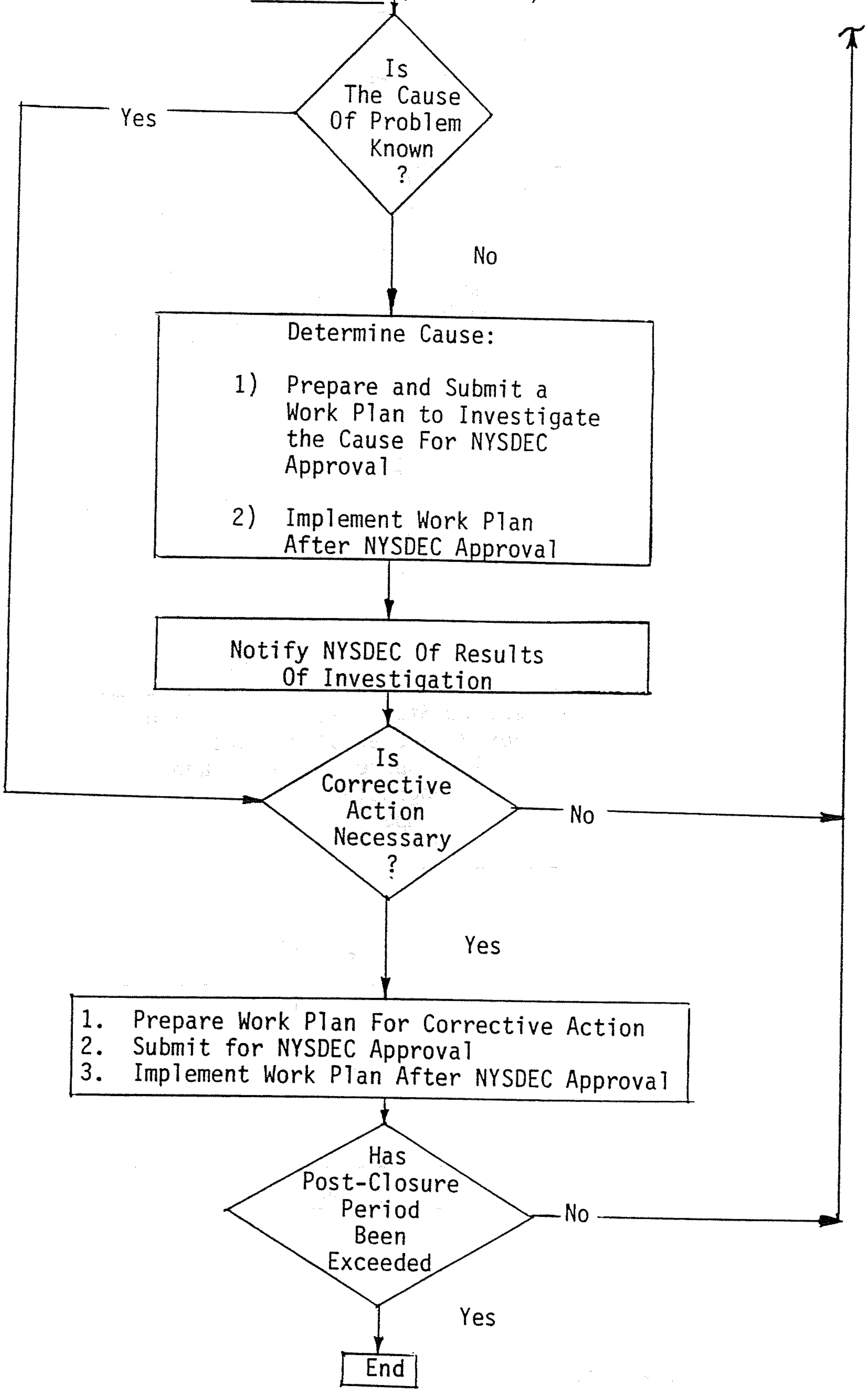
DECISION TREE FOR DETERMINING/CORRECTING WATER QUALITY DEGRADATION



NYSDEC - New York State Department
of Environmental Conservation

NYSDOH - New York State Department of Health

FIGURE 4-1 (Continued)



techniques. The waste will be removed and disposed of in an approved disposal facility, as appropriate. Efforts will be taken to eliminate further dumping and to restrict subsequent entry to the site. LTV Steel will assist the NYSDEC and/or USEPA in the prosecution of persons found in the act of illedgal dumping and in seeking reimbursement from the responsible party for all costs incurred in the removing and disposal of the waste.

4.4.5 Quality Assurance/Quality Control

To assure the performance of site inspection and maintenance, a reporting procedure has been established. A site inspection checklist and maintenance schedule is provided in Appendix G. The site inspection checklist was developed in accordance with the parameters identified in Section 3.0. The maintenance schedule will be completed after regularly scheduled site inspections and inspections following severe storms and will be submitted to the NYSDEC on a quarterly basis.

LTV Steel personnel responsible for performing site inspections and supervising maintenance operations will be fully qualified to perform the work. The site inspection checklist and maintenance schedule will be signed by authorized personnel. Maintenance and repair work shall conform to the requirements set forth in Section 3.0.

5.0 CLOSURE AND POST-CLOSURE COST

5.1 Closure and Post-Closure Costs

Closure costs developed in accordance with the site closure plan described in Section 3.0 are presented in Table 5-1. Post-closure costs associated with ground and surface water monitoring and site inspection and maintenance as described in Section 4.0 are presented in Table 5-2. Because of the uncertainty of escalating costs, the total estimated closure/post-closure costs are based on 1988 dollars. These costs were obtained from a variety of sources, including vendor/supplier information, Malcolm Pirnie bid tabulations and Means' Construction Cost Data 1988.

Several assumptions were used when compiling these cost estimates, including:

- clay and topsoil will be obtained from sources within 45 miles of the site;
- contractor overhead and profit is included in the unit costs, and;
- the volume of clay to be purchased and handled at the landfill is 25% greater than the final compacted volume, and is recorded as such in the cost estimate.

The actual construction cost for the landfill closure will not be known until the work is competitively bid. The present cost estimate for the final cover is very sensitive to the unit price for the off-site soil material. The unit price for delivery of off-site clay to the landfill has been estimated to be $10.00/c.y., however, each $1.00/c.y. increase or decrease in the unit price will increase or decrease the cost for the final cap by approximately $450,000.

The post-closure period was assumed to be 30 years. The analytical costs are based on the routine (quantity) and annual parameters listed in Section 4.0. Depending upon the results of the annual review of this list, the actual analytical cost may vary.

The total estimated closure cost for the Miscellaneous Debris/Fine Refuse, Fine Refuse and Railroad Fill Areas is $11,931,112 based on the costs provided in Table 5-1. Annual post-closure costs which include the total Part 360 monitoring required for the entire site are estimated to be $34,500 (1988 dollars) for the 30-year post-closure period.

TABLE 5-1

LTV STEEL COMPANY
MARILLA STREET LANDFILL

CLOSURE PLAN FOR MISCELLANEOUS DEBRIS/FINE REFUSE,
FINE REFUSE AND RAILROAD FILL AREAS

CLOSURE COST

ITEM/MATERIAL	UNITS	QUANTITY	UNIT COST	TOTAL MATERIAL COST
SITE PREPARATION:				
- Rough Grading	CY	350,000	$ 5.00	$1,750,000
- Fine Grading	ACRES	59	2,100.00	123,900
RECOMPACTED SOIL:				
- Furnish and Deliver	CY	238,000(1)	10.00	2,380,000
- On-site Hauling	CY	238,000(1)	2.00	476,000
- Place and Compact	CY	238,000(1)	5.00	1,190,000
- Fine Grade	ACRES	59	2,100.00	123,900
- Soil Testing and Cap Certification	ACRES	59	3,500.00	206,500
- On-site Inspection	LS	-	200,000.00	200,000
TOPSOIL:				
- Furnish and Deliver	CY	95,200	15.00	1,428,000
- On-site Hauling	CY	95,200	2.00	190,400
- Place and Grade	CY	95,000	3.00	285,600
- Seed and Mulch	ACRES	59	5,600.00	330,400
TERRACES:				
- Furnish and Deliver	CY	7,775	10.00	77,750
- Hauling	CY	1,750	2.00	3,500
- Place and Compact	CY	7,775	5.00	38,875
- Riprap	CY	1,750	25.00	43,750
GAS VENTILATION SYSTEM:				
- Gas Vents	EACH	63	200.00	12,600
SURFACE WATER DRAINAGE SYSTEM:				
- Perimeter Drainage Ditches	FT	7,905	4.00	31,620
- Side Slope Drainage Ditches	FT	4,100	3.00	12,300
- Riprap	CY	1,800	25.00	45,000
CLEAN FILL				
- Furnish and Deliver and Place and Compact	CY	75,700(1)	17.00	1,286,900

TABLE 5-1 (Continued)

LTV STEEL COMPANY
MARILLA STREET LANDFILL

CLOSURE PLAN FOR MISCELLANEOUS DEBRIS/FINE REFUSE, FINE REFUSE AND RAILROAD FILL AREAS

CLOSURE COST (Continued)

ITEM/MATERIAL	UNITS	QUANTITY	UNIT COST	TOTAL MATERIAL COST
PERIMETER KEY	FT	6,385	5.00	31,925
FENCING	FT	1,900	$12.00	22,800
GATE	EACH	1	$200.00	200
EQUIPMENT MOBILIZATION AND DEMOBILIZATION	LS		$100,000.00	$ 100,000
			SUB-TOTAL	$10,391,920.00
ENGINEERING				$ 500,000
CONTINGENCIES @ 10%				$1,039,192.00
			TOTAL	$11,931,112.00

(1) Quantity assumes 25 percent compaction

TABLE 5-2

MARILLA STREET LANDFILL(6)
MISCELLANEOUS DEBRIS/FINE REFUSE AREA, FINE REFUSE AND RAILROAD FILL AREAS
CLOSURE PLAN

POST-CLOSURE COSTS

	Item/Material	Units	Quantity	Unit Cost ($)	Total Cost ($)
1.	Quarterly Laboratory Testing(1)(2)	Years	30	3,500.00	105,000
2.	Annual Laboratory Testing(8)(2)	Years	30	21,000.00	630,000
3.	Sample Collection(3)	Manhours	3,840	20.00	76,800
4.	Data Evaluation(4)	Manhours	600	50.00	30,000
5.	Site Inspection(5)	Manhours	960	25.00	24,000
6.	Site Maintenance(7)	Years	30	2,500.00	75,000
			Subtotal		$ 940,800
			Contingencies @ 10%		94,200
			GRAND TOTAL		$1,035,000
			Annual Costs		$34,500

NOTES:

1. Four sample events per year for 30 years.
2. Includes 2 QA/QC samples.
3. Two persons for eight days per year for 30 years.
4. Twenty hours per year for 30 years.
5. Site investigation based on one person for four days per year for 30 years.
6. Costs based on 1988 dollars. Actual costs may vary depending on cost inflation.
7. Assumed since scope of work is undefined.
8. One sample event per year for 30 years.

APPENDIX A

BOF DUST AREA RCRA PART A APPLICATION

NOVEMBER 1980
1985

Please print or type in the unshaded areas only
(fill—in areas are spaced for elite type, i.e., 12 characters/inch).

Form Approved OMB No. 158-R0175

FORM 1 GENERAL

U.S. ENVIRONMENTAL PROTECTION AGENCY

GENERAL INFORMATION

Consolidated Permits Program

(Read the "General Instructions" before starting.)

I. EPA I.D. NUMBER

F NYD000813402

LABEL ITEMS

I. EPA I.D. NUMBER

III. FACILITY NAME

V. FACILITY MAILING ADDRESS

VI. FACILITY LOCATION

PLEASE PLACE LABEL IN THIS SPACE

GENERAL INSTRUCTIONS

If a preprinted label has been provided, affi it in the designated space. Review the infor ation carefully; if any of it is incorrect, cro through it and enter the correct data in t appropriate fill—in area below. Also, if any the preprinted data is absent *(the area to t left of the label space lists the informati that should appear)*, please provide it in t proper fill—in area(s) below. If the label complete and correct, you need not compl Items I, III, V, and VI *(except VI-B whi must be completed regardless)*. Complete items if no label has been provided. Refer the instructions for detailed item desc tions and for the legal authorizations unc which this data is collected.

II. POLLUTANT CHARACTERISTICS

INSTRUCTIONS: Complete A through J to determine whether you need to submit any permit application forms to the EPA. If you answer "yes" to any questions, you must submit this form and the supplemental form listed in the parenthesis following the question. Mark "X" in the box in the third column if the supplemental form is attached. If you answer "no" to each question, you need not submit any of these forms. You may answer "no" if your activity is excluded from permit requirements; see Section C of the instructions. See also, Section D of the instructions for definitions of bold—faced terms.

SPECIFIC QUESTIONS	MARK 'X' YES	NO	FORM ATTACHED	SPECIFIC QUESTIONS	MARK 'X' YES	NO	FORM ATTAC
A. Is this facility a publicly owned treatment works which results in a discharge to waters of the U.S.? (FORM 2A)		X		B. Does or will this facility *(either existing or proposed)* include a concentrated animal feeding operation or aquatic animal production facility which results in a discharge to waters of the U.S.? (FORM 2B)		X	
C. Is this a facility which currently results in discharges to waters of the U.S. other than those described in A or B above? (FORM 2C)		X		D. Is this a proposed facility *(other than those described in A or B above)* which will result in a discharge to waters of the U.S.? (FORM 2D)		X	
E. Does or will this facility treat, store, or dispose of hazardous wastes? (FORM 3)	X		X	F. Do you or will you inject at this facility industrial or municipal effluent below the lowermost stratum containing, within one quarter mile of the well bore, underground sources of drinking water? (FORM 4)		X	
G. Do you or will you inject at this facility any produced water or other fluids which are brought to the surface in connection with conventional oil or natural gas production, inject fluids used for enhanced recovery of oil or natural gas, or inject fluids for storage of liquid hydrocarbons? (FORM 4)		X		H. Do you or will you inject at this facility fluids for special processes such as mining of sulfur by the Frasch process, solution mining of minerals, in situ combustion of fossil fuel, or recovery of geothermal energy? (FORM 4)		X	
I. Is this facility a proposed stationary source which is one of the 28 industrial categories listed in the instructions and which will potentially emit 100 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an attainment area? (FORM 5)		X		J. Is this facility a proposed stationary source which is NOT one of the 28 industrial categories listed in the instructions and which will potentially emit 250 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an attainment area? (FORM 5)		X	

III. NAME OF FACILITY

1 SKIP REPUBLIC STEEL BUFFALO DISTRICT

IV. FACILITY CONTACT

A. NAME & TITLE *(last, first, & title)*	B. PHONE *(area code & no.)*
2 POTWORA JOHN SUPT ENVIR CONT	716 821 5410

V. FACILITY MAILING ADDRESS

A. STREET OR P.O. BOX

3 PO BOX 6

B. CITY OR TOWN	C. STATE	D. ZIP CODE
4 BUFFALO	NY	14240

VI. FACILITY LOCATION

A. STREET, ROUTE NO. OR OTHER SPECIFIC IDENTIFIER

5 HOPKINS AND MARILLA STREETS

B. COUNTY NAME

ERIE

C. CITY OR TOWN	D. STATE	E. ZIP CODE	F. COUNTY CODE *(if known)*
6 BUFFALO	NY	14220	

TINUED FROM THE FRONT

SIC CODES *(4-digit, in order of priority)*

A. FIRST	B. SECOND
3312 (specify) IRON AND STEEL PLANT	7 (specify)
C. THIRD	D. FOURTH
(specify)	7 (specify)

OPERATOR INFORMATION

A. NAME: CLARENCE A HACKETT INC

B. Is the name listed in Item VIII-A also the owner? ☐ YES ☒ NO

C. STATUS OF OPERATOR *(Enter the appropriate letter into the answer box; if "Other", specify.)*

F = FEDERAL
S = STATE
P = PRIVATE
M = PUBLIC *(other than federal or state)*
O = OTHER *(specify)*

P *(specify)*

D. PHONE *(area code & no.)*: A 716 692 8300

E. STREET OR P.O. BOX: O BOX 130

F. CITY OR TOWN: TONAWANDA

G. STATE: NY

H. ZIP CODE: 14150

IX. INDIAN LAND

Is the facility located on Indian lands? ☐ YES ☒ NO

EXISTING ENVIRONMENTAL PERMITS

A. NPDES *(Discharges to Surface Water)*	D. PSD *(Air Emissions from Proposed Sources)*
N	9 P
B. UIC *(Underground Injection of Fluids)*	E. OTHER *(specify)*
U	9 DEC#915010212 *(specify)* NY DEC Permit Application for Solid Waste Mgmt Facility
C. RCRA *(Hazardous Wastes)*	E. OTHER *(specify)*
	9 *(specify)*

MAP

ttach to this application a topographic map of the area extending to at least one mile beyond property bounderies. The map must show e outline of the facility, the location of each of its existing and proposed intake and discharge structures, each of its hazardous waste eatment, storage, or disposal facilities, and each well where it injects fluids underground. Include all springs, rivers and other surface ater bodies in the map area. See instructions for precise requirements.

NATURE OF BUSINESS *(provide a brief description)*

Republic Steel's Buffalo District utilizes the facilities at the Hopkins and Marilla Streets site as a reclamation site for by-products of the steel making process. These items include dewatered sludge from waste water treatment, refractory brick, mill scale and blast furnace dust. These items are all sold or reclaimed.

III. CERTIFICATION *(see instructions)*

certify under penalty of law that I have personally examined and am familiar with the information submitted in this application and all ttachments and that, based on my inquiry of those persons immediately responsible for obtaining the information contained in the pplication, I believe that the information is true, accurate and complete. I am aware that there are significant penalties for submitting alse information, including the possibility of fine and imprisonment.

ME & OFFICIAL TITLE *(type or print)*: P. N. WIGTON, Vice President
Steel Operations

B. SIGNATURE: P. N. Wigton

C. DATE SIGNED: 11-17-80

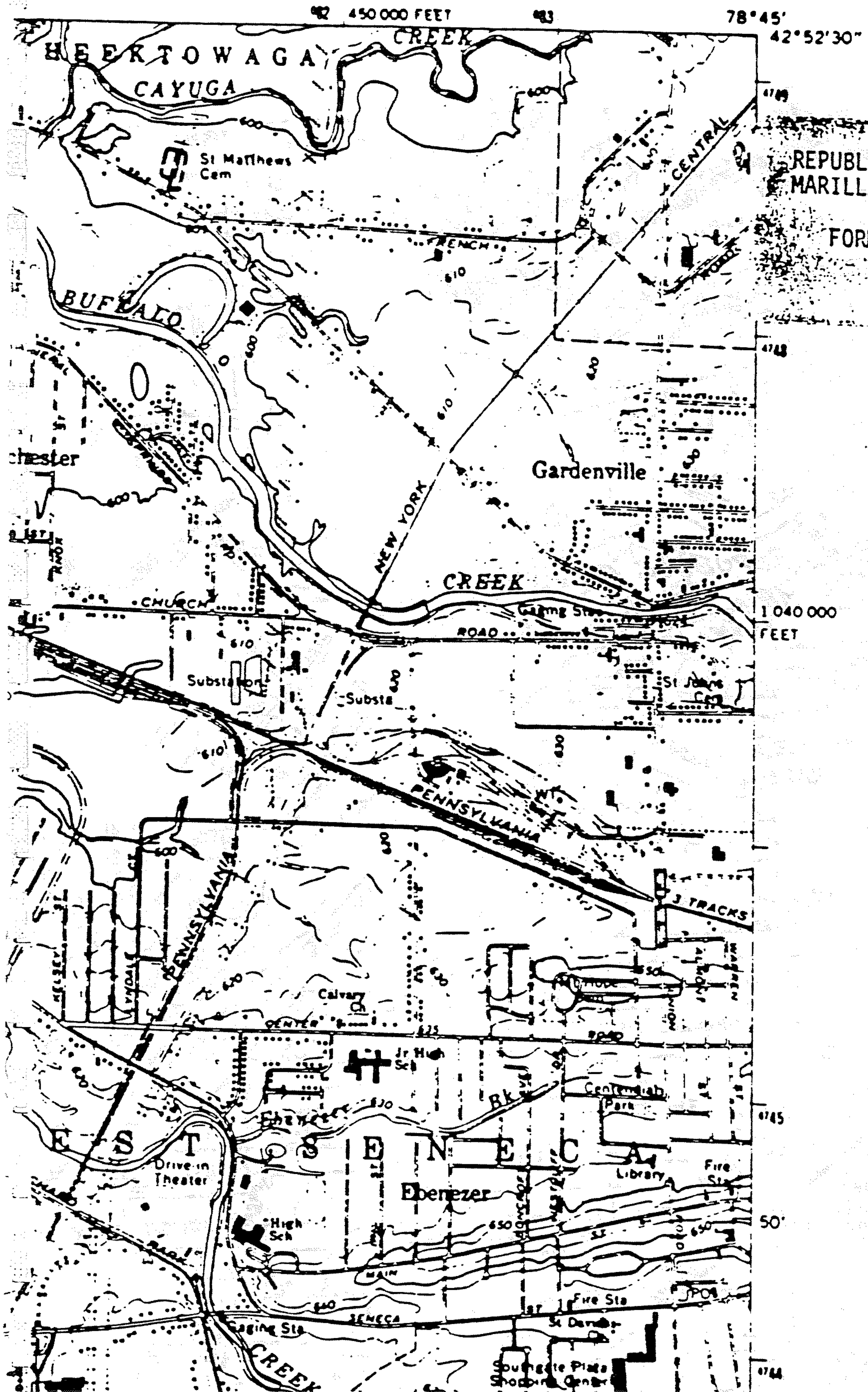
OMMENTS FOR OFFICIAL USE ONLY

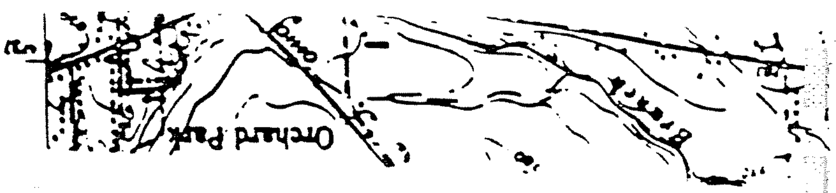
BUFFALO SE QUADRANGLE
NEW YORK–ERIE CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
SE/4 BUFFALO 15' QUADRANGLE

5360 I NW
(LANCASTER)

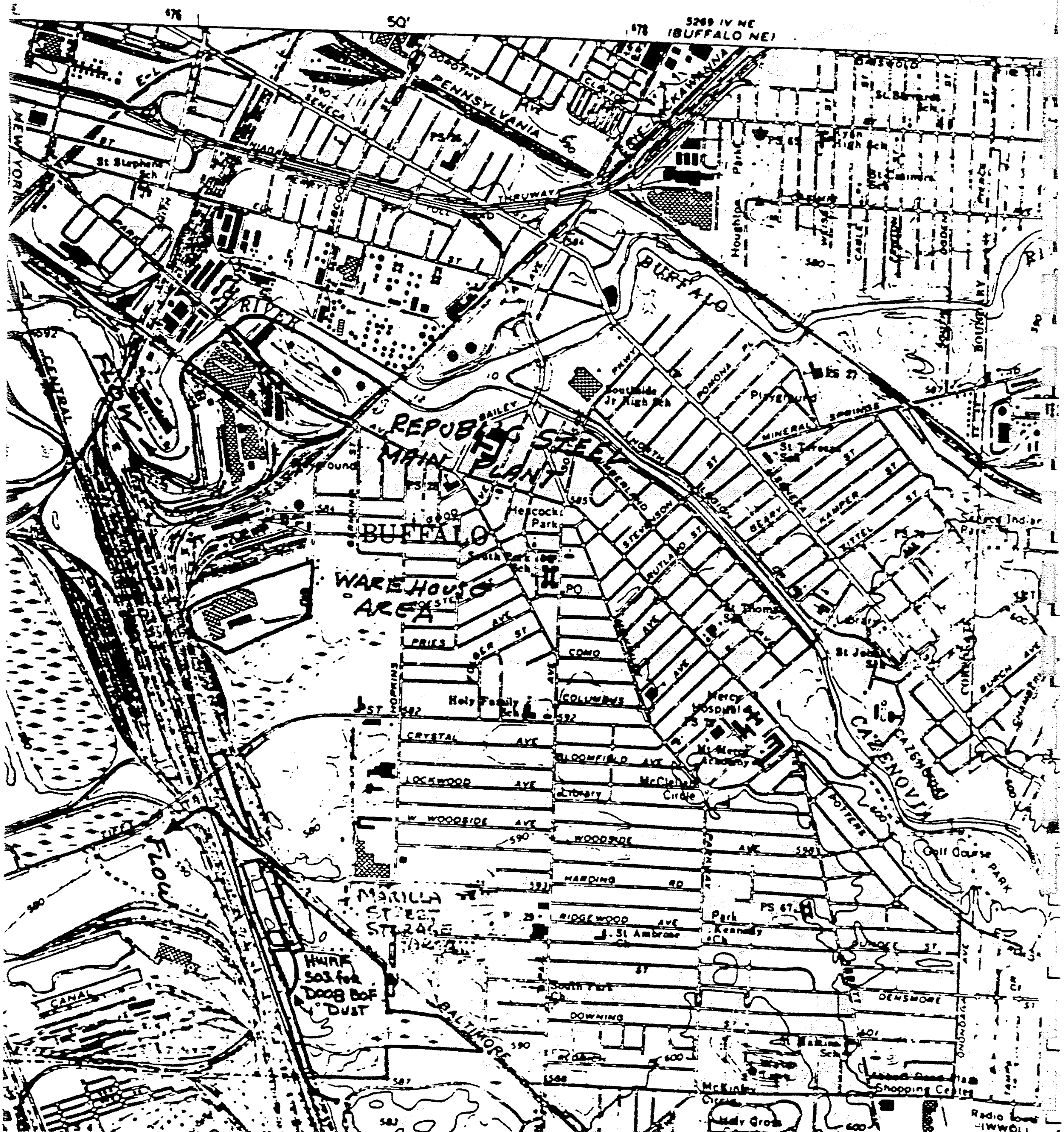
REPUBLIC STEEL BUFFALO DISTRICT
MARILLA STREET STORAGE AREA

FORM 1 ITEM XI 1 of 1




Orchard Park
Branch

OR


50'
5269 IV NE
(BUFFALO NE)
REPUBLIC STEEL
MAIN PLANT
WAREHOUSE
AREA
MARILLA
STREET
STORAGE
HWRF
SO3 for
DOOG BOF
DUST
FLOW
FLOW
BUFFALO
BUFFALO RIVER
CAZENOVIA
PENNSYLVANIA
SENECA
THRUWAY
NEW YORK
CENTRAL
ERIE LACKAWANNA
St Stephens Sch
Southside Jr High Sch
Heacock Park
South Park High Sch
Holy Family Sch
Mercy Hospital
Mt Mercy Academy
McClellan Circle
Library
St Ambrose Ch
South Park Ch
Kennedy Park
McKinley Circle
Holy Cross
Abbott Road Plaza Shopping Center
Golf Course
CAZENOVIA PARK
Seneca Indian Park
St Teresa Sch
St Thomas Sch
St John Sch
Playground
Houghton Park
St Casimir Sch
St Bernard Sch
CRYSTAL AVE
LOCKWOOD AVE
W WOODSIDE AVE
WOODSIDE AVE
HARDING RD
RIDGEWOOD AVE
DOWNING
DENSMORE
BALTIMORE
MINERAL SPRINGS
SOUTH PARK AVE
HOPKINS
COLUMBUS
COMO
PRIES
BAILEY
CANAL
ONONDAGA
Radio Tower (WWOL)
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592
600

(fill—in areas are spaced for elite type, i.e., 12 characters/inch).

Form Approved OMB No. 158-S80004

FORM **3** RCRA

EPA

U.S. ENVIRONMENTAL PROTECTION AGENCY

HAZARDOUS WASTE PERMIT APPLICATION

Consolidated Permits Program

(This information is required under Section 3005 of RCRA.)

I. EPA I.D. NUMBER

F N Y D 0 0 0 8 1 3 4 0 2

FOR OFFICIAL USE ONLY

PPLICATION APPROVED	DATE RECEIVED (yr., mo., & day)	COMMENTS

. FIRST OR REVISED APPLICATION

..ace an "X" in the appropriate box in A or B below *(mark one box only)* to indicate whether this is the first application you are submitting for your facility or revised application. If this is your first application and you already know your facility's EPA I.D. Number, or if this is a revised application, enter your facility's EPA I.D. Number in Item I above.

.. FIRST APPLICATION *(place an "X" below and provide the appropriate date)*

☒ 1. EXISTING FACILITY *(See instructions for definition of "existing" facility. Complete item below.)*

☐ 2. NEW FACILITY *(Complete item below.)*

YR.	MO.	DAY
80	11	19

FOR EXISTING FACILITIES, PROVIDE THE DATE *(yr., mo., & day)* OPERATION BEGAN OR THE DATE CONSTRUCTION COMMENCED *(use the boxes to the left)*

YR.	MO.	DAY

FOR NEW FACILITIE PROVIDE THE DATE *(yr., mo., & day)* OPER TION BEGAN OR IS EXPECTED TO BEGI

B. REVISED APPLICATION *(place an "X" below and complete Item I above)*

☐ 1. FACILITY HAS INTERIM STATUS

☐ 2. FACILITY HAS A RCRA PERMIT

II. PROCESSES – CODES AND DESIGN CAPACITIES

A. PROCESS CODE – Enter the code from the list of process codes below that best describes each process to be used at the facility. Ten lines are provided for entering codes. If more lines are needed, enter the code*(s)* in the space provided. If a process will be used that is not included in the list of codes below, ther describe the process *(including its design capacity)* in the space provided on the form *(Item III-C)*.

. PROCESS DESIGN CAPACITY – For each code entered in column A enter the capacity of the process.

1. **AMOUNT** – Enter the amount.
2. **UNIT OF MEASURE** – For each amount entered in column B(1), enter the code from the list of unit measure codes below that describes the unit of measure used. Only the units of measure that are listed below should be used.

PROCESS	PRO-CESS CODE	APPROPRIATE UNITS OF MEASURE FOR PROCESS DESIGN CAPACITY
Storage:		
CONTAINER *(barrel, drum, etc.)*	S01	GALLONS OR LITERS
TANK	S02	GALLONS OR LITERS
WASTE PILE	S03	CUBIC YARDS OR CUBIC METERS
SURFACE IMPOUNDMENT	S04	GALLONS OR LITERS
Disposal:		
NJECTION WELL	D79	GALLONS OR LITERS
LANDFILL	D80	ACRE-FEET *(the volume that would cover one acre to a depth of one foot)* OR HECTARE-METER
LAND APPLICATION	D81	ACRES OR HECTARES
OCEAN DISPOSAL	D82	GALLONS PER DAY OR LITERS PER DAY
SURFACE IMPOUNDMENT	D83	GALLONS OR LITERS

PROCESS	PRO-CESS CODE	APPROPRIATE UNITS OF MEASURE FOR PROCESS DESIGN CAPACITY
Treatment:		
TANK	T01	GALLONS PER DAY OR LITERS PER DAY
SURFACE IMPOUNDMENT	T02	GALLONS PER DAY OR LITERS PER DAY
INCINERATOR	T03	TONS PER HOUR OR METRIC TONS PER HOUR; GALLONS PER HOUR OR LITERS PER HOUR
OTHER *(Use for physical, chemical, thermal or biological treatment processes not occurring in tanks, surface impoundments or incinerators. Describe the processes in the space provided; Item III-C.)*	T04	GALLONS PER DAY OR LITERS PER DAY

UNIT OF MEASURE	UNIT OF MEASURE CODE
GALLONS	G
LITERS	L
CUBIC YARDS	Y
CUBIC METERS	C
GALLONS PER DAY	U

UNIT OF MEASURE	UNIT OF MEASURE CODE
LITERS PER DAY	V
TONS PER HOUR	D
METRIC TONS PER HOUR	W
GALLONS PER HOUR	E
LITERS PER HOUR	H

UNIT OF MEASURE	UNIT OF MEASURE CODE
ACRE-FEET	A
HECTARE-METER	F
ACRES	B
HECTARES	Q

EXAMPLE FOR COMPLETING ITEM III *(shown in line numbers X-1 and X-2 below):* A facility has two storage tanks, one tank can hold 200 gallons and the other can hold 400 gallons. The facility also has an incinerator that can burn up to 20 gallons per hour.

		T/A	C
	DUP		1

LINE NUMBER	A. PROCESS CODE (from list above)	B. PROCESS DESIGN CAPACITY 1. AMOUNT (specify)	2. UNIT OF MEASURE (enter code)	FOR OFFICIAL USE ONLY	LINE NUMBER	A. PROCESS CODE (from list above)	B. PROCESS DESIGN CAPACITY 1. AMOUNT	2. UNIT OF MEASURE (enter code)	FOR OFFICIA USE ONLY
-1	S 0 2	600	G		5				
X-2	T 0 3	20	E		6				
1	S 0 3	60,000	Y		7				
					8				
3					9				
4					10				

ntinued from the front.

I. PROCESSES *(continued)*

SPACE FOR ADDITIONAL PROCESS CODES OR FOR DESCRIBING OTHER PROCESSES *(code "T04")*. FOR EACH PROCESS ENTERED HERE INCLUDE DESIGN CAPACITY.

/. DESCRIPTION OF HAZARDOUS WASTES

. **EPA HAZARDOUS WASTE NUMBER** — Enter the four—digit number from 40 CFR, Subpart D for each listed hazardous waste you will handle. If you handle hazardous wastes which are not listed in 40 CFR, Subpart D, enter the four—digit number*(s)* from 40 CFR, Subpart C that describes the characteristics and/or the toxic contaminants of those hazardous wastes.

ESTIMATED ANNUAL QUANTITY — For each listed waste entered in column A estimate the quantity of that waste that will be handled on an annual basis. For each characteristic or toxic contaminant entered in column A estimate the total annual quantity of all the non—listed waste*(s)* that will be handled which possess that characteristic or contaminant.

. **UNIT OF MEASURE** — For each quantity entered in column B enter the unit of measure code. Units of measure which must be used and the appropriate codes are:

ENGLISH UNIT OF MEASURE	CODE	METRIC UNIT OF MEASURE	CODE
POUNDS	P	KILOGRAMS	K
TONS	T	METRIC TONS	M

If facility records use any other unit of measure for quantity, the units of measure must be converted into one of the required units of measure taking into account the appropriate density or specific gravity of the waste.

. **PROCESSES**

1. PROCESS CODES:
   For listed hazardous waste: For each listed hazardous waste entered in column A select the code*(s)* from the list of process codes contained in Item III to indicate how the waste will be stored, treated, and/or disposed of at the facility.
   For non—listed hazardous wastes: For each characteristic or toxic contaminant entered in column A, select the code*(s)* from the list of process codes contained in Item III to indicate all the processes that will be used to store, treat, and/or dispose of all the non—listed hazardous wastes that possess that characteristic or toxic contaminant.
   Note: Four spaces are provided for entering process codes. If more are needed: (1) Enter the first three as described above; (2) Enter "000" in the extreme right box of Item IV-D(1); and (3) Enter in the space provided on page 4, the line number and the additional code*(s)*.
2. PROCESS DESCRIPTION: If a code is not listed for a process that will be used, describe the process in the space provided on the form.

IOTE: HAZARDOUS WASTES DESCRIBED BY MORE THAN ONE EPA HAZARDOUS WASTE NUMBER — Hazardous wastes that can be described by nore than one EPA Hazardous Waste Number shall be described on the form as follows:

1. Select one of the EPA Hazardous Waste Numbers and enter it in column A. On the same line complete columns B,C, and D by estimating the total annual quantity of the waste and describing all the processes to be used to treat, store, and/or dispose of the waste.
2. In column A of the next line enter the other EPA Hazardous Waste Number that can be used to describe the waste. In column D(2) on that line enter "included with above" and make no other entries on that line.
3. Repeat step 2 for each other EPA Hazardous Waste Number that can be used to describe the hazardous waste.

XAMPLE FOR COMPLETING ITEM IV *(shown in line numbers X-1, X-2, X-3, and X-4 below)* — A facility will treat and dispose of an estimated 900 pounds er year of chrome shavings from leather tanning and finishing operation. In addition, the facility will treat and dispose of three non—listed wastes. Two wastes re corrosive only and there will be an estimated 200 pounds per year of each waste. The other waste is corrosive and ignitable and there will be an estimatec 00 pounds per year of that waste. Treatment will be in an incinerator and disposal will be in a landfill.

LINE NO.	A. EPA HAZARD. WASTE NO *(enter code)*	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE *(enter code)*	D. PROCESSES	
				1. PROCESS CODES *(enter)*	2. PROCESS DESCRIPTION *(If a code is not entered in D(1))*
X-1	K 0 5 4	900	P	T 0 3 D 8 0	
	D 0 0 2	400	P	T 0 3 D 8 0	
X-3	D 0 0 1	100	P	T 0 3 D 8 0	
X-4	D 0 0 2				included with above

ntinued from page 2.
TE: *Photocopy this page before completing if you have more than 26 wastes to list.*

Form Approved OMB No. 158-S80004

EPA I.D. NUMBER (enter from page 1)			FOR OFFICIAL USE ONLY			
NYD000813402	T/A	C: 1	W: DUP	T/A	C: 2	DUP

DESCRIPTION OF HAZARDOUS WASTES *(continued)*

LINE NO.	A. EPA HAZARD. WASTE NO. (enter code)	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (enter code)	D. PROCESSES 1. PROCESS CODES (enter)	D. PROCESSES 2. PROCESS DESCRIPTION (if a code is not entered in D(1))
1	D008	-11,000	T	S03	BOF Dust Storage Pile
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
[illegible]					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					

CONTINUE ON REV

nued from the front.

. DESCRIPTION OF HAZARDOUS WASTES *(continued)*

. USE THIS SPACE TO LIST ADDITIONAL PROCESS CODES FROM ITEM D(1) ON PAGE 3.

EPA I.D. NO. *(enter from page 1)*

												T/A	C
N	Y	D	0	0	0	8	1	3	4	0	2		6

. FACILITY DRAWING

ll existing facilities must include in the space provided on page 5 a scale drawing of the facility *(see instructions for more detail).*

I. PHOTOGRAPHS

ll existing facilities must include photographs *(aerial or ground—level)* that clearly delineate all existing structures; existing storage, eatment and disposal areas; and sites of future storage, treatment or disposal areas *(see instructions for more detail).*

ACILITY GEOGRAPHIC LOCATION

LATITUDE *(degrees, minutes, & seconds)*	LONGITUDE *(degrees, minutes, & seconds)*
42 50 020	073 50 000

III. FACILITY OWNER

☐ A. If the facility owner is also the facility operator as listed in Section VIII on Form 1, "General Information", place an "X" in the box to the left and skip to Section IX below.

B. If the facility owner is not the facility operator as listed in Section VIII on Form 1, complete the following items:

1. NAME OF FACILITY'S LEGAL OWNER	2. PHONE NO. *(area code & no*
REPUBLIC STEEL CORPORATION	216-622-500

3. STREET OR P.O. BOX	C	4. CITY OR TOWN	5. ST.	6. ZIP CODE
P.O. BOX 6778	G	CLEVELAND	OH	44101

. OWNER CERTIFICATION

certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached ocuments, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the ubmitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, ncluding the possibility of fine and imprisonment.

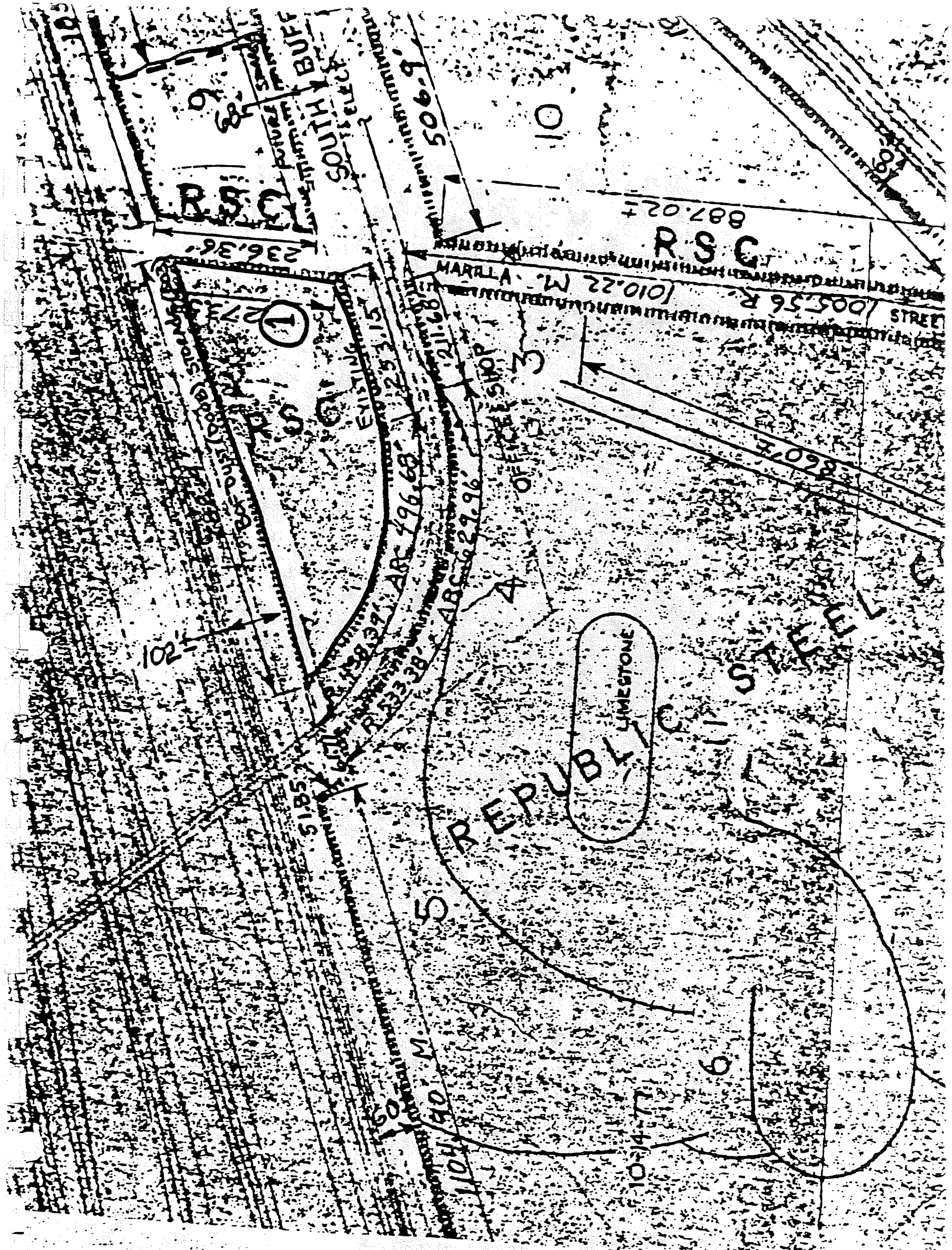
. NAME *(print or type)*	B. SIGNATURE	C. DATE SIGNED
P.N. WIGTON, Vice President Steel Operations		11-17-80

. OPERATOR CERTIFICATION

certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached ments, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the nitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, ncluding the possibility of fine and imprisonment.

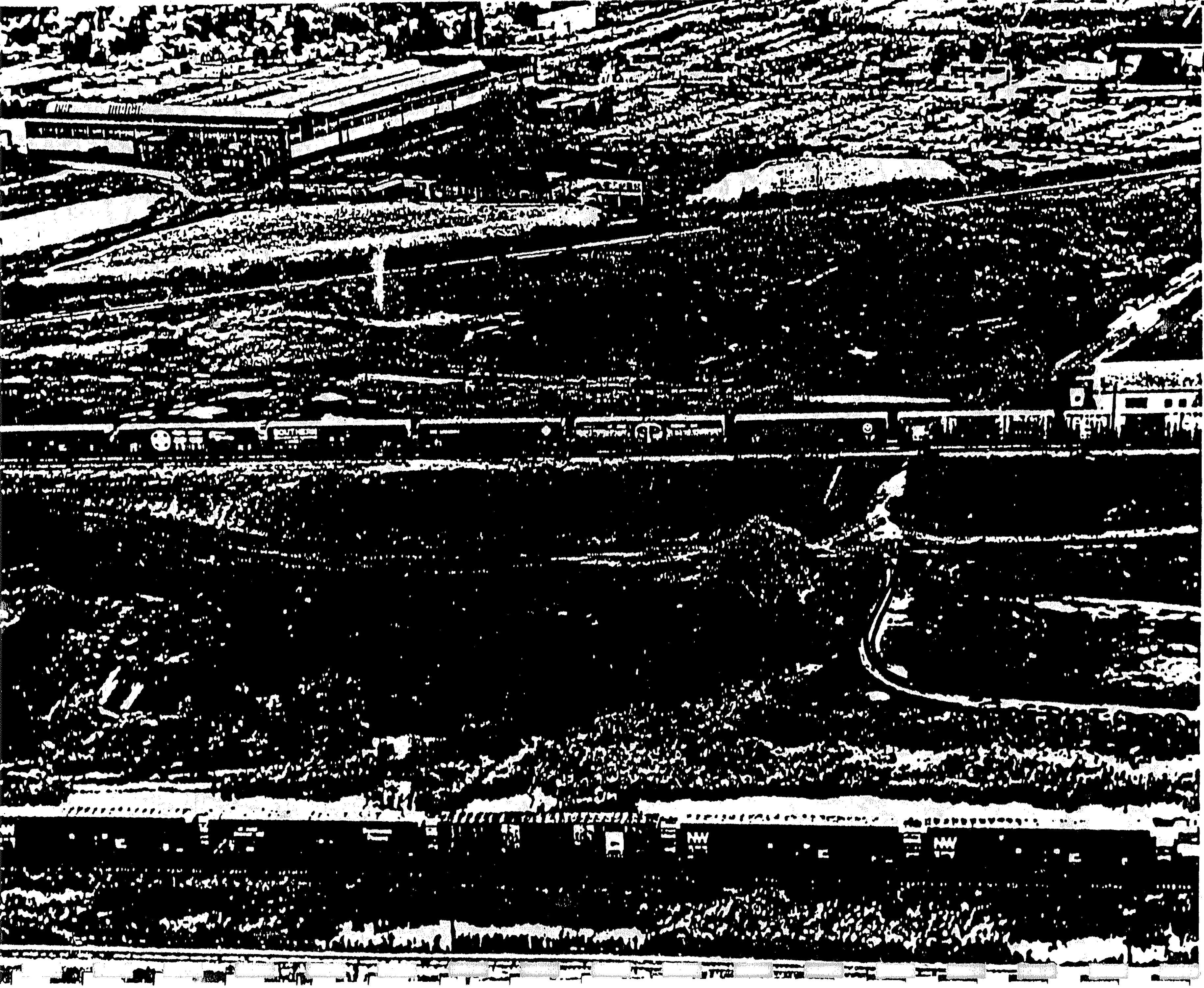
William C Hallett (Pres.)

. NAME *(print or type)*	B. SIGNATURE	C. DATE SIGNED
ALTER BECKWITH, CHIEF ENGINEER	Walter Beckwith	Nov. 6, 1980

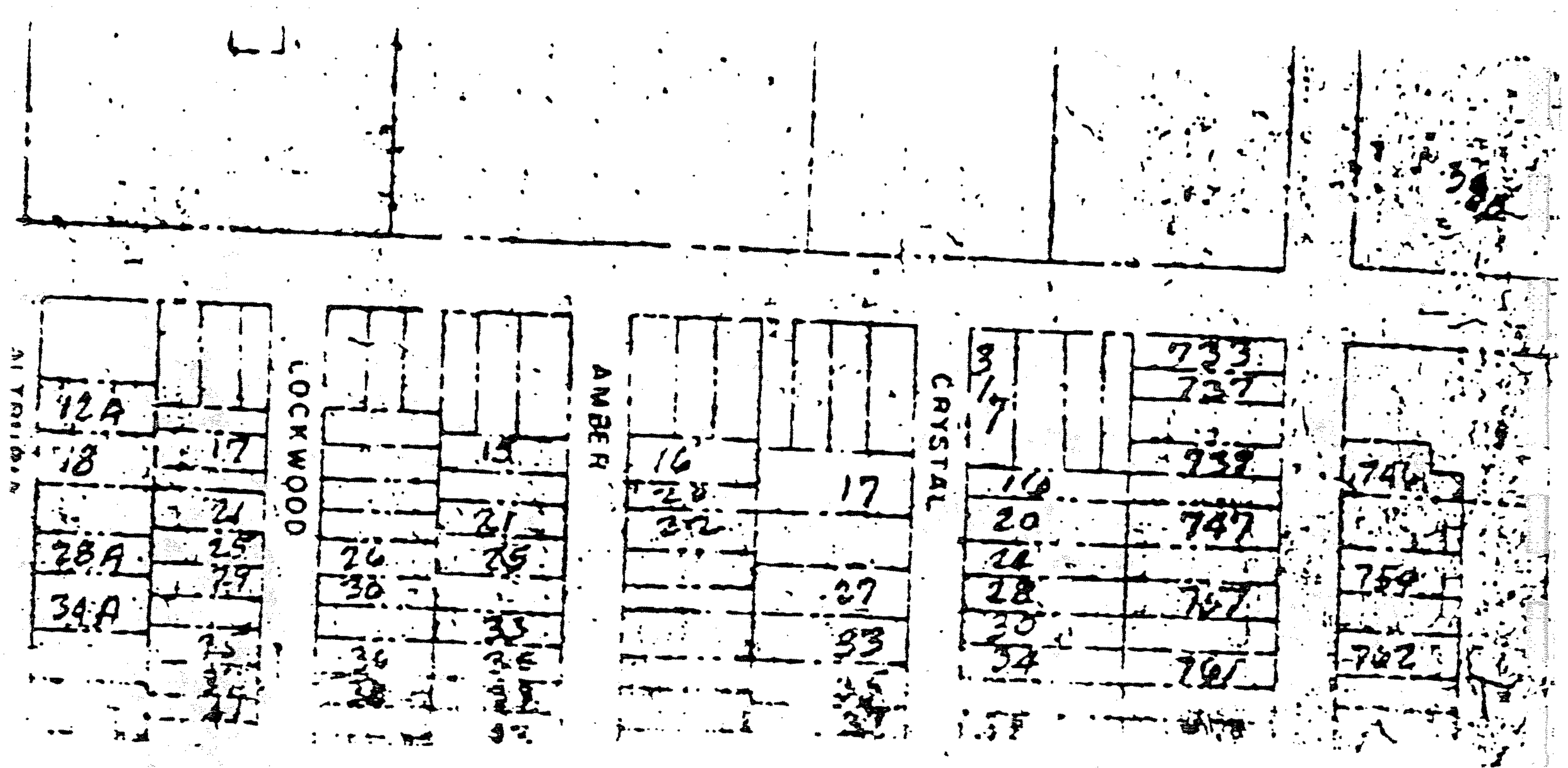


RSC
SOUTH BUFF
FUTURE
9
8
10
5069.9
887.02±
RSC
MARILLA
STREET
1010.22 M.
1005.56 R.
236.36'
①
RSC
EXISTING
253.15
211.28
OFFICE SHOP
3
860'
ARC 496.68'
ARC 629.96'
R 1839'
R 5333.8'
102'
5185
4
LIMESTONE
REPUBLIC STEEL C
5
6
7
1014.7
1040.90 M.
60'

REPUBLIC STEEL - BUFFALO DIVN
MARILLA STREET STORAGE AREA - FORM B
7/II
121



Form 3 Ia-II
1981



REPUBLIC STEEL - BUFFAL
MARILLA STREET STORAGE A
FORM 3 Item V 1 of 1

ENG-715 5-76 **ENGINEERING DRAWING COMPUTER INPUT**

DRAWING NUMBER			SEARCH ARGUMENT				
ALPHA	NUMERIC	ISSUE	DIST	CAT	DEPT	ITEM	DOC TYPE
A	3343	2	5	2	230	22	274

DRAWING TITLE

MARILLA STORAGE AREAS

MENSIONS

ISSUE OR REVISION		
No.	DATE	BY
1	5/11/78	MSJ
2	4-2-79	MSJ
3		
4		
5		
6		
7		
8		

REPUBLIC STEEL CORPORATION

DISTRICT. DIVISION BUFFALO PLANT. WORKS BUFFALO, N. Y.

DEPARTMENT GENERAL PLANT

ITEM MARILLA STREET STORAGE AREA

PROPERTY LINE DESCRIPTION

DESIGNATED STORAGE AREAS

LOCATED MAPS

SCALE

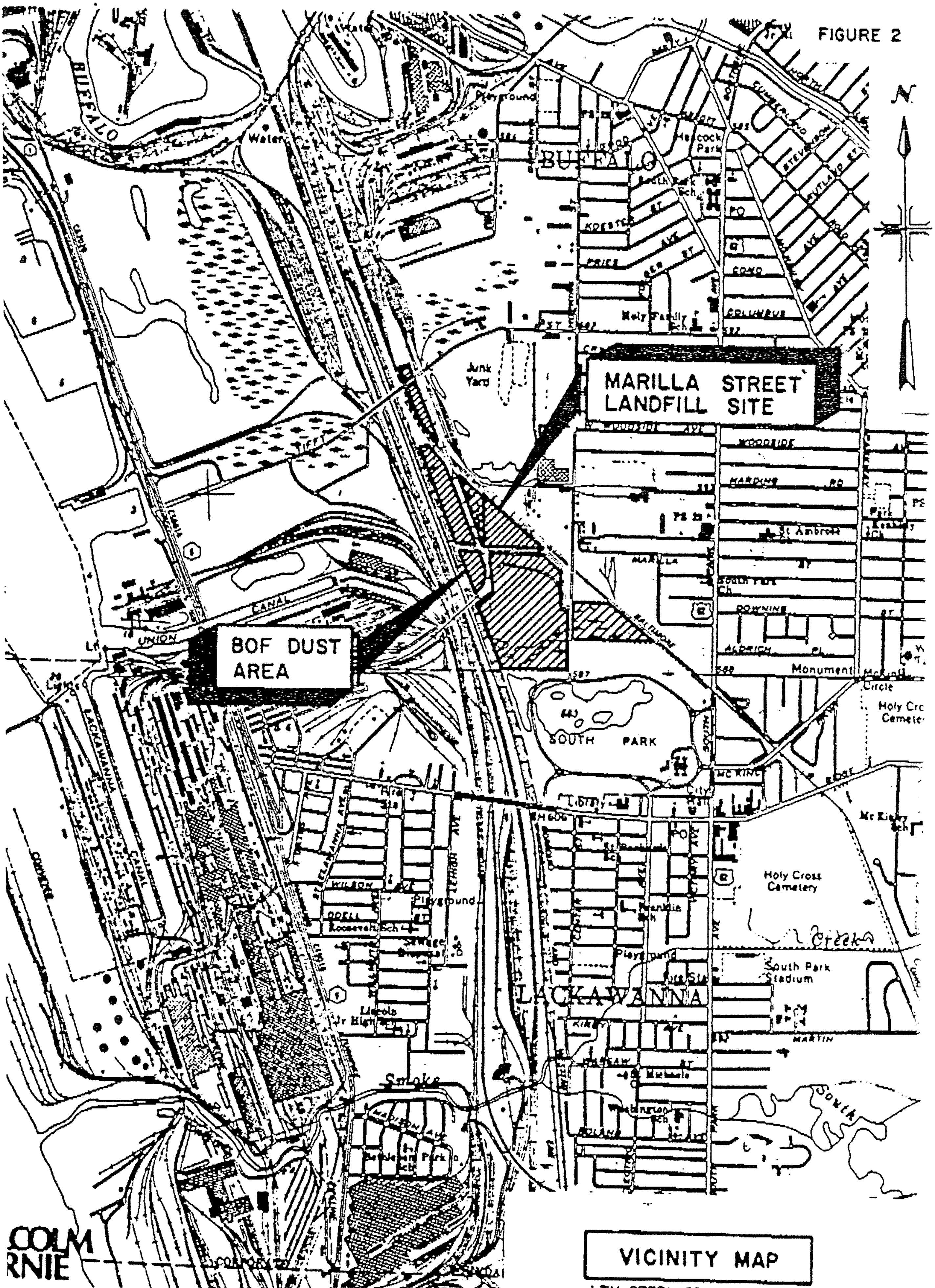
DRAWN G.C.H. DATE 10/27/77

CHECKED DATE

CHECKED SAFETY

A-3343

FIGURE 2



COLM
RNIE

VICINITY MAP

Certification Statement

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to be the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

11/8/85
Date

LTV Steel Company, Inc.
Buffalo, New York BOF Dust Area
Facility

J.T.
Signature of Executive Officer

Vice President Bar Division
Title

1301a

ase print or type in the unshaded areas only
l-in areas are spaced for elite type, i.e., 12 characters/inch).

Form Approved OMB No. 158-R0175

FORM 1 GENERAL

U.S. ENVIRONMENTAL PROTECTION AGENCY

GENERAL INFORMATION

Consolidated Permits Program
(Read the "General Instructions" before starting.)

I. EPA I.D. NUMBER

F N Y D 0 0 0 8 1 3 4 0 2 D

LABEL ITEMS

EPA I.D. NUMBER

. FACILITY NAME

FACILITY MAILING ADDRESS

FACILITY LOCATION

PLEASE PLACE LABEL IN THIS SPACE

GENERAL INSTRUCTIONS

If a preprinted label has been provided, affix it in the designated space. Review the information carefully; if any of it is incorrect, cross through it and enter the correct data in the appropriate fill—in area below. Also, if any of the preprinted data is absent *(the area to the left of the label space lists the information that should appear)*, please provide it in the proper fill—in area(s) below. If the label is complete and correct, you need not complete Items I, III, V, and VI *(except VI-B which must be completed regardless)*. Complete all items if no label has been provided. Refer to the instructions for detailed item descriptions and for the legal authorizations under which this data is collected.

POLLUTANT CHARACTERISTICS

NSTRUCTIONS: Complete A through J to determine whether you need to submit any permit application forms to the EPA. If you answer "yes" to any uestions, you must submit this form and the supplemental form listed in the parenthesis following the question. Mark "X" in the box in the third column the supplemental form is attached. If you answer "no" to each question, you need not submit any of these forms. You may answer "no" if your activity excluded from permit requirements; see Section C of the instructions. See also, Section D of the instructions for definitions of bold—faced terms.

SPECIFIC QUESTIONS	YES	NO	FORM ATTACHED	SPECIFIC QUESTIONS	YES	NO	FORM ATTACHED
. Is this facility a publicly owned treatment works which results in a discharge to waters of the U.S.? (FORM 2A)		X		B. Does or will this facility *(either existing or proposed)* include a concentrated animal feeding operation or aquatic animal production facility which results in a discharge to waters of the U.S.? (FORM 2B)		X	
Is this a facility which currently results in discharges to waters of the U.S. other than those described in A or B above? (FORM 2C)		X		D. Is this a proposed facility *(other than those described in A or B above)* which will result in a discharge to waters of the U.S.? (FORM 2D)		X	
Does or will this facility treat, store, or dispose of hazardous wastes? (FORM 3)	X		X	F. Do you or will you inject at this facility industrial or municipal effluent below the lowermost stratum containing, within one quarter mile of the well bore, underground sources of drinking water? (FORM 4)		X	
Do you or will you inject at this facility any produced water or other fluids which are brought to the surface in connection with conventional oil or natural gas production, inject fluids used for enhanced recovery of oil or natural gas, or inject fluids for storage of liquid hydrocarbons? (FORM 4)		X		H. Do you or will you inject at this facility fluids for special processes such as mining of sulfur by the Frasch process, solution mining of minerals, in situ combustion of fossil fuel, or recovery of geothermal energy? (FORM 4)		X	
Is this facility a proposed stationary source which is one of the 28 industrial categories listed in the instructions and which will potentially emit 100 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an attainment area? (FORM 5)		X		J. Is this facility a proposed stationary source which is NOT one of the 28 industrial categories listed in the instructions and which will potentially emit 250 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an attainment area? (FORM 5)		X	

NAME OF FACILITY

TV STEEL CO., INC. BUFFALO DISTRICT

FACILITY CONTACT

A. NAME & TITLE *(last, first, & title)*

SZUHAY LAWRENCE, MGR ENV. CONTROL

B. PHONE *(area code & no.)*

216 429 6475

ACILITY MAILING ADDRESS

A. STREET OR P.O. BOX

3100 EAST 45TH STREET

B. CITY OR TOWN

CLEVELAND

C. STATE

OH

D. ZIP CODE

44127

ACILITY LOCATION

A. STREET, ROUTE NO. OR OTHER SPECIFIC IDENTIFIER

HOPKINS AND MARILLA STREETS

B. COUNTY NAME

RIE

C. CITY OR TOWN

BUFFALO

D. STATE

NY

E. ZIP CODE

14220

F. COUNTY CODE *(if known)*

Form 3510-1 (6-80)

CONTINUE ON REVERSE

TINUED FROM THE FRONT

IC CODES (4-digit, in order of priority)

A. FIRST
3312 (specify) IRON AND STEEL PLANT

B. SECOND
C 7 (specify)

C. THIRD
(specify)

D. FOURTH
C 7 (specify)

OPERATOR INFORMATION

A. NAME
TV STEEL CO., INC.

B. Is the name listed in Item VIII-A also the owner? ☒ YES ☐ NO

C. STATUS OF OPERATOR (Enter the appropriate letter into the answer box; if "Other", specify.)
FEDERAL M = PUBLIC (other than federal or state)
STATE O = OTHER (specify)
PRIVATE
P (specify)

D. PHONE (area code & no.)
C A 216 622 5000

E. STREET OR P.O. BOX
O BOX 6778

F. CITY OR TOWN
CLEVELAND

G. STATE
OH

H. ZIP CODE
44101

IX. INDIAN LAND
Is the facility located on Indian lands? ☐ YES ☒ NO

ISTING ENVIRONMENTAL PERMITS

A. NPDES (Discharges to Surface Water)

D. PSD (Air Emissions from Proposed Sources)
9 P

UIC (Underground Injection of Fluids)

E. OTHER (specify)
C T I 9 DEC 915010212 (specify) NY DEC Permit Application for Solid Waste Mgmnt Facility

C. RCRA (Hazardous Wastes)

E. OTHER (specify)
C T I 9 (specify)

tach to this application a topographic map of the area extending to at least one mile beyond property boundaries. The map must show outline of the facility, the location of each of its existing and proposed intake and discharge structures, each of its hazardous waste ment, storage, or disposal facilities, and each well where it injects fluids underground. Include all springs, rivers and other surface bodies in the map area. See instructions for precise requirements.

NATURE OF BUSINESS (provide a brief description)

LTV STEEL Buffalo District utilizes a portion of the facilities at the Hopkins and Marilla Streets site as a reclamation site for by-products of the steel making process. These items include iron and steel making slags, refractory brick, mill scale and blast furnace dust. These items are all sold or reclaimed.

CERTIFICATION (see instructions)

tify under penalty of law that I have personally examined and am familiar with the information submitted in this application and all ments and that, based on my inquiry of those persons immediately responsible for obtaining the information contained in the ation, I believe that the information is true, accurate and complete. I am aware that there are significant penalties for submitting information, including the possibility of fine and imprisonment.

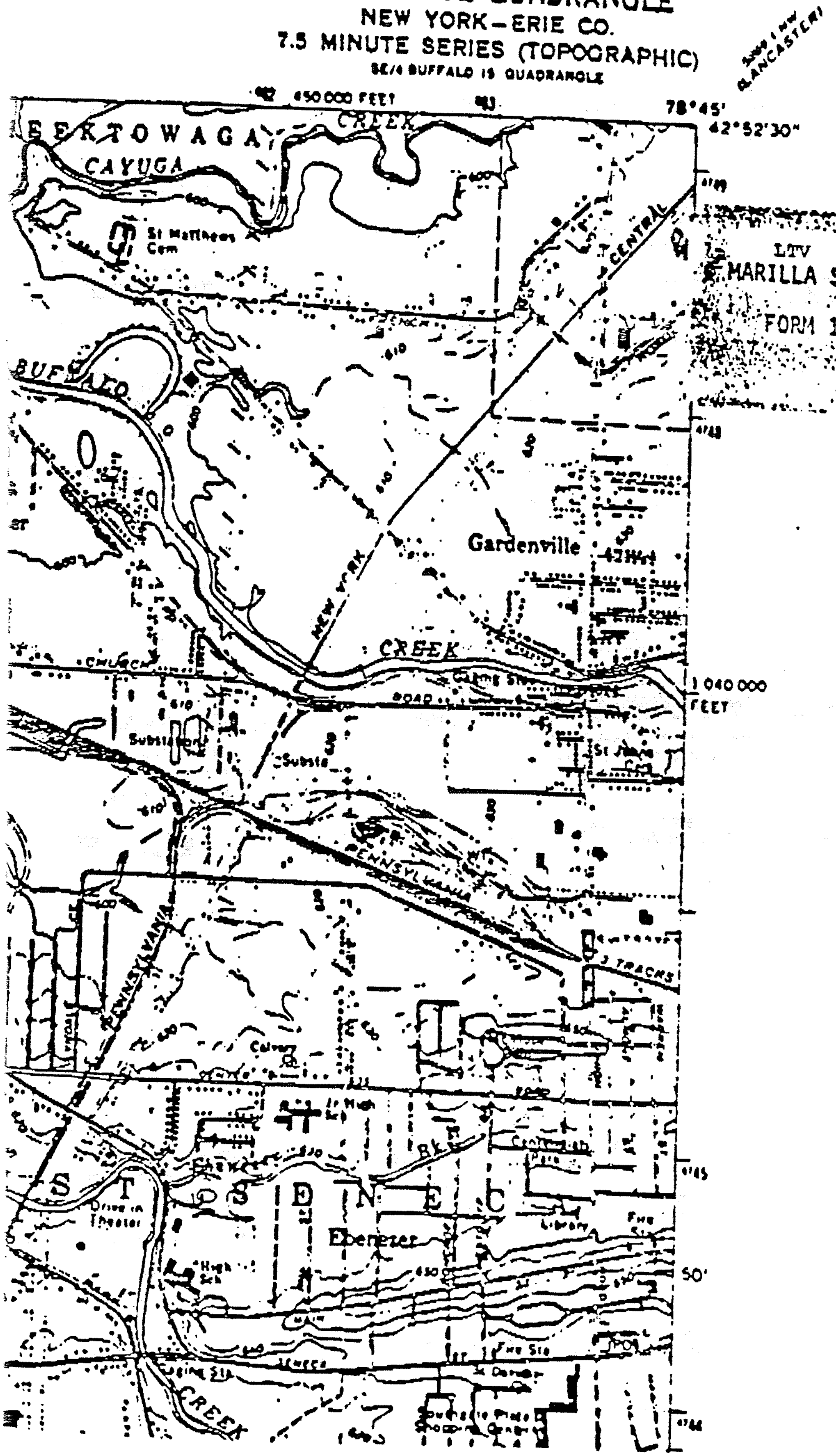
& OFFICIAL TITLE (type or print)
T. Anderson Vice President
Bar Division

B. SIGNATURE
A.T. Anderson

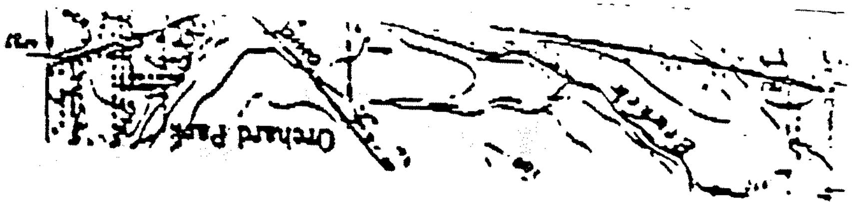
C. DATE SIGNED
11/6/85

ENTS FOR OFFICIAL USE ONLY

BUFFALO SE QUADRANGLE
NEW YORK-ERIE CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
SE/4 BUFFALO 15 QUADRANGLE



LTV STEEL BUFFALO DISTRICT
MARILLA STREET STORAGE AREA
FORM 1 ITEM XI 1 of 1


Orchard Park


50'
5969 IV NE
(BUFFALO NE)
PENNSYLVANIA
SENECA
CLINTON
RIVER
BUFFALO
REPUBLIC STEEL
MAIN PLANT
BUFFALO
WAREHOUSE
AREA
PRICE
COMO
COLUMBUS
Holy Family
CRYSTAL AVE
BLOOMFIELD AVE
LOCKWOOD AVE
WOODSIDE AVE
WOODSIDE
HARDING
RIDGEWOOD AVE
St Ambrose
Mercy Hospital
Heacock Park
CAZENOVIA
Golf Course
PARK
BALTIMORE
DISTILLA
STEEL
STORAGE
HWRK
503 for
DOCS BOF
DUST

Please print or type in the unshaded areas only
(fill—in areas are spaced for elite type, i.e., 12 characters/inch).

FORM 3 RCRA

U.S. ENVIRONMENTAL PROTECTION AGENCY

HAZARDOUS WASTE PERMIT APPLICATION

Consolidated Permits Program

(This information is required under Section 3005 of RCRA.)

Form Approved OMB No. 158-S80004

I. EPA I.D. NUMBER

F N Y D 0 0 0 8 1 3 4 0 2 1

FOR OFFICIAL USE ONLY

APPLICATION APPROVED	DATE RECEIVED (yr., mo., & day)	COMMENTS

II. FIRST OR REVISED APPLICATION

Place an "X" in the appropriate box in A or B below *(mark one box only)* to indicate whether this is the first application you are submitting for your facility or a revised application. If this is your first application and you already know your facility's EPA I.D. Number, or if this is a revised application, enter your facility's EPA I.D. Number in Item I above.

A. FIRST APPLICATION *(place an "X" below and provide the appropriate date)*

☐ 1. EXISTING FACILITY *(See instructions for definition of "existing" facility. Complete item below.)*

YR. ☐ MO. ☐ DAY ☐ FOR EXISTING FACILITIES, PROVIDE THE DATE *(yr., mo., & day)* OPERATION BEGAN OR THE DATE CONSTRUCTION COMMENCED *(use the boxes to the left)*

☐ 2. NEW FACILITY *(Complete item below.)*

YR. ☐ MO. ☐ DAY ☐ FOR NEW FACILITIES, PROVIDE THE DATE *(yr., mo., & day)* OPERATION BEGAN OR IS EXPECTED TO BEGIN

B. REVISED APPLICATION *(place an "X" below and complete Item I above)*

☒ 1. FACILITY HAS INTERIM STATUS

☐ 2. FACILITY HAS A RCRA PERMIT

III. PROCESSES – CODES AND DESIGN CAPACITIES

A. PROCESS CODE – Enter the code from the list of process codes below that best describes each process to be used at the facility. Ten lines are provided for entering codes. If more lines are needed, enter the code(s) in the space provided. If a process will be used that is not included in the list of codes below, then describe the process *(including its design capacity)* in the space provided on the form *(Item III-C)*.

B. PROCESS DESIGN CAPACITY – For each code entered in column A enter the capacity of the process.

1. AMOUNT – Enter the amount.
2. UNIT OF MEASURE – For each amount entered in column B(1), enter the code from the list of unit measure codes below that describes the unit of measure used. Only the units of measure that are listed below should be used.

PROCESS	PROCESS CODE	APPROPRIATE UNITS OF MEASURE FOR PROCESS DESIGN CAPACITY
Storage:		
CONTAINER *(barrel, drum, etc.)*	S01	GALLONS OR LITERS
TANK	S02	GALLONS OR LITERS
WASTE PILE	S03	CUBIC YARDS OR CUBIC METERS
SURFACE IMPOUNDMENT	S04	GALLONS OR LITERS
Disposal:		
INJECTION WELL	D79	GALLONS OR LITERS
LANDFILL	D80	ACRE-FEET *(the volume that would cover one acre to a depth of one foot)* OR HECTARE-METER
LAND APPLICATION	D81	ACRES OR HECTARES
OCEAN DISPOSAL	D82	GALLONS PER DAY OR LITERS PER DAY
SURFACE IMPOUNDMENT	D83	GALLONS OR LITERS

PROCESS	PROCESS CODE	APPROPRIATE UNITS OF MEASURE FOR PROCESS DESIGN CAPACITY
Treatment:		
TANK	T01	GALLONS PER DAY OR LITERS PER DAY
SURFACE IMPOUNDMENT	T02	GALLONS PER DAY OR LITERS PER DAY
INCINERATOR	T03	TONS PER HOUR OR METRIC TONS PER HOUR; GALLONS PER HOUR OR LITERS PER HOUR
OTHER *(Use for physical, chemical, thermal or biological treatment processes not occurring in tanks, surface impoundments or incinerators. Describe the processes in the space provided; Item III-C.)*	T04	GALLONS PER DAY OR LITERS PER DAY

UNIT OF MEASURE	UNIT OF MEASURE CODE
GALLONS	G
LITERS	L
CUBIC YARDS	Y
CUBIC METERS	C
GALLONS PER DAY	U

UNIT OF MEASURE	UNIT OF MEASURE CODE
LITERS PER DAY	V
TONS PER HOUR	D
METRIC TONS PER HOUR	W
GALLONS PER HOUR	E
LITERS PER HOUR	H

UNIT OF MEASURE	UNIT OF MEASURE CODE
ACRE-FEET	A
HECTARE-METER	F
ACRES	B
HECTARES	Q

XAMPLE FOR COMPLETING ITEM III *(shown in line numbers X-1 and X-2 below)*: A facility has two storage tanks, one tank can hold 200 gallons and the ther can hold 400 gallons. The facility also has an incinerator that can burn up to 20 gallons per hour.

DUP T/A C 1

NUMBER	A. PROCESS CODE (from list above)	B. PROCESS DESIGN CAPACITY 1. AMOUNT (specify)	2. UNIT OF MEASURE (enter code)	FOR OFFICIAL USE ONLY	LINE NUMBER	A. PROCESS CODE (from list above)	B. PROCESS DESIGN CAPACITY 1. AMOUNT	2. UNIT OF MEASURE (enter code)	FOR OFFICIAL USE ONLY
1	S02	600	G		5				
2	T03	20	E		6				
	D80	84.7	A		7				
					8				
					9				
					10				

A Form 3510-3 (6-80)

CONTINUE ON REVERSE

·ntinued from the front.

PROCESSES *(continued)*

·PACE FOR ADDITIONAL PROCESS CODES OR FOR DESCRIBING OTHER PROCESSES *(code "T04")*. FOR EACH PROCESS ENTERED HERE ·CLUDE DESIGN CAPACITY.

·ESCRIPTION OF HAZARDOUS WASTES

A HAZARDOUS WASTE NUMBER — Enter the four—digit number from 40 CFR, Subpart D for each listed hazardous waste you will handle. If you ·andle hazardous wastes which are not listed in 40 CFR, Subpart D, enter the four—digit number*(s)* from 40 CFR, Subpart C that describes the characteris- ·ics and/or the toxic contaminants of those hazardous wastes.

·TIMATED ANNUAL QUANTITY — For each listed waste entered in column A estimate the quantity of that waste that will be handled on an annual ·s. For each characteristic or toxic contaminant entered in column A estimate the total annual quantity of all the non—listed waste*(s)* that will be handled ·hich posses that characteristic or contaminant.

·IT OF MEASURE — For each quantity entered in column B enter the unit of measure code. Units of measure which must be used and the appropriate ·s are:

ENGLISH UNIT OF MEASURE	CODE	METRIC UNIT OF MEASURE	CODE
POUNDS	P	KILOGRAMS	K
TONS	T	METRIC TONS	M

·cility records use any other unit of measure for quantity, the units of measure must be converted into one of the required units of measure taking into ·unt the appropriate density or specific gravity of the waste.

·ROCESSES

·ROCESS CODES:

·or listed hazardous waste: For each listed hazardous waste entered in column A select the code*(s)* from the list of process codes contained in Item III ·o indicate how the waste will be stored, treated, and/or disposed of at the facility.

For non—listed hazardous wastes: For each characteristic or toxic contaminant entered in column A, select the code*(s)* from the list of process codes contained in Item III to indicate all the processes that will be used to store, treat, and/or dispose of all the non—listed hazardous wastes that possess ·hat characteristic or toxic contaminant.

·lote: Four spaces are provided for entering process codes. If more are needed: (1) Enter the first three as described above; (2) Enter "000" in the ·xtreme right box of Item IV-D(1); and (3) Enter in the space provided on page 4, the line number and the additional code*(s)*.

·. PROCESS DESCRIPTION: If a code is not listed for a process that will be used, describe the process in the space provided on the form.

HAZARDOUS WASTES DESCRIBED BY MORE THAN ONE EPA HAZARDOUS WASTE NUMBER — Hazardous wastes that can be described by ·n one EPA Hazardous Waste Number shall be described on the form as follows:

·elect one of the EPA Hazardous Waste Numbers and enter it in column A. On the same line complete columns B,C, and D by estimating the total annual quantity of the waste and describing all the processes to be used to treat, store, and/or dispose of the waste.

In column A of the next line enter the other EPA Hazardous Waste Number that can be used to describe the waste. In column D(2) on that line enter ·included with above" and make no other entries on that line.

·epeat step 2 for each other EPA Hazardous Waste Number that can be used to describe the hazardous waste.

·MPLE FOR COMPLETING ITEM IV *(shown in line numbers X-1, X-2, X-3, and X-4 below)* — A facility will treat and dispose of an estimated 900 pounds ·er of chrome shavings from leather tanning and finishing operation. In addition, the facility will treat and dispose of three non—listed wastes. Two wastes ·sive only and there will be an estimated 200 pounds per year of each waste. The other waste is corrosive and ignitable and there will be an estimated ·nds per year of that waste. Treatment will be in an incinerator and disposal will be in a landfill.

A. EPA HAZARD. WASTE NO (·ter code)	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (enter code)	D. PROCESSES 1. PROCESS CODES (enter)	D. PROCESSES 2. PROCESS DESCRIPTION (if a code is not entered in D(1))
0 5 4	900	P	T 0 3 D 8 0	
0 0 2	400	P	T 0 3 D 8 0	
D 0 0 1	100	P	T 0 3 D 8 0	
0 0 2				Included with above

·orm 3510-3 (6-80)

CONTINUE ON PAGE 3

ontinued from page 2.
OTE: Photocopy this page before completing if you have more than 26 wastes to list.

Form Approved OMB No. 158-S80004

EPA I.D. NUMBER (enter from page 1)	T/A C	FOR OFFICIAL USE ONLY		T/A C	
NYD000813402	1	W	DUP	2	DUP

IV. DESCRIPTION OF HAZARDOUS WASTES (continued)

LINE NO.	A. EPA HAZARD. WASTE NO. (enter code)	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (enter code)	D. PROCESSES 1. PROCESS CODES (enter)				2. PROCESS DESCRIPTION (if a code is not entered in D(1))
1	D008	0		D80				The BOF Dust and slag landfill is at capacity and the wastes are no longer generated.
2								
3								
4								
5								
6								
7								
8								
9								
10								
1								
2								
3								
4								
5								
6								
7								
8								
9								
0								
1								
2								
3								
4								
5								
6								

A Form 3510-3 (6-80)

PAGE 3 ____ OF 5
(enter "A", "B", "C", etc. behind the "3" to identify photocopied pages)

CONTINUE ON REVERSE

ıued from the front.

DESCRIPTION OF HAZARDOUS WASTES *(continued)*

USE THIS SPACE TO LIST ADDITIONAL PROCESS CODES FROM ITEM D(1) ON PAGE 3.

EPA I.D. NO. *(enter from page 1)*

Y	D	0	0	0	8	1	3	4	0	2	6

FACILITY DRAWING

ıisting facilities must include in the space provided on page 5 a scale drawing of the facility *(see instructions for more detail).*

HOTOGRAPHS

existing facilities must include photographs *(aerial or ground–level)* that clearly delineate all existing structures; existing storage, atment and disposal areas; and sites of future storage, treatment or disposal areas *(see instructions for more detail).*

FACILITY GEOGRAPHIC LOCATION

LATITUDE *(degrees, minutes, & seconds)*	LONGITUDE *(degrees, minutes, & seconds)*
42 50 020	073 50 000

FACILITY OWNER

A. If the facility owner is also the facility operator as listed in Section VIII on Form 1, "General Information", place an "X" in the box to the left and skip to Section IX below.

ı. If the facility owner is not the facility operator as listed in Section VIII on Form 1, complete the following items:

1. NAME OF FACILITY'S LEGAL OWNER

2. PHONE NO. *(area code & no.)*

3. STREET OR P.O. BOX

4. CITY OR TOWN G

5. ST.

6. ZIP CODE

WNER CERTIFICATION

rtify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached ıments, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the ıtted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, ıding the possibility of fine and imprisonment.

IAME *(print or type)*	B. SIGNATURE	C. DATE SIGNED
J. T. Anderson	J T Anderson	11/6/85

OPERATOR CERTIFICATION

fy under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached ıents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the ıitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, uding the possibility of fine and imprisonment.

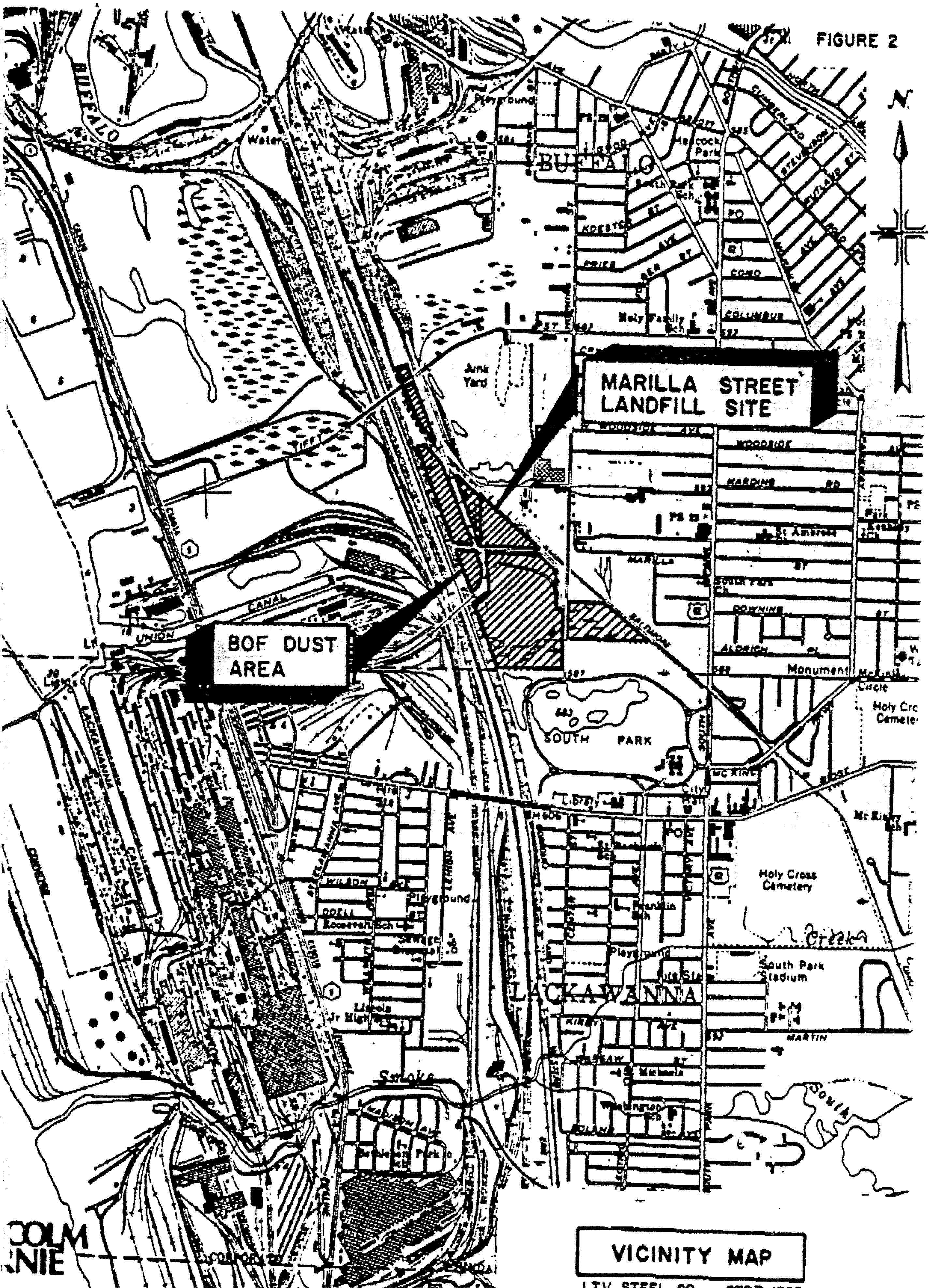
ME *(print or type)*	B. SIGNATURE	C. DATE SIGNED

CONTINUE ON PAGE 5

SEE ATTACHMENTS.

See Figure 1-1 through Figure 1-3 of attached closure plan.

FIGURE 2



VICINITY MAP

LTV STEEL CO.

Certification Statement

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to be the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

11/8/85
Date

LTV Steel Company, Inc.
Buffalo, New York BOF Dust Area
Facility

J. T. Anderson
Signature of Executive Officer

Vice President Bar Division
Title

APPENDIX B

BORING AND MONITORING WELL LOGS

NOTE: WELLS ABONDONED
DUE TO VANDALISM

EARTH DIMENSIONS, INC.

Test Borings and Logs
797 Center Street • East Aurora, New York 14052 • (716) 655-1717

HOLE NO 1

SURF ELEV 586.77

4G79

PROJECT Republic Steel - Monitoring well installation South Buffalo, New York

LOCATION See survey

CLIENT McPhee, Smith, Rosenstein Engineers, PC

DATE STARTED 7/18/79 COMPLETED 7/18/

DEPTH (feet)	SAMPLE NO	BLOWS ON SAMPLER					DESCRIPTION & CLASSIFICATION	WELL	WATER TABLE & REMARKS
	1	5	8	9	12	17	Slightly moist dark brown silt loam (SANDY-SILT) topsoil, granular 0.9	2 inch PVC pipe Bentonite	Sample #1 bridges contact. 2.0
							Moist distinctly [redacted] yellowish brown coarse (SANDY-SILT), friable,		
							- - - - grades downward to - - - - - - 3.0		3.0
	2	7	7	9		16	Moist to extremely [redacted] medium consistance, slightly plastic		
5									5.0
							- - - - - - clear transition to - - - - 6.5		2 wells installe both with 3 ft. sand followed by ft. of bentonite
	3	8	12	15		27	Moist dark brownish gray silt loam (SANDY-SILT), firm, slightly plastic to nonplastic, massive structure		Mostly silty lak sediments to end of boring.
10									
	4	8	22	20		42			
15									
							- - - - - - clear transition to - - - 16.0		17.0 18.0
20	5	3	4	4		8	Extremely moist dark gray silty clay (CLAYEY-SILT), soft, plastic and cohesive 20.0	Well Screen Sand Pack	[redacted]

Bore completed at 20.0 feet.

dew

N = NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLC

EARTH DIMENSIONS, INC.

Test Borings and Logs
797 Center Street • East Aurora, New York 14052 • (716) 655-1717

HOLE NO. 2

SURF. ELEV. 582.

4G79 PROJECT Republic Steel - Monitoring well installation South Buffalo, New York

LOCATION See survey (Southern bore

CLIENT McPhee, Smith, Rosenstein Engineeers,PC

DATE STARTED 7/16/79 COMPLETED 7/1

DEPTH (feet)	SAMPLE NO	BLOWS ON SAMPLER				N	DESCRIPTION & CLASSIFICATION	WELL	WATER TABLE & REMARKS
							Black extremely moist rubble and muck 0.4	2 inch PVC pipe Bentonite	
							Hardened slag fill 3.9	Sand	2.0 2.0 3.
5	1	5	2	2		4	Extremely moist to wet black silty muck soil, soft with stem and root matter		5.0 5.0
	2	2	5	15		20		Bentonite	Layer of ha slag appears underly pon southern si site.
	3	7	12	15		27	7.5		
10	4	6	8	12		20	Moist to extremely moist highly mottled greenish brown to brown silty clay loam (CLAYEY-SILT) with vertical desiccation cracks and thin to medium size silt lenses, firm, plastic		Solidified fill to 3.9 over wet muck 7.5 ft. ove ty and clay lake sediment 20.0 ft. ov cial till (
15	5	5	6	7		13	- - - clear transition to - - - - 11.0 Extremely moist to wet dark brownish gray silty clay (CLAYEY-SILT), soft, plastic 20.0		
							Wet dark grayish brown silty clay loam (CLAYEY-SILT) with 10% firm and medium subangular dolomitic gravel, soft, plastic to slightly plastic 22.5		Water 0.5 f surface at co tion.
20	6	4	3	3		6	Moist dark grayish brown heavy silt loam (CLAYEY-SILT) with 15% dolomitic gravel, very firm in place, slightly plastic	Well Screen Sand Pack	21.0 21.5 Boring co ted at 2 ft.
25	7	40	44			84			24.0
							Boring completed at 24.0 feet.		

dew

N = NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER

BY Duane R. Lenhardt, Geologist

SHEET 1 OF 1

EARTH DIMENSIONS, INC.

Test Borings and Logs
797 Center Street • East Aurora, New York 14052 • (716) 655-1717

HOLE NO 3

SURF ELEV 580.64

4G79 PROJECT Republic Steel - Monitoring well installation South Buffalo, New York

LOCATION See survey (near southeast of northern pond)

CLIENT McPhee, Smith, Rosenstein Engineers, PC DATE STARTED 7/20/79 COMPLETED 7/

DEPTH (feet)	SAMPLE NO.	BLOWS ON SAMPLER					DESCRIPTION & CLASSIFICATION	WELL		WATER TABLE & REMARKS
							Wet mixed industrial fill including cindery flyash, slag and brick fragments, loose 3.5	2 inch PVC pipe	Bentonite	
							Wet black organic rich silt loam (SANDY-SILT), soft, nonplastic 4.5			Original sur zone.
5	1	3	3	3		6	Wet greenish to yellowish brown coarse silt loam (SANDY-SILT), very friable, nonplastic 6.5			Industrial f to 3.5 ft. o silty lake s ments to 12. over loamy d glacial till 13.7 ft. ove bedrock.
	2	5	7	9	12	16	Extremely moist to moist highly mottled grayish brown silty clay loam (CLAYEY-SILT) with finely laminated structure, medium to firm consistance, plastic			
10							------ grades downward to ------ 10.0			
	3	2	2	3	4	5	Extremely moist reddish to grayish brown silty clay (CLAYEY-SILT) with thin silt lenses, soft to medium consistance, plastic, cohesive 12.0		11.0	
									12.0	Auger resis noted at 1 ft.
	4	3	4	79/3			Wet dark brownish gray gravelly loam (CLAY-SAND-SILT) till with 20-25% fine & medium gravel, soft, slightly plastic 13.7	Well Screen	Sand Pack	
	5						Weathered gray fissile shale, thin bedded 14.0		14.0	
15							[redacted]			Water at sur at completio

dew N = NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BL

[illegible] R. Lombardt, Geologist

NOTE: WELLS ABANDONED DUE TO VANDALISM

EARTH DIMENSIONS, INC.
Test Borings and Logs
787 Center Street • East Aurora, New York 14052 • (716) 655-1717

4G79

HOLE NO. 4

PROJECT Republic Steel - Monitoring well installation South Buffalo, New York

CLIENT McPhee, Smith, Rosenstein Engineers, PC

SURF. ELEV 584.(

LOCATION See survey (westward flowing drainage ditch)

DATE STARTED 7/7/79 COMPLETED 7/

DEPTH (feet)	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	N	DESCRIPTION & CLASSIFICATION	WELL	WATER TABLE & REMARKS
	1	1	1	2	3	5	Extremely moist to wet black cindery flyash fill, loose 2.0	2 inch PVC pipe Bentonite	
	2	3	3	3		6	Extremely moist black organic silt loam (SANDY-SILT) topsoil, very friable, nonplastic 3.5		
							---- clear transition to -----		4.0
5							Extremely moist yellowish brown fine sandy loam (SILTY-SAND), very friable, nonplastic 6.0		5.0
							---- grades downward to -----		
	3	11	11	11		22	[redacted] 9.5		7.0 7.5
10	4	5	6	7		13	Moist dark brownish gray silty clay loam (CLAYEY-SILT) with very thin silt lenses, medium to firm consistence, plastic 15.0		Industria 2.0 ft. ov water sorte sands at ft. over lake sedime to 19.0 ft dense loa cial till of boring.
15							---- grades downward to -----		
	5	2	2	3		5	Extremely moist dark brownish gray silty clay (CLAYEY-SILT), soft, plastic with occasional fine gravel fragments 19.0		[redacted] 19.0
20	6	2	15	56	42	71	Wet becoming moist downward dark grayish brown loam (CLAY-SAND-SILT) till with 15% fine and medium gravel, very firm in place, nonplastic 21.5	Well Screen Sand Pack	20.0 22.0
	7	59	47				Weathered shale bedrock, fissile, thin bedded 22.5		22.5
25							Boring completed at 22.5 feet.		

dew

N = NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER

Duane R. Lenhardt Geologist

EARTH DIMENSIONS, INC.
Test Borings and Logs
797 Center Street • East Aurora, New York 14052 • (716) 655-1717

4G79

HOLE NO. 5

SURF. ELEV. 534.13

PROJECT Republic Steel - Monitoring well installation South Buffalo, New York

LOCATION See survey

CLIENT McPhee, Smith, Rosenstein Engineers, PC

DATE STARTED 7/20/79

COMPLETED 7/2

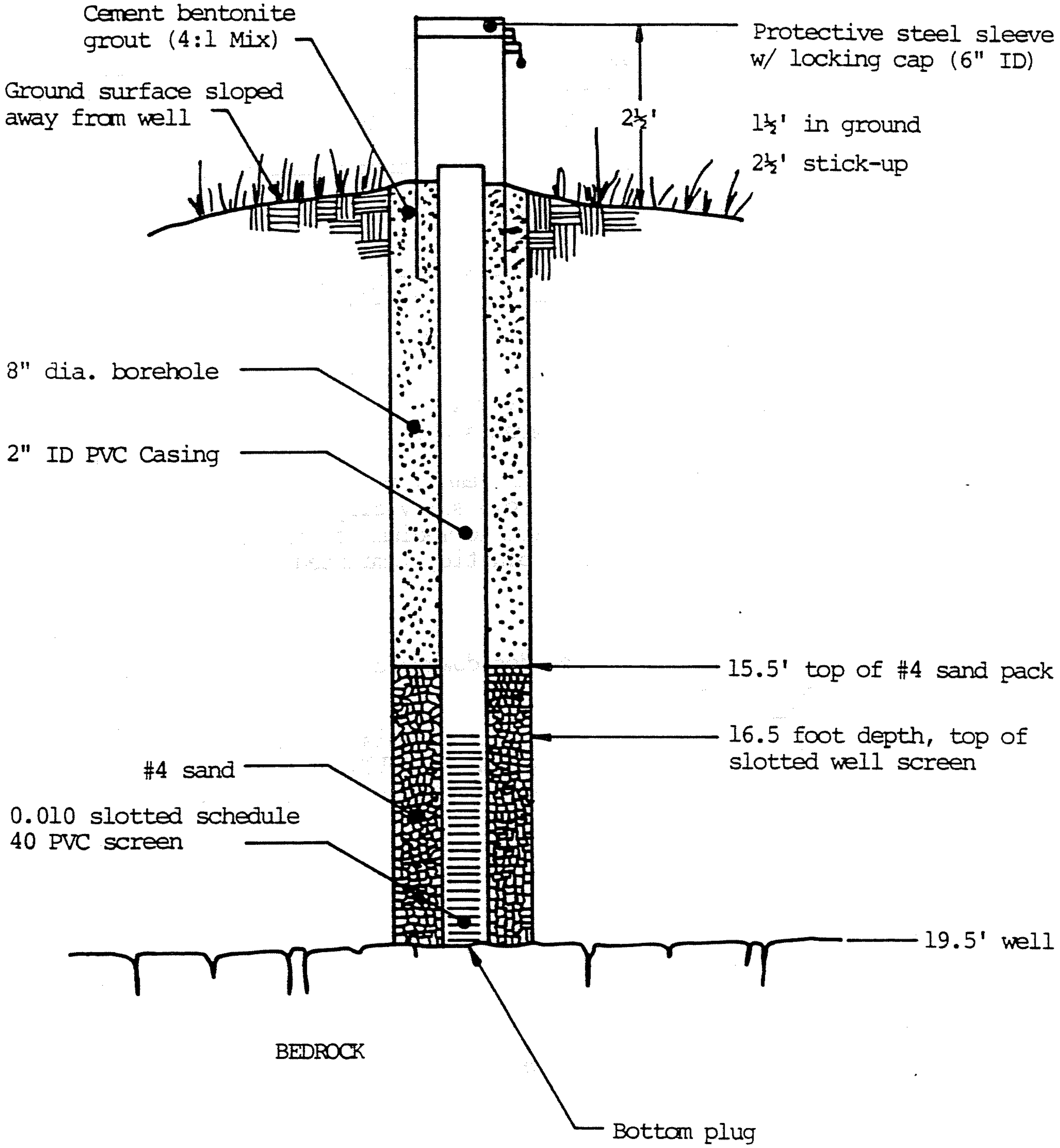
DEPTH (feet)	SAMPLE NO	BLOWS ON SAMPLER					DESCRIPTION & CLASSIFICATION	WELL	WATER TABLE & REMARKS
	1	3	5	6	9	11	Extremely moist black organic rich silt loam (SANDY-SILT), granular		
							1.2		
							Extremely moist highly mottled yellowish brown coarse silt loam (SANDY-SILT), very friable, nonplastic		2.0
	2	7	9	13		22	---- grades downward to ---- 2.5		3.0
5							Moist to extremely moist distinctly mottled brown silty clay loam (CLAYEY-SILT), firm to medium consistance, slightly plastic, lamianted		5.0
							---- grades downward to ---- 6.5	2 inch PVC pipe Bentonite	
	3	8	12	14		26	Extremely moist grayish brown heavy silt loam (CLAYEY-SILT), massive structure, slightly plastic, medium consistance		Original su on edge of pressional along Marill Street. Silty lake ments to the of bore.
10									
	4	5	6	8		14			
							---- grades downward to ---- 13.0		
							Extremely moist dark grayish brown silty clay loam (CLAYEY-SILT), soft, plastic, cohesive		
15									15.0
									16.0
								Well Screen Sand Pack	18.0
20	5	2	3	3	4	6	20.0	[redacted]	

dew

Boring completed at 20.0 feet.

N = NUMBER OF BLOWS TO DRIVE --- " SPOON --- " WITH --- lb. WT. FALLING --- " PER BL

Duane R. Lenhardt, Geologist



MALCOLM PIRNIE

MONITORING WELL DETAIL FOR WELL NO. 4A

REPUBLIC STEEL SEPTEMBER 1984

EARTH DIMENSIONS, INC.

Test Borings and Logs
East Aurora, New York 14052 • (716) 655-1717

MONITORING WELLS 6A & 6B

SURF. ELEV. ________

PROJECT 4G79b: Monitoring well installation Republic Steel landfill, South Buffalo, N.Y.

LOCATION: Landfill area east side of Hopkins Road

CLIENT: Malcolm Pirnie, Inc.

DATE STARTED: 8/16/84

COMPLETED: 8/16/84

DEPTH feet	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	N	DESCRIPTION & CLASSIFICATION
	1	12	22	70		92	Moist black gravelly sandy loam (SILTY-SAND) fill with 15 to 40% slag and cindery fill, very dense 3.5
5	2	9	14	23	34	37	Extremely moist black gravelly sandy loam (SILTY-SAND) fill with 15 to 40% slag and cindery fill, dense 7.0
	3	9	12	6	5	18	Moist to extremely moist black silt loam (CLAYEY-SILT) original topsoil, compact 9.0
10	4	6	11	17	20	28	Moist to extremely moist distinctly mottled olive brown silt loam (CLAYEY-SILT), very stiff, thinly laminated with coarse silt-fine sand interlayers ¼ to 2" thick - - - - - - clear transition to - - - 12.0
	5	2	9	16	23	25	Extremely moist faintly mottled olive brown silty clay loam (CLAYEY-SILT), very stiff, thinly laminated with very thin coarse silt lenses - - - - clear transition to - - - 13.0
15	6	6	19	27	32	46	Moist faintly mottled olive brown silty clay loam (CLAYEY-SILT), hard, thinly laminated with occasional very thin coarse silt lenses

WELL 6A

Two inch inside diameter PVC pipe

Cement/bentonite grout

15.2

(1)

16.2

#4 sand

WATER TABLE & REMARKS

Soil and slaggy fill to 7.0 feet over silty lake sediment to 12.0 feet over clayey lake sediment to end of boring.

(1) Granular bentonite

Cont. on sheet 2...

WE
6

2 inch inside diameter PVC pipe

8.5

9.5

11.0

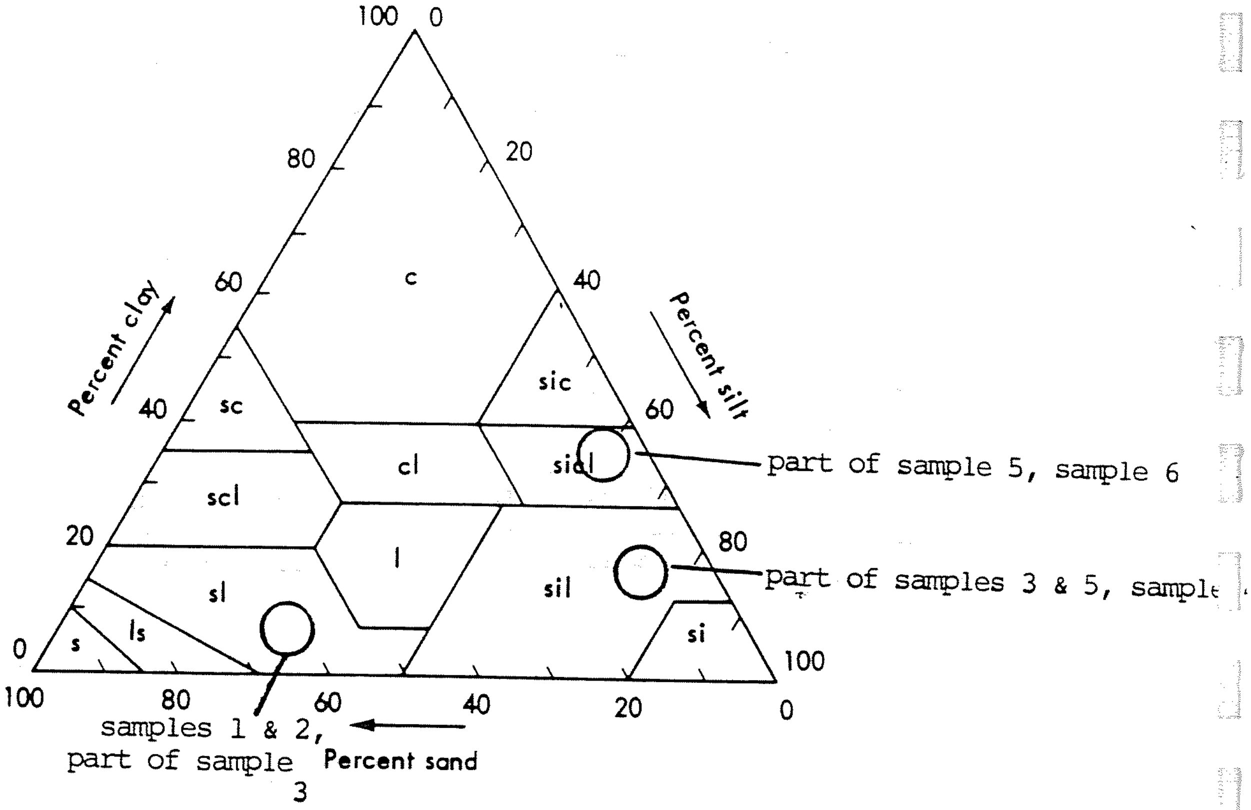
Screen

13.0

N = NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW.

4G79b

MONITORING WELLS 6A & 6B



c	Clay	scl	Sandy clay loam
si	Silt	sicl	Silty clay loam
s	Sand	cl	Clay loam
l	Loam	sil	Silt loam
sc	Sandy clay	sl	Sandy loam
sic	Silty clay	ls	Loamy sand

Textural triangle showing the percentages of clay (less than 0.002 mm), silt (0.002-0.05 mm), and sand (0.05-2.0 mm) in the basic soil textural classes (adapted from Soil Survey Staff, 1951).

ESTIMATED FIELD TEXTURES

MONITORING WELLS 6A & 6B continued

SURF. ELEV. ____________

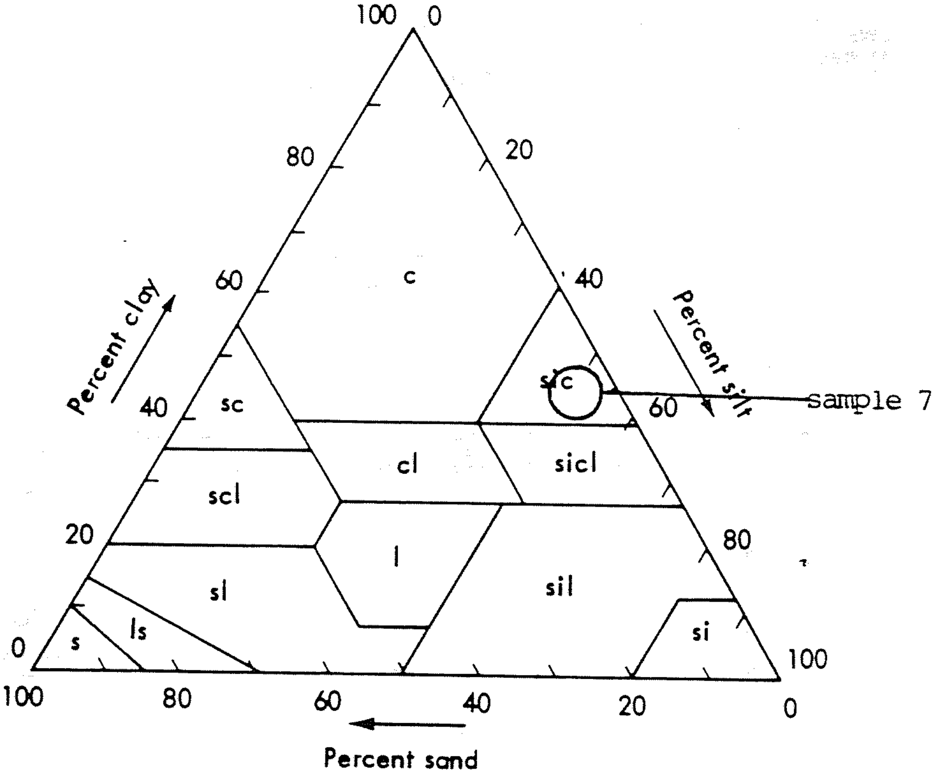
PROJECT Monitoring well installation
4G79b Republic Steel landfill, South Buffalo, N.Y.
CLIENT Malcolm Pirnie, Inc.

LOCATION Landfill area east side of Hopkins Road
DATE STARTED 8/16/84 COMPLETED 8/16/8

DEPTH feet	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	N	DESCRIPTION & CLASSIFICATION	WELL 6A	WATER TABLE & REMARKS
							Moist faintly mottled olive brown silty clay loam (CLAYEY-SILT), hard, thinly laminated with occasional very thin coarse silt lenses - - - - grades downward to - - - 19.0	2" ID PVC pipe # 4 size sand	
20	7	WR	5	8	11	13	Wet dark gray silty clay (CLAYEY-SILT), stiff, thinly laminated	21.5 Screen 23.5 Soil backfill	WR - sampler penetration with weight rods only.
							24.5	24.5	
25							Sampling completed at 21.5 feet. Augered to 24.5 feet. Hole collapsed to 23.5 feet after pulling augers back to 10.0 feet. Augered well 6B to 13.0 feet.	No water at completion.	
30									
35									

N = NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW.

MONITORING WELLS 6A & 6B continued



c	Clay	scl	Sandy clay loam
si	Silt	sicl	Silty clay loam
s	Sand	cl	Clay loam
l	Loam	sil	Silt loam
sc	Sandy clay	sl	Sandy loam
sic	Silty clay	ls	Loamy sand

Textural triangle showing the percentages of clay (less than 0.002 mm), silt (0.002-0.05 mm), and sand (0.05-2.0 mm) in the basic soil textural classes (adapted from Soil Survey Staff, 1951).

ESTIMATED FIELD TEXTURES

BORING B-2

PROJECT: LTV MARILLA STREET LANDFILL
PROJECT NO: 848-02-1
DATE: JUNE 10, 1985
LOCATION: SOUTH BUFFALO, NEW YORK
DRILLING CONTRACTOR: EARTH DIMENSIONS
INSPECTOR: J. WHITNEY
DRILLING METHOD: 8" x 4 1/4" HOLLOW STEM AUGER
SAMPLING METHOD: 2" ø SPLIT SPOON AT 5' INTERVALS
ELEVATION:
DATUM:

SAMPLE				DEPTH	STRATA	SOIL DESCRIPTION density, color, SOIL, admixtures, moisture, other notes, ORIGIN	WELL CONST.	REMARKS
no.	depth	blows per 6"						
S-1	0'-2'	6	6			MEDIUM DENSE DARK BROWN SAND AND GRAVEL SIZE FILL, DRY WITH REDDISH BROWN STAINING		
		10	5					
			9					
S-2	4.5-6.5	15	13	5		DENSE DARK BROWN SAND AND GRAVEL SIZE FILL, DRY WITH REDDISH BROWN STAINING		
		13						
S-3	9.5-11.5		2					
		5	5	10		MEDIUM DENSE BROWN SILT, SAND AND GRAVEL SIZE FILL, MOIST WITH REDDISH BROWN STAINING		
		36						
S-4	14.5-16.5		8					
		40	8	15		VERY DENSE GREY-BLACK GRAVEL SIZE FILL, WITH TRACE OF BROWN STAINING, DRY		
		20						
S-5	19.5-21.5		20					
		35	26	20		VERY DENSE DARK BROWN GRAVEL SIZE FILL WITH TRACE OF BROWN STAINING, DRY		
		32						
S-6	24.5-26.5		12					
		60	68	25		VERY DENSE REDDISH-BROWN SAND GRAVEL SIZE FILL WITH SOME SILT SIZE PARTICLES, WET		
		6						
			1					
S-7	29.5-31.5	4	4					
		4		30		TYPE SAME TO 29.9' SOFT BLACK SILT, WET (ORIGINAL POND BOTTOM) TO 30.5' LOOSE GREENISH BROWN VERY FINE TO FINE SAND, WET BOTTOM OF BORING AT 31.5'		
				35				

NOTES:

BORING B-3

PROJECT: LTV MARILLA STREET LANDFILL	**PROJECT NO:** 848-02-1
DATE: JUNE 11, 1985	**LOCATION:** SOUTH BUFFALO, NEW YORK
DRILLING CONTRACTOR: EARTH DIMENSIONS	**INSPECTOR:** J. WHITNEY
DRILLING METHOD: 8" x 4 1/4" HOLLOW STEM AUGER	**SAMPLING METHOD:** 2" ø SPLIT SPOON AT 5' INTERVALS
ELEVATION:	**DATUM:**

SAMPLE				DEPTH	STRATA	SOIL DESCRIPTION density, color, SOIL, admixtures, moisture, other notes, ORIGIN	WELL CONST.	REMARKS
no.	depth	blows per 6"						
S-1	0'-2'	7	14			MEDIUM DENSE GREY SAND AND GRAVEL SIZE FILL TO 1.5' TO MEDIUM DENSE BROWN STAINED SAND AND GRAVEL SIZE FILL TO 1.7' TO GREY TO 2.0'		
		16	17					
S-2	4.5-6.5		8					
		6	6	5		MEDIUM DENSE GREY COARSE SAND AND GRAVEL SIZE FILL WITH BROWN STAINING, MOIST TO 6.2' TO DRY AT 6.5'.		
		17						
S-3	9.5'-11.5		25					
		58	41	10		EXTREMELY DENSE LIGHT GREY TO BLACK COARSE SAND AND GRAVEL SIZE FILL W/ CEMENTED SLAG AND BRICK FRAGMENTS, DRY.		
		17						
						AUGER AND SAMPLER REFUSAL AT 13.0 - BOTTOM OF BORING		
				15				
				20				
				25				
				30				
				35				

NOTES:

BORING B-4

PROJECT: LTV MARILLA STREET LANDFILL
PROJECT NO: 848-02-1
DATE: JUNE 12, 1985
LOCATION: SOUTH BUFFALO, NEW YORK
DRILLING CONTRACTOR: EARTH DIMENSIONS
INSPECTOR: J. WHITNEY
DRILLING METHOD: 8" x 4 1/4" HOLLOW STEM AUGER
SAMPLING METHOD: 2" ø SPLIT SPOON AT 5' INTERVALS
ELEVATION:
DATUM:

SAMPLE				DEPTH	STRATA	SOIL DESCRIPTION	WELL CONST.	REMARKS
no.	depth	blows per 6"				density, color, SOIL, admixtures, moisture, other notes, ORIGIN		
S-1	0'-1.5'	10	21			DENSE BROWN SAND AND GRAVEL SIZE INDUSTRIAL FILL, DRY FRIABLE - AUGER REFUSAL @ 1.5'		STEEL MAKING SLAG
		100						
S-2	4.5'-6.5'		17					
		30	28	5		VERY DENSE BROWN AND BLACK SAND TO COARSE GRAVEL INDUST. FILL, DRY LOOSE WHEN DISTURBED SLAG.		STEEL MAKING SLAG
		32						
S-3	9.5'-11.5		14					
		38	54	10		VERY DENSE GREY AND BLACK SAND TO COARSE GRAVEL W/ 1" SLAG FRAGMENTS, INDUSTRIAL FILL TO 11', LIGHT GREY FRACTURED SLAG W/ SAND AND GRAVEL SIZE FILL TO 11.5'		STEEL MAKING SLAG AND LIME STONE.
		37						
				15		AUGER REFUSAL AT 12.5'		
				20				
				25				
				30				
				35				

NOTES: INFORMATION IN REMARKS COLUMN IS BASED ON EXAMINATION OF SAMPLES BY LTV PERSONNEL

BORING B-5

PROJECT: LTV MARILLA STREET LANDFILL	**PROJECT NO:** 848-02-1
DATE: JUNE 11, 1985	**LOCATION:** SOUTH BUFFALO, NEW YORK
DRILLING CONTRACTOR: EARTH DIMENSIONS	**INSPECTOR:** J. WHITNEY
DRILLING METHOD: 8" x 4 1/4" HOLLOW STEM AUGER	**SAMPLING METHOD:** 2" ø SPLIT SPOON AT 5' INTERVALS
ELEVATION:	**DATUM:**

SAMPLE no.	SAMPLE depth	blows per 6"		DEPTH	STRATA	SOIL DESCRIPTION density, color, SOIL, admixtures, moisture, other notes, ORIGIN	WELL CONST.	REMARKS
S-1	0'-2'	9 25	15 15			VERY DENSE DARK BROWN MIXTURE OF GRAVEL AND SILT SIZE INDUSTRIAL FILL, DRY.		CLARIFIER SLUDGE A STEEL MAKING SLA
S-2	4.5'-6.5'	 4 7	7 8 	5		MEDIUM DENSE BROWN SAND AND GRAVEL SIZE FILL TO 5'.0' TO MED. DENSE BLACK GRAVEL, SAND & SILT SIZE INDUSTRIAL FILL, MOIST.		CLARIFIER SLUDGE
S-3	10'-12'	3 3	3 2	10		LOOSE BLACK FINE SAND AND SILT SIZE W/ SOME GRAVEL SIZE FILL (INDUS.) SOME BROWN STAINING, MOIST		CLARIFIER SLUDGE
S-4	15'-17'	1 2	1 3	15		SOFT BLACK SILT SIZE, SOME GRAVEL SIZE FILL TO 16.0', WET TO SOFT REDDISH BROWN SILT SIZE FILL, WET TO 16.33' TO SOFT BLACK SILT SIZE SOME GRAVEL TO 16.75', SOFT REDDISH BROWN SILT SIZE FILL @ 17.0'		BOF DUST
S-5	20'-22'	10 8	6 16	20		MEDIUM DENSE REDDISH BROWN SILT SIZE W/ SOME GRAVEL SIZE FILL TO 21.5' TO GREYISH BLACK SILT SIZE BRICK FRAGMENTS, MOIST.		CLARIFIER SLUDGE, STEEL MAK SLAG AND BOF DUST
S-6	25'-27'	2 3	2 9	25		BRICK FRAGMENTS TO 25.5' TO SOFT BLACK SILT SIZE FILL, WET TO 26.5' TO LOOSE GREENISH BLUE FINE GRAVEL SIZE FILL, WET.		CLARIFIER SLUDGE A STEEL MAKING SLAG
S-7	30'-32'	3 5	8 4	30		DENSE GREY ANNULAR CEMENTED SLAG FRAGMENTS WITH SOME GRAVEL AND SAND SIZE FILL, BROWN STAINING, WET.		STEEL MAKING SLAG AND BLAST FURNACE SLAG.
S-8	—	50/2		35		SAMPLER REFUSAL AT 35'-2". WET GREY SILT AND FINE SAND W/ SHALE FRAGMENTS (FLOWED UP INTO SAMPLER) AUGER REFUSAL AT 35.4'.		

NOTES: INFORMATION IN REMARKS COLUMN IS BASED ON EXAMINATION OF SAMPLES BY LTV PERSONNEL.

MALCOLM PIRNIE ENVIRONMENTAL ENGINEERS, SCIENTISTS & PLANNERS

SHEET 1 OF 1

BORING B-6

PROJECT: LTV MARILLA STREET LANDFILL
PROJECT NO: 848-02-1
DATE: JUNE 12, 1985
LOCATION: SOUTH BUFFALO, NEW YORK
DRILLING CONTRACTOR: EARTH DIMENSIONS
INSPECTOR: J. WHITNEY
DRILLING METHOD: 8" x 4 1/4" HOLLOW STEM AUGER
SAMPLING METHOD: 2" ø SPLIT SPOON AT 5' INTERVALS
ELEVATION:
DATUM:

SAMPLE no.	SAMPLE depth	blows per 6"		DEPTH	STRATA	SOIL DESCRIPTION density, color, SOIL, admixtures, moisture, other notes, ORIGIN	WELL CONST.	REMARKS
S-1	0'-2'	25	23			DENSE GREY GRAVEL AND SAND SIZE FILL BROWN STAINING, DRY TO 1' TO GREY SOLID SLAG FRAGMENTS TO 1.25' TO GREY GRAVEL AND SAND SIZE FILL SOME BRICK FRAGMENTS TO 2'		STEEL MAKING SLAG AND BRICK
		17	9					
S-2	4.5'-6.5'		24					
		20	17	5		MINIMAL RECOVERY SAMPLE - S-2 GRAY SLAG FRAGMENTS; PUSHED A PIECE OF SLAG AHEAD OF SAMPLER		STEEL MAKING SLAG
		24						
S-3	9.5'-10.3'		34					
		100/4"		10		VERY DENSE DARK BROWN TO DARK GREY GRAVEL AND COASRS SAND SIZE INDUSTRIAL FILL W/ SOME SLAG FRAGMENTS DRY. AUGER REFUSAL @ 12.5' (BOTTOM OF BORING)		STEEL MAKING SLAG
				15				
				20				
				25				
				30				
				35				

NOTES: INFORMATION IN REMARKS COLUMN IS BASED ON EXAMINATION OF SAMPLES BY LTV PERSONNEL.

BORING B-7

PROJECT: LTV MARILLA STREET LANDFILL

PROJECT NO: 848-02-1

DATE: JUNE 20, 1985

LOCATION: SOUTH BUFFALO, NEW YORK

DRILLING CONTRACTOR: EARTH DIMENSIONS

INSPECTOR: J. WHITNEY

DRILLING METHOD: 8" x 4 ¼" HOLLOW STEM AUGER

SAMPLING METHOD: 2" ø SPLIT SPOON AT 5' INTERVALS

ELEVATION:

DATUM:

SAMPLE				DEPTH	STRATA	SOIL DESCRIPTION	WELL CONST.	REMARKS
no.	depth	blows per 6"				density, color, SOIL, admixtures, moisture, other notes, ORIGIN		
S-1	0'-2'	3	18			VERY DENSE BLACK FINE SAND AND GRAVEL SIZE CINDERY ASH AND SLAG FRAGMENTS FILL DRY LOOSE WHEN DISTURBED.		STEEL MAKING SLAG
		26	66					
S-2	4.5'-6:5'		13					
		21	23	5		VERY DENSE DARK BROWN SAND SIZE CINDERY ASH WITH SOME BRICK AND GRAVEL SIZE SLAG FRAGMENTS FILL, DRY, LOOSE WHEN DISTURBED.		STEEL MAKING SLAG AND SCARFING FLASH
		23						
S-3	9.5'-11.5'		3					
		15	16	10		DENSE BROWN SAND AND GRAVEL SIZE INDUSTRIAL FILL, DRY W/ SOME SLAG FRAGMENTS, LOOSE WHEN DISTURBED.		STEEL MAKING SLA
		10						
S-4	14.5'-16.5'		1					
		1	1/12"	15		SOFT REDDISH BROWN SILT AND FINE SAND SIZE FILL, WET		STEEL MAKING DUST
S-5	19.5'-21.5'		7					
		31	24	20		VERY DENSE DARK BROWN SAND AND COARSE GRAVEL SIZE INDUSTRIAL FILL, DRY, W/SOME BRICK AND SLAG FRAGMENTS		STEEL AN BLAST FURNACE SLAG
		22						
S-6	24.5'-26.5'		7					
		47	66	25		VERY DENSE DARK BROWN COARSE SAND AND GRAVEL SIZE INDUSTRIAL FILL, DRY W/ SOME SLAG AND DETERIORATED BRICK FRAGMENTS BOTTOM OF BORING AT 26.5'		
		45						
				30				
				35				

NOTES: AUGERS LOST IN HOLE, HOLE ABANDONED AT 26.5'

INFORMATION IN REMARKS COLUMN IS BASED ON EXAMINATION OF SAMPLES BY LTV SAMPLES

MALCOLM PIRNIE

SHEET 1 OF 1

BORING B-8

PROJECT: LTV MARILLA STREET LANDFILL
PROJECT NO: 848-02-1
DATE: JUNE 12, 1985
LOCATION: SOUTH BUFFALO, NEW YORK
DRILLING CONTRACTOR: EARTH DIMENSIONS
INSPECTOR: J. WHITNEY
DRILLING METHOD: 8" x 4 ¼" HOLLOW STEM AUGER
SAMPLING METHOD: 2" ø SPLIT SPOON AT 5' INTERVALS
ELEVATION:
DATUM:

SAMPLE no.	SAMPLE depth	blows per 6"		DEPTH	STRATA	SOIL DESCRIPTION density, color, SOIL, admixtures, moisture, other notes, ORIGIN	WELL CONST.	REMARKS
S-1	0'-2'	61	55			VERY DENSE BROWN TO GREY BLUE TO BLACK SAND TO COARSE GRAVEL SIZE INDUSTRIAL FILL SOME BRICK FRAGMENTS, DRY		STEEL MAKING SLAG AND BRICK
		32	21					
			10					
S-2	4.5'-6.25'	7	8	5		MEDIUM DENSE BLACK/GREY COARSE SAND TO GRAVEL SIZE FILL W/ SOME SLAG FRAGMENTS		STEEL MAKING SLAG
		50/5"						
			55					
S-3	9.5'-11.33'	68	88	10		VERY DENSE BLACK/GREY/BROWN COARSE SAND TO GRAVEL SIZE FILL W/ SOME SLAG, BRICK AND WOOD FRAGMENTS		STEEL MAKING SLAG AND GRAVEL
		100/4"						
				15		AUGER REFUSAL @ 11.3' (BOTTOM OF BORING)		
				20				
				25				
				30				
				35				

NOTES: INFORMATION IN REMARKS COLUMN IS BASED ON EXAMINATION OF SAMPLES BY LTV PERSONNEL.

BORING B-7

PROJECT: LTV MARILLA STREET LANDFILL	**PROJECT NO:** 848-02-1
DATE: JULY 8, 1985	**LOCATION:** SOUTH BUFFALO, NEW YORK
DRILLING CONTRACTOR: EARTH DIMENSIONS	**INSPECTOR:** J. WHITNEY
DRILLING METHOD: 8" x 4 1/4" HOLLOW STEM AUGER	**SAMPLING METHOD:** 2" ø SPLIT SPOON AT 5' INTERVALS
ELEVATION:	**DATUM:**

SAMPLE				DEPTH	STRATA	SOIL DESCRIPTION	WELL CONST.	REMARKS
no.	depth	blows per 6"				density, color, SOIL, admixtures, moisture, other notes, ORIGIN		
S-1	0'-2'	5	10			MEDIUM DENSE BLACK FINE SAND TO GRAVEL SIZE CINDERY ASH AND SLAG W/SOME BROWN STAINING FILL, MOIST.		CLARIFIER SLUDGE
		14	12					
S-2	5.0'-5.75'	50	100/3	5		EXTREMELY DENSE BLACK SAND TO GRAVEL SIZE FILL WITH SOME SLAG FRAGMENTS, DRY.		CLARIFIER SLUDGE AND SLAG
S-3	10'-12'	1	2	10		VERY SOFT BLACK SILT TO FINE SAND SIZE ASH FILL TO 19.5' TO BLACK SAND AND GRAVEL SIZE FILL TO 12' WET TO 11.5, DRY TO 12.0'		CLARIFIER SLUDGE
		3	9					
S-4	15'-17'	1	3	15		SOFT DARK BROWN TO BLACK SILT, SAND AND GRAVEL SIZE FILL, MOIST.		CLARIFIER SLUDGE
		3	6					
S-5	20'-22'	1	6	20		MEDIUM DENSE DARK BROWN TO BLACK SAND AND GRAVEL SIZE CINDERY ASH AND SLAG FILL WITH SOME SLAG FRAGMENTS, DRY.		CLARIFIER SLUDGE
		12	10					
S-6	25'-27'	5	5	25		MEDIUM DENSE DARK BROWN SAND AND GRAVEL SIZE FILL, DRY W/ SOME SLAG FRAGMENTS.		CLARIFIER SLUDGE
		6	4					
S-7	30'-32'	2	5	30		STIFF DARK GREY SILT AND FINE SAND SIZE FILL, MOIST WITH SOME GRAVEL SIZED SLAG.		CLARIFIER SLUDGE
		7	5					
S-8		3	6	35		MEDIUM DENSE DARK GREY FINE SAND SIZE FILL WITH GRAVEL SIZE SLAG PARTICLES.		CLARIFIER SLUDGE
		4	3					

NOTES: SAMPLE S-6 NO RECOVERY (PUSHED A PIECE OF SLAG AHEAD OF SAMPLER) SAMPLER DROPPED WITH WEIGHT OF RODS FOR NEW RECOVERY.
INFORMATION IN REMARKS COLUMN BASED ON EXAMINATION OF SAMPLES BY LTV PERSONNEL.

BORING B-9

PROJECT: LTV MARILLA STREET LANDFILL
PROJECT NO: 848-02-1
DATE: JULY 8, 1985
LOCATION: SOUTH BUFFALO, NEW YORK
DRILLING CONTRACTOR: EARTH DIMENSIONS
INSPECTOR: J. WHITNEY
DRILLING METHOD: 8" x 4 1/4" HOLLOW STEM AUGER
SAMPLING METHOD: 2" ø SPLIT SPOON AT 5' INTERVALS
ELEVATION:
DATUM:

SAMPLE				DEPTH	STRATA	SOIL DESCRIPTION	WELL CONST.	REMARKS
no.	depth	blows per 6"				density, color, SOIL, admixtures, moisture, other notes, ORIGIN		
S-9	40'-42'	33	48	40		VERY DENSE GREY COARSE SAND AND GRAVEL SIZE FILL, WET @ 41.0' W/ SOME SLAG FRAGMENTS.		BLAST FURNACE SLAG.
		21	9					
			50/.05"	45				
S-10	44.5'					BOTTOM OF BORING @ 44.5'		
				50				
				55				
				60				
				65				
				70				
				75				
				80				

NOTES: NO RECOVERY SAMPLE S-10 SOME SAND FLOWED UP INTO SAMPLER

INFORMATION IN REMARKS COLUMN IS BASED ON EXAMINATION OF SAMPLES BY LTV PERSONNEL

BORING B-10

PROJECT: LTV MARILLA STREET LANDFILL

PROJECT NO: 848-02-1

DATE: JUNE 11, 1985

LOCATION: SOUTH BUFFALO, NEW YORK

DRILLING CONTRACTOR: EARTH DIMENSIONS

INSPECTOR: J. WHITNEY

DRILLING METHOD: 8" x 4 1/4" HOLLOW STEM AUGER

SAMPLING METHOD: 2" ø SPLIT SPOON AT 5' INTERVALS

ELEVATION:

DATUM:

SAMPLE no.	SAMPLE depth	blows per 6"		DEPTH	STRATA	SOIL DESCRIPTION density, color, SOIL, admixtures, moisture, other notes, ORIGIN	WELL CONST.	REMARKS
S-1	0'-2'	5 8	6 8			MEDIUM DENSE BLACK GRAVEL SIZE FILL TO 6" TO BROWN SAND AND GRAVEL SIZE FILL TO 2' WITH SOME SEAMS OF BLACK SILT SIZE PARTICLES (FILL)		CLARIFIER SLUDGE AI SLAG
S-2	5'-7'	2 3	2 2	5		LOOSE BLACK CINDERY SAND DRY FILL.		BLAST FURNACE FLUEDUST
S-3	10'-12'	2 3	2 2	10		VERY LOOSE BLACK CINDERY SAND SOME CINDER FRAGMENTS W/ SLIGHT BROWN STAINING DRY FILL		FLUEDUST AND SLAG
S-4	15'-17'	1 1	2 1	15		SIMILAR		FLUE DUST WITH SOM SLAG
S-5	20'-22'	2 10	10 11	20		MEDIUM DENSE GREENISH BLUE COARSE GRAVEL SIZE FILL WITH SOME SLAG FRAGMENTS, MOIST		BLAST FURNACE SLAG
S-6	25'-27'	1 5	2 10	25		LOOSE GRAVEL AND SAND SIZE GREY SLAG TO 25.5' TO SOFT BLACK PEAT SOME WOOD TO 26.0' TO LOOSE LIGHT BROWN FINE SAND TO 27' - BOTTOM OF BORING @ 27'		
				30				
				35				

NOTES: INFORMATION IN REMARKS COLUMN IS BASED ON EXAMINATION OF SAMPLES BY LTV PERSONNEL

BORING B-11

PROJECT: LTV MARILLA STREET LANDFILL

PROJECT NO: 848-02-1

DATE: JUNE 12, 1985

LOCATION: SOUTH BUFFALO, NEW YORK

DRILLING CONTRACTOR: EARTH DIMENSIONS

INSPECTOR: J. WHITNEY

DRILLING METHOD: 8" x 4 1/4" HOLLOW STEM AUGER

SAMPLING METHOD: 2" ⌀ SPLIT SPOON AT 5' INTERVALS

ELEVATION:

DATUM:

SAMPLE				DEPTH	STRATA	SOIL DESCRIPTION density, color, SOIL, admixtures, moisture, other notes, ORIGIN	WELL CONST.	REMARKS
no.	depth	blows per 6"						
S-1	0'-2'	1	7			MEDIUM DENSE BROWN TO BLACK COARSE SAND TO GRAVEL SIZE FILL W/ SOME WOOD AND BRICK FRAGMENTS, DRY		HOT POURED SLAG FROM E-L RIGHT-OF-WAY
		8	22					
S-2	4.5'-6.5'		7					
		8	8	5		MEDIUM DENSE DARK BROWN COARSE SAND TO COARSE GRAVEL SIZE FILL (SLAG) W/ SOME WOOD FRAGMENTS, DRY.		MISC. FILL
		6						
S-3	9.5'-11.5'		7					
		6	8	10		FIRM LIGHT BROWN CLAYEY SILT, WET (LAKE SEDIMENT) LAMINATED. BOTTOM OF BORING @ 11.5'		
		10						
				15				
				20				
				25				
				30				
				35				

NOTES: INFORMATION IN REMARKS COLUMN IS BASED ON EXAMINATION OF SAMPLES BY LTV PERSONNEL.

BORING B-12

PROJECT: LTV MARILLA STREET LANDFILL	**PROJECT NO:** 848-02-1
DATE: JUNE 19, 1985	**LOCATION:** SOUTH BUFFALO, NEW YORK
DRILLING CONTRACTOR: EARTH DIMENSIONS	**INSPECTOR:** J. WHITNEY
DRILLING METHOD: 7"x 3¼" HOLLOW STEM AUGER 0'-30', REDRILLED W/ 8"x 3⅜" H.S.A.	**SAMPLING METHOD:** 2" ø SPLIT SPOON AT 5' INTERVALS
ELEVATION:	**DATUM:**

SAMPLE no.	SAMPLE depth	blows per 6"		DEPTH	STRATA	SOIL DESCRIPTION density, color, SOIL, admixtures, moisture, other notes, ORIGIN	WELL CONST.	REMARKS
S-1	0'-1.17'	9 100/2"	32			VERY DENSE DARK BROWN SAND AND GRAVEL SIZE FILL, DRY LOOSE WHEN DISTURBED		STEEL MAKIN SLAG AND BLAST FURNACE SLAG
S-2	4.5'-5.3'	100/4"	37	5		VERY DENSE DARK BROWN SAND AND GRAVEL SIZE FILL		STEEL MAKIN SLAG AND BLAST FURNACE SLAG.
S-3	9.5'-11.5'	43 30	95 30	10		SIMILAR		STEEL MAKIN SLAG AND BLAST FURNACE SLAG.
S-4	14.5'-16.5'	17 20	8 24	15		SIMILAR		STEEL MAKIN SLAG AND BLAST FURNACE SLAG
S-5	19.5'-21.5'	32 15	29 23	20		VERY DENSE OLIVE BROWN SAND, GRAVEL AND SILT SIZE FILL MOIST, SOME BRICK FRAGMENTS AND SLAG.		STEEL MAKI SLAG, BLAS FURNACE SLA AND BRICK FRAGMENT
S-6	24.5'-26.5'	40 40	14 33	25		VERY DENSE DARK BROWN SAND AND GRAVEL SIZE FILL, WET @ 25.5' to 25.7' SOME BRICK AND SLAG FRAGMENTS.		STEEL MAKIN SLAG
S-7	29.5'-31.3'	42 100/4"	16 50	30		VERY DENSE GREY/BLACK COARSE SAND AND GRAVEL SIZE FILL, DRY W/ SOME SLAG AND CINDER FRAGMENTS.		STEEL MAKIN SLAG WITH SOME PEAQUARTZ.
S-8	34.5'-36.5'	37 100/4.5'	36 66	35		EXTREMELY DENSE GRAY/BLACK COARSE SAND AND GRAVEL SIZE FILL WET WITH SOME SLAG AND BRICK FRAGMENTS. AUGER REFUSAL@ 39' (BOTTOM OF BORING) AUGERS LOST IN HOLE, ABANDONED, MOVED TO MW-8B *		

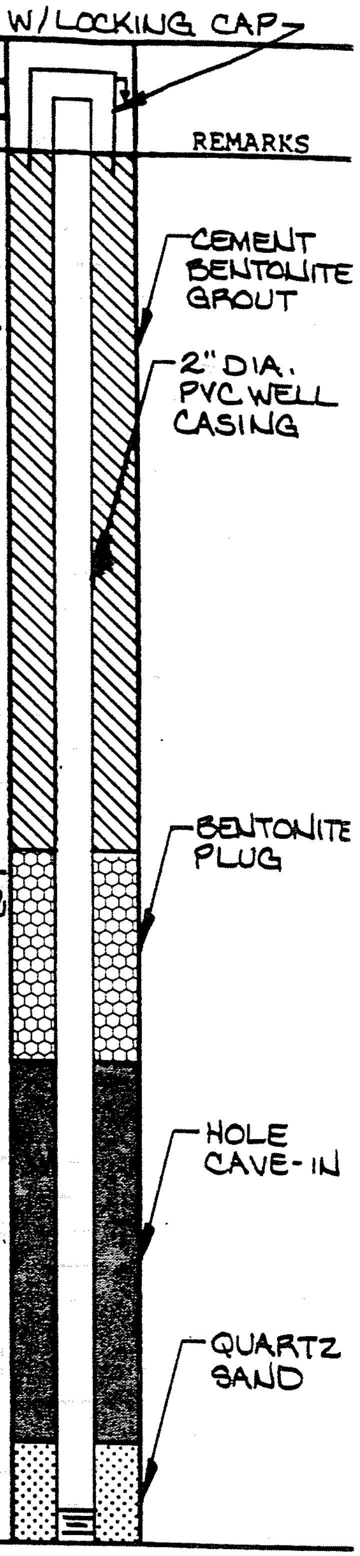
NOTES: EXTREMELY DIFFICULT AUGERING BETWEEN 17 + 19.5', 30' & DOWN AUGER REFUSAL@39 HAD TO HEAT THE AUGERS TO BREAK APART, LEFT AUGERS IN GROUND @ 1:30 (6-20-85) AUGERS LOST IN HOLE 7-3-85; INFORMATION IN REMARKS COLUMN IS BASED ON EXAMINATION OF SAMPLES BY LTV PERSONNEL.

* REDRILLED FIRST 30' W/8"x 3⅜" AUGERS (RAN OUT OF 7"x 3¼")

BORING MW-7A

PROJECT: LTV MARILLA STREET LANDFILL
PROJECT NO: 848-02-1
DATE: JUNE 18, 1985
LOCATION: SOUTH BUFFALO, NEW YORK
DRILLING CONTRACTOR: EARTH DIMENSIONS
INSPECTOR: J. WHITNEY
DRILLING METHOD: 8" x 4 1/4" HOLLOW STEM AUGER
SAMPLING METHOD: 2" ø SPLIT SPOON AT 5' INTERVALS
ELEVATION:

SAMPLE no.	SAMPLE depth	blows per 6"		DEPTH	STRATA	SOIL DESCRIPTION density, color, SOIL, admixtures, moisture, other notes, ORIGIN
S-1	0'-2'	7 8	5 9			MEDIUM DENSE DARK BROWN SAND AND GRAVEL SIZE FILL W/ SOME BRICK SILT SIZE PARTICLES
S-2	4.5'-6.5'	 5 6	5 4	5		LOOSE BROWN SAND AND GRAVEL SILT SIZE FILL, MOIST
S-3	9.5'-11.0'	 90	23 75	10		VERY DENSE DARK BROWN TO BLACK SAND AND GRAVEL SIZE FILL, DRY
S-4	14.5'-16.5'	1	WOR/18"	15		NO RECOVERY SAMPLE S-4
S-5	19.5'-20.08'	 100/1"	70	20		VERY DENSE BROWN SAND AND GRAVEL SIZE FILL W/ SOME SLAG FRAGMENTS, MOIST
S-6	24.5'-26.5'	WOR 1	WOR 1	25		VERY SOFT BROWN SILT SIZE FILL, WET TO 26.25' TO BLACK FINE SAND SIZE FILL, WET TO 26.5'
S-7	29.5'-31.5'	WOR 3	3 9	30		LOOSE LIGHT GREENISH-GREY FINE SILTY SAND TO 31', MOIST TO STIFF LIGHT GREENISH GREY CLAYEY SILT LAMINATED WITH A BROWN VERY FINE SAND, DRY TO 31.5'
S-8	34.5'-36.5'	 6 9	3 9	35		FIRM GREY SILTY CLAY MOTTLED W/ BROWN OXIDATION LAYERS, LAKE SEDIMENTS
			WOR			



NOTES: WOR - WEIGHT OF RODS
WOH - WEIGHT OF HAMMERS

MALCOLM PIRNIE

SHEET 1 OF 2

BORING MW-7A

PROJECT: LTV MARILLA STREET LANDFILL
PROJECT NO: 848-02-1
DATE: JUNE 18-19, 1985
LOCATION: SOUTH BUFFALO, NEW YORK
DRILLING CONTRACTOR: EARTH DIMENSIONS
INSPECTOR: J. WHITNEY
DRILLING METHOD: 8" x 3 3/8" HOLLOW STEM AUGER
SAMPLING METHOD: 2" ø SPLIT SPOON AT 5' INTERVALS
ELEVATION:
DATUM:

SAMPLE				DEPTH	STRATA	SOIL DESCRIPTION density, color, SOIL, admixtures, moisture, other notes, ORIGIN	WELL CONST.	REMARKS
no.	depth	blows per 6"						
S-9	39.5-41.2'	1	8	40		SOFT GREY SANDY SILT W/ SOME COARSE SAND AND GRAVEL, SOME SHALE FRAGMENTS, WET, GLACIAL TILL BOTTOM OF BORING @ 41.2'	 BOTTOM OF WELL	2" DIA. .010" SLOTTED PVC WELL SCREEN
		100/2"						
				45				
				50				
				55				
				60				
				65				
				70				
				75				

NOTES:

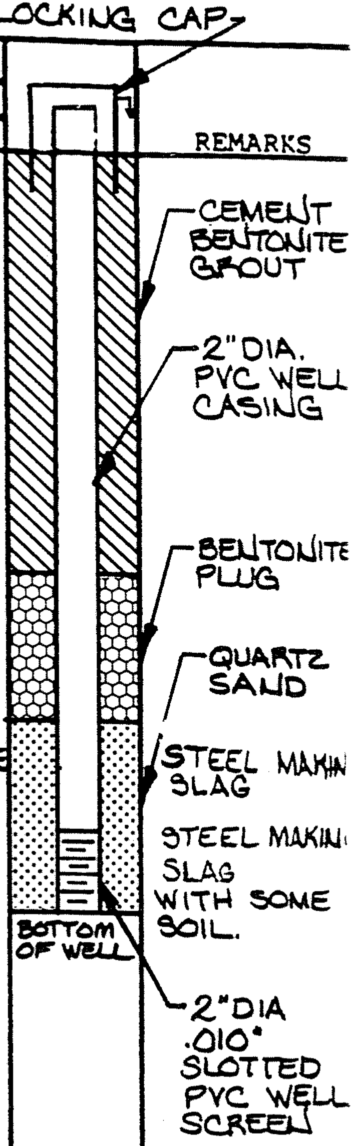
MALCOLM PIRNIE ENVIRONMENTAL ENGINEERS, SCIENTISTS & PLANNERS

SHEET 2 OF 2

BORING MW-8B

PROJECT: LTV MARILLA STREET LANDFILL
PROJECT NO: 848-02-1
DATE: JULY 8-9, 1985
LOCATION: SOUTH BUFFALO, NEW YORK
DRILLING CONTRACTOR: EARTH DIMENSIONS
INSPECTOR: J. WHITNEY
DRILLING METHOD: 8" x 4 1/4" HOLLOW STEM AUGER
SAMPLING METHOD: 2" ø SPLIT SPOONS AT 5' INTERVALS
ELEVATION:

SAMPLE no.	SAMPLE depth	blows per 6"	blows per 6"	DEPTH	SOIL DESCRIPTION density, color, SOIL, admixtures, moisture, other notes, ORIGIN
				5	SEE B-12
				10	
				15	
S-1	16.5'-18.1'	11	12		VERY DENSE DARK BROWN COARSE SAND AND GRAVEL SIZE FILL W/SOME BRICK AND SLAG FRAGMENTS
		30	60/1		
S-2	20'-21.8'	66	45	20	EXTREMELY DENSE MOTTLED GREY GRAVEL SIZE FILL, MOIST W/ 40% SLAG FRAGMENTS
		33	100/5"		BOTTOM OF BORING @ 21.8' AUGER AND SAMPLER REFUSAL
				25	
				30	
				35	



STEEL MAKING SLAG

STEEL MAKING SLAG WITH SOME SOIL.

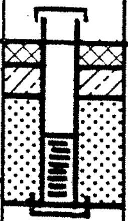
NOTES: INFORMATION IN REMARKS COLUMN BASED ON EXAMINATION OF SAMPLES BY LTV PERSONNEL.

MALCOLM PIRNIE ENVIRONMENTAL ENGINEERS, SCIENTISTS & PLANNERS

BORING MW-3B

PROJECT: LTV MARILLA STREET LANDFILL
PROJECT NO: 848-03-1
DATE: OCTOBER 4, 1985
LOCATION: SOUTH BUFFALO, NEW YORK
DRILLING CONTRACTOR: ROCHESTER DRILLING
INSPECTOR: J. WHITNEY
DRILLING METHOD: HAND HELD AUGER (POWER, 6"Ø)
SAMPLING METHOD:
ELEVATION:
DATUM:

SAMPLE no.	SAMPLE depth	blows per 6"		DEPTH	STRATA	SOIL DESCRIPTION density, color, SOIL, admixtures, moisture, other notes, ORIGIN
						Grey Sand and Gravel size FILL (grading to Reddish Brown) at 6" (Steel making Slag and Dust) to 4'-6".
S-1	5.5'			5		Clear transition to Soft black Organic Matter to 5'-0", wet grading to FINE SAND with reddish brown staining
				10		Soft grey Clayey Silt retrieved from bottom of flush-joint casing used to set well.
				15		
				20		
				25		
				30		
				35		



PROTECTIVE CAP
CEMENT, CAP 0-1'
BENTONITE PELLETS 1'-1.8'
SAND 1.8'-5.'
0.010 SCREEN 3'-5'
CAP AT 5'

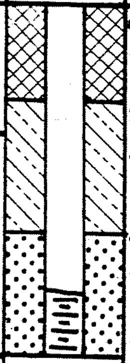
NOTES:

MALCOLM PIRNIE
ENVIRONMENTAL ENGINEERS, SCIENTISTS & PLANNERS

SHEET 1 OF 1

BORING MW-4B

PROJECT: LTV MARILLA STREET
PROJECT NO: 848-03-1110
DATE: OCTOBER 25, 1985
LOCATION: 5'W OF MW-4A
DRILLING CONTRACTOR: ROCHESTER DRILLING
INSPECTOR: KCO
DRILLING METHOD: 8" O.D. × 3 3/4" I.D. HOLLOW STEM AUGER
SAMPLING METHOD: SPLIT SPOON SAMPLE STANDARD PENETRATION TEST
ELEVATION:
DATUM:

SAMPLE				DEPTH	STRATA	SOIL DESCRIPTION	WELL CONST.	REMARKS
no.	depth	blows per 6"				density, color, SOIL, admixtures, moisture, other notes, ORIGIN		
S-1	0'-2'	3	8			MEDIUM DENSE, REDDISH BROWN, SAND AND GRAVEL, SOME SILT, WET, SLAG, FILL CHANGING @ 4 FT TO:		CEMENT CAP 0' TO 3'
		9	14					
S-2	5'-7'	20	22	5		DENSE, BROWN, SAND, SOME GRAVEL, SATURATED, PLANT FRAGMENTS AND ROOTS, YELLOWISH-BROWN LENSES		BENTONITE PELLETS 3' TO 7'
		22	20					WELL SORTED SAND 7'-11'
S-3	10'-12'	10	3	10		CHANGING AT 11.0' FT TO:		WELL SCREEN 9'-11
		3	5			STIFF, GREY, CLAYEY SILT, MOIST		
				15		BOTTOM OF BORING AT 11 FT.		
				20				
				25				
				30				
				35				

NOTES: CLASSIFICATION BASED UPON VISUAL INSPECTION BY MPI INSPECTOR IN FIELD. WELL 2" DIAMETER PVC CASING WITH SLOTTED SCREEN. PROTECTIVE STEEL CASING WITH LOCKING CAP OVER STICK-UP.

MALCOLM PIRNIE ENVIRONMENTAL ENGINEERS, SCIENTISTS & PLANNERS

SHEET 1 OF 1

BORING MW-7B

PROJECT: LTV MARILLA STREET LANDFILL

PROJECT NO: 848-03-1

DATE: SEPTEMBER 27, 1985

LOCATION: SOUTH BUFFALO, NEW YORK

DRILLING CONTRACTOR: ROCHESTER DRILLING

INSPECTOR: J. WHITNEY

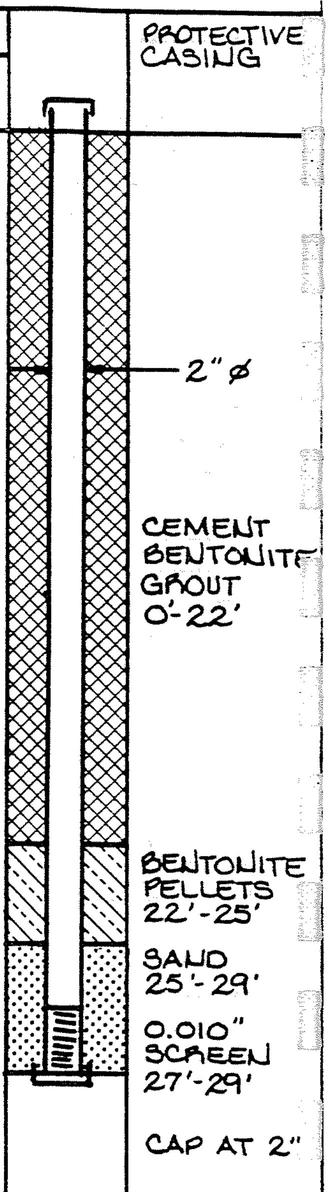
DRILLING METHOD: 8" x 3 3/4" HOLLOW STEM AUGERS

SAMPLING METHOD: 2" ø SPLIT SPOON

ELEVATION:

DATUM:

SAMPLE				DEPTH	STRATA	SOIL DESCRIPTION
no.	depth	blows per 6"				density, color, SOIL, admixtures, moisture, other notes, ORIGIN
S-1	29'-31'	6 13	8 13	30		Firm grey Silty Clay laminated with fine brown Sand, moist, Lake Sediments.



NOTES:

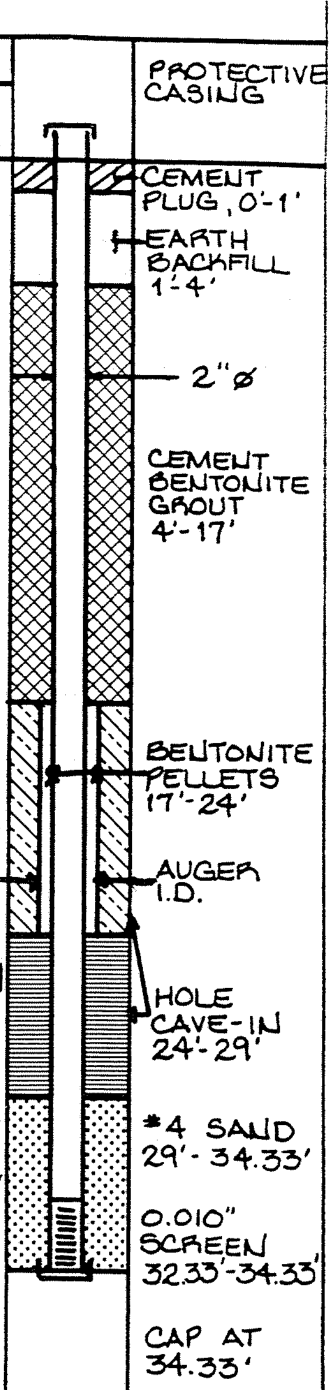
MALCOLM PIRNIE
ENVIRONMENTAL ENGINEERS, SCIENTISTS & PLANNERS

SHEET ___ OF ___

BORING MW-9S

PROJECT: LTV MARILLA STREET LANDFILL
PROJECT NO: 848-03-1
DATE: STARTED: OCT 1, COMPLETED: OCT 3
LOCATION: SOUTH BUFFALO, NEW YORK
DRILLING CONTRACTOR: ROCHESTER DRILLING
INSPECTOR: J. WHITNEY
DRILLING METHOD: 8" x 3 3/4" HOLLOW STEM AUGER
SAMPLING METHOD: 2" ø SPLIT SPOON
ELEVATION:
DATUM:

SAMPLE no.	SAMPLE depth	blows per 6"		DEPTH	STRATA	SOIL DESCRIPTION density, color, SOIL, admixtures, moisture, other notes, ORIGIN
S-1	5'-7'	10	40	5		Very dense brown Gravel and Sand size FILL consisting of Brick and Slag fragments, moist
		22	9			
S-2	10'-12'	9	10	10		Dense grey/black Sand and Gravel size FILL (SLAG) and brick fragments, dry.
		14	12			
S-3	15'-17'	9	6	15		Medium dense brown Sand and Gravel size FILL (SLAG) and brick fragments, dry.
		8	9			
S-4	20'-22'	18	18	20		Dense dark brown Sand and Gravel size FILL (SLAG) and brick fragments, moist.
		20	7			
S-5	25.5'-26'		50/6	25		Very dense dark brown Sand and Gravel size FILL (SLAG) and brick fragments, moist.
S-6	30'-32'	7	6	30		Loose brown Sand and Gravel size FILL (SLAG) and brick, wet
		6	5			
S-7	35'-37'	4	5	35		Firm grey Silty Clay with trace organics, grading to stiff grey TILL, damp.
		11	11			

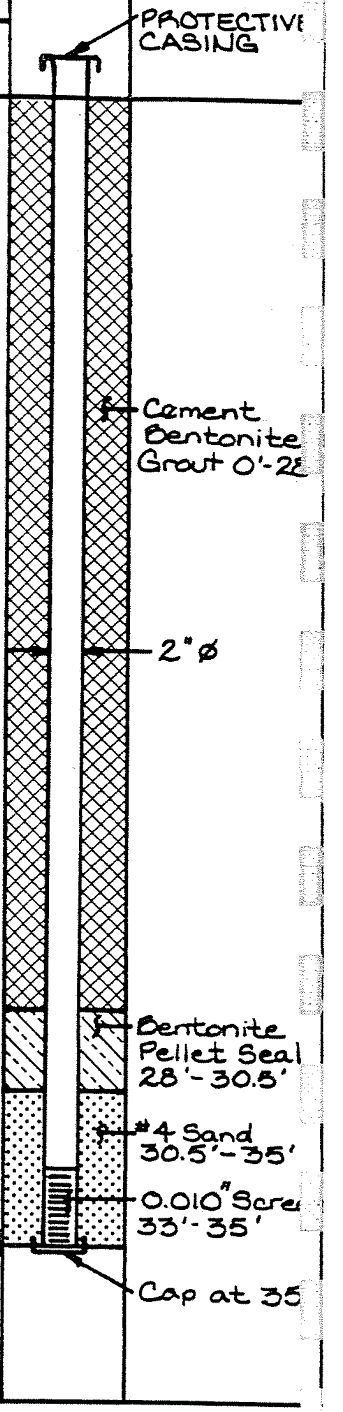


NOTES: POOR SAMPLE RECOVERY S-3

BORING MW-108

PROJECT: LTV MARILLA STREET LANDFILL
PROJECT NO: 848-03-1
DATE: SEPTEMBER 30, 1985
LOCATION: SOUTH BUFFALO, NEW YORK
DRILLING CONTRACTOR: ROCHESTER DRILLING
INSPECTOR: J. WHITNEY
DRILLING METHOD: 8"x 3 3/4" HOLLOW STEM AUGER
SAMPLING METHOD: 2" ø SPLIT SPOON
ELEVATION:
DATUM:

SAMPLE no.	SAMPLE depth	blows per 6"		DEPTH	STRATA	SOIL DESCRIPTION density, color, SOIL, admixtures, moisture, other notes, ORIGIN
				5		
				10		
				15		
				20		
				25		
S-1	30'-32'	2	2	30		Loose brown Sand and Gravel size FILL, moist (SLAG and STEEL MAKING DUST)
		2	2			
S-2	35'-37'	3	5	35		Firm grey Silty CLAY, laminated with fine brown Sand, moist, Lake Sediments.
		8	10			



NOTES:

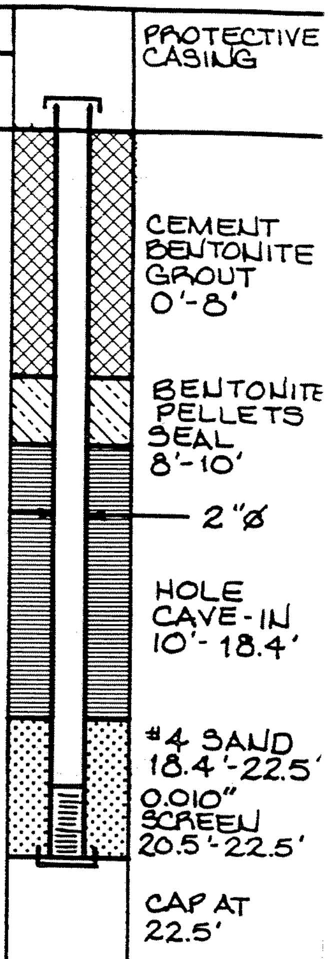
MALCOLM PIRNIE
ENVIRONMENTAL ENGINEERS, SCIENTISTS & PLANNERS

SHEET 1 OF 1

BORING MW-11S

PROJECT: LTV MARILLA STREET LANDFILL
PROJECT NO: 848-03-1
DATE: SEPTEMBER 30, 1985
LOCATION: SOUTH BUFFALO, NEW YORK
DRILLING CONTRACTOR: ROCHESTER DRILLING
INSPECTOR: J. WHITNEY
DRILLING METHOD: 8" x 3 3/4" HOLLOW STEM AUGERS
SAMPLING METHOD: 2" Ø SPLIT SPOON
ELEVATION:
DATUM:

SAMPLE no.	SAMPLE depth	blows per 6"		DEPTH	STRATA	SOIL DESCRIPTION density, color, SOIL, admixtures, moisture, other notes, ORIGIN
				5		
				10		
				15		
S-1	20'-22'	12	4	20		Fill to 21.0' to loose grey Fine SAND to 21.5' to soft grey Silty CLAY, wet
		2	3			
				25		
				30		
				35		



NOTES:

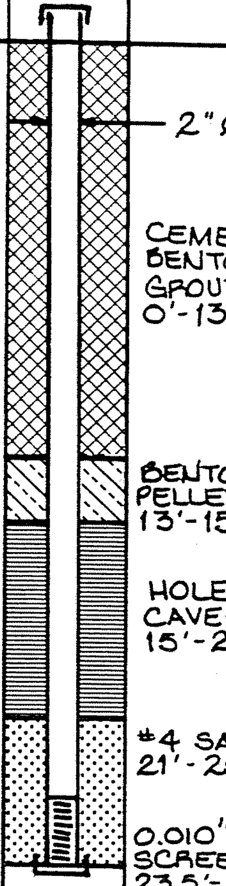
MALCOLM PIRNIE
ENVIRONMENTAL ENGINEERS, SCIENTISTS & PLANNERS

SHEET ___ OF ___

BORING MW-12B

PROJECT: LTV MARILLA STREET LANDFILL
PROJECT NO: 848-03-1
DATE: OCTOBER 3, 1985
LOCATION: SOUTH BUFFALO, NEW YORK
DRILLING CONTRACTOR: ROCHESTER DRILLING
INSPECTOR: J. WHITNEY
DRILLING METHOD: 8" x 3 3/4" HOLLOW STEM AUGER
SAMPLING METHOD: 2" ø SPLIT SPOON @ 5' INTERVALS
ELEVATION:
DATUM:

SAMPLE no.	SAMPLE depth	blows per 6"		DEPTH	STRATA	SOIL DESCRIPTION density, color, SOIL, admixtures, moisture, other notes, ORIGIN
S-1	5'-7'	7	10	5		Very dense brown Sand and Gravel size FILL (SLAG) and brick fragments, damp
		35	40			
S-2	10'- 12'	12	17	10		Very dense brown Sand and Gravel size FILL (SLAG) and some brick fragments, damp
		25	20			
S-3	15'-17'	3	11	15		Medium dense brown Sand and Gravel size FILL (SLAG) with little brick fragments.
		10	11			
S-4	20'-22'	4	3	20		Loose brown Sand and Gravel size FILL (SLAG) wet clear transition to loose brown fine Sand @ 21'-6", wet.
		2	3			
S-5	22'-24'	6	7			Same to 26'
		7	7			
S-6	25'-27'	2	3	25		Clear transition to soft brown Clayey Silt laminated with fine brown SAND, moist
		4	4			
				30		
				35		



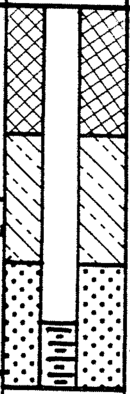
NOTES:

MALCOLM PIRNIE
ENVIRONMENTAL ENGINEERS, SCIENTISTS & PLANNERS

SHEET ___ OF ___

BORING MW-13B

PROJECT: LTV MARILLA STREET
PROJECT NO: 848-03-1110
DATE: OCTOBER 25, 1983
LOCATION: ~100' W OF MW-4A + MW-4B
DRILLING CONTRACTOR: ROCHESTER DRILLING
INSPECTOR: KCO
DRILLING METHOD: 8" O.D. x 3 3/4" I.D. HOLLOW STEM AUGER
SAMPLING METHOD: SPLIT SPOON SAMPLE STANDARD PENETRATION TEST
ELEVATION:
DATUM:

SAMPLE				DEPTH	STRATA	SOIL DESCRIPTION	WELL CONST.	REMARKS
no.	depth	blows per 6"				density, color, SOIL, admixtures, moisture, other notes, ORIGIN		
S-1	0'-2'	5	5			MEDIUM DENSE, BLACK, SAND AND GRAVEL, SOME SILT, WET, SLAG, BRICK, CONCRETE, FILL		CEMENT CAP 0'-4'
		10						
S-2	5'-7'	1	2	5		CHANGING AT 6FT TO:		BENTONITE PELLETS 4'-8'
		1	2			VERY LOOSE, BROWN, FINE SAND, TRACE GRAVEL, WET, PLANT FRAGMENTS, YELLOWISH-BROWN LENSES.		WELL SORTED SAND 8'-12'
S-3	10'-12'	3	4	10		CHANGING AT 11'-10" TO:		WELL SCREEN 10'-12'
		4	3					
S-4	12'-14'	2	3			FIRM, GREY, CLAYEY SILT, MOIST.		
		4	4					
				15				
						BOTTOM OF BORING @ 12 FT		
				20				
				25				
				30				
				35				

NOTES: CLASSIFICATION BASED UPON VISUAL INSPECTION BY MPI INSPECTOR IN FIELD. WELL 2" DIAMETER PVC CASING WITH SLOTTED SCREEN. PROTECTIVE STEEL CASING WITH LOCKING CAP OVER STICK-UP.

BORING [illegible]

PROJECT: LTV MARILLA STEET LAUNDFILL

PROJECT NO: 84-8-04-9

DATE: JULY 1, 1986

LOCATION: SOUTH BUFFALO, NEW YORK

DRILLING CONTRACTOR: ROCHESTER DRILLING

INSPECTOR: J. AMEND

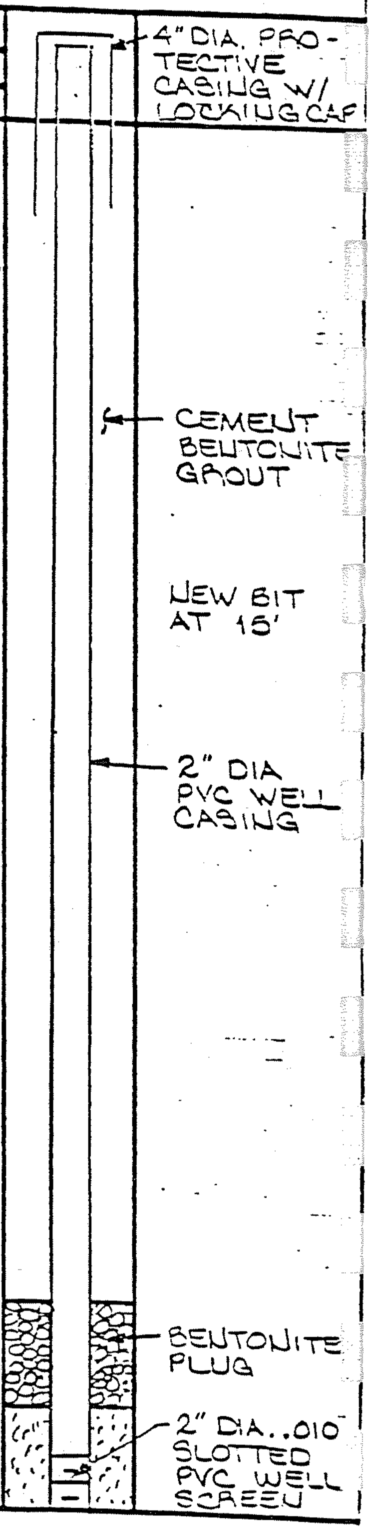
DRILLING METHOD: 8" × 4 1/4" HOLLOW STEM AUGER

SAMPLING METHOD: 2" Ø SPLIT SPOON AT 5' INTERVALS

ELEVATION:

DATUM:

SAMPLE				DEPTH	STRATA	SOIL DESCRIPTION
no.	depth	blows per 6"				density, color, SOIL, admixtures, moisture, other notes, ORIGIN
S-1	1-5'	18	29			MEDIUM DENSE, DARK BROWN SAND AND GRAVEL SIZE FILL AND SLAG, SOME YELLOW BRICK, MED MOIST NO RECOVERY SAMPLE DEPTH 5-7 FEET
		40	27			
				5		
S-2	10-12'	25	100/3	10		VERY DENSE, SILVER GRAY SLAG MIXED WITH DARK BROWN SAND AND GRAVEL MOIST
S-3	15-17'	29	43	15		MEDIUM DENSE LT BROWN TO DARK BROWN FINE GRAVEL AND SLAG, SOME BRICK AND GLASS FRAGMENTS, MOIST
		45	45			
S-4	20-22'	33	54	20		MEDIUM DENSE RED BROWN TO BLACK FINE TIGHTLY PACKED SAND AND FILL SOME FINE SLAG AND BRICK, MOIST
		26	42			
S-5	25-27'	40	26	25		MEDIUM DENSE, RED BROWN WITH GRAY STREAKS, FINE SLAG AND FILL MATERIAL, MOIST
		44	39			
S-6	30-32	100/3		30		VERY DENSE, BLACK FINE [illegible] GRAVEL AND SAND, WET
S-7	35-37	9	18	35		LOOSE GRAY, BLACK SILT SIZE FILL MIXED WITH SMALL STONES, WET.
		16	17			



NEW BIT AT 15'

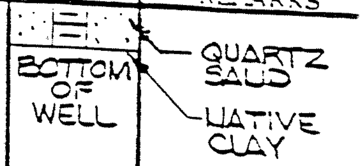
NOTES:

MALCOLM PIRNIE

SHEET 1 OF

BORING 14B

PROJECT: LTV/ MARILLA STREET LANDFILL
PROJECT NO: 848-03-1
DATE: JULY 1, 1986
LOCATION: SOUTH BUFFALO, NEW YORK
ELEVATION:
DATUM:

SAMPLE						SOIL DESCRIPTION		
no.	depth	blows per 6"		DEPTH	STRATA	density, color, SOIL, admixtures, moisture, other notes, ORIGIN	WELL CONST.	REMARKS
S-8	40-42	7	16			VERY LOOSE TO 41 MEDIUM GREEN/GRAY CLAY MOTTLED @ 41'		
		23	37					
				45				
				50				
				55				
				60				
				65				
				70				
				75				

NOTES:

MALCOLM PIRNIE ENVIRONMENTAL ENGINEERS, SCIENTISTS & PLANNERS

SHEET 2 OF

APPENDIX C

GROUND WATER QUALITY MONITORING REPORT
MARCH 1988

MALCOLM PIRNIE

LTV MARILLA STREET LANDFILL
BUFFALO, NEW YORK

GROUND WATER QUALITY MONITORING REPORT FOR FEBRUARY 1988 SAMPLING PERIOD

PROJECT NO. 0848-11-9

Prepared For:
LTV STEEL COMPANY
Cleveland, Ohio

MARCH 1988

MALCOLM PIRNIE, INC.
S3515 Abbott Road
P.O. Box 1938
Buffalo, New York 14219

1.0 INTRODUCTION

This monitoring report has been prepared as specified in the Annual Report recently submitted to the NYSDEC dated June 1987; and to comply with NYSDEC Part 360 quarterly ground water monitoring requirements for the Marilla Street Landfill. It includes the following items as related to the February 1988 sampling period:

- Summary of on-site ground water flow conditions;
- RCRA compliance monitoring data collected from upgradient Well 6B (third quarter);
- Routine monitoring data collected from downgradient RCRA wells in the BOF Dust Area (viz. 4B, 7B, 7A, 9B, 13B and 14B) and the West Pond;
- NYSDEC recommended monitoring data collected from Part 360 Wells 2A, 2B, 3A, 4A, 5A, 5B and 6A;
- Evaluation of statistically significant changes from the "initial" background levels of the four indicator parameters (viz. pH, TOC, TOX and Conductivity).

1.1 DEFINITIONS

1.1.1 RCRA Monitoring Wells

Wells 6B, 4B, 7A, 7B, 9B, 13B, 14B and the West Pond constitute the ground water compliance monitoring system for the BOF Dust Area, regulated under 6NYCRR Part 373.

1.1.2 Part 360 Monitoring Wells

Wells 2A, 2B, 3A, 4A, 5A, 5B and 6A constitute the ground water monitoring system for areas of the landfill outside of the BOF Dust Area, regulated under 6NYCRR Part 360.

1.1.3 "Initial" Background Values

Mean concentration and the coefficient of variance of the four indicator parameters (viz. pH, specific conductivity, TOC and TOX) determined from sampling the upgradient RCRA well, 6B. These values were reported in the October 1987 Quarterly Sampling Report.

1.1.4 Evaluation Procedure

The statistical procedure presented in Appendix D has been used to statistically compare the mean values of pH, specific conductivity, TOC and TOX to the "initial" background values. The evaluation of the statistical parameters (defined in Appendix D) is performed as discussed below.

1.1.4.1 For TOX, TOC and Specific Conductivity:

- If $t^* \geq t_c$ then conclude there has been a statistically significant increase.
- If $t^* < t_c$, then conclude there has not been a statistically significant increase.

1.1.4.2 For pH:

- If $/t^*/ > t_c$ and $t^* < 0$, then conclude there has been a statistically significant decrease.
- If $/t^*/ < t_c$, then conclude there has not been a statistically signifiant change.
- If $t^* \geq t_c$ and $t^* > 0$, then conclude there has been a statistically significant increase.

Absolute values of t* were used for the evaluation of pH in accordance with Reference 1.

2.0 GROUND WATER ELEVATIONS AND FLOW CONDITIONS

Water levels were measured on February 3, 1988 in all 19 on-site wells and three surface water staff gauges located in the drainage ditch immediately west of the site (refer to Plate 1 for locations). Table 1 is a summary of all water level data obtained since July 1987. Measurements obtained from the staff gauges were used in further defining the shallow ground water conditions on-site.

Site ground water flow conditions inferred from February 3, 1988 water levels are not substantially different from flow patterns discussed in the October 1987, and January 1988 reports.

Plates 1 and 2 are ground water isopotential maps for the on-site shallow wells and deep wells, respectively. Both maps were prepared from elevations recorded on February 3, 1988. The map for the shallow wells, based on 13 locations, depicts a ground water "low" in the central portion of the site. Ground water flows from both east and west directions to this central region and ultimately discharges into the West Pond. Surface water in the nearby ditch is also moving toward the West Pond, as evidenced from staff gauge measurements. At the opposite end of the site, to the south, the observed ground water flow is migrating in a west to southwest direction.

In the vicinity of the BOF Dust Area, it is believed that shallow ground water flows radially outward in all directions, which is substantiated from both monitoring well and surface water data. This mounding is thought to be partly attributed to the hydraulic conductivity of the material(s) underlying the BOF Dust Area. A downward flow component exists within this area (as evidenced from well pairs 4 and 7) with precipitation being the primary source of recharge.

The isopotential map for the deep wells (based upon six locations) illustrates a different flow pattern where ground water is moving in both west and southwest directions across the site.

3.0 ANALYTICAL DATA SUMMARY

Tables 2 through 4 present the analytical data for the February 1988 quarterly sampling period. Analytical testing was performed by Recra Environmental, Inc. of Amherst, New York. The laboratory report is included in Appendix A. Field sampling data sheets, prepared by Malcolm Pirnie, Inc. are presented as Appendix B.

Analytical results were evaluated both by inspection and statistical analysis. The sample mean and sample variance were calculated from quadruplicate measurements (necessitating four aliquots from the same sample for any given analysis) of pH, specific conductance, TOC and TOX, for upgradient well 6B and downgradient wells 4B, 7B, 7A, 9B, 13B, 14B and the West Pond. The mean of each of these indicator parameters, for all locales previously mentioned (both upgradient and downgradient), were then individually compared to the "initial" background mean of each indicator parameter (from well 6B) by using the Cochran's Approximation to the Behrens-Fisher t-test. The calculation sheets for each parameter are presented in Appendix C. Appendix D details the statistical procedure utilized in Appendix C. This provides a determination of statistically significant increases (decreases also for pH) over the "initial" background level. Statistically significant changes in the indicator parameters are summarized in Table 5.

In comparing the various parameters relative to the upgradient well, 6B, several conclusions can be drawn:

- pH (units): Statistically significant increases occurred in wells 4B (8.88), 7B (12.75), 14B (9.40), and the West Pond (9.88).
- Specific Conductivity (umhos/cm): Statistically significant increases occurred in wells 7B (10,287), 9B (2363), 13B (2000), and 14B (2050). A higher value also occurred in well 5B (2500).
- TOC (mg/l): Statistically significant increases occurred in wells 7B (297.5), 9B (80.0), and 13B (73.5). A higher value also occurred in well 3A (60).
- Chloride (mg/l): Significantly higher values occurred in wells 5B (360), 7B (350).

- Fluoride (mg/l): Higher values occurred in well 7B (7.0) and West Pond (1.9).
- Sulfate (mg/l): Higher values occur in wells 9B (910) and 14B (920).
- Total Phenols: Higher values occur in wells 2B (0.022), and 7B (0.36).
- Soluble Iron (mg/l): Higher values occur in wells 3A (.57), 5A (.72), 5B (4.2), 6A (1.4), 7A (3.9), 7B (5.9), 9B (1.6), 13B (0.61) and 14B (2.7).
- Soluble Manganese (mg/l): Higher values occur in wells 4B (0.91), 7A (0.35), 9B (1.8) and 13B (4.1).
- Soluble Lead (mg/l): Higher values occur in wells 7A (1.1), 7B (0.40), 9B (0.55) and 13B (0.10).
- Tetrachloroethene (ug/l): Higher values occur in well 14B (7.8).
- Quadruplicate TOC analyses for wells 6B, 7A and 7B exhibited a comparatively high variance. This is suspected to be a function of the variable amount of particulate matter present in the sample aliquot which is a common occurrence.

TABLE 1

LTV STEEL
MARILLA STREET LANDFILL INVESTIGATION CLOSURE

SUMMARY OF GROUND WATER AND SURFACE WATER ELEVATIONS

WELL NO.	07/06/87	07/21/87	08/04/87	08/12/87	08/28/87	09/25/87	11/18/87	02/03/88
2A	581.17					582.00	582.29	582.58
2B	582.14					582.05	582.48	582.92
3A	580.69					580.81	581.04	581.16
3B	580.42					579.86	580.27	580.41
4A	579.78					579.48	579.44	579.62
4B	582.61					582.01	582.20	582.46
5A	583.96					583.63	583.96	583.87
5B	585.75					585.94	585.80	586.10
6A	584.81					583.56	584.67	585.38
6B	585.04	584.49	584.15	583.64		583.64	585.17	585.82
7A	579.15					579.43	579.43	579.63
7B	583.97					583.74	583.06	583.47
8B	582.73					582.58	582.72	582.98
9B	582.25					582.28	582.53	582.68
10B	583.65					583.63	583.67	583.38
11B	582.66					582.37	582.59	582.72
12B	582.11					582.39	582.59	582.84
13B	582.52					581.91	582.23	582.35
14B	582.37					582.78	583.08	583.21
Surface Water Staff Gauges								
North Gauge					581.31	581.51	581.61	581.71
Mid Gauge					581.58	581.89	582.13	582.18
South Gauge					581.67	581.92	582.15	582.37

Elevations in Feet Above Mean Sea Level

TABLE 2

LTV STEEL
MARILLA STREET LANDFILL

RCRA COMPLIANCE BASELINE MONITORING DATA FOR WELL 6B

PARAMETER (Units as ug/l except as noted)	MW-6B (02/03/88)
pH (units)*	6.6/6.9/6.9/6.95
Temperature (^{o}C)*	10
Specific Conductivity (umhos/cm)*	1550/1650 1650/1650
Total Organic Halide	28/26/28/28
Total Organic Carbon (mg/l)	32/20/21/59
Chloride (mg/l)	27
Fluoride (mg/l)	0.11
Nitrate (mg NO_3-N/L)	0.16
Total Recoverable Phenolics (mg/l)	0.013
Sulfate (mg/l)	430
Fecal Coliform (Colony/100 ml)	<10
Total Radium (pCi/L)	6.6±3.0
Gross Alpha (pCi/L)	<5
Gross Beta (pCi/L)	4.6±2.3
Tetrachloroethene	<0.2
Endrin	<0.005
Lindane	<0.005
Methoxychlor	<0.05
Toxaphene	<0.5
2,4-D	<0.1
2,4,5-TP	<0.05

*field measured

TABLE 2 (Continued)

LTV STEEL
MARILLA STREET LANDFILL

RCRA COMPLIANCE BASELINE MONITORING DATA FOR WELL 6B

PARAMETER (Units as mg/l except as noted)	MW-6B (02/03/88)
Total Arsenic	0.006
Total Barium	0.04
Total Cadmium	<0.005
Total Chromium	0.019
Total Iron	17
Total Lead	<0.03
Total Manganese	0.35
Total Mercury	<0.0005
Total Selenium	<0.005
Total Silver	<0.005
Total Sodium	24
Soluble Arsenic	<0.005
Soluble Barium	<0.03
Soluble Cadmium	<0.005
Soluble Chromium	<0.005
Soluble Iron	<0.04
Soluble Lead	<0.03
Soluble Manganese	0.039
Soluble Mercury	<0.0005
Soluble Selenium	<0.005
Soluble Silver	<0.005
Soluble Sodium	23

TABLE 3

LTV STEEL
MARILLA STREET LANDFILL

RCRA COMPLIANCE PART 373 ROUTINE PARAMETERS

PARAMETER (Units as mg/l except as noted)	MW-4B (02/05/88)	MW-7A (02/03/88)	MW-7B (02/04/88**)	MW-9B (02/03/88)	MW-13B (02/05/88)	MW-14B (02/05/88)	WP-1 (02/05/88)
pH (units)*	8.8/8.9 8.8/9.0	7.0/7.0 7.0/7.0	12.6/12.8 12.8/12.8	6.7/6.8 6.8/6.8	6.7/6.85 7.0/7.0	9.4/9.4 9.4/9.4	9.8/9.9 9.9/9.9
Temperature (^{o}C)*	8	-	10	-	8	8	0
Specific Conductivity (umhos/cm)*	1100/1150 1160/1130	1020/1020 1020/1020	10400/10750 10000/10000	2250/2300 2500/2400	2000/2000 2000/2000	2000/2100 2100/2000	750/725 725/750
Total Organic Halogen (ug/l)	8.5/5.9 11/9.4	<5/<5 <5/<5	16/38 38/37	65/30 15/37	22/50 81/32	18/18 15/13	29/37 30/26
Total Organic Carbon	24/20 26/24	16/15 27/46	380/190 390/230	80/95 68/77	86/56 81/71	22/21 26/31	21/18 20/16
Tetrachloroethene (ug/l)	<0.2	<0.2	<0.2	<0.2	<0.2	7.8	<0.2
Chloride	47	61	350	47	160	100	65
Fluoride	0.96	0.93	7.0	0.33	0.74	1.1	1.9
Total Recoverable Phenolics	<0.01	<0.01	0.36	<0.01	<0.01	<0.01	<0.02
Sulfate	310	82	68	910	170	920	160

* field measured
**field measurements taken 02/05/88

WP-1 = West Pond

TABLE 3 (Continued)

LTV STEEL
MARILLA STREET LANDFILL

RCRA COMPLIANCE PART 373 ROUTINE PARAMETERS

PARAMETER (Units as mg/l except as noted)	MW-4B (02/05/88)	MW-7A (02/03/88)	MW-7B (02/04/88**)	MW-9B (02/03/88)	MW-13B (02/05/88)	MW-14B (02/05/88)	WP-1 (02/05/88)
Total Arsenic	0.006	0.043	0.021	0.016	0.018	<0.005	<0.005
Total Cadmium	0.081	<0.005	<0.005	0.007	<0.005	<0.005	<0.005
Total Chromium	0.006	0.17	0.016	0.21	0.025	0.009	0.006
Total Iron	3.1	180	4.9	52	42	1.5	1.1
Total Lead	<0.07	1.5	0.53	0.60	0.10	<0.07	<0.07
Total Manganese	1.1	5.4	0.16	4.5	6.9	0.14	0.14
Total Mercury	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Soluble Arsenic	<0.005	<0.005	0.015	<0.005	<0.005	<0.005	<0.005
Soluble Cadmium	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Soluble Chromium	<0.005	<0.005	<0.005	0.005	<0.005	<0.006	<0.005
Soluble Iron	<0.02	3.9	5.9	1.6	0.61	2.7	0.09
Soluble Lead	<0.07	1.1	0.40	0.55	0.10	<0.07	<0.05
Soluble Manganese	0.91	0.35	0.022	1.8	4.1	0.24	0.044
Soluble Mercury	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005

*field measurements taken 02/05/88 WP-1 = West Pond

TABLE 4

LTV STEEL
MARILLA STREET LANDFILL

NYSDEC RECOMMENDED PART 360 ROUTINE GROUND WATER MONITORING DATA

PARAMETER (Units as mg/l except as noted)	MW-2A (02/04/88)	MW-2B (02/04/88)	MW-3A-1 (02/04/88)	MW-4A (02/04/88)	MW-5A (02/03/88)	MW-5B (02/03/88)	MW-6A (02/03/88)
pH (units)*	-	-	-	-	-	-	7.0
Temperature (^{o}C)*	-	-	-	-	-	6.6	10
Specific Conductivity (umhos/cm)*	800	-	1600	750	1150	2500	1450
Total Organic Carbon	21	20	60	19	47	26	20
Chloride	120	73	65	29	44	360	52
Total Recoverable Phenolics	<0.01	0.022	<0.01	<0.01	<0.01	<0.01	<0.01
Filterable Residue (180^{o}C)	400	350	800	310	690	670	810
Sulfate	4.0	180	180	110	130	290	290
Total Chromium	0.005	0.005	0.31	0.006	0.045	0.007	0.15
Total Iron	0.60	1.3	610	2.3	54	10	210
Total Lead	<0.05	<0.05	0.54	<0.05	<0.05	<0.05	0.10
Soluble Chromium	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Soluble Iron	0.03	0.02	0.57	0.08	0.72	4.2	1.4
Soluble Lead	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

*Field Measured; pH measurements were not obtained for all Part 360 monitoring wells because of pH/temperature meter became inoperative in the field.

TABLE 5

LTV STEEL
MARILLA STREET LANDFILL

SUMMARY OF STATISTICAL ANALYSIS OF RCRA INDICATOR PARAMETERS

PARAMETER	INITIAL** BACKGROUND VALUES-6B	CURRENT BACKGROUND VALUES-6B	DOWNGRADIENT SAMPLE LOCATIONS						
			4B	7A	7B	9B	13B	14B	WEST POND
Average pH Result*	6.9 -	6.84 -	8.88 Increase	7.00 -	12.75 Increase	6.77 -	6.89 -	9.40 Increase	9.88 Increase
Average Specific Conductivity Result*	1503 -	1625 -	1135 -	1020 -	10287 Increase	2363 Increase	2000 Increase	2050 Increase	737 -
Average Total Organic Halogen Result*	39 -	27.5 -	8.7 -	5 -	32.25 -	36.8 -	46.25 -	16 -	30.5 -
Average Total Organic Carbon Result*	33 -	33 -	23.5 -	26 -	297.5 Increase	80.0 Increase	73.5 Increase	25 -	18.8 -

*Statistically significant change.
Blank space means no increase (or decrease for pH).

**From October 1987 Quarterly Sampling Report

REFERENCES

1. McBean, E.A., Kompter, M., Rouers, F. (1988), A Critical Examination of Approximations Implicit in Cochran's Procedure. Ground Water Monitoring Review, Winter 1988, pp. 83-87.

APPENDIX A

LABORATORY DATA

1/7898

RECRA ENVIRONMENTAL, INC.

Chemical Waste Analysis, Prevention and Control

March 7, 1988

Mr. Robert O'Laskey
Malcolm Pirnie, Inc.
South 3515 Abbott Road
Orchard Park, NY 14219

Re: Analytical Results

Dear Mr. O'Laskey:

Please find enclosed results concerning the analyses of the samples recently submitted by your firm. Results of analysis for Radiation parameters will be submitted to you upon receipt from the subcontracted laboratory.

Pertinent Information: Quote #: Q88-025
Matrix: Aqueous
Samples Received: 2/3-5/88
Sample Dates: 2/3-5/88

If you have any questions concerning these data, do not hesitate to contact our Customer Service Representative at (716) 691-2600.

Sincerely,

RECRA ENVIRONMENTAL, INC.

Arun K. Bhattacharya, Ph.D.
Senior Vice President/
Laboratory Director

MDL/AKB/mdl
Enclosure

I.D. #88-162
#88-162A, Partial
#88-162B & C
#8A1118

ANALYTICAL RESULTS

Prepared For

Malcolm Pirnie, Inc.
S-3515 Abbott Road
Orchard Park, New York 14219

Prepared By

Recra Environmental, Inc.
10 Hazelwood Drive, Suite 106
Amherst, New York 14150

METHODOLOGIES

The specific methodologies employed in obtaining the enclosed analytical results are indicated on the specific data table. The method numbers presented refer to one of the following U.S. Environmental Protection Agency references unless noted otherwise in this report.

- 40 CFR Part 136 "Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act" October 26, 1984 (Federal Register) U.S. Environmental Protection Agency.
- U.S. Environmental Protection Agency "Test Methods for Evaluating Solid Waste - Physical/Chemical Methods". Office of Solid Waste and Emergency Response. July 1982, SW-846, Second Edition.

COMMENTS

Comments pertain to data on one or all pages of this report.

The values reported as "less than" (<) indicate the working detection limit for the particular sample and/or parameter.

Total Organic Carbon results may not include volatile constituents since the sample was purged with an inert gas prior to analysis.

AQUEOUS MATRIX
SELECTED METHOD 8080 - ORGANOCHLORINE PESTICIDES

COMPOUND (Units of Measure = µg/l)	SAMPLE IDENTIFICATION (DATE)
	MW-6B (2/4/88)
Lindane	<0.005
Endrin	<0.005
Toxaphene	<0.5
Methoxychlor	<0.05
Extraction Date	2/4/88
Analysis Date	2/13/88

AQUEOUS MATRIX
SELECTED METHOD 601 - PURGEABLE HALOCARBONS

COMPOUND (Units of Measure = µg/l)	SAMPLE IDENTIFICATION (DATE)
	MW-6B (2/4/88)
Tetrachloroethene	<0.2
Analysis Date	2/12/88
Surrogate Compound Level Added = 15 µg/l (% Recovery)	
Bromochloromethane	98

AQUEOUS MATRIX
METHOD 8150

PARAMETER	UNITS OF MEASURE	EXTRACTION DATE	ANALYSIS DATE	SAMPLE IDENTIFICATION (DATE)
				MW-6B (2/4/88)
2,4-D	µg/l	2/10/88	2/10/88	<0.1
2,4,5-TP	µg/l	2/10/88	2/10/88	<0.05

AQUEOUS MATRIX
SELECTED METHOD 601 - PURGEABLE HALOCARBONS

COMPOUND (Units of Measure = µg/l)	SAMPLE IDENTIFICATION (DATE)		
	MW-4B (2/5/88)	MW-7A (2/3/88)	MW-7B (2/4/88)
Tetrachloroethene	<0.2	<0.2	<0.2
Analysis Date	2/12/88	2/12/88	2/12/88
Surrogate Compound Level Added = 15 µg/l (% Recovery) Bromochloromethane	108	99	101

AQUEOUS MATRIX
SELECTED METHOD 601 - PURGEABLE HALOCARBONS

COMPOUND (Units of Measure = µg/l)	SAMPLE IDENTIFICATION (DATE)	
	MW-9B (2/3/88)	MW-13B (2/5/88)
Tetrachloroethene	<0.2	<0.2
Analysis Date	2/12/88	2/12/88
Surrogate Compound Level Added = 15 µg/l (% Recovery) Bromochloromethane	114	102

AQUEOUS MATRIX
SELECTED METHOD 601 - PURGEABLE HALOCARBONS

COMPOUND (Units of Measure = µg/l)	SAMPLE IDENTIFICATION (DATE)	
	MW-14B (2/5/88)	WP-1 (2/5/88)
Tetrachloroethene	7.8	<0.2
Analysis Date	2/12/88	2/12/88
Surrogate Compound Level Added = 15 µg/l (% Recovery) Bromochloromethane	104	97

AQUEOUS MATRIX
TOTAL METALS

PARAMETER (Units of Measure = mg/l)	METHOD NUMBER	ANALYSIS DATE	SAMPLE IDENTIFICATION (DATE)
			MW-6B (2/3/88)
Total Arsenic	206.2	2/12/88	0.006
Total Barium	208.1	2/15/88	0.04
Total Cadmium	213.1	2/15/88	<0.005
Total Chromium	218.1	2/15/88	0.019
Total Iron	236.1	3/1/88	17
Total Lead	239.1	2/15/88	<0.03
Total Manganese	243.1	2/16/88	0.35
Total Mercury	245.1	2/17/88	<0.0005
Total Selenium	270.2	2/12/88	<0.005
Total Silver	272.1	2/15/88	<0.005
Total Sodium	273.1	2/16/88	24

AQUEOUS MATRIX
SOLUBLE METALS

COMPOUND (Units of Measure = mg/l)	METHOD NUMBER	ANALYSIS DATE	SAMPLE IDENTIFICATION (DATE)
			MW-6B (2/3/88)
Soluble Arsenic	206.2	2/12/88	<0.005
Soluble Barium	208.1	2/15/88	<0.03
Soluble Cadmium	213.1	2/15/88	<0.005
Soluble Chromium	218.1	2/15/88	<0.005
Soluble Iron	236.1	3/1/88	<0.04
Soluble Lead	239.1	2/15/88	<0.03
Soluble Manganese	243.1	2/16/88	0.039
Soluble Mercury	245.1	2/17/88	<0.0005
Soluble Selenium	270.2	2/12/88	<0.005
Soluble Silver	272.1	2/15/88	<0.005
Soluble Sodium	273.1	2/16/88	23

AQUEOUS MATRIX
TOTAL METALS

PARAMETER (Units of Measure = mg/l)	METHOD NUMBER	ANALYSIS DATE	SAMPLE IDENTIFICATION (DATE)	
			MW-2A (2/4/88)	MW-2B (2/4/88)
Total Chromium	218.1	2/29/88	0.005	0.005
Total Iron	236.1	3/1/88	0.60	1.3
Total Lead	239.1	2/22/88	<0.05	<0.05

AQUEOUS MATRIX
TOTAL METALS

PARAMETER (Units of Measure = mg/l)	METHOD NUMBER	ANALYSIS DATE	SAMPLE IDENTIFICATION (DATE)	
			MW-3A (2/4/88)	MW-4A (2/4/88)
Total Chromium	218.1	2/29/88	0.31	0.006
Total Iron	236.1	3/1/88	610	2.3
Total Lead	239.1	2/22/88	0.54	<0.05

AQUEOUS MATRIX
TOTAL METALS

PARAMETER (Units of Measure = mg/l)	METHOD NUMBER	ANALYSIS DATE	SAMPLE IDENTIFICATION (DATE)	
			MW-5A (2/3/88)	MW-5B (2/3/88)
Total Chromium	218.1	2/29/88	0.045	0.007
Total Iron	236.1	3/1/88	54	10
Total Lead	239.1	2/22/88	<0.05	<0.05

AQUEOUS MATRIX
TOTAL METALS

PARAMETER (Units of Measure = mg/l)	METHOD NUMBER	ANALYSIS DATE	SAMPLE IDENTIFICATION (DATE) MW-6A (2/3/88)
Total Chromium	218.1	2/29/88	0.15
Total Iron	236.1	3/1/88	210
Total Lead	239.1	2/22/88	0.10

AQUEOUS MATRIX
SOLUBLE METALS

COMPOUND (Units of Measure = mg/l)	METHOD NUMBER	ANALYSIS DATE	SAMPLE IDENTIFICATION (DATE)	
			MW-2A (2/4/88)	MW-2B (2/4/88)
Soluble Chromium	218.1	2/29/88	<0.005	<0.005
Soluble Iron	236.1	3/1/88	0.03	0.02
Soluble Lead	239.1	2/29/88	<0.05	<0.05

AQUEOUS MATRIX
SOLUBLE METALS

COMPOUND (Units of Measure = mg/l)	METHOD NUMBER	ANALYSIS DATE	SAMPLE IDENTIFICATION (DATE)	
			MW-3A (2/4/88)	MW-4A (2/4/88)
Soluble Chromium	218.1	2/29/88	<0.005	<0.005
Soluble Iron	236.1	3/1/88	0.57	0.08
Soluble Lead	239.1	2/29/88	<0.05	<0.05

AQUEOUS MATRIX
SOLUBLE METALS

COMPOUND (Units of Measure = mg/l)	METHOD NUMBER	ANALYSIS DATE	SAMPLE IDENTIFICATION (DATE)	
			MW-5A (2/3/88)	MW-5B (2/3/88)
Soluble Chromium	218.1	2/29/88	<0.005	<0.005
Soluble Iron	236.1	3/1/88	0.72	4.2
Soluble Lead	239.1	2/29/88	<0.05	<0.05

AQUEOUS MATRIX
SOLUBLE METALS

COMPOUND (Units of Measure = mg/l)	METHOD NUMBER	ANALYSIS DATE	SAMPLE IDENTIFICATION (DATE)
			MW-6A (2/3/88)
Soluble Chromium	218.1	2/29/88	<0.005
Soluble Iron	236.1	3/1/88	1.4
Soluble Lead	239.1	2/29/88	0.05

AQUEOUS MATRIX
TOTAL METALS

PARAMETER (Units of Measure = mg/l)	METHOD NUMBER	ANALYSIS DATE	SAMPLE IDENTIFICATION (DATE)	
			MW-4B (2/5/88)	MW-7A (2/3/88)
Total Arsenic	206.2	2/12/88	0.006	0.043
Total Cadmium	213.1	2/16/88	0.081	<0.005
Total Chromium	218.1	2/16/88	0.006	0.17
Total Iron	236.1	3/1/88	3.1	180
Total Lead	239.1	2/29/88	<0.07	1.5
Total Manganese	243.1	3/2/88	1.1	5.4
Total Mercury	245.1	3/1/88	<0.0005	<0.0005

AQUEOUS MATRIX
TOTAL METALS

PARAMETER (Units of Measure = mg/l)	METHOD NUMBER	ANALYSIS DATE	SAMPLE IDENTIFICATION (DATE)	
			MW-7B (2/4/88)	MW-9B (2/3/88)
Total Arsenic	206.2	2/12/88	0.021	0.016
Total Cadmium	213.1	2/16/88	<0.005	0.007
Total Chromium	218.1	2/16/88	0.016	0.21
Total Iron	236.1	3/1/88	4.9	52
Total Lead	239.1	2/29/88	0.53	0.60
Total Manganese	243.1	3/2/88	0.16	4.5
Total Mercury	245.1	3/1/88	<0.0005	<0.0005

AQUEOUS MATRIX
TOTAL METALS

PARAMETER (Units of Measure = mg/l)	METHOD NUMBER	ANALYSIS DATE	SAMPLE IDENTIFICATION (DATE)	
			MW-13B (2/5/88)	MW-14B (2/5/88)
Total Arsenic	206.2	2/12/88	0.018	<0.005
Total Cadmium	213.1	2/16/88	<0.005	<0.005
Total Chromium	218.1	2/16/88	0.025	0.009
Total Iron	236.1	3/1/88	42	1.5
Total Lead	239.1	2/29/88	0.10	<0.07
Total Manganese	243.1	3/2/88	6.9	0.14
Total Mercury	245.1	3/1/88	<0.0005	<0.0005

AQUEOUS MATRIX
TOTAL METALS

PARAMETER (Units of Measure = mg/l)	METHOD NUMBER	ANALYSIS DATE	SAMPLE IDENTIFICATION (DATE)
			WP-1 (2/5/88)
Total Arsenic	206.2	2/12/88	<0.005
Total Cadmium	213.1	2/16/88	<0.005
Total Chromium	218.1	2/16/88	0.006
Total Iron	236.1	3/1/88	1.1
Total Lead	239.1	2/29/88	<0.07
Total Manganese	243.1	3/2/88	0.14
Total Mercury	245.1	3/1/88	<0.0005

AQUEOUS MATRIX
SOLUBLE METALS

COMPOUND (Units of Measure = mg/l)	METHOD NUMBER	ANALYSIS DATE	SAMPLE IDENTIFICATION (DATE)	
			MW-4B (2/5/88)	MW-7A (2/3/88)
Soluble Arsenic	206.2	2/15/88	<0.005	<0.005
Soluble Cadmium	213.1	2/16/88	<0.005	<0.005
Soluble Chromium	218.1	2/16/88	<0.005	0.005
Soluble Iron	236.1	3/1/88	0.02	3.9
Soluble Lead	239.1	2/29/88	<0.07	1.1
Soluble Manganese	243.1	3/2/88	0.91	0.35
Soluble Mercury	245.1	3/1/88	<0.0005	<0.0005

AQUEOUS MATRIX
SOLUBLE METALS

COMPOUND (Units of Measure = mg/l)	METHOD NUMBER	ANALYSIS DATE	SAMPLE IDENTIFICATION (DATE)	
			MW-7B (2/4/88)	MW-9B (2/3/88)
Soluble Arsenic	206.2	2/15/88	0.015	<0.005
Soluble Cadmium	213.1	2/16/88	<0.005	<0.005
Soluble Chromium	218.1	2/16/88	<0.005	0.005
Soluble Iron	236.1	3/1/88	0.59	1.6
Soluble Lead	239.1	2/29/88	0.40	0.55
Soluble Manganese	243.1	3/2/88	0.022	1.8
Soluble Mercury	245.1	3/1/88	<0.0005	<0.0005

AQUEOUS MATRIX
SOLUBLE METALS

COMPOUND (Units of Measure = mg/l)	METHOD NUMBER	ANALYSIS DATE	SAMPLE IDENTIFICATION (DATE)	
			MW-13B (2/5/88)	MW-14B (2/5/88)
Soluble Arsenic	206.2	2/15/88	<0.005	<0.005
Soluble Cadmium	213.1	2/16/88	<0.005	<0.005
Soluble Chromium	218.1	2/16/88	<0.005	<0.006
Soluble Iron	236.1	3/1/88	0.61	2.7
Soluble Lead	239.1	2/29/88	0.10	<0.07
Soluble Manganese	243.1	3/2/88	4.1	0.24
Soluble Mercury	245.1	3/1/88	<0.0005	<0.0005

AQUEOUS MATRIX
SOLUBLE METALS

COMPOUND (Units of Measure = mg/l)	METHOD NUMBER	ANALYSIS DATE	SAMPLE IDENTIFICATION (DATE)
			WP-1 (2/5/88)
Soluble Arsenic	206.2	2/15/88	<0.005
Soluble Cadmium	213.1	2/16/88	<0.005
Soluble Chromium	218.1	2/16/88	<0.005
Soluble Iron	236.1	3/1/88	0.09
Soluble Lead	239.1	2/29/88	<0.05
Soluble Manganese	243.1	3/2/88	0.044
Soluble Mercury	245.1	3/1/88	<0.0005

AQUEOUS MATRIX
WATER QUALITY TESTING

PARAMETER	METHOD NUMBER	UNITS OF MEASURE	ANALYSIS DATE	SAMPLE IDENTIFICATION (DATE)
				MW-6B (2/3/88)
Total Organic Carbon	415.1	mg/l	2/26/88	32/20/21/59
Chloride	325.3	mg/l	2/12/88	27
Fluoride	340.2	mg/l	2/13/88	0.11
Nitrate	352.1	mg NO_3-N/L	2/5/88	0.16
Total Recoverable Phenolics	420.1	mg/l	2/22/88	0.013
Sulfate	375.4	mg/l	3/1/88	430

AQUEOUS MATRIX
WATER QUALITY TESTING

PARAMETER	METHOD NUMBER	UNITS OF MEASURE	ANALYSIS DATE	SAMPLE IDENTIFICATION (DATE) MW-2A (2/4/88)	MW-2B (2/4/88)
Total Organic Carbon	415.1	mg/l	3/1/88	21	20
Chloride	325.3	mg/l	2/12/88	120	73
Total Recoverable Phenolics	420.1	mg/l	2/23/88	<0.01	0.022
Filterable Residue (180°C)	160.1	mg/l	2/5/88	400	350
Sulfate	375.4	mg/l	3/1/88	4.0	180

AQUEOUS MATRIX
WATER QUALITY TESTING

PARAMETER	METHOD NUMBER	UNITS OF MEASURE	ANALYSIS DATE	SAMPLE IDENTIFICATION (DATE) MW-3A (2/4/88)	MW-4A (2/4/88)
Total Organic Carbon	415.1	mg/l	3/1/88	60	19
Chloride	325.3	mg/l	2/12/88	65	29
Total Recoverable Phenolics	420.1	mg/l	2/23/88	<0.01	<0.01
Filterable Residue (180°C)	160.1	mg/l	2/5/88	800	310
Sulfate	375.4	mg/l	3/1/88	180	110

AQUEOUS MATRIX
WATER QUALITY TESTING

PARAMETER	METHOD NUMBER	UNITS OF MEASURE	ANALYSIS DATE	SAMPLE IDENTIFICATION (DATE)	
				MW-5A (2/4/88)	MW-5B (2/3/88)
Total Organic Carbon	415.1	mg/l	3/1/88	47	26
Chloride	325.3	mg/l	2/12/88	44	360
Total Recoverable Phenolics	420.1	mg/l	2/23/88	<0.01	<0.01
Filterable Residue (180°C)	160.1	mg/l	2/5/88	690	670
Sulfate	375.4	mg/l	3/1/88	130	290

AQUEOUS MATRIX
WATER QUALITY TESTING

PARAMETER	METHOD NUMBER	UNITS OF MEASURE	ANALYSIS DATE	SAMPLE IDENTIFICATION (DATE)
				MW-6A (2/3/88)
Total Organic Carbon	415.1	mg/l	3/1/88	20
Chloride	325.3	mg/l	2/12/88	52
Total Recoverable Phenolics	420.1	mg/l	2/23/88	<0.01
Filterable Residue (180°C)	160.1	mg/l	2/5/88	810
Sulfate	375.4	mg/l	3/1/88	290

AQUEOUS MATRIX
WATER QUALITY TESTING

PARAMETER	METHOD NUMBER	UNITS OF MEASURE	ANALYSIS DATE	SAMPLE IDENTIFICATION (DATE)	
				MW-4B (2/5/88)	MW-7A (2/3/88)
Total Organic Carbon	415.1	mg/l	2/26/88	24/20/26/24	16/15/27/46
Chloride	325.3	mg/l	2/12/88	47	61
Fluoride	340.2	mg/l	2/13/88	0.96	0.93
Total Recoverable Phenolics	420.1	mg/l	2/22/88	<0.01	<0.01
Sulfate	375.4	mg/l	3/1/88	310	82

AQUEOUS MATRIX
WATER QUALITY TESTING

PARAMETER	METHOD NUMBER	UNITS OF MEASURE	ANALYSIS DATE	SAMPLE IDENTIFICATION (DATE)	
				MW-7B (2/4/88)	MW-9B (2/3/88)
Total Organic Carbon	415.1	mg/l	2/26/88	380/190/390/230	80/95/68/77
Chloride	325.3	mg/l	2/12/88	350	47
Fluoride	340.2	mg/l	2/13/88	7.0	0.33
Total Recoverable Phenolics	420.1	mg/l	2/22/88	0.36	<0.01
Sulfate	375.4	mg/l	3/1/88	68	910

AQUEOUS MATRIX
WATER QUALITY TESTING

PARAMETER	METHOD NUMBER	UNITS OF MEASURE	ANALYSIS DATE	SAMPLE IDENTIFICATION (DATE)	
				MW-13B (2/5/88)	MW-14B (2/5/88)
Total Organic Carbon	415.1	mg/l	2/26/88	86/56/81/71	22/21/26/31
Chloride	325.3	mg/l	2/12/88	160	100
Fluoride	340.2	mg/l	2/13/88	0.74	1.1
Total Recoverable Phenolics	420.1	mg/l	2/22/88	<0.01	<0.01
Sulfate	375.4	mg/l	3/1/88	170	920

AQUEOUS MATRIX
WATER QUALITY TESTING

PARAMETER	METHOD NUMBER	UNITS OF MEASURE	ANALYSIS DATE	SAMPLE IDENTIFICATION (DATE)
				WP-1 (2/5/88)
Total Organic Carbon	415.1	mg/l	2/26/88	21/18/20/16
Chloride	325.3	mg/l	2/12/88	65
Fluoride	340.2	mg/l	2/13/88	1.9
Total Recoverable Phenolics	420.1	mg/l	2/22/88	<0.02
Sulfate	375.4	mg/l	3/1/88	160

AQUEOUS MATRIX
METHOD 9020

SAMPLE IDENTIFICATION	SAMPLE DATE	PARAMETER (UNITS OF MEASURE)
		TOTAL ORGANIC HALIDES (TOX) (μg/l)
MW-4B	2/5/88	8.5/5.9/11/9.4
MW-6B	2/3/88	28/26/28/28
MW-7A	2/3/88	<5/<5/<5/<5
MW-7B	2/4/88	16/38/38/37
MW-9B	2/3/88	65/30/15/37
MW-13B	2/5/88	22/50/81/32
MW-14B	2/5/88	18/18/15/13
WP-1	2/5/88	29/37/30/26

AQUEOUS MATRIX

SAMPLE IDENTIFICATION	SAMPLE DATE	PARAMETER (UNITS OF MEASURE)
		FECAL COLIFORM* (Colonies/100ml)
MW-6B	2/3/88	<10

*Analysis performed according to The Standard Methods for the Examination of Water and Wastewater, 15th Edition.

QUALITY CONTROL INFORMATION - PRECISION
AQUEOUS MATRIX
SELECTED METHOD 601 - PURGEABLE HALOCARBONS

SAMPLE IDENTIFICATION MW-14B

COMPOUND (Units of Measure = µg/l)	VALUE 1	VALUE 2	MEAN	STANDARD DEVIATION
Tetrachloroethene	8.5	7.0	7.8	1.1
Analysis Date	2/12/88	2/12/88	-	-
Surrogate Compound Level Added = 15 µg/l (% Recovery) Bromochloromethane	100	107	104	4.9

QUALITY CONTROL INFORMATION - ACCURACY
AQUEOUS MATRIX
SELECTED METHOD 601 - PURGEABLE HALOCARBONS

SAMPLE IDENTIFICATION MW-14B

COMPOUND	NANOGRAMS OF SPIKE	PERCENT RECOVERY
Tetrachloroethene	20	94
Analysis Date	2/12/88	
Surrogate Compound Level Added = 15 µg/l (% Recovery) Bromochloromethane	115	

QUALITY CONTROL INFORMATION - PRECISION
AQUEOUS MATRIX
SOLUBLE METALS

COMPOUND (Units of Measure = mg/l)	METHOD NUMBER	SAMPLE IDENTIFICATION	VALUE 1	VALUE 2	MEAN	STANDARD DEVIATION
Soluble Arsenic	206.2	MW-6B	<0.005	<0.005	<0.005	-
Soluble Barium	208.1		<0.03	<0.03	<0.03	-
Soluble Cadmium	213.1		<0.005	<0.005	<0.005	-
Soluble Chromium	218.1		<0.005	<0.005	<0.005	-
Soluble Iron	236.1		<0.04	<0.04	<0.04	-
Soluble Lead	239.1		<0.03	<0.03	<0.03	-
Soluble Manganese	243.1		0.034	0.043	0.039	0.0064
Soluble Mercury	245.1		<0.0005	<0.0005	<0.0005	-
Soluble Selenium	270.2		<0.005	<0.005	<0.005	-
Soluble Silver	272.1		<0.005	<0.005	<0.005	-
Soluble Sodium	273.1		23	23	23	0

QUALITY CONTROL INFORMATION - ACCURACY
AQUEOUS MATRIX
SOLUBLE METALS

COMPOUND	METHOD NUMBER	SAMPLE IDENTIFICATION	MICROGRAMS OF SPIKE	PERCENT RECOVERY
Soluble Arsenic	206.2	MW-6B	50	90
Soluble Barium	208.1		5,000	100
Soluble Cadmium	213.1		500	103
Soluble Chromium	218.1		500	93
Soluble Iron	236.1		500	100
Soluble Lead	239.1		500	105
Soluble Manganese	243.1		500	105
Soluble Mercury	245.1		0.40	88
Soluble Selenium	270.2		50	90
Soluble Silver	272.1		500	97
Soluble Sodium	273.1		20,000	100

QUALITY CONTROL INFORMATION - PRECISION
AQUEOUS MATRIX
TOTAL METALS

PARAMETER (Units of Measure = mg/l)	METHOD NUMBER	SAMPLE IDENTIFICATION	VALUE 1	VALUE 2	MEAN	STANDARD DEVIATION
Total Chromium	218.1	MW-3A	0.31	0.31	0.31	0
Total Iron	236.1		610	610	610	0
Total Lead	239.1		0.52	0.55	0.54	0.021

QUALITY CONTROL INFORMATION - ACCURACY
AQUEOUS MATRIX
TOTAL METALS

PARAMETER	METHOD NUMBER	SAMPLE IDENTIFICATION	MICROGRAMS OF SPIKE	PERCENT RECOVERY
Total Chromium	218.1	MW-3A	500	96
Total Iron	236.1		500	99
Total Lead	239.1		500	99

QUALITY CONTROL INFORMATION - PRECISION
AQUEOUS MATRIX
TOTAL METALS

PARAMETER (Units of Measure = mg/l)	METHOD NUMBER	SAMPLE IDENTIFICATION	VALUE 1	VALUE 2	MEAN	STANDARD DEVIATION
Total Arsenic	206.2	MW-14B	<0.005	<0.005	<0.005	-
Total Cadmium	213.1		<0.005	<0.005	<0.005	-
Total Chromium	218.1		0.010	0.008	0.009	0.0014
Total Iron	236.1		1.5	1.5	1.5	0
Total Lead	239.1		<0.07	<0.07	<0.07	-
Total Manganese	243.1		0.14	0.14	0.14	0
Total Mercury	245.1		<0.0005	<0.0005	<0.0005	-

QUALITY CONTROL INFORMATION - ACCURACY
AQUEOUS MATRIX
TOTAL METALS

PARAMETER	METHOD NUMBER	SAMPLE IDENTIFICATION	MICROGRAMS OF SPIKE	PERCENT RECOVERY
Total Arsenic	206.2	MW-14B	50	106
Total Cadmium	213.1		500	105
Total Chromium	218.1		500	105
Total Iron	236.1		500	90
Total Lead	239.1		500	106
Total Manganese	243.1		500	100
Total Mercury	245.1		0.40	86

QUALITY CONTROL INFORMATION - PRECISION
AQUEOUS MATRIX
WATER QUALITY TESTING

PARAMETER	METHOD NUMBER	UNITS OF MEASURE	SAMPLE IDENTIFICATION	VALUE 1	VALUE 2	MEAN	STANDARD DEVIATION
Total Organic Carbon	415.1	mg/l	MW-6A	19	21	20	1.4
Chloride	325.3	mg/l	MW-7A	61	61	61	0
Fluoride	340.2	mg/l	MW-9B	0.33	0.33	0.33	0
Total Recoverable Phenolics	420.1	mg/l	MW-4A	<0.01	<0.01	<0.01	-
Filterable Residue (180°C)	160.1	mg/l	MW-5B	670	670	670	0
Sulfate	375.4	mg/l	MW-5A	130	130	130	0

QUALITY CONTROL INFORMATION - ACCURACY
AQUEOUS MATRIX
WATER QUALITY TESTING

PARAMETER	METHOD NUMBER	SAMPLE IDENTIFICATION	MICROGRAMS OF SPIKE	PERCENT RECOVERY
Total Organic Carbon	415.1	MW-4B	200	107
Chloride	325.3	MW-7A	2,500	100
Fluoride	340.2	MW-9B	50	94
Total Recoverable Phenolics	420.1	MW-4A	30	90
Sulfate	375.4	MW-5A	100	98

1/7992

RECRA ENVIRONMENTAL, INC.

Chemical Waste Analysis, Prevention and Control

March 21, 1988

Mr. Robert O'Laskey
Malcolm Pirnie, Inc.
South 3515 Abbott Road
Orchard Park, NY 14219

Re: Analytical Results

Dear Mr. O'Laskey:

Please find enclosed subcontracted results concerning the radiation analyses of the sample recently submitted by your firm. This report completes the requested analyses for this particular sample set.

Pertinent Information: Quote #: Q88-025
Matrix: Aqueous
Sample Received: 2/4/88
Sample Date: 2/4/88

If you have any questions concerning these data, do not hesitate to contact our Customer Service Representative at (716) 691-2600.

Sincerely,

RECRA ENVIRONMENTAL, INC.

Arun K. Bhattacharya, Ph.D.
Senior Vice President/
Laboratory Director

DJT/AKB/mdl
Enclosure

I.D. #88-162A, Final
#8A1118

1/7992

AQUEOUS MATRIX

PARAMETER	UNITS OF MEASURE	ANALYSIS DATE	SAMPLE IDENTIFICATION (DATE)
			MW-6B (2/4/88)
Total Radium	pCi/Liter	2/23/88	6.6 ± 3.0
Gross Alpha	pCi/Liter	3/4/88	<5.0
Gross Beta	pCi/Liter	3/4/88	4.6 ± 2.3

RECRA ENVIRONMENTAL, INC.

CHAIN OF CUSTODY RECORD

PROJECT NO.:

SITE NAME: LTV Steel,

SAMPLERS (SIGNATURE): Robert O'Dusley (Malcolm Pirnie)

STATION NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	16 oz Glass	16oz Plastic	1L Amber	40 ml vial	8oz Amber	4oz Plastic	REMARKS
	2/4	1^{00}		x	MW-4A	1	~~1~~ RO					1	~~Phenols~~ TOC
								~~1~~ RO					
	2/4	2^{00}		x	MW 3A	1	1						Phenol
						2		2					Metals
						1		1					Water Quality
						1						1	TOC
	2:30	2/4		x	MW-2A	1	1	~~1~~ RO					Phenols
						2		2					Metals
						1		1					Water Quality
						1						1	TOC
	2:45	2/4		x	MW-2B	1	1						Phenols
						2		2					Metals
						1		1					Water Quality
						1						1	TOC

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)	RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)
	2/4/88	4:52	J. Calert				

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)	RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED FOR LABORATORY BY (SIGNATURE)	DATE	TIME	REMARKS

Distribution: Original accompanies shipment; copy to coordinator field files.

RECRA ENVIRONMENTAL, INC.

CHAIN OF CUSTODY RECORD

PROJECT NO.:

SITE NAME: LTV steel

SAMPLERS (SIGNATURE): Robert O'Laskey (Malcolm Pirnie)

STATION NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CON-TAINERS	16oz Glass	16oz Plastic	1L Amber	40ml VOA	8oz Amber	4oz Plastic	1/2 Gal Plastic	REMARKS
	2/4	8^{30}		x	MW-5A	1	1							Phenol
					↓	1		1						Water Quality
	2/4	8 [illegible]		X	MW-6B	1							1	α, β, Ra
						2			2					Pesticides/Herbicides
					↓	2				2				Volatiles
	2/4	11^{00}		x	MW-7B	1	1							Phenols
						2		2						Metals
						1		1						Water Quality
						2				2				Volatiles
						4					4			TOX
					↓	4						4		TOC
	2/4	1^{00}		x	MW-4A		1							Phenols
								2						Metals
					↓			1						Water Quality

RELINQUISHED BY (SIGNATURE)	DATE / TIME	RECEIVED BY (SIGNATURE)	RELINQUISHED BY (SIGNATURE)	DATE / TIME	RECEIVED BY (SIGNATURE)
	2/4/88 4:50	J. Calvert			

RELINQUISHED BY (SIGNATURE)	DATE / TIME	RECEIVED BY (SIGNATURE)	RELINQUISHED BY (SIGNATURE)	DATE / TIME	RECEIVED BY (SIGNATURE)

RELINQUISHED BY (SIGNATURE)	DATE / TIME	RECEIVED FOR LABORATORY BY (SIGNATURE)	DATE / TIME	REMARKS

Distribution: Original accompanies shipment; copy to coordinator field files.

RECRA ENVIRONMENTAL, INC.

CHAIN OF CUSTODY RECORD

PROJECT NO.:

SITE NAME: LTV steel

SAMPLERS (SIGNATURE): Robert Odaskeys Malcolm Pirnie

STATION NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	8oz Amber	4oz Plastic	16oz Plastic	16oz Glass	40ml VoA		REMARKS
	2/3	4 pm		x	MW-5B	1				1			Phenol
						1		1					TOC
	2/3	2:00 pm		x	MW-9B	1				1			Phenol
						4	4						TOX
						4		4					TOC
						2			2				Metals
						1			1				Water Quality
						2					2		Volatiles
	2/3	11:30 pm		x	MW-6A	1				1			Phenols
						2			2				Metals
						1			1				Water Quality
						1		1					TOC
	2/3	4:30 pm		x	MW-5A	2			2				Metals
						1		1					TOC

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)	RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)
	2/3	8:14					

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)	RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED FOR LABORATORY BY (SIGNATURE)	DATE/TIME	REMARKS

Distribution: Original accompanies shipment, copy to coordinator field files.

RECRA ENVIRONMENTAL, INC.

CHAIN OF CUSTODY RECORD

PROJECT NO.:

SITE NAME: LTV Steel

SAMPLERS (SIGNATURE): Robert O'daskey (Malcolm Pirnie)

STATION NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	8oz Amber	4oz Plastic	16oz Plastic	16oz Glass	40ml VOA	REMARKS
	2/3	11^{00} Am		x	MW-6B	4	4					TOX
						4		4				TOC
						1			1			Water Quality
						2			2			Metals
						1				1		Phenols
						/					~~2~~ Ro-	~~EE- Volatiles~~ Ro
	2/3	3^{00} pm		x	MW-7A	4	4					TOX
						4		4				TOC
						1				1		Phenol
						1			1			Water Quality
						2			2			Metals
						2					2	Volatiles
	2/3	4:00 pm		x	MW-5B	2			2			Metals
						1			1			Water Quality

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)	RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)
	2/3	8:14					

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)	RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED FOR LABORATORY BY (SIGNATURE)	DATE/TIME	REMARKS

Distribution: Original accompanies shipment; copy to coordinator field files.

RECRA ENVIRONMENTAL, INC.

CHAIN OF CUSTODY RECORD

PROJECT NO.:

SITE NAME: LTV Steel

SAMPLERS (SIGNATURE): Robert O'Laskey (Malcolm Pirnie)

STATION NO.	DATE	TIME	COMP	GRAB	STATION LOCATION	NO. OF CONTAINERS	16 oz Glass	16 oz Plastic	8 oz Amber	4 oz Plastic	40ml VOA		REMARKS
	2/5	~~2100~~ 1130		x	WP-1	1		1					Water Quality
						4			4				TOX
						4				4			TOC
						2					2		Volatiles
	2/5	2100		x	MW-14B		1						Phenol
								2					Metals
								1					Water Quality
									4				TOX
										4			TOC
											2		Volatiles

RELINQUISHED BY (SIGNATURE)	DATE / TIME	RECEIVED BY (SIGNATURE)	RELINQUISHED BY (SIGNATURE)	DATE / TIME	RECEIVED BY (SIGNATURE)
	2/5/88 6:04pm				

RELINQUISHED BY (SIGNATURE)	DATE / TIME	RECEIVED BY (SIGNATURE)	RELINQUISHED BY (SIGNATURE)	DATE / TIME	RECEIVED BY (SIGNATURE)

RELINQUISHED BY (SIGNATURE)	DATE / TIME	RECEIVED FOR LABORATORY BY (SIGNATURE)	DATE / TIME	REMARKS

Distribution: Original accompanies shipment; copy to coordinator field files.

RECRA ENVIRONMENTAL, INC.

CHAIN OF CUSTODY RECORD

PROJECT NO.:

SITE NAME: LTV Steel

SAMPLERS (SIGNATURE): Robert O'Laskey (Malcolm Pirnie)

STATION NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CON-TAINERS	16oz glass	16 oz Plastic	8oz Amber	4oz Plastic	40ml VOA		REMARKS
	2/5	11:30		X	MW-4B	1	1						Phenol
						2		2					Metals
						1		1					Water Quality
						4			4				TOX
						4				4			TOC
						2					2		Volatiles
	2/5	12:30		X	MW-13B	1	1						Phenols
						2		2					Metals
						1		1					Water Quality
						4			4				TOX
						4				4			TOC
						2					2		Volatiles
	2/5	1:30		X	~~A~~WP-1	1	1						Phenols
						2		2					Metals

RELINQUISHED BY (SIGNATURE)	DATE / TIME	RECEIVED BY (SIGNATURE)	RELINQUISHED BY (SIGNATURE)	DATE / TIME	RECEIVED BY (SIGNATURE)
	2/5/88 6:14	A.			

RELINQUISHED BY (SIGNATURE)	DATE / TIME	RECEIVED BY (SIGNATURE)	RELINQUISHED BY (SIGNATURE)	DATE / TIME	RECEIVED BY (SIGNATURE)

RELINQUISHED BY (SIGNATURE)	DATE / TIME	RECEIVED FOR LABORATORY BY (SIGNATURE)	DATE / TIME	REMARKS

Distribution: Original accompanies shipment, copy to coordinator field files.

APPENDIX B

FIELD DATA SHEET

MALCOLM PIRNIE

WATER QUALITY SAMPLING FIELD DATA SHEET

LOCATION No.: Well 2A
LAB SAMPLE No.: MW-2A

PROJECT: Marilla Street Landfill
DATE: 2/4 TIME: 2:30
CLIENT: LTV Steel
WEATHER CONDITIONS:
JOB No: 0848-11-9
AIR TEMPERATURE:
SAMPLER: R O'Laskey
TYPE OF SAMPLE: ☐ GROUND-WATER ☐ SURFACE-WATER ☐ OTHER

WELL DATA:

CASING DIAMETER: 2" ☑ PVC ☐ STEEL ☐ OTHER:
SCREEN DIAMETER: 2" ☑ PVC ☐ GALVANIZED STEEL ☐ STAINLESS STEEL ☐ OPEN ROCK
STATIC WATER LEVEL: 2.92 BOTTOM DEPTH: 26.65
DATUM: ☐ TOP OF PROTECTIVE CASING ☐ TOP OF WELL CASING ☐ OTHER:
GROUND SURFACE TO DATUM: WATER VOLUME IN WELL: 3.8 gal
CONDITION OF WELL:

PUMPING DATA:

METHOD: ☐ SUBMERSIBLE PUMP ☐ PERISTALTIC PUMP ☐ DIAPHRAGM PUMP ☐ BAILER
☐ OTHER:
IS PUMPING EQUIPMENT DEDICATED TO SAMPLE LOCATION ? ☐ YES ☐ NO
PUMPING RATE: ELAPSED TIME: VOLUME PUMPED: 5 gal
WAS WELL EVACUATED ? ☐ YES ☐ NO WELL VOLUMES PUMPED: pumped/bailed dry

SAMPLING DATA:

METHOD: ☐ SUBMERSIBLE PUMP ☐ PERISTALTIC PUMP ☒ BAILER
☐ OTHER: Teflon
IS SAMPLING EQUIPMENT DEDICATED TO SAMPLE LOCATION ? ☐ YES ☒ NO
DEPTH OF SAMPLE:
CONTAINERS: NUMBER/TYPE: DEC Recommended (Part 360) Parameter List

PHYSICAL & CHEMICAL DATA:

APPEARANCE: ☐ CLEAR ☐ TURBID ☐ COLOR: ☐ CONTAINS SEDIMENT:
☐ CONTAINS IMMISCIBLE LIQUID ☐ OTHER:
ODOR: ☐ YES: ☐ NO
FIELD DETERMINATIONS:
TEMPERATURE: Ph: SPEC. COND: 800
OTHER:

REMARKS: pumped dry -4g
bailed 1g } 10:30 2/4

MALCOLM PIRNIE

WATER QUALITY SAMPLING FIELD DATA SHEET

LOCATION No.: Well 2B

LAB SAMPLE No.: MW-2B

PROJECT: Marilla Street Landfill

DATE: 2/4 TIME: 2:45

CLIENT: LTV Steel

WEATHER CONDITIONS:

JOB No: 0848-11-9

AIR TEMPERATURE:

SAMPLER: R O'Laskey

TYPE OF SAMPLE: ☐ GROUND-WATER ☐ SURFACE-WATER ☐ OTHER

WELL DATA:

CASING DIAMETER: 2" ☑ PVC ☐ STEEL ☐ OTHER:

SCREEN DIAMETER: 2" ☑ PVC ☐ GALVANIZED STEEL ☐ STAINLESS STEEL ☐ OPEN ROCK

STATIC WATER LEVEL: 2.53 BOTTOM DEPTH: 6.26

DATUM: ☐ TOP OF PROTECTIVE CASING ☐ TOP OF WELL CASING ☐ OTHER:

GROUND SURFACE TO DATUM: WATER VOLUME IN WELL: 0.6gal

CONDITION OF WELL:

PUMPING DATA:

METHOD: ☐ SUBMERSIBLE PUMP ☐ PERISTALTIC PUMP ☐ DIAPHRAGM PUMP ☒ BAILER ☐ OTHER:

IS PUMPING EQUIPMENT DEDICATED TO SAMPLE LOCATION ? ☐ YES ☐ NO

PUMPING RATE: ELAPSED TIME: VOLUME PUMPED: 1 gal

WAS WELL EVACUATED ? ☐ YES ☐ NO WELL VOLUMES PUMPED: bailed dry

SAMPLING DATA:

METHOD: ☐ SUBMERSIBLE PUMP ☐ PERISTALTIC PUMP ☒ BAILER ☐ OTHER: Teflon

IS SAMPLING EQUIPMENT DEDICATED TO SAMPLE LOCATION ? ☐ YES ☒ NO

DEPTH OF SAMPLE:

CONTAINERS: NUMBER / TYPE: DEC Recommended (Part 360) Parameter List

PHYSICAL & CHEMICAL DATA:

APPEARANCE: ☐ CLEAR ☐ TURBID ☐ COLOR: ☐ CONTAINS SEDIMENT: ☐ CONTAINS IMMISCIBLE LIQUID ☐ OTHER:

ODOR: ☐ YES: ☐ NO

FIELD DETERMINATIONS:

TEMPERATURE: Ph: SPEC. COND:

OTHER:

REMARKS: bail - slow recovery 10:30 2/4

MALCOLM PIRNIE

WATER QUALITY SAMPLING FIELD DATA SHEET

LOCATION No.: Well 3A

LAB SAMPLE No.: MW-3A

PROJECT: Marilla Street Landfill

CLIENT: LTV Steel

JOB No: 0848-11-9

SAMPLER: R O'Laskey

DATE: 2/4 TIME: 2:00

WEATHER CONDITIONS:

AIR TEMPERATURE:

TYPE OF SAMPLE: ☐ GROUND-WATER ☐ SURFACE-WATER ☐ OTHER

WELL DATA:

CASING DIAMETER: 2" ☑ PVC ☐ STEEL ☐ OTHER:

SCREEN DIAMETER: 2" ☑ PVC ☐ GALVANIZED STEEL ☐ STAINLESS STEEL ☐ OPEN ROCK

STATIC WATER LEVEL: 2.35 BOTTOM DEPTH: 16.85

DATUM: ☐ TOP OF PROTECTIVE CASING ☐ TOP OF WELL CASING ☐ OTHER:

GROUND SURFACE TO DATUM: WATER VOLUME IN WELL: 2.4 gal

CONDITION OF WELL:

PUMPING DATA:

METHOD: ☐ SUBMERSIBLE PUMP ☐ PERISTALTIC PUMP ☐ DIAPHRAGM PUMP ☐ BAILER ☐ OTHER:

IS PUMPING EQUIPMENT DEDICATED TO SAMPLE LOCATION ? ☐ YES ☐ NO

PUMPING RATE: ELAPSED TIME: VOLUME PUMPED: 5 gal

WAS WELL EVACUATED ? ☐ YES ☐ NO WELL VOLUMES PUMPED: pumped/bailed dry

SAMPLING DATA:

METHOD: ☐ SUBMERSIBLE PUMP ☐ PERISTALTIC PUMP ☒ BAILER ☐ OTHER: Teflon

IS SAMPLING EQUIPMENT DEDICATED TO SAMPLE LOCATION ? ☐ YES ☒ NO

DEPTH OF SAMPLE:

CONTAINERS: NUMBER/TYPE: DEC Recommended (Part 360) Parameter List

PHYSICAL & CHEMICAL DATA:

APPEARANCE: ☐ CLEAR ☐ TURBID ☐ COLOR: ☐ CONTAINS SEDIMENT: ☐ CONTAINS IMMISCIBLE LIQUID ☐ OTHER:

ODOR: ☐ YES: ☐ NO

FIELD DETERMINATIONS:

TEMPERATURE: Ph: SPEC. COND: 1600

OTHER:

REMARKS: Pumped 3 gal → dry
bailed 2 gal → dry

MALCOLM PIRNIE

WATER QUALITY SAMPLING FIELD DATA SHEET

LOCATION No.: Well 4A

LAB SAMPLE No.: MW-4A

PROJECT: Marilla Street Landfill

CLIENT: LTV Steel

JOB No: 0848-11-9

SAMPLER: R O'Laskey

DATE: ____ TIME: ____

WEATHER CONDITIONS: ____

AIR TEMPERATURE: ____

TYPE OF SAMPLE: ☐ GROUND-WATER ☐ SURFACE-WATER ☐ OTHER

WELL DATA:

CASING DIAMETER: 2" ☑ PVC ☐ STEEL ☐ OTHER: ____

SCREEN DIAMETER: 2" ☑ PVC ☐ GALVANIZED STEEL ☐ STAINLESS STEEL ☐ OPEN ROCK

STATIC WATER LEVEL: 6.46 BOTTOM DEPTH: 21.05

DATUM: ☐ TOP OF PROTECTIVE CASING ☐ TOP OF WELL CASING ☐ OTHER: ____

GROUND SURFACE TO DATUM: ____ WATER VOLUME IN WELL: 2.4 gal

CONDITION OF WELL: ____

PUMPING DATA:

METHOD: ☐ SUBMERSIBLE PUMP ☐ PERISTALTIC PUMP ☐ DIAPHRAGM PUMP ☐ BAILER

☐ OTHER: Centrifugal

IS PUMPING EQUIPMENT DEDICATED TO SAMPLE LOCATION ? ☐ YES ☒ NO

PUMPING RATE: ____ ELAPSED TIME: ____ VOLUME PUMPED: 15 g

WAS WELL EVACUATED ? ☐ YES ☐ NO WELL VOLUMES PUMPED: ____

SAMPLING DATA:

METHOD: ☐ SUBMERSIBLE PUMP ☐ PERISTALTIC PUMP ☒ BAILER

☐ OTHER: Teflon

IS SAMPLING EQUIPMENT DEDICATED TO SAMPLE LOCATION ? ☐ YES ☒ NO

DEPTH OF SAMPLE: ____

CONTAINERS: NUMBER / TYPE: DEC Recommended (Part 360) Parameter List

PHYSICAL & CHEMICAL DATA:

APPEARANCE: ☒ CLEAR ☐ TURBID ☐ COLOR: ____ ☐ CONTAINS SEDIMENT: ____

☐ CONTAINS IMMISCIBLE LIQUID ☐ OTHER: ____

ODOR: ☒ YES: H_2S ☐ NO

FIELD DETERMINATIONS:

TEMPERATURE: ____ Ph: ____ SPEC. COND: 750

OTHER: ____

REMARKS: Rapid Recovery - held pump inlet line slightly below w.l

MALCOLM PIRNIE

WATER QUALITY SAMPLING FIELD DATA SHEET

LOCATION No.: Well 4B

LAB SAMPLE No.: MW-4B

PROJECT: Marilla Street Landfill

CLIENT: LTV Steel

JOB No: 0848-11-9

SAMPLER: R O'Laskey

DATE: 2/5 TIME: 1200

WEATHER CONDITIONS:

AIR TEMPERATURE:

TYPE OF SAMPLE: ☐ GROUND-WATER ☐ SURFACE-WATER ☐ OTHER

WELL DATA:

CASING DIAMETER: 2" ☑ PVC ☐ STEEL ☐ OTHER:

SCREEN DIAMETER: 2" ☑ PVC ☐ GALVANIZED STEEL ☐ STAINLESS STEEL ☐ OPEN ROCK

STATIC WATER LEVEL: 4.10 BOTTOM DEPTH: 13.05

DATUM: ☐ TOP OF PROTECTIVE CASING ☐ TOP OF WELL CASING ☐ OTHER:

GROUND SURFACE TO DATUM: WATER VOLUME IN WELL: 1.5 gal

CONDITION OF WELL:

PUMPING DATA:

METHOD: ☐ SUBMERSIBLE PUMP ☐ PERISTALTIC PUMP ☐ DIAPHRAGM PUMP ☐ BAILER ☐ OTHER:

IS PUMPING EQUIPMENT DEDICATED TO SAMPLE LOCATION ? ☐ YES ☐ NO

PUMPING RATE: ELAPSED TIME: VOLUME PUMPED: /Bail'g 3.5g

WAS WELL EVACUATED ? ☐ YES ☐ NO WELL VOLUMES PUMPED:

SAMPLING DATA:

METHOD: ☐ SUBMERSIBLE PUMP ☐ PERISTALTIC PUMP ☑ BAILER ☐ OTHER: Teflon

IS SAMPLING EQUIPMENT DEDICATED TO SAMPLE LOCATION ? ☐ YES ☒ NO

DEPTH OF SAMPLE:

CONTAINERS: NUMBER/TYPE: Routine Part 373 Parameter list

PHYSICAL & CHEMICAL DATA:

APPEARANCE: ☐ CLEAR ☐ TURBID ☐ COLOR: ☐ CONTAINS SEDIMENT: ☐ CONTAINS IMMISCIBLE LIQUID ☐ OTHER:

ODOR: ☐ YES: ☐ NO

FIELD DETERMINATIONS:

TEMPERATURE: 8° Ph: 8.8, 8.9, 9.3, 9.0 SPEC. COND: 1100 1150 1160 1130

OTHER:

REMARKS: pumped 2.5 gal
bailed dry 1 gal

MALCOLM PIRNIE

WATER QUALITY SAMPLING FIELD DATA SHEET

LOCATION No.: Well 5A

LAB SAMPLE No.: MW-5A

PROJECT: Marilla Street Landfill

CLIENT: LTV Steel

JOB No: 0848-11-9

SAMPLER: R O'Laskey

DATE: 2/3 TIME: 4:30

WEATHER CONDITIONS:

AIR TEMPERATURE:

TYPE OF SAMPLE: ☐ GROUND-WATER ☐ SURFACE-WATER ☐ OTHER

WELL DATA:

CASING DIAMETER: 2" ☑ PVC ☐ STEEL ☐ OTHER:

SCREEN DIAMETER: 2" ☒ PVC ☐ GALVANIZED STEEL ☐ STAINLESS STEEL ☐ OPEN ROCK

STATIC WATER LEVEL: 2.15 BOTTOM DEPTH: 20.0

DATUM: ☐ TOP OF PROTECTIVE CASING ☐ TOP OF WELL CASING ☐ OTHER:

GROUND SURFACE TO DATUM: WATER VOLUME IN WELL: 2.9 gal

CONDITION OF WELL:

PUMPING DATA:

METHOD: ☐ SUBMERSIBLE PUMP ☐ PERISTALTIC PUMP ☐ DIAPHRAGM PUMP ☐ BAILER ☐ OTHER:

IS PUMPING EQUIPMENT DEDICATED TO SAMPLE LOCATION? ☐ YES ☐ NO

PUMPING RATE: ELAPSED TIME: VOLUME PUMPED: 3 gal

WAS WELL EVACUATED? ☐ YES ☐ NO WELL VOLUMES PUMPED: Pumped Dry

SAMPLING DATA:

METHOD: ☐ SUBMERSIBLE PUMP ☐ PERISTALTIC PUMP ☒ BAILER ☐ OTHER: Teflon

IS SAMPLING EQUIPMENT DEDICATED TO SAMPLE LOCATION? ☐ YES ☒ NO

DEPTH OF SAMPLE:

CONTAINERS: NUMBER/TYPE: DEC Recommended (Part 360) Parameter List

PHYSICAL & CHEMICAL DATA:

APPEARANCE: ☐ CLEAR ☐ TURBID ☐ COLOR: ☐ CONTAINS SEDIMENT: ☐ CONTAINS IMMISCIBLE LIQUID ☐ OTHER:

ODOR: ☐ YES: ☐ NO

FIELD DETERMINATIONS:

TEMPERATURE: Ph: SPEC. COND: 1150

OTHER:

REMARKS: pumped dry 2/3 12:30 [illegible] 12/3

MALCOLM PIRNIE

WATER QUALITY SAMPLING FIELD DATA SHEET

LOCATION No.: Well 5B

LAB SAMPLE No.: MW-5B

PROJECT: Marilla Street Landfill

DATE: 2/3

TIME: 4:00

CLIENT: LTV Steel

WEATHER CONDITIONS:

JOB No: 0848-11-9

AIR TEMPERATURE:

SAMPLER: R O'Laskey

TYPE OF SAMPLE: ☐ GROUND-WATER ☐ SURFACE-WATER ☐ OTHER

WELL DATA:

CASING DIAMETER: 2" ☑ PVC ☐ STEEL ☐ OTHER:

SCREEN DIAMETER: 2" ☑ PVC ☐ GALVANIZED STEEL ☐ STAINLESS STEEL ☐ OPEN ROCK

STATIC WATER LEVEL: 3.37 BOTTOM DEPTH: 8.2

DATUM: ☐ TOP OF PROTECTIVE CASING ☐ TOP OF WELL CASING ☐ OTHER:

GROUND SURFACE TO DATUM: WATER VOLUME IN WELL: 0.8 gal

CONDITION OF WELL:

PUMPING DATA:

METHOD: ☐ SUBMERSIBLE PUMP ☐ PERISTALTIC PUMP ☐ DIAPHRAGM PUMP ☐ BAILER ☐ OTHER:

IS PUMPING EQUIPMENT DEDICATED TO SAMPLE LOCATION? ☐ YES ☐ NO

PUMPING RATE: ELAPSED TIME: VOLUME PUMPED: 1.5 gal

WAS WELL EVACUATED? ☐ YES ☐ NO WELL VOLUMES PUMPED: Bailed Dry

SAMPLING DATA:

METHOD: ☐ SUBMERSIBLE PUMP ☐ PERISTALTIC PUMP ☒ BAILER ☐ OTHER: Teflon

IS SAMPLING EQUIPMENT DEDICATED TO SAMPLE LOCATION? ☐ YES ☒ NO

DEPTH OF SAMPLE:

CONTAINERS: NUMBER/TYPE: DEC Recommended (Part360) Parameter List

PHYSICAL & CHEMICAL DATA:

APPEARANCE: ☐ CLEAR ☐ TURBID ☐ COLOR: ☐ CONTAINS SEDIMENT: ☐ CONTAINS IMMISCIBLE LIQUID ☐ OTHER:

ODOR: ☐ YES: ☐ NO

FIELD DETERMINATIONS:

TEMPERATURE: Ph: 6.6 SPEC. COND: 2500

OTHER:

REMARKS: Bailed 2/3 12:30

MALCOLM PIRNIE

WATER QUALITY SAMPLING FIELD DATA SHEET

LOCATION No.: Well 6A

LAB SAMPLE No.: MW-6A

PROJECT: Marilla Street Landfill

DATE: 2/30 TIME: 11:30

CLIENT: LTV Steel

WEATHER CONDITIONS:

JOB No: 0848-11-9

AIR TEMPERATURE:

SAMPLER: R O'Laskey

TYPE OF SAMPLE: ☐ GROUND-WATER ☐ SURFACE-WATER ☐ OTHER

WELL DATA:

CASING DIAMETER: 2" ☑ PVC ☐ STEEL ☐ OTHER:

SCREEN DIAMETER: 2" ☑ PVC ☐ GALVANIZED STEEL ☐ STAINLESS STEEL ☐ OPEN ROCK

STATIC WATER LEVEL: 9.73 BOTTOM DEPTH: 26.5

DATUM: ☐ TOP OF PROTECTIVE CASING ☐ TOP OF WELL CASING ☐ OTHER:

GROUND SURFACE TO DATUM: WATER VOLUME IN WELL: 2.7 gal

CONDITION OF WELL:

PUMPING DATA:

METHOD: ☐ SUBMERSIBLE PUMP ☐ PERISTALTIC PUMP ☐ DIAPHRAGM PUMP ☒ BAILER

☐ OTHER:

IS PUMPING EQUIPMENT DEDICATED TO SAMPLE LOCATION ? ☐ YES ☐ NO

PUMPING RATE: ELAPSED TIME: VOLUME PUMPED: 5 gal

WAS WELL EVACUATED ? ☐ YES ☐ NO WELL VOLUMES PUMPED: Bailed Dry

SAMPLING DATA:

METHOD: ☐ SUBMERSIBLE PUMP ☐ PERISTALTIC PUMP ☒ BAILER

☐ OTHER: Teflon

IS SAMPLING EQUIPMENT DEDICATED TO SAMPLE LOCATION ? ☐ YES ☒ NO

DEPTH OF SAMPLE:

CONTAINERS: NUMBER/TYPE: DEC Recommended (Part 360) Parameter List

PHYSICAL & CHEMICAL DATA:

APPEARANCE: ☐ CLEAR ☐ TURBID ☐ COLOR: ☐ CONTAINS SEDIMENT:

☐ CONTAINS IMMISCIBLE LIQUID ☐ OTHER:

ODOR: ☐ YES: ☐ NO

FIELD DETERMINATIONS:

TEMPERATURE: 10° Ph: 7.00 SPEC. COND: 1450

OTHER:

REMARKS: silty on bottom

MALCOLM PIRNIE

WATER QUALITY SAMPLING FIELD DATA SHEET

LOCATION No.: Well 6B

LAB SAMPLE No.: MW-6B

PROJECT: Marilla Street Landfill

DATE: 2/3

TIME: 11:00

CLIENT: LTV Steel

WEATHER CONDITIONS:

JOB No: 0848-11-9

AIR TEMPERATURE:

SAMPLER: R O'Laskey

TYPE OF SAMPLE: ☐ GROUND-WATER ☐ SURFACE-WATER ☐ OTHER

WELL DATA:

CASING DIAMETER: 2" ☑ PVC ☐ STEEL ☐ OTHER:

SCREEN DIAMETER: 2" ☑ PVC ☐ GALVANIZED STEEL ☐ STAINLESS STEEL ☐ OPEN ROCK

STATIC WATER LEVEL: 9.62

BOTTOM DEPTH: 15.6

DATUM: ☐ TOP OF PROTECTIVE CASING ☐ TOP OF WELL CASING ☐ OTHER:

GROUND SURFACE TO DATUM:

WATER VOLUME IN WELL: 1.0 gal

CONDITION OF WELL:

PUMPING DATA:

METHOD: ☐ SUBMERSIBLE PUMP ☐ PERISTALTIC PUMP ☐ DIAPHRAGM PUMP ☐ BAILER ☐ OTHER:

IS PUMPING EQUIPMENT DEDICATED TO SAMPLE LOCATION ? ☐ YES ☐ NO

PUMPING RATE:

ELAPSED TIME:

VOLUME PUMPED: 2.5g

WAS WELL EVACUATED ? ☐ YES ☐ NO

WELL VOLUMES PUMPED: Bailed Dry

SAMPLING DATA:

METHOD: ☐ SUBMERSIBLE PUMP ☐ PERISTALTIC PUMP ☑ BAILER ☐ OTHER: Teflon

IS SAMPLING EQUIPMENT DEDICATED TO SAMPLE LOCATION ? ☐ YES ☐ NO

DEPTH OF SAMPLE:

CONTAINERS: NUMBER/TYPE: Full Background Parameters

PHYSICAL & CHEMICAL DATA:

APPEARANCE: ☐ CLEAR ☐ TURBID ☐ COLOR: ☐ CONTAINS SEDIMENT: ☐ CONTAINS IMMISCIBLE LIQUID ☐ OTHER:

ODOR: ☐ YES: ☐ NO

FIELD DETERMINATIONS:

TEMPERATURE: 10°

Ph: 6.6 6.9 6.7 6.75

SPEC. COND: 1550 1650 1650 1650

OTHER:

REMARKS:

12/3 Metals
TOC
TOX
Water Qual
F.Col.
ph, cond
} 12/3

VOA
Pest/Herb
Gross α β Ra
} 12/4 W.L. 9.4
8:00 Am

MALCOLM PIRNIE

WATER QUALITY SAMPLING FIELD DATA SHEET

LOCATION No.: Well 7A

LAB SAMPLE No.: MW-7A

PROJECT: Marilla Street Landfill

DATE: 2/3 TIME: 3:00

CLIENT: LTV Steel

WEATHER CONDITIONS:

JOB No: 0848-11-9

AIR TEMPERATURE:

SAMPLER: R O'Laskey

TYPE OF SAMPLE: ☐ GROUND-WATER ☐ SURFACE-WATER ☐ OTHER

WELL DATA:

CASING DIAMETER: 2" ☑ PVC ☐ STEEL ☐ OTHER:

SCREEN DIAMETER: 2" ☑ PVC ☐ GALVANIZED STEEL ☐ STAINLESS STEEL ☐ OPEN ROCK

STATIC WATER LEVEL: 25.80 BOTTOM DEPTH: 42.05

DATUM: ☐ TOP OF PROTECTIVE CASING ☐ TOP OF WELL CASING ☐ OTHER:

GROUND SURFACE TO DATUM: WATER VOLUME IN WELL: 2.6 gal

CONDITION OF WELL:

PUMPING DATA:

METHOD: ☐ SUBMERSIBLE PUMP ☐ PERISTALTIC PUMP ☐ DIAPHRAGM PUMP ☒ BAILER ☐ OTHER:

IS PUMPING EQUIPMENT DEDICATED TO SAMPLE LOCATION ? ☐ YES ☐ NO

PUMPING RATE: ELAPSED TIME: VOLUME PUMPED: 8 gal

WAS WELL EVACUATED ? ☐ YES ☐ NO WELL VOLUMES PUMPED:

SAMPLING DATA:

METHOD: ☐ SUBMERSIBLE PUMP ☐ PERISTALTIC PUMP ☑ BAILER ☐ OTHER: Teflon

IS SAMPLING EQUIPMENT DEDICATED TO SAMPLE LOCATION ? ☐ YES ☒ NO

DEPTH OF SAMPLE:

CONTAINERS: NUMBER/TYPE: Routine Part 373 Parameter list

PHYSICAL & CHEMICAL DATA:

APPEARANCE: ☐ CLEAR ☐ TURBID ☐ COLOR: Dark Gry Brn ☐ CONTAINS SEDIMENT: ☐ CONTAINS IMMISCIBLE LIQUID ☐ OTHER:

ODOR: ☒ YES: ☐ NO

FIELD DETERMINATIONS:

TEMPERATURE: Ph: [illegible] 7.0 7.0 7.0 SPEC. COND: [illegible] 1080 1020 1020

OTHER:

REMARKS: use Pump to purge next round
good recovery

MALCOLM PIRNIE

WATER QUALITY SAMPLING FIELD DATA SHEET

LOCATION No.: Well 7B

LAB SAMPLE No.: MW-7B

PROJECT: Marilla Street Landfill
DATE: 2/4 TIME: 9:00
CLIENT: LTV Steel
WEATHER CONDITIONS:
JOB No: 0848-11-9
AIR TEMPERATURE:
SAMPLER: R O'Laskey
TYPE OF SAMPLE: ☐ GROUND-WATER ☐ SURFACE-WATER ☐ OTHER

WELL DATA:

CASING DIAMETER: 2" ☑ PVC ☐ STEEL ☐ OTHER:
SCREEN DIAMETER: 2" ☑ PVC ☐ GALVANIZED STEEL ☐ STAINLESS STEEL ☐ OPEN ROCK
STATIC WATER LEVEL: 21.35 BOTTOM DEPTH: 30.60
DATUM: ☐ TOP OF PROTECTIVE CASING ☐ TOP OF WELL CASING ☐ OTHER:
GROUND SURFACE TO DATUM: WATER VOLUME IN WELL: 1.5 gal
CONDITION OF WELL:

PUMPING DATA:

METHOD: ☐ SUBMERSIBLE PUMP ☐ PERISTALTIC PUMP ☐ DIAPHRAGM PUMP ☒ BAILER
☐ OTHER:
IS PUMPING EQUIPMENT DEDICATED TO SAMPLE LOCATION ? ☐ YES ☐ NO
PUMPING RATE: ELAPSED TIME: VOLUME PUMPED: 2.5 gal
WAS WELL EVACUATED ? ☐ YES ☐ NO WELL VOLUMES PUMPED: Bailed Dry

SAMPLING DATA:

METHOD: ☐ SUBMERSIBLE PUMP ☐ PERISTALTIC PUMP ☑ BAILER
☐ OTHER: Teflon
IS SAMPLING EQUIPMENT DEDICATED TO SAMPLE LOCATION ? ☐ YES ☒ NO
DEPTH OF SAMPLE:
CONTAINERS: NUMBER / TYPE: Routine Part 373 Parameter list

PHYSICAL & CHEMICAL DATA:

APPEARANCE : ☐ CLEAR ☐ TURBID ☐ COLOR: ☐ CONTAINS SEDIMENT:
☐ CONTAINS IMMISCIBLE LIQUID ☐ OTHER:
ODOR: ☐ YES: ☐ NO
FIELD DETERMINATIONS:
TEMPERATURE: 10° Ph: 12.6 12.8, 12.3 12.8 SPEC. COND: 10,400 10,050 10,000 10,000
OTHER:

REMARKS: Purged 2/3 3:45
Sampled 2/4 9:00 w.l. 23.5
Purged 2/5 9:30 1.5 gal bailed dry

All Laboratory samples collected 2/4
pH meter inoperative
pH + cond measured 2/5 9:30

MALCOLM PIRNIE

WATER QUALITY SAMPLING FIELD DATA SHEET

LOCATION No.: Well 9B

LAB SAMPLE No.: MW-9B

PROJECT: Marilla Street Landfill

DATE: 2/3

TIME: 2:30

CLIENT: LTV Steel

WEATHER CONDITIONS:

JOB No: 0848-11-9

AIR TEMPERATURE:

SAMPLER: R O'Laskey

TYPE OF SAMPLE: ☐ GROUND-WATER ☐ SURFACE-WATER ☐ OTHER

WELL DATA:

CASING DIAMETER: 2" ☑ PVC ☐ STEEL ☐ OTHER:

SCREEN DIAMETER: 2" ☑ PVC ☐ GALVANIZED STEEL ☐ STAINLESS STEEL ☐ OPEN ROCK

STATIC WATER LEVEL: 31.00

BOTTOM DEPTH: 35.25

DATUM: ☐ TOP OF PROTECTIVE CASING ☐ TOP OF WELL CASING ☐ OTHER:

GROUND SURFACE TO DATUM:

WATER VOLUME IN WELL: 0.7gal

CONDITION OF WELL:

PUMPING DATA:

METHOD: ☐ SUBMERSIBLE PUMP ☐ PERISTALTIC PUMP ☐ DIAPHRAGM PUMP ☑ BAILER

☐ OTHER:

IS PUMPING EQUIPMENT DEDICATED TO SAMPLE LOCATION ? ☐ YES ☐ NO

PUMPING RATE:

ELAPSED TIME:

VOLUME PUMPED: 3.5g

WAS WELL EVACUATED ? ☐ YES ☐ NO

WELL VOLUMES PUMPED:

SAMPLING DATA:

METHOD: ☐ SUBMERSIBLE PUMP ☐ PERISTALTIC PUMP ☑ BAILER

☐ OTHER: Teflon

IS SAMPLING EQUIPMENT DEDICATED TO SAMPLE LOCATION ? ☐ YES ☒ NO

DEPTH OF SAMPLE:

CONTAINERS: NUMBER/TYPE: Routine Part 373 Parameter list

PHYSICAL & CHEMICAL DATA:

APPEARANCE: ☐ CLEAR ☐ TURBID ☐ COLOR: ☐ CONTAINS SEDIMENT:

☐ CONTAINS IMMISCIBLE LIQUID ☐ OTHER:

ODOR: ☐ YES: ☐ NO

FIELD DETERMINATIONS:

TEMPERATURE:

Ph: 6.7 6.8 6.8 6.8

SPEC. COND: 2250 2300 2500 2400

OTHER:

REMARKS: Good Recovery

MALCOLM PIRNIE

WATER QUALITY SAMPLING FIELD DATA SHEET

LOCATION No.: Well 13B

LAB SAMPLE No.: MW-13B

PROJECT: Marilla Street Landfill

CLIENT: LTV Steel

JOB No: 0848-11-9

SAMPLER: R O'Laskey

DATE: 2/5

TIME: ~~124~~ 12^{35}

WEATHER CONDITIONS:

AIR TEMPERATURE:

TYPE OF SAMPLE: ☐ GROUND-WATER ☐ SURFACE-WATER ☐ OTHER

WELL DATA:

CASING DIAMETER: 2" ☑ PVC ☐ STEEL ☐ OTHER:

SCREEN DIAMETER: 2" ☑ PVC ☐ GALVANIZED STEEL ☐ STAINLESS STEEL ☐ OPEN ROCK

STATIC WATER LEVEL: 5.98

BOTTOM DEPTH: 12.9

DATUM: ☐ TOP OF PROTECTIVE CASING ☐ TOP OF WELL CASING ☐ OTHER:

GROUND SURFACE TO DATUM:

WATER VOLUME IN WELL: 1.14 gal

CONDITION OF WELL:

PUMPING DATA:

METHOD: ☐ SUBMERSIBLE PUMP ☐ PERISTALTIC PUMP ☐ DIAPHRAGM PUMP ☒ BAILER ☐ OTHER:

IS PUMPING EQUIPMENT DEDICATED TO SAMPLE LOCATION ? ☐ YES ☐ NO

PUMPING RATE:

ELAPSED TIME:

VOLUME PUMPED: 4 gal

WAS WELL EVACUATED ? ☐ YES ☐ NO

WELL VOLUMES PUMPED:

SAMPLING DATA:

METHOD: ☐ SUBMERSIBLE PUMP ☐ PERISTALTIC PUMP ☑ BAILER ☐ OTHER: Teflon

IS SAMPLING EQUIPMENT DEDICATED TO SAMPLE LOCATION ? ☐ YES ☒ NO

DEPTH OF SAMPLE:

CONTAINERS: NUMBER/TYPE: Routine Part 373 Parameter list

PHYSICAL & CHEMICAL DATA:

APPEARANCE: ☐ CLEAR ☐ TURBID ☐ COLOR: ☐ CONTAINS SEDIMENT: ☐ CONTAINS IMMISCIBLE LIQUID ☐ OTHER:

ODOR: ☐ YES: ☐ NO

FIELD DETERMINATIONS:

TEMPERATURE: 8°

Ph: 6.7, 6.85, 7.0 7.0

SPEC. COND: 2000 2000 2000 2000

OTHER:

REMARKS:

MALCOLM PIRNIE

WATER QUALITY SAMPLING FIELD DATA SHEET

LOCATION No.: Well 14B

LAB SAMPLE No.: MW-14B

PROJECT: Marilla Street Landfill

CLIENT: LTV Steel

JOB No: 0848-11-9

SAMPLER: R O'Laskey

DATE: 2/5 TIME: 2:30

WEATHER CONDITIONS:

AIR TEMPERATURE:

TYPE OF SAMPLE: ☐ GROUND-WATER ☐ SURFACE-WATER ☐ OTHER

WELL DATA:

CASING DIAMETER: 2" ☑ PVC ☐ STEEL ☐ OTHER:

SCREEN DIAMETER: 2" ☑ PVC ☐ GALVANIZED STEEL ☐ STAINLESS STEEL ☐ OPEN ROCK

STATIC WATER LEVEL: 30.47 BOTTOM DEPTH: 44.40

DATUM: ☐ TOP OF PROTECTIVE CASING ☒ TOP OF WELL CASING ☐ OTHER:

GROUND SURFACE TO DATUM: WATER VOLUME IN WELL: 2.3 gal

CONDITION OF WELL:

PUMPING DATA:

METHOD: ☐ SUBMERSIBLE PUMP ☐ PERISTALTIC PUMP ☐ DIAPHRAGM PUMP ☒ BAILER

☐ OTHER:

IS PUMPING EQUIPMENT DEDICATED TO SAMPLE LOCATION ? ☐ YES ☐ NO

PUMPING RATE: ELAPSED TIME: VOLUME PUMPED: 4.5 gal

WAS WELL EVACUATED ? ☐ YES ☐ NO WELL VOLUMES PUMPED: bailed dry

SAMPLING DATA:

METHOD: ☐ SUBMERSIBLE PUMP ☐ PERISTALTIC PUMP ☑ BAILER

☐ OTHER: Teflon

IS SAMPLING EQUIPMENT DEDICATED TO SAMPLE LOCATION ? ☐ YES ☒ NO

DEPTH OF SAMPLE:

CONTAINERS: NUMBER / TYPE: Routine Part 373 Parameter list

PHYSICAL & CHEMICAL DATA:

APPEARANCE: ☐ CLEAR ☐ TURBID ☐ COLOR: ☐ CONTAINS SEDIMENT:

☐ CONTAINS IMMISCIBLE LIQUID ☐ OTHER:

ODOR: ☐ YES: ☐ NO

FIELD DETERMINATIONS:

TEMPERATURE: 8°C Ph: 9.4, 9.4, 9.4, 9.4 SPEC. COND: 2000 2100 2100 2000

OTHER:

REMARKS: Purged 2/5 10:00 Am

MALCOLM PIRNIE

WATER QUALITY SAMPLING FIELD DATA SHEET

LOCATION No.: West Pond

LAB SAMPLE No.: WP-1

PROJECT: Marilla Street Landfill

DATE: 2/5 TIME: 1:30

CLIENT: LTU Steel

WEATHER CONDITIONS:

JOB No: 0848-11-9

AIR TEMPERATURE:

SAMPLER: R. O'Laskey

TYPE OF SAMPLE: ☐ GROUND-WATER ☐ SURFACE-WATER ☐ OTHER

WELL DATA:

CASING DIAMETER: ☐ PVC ☐ STEEL ☐ OTHER:

SCREEN DIAMETER: ☐ PVC ☐ GALVANIZED STEEL ☐ STAINLESS STEEL ☐ OPEN ROCK

STATIC WATER LEVEL: BOTTOM DEPTH:

DATUM: ☐ TOP OF PROTECTIVE CASING ☐ TOP OF WELL CASING ☐ OTHER:

GROUND SURFACE TO DATUM: WATER VOLUME IN WELL:

CONDITION OF WELL:

PUMPING DATA:

METHOD: ☐ SUBMERSIBLE PUMP ☐ PERISTALTIC PUMP ☐ DIAPHRAGM PUMP ☐ BAILER ☐ OTHER:

IS PUMPING EQUIPMENT DEDICATED TO SAMPLE LOCATION ? ☐ YES ☐ NO

PUMPING RATE: ELAPSED TIME: VOLUME PUMPED:

WAS WELL EVACUATED ? ☐ YES ☐ NO WELL VOLUMES PUMPED:

SAMPLING DATA:

METHOD: ☐ SUBMERSIBLE PUMP ☐ PERISTALTIC PUMP ☐ BAILER ☐ OTHER:

IS SAMPLING EQUIPMENT DEDICATED TO SAMPLE LOCATION ? ☐ YES ☐ NO

DEPTH OF SAMPLE:

CONTAINERS: NUMBER/TYPE: Routine Part 373 Parameter List

PHYSICAL & CHEMICAL DATA:

APPEARANCE: ☐ CLEAR ☐ TURBID ☐ COLOR: ☐ CONTAINS SEDIMENT:

☐ CONTAINS IMMISCIBLE LIQUID ☐ OTHER:

ODOR: ☐ YES: ☐ NO

FIELD DETERMINATIONS:

TEMPERATURE: 0°C Ph: 9.8, 9.9, 9.7, 9.9 SPEC. COND: 750 725 725 750

OTHER:

REMARKS: Broke thru 4" of ice, sampled in 10" of water, 4' from shore

APPENDIX C

STATISTICAL CALCULATIONS

PROJECT NAME: LTV STEEL

TEST DATE: 2/5/88

WELL NUMBER: MW-4B

PARAMETER: COND

LEVEL OF SIGNIFICANCE = 0.01
NUMBER OF BACKGROUND MEASUREMENTS (Nb) 16
BACKGROUND MEAN (Xb) 1503
BACKGROUND VARIANCE (S2b) 62823
BACKGROUND CRITICAL VALUE (tb) 2.602

NEW DATA

Xm	S2m	Nm	tm	t*	tc
1135.00	700.0	4	4.541	-5.75	2.685

PARAMETER: pH

LEVEL OF SIGNIFICANCE = 0.005
NUMBER OF BACKGROUND MEASUREMENTS (Nb) 16
BACKGROUND MEAN (Xb) 6.9
BACKGROUND VARIANCE (S2b) .3
BACKGROUND CRITICAL VALUE (tb) 2.947

NEW DATA

Xm	S2m*	Nm	tm	t*	tc
8.88	0.0	4	5.841	13.62	3.262

*

THE MONITORING VARIANCE (S^2_m)
WAS CALCULATED TO SEVEN (7)
DECIMAL PLACES, BUT ONLY
PRINTED TO ONE (1) DECIMAL PLACE.

PROJECT NAME: LTV STEEL

TEST DATE: 2/5/88

WELL NUMBER: MW-4B

PARAMETER: TOC

LEVEL OF SIGNIFICANCE = 0.01
NUMBER OF BACKGROUND MEASUREMENTS (Nb) 16
BACKGROUND MEAN (Xb) 33
BACKGROUND VARIANCE (S2b) 514
BACKGROUND CRITICAL VALUE (tb) 2.602

NEW DATA

Xm	S2m	Nm	tm	t*	tc
23.50	6.3	4	4.541	-1.64	2.693

PARAMETER: TOX

LEVEL OF SIGNIFICANCE = 0.01
NUMBER OF BACKGROUND MEASUREMENTS (Nb) 16
BACKGROUND MEAN (Xb) 39
BACKGROUND VARIANCE (S2b) 231
BACKGROUND CRITICAL VALUE (tb) 2.602

NEW DATA

Xm	S2m	Nm	tm	t*	tc
8.70	4.6	4	4.541	-7.68	2.744

```
PROJECT NAME: LTV STEEL  WELL NUMBER: MW-6B       TEST DATE: 2/3/88
                          PARAMETER: pH

LEVEL OF SIGNIFICANCE = 0.005
NUMBER OF BACKGROUND MEASUREMENTS (Nb)  16
BACKGROUND MEAN (Xb)  6.9
BACKGROUND VARIANCE (S2b)  .3
BACKGROUND CRITICAL VALUE (tb)  2.947

                              NEW DATA
   Xm          S2m           Nm          tm              t*        tc
-----------------------------------------------------------------------
   6.84       0.0           4          5.841          -0.39      3.684



                          PARAMETER: SPECIFIC CONDUCTIVITY

LEVEL OF SIGNIFICANCE = 0.01
NUMBER OF BACKGROUND MEASUREMENTS (Nb)  16
BACKGROUND MEAN (Xb)  1503
BACKGROUND VARIANCE (S2b)  62823
BACKGROUND CRITICAL VALUE (tb)  2.602

                              NEW DATA
   Xm          S2m           Nm          tm              t*        tc
-----------------------------------------------------------------------
1625.00    2500.0           4          4.541           1.81      2.868
```

PROJECT NAME: LTV STEEL

TEST DATE: 2/3/88

WELL NUMBER: MW-6B

PARAMETER: TOC

LEVEL OF SIGNIFICANCE = 0.01
NUMBER OF BACKGROUND MEASUREMENTS (Nb) 16
BACKGROUND MEAN (Xb) 33
BACKGROUND VARIANCE (S2b) 514
BACKGROUND CRITICAL VALUE (tb) 2.602

NEW DATA

Xm	S2m	Nm	tm	t*	tc
33.00	330.0	4	4.541	0.00	3.998

PARAMETER: TOX

LEVEL OF SIGNIFICANCE = 0.01
NUMBER OF BACKGROUND MEASUREMENTS (Nb) 16
BACKGROUND MEAN (Xb) 39
BACKGROUND VARIANCE (S2b) 231
BACKGROUND CRITICAL VALUE (tb) 2.602

NEW DATA

Xm	S2m	Nm	tm	t*	tc
27.50	1.0	4	4.541	-3.00	2.635

```
PROJECT NAME: LTV STEEL                                     TEST DATE: 2/3/88
                              WELL NUMBER: MW-7A

                               PARAMETER: pH

LEVEL OF SIGNIFICANCE = 0.005
NUMBER OF BACKGROUND MEASUREMENTS (Nb)  16
BACKGROUND MEAN (Xb)  6.9
BACKGROUND VARIANCE (S2b)  .3
BACKGROUND CRITICAL VALUE (tb)  2.947

                                   NEW DATA
   Xm           S2m           Nm            tm                t*          tc
-----------------------------------------------------------------------------
   7.00         0.0           4             5.841             0.73        2.947




                              PARAMETER: SPECIFIC CONDUCTIVITY

LEVEL OF SIGNIFICANCE = 0.01
NUMBER OF BACKGROUND MEASUREMENTS (Nb)  16
BACKGROUND MEAN (Xb)  1503
BACKGROUND VARIANCE (S2b)  62823
BACKGROUND CRITICAL VALUE (tb)  2.602

                                   NEW DATA
   Xm           S2m           Nm            tm                t*          tc
-----------------------------------------------------------------------------
1020.00         0.0           4             4.541             -7.71       2.602
```

```
PROJECT NAME: LTV STEEL                                    TEST DATE: 2/3/88
                               WELL NUMBER: MW-7A

                                PARAMETER: TOC

LEVEL OF SIGNIFICANCE = 0.01
NUMBER OF BACKGROUND MEASUREMENTS (Nb)  16
BACKGROUND MEAN (Xb)  33
BACKGROUND VARIANCE (S2b)  514
BACKGROUND CRITICAL VALUE (tb)  2.602

                                   NEW DATA
   Xm           S2m            Nm           tm               t*         tc
----------------------------------------------------------------------------
  26.00       207.3            4          4.541            -0.76      3.799




                                PARAMETER: TOX

LEVEL OF SIGNIFICANCE = 0.01
NUMBER OF BACKGROUND MEASUREMENTS (Nb)  16
BACKGROUND MEAN (Xb)  39
BACKGROUND VARIANCE (S2b)  231
BACKGROUND CRITICAL VALUE (tb)  2.602

                                   NEW DATA
   Xm           S2m            Nm           tm               t*         tc
----------------------------------------------------------------------------
   5.00         0.0            4          4.541            -8.95      2.602
```

```
PROJECT NAME: LTV STEEL                                    TEST DATE: 2/4/88
                          WELL NUMBER: MW-7B

                           PARAMETER: pH

LEVEL OF SIGNIFICANCE = 0.005
NUMBER OF BACKGROUND MEASUREMENTS (Nb)  16
BACKGROUND MEAN (Xb)  6.9
BACKGROUND VARIANCE (S2b)  .3
BACKGROUND CRITICAL VALUE (tb)  2.947

                               NEW DATA
   Xm           S2m           Nm          tm               t*         tc
-----------------------------------------------------------------------------
  12.75         0.0           4          5.841            40.13      3.287



                          PARAMETER: SPECIFIC CONDUCTIVITY

LEVEL OF SIGNIFICANCE = 0.01
NUMBER OF BACKGROUND MEASUREMENTS (Nb)  16
BACKGROUND MEAN (Xb)  1503
BACKGROUND VARIANCE (S2b)  62823
BACKGROUND CRITICAL VALUE (tb)  2.602

                               NEW DATA
   Xm           S2m           Nm          tm               t*         tc
-----------------------------------------------------------------------------
%10287.50   %130625.0           4          4.541          45.93       4.333
```

```
PROJECT NAME: LTV STEEL                                TEST DATE: 2/4/88
                          WELL NUMBER: MW-7B

                           PARAMETER: TOC

LEVEL OF SIGNIFICANCE = 0.01
NUMBER OF BACKGROUND MEASUREMENTS (Nb)  16
BACKGROUND MEAN (Xb)  33
BACKGROUND VARIANCE (S2b)  514
BACKGROUND CRITICAL VALUE (tb)  2.602

                              NEW DATA
   Xm          S2m            Nm          tm               t*        tc
-----------------------------------------------------------------------
 297.50    %10491.7            4         4.541            5.13      4.518
```

```
PROJECT NAME: LTV STEEL                                TEST DATE: 2/4/88
                          WELL NUMBER: MW-7B

                           PARAMETER: TOX

LEVEL OF SIGNIFICANCE = 0.01
NUMBER OF BACKGROUND MEASUREMENTS (Nb)  16
BACKGROUND MEAN (Xb)  39
BACKGROUND VARIANCE (S2b)  231
BACKGROUND CRITICAL VALUE (tb)  2.602

                              NEW DATA
   Xm          S2m            Nm          tm               t*        tc
-----------------------------------------------------------------------
  32.25      117.6            4         4.541           -1.02      3.902
```

```
PROJECT NAME: LTV STEEL
                                                          TEST DATE: 2/3/88
                              WELL NUMBER: MW-9B

                               PARAMETER: pH

LEVEL OF SIGNIFICANCE = 0.005
NUMBER OF BACKGROUND MEASUREMENTS (Nb)  16
BACKGROUND MEAN (Xb)  6.9
BACKGROUND VARIANCE (S2b)  .3
BACKGROUND CRITICAL VALUE (tb)  2.947

                                  NEW DATA
   Xm          S2m          Nm          tm              t*        tc
------------------------------------------------------------------------
   6.77        0.0          4           5.841           -0.90     3.040



                               PARAMETER: SPECIFIC CONDUCTIVITY

LEVEL OF SIGNIFICANCE = 0.01
NUMBER OF BACKGROUND MEASUREMENTS (Nb)  16
BACKGROUND MEAN (Xb)  1503
BACKGROUND VARIANCE (S2b)  62823
BACKGROUND CRITICAL VALUE (tb)  2.602

                                  NEW DATA
   Xm          S2m          Nm          tm              t*        tc
------------------------------------------------------------------------
2362.50     %12291.7        4           4.541           10.27     3.453
```

PROJECT NAME: LTV STEEL TEST DATE: 2/3/88

WELL NUMBER: MW-9B

PARAMETER: TOC

LEVEL OF SIGNIFICANCE = 0.01
NUMBER OF BACKGROUND MEASUREMENTS (Nb) 16
BACKGROUND MEAN (Xb) 33
BACKGROUND VARIANCE (S2b) 514
BACKGROUND CRITICAL VALUE (tb) 2.602

NEW DATA

Xm	S2m	Nm	tm	t*	tc
80.00	126.0	4	4.541	5.89	3.562

PARAMETER: TOX

LEVEL OF SIGNIFICANCE = 0.01
NUMBER OF BACKGROUND MEASUREMENTS (Nb) 16
BACKGROUND MEAN (Xb) 39
BACKGROUND VARIANCE (S2b) 231
BACKGROUND CRITICAL VALUE (tb) 2.602

NEW DATA

Xm	S2m	Nm	tm	t*	tc
36.75	438.9	4	4.541	-0.20	4.316

```
PROJECT NAME: LTV STEEL                                        TEST DATE: 2/5/88
                              WELL NUMBER: MW-13B

                               PARAMETER: pH

LEVEL OF SIGNIFICANCE = 0.005
NUMBER OF BACKGROUND MEASUREMENTS (Nb)  16
BACKGROUND MEAN (Xb)  6.9
BACKGROUND VARIANCE (S2b)  .3
BACKGROUND CRITICAL VALUE (tb)  2.947

                                  NEW DATA
   Xm           S2m           Nm           tm              t*         tc
-----------------------------------------------------------------------------
   6.89         0.0           4            5.841           -0.08      3.571




                               PARAMETER: SPECIFIC CONDUCTIVITY

LEVEL OF SIGNIFICANCE = 0.01
NUMBER OF BACKGROUND MEASUREMENTS (Nb)  16
BACKGROUND MEAN (Xb)  1503
BACKGROUND VARIANCE (S2b)  62823
BACKGROUND CRITICAL VALUE (tb)  2.602

                                  NEW DATA
   Xm           S2m           Nm           tm              t*         tc
-----------------------------------------------------------------------------
2000.00         0.0           4            4.541           7.93       2.602
```

```
PROJECT NAME: LTV STEEL                                      TEST DATE: 2/5/88
                          WELL NUMBER: MW-13B

                           PARAMETER: TOC

LEVEL OF SIGNIFICANCE = 0.01
NUMBER OF BACKGROUND MEASUREMENTS (Nb)  16
BACKGROUND MEAN (Xb)  33
BACKGROUND VARIANCE (S2b)  514
BACKGROUND CRITICAL VALUE (tb)  2.602

                              NEW DATA
   Xm          S2m            Nm           tm              t*        tc
----------------------------------------------------------------------------
  73.50       175.0           4          4.541            4.65      3.720



                           PARAMETER: TOX

LEVEL OF SIGNIFICANCE = 0.01
NUMBER OF BACKGROUND MEASUREMENTS (Nb)  16
BACKGROUND MEAN (Xb)  39
BACKGROUND VARIANCE (S2b)  231
BACKGROUND CRITICAL VALUE (tb)  2.602

                              NEW DATA
   Xm          S2m            Nm           tm              t*        tc
----------------------------------------------------------------------------
  46.25       670.9           4          4.541            0.54      4.387
```

```
PROJECT NAME: LTV STEEL                                      TEST DATE: 2/5/88
                              WELL NUMBER: MW-14B

                               PARAMETER: pH

LEVEL OF SIGNIFICANCE = 0.005
NUMBER OF BACKGROUND MEASUREMENTS (Nb)  16
BACKGROUND MEAN (Xb)  6.9
BACKGROUND VARIANCE (S2b)  .3
BACKGROUND CRITICAL VALUE (tb)  2.947

                                   NEW DATA
   Xm           S2m           Nm           tm               t*          tc
----------------------------------------------------------------------------
   9.40         0.0           4           5.841            18.26       2.947

                              PARAMETER: SPECIFIC CONDUCTIVITY

LEVEL OF SIGNIFICANCE = 0.01
NUMBER OF BACKGROUND MEASUREMENTS (Nb)  16
BACKGROUND MEAN (Xb)  1503
BACKGROUND VARIANCE (S2b)  62823
BACKGROUND CRITICAL VALUE (tb)  2.602

                                   NEW DATA
   Xm           S2m           Nm           tm               t*          tc
----------------------------------------------------------------------------
2050.00       3333.3          4           4.541             7.93       2.941
```

```
PROJECT NAME: LTV STEEL                                          TEST DATE: 2/5/88
                              WELL NUMBER: MW-14B

                               PARAMETER: TOC

LEVEL OF SIGNIFICANCE = 0.01
NUMBER OF BACKGROUND MEASUREMENTS (Nb)  16
BACKGROUND MEAN (Xb)  33
BACKGROUND VARIANCE (S2b)  514
BACKGROUND CRITICAL VALUE (tb)  2.602

                                   NEW DATA
   Xm           S2m           Nm            tm               t*          tc
-----------------------------------------------------------------------------
  25.00         20.7           4           4.541           -1.31        2.871




                               PARAMETER: TOX

LEVEL OF SIGNIFICANCE = 0.01
NUMBER OF BACKGROUND MEASUREMENTS (Nb)  16
BACKGROUND MEAN (Xb)  39
BACKGROUND VARIANCE (S2b)  231
BACKGROUND CRITICAL VALUE (tb)  2.602

                                   NEW DATA
   Xm           S2m           Nm            tm               t*          tc
-----------------------------------------------------------------------------
  16.00          6.0           4           4.541           -5.76        2.784
```

```
PROJECT NAME: LTV STEEL                                         TEST DATE: 2/5/88
                              WELL NUMBER: WEST POND

                               PARAMETER: pH

LEVEL OF SIGNIFICANCE = 0.005
NUMBER OF BACKGROUND MEASUREMENTS (Nb)  16
BACKGROUND MEAN (Xb)  6.9
BACKGROUND VARIANCE (S2b)  .3
BACKGROUND CRITICAL VALUE (tb)  2.947

                                    NEW DATA
   Xm           S2m            Nm            tm                t*          tc
----------------------------------------------------------------------------------
   9.88         0.0            4             5.841             21.37       3.040



                               PARAMETER: SPECIFIC CONDUCTIVITY

LEVEL OF SIGNIFICANCE = 0.01
NUMBER OF BACKGROUND MEASUREMENTS (Nb)  16
BACKGROUND MEAN (Xb)  1503
BACKGROUND VARIANCE (S2b)  62823
BACKGROUND CRITICAL VALUE (tb)  2.602

                                    NEW DATA
   Xm           S2m            Nm            tm                t*          tc
----------------------------------------------------------------------------------
 737.50      208.3             4             4.541             %-12.14     2.627
```

```
PROJECT NAME: LTV STEEL                                    TEST DATE: 2/5/88
                         WELL NUMBER: WEST POND

                          PARAMETER: TOC

LEVEL OF SIGNIFICANCE = 0.01
NUMBER OF BACKGROUND MEASUREMENTS (Nb)  16
BACKGROUND MEAN (Xb)  33
BACKGROUND VARIANCE (S2b)  514
BACKGROUND CRITICAL VALUE (tb)  2.602

                                   NEW DATA
   Xm           S2m               Nm         tm              t*          tc
-----------------------------------------------------------------------------
  18.75        4.9               4          4.541           -2.47       2.673
```

```
PROJECT NAME: LTV STEEL                                    TEST DATE: 2/5/88
                         WELL NUMBER: WEST POND

                          PARAMETER: TOX

LEVEL OF SIGNIFICANCE = 0.01
NUMBER OF BACKGROUND MEASUREMENTS (Nb)  16
BACKGROUND MEAN (Xb)  39
BACKGROUND VARIANCE (S2b)  231
BACKGROUND CRITICAL VALUE (tb)  2.602

                                   NEW DATA
   Xm           S2m               Nm         tm              t*          tc
-----------------------------------------------------------------------------
  30.50        21.7              4          4.541           -1.91       3.131
```

APPENDIX D

STATISTICAL PROCEDURES

[OMB No.2000-0423; 1/31/84]

GROUND-WATER MONITORING GUIDANCE FOR OWNERS AND OPERATORS OF INTERIM STATUS FACILITIES

Instructions for complying with 40 CFR Part 265, Subpart F.

OFFICE OF SOLID WASTE AND EMERGENCY RESPONSE

U.S. Environmental Protection Agency
Washington, D.C.

1983

2.5.2 Statistical Analysis

The owner or operator of a facility must perform a statistical analysis of the concentrations or values of the indicator parameters, as determined from the sampling and analysis of the required monitoring wells. If the analytical results for Total Organic Carbon and TOX are reported by the laboratory as below detection limits, then the owner or operator should use values of one milligram per liter for Total Organic Carbon and five micrograms per liter for TOX in the statistical analysis.

Section 265.92(c)(2) on sampling and analysis requires that the initial background mean and variance for each indicator parameter be determined by pooling the replicate measurements for the respective parameter concentrations in samples obtained from the upgradient well(s) during the first year. Replicate analyses are not required for downgradient wells during the first year.

After the first year of monitoring, §265.92(d)(2) on sampling and analysis and §265.93(b) on preparation, evaluation, and response require the owner or operator to analyze for and calculate the mean and variance of each indicator parameter (i.e., pH, Specific Conductance, Total Organic Carbon, and Total Organic Halogen), based on at least four replicate measurements on each sample, for each well in the monitoring system. Results for each indicator parameter from each sampling event (for each and every well in the monitoring system) must be compared with the initial background mean (i.e., that established for the upgradient well(s) during the first year). The student's t-test at the 0.01 level of significance must be used to determine statistically significant increases (or decreases also, in the case of pH) over the initial background values.

First Year Statistical Analysis

During the first year, the initial background mean and variance for each indicator parameter must be determined for samples from upgradient wells.

Arithmetic Mean

In order to perform the t-test, the raw data from the background and monitoring wells must be reduced to specific summary measures. These measures are the mean (an average) and the variance (a measure of variability of the data). For any set of data the mean ($\bar{X}$) is equal to the sum of the measurements divided by the number of measurements (n).

The indicator parameter values for all four quarters of the first year are used to calculate the mean. If more than one upgradient well is being used, the owner or operator must calculate the overall mean value (of each indicator parameter) for all of the upgradient wells. This can be accomplished by summing the data from all of the upgradient wells and dividing this sum by the total number of measurements for each parameter. These first-year upgradient mean values are important since they establish the initial background concentrations to which all subsequent upgradient and downgradient concentrations or values will be compared.

Variance

The variance is an average of the squares of the differences between the actual value and the mean, and is a measure of variability. The mean and variance are used in the Student's t-test to determine whether any changes in the concentration of the indicator parameters are statistically significant. In this context, the variance may be defined as: the sum of the squares of the differences of the individual measurements and the mean, divided by one less than the number of measurements. Symbolically, the sample variance is calculated as follows:

$$s^2 = \frac{\sum_{i=1}^{n} (X_i - \overline{X})^2}{n - 1}$$

where s^2 = sample variance;

X_i = value of each measurement;

$\overline{X}$ = mean of the measurements;

Σ = "the sum of" a set of numbers from the first value (where i = 1) to the last value (where i = n). In this case, the squared differences of the measurements and the mean are added; and

n = the number of measurements.

For example, in determining the sample variance of the background value of the pH of an upgradient well for the first year, the owner or operator would proceed in the following manner:

- Substract the mean pH value (e.g., 6.4) from each pH measurement, square this value, and sum the squared differences as follows:

	Measurement	Mean	Difference	Squared Difference
1st Quarter	5.7	6.4	-0.7	0.49
	6.3	6.4	-0.1	0.01
	6.8	6.4	0.4	0.16
	4.8	6.4	-1.6	2.56
2nd Quarter	7.5	6.4	1.1	1.21
	8.2	6.4	1.8	3.24
	6.9	6.4	0.5	0.24
	6.1	6.4	-0.3	0.09
3rd Quarter	5.7	6.4	-.07	0.49
	4.3	6.4	-2.1	4.41
	5.5	6.4	-0.9	0.81
	6.2	6.4	-0.2	0.04
4th Quarter	4.7	6.4	-1.7	2.89
	8.6	6.4	2.2	4.84
	8.9	6.4	2.5	6.25
	6.0	6.4	-0.4	0.16
			Total	27.90;

- Divide the sum of the squared differences by the number of measurements minus one, as follows:

Sample Variance = $s^2 = \frac{27.9}{n-1} = \frac{27.9}{16-1} = 1.86$; and

- Keep at least two decimal places for accuracy in calculations.

The variance for specific conductance, total organic carbon, and total organic halogen can be calculated in a similar manner. If more than one upgradient well is being used, the sample variance can be calculated by pooling all the measurements (for each indicator parameter) to determine the mean, subtracting the mean from each measurement, squaring and summing the differences as in the first step above, and dividing this sum by the number of measurements minus one, as in the second step above.

Subsequent Statistical Analysis (after the first year)

After determining initial background values during the first year, the owner or operator must, at least semi-annually, calculate the sample mean and sample variance for four replicate measures (necessitating four aliquots from the same sample for any destructive analyses) of pH, specific conductance, total organic carbon, and total organic halogen, for each upgradient and downgradient ground-water monitoring well. (The regulations allow for a greater sampling and analysis frequency than the minimum, hence providing an opportunity to lessen the prospect of false positive indications of facility impact on ground water.) These values should be determined in the manner described previously. The mean of each of these indicator parameters for each upgradient and downgradient well must be individually compared to the initial background mean for each indicator parameter by using the Student's t-test at the 0.01 level of significance. This provides a determination of statistically significant increases (or decreases also for pH) over the initial background level.

Student's t-test

[Note: The methodology for application of the Student's t-test presented in this guidance document differs from that offered in the May 2, 1980, background document for ground-water monitoring. Although both methods could be appropriate, the one recommended in this guidance document is preferred.]

The Student's t-test is a statistical method used to determine the significance of a change between initial background and subsequent parameter values and must be calculated at least semi-annually for each well for each indicator parameter. Using all the available background data (n_b readings), calculate the background mean ($\overline{X}_b$) and background variance (s_b^2). For the single monitoring well under investigation (n_m readings), calculate the monitoring mean ($\overline{X}_m$) and monitoring variance (s_m^2).

The t-test uses these data summary measures to calculate a t-statistic (t*) and a comparison t-statistic (t_c). The t* value is compared to the t_c value and a conclusion reached as to whether there has been a statistically significant change in the indicator parameter value.

The t-test for the difference of two groups is given by:

$$t^* = \frac{\overline{X}_m - \overline{X}_b}{\sqrt{\dfrac{s_m^2}{n_m} + \dfrac{s_b^2}{n_b}}}$$

If the t* is negative (except for pH), then there is no significant difference between the monitoring data and background data.

The t-statistic (t_c) against which t* will be compared, necessitates finding t_b and t_m from Table 2-4 where,

t_b = Table 2-4 with (n_b-1) degrees of freedom, 0.01 level of significance; and

t_m = Table 2-4 with (n_m-1) degrees of freedom, 0.01 level of significance.

[NB: if pH is being examined, use 0.005 as the level of significance]. Finally, the special weightings W_b and W_m are defined as:

$$W_b = \frac{s_b^2}{n_b} \quad \text{and} \quad W_m = \frac{s_m^2}{n_m},$$

and so the comparison t-statistic is

$$t_c = \frac{W_b t_b + W_m t_m}{W_b + W_m}.$$

The t-statistic (t*) is now compared with the comparison t-statistic (t_c) using the following decision-rule:

If t* is equal to or larger that t_c, then conclude that there most likely has been an increase in indicator parameter. [In the case for pH, it is decrease if the t* as originally calculated was negative, and increase if the original t* was positive.]

If t* is less than t_c, then conclude that most likely there has not been a change in indicator parameter.

The procedure described above is known as Cochrans' Approximation to the Behrens-Fisher solution of the comparison of two independent samples with unequal population variances. For further information, see Snedecor and Cochran (1967) or Steel and Torrie (1960).

Example of the t-test

These readings represent TOC values collected from a hazardous waste disposal facility. Background well samples

Table 2-4

The Critical t-values at the 0.01 and 0.005 Levels of Significance

Degrees of Freedom	Level of Significance = 0.01	Level of Significance = 0.005
1	31.821	63.657
2	6.965	9.925
3	4.541	5.841
4	3.747	4.604
5	3.365	4.032
6	3.143	3.707
7	2.998	3.499
8	2.896	3.355
9	2.821	3.250
10	2.764	3.169
11	2.718	3.106
12	2.681	3.055
13	2.650	3.012
14	2.624	2.977
15	2.602	2.947
16	2.583	2.921
17	2.567	2.898
18	2.552	2.878
19	2.539	2.861
20	2.528	2.845
21	2.518	2.831
22	2.508	2.819
23	2.500	2.807
24	2.492	2.797
25	2.485	2.787
26	2.479	2.779
27	2.473	2.771
28	2.467	2.763
29	2.462	2.756
30	2.457	2.750
40	2.423	2.704
60	2.390	2.660
120	2.358	2.617
	2.326	2.576

Adapted from Table III, Statistical Tables for Biological, Agricultural and Medical Research, Fisher and Yates, 1963.

were collected quarterly and four determinations made on each quarterly sample. For the purposes of this example, only one monitoring well will be considered.

BACKGROUND WELL				MONITORING WELL
1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	
20	12	15	6	42
15	12	16	9	43
15	13	14	10	38
19	13	15	9	36

For the background data the mean ($\overline{X}_b$) is,

$$\overline{X}_b = \frac{20 + 12 + 15 \ldots + 9}{16} \quad \text{, or}$$

$$\overline{X}_b = 13.31$$

and the background variance (s_b^2) is,

$$s_b^2 = \frac{(20-13.31)^2 + (12-13.31)^2 \ldots + (9-13.31)^2}{16 - 1},$$

or

$$s_b^2 = 13.43$$

For the monitoring data, the mean ($\overline{X}_m$) is,

$$\overline{X}_m = \frac{42 + 43 + 38 + 36}{4} \quad \text{, or}$$

$$\overline{X}_m = 39.75$$

and the monitoring variance (s_m) is

$$s_m^2 = \frac{(42-39.75)^2 + (43-39.75)^2 + (38-39.75)^2 + (36-39.75)^2}{4 - 1} \quad \text{, or}$$

$$s_m^2 = 10.92$$

$$t^* = \frac{\overline{X}_m - \overline{X}_b}{\sqrt{\dfrac{s_m^2}{n_m} + \dfrac{s_b^2}{n_b}}}$$, and for this example,

$$t^* = \frac{39.75 - 13.31}{\sqrt{\frac{10.92}{4} + \frac{13.43}{16}}}, \text{ or}$$

$$t^* = 13.99$$

Now, from Table 2-4

t_b = Table 2-4 with 15 degree of freedom, significance level = 0.01,

t_b = 2.602,

t_m = Table 2-4 with 3 degree of freedom, significance level = 0.01,

t_m = 4.541.

The weights are:

$$W_m = \frac{s_m^2}{n_m} = \frac{10.92}{4} = 2.7300,$$

and

$$W_b = \frac{s_b^2}{n_b} = \frac{13.43}{16} = 0.8394$$

Therefore,

$$t_c = \frac{W_b t_b + W_m t_m}{W_b + W_m}, \text{ and for this example,}$$

$$t_c = \frac{(0.8394 \times 2.602) + (2.7300 \times 4.541)}{(0.8394 + 2.7300)},$$

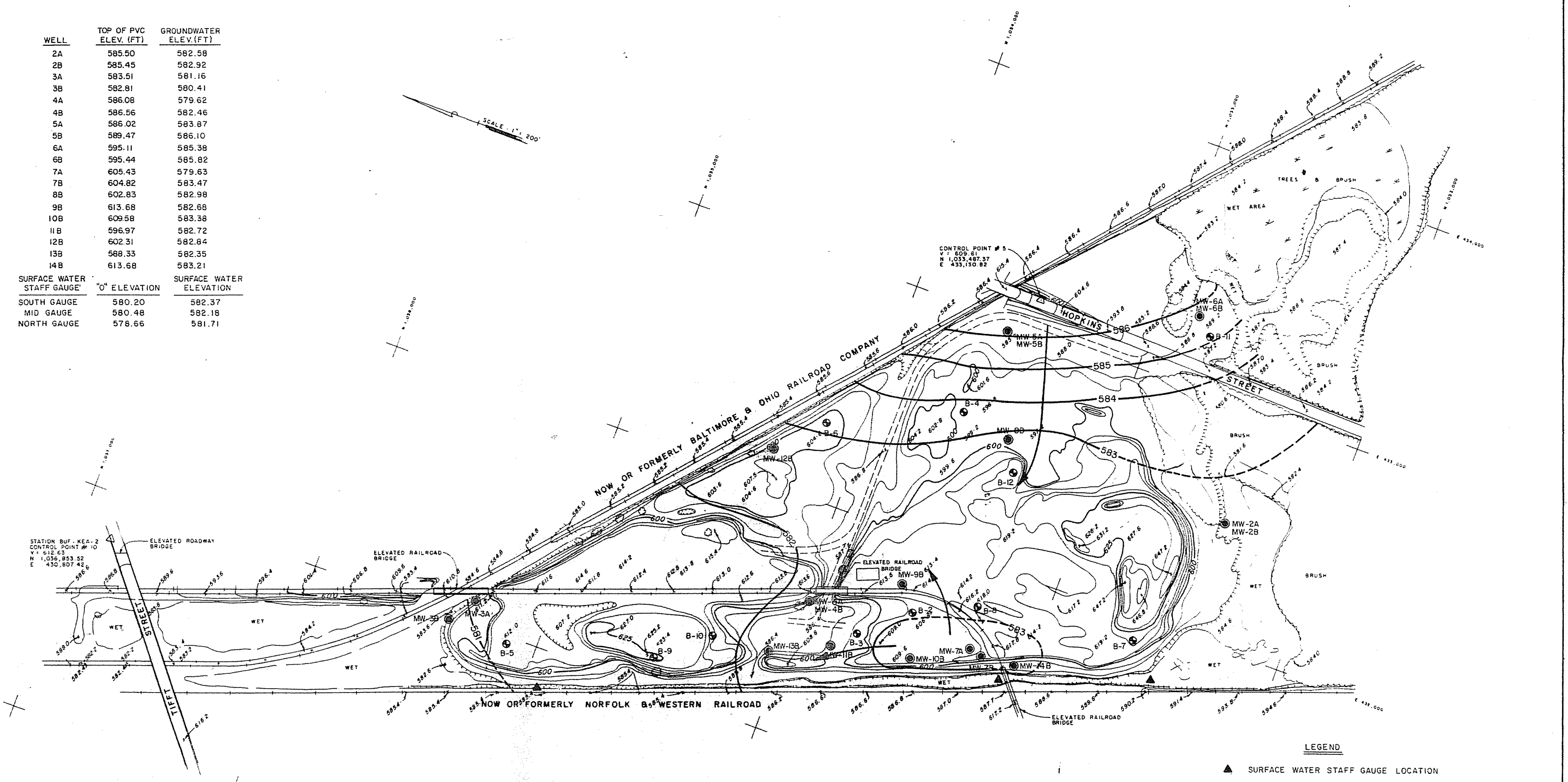
giving t_c = 4.085.

As t* (=13.99) is larger than t_c (=4.085), the conclusion is that there has been a statistically significant increase in TOC level.

PLATE I

WELL	TOP OF PVC ELEV. (FT)	GROUNDWATER ELEV.(FT)
2A	585.50	582.58
2B	585.45	582.92
3A	583.51	581.16
3B	582.81	580.41
4A	586.08	579.62
4B	586.56	582.46
5A	586.02	583.87
5B	589.47	586.10
6A	595.11	585.38
6B	595.44	585.82
7A	605.43	579.63
7B	604.82	583.47
8B	602.83	582.98
9B	613.68	582.68
10B	609.58	583.38
11B	596.97	582.72
12B	602.31	582.84
13B	588.33	582.35
14B	613.68	583.21

SURFACE WATER STAFF GAUGE'	"0" ELEVATION	SURFACE WATER ELEVATION
SOUTH GAUGE	580.20	582.37
MID GAUGE	580.48	582.18
NORTH GAUGE	578.66	581.71



LEGEND

▲ SURFACE WATER STAFF GAUGE LOCATION

⊕ APPROXIMATE LOCATION OF SOIL BORINGS

◉ APPROXIMATE LOCATION OF MONITORING WELLS

NOTE: A - DESIGNATES DEEP
B - DESIGNATES SHALLOW

← DIRECTION OF GROUNDWATER FLOW GROUNDWATER SYSTEM

—567— GROUNDWATER ELEVATION CONTOUR

LEGEND

═	PAVED ROAD	— —	INTERMITTENT DRAINAGE	▭	BUILDING
═	TRACK	—600—	INDEX CONTOUR	⬭	DEPRESSION
∽	TREED AREA			625.4	SPOT ELEVATION

DASHED CONTOURS INDICATE APPROXIMATE ELEVATION DUE TO THE GROUND BEING PARTIALLY OBSCURED

PHOTOGRAMMETRIC COMPILATION BY EL COMP DATA SYSTEMS DIVISION OF
McINTOSH & McINTOSH, INC. JOB NO. 2187
DATE OF PHOTOGRAPHY: APRIL 18, 1985
CONTOUR INTERVAL 5 FEET, U.S.G.S. DATUM, NEW YORK STATE WEST ZONE COORDINATE SYSTEMS

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MALCOLM PIRNIE

REVISIONS

NO	BY	DATE	REMARKS
	J.A.B.	8/26/85	SPOT ELEVATIONS ADDED ON RAILROADS
	J.A.B.	8/26/85	WET AREAS ADDED

DES
DWN
CKD

LTV STEEL COMPANY
CLEVELAND, OHIO

MARILLA STREET LANDFILL, BUFFALO, NEW YORK

GROUNDWATER ISOPOTENTIAL MAP FOR SHALLOW WELLS (2/3/88)

MALCOLM PIRNIE, INC.
DATE ....
SHEET ...... OF ......
DWG NO. ....

PLATE 2

WELL	TOP OF PVC ELEV. (FT)	GROUNDWATER ELEV.(FT)
2A	585.50	582.58
2B	585.45	582.92
3A	583.51	581.16
3B	582.81	580.41
4A	586.08	579.62
4B	586.56	582.46
5A	586.02	583.87
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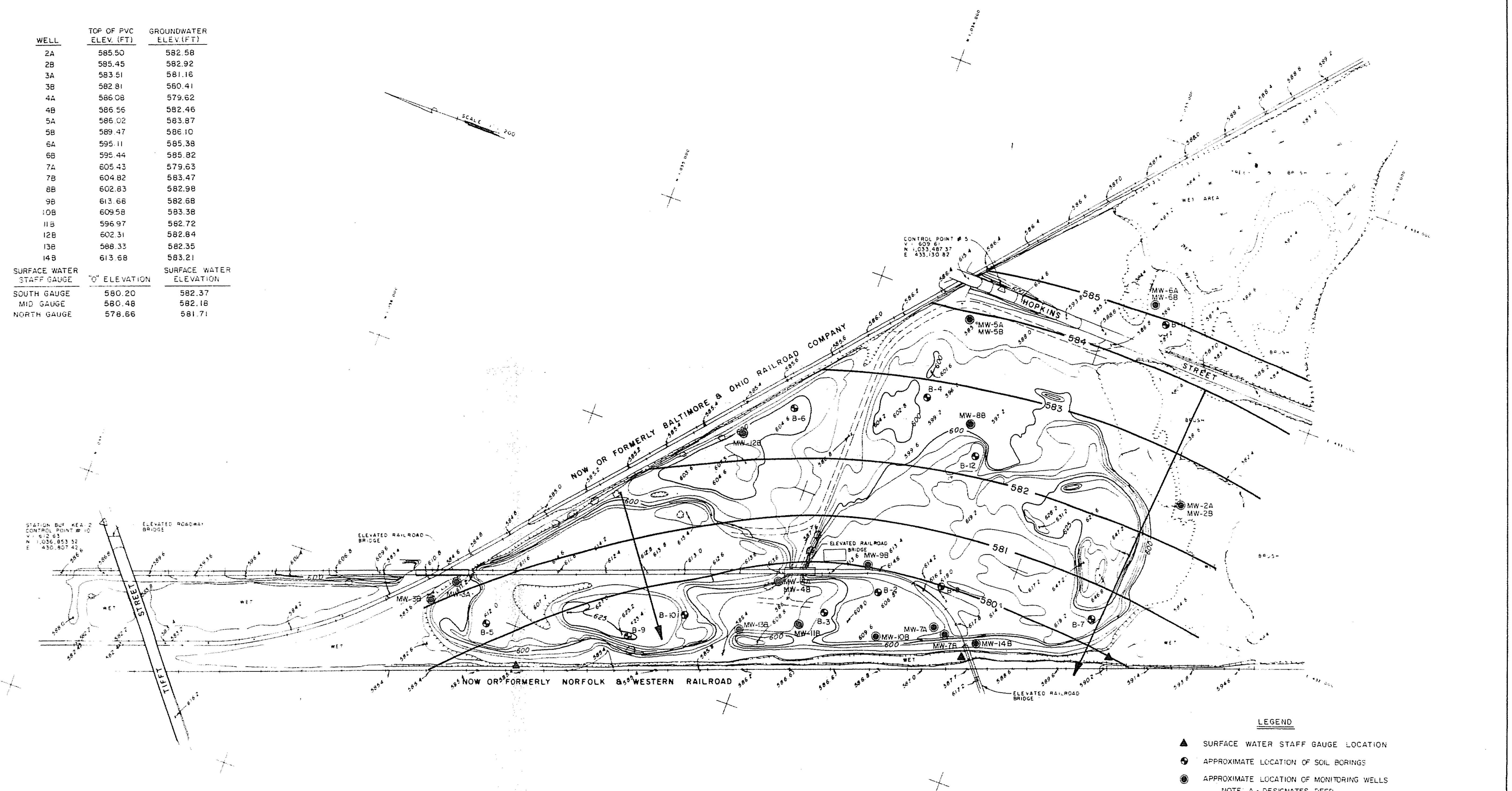
6B	595.44	585.82
7A	605.43	579.63
7B	604.82	583.47
8B	602.83	582.98
9B	613.68	582.68
10B	609.58	583.38
11B	596.97	582.72
12B	602.31	582.84
13B	588.33	582.35
14B	613.68	583.21

SURFACE WATER STAFF GAUGE	"O" ELEVATION	SURFACE WATER ELEVATION
SOUTH GAUGE	580.20	582.37
MID GAUGE	580.48	582.18
NORTH GAUGE	578.66	581.71



LEGEND

PAVED ROAD
TRACK
TREED AREA
INTERMITTENT DRAINAGE
600 INDEX CONTOUR
BUILDING
DEPRESSION
625.2 SPOT ELEVATION
DASHED CONTOURS INDICATE APPROXIMATE ELEVATION DUE TO THE GROUND BEING PARTIALLY OBSCURED

PHOTOGRAMMETRIC COMPILATION BY EL COMP DATA SYSTEMS DIVISION OF
McINTOSH & McINTOSH, INC JOB NO 2187
DATE OF PHOTOGRAPHY APRIL 18, 1985
CONTOUR INTERVAL 5 FEET, USGS DATUM, NEW YORK STATE WEST ZONE COORDINATE SYSTEMS

LEGEND

▲ SURFACE WATER STAFF GAUGE LOCATION

◒ APPROXIMATE LOCATION OF SOIL BORINGS

◉ APPROXIMATE LOCATION OF MONITORING WELLS

NOTE: A - DESIGNATES DEEP
B - DESIGNATES SHALLOW

← DIRECTION OF GROUNDWATER FLOW
GROUNDWATER SYSTEM

—567— GROUNDWATER ELEVATION CONTOUR

WARNING IT IS A VIOLATION OF NEW YORK EDUCATION LAW SECTION 7209 2 FOR ANY PERSON UNLESS HE IS ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER OR LAND SURVEYOR, TO ALTER THIS DOCUMENT IN ANY WAY. IF ALTERED, THE ALTERING PERSON SHALL COMPLY WITH THE REQUIREMENTS OF NEW YORK EDUCATION LAW SECTION 7209 2

MALCOLM PIRNIE

REVISIONS

NO	BY	DATE	REMARKS
	JAB	8/26/85	SPOT ELEVATIONS ADDED ON RAILROADS
	JAB	8/26/85	WET AREAS ADDED

DES

DWN

CKD

LTV STEEL COMPANY
CLEVELAND, OHIO

MARILLA STREET LANDFILL, BUFFALO, NEW YORK

GROUNDWATER ISOPOTENTIAL MAP FOR
DEEP WELLS (2/3/88)

MALCOLM PIRNIE, INC.

DATE

SHEET OF

DWG NO

MALCOLM PIRNIE

APPENDIX D

GROUND WATER MONITORING REPORT
JULY 1988

MALCOLM
PIRNIE

LTV MARILLA STREET LANDFILL
BUFFALO, NEW YORK

GROUND WATER QUALITY MONITORING REPORT
FOR MAY 1988 SAMPLING PERIOD

PROJECT NO. 0848-12-9

Prepared For:
LTV STEEL COMPANY
Cleveland, Ohio

JULY 1988

MALCOLM PIRNIE, INC.
S3515 Abbott Road
P.O. Box 1938
Buffalo, New York 14219

1.0 INTRODUCTION

This monitoring report has been prepared as specified in the Annual Report recently submitted to the NYSDEC dated June 1987; and to comply with NYSDEC Part 360 quarterly ground water monitoring requirements for the Marilla Street Landfill. It includes the following items as related to the May 1988 sampling period:

- Summary of on-site ground water flow conditions;
- RCRA compliance monitoring data collected from upgradient Well 6B (fourth quarter);
- Routine monitoring data collected from downgradient RCRA wells in the BOF Dust Area (viz. 4B, 7B, 7A, 9B, 13B and 14B) and the West Pond;
- NYSDEC recommended monitoring data collected from Part 360 Wells 2A, 2B, 3A, 4A, 5A, 5B and 6A;
- Evaluation of statistically significant changes from the "initial" background levels of the four indicator parameters (viz. pH, TOC, TOX and Conductivity).

1.1 DEFINITIONS

1.1.1 RCRA Monitoring Wells

Wells 6B, 4B, 7A, 7B, 9B, 13B, 14B and the West Pond constitute the ground water compliance monitoring system for the BOF Dust Area, regulated under 6NYCRR Part 373.

1.1.2 Part 360 Monitoring Wells

Wells 2A, 2B, 3A, 4A, 5A, 5B and 6A constitute the ground water monitoring system for areas of the landfill outside of the BOF Dust Area, regulated under 6NYCRR Part 360.

1.1.3 "Initial" Background Values

Mean concentration and the coefficient of variance of the four indicator parameters (viz. pH, specific conductivity, TOC and TOX) determined from sampling the upgradient RCRA well, 6B. These values were reported in the October 1987 Quarterly Sampling Report.

1.1.4 Evaluation Procedure

The statistical procedure presented in Appendix D has been used to statistically compare the mean values of pH, specific conductivity, TOC and TOX to the "initial" background values. The evaluation of the statistical parameters (defined in Appendix D) is performed as discussed below.

1.1.4.1 For TOX, TOC and Specific Conductivity:

- If $t^* \geq t_c$
  then conclude there has been a
  statistically significant increase.
- If $t^* < t_c$,
  then conclude there has not been a
  statistically significant increase.

1.1.4.2 For pH:

- If $/t^*/ > t_c$ and $t^* < 0$,
  then conclude there has been a
  statistically significant decrease.
- If $/t^*/ < t_c$,
  then conclude there has not been a
  statistically signifiant change.
- If $t^* \geq t_c$ and $t^* > 0$,
  then conclude there has been a
  statistically significant increase.

Absolute values of t* were used for the evaluation of pH in accordance with Reference 1.

2.0 GROUND WATER ELEVATIONS AND FLOW CONDITIONS

Water levels were measured on May 2, 1988 in all 19 on-site wells and three surface water staff gauges located in the drainage ditch immediately west of the site (refer to Plate 1 for locations). Table 1 is a summary of all water level data obtained since July 1987. Measurements obtained from the staff gauges were used in further defining the shallow ground water conditions on-site.

Site ground water flow conditions inferred from May 2, 1988 water levels are not substantially different from flow patterns discussed in the previous reports.

Plates 1 and 2 are ground water isopotential maps for the on-site shallow wells and deep wells, respectively. Both maps were prepared from elevations recorded on May 2, 1988. The map for the shallow wells, based on 13 locations, depicts a ground water "low" in the central portion of the site. Ground water flows from both east and west directions to this central region and ultimately discharges into the West Pond. Surface water in the nearby ditch is also moving toward the West Pond, as evidenced from staff gauge measurements. At the opposite end of the site, to the south, the observed ground water flow is migrating in a west to southwest direction.

In the vicinity of the BOF Dust Area, it is believed that shallow ground water flows radially outward in all directions, which is substantiated from both monitoring well and surface water data. This mounding is thought to be partly attributed to the hydraulic conductivity of the material(s) underlying the BOF Dust Area. A downward flow component exists within this area (as evidenced from well pairs 4 and 7) with precipitation being the primary source of recharge.

The isopotential map for the deep wells (based upon six locations) illustrates a different flow pattern where ground water is moving in both west and southwest directions across the site.

3.0 ANALYTICAL DATA SUMMARY

Tables 2 through 4 present the analytical data for the May 1988 quarterly sampling period. Analytical testing was performed by Recra Environmental, Inc. of Amherst, New York. The laboratory report is included in Appendix A. Field sampling data sheets, prepared by Malcolm Pirnie, Inc. are presented as Appendix B.

Analytical results were evaluated both by inspection and statistical analysis. The sample mean and sample variance were calculated from quadruplicate measurements (necessitating four aliquots from the same sample for any given analysis) of pH, specific conductance, TOC and TOX, for upgradient well 6B and downgradient wells 4B, 7B, 7A, 9B, 13B, 14B and the West Pond. The mean of each of these indicator parameters, for all locales previously mentioned (both upgradient and downgradient), were then individually compared to the "initial" background mean of each indicator parameter (from well 6B) by using the Cochran's Approximation to the Behrens-Fisher t-test. The calculation sheets for each parameter are presented in Appendix C. Appendix D details the statistical procedure utilized in Appendix C. This provides a determination of statistically significant increases (decreases also for pH) over the "initial" background level. Statistically significant changes in the indicator parameters are summarized in Table 5.

In comparing the various parameters relative to the upgradient well, 6B, several conclusions can be drawn:

- pH (units): Statistically significant increases occurred in wells 4B (8.63), 7B (12.60), 14B (9.55), and the West Pond (9.35).

- Specific Conductivity (umhos/cm): Statistically significant increases occurred in wells 6B (1704), 7B (9813), 9B (2312), 13B (1900), and 14B (2275). A higher value also occurred in well 5B (2450).

- TOC (mg/l): Statistically significant increase occurred in well 7B (210). Higher values also occurred in wells 3A (97), 5B (84), and 6A (53).

- Chloride (mg/l): Significantly higher values occurred in wells 5B (270), 7B (360).

- Fluoride (mg/l): Significantly higher value occurred in well 7B (6.6).

- Sulfate (mg/l): Higher values occur in wells 9B (1100) and 14B (980).

- Total Phenols: Higher values occur in wells 2B (0.046), and 7B (0.98).

- Soluble Iron (mg/l): Higher values occur in wells 2A (1.2), 3A (2.4), 4A (2.0), 4B (1.1), 5B (2.8), 6A (2.5), 7A (9.1), 7B (1.5), 9B (2.6), 13B (3.6) and 14B (1.6).

- Soluble Manganese (mg/l): Higher values occur in wells 4B (0.90), 7A (0.67), 9B (1.4) and 13B (2.5).

- Soluble Lead (mg/l): Higher values occur in wells 7A (0.17) and 7B (0.048).

- Tetrachloroethene (ug/l): Higher values occur in well 14B (11).

- Quadruplicate TOC analyses for wells 7A, 9B and 13B exhibited a comparatively high variance. This is suspected to be a function of the variable amount of particulate matter present in the sample aliquot which is a common occurrence.

TABLE 1

LTV STEEL
MARILLA STREET LANDFILL INVESTIGATION CLOSURE

SUMMARY OF GROUND WATER AND SURFACE WATER ELEVATIONS

WELL NO.	07/06/87	08/28/87	09/25/87	11/18/87	02/03/88	05/02/88
2A	581.17		582.00	582.29	582.58	582.34
2B	582.14		582.05	582.48	582.92	581.93
3A	580.69		580.81	581.04	581.16	581.06
3B	580.42		579.86	580.27	580.41	580.16
4A	579.78		579.48	579.44	579.62	579.56
4B	582.61		582.01	582.20	582.46	582.24
5A	583.96		583.63	583.96	583.87	583.17
5B	585.75		585.94	585.80	586.10	587.17
6A	584.81		583.56	584.67	585.38	584.80
6B	585.04		583.64	585.17	585.82	585.06
7A	579.15		579.43	579.43	579.63	579.58
7B	583.97		583.74	583.06	583.47	583.59
8B	582.73		582.58	582.72	582.98	582.68
9B	582.25		582.28	582.53	582.68	582.40
10B	583.65		583.63	583.67	583.38	583.97
11B	582.66		582.37	582.59	582.72	582.50
12B	582.11		582.39	582.59	582.84	582.71
13B	582.52		581.91	582.23	582.35	581.95
14B	582.37		582.78	583.08	583.21	582.90
Surface Water Staff Gauges						
North Gauge		581.31	581.51	581.61	581.71	582.65
Mid Gauge		581.58	581.89	582.13	582.18	582.39
South Gauge		581.67	581.92	582.15	582.37	581.16

Elevations in Feet Above
Mean Sea Level

TABLE 2

LTV STEEL
MARILLA STREET LANDFILL

RCRA COMPLIANCE BASELINE MONITORING DATA FOR WELL 6B

PARAMETER (Units as ug/l except as noted)	MW-6B (05/03/88)
pH (units)*	7.1/7.2/7.2/7.2
Temperature (^{o}C)*	13
Specific Conductivity (umhos/cm)*	1680/1710 1700/1725
Total Organic Halide	31/12.4/23/18.6
Total Organic Carbon (mg/l)	6.5/16/4.5/19
Chloride (mg/l)	24
Fluoride (mg/l)	<0.1
Nitrate (mg NO_3-N/L)	0.30
Total Recoverable Phenolics (mg/l)	<0.01
Sulfate (mg/l)	430
Fecal Coliform (Colony/100 ml)	<10
Total Radium (pCi/L)	<4.0
Gross Alpha (pCi/L)	<5
Gross Beta (pCi/L)	<3.0
Tetrachloroethene	<0.2
Endrin	<0.01
Lindane	<0.01
Methoxychlor	<0.1
Toxaphene	<0.5
2,4-D	<0.16
2,4,5-TP	<0.04

*field measured

TABLE 2 (Continued)

LTV STEEL
MARILLA STREET LANDFILL

RCRA COMPLIANCE BASELINE MONITORING DATA FOR WELL 6B

PARAMETER (Units as mg/l except as noted)	MW-6B (05/03/88)
Total Arsenic	<0.005
Total Barium	0.030
Total Cadmium	<0.005
Total Chromium	<0.005
Total Iron	1.9
Total Lead	<0.03
Total Manganese	0.051
Total Mercury	<0.0005
Total Selenium	<0.005
Total Silver	<0.005
Total Sodium	24
Soluble Arsenic	<0.005
Soluble Barium	<0.02
Soluble Cadmium	<0.005
Soluble Chromium	<0.005
Soluble Iron	0.58
Soluble Lead	<0.03
Soluble Manganese	0.013
Soluble Mercury	<0.0005
Soluble Selenium	<0.005
Soluble Silver	<0.005
Soluble Sodium	23

TABLE 3

LTV STEEL
MARILLA STREET LANDFILL

RCRA COMPLIANCE PART 373 ROUTINE PARAMETERS

PARAMETER (Units as mg/l except as noted)	MW-4B (05/02/88)	MW-7A (05/02/88)	MW-7B (05/03/88)	MW-9B (05/02/88)	MW-13B (05/02/88)	MW-14B (05/02/88)	WP-1 (05/03/88)
pH (units)*	8.6/8.6 8.7/8.6	7.1/7.2 7.1/7.1	12.6/12.6 12.6/12.6	6.7/6.7 6.7/6.8	7.2/7.3 7.2/7.2	9.5/9.6 9.6/9.5	9.3/9.3 9.4/9.4
Temperature (°C)*	14	14	15	13	13	15	15
Specific Conductivity (umhos/cm)*	1210/1180 1070/1100	1025/1025 1050/1060	9650/9900 9900/9800	2250/2250 2250/2500	2000/1900 1900/1800	2250/2250 2300/2300	1150/1150 1140/1150
Total Organic Halogen (ug/l)	10.2/≤10 ≤10/10.8	33.2/10.6 ≤10/≤10	**	≤10/≤10 30.8/22.2	≤10/21.8 7.2/51.0	20.2/≤10 38.2/12.4	27.2/≤10 22.2/72.2
Total Organic Carbon	10/18 15/16	26/7 20/15	238/203 205/193	21/70 45/4	44/93 46/86	20/20 14/20	11/8 4/6.5
Tetrachloroethene (ug/l)	<0.2	≤0.2	<0.2	<0.2	<0.2	11	<0.2
Chloride	47	55	360	39	139	97	140
Fluoride	0.94	1.1	6.6	0.33	0.73	1.0	1.1
Total Recoverable Phenolics	<0.01	<0.01	0.98	<0.01	<0.01	<0.01	<0.01
Sulfate	300	86	88	1100	160	980	140

* Field measured

WP-1 = West Pond

** Subcontracting Lab failed to analyze sample due to a misunderstanding between RECRA Environmental and the subcontracting laboratory.

TABLE 3 (Continued)

LTV STEEL
MARILLA STREET LANDFILL

RCRA COMPLIANCE PART 373 ROUTINE PARAMETERS

PARAMETER (Units as mg/l except as noted)	MW-4B (05/02/88)	MW-7A (05/02/88)	MW-7B (05/03/88)	MW-9B (05/02/88)	MW-13B (05/02/88)	MW-14B (05/02/88)	WP-1 (05/03/88)
Total Arsenic	0.005	0.026	0.022	0.005	0.005	<0.005	<0.005
Total Cadmium	0.015	<0.005	<0.005	0.005	<0.005	<0.005	<0.005
Total Chromium	0.006	0.14	0.009	0.053	0.006	<0.006	<0.006
Total Iron	1.8	144	3.3	10	6.6	2.2	2.1
Total Lead	<0.005	1.2	0.093	0.15	0.006	<0.005	<0.007
Total Manganese	1.0	4.2	0.077	2.3	4.7	0.08	0.031
Total Mercury	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Soluble Arsenic	<0.005	<0.005	0.017	<0.005	<0.005	<0.005	<0.005
Soluble Cadmium	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Soluble Chromium	<0.006	<0.011	<0.006	0.006	<0.006	<0.006	<0.006
Soluble Iron	1.1	9.1	1.5	2.6	3.6	1.6	0.91
Soluble Lead	<0.005	0.17	0.048	0.015	<0.005	<0.005	<0.005
Soluble Manganese	0.90	0.67	0.016	1.4	2.5	0.040	0.011
Soluble Mercury	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005

WP-1 = West Pond

TABLE 4

LTV STEEL
MARILLA STREET LANDFILL

NYSDEC RECOMMENDED PART 360 ROUTINE GROUND WATER MONITORING DATA

PARAMETER (Units as mg/l except as noted)	MW-2A (05/03/88)	MW-2B (05/03/88)	MW-3A-1 (05/03/88)	MW-4A (05/02/88)	MW-5A (05/03/88)	MW-5B (05/03/88)	MW-6A (05/03/88)
pH (units)*	7.8	11.8	6.9	7.3	7.4	7.3	7.5
Temperature (^{0}C)*	11.5	10	10	13	12	9	12
Specific Conductivity (umhos/cm)*	740	2200	1480	750	1340	2450	1410
Total Organic Carbon	16	19	97	4.8	25	84	53
Chloride	122	72	66	36	45	270	50
Total Recoverable Phenolics	<0.01	0.046	<0.01	<0.01	<0.01	<0.01	<0.01
Filterable Residue (180^{0}C)	420	670	820	350	690	1100	860
Sulfate	5.8	110	150	120	160	390	320
Total Chromium	0.008	0.019	0.060	0.008	0.006	0.43	0.008
Total Iron	3.2	3.3	88	3.0	1.4	27	3.3
Total Lead	0.008	0.009	0.048	0.006	0.010	0.11	0.007
Soluble Chromium	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Soluble Iron	1.2	<0.02	2.4	2.0	0.93	2.8	2.5
Soluble Lead	<0.005	<0.005	<0.005	<0.005	<0.005	0.009	<0.005

*Field Measured

TABLE 5

LTV STEEL
MARILLA STREET LANDFILL

SUMMARY OF STATISTICAL ANALYSIS OF RCRA INDICATOR PARAMETERS

PARAMETER	INITIAL** BACKGROUND VALUES-6B	CURRENT BACKGROUND VALUES-6B	DOWNGRADIENT SAMPLE LOCATIONS						
			4B	7A	7B	9B	13B	14B	WEST POND
Average pH Result*	6.9 -	7.2 -	8.6 Increase	7.1 -	12.6 Increase	6.7 -	7.2 -	9.55 Increase	9.35 Increase
Average Specific Conductivity Result*	1503 -	1704 Increase	1140 -	1040 -	9812 Increase	2312 Increase	1900 Increase	2275 Increase	1147 -
Average Total Organic Halogen Result*	39 -	21.2 -	10.2 -	15.9 -	NA -	18.2 -	22.5 -	20.2 -	32.9 -
Average Total Organic Carbon Result*	33 -	11.5 -	14.7 -	17 -	210 Increase	35 -	67.2 -	18.5 -	7.4 -

NA - Not analyzed.
*Statistically significant change.
Blank space means no increase (or decrease for pH).

**From October 1987 Quarterly Sampling Report

REFERENCES

1. McBean, E.A., Kompter, M., Rouers, F. (1988), A Critical Examination of Approximations Implicit in Cochran's Procedure. Ground Water Monitoring Review, Winter 1988, pp. 83-87.

APPENDIX A

LABORATORY DATA

1/8626

RECRA ENVIRONMENTAL, INC.

Chemical Waste Analysis, Prevention and Control

June 6, 1988

Mr. Robert O'Laskey
Malcolm Pirnie, Inc.
S-3515 Abbott Road
Orchard Park, NY 14219

Re: Analytical Results

Dear Mr. O'Laskey:

Please find enclosed results concerning the analyses of the samples recently submitted by your firm. Results of the Radiation analyses on Sample 6B will be forwarded to you immediately upon availability from the subcontract laboratory.

Pertinent Information: Quote #: Q88-270
Matrix: Aqueous
Samples Received: 5/2-3/88
Sample Dates: 5/2-3/88

If you have any questions concerning these data, do not hesitate to contact our Customer Service Representative at (716) 691-2600.

Sincerely,

RECRA ENVIRONMENTAL, INC.

Arun K. Bhattacharya, Ph.D.
Senior Vice President/
Laboratory Director

DJT/AKB/sk
Enclosure

I.D. #88-689
88-689A,B
88-689C Partial

Audubon Business Centre • 10 Hazelwood Drive, Suite No. 106 • Amherst, New York 14150 • (716) 691-2600

ANALYTICAL RESULTS

Prepared For

Malcolm Pirnie, Inc.
S-3515 Abbott Road
Orchard Park, NY 14219

Prepared By

Recra Environmental, Inc.
10 Hazelwood Drive, Suite 106
Amherst, New York 14150

METHODOLOGIES

The specific methodologies employed in obtaining the enclosed analytical results are indicated on the specific data table. The method numbers presented refer to one of the following U.S. Environmental Protection Agency references unless noted otherwise in this report.

- 40 CFR Part 136 "Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act" October 26, 1984 (Federal Register) U.S. Environmental Protection Agency.
- U.S. Environmental Protection Agency "Test Methods for Evaluating Solid Waste - Physical/Chemical Methods". Office of Solid Waste and Emergency Response. July 1982, SW-846, Second Edition.

COMMENTS

Comments pertain to data on one or all pages of this report.

The values reported as "less than" (<) indicate the working detection limit for the particular sample and/or parameter.

The values reported as "less than or equal to" (≤) indicate the compound may be present at trace levels relative to the detection limit but not subject to accurate quantification.

Total Organic Carbon results may not include volatile constituents since the sample was purged with an inert gas prior to analysis.

Fecal Coliform and Total Organic Halogens (TOX) results were subcontracted by Recra Environmental, Inc.

AQUEOUS MATRIX
SELECTED METHOD 8010 - PURGEABLE HALOCARBONS

COMPOUND (Units of Measure = µg/l)	SAMPLE IDENTIFICATION			
	4B	6B	7A	7B
Tetrachloroethene	<0.2	<0.2	≤0.2	<0.2
Analysis Date	5/4/88	5/4/88	5/4/88	5/5/88
Surrogate Compound Level Added = 15 µg/l (% Recovery) Bromochloromethane	76	94	91	107

AQUEOUS MATRIX
SELECTED METHOD 8010 - PURGEABLE HALOCARBONS

COMPOUND (Units of Measure = µg/l)	SAMPLE IDENTIFICATION			
	9B	13B	14B	WP-1
Tetrachloroethene	<0.2	<0.2	11	<0.2
Analysis Date	5/4/88	5/4/88	5/4/88	5/4/88
Surrogate Compound Level Added = 15 µg/l (% Recovery) Bromochloromethane	105	98	97	100

AQUEOUS MATRIX

PARAMETER (Units of Measure = µg/l)	EXTRACTION DATE	ANALYSIS DATE	SAMPLE IDENTIFICATION
			6B
Endrin	5/6/88	5/13/88	<0.01
Lindane	5/6/88	5/13/88	<0.01
Methoxychlor	5/6/88	5/13/88	<0.1
Toxaphene	5/6/88	5/13/88	<0.5
2,4-D	5/10/88	5/16/88	0.16
2,4,5-TP	5/10/88	5/16/88	<0.04

AQUEOUS MATRIX
TOTAL METALS

PARAMETER (Units of Measure = mg/l)	METHOD NUMBER	ANALYSIS DATE	SAMPLE IDENTIFICATION	
			2A	2B
Total Chromium	7190	5/19/88	0.0080	0.019
Total Iron	7380	5/19/88	3.2	3.3
Total Lead	7421	5/23/88	0.0080	0.0090

AQUEOUS MATRIX
TOTAL METALS

PARAMETER (Units of Measure = mg/l)	METHOD NUMBER	ANALYSIS DATE	SAMPLE IDENTIFICATION	
			3A	4A
Total Chromium	7190	5/19/88	0.060	0.0080
Total Iron	7380	5/19/88	88	3.0
Total Lead	7421	5/23/88	0.048	0.0060

AQUEOUS MATRIX
TOTAL METALS

PARAMETER (Units of Measure = mg/l)	METHOD NUMBER	ANALYSIS DATE	SAMPLE IDENTIFICATION	
			5A	5B
Total Chromium	7190	5/19/88	0.0060	0.43
Total Iron	7380	5/19/88	1.4	27
Total Lead	7421	5/23/88	0.010	0.11

AQUEOUS MATRIX
TOTAL METALS

PARAMETER (Units of Measure = mg/l)	METHOD NUMBER	ANALYSIS DATE	SAMPLE IDENTIFICATION
			6A
Total Chromium	7190	5/19/88	0.0080
Total Iron	7380	5/19/88	3.3
Total Lead	7421	5/23/88	0.0070

AQUEOUS MATRIX
SOLUBLE METALS

COMPOUND (Units of Measure = mg/l)	METHOD NUMBER	ANALYSIS DATE	SAMPLE IDENTIFICATION	
			2A	2B
Soluble Chromium	7190	5/19/88	<0.005	<0.005
Soluble Iron	7380	5/19/88	1.2	<0.02
Soluble Lead	7421	5/22/88	<0.005	<0.005

AQUEOUS MATRIX
SOLUBLE METALS

COMPOUND (Units of Measure = mg/l)	METHOD NUMBER	ANALYSIS DATE	SAMPLE IDENTIFICATION	
			3A	4A
Soluble Chromium	7190	5/19/88	<0.005	<0.005
Soluble Iron	7380	5/19/88	2.4	2.0
Soluble Lead	7421	5/22/88	<0.005	<0.005

AQUEOUS MATRIX
SOLUBLE METALS

COMPOUND (Units of Measure = mg/l)	METHOD NUMBER	ANALYSIS DATE	SAMPLE IDENTIFICATION	
			5A	5B
Soluble Chromium	7190	5/19/88	<0.005	<0.005
Soluble Iron	7380	5/19/88	0.93	2.8
Soluble Lead	7421	5/22/88	<0.005	0.0090

AQUEOUS MATRIX
SOLUBLE METALS

COMPOUND (Units of Measure = mg/l)	METHOD NUMBER	ANALYSIS DATE	SAMPLE IDENTIFICATION
			6A
Soluble Chromium	7190	5/19/88	<0.005
Soluble Iron	7380	5/19/88	2.5
Soluble Lead	7421	5/22/88	<0.005

AQUEOUS MATRIX
TOTAL METALS

PARAMETER (Units of Measure = mg/l)	METHOD NUMBER	ANALYSIS DATE	SAMPLE IDENTIFICATION	
			4B	7A
Total Arsenic	7060	5/25/88	0.0050	0.026
Total Cadmium	7130	5/18/88	0.015	<0.005
Total Chromium	7190	5/18/88	<0.006	0.14
Total Iron	7380	5/19/88	1.8	144
Total Lead	7421	5/21/88	<0.005	1.2
Total Manganese	7460	5/23/88	1.0	4.2
Total Mercury	7470	6/2/88	<0.0005	<0.0005

AQUEOUS MATRIX
TOTAL METALS

PARAMETER (Units of Measure = mg/l)	METHOD NUMBER	ANALYSIS DATE	SAMPLE IDENTIFICATION	
			7B	9B
Total Arsenic	7060	5/25/88	0.022	<0.005
Total Cadmium	7130	5/18/88	<0.005	<0.005
Total Chromium	7190	5/18/88	0.0090	0.053
Total Iron	7380	5/19/88	3.3	10
Total Lead	7421	5/21/88	0.093	0.15
Total Manganese	7460	5/23/88	0.077	2.3
Total Mercury	7470	6/2/88	<0.0005	<0.0005

AQUEOUS MATRIX
TOTAL METALS

PARAMETER (Units of Measure = mg/l)	METHOD NUMBER	ANALYSIS DATE	SAMPLE IDENTIFICATION 13B	14B
Total Arsenic	7060	5/25/88	<0.005	<0.005
Total Cadmium	7130	5/18/88	<0.005	<0.005
Total Chromium	7190	5/18/88	<0.006	<0.006
Total Iron	7380	5/19/88	6.6	2.2
Total Lead	7421	5/21/88	0.0060	<0.005
Total Manganese	7460	5/23/88	4.7	0.080
Total Mercury	7470	6/2/88	<0.0005	<0.0005

AQUEOUS MATRIX
TOTAL METALS

PARAMETER (Units of Measure = mg/l)	METHOD NUMBER	ANALYSIS DATE	SAMPLE IDENTIFICATION WP-1
Total Arsenic	7060	5/25/88	<0.005
Total Cadmium	7130	5/18/88	<0.005
Total Chromium	7190	5/18/88	<0.006
Total Iron	7380	5/19/88	2.1
Total Lead	7421	5/21/88	0.0070
Total Manganese	7460	5/23/88	0.031
Total Mercury	7470	6/2/88	<0.0005

AQUEOUS MATRIX
TOTAL METALS

PARAMETER (Units of Measure = mg/l)	METHOD NUMBER	ANALYSIS DATE	SAMPLE IDENTIFICATION
			6B
Total Arsenic	7060	5/26/88	<0.005
Total Barium	7080	5/19/88	0.030
Total Cadmium	7130	5/18/88	<0.005
Total Chromium	7190	5/19/88	<0.005
Total Iron	7380	5/19/88	1.9
Total Lead	7421	5/26/88	<0.03
Total Manganese	7460	5/23/88	0.051
Total Mercury	7470	5/25/88	<0.0005
Total Selenium	7740	5/26/88	<0.005
Total Silver	7760	5/19/88	<0.005
Total Sodium	7770	5/19/88	24

AQUEOUS MATRIX
SOLUBLE METALS

COMPOUND (Units of Measure = mg/l)	METHOD NUMBER	ANALYSIS DATE	SAMPLE IDENTIFICATION	
			4B	7A
Soluble Arsenic	7060	5/25/88	<0.005	<0.005
Soluble Cadmium	7130	5/18/88	<0.005	<0.005
Soluble Chromium	7190	5/18/88	<0.006	0.011
Soluble Iron	7380	5/19/88	1.1	9.1
Soluble Lead	7421	5/23/88	<0.005	0.17
Soluble Manganese	7460	5/23/88	0.90	0.67
Soluble Mercury	7470	6/2/88	<0.0005	<0.0005

AQUEOUS MATRIX
SOLUBLE METALS

COMPOUND (Units of Measure = mg/l)	METHOD NUMBER	ANALYSIS DATE	SAMPLE IDENTIFICATION	
			7B	9B
Soluble Arsenic	7060	5/25/88	0.017	<0.005
Soluble Cadmium	7130	5/18/88	<0.005	<0.005
Soluble Chromium	7190	5/18/88	<0.006	<0.006
Soluble Iron	7380	5/19/88	1.5	2.6
Soluble Lead	7421	5/23/88	0.048	0.015
Soluble Manganese	7460	5/23/88	0.016	1.4
Soluble Mercury	7470	6/12/88	<0.0005	<0.0005

AQUEOUS MATRIX
SOLUBLE METALS

COMPOUND (Units of Measure = mg/l)	METHOD NUMBER	ANALYSIS DATE	SAMPLE IDENTIFICATION	
			13B	14B
Soluble Arsenic	7060	5/25/88	<0.005	<0.005
Soluble Cadmium	7130	5/18/88	<0.005	<0.005
Soluble Chromium	7190	5/18/88	<0.006	<0.006
Soluble Iron	7380	5/19/88	3.6	1.6
Soluble Lead	7421	5/23/88	<0.005	<0.005
Soluble Manganese	7460	5/23/88	2.7	0.040
Soluble Mercury	7470	6/2/88	<0.0005	<0.0005

AQUEOUS MATRIX
SOLUBLE METALS

COMPOUND (Units of Measure = mg/l)	METHOD NUMBER	ANALYSIS DATE	SAMPLE IDENTIFICATION
			WP-1
Soluble Arsenic	7060	5/25/88	<0.005
Soluble Cadmium	7130	5/18/88	<0.005
Soluble Chromium	7190	5/18/88	<0.006
Soluble Iron	7380	5/19/88	0.91
Soluble Lead	7421	5/23/88	<0.005
Soluble Manganese	7460	5/23/88	0.011
Soluble Mercury	7470	6/2/88	<0.0005

AQUEOUS MATRIX
SOLUBLE METALS

COMPOUND (Units of Measure = mg/l)	METHOD NUMBER	ANALYSIS DATE	SAMPLE IDENTIFICATION
			6B
Soluble Arsenic	7060	5/26/88	<0.005
Soluble Barium	7080	5/19/88	<0.02
Soluble Cadmium	7130	5/18/88	<0.005
Soluble Chromium	7190	5/19/88	<0.005
Soluble Iron	7380	5/19/88	0.58
Soluble Lead	7421	5/26/88	<0.03
Soluble Manganese	7460	5/23/88	0.013
Soluble Mercury	7470	5/25/88	<0.0005
Soluble Selenium	7740	5/26/88	<0.005
Soluble Silver	7760	5/19/88	<0.005
Soluble Sodium	7770	5/19/88	23

AQUEOUS MATRIX
WATER QUALITY TESTING

PARAMETER	METHOD NUMBER	UNITS OF MEASURE	ANALYSIS DATE	SAMPLE IDENTIFICATION	
				2A	2B
Total Organic Carbon	9060	mg/l	5/11/88	16	19
Chloride	9252	mg/l	5/24/88	122	72
Total Recoverable Phenolics	9065	mg/l	5/16/88	<0.01	0.046
Filterable Residue (180°C)	160.1	mg/l	5/4/88	420	670
Sulfate	9038	mg/l	5/20/88	5.8	110

AQUEOUS MATRIX
WATER QUALITY TESTING

PARAMETER	METHOD NUMBER	UNITS OF MEASURE	ANALYSIS DATE	SAMPLE IDENTIFICATION	
				3A	4A
Total Organic Carbon	9060	mg/l	5/11/88	97	4.8
Chloride	9252	mg/l	5/24/88	66	36
Total Recoverable	9065	mg/l	5/16/88	<0.01	<0.01
Filterable Residue (180°C)	160.1	mg/l	5/4/88	820	350
Sulfate	9038	mg/l	5/20/88	150	120

AQUEOUS MATRIX
WATER QUALITY TESTING

PARAMETER	METHOD NUMBER	UNITS OF MEASURE	ANALYSIS DATE	SAMPLE IDENTIFICATION	
				5A	5B
Total Organic Carbon	9060	mg/l	5/11/88	25	84
Chloride	9252	mg/l	5/24/88	45	270
Total Recoverable	9065	mg/l	5/16/88	<0.01	<0.01
Filterable Residue	160.1	mg/l	5/4/88	690	1,100
Sulfate	9038	mg/l	5/20/88	160	390

AQUEOUS MATRIX
WATER QUALITY TESTING

PARAMETER	METHOD NUMBER	UNITS OF MEASURE	ANALYSIS DATE	SAMPLE IDENTIFICATION
				6A
Total Organic Carbon	9060	mg/l	5/11/88	53
Chloride	9252	mg/l	5/24/88	50
Total Recoverable	9065	mg/l	5/16/88	<0.01
Filterable Residue (180°C)	160.1	mg/l	5/4/88	860
Sulfate	9038	mg/l	5/20/88	320

AQUEOUS MATRIX
WATER QUALITY TESTING

PARAMETER	METHOD NUMBER	UNITS OF MEASURE	ANALYSIS DATE	SAMPLE IDENTIFICATION	
				4B	7A
Total Organic Carbon	9060	mg/l	5/24/88	10/18 15/16	26/7.0 20/15
Chloride	9252	mg/l	5/24/88	47	55
Fluoride	340.2	mg/l	5/18/88	0.94	1.1
Total Recoverable Phenolics	9065	mg/l	5/16/88	<0.01	<0.01
Sulfate	9038	mg/l	5/20/88	300	86

AQUEOUS MATRIX
WATER QUALITY TESTING

PARAMETER	METHOD NUMBER	UNITS OF MEASURE	ANALYSIS DATE	SAMPLE IDENTIFICATION	
				7B	9B
Total Organic Carbon	9060	mg/l	5/24/88	238/203 205/193	21/70 45/4.0
Chloride	9252	mg/l	5/24/88	360	39
Fluoride	340.2	mg/l	5/18/88	6.6	0.33
Total Recoverable	9065	mg/l	5/16/88	0.98	<0.01
Sulfate	9030	mg/l	5/20/88	88	1,100

AQUEOUS MATRIX
WATER QUALITY TESTING

PARAMETER	METHOD NUMBER	UNITS OF MEASURE	ANALYSIS DATE	SAMPLE IDENTIFICATION	
				13B	14B
Total Organic Carbon	9060	mg/l	5/24/88	44/93 46/86	20/20 14/20
Chloride	9252	mg/l	5/24/88	139	97
Fluoride	340.2	mg/l	5/18/88	0.73	1.0
Total Recoverable Phenolics	9065	mg/l	5/16/88	<0.01	<0.01
Sulfate	9030	mg/l	5/20/88	160	980

AQUEOUS MATRIX
WATER QUALITY TESTING

PARAMETER	METHOD NUMBER	UNITS OF MEASURE	ANALYSIS DATE	SAMPLE IDENTIFICATION
				WP-1
Total Organic Carbon	9060	mg/l	5/24/88	11/8.0 4.0/6.5
Chloride	9252	mg/l	5/24/88	140
Fluoride	340.2	mg/l	5/18/88	1.1
Total Recoverable Phenolics	9065	mg/l	5/16/88	<0.01
Sulfate	9038	mg/l	5/20/88	140

AQUEOUS MATRIX
WATER QUALITY TESTING

PARAMETER	METHOD NUMBER	UNITS OF MEASURE	ANALYSIS DATE	SAMPLE IDENTIFICATION
				6B
Total Organic Carbon	9060	mg/l	5/24/88	6.5/16 4.5/19
Chloride	9252	mg/l	5/24/88	24
Fluoride	340.2	mg/l	5/18/88	<0.1
Nitrate	9200	mg NO_3-N/L	5/4/88	0.30
Total Recoverable Phenolics	9065	mg/l	5/16/88	<0.01
Sulfate	9038	mg/l	5/20/88	430

AQUEOUS MATRIX
METHOD 902

SAMPLE IDENTIFICATION	PARAMETER (UNITS OF MEASURE)
	TOTAL ORGANIC HALOGENS (µg/l)
4B	10.2/ ≤10/ ≤10/ 10.8
6B	31.0/ 12.4/ 23.0/ 18.6
7A	33.2/ 10.6/ ≤10/ ≤10
9B	≤10/ ≤10/ 30.8/ 22.2
13B	≤10/ 21.8/ 7.2/ 51.0
14B	20.2/ ≤10/ 38.2/ 12.4
WP-1	27.2/ ≤10/ 22.2/ 72.2

AQUEOUS MATRIX

SAMPLE IDENTIFICATION	PARAMETER (UNITS OF MEASURE) FECAL COLIFORM* (colonies/100ml)
6B	<10

*Standard methods for the Examination of Water and Wastewater, 16th Edition.

QUALITY CONTROL INFORMATION - PRECISION
AQUEOUS MATRIX
SELECTED METHOD 8010 - PURGEABLE HALOCARBONS

SAMPLE IDENTIFICATION 14B

COMPOUND (Units of Measure = µg/l)	VALUE 1	VALUE 2	MEAN	STANDARD DEVIATION
Tetrachloroethene	12	9.7	11	1.6
Analysis Date Surrogate Compound Level Added = 15 µg/l (% Recovery) Bromochloromethane	5/4/88 101	5/4/88 93	- 97	- 5.7

QUALITY CONTROL INFORMATION - ACCURACY
AQUEOUS MATRIX
SELECTED METHOD 8010 - PURGEABLE HALOCARBONS

SAMPLE IDENTIFICATION 14B

COMPOUND	NANOGRAMS OF SPIKE	PERCENT RECOVERY
Tetrachloroethene	20	120
Analysis Date Surrogate Compound Level Added = 15 µg/l (% Recovery) Bromochloromethane	5/4/88 124	

QUALITY CONTROL INFORMATION - PRECISION
AQUEOUS MATRIX
TOTAL METALS

PARAMETER (Units of Measure = mg/l)	METHOD NUMBER	SAMPLE IDENTIFICATION	VALUE 1	VALUE 2	MEAN	STANDARD DEVIATION
Total Arsenic	7060	7B	0.022	0.022	0.022	0
Total Cadmium	7130		<0.005	<0.005	<0.005	-
Total Chromium	7190		0.010	0.0080	0.0090	0.0014
Total Iron	7380		3.5	3.1	3.3	0.28
Total Lead	7421		0.092	0.093	0.093	0.00071
Total Manganese	7460		0.080	0.073	0.077	0.0049
Total Mercury	7470		<0.0005	<0.0005	<0.0005	-

QUALITY CONTROL INFORMATION - ACCURACY
AQUEOUS MATRIX
TOTAL METALS

PARAMETER	METHOD NUMBER	SAMPLE IDENTIFICATION	MICROGRAMS OF SPIKE	PERCENT RECOVERY
Total Arsenic	7060	7B	50	90
Total Cadmium	7130		500	99
Total Chromium	7190		500	92
Total Iron	7380		5000	100
Total Lead	7421		50	135
Total Manganese	7460		500	101
Total Mercury	7470		0.40	102

QUALITY CONTROL INFORMATION - PRECISION
AQUEOUS MATRIX
SOLUBLE METALS

COMPOUND (Units of Measure = mg/l)	METHOD NUMBER	SAMPLE IDENTIFICATION	VALUE 1	VALUE 2	MEAN	STANDARD DEVIATION
Soluble Arsenic	7060	7B	0.017	0.016	0.017	0.00071
Soluble Barium	7080	6B	<0.02	<0.02	<0.02	-
Soluble Cadmium	7130	7B	<0.005	<0.005	<0.005	-
Soluble Chromium	7190	7B	<0.006	<0.006	<0.006	-
Soluble Iron	7380	7B	1.5	1.5	1.5	0
Soluble Lead	7421	7B	0.047	0.044	0.046	0.0021
Soluble Manganese	7460	7B	0.015	0.017	0.016	0.0014
Soluble Mercury	7470	7B	<0.0005	<0.0005	<0.0005	-
Soluble Selenium	7740	6B	<0.005	<0.005	<0.005	-
Soluble Sodium	7770	6B	24	23	24	0.71

QUALITY CONTROL INFORMATION - ACCURACY
AQUEOUS MATRIX
SOLUBLE METALS

COMPOUND	METHOD NUMBER	SAMPLE IDENTIFICATION	MICROGRAMS OF SPIKE	PERCENT RECOVERY
Soluble Arsenic	7060	7B	50	103
Soluble Barium	7080	6B	5,000	106
Soluble Cadmium	7130	7B	500	102
Soluble Chromium	7190	7B	500	98
Soluble Iron	7380	7B	5,000	101
Soluble Lead	7421	7B	50	103
Soluble Manganese	7460	7B	500	102
Soluble Mercury	7470	7B	0.4	109
Soluble Selenium	7740	6B	50	92
Soluble Sodium	7770	6B	20,000	100

QUALITY CONTROL INFORMATION - PRECISION
AQUEOUS MATRIX
WATER QUALITY TESTING

PARAMETER	METHOD NUMBER	UNITS OF MEASURE	SAMPLE IDENTIFICATION	VALUE 1	VALUE 2	MEAN	STANDARD DEVIATION
Total Organic Carbon	9060	mg/l	2B	19	18	19	0.71
Chloride	9252	mg/l	2B	72	72	72	0
Fluoride	340.2	mg/l	6B	<0.1	<0.1	<0.1	-
Nitrate	9200	mg NO_3-N/L	*	0.10	0.085	0.093	0.011
Total Recoverable Phenolics	9065	mg/l	7B	1.1	0.88	0.99	0.16
Filterable Residue (180°C)	160.1	mg/l	5B	1,100	1,100	1,100	0
Sulfate	9038	mg/l	2B	110	110	110	0

*Quality control results were generated from a sample of similar matrix at the time of analysis.

QUALITY CONTROL INFORMATION - ACCURACY
AQUEOUS MATRIX
WATER QUALITY TESTING

PARAMETER	METHOD NUMBER	SAMPLE IDENTIFICATION	MICROGRAMS OF SPIKE	PERCENT RECOVERY
Total Organic Carbon	9060	9B	100	101
Chloride	9252	2B	2,500	101
Fluoride	340.2	*	2,500	90
Total Recoverable Phenolics	9065	7B	30	84
Sulfate	9038	2B	100	89

*Quality control results were generated from a sample of similar matrix at the time of analysis.

1/8668

RECRA ENVIRONMENTAL, INC.

Chemical Waste Analysis, Prevention and Control

June 10, 1988

Mr. Robert O'Laskey
Malcolm Pirnie, Inc.
S-3515 Abbott Road
Orchard Park, NY 14219

Re: Analytical Results

Dear Mr. O'Laskey:

Please find enclosed subcontracted results concerning the radiation analyses of the sample recently submitted by your firm. This report completes the requested analyses for this particular sample lot.

Pertinent Information:
Quote #: Q88-270
Matrix: Aqueous
Sample Received: 5/3/88
Sample Date: 5/3/88

If you have any questions concerning these data, do not hesitate to contact our Customer Service Representative at (716) 691-2600.

Sincerely,

RECRA ENVIRONMENTAL, INC.

Arun K. Bhattacharya, Ph.D.
Senior Vice President/
Laboratory Director

KEK/AKB/sk
Enclosure

I.D. #88-689C-Final
#8A1281

Audubon Business Centre • 10 Hazelwood Drive, Suite No. 106 • Amherst, New York 14150 • (716) 691-2600

1/8668

AQUEOUS MATRIX

PARAMETER	UNITS OF MEASURE	ANALYSIS DATE	SAMPLE IDENTIFICATION (DATE) MW-6B (5/3/88)
Total Radium	pCi/Liter	5/26/88	<4.0
Gross Alpha	pCi/Liter	5/29/88	<5.0
Gross Beta	pCi/Liter	5/29/88	<3.0

I.D. #88-689C

RECRA ENVIRONMENTAL, INC.

CHAIN OF CUSTODY RECORD

PROJECT NO.: 0848-12-9

SITE NAME: LTV-Marilla St

SAMPLERS (SIGNATURE): Robert O'Laskey (Malcolm Pirnie)

STATION NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	40ml VOA	8oz Amber	16oz Glass	16oz Plastic	4oz Plastic		REMARKS
	5/2	2pm		x	4A	3					3		~~VOA~~ Total/Sol. Cr, Fe, Pb; TOC
					↓	1			1				Phenol
					↓	1				1			Water Quality
	5/2	2:10 pm		✓	4B	2	2						VOA
					↓	4		4					TOX
					↓	1			1				Phenols
					↓	3				3			Tot/Sol. Metals; Water Quality
					↓	4					4		TOC
	5/2	4pm		✓	7A	2	2						VOC
					↓	4		4					TOX
					↓	1			1				Phenols
					↓	3				3			Tot/Sol. metals; Water Quality
					↓	4					4		TOC
	5/2	12 pm			9B	2	2						VOC

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)	RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)
Robert O'Laskey	5-2-88	17:58					

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)	RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED FOR LABORATORY BY (SIGNATURE)	DATE/TIME	REMARKS

Distribution: Original accompanies shipment; copy to coordinator field files

RECRA ENVIRONMENTAL, INC.

CHAIN OF CUSTODY RECORD

PROJECT NO.: 0848-12-9

SITE NAME: LTV Marilla St

SAMPLERS (SIGNATURE): Robert O'Laskey (Malcolm Pirnie)

STATION NO	DATE	TIME	COMP	GRAB	STATION LOCATION	NO. OF CON-TAINERS	40ml VOA	8oz Amber	16oz Glass	16oz Plastic	4 oz Plastic		REMARKS
	5/2				9B (cont'd)	4		4					TOX
						1			1				Phenol
						3				3			Tot/Sol. Metals ; Water Quality
						4					4		TOC
	5/2	2:30 Pm			13B	2	2						VOC
						4		4					TOX
						1			1				Phenol
						3				3			Tot/Sol. Metals ; Water Quality
						4					4		TOC
	5/2	4:20 PM			14B	2	2						VOC
						4		4					TOX
						1			1				Phenols
						3				3			Tot/Sol. Metals ; Water Quality
						4					4		TOC

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)	RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)
Robert O'Laskey	5-2-98	17:58					

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)	RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED FOR LABORATORY BY (SIGNATURE)	DATE / TIME	REMARKS

Distribution: Original accompanies shipment; copy to coordinator field files

1 3

RECRA ENVIRONMENTAL, INC.

CHAIN OF CUSTODY RECORD

PROJECT NO.: 0848-12-9

SITE NAME: LTV-Marilla St

SAMPLERS (SIGNATURE): Robert O'Laskey (Malcolm Pirnie)

STATION NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	40 ml VOC	8oz Amber	16oz Glass	16oz Plastic	4oz Plastic		REMARKS
	5/3	3^{00}		✓	WP-1	2	2						VOA
						4		4					TOX
						1			1				Phenol
						3				3			Tot., Sol. Metals; Water Qual
						4					4		TOC
	5/3	12^{00}			7B	2	2						VOA
						4		4					TOX
						1			1				Phenol
						3				3			Tot/Sol Metals; Water Qual
						4					4		TOC
	5/3	1:30		✓	6A RO	1			1				Phenol
						3				3			Tot/Sol. Metals; Water Qual
						1					1		TOC
	~~5/3~~	~~8:30~~		~~X~~	~~6B~~ RO								

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)	RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)
	5/3/88	1725					

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)	RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED FOR LABORATORY BY (SIGNATURE)	DATE/TIME	REMARKS

Distribution: Original accompanies shipment, copy to coordinator field files of 3

RECRA ENVIRONMENTAL, INC.

CHAIN OF CUSTODY RECORD

PROJECT NO.: 0848-12-9

SITE NAME: LTV-Marilla St

SAMPLERS (SIGNATURE): Robert Odusky (Malcolm Pirnie)

STATION NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CON-TAINERS	40ml VOA	16oz Glass	16oz Plastic	1l Amber	8oz Amber	4oz Plastic	1/2gal Plastic	Bag	REMARKS
	5/3	1:30		✓	6B	2	2								VOA
						1		1							Phenol
						3			3						Tot/Sol Metals; Water Qual
						2				2					Pesticides/Herbicides
						4					4				TOX
						4						4			TOC
						1							1		α, β, Ra
						1								1	Fecal Coliform
	5/3	3:00		✓	3A	1		1							Phenol
						4			4						Sol/Tot. Metal/Water Qual/To
	5/3	9:00		✓	5A	1		1							Phenol
						4			4						Sol/Tot. Metals/Water Qual/TOC.
					5B	1		1							Phenol
	5/3	9:00		✓		4			4						Sol/Tot Metals/Water Qual/TOC.

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)	RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)
Mark R Keller	5/3/88	1725	J. Calvert				
RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)	RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED FOR LABORATORY BY (SIGNATURE)	DATE/TIME	REMARKS

Distribution: Original accompanies shipment, copy to coordinator field files

3/of 3

RECRA ENVIRONMENTAL, INC.

CHAIN OF CUSTODY RECORD

PROJECT NO.: 0848-12-9

SITE NAME: LTU - Marilla St

SAMPLERS (SIGNATURE): Robert Odaskey (Malcolm Pirnie)

STATION NO.	DATE	TIME	COMP	GRAB	STATION LOCATION	NO. OF CONTAINERS	16 oz Glass	16oz Plastic					REMARKS
	5/3	3:30		✓	2A	1	1						Phenols
					↓	4		4					Sol/Tot Metals/Water Qual/TOC
	5/3	3:30		✓	2B	1	1						Phenols
					↓	4		4					Sol/Tot Metals/Water Qual/TOC

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)	RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)
	5/3/88	1725	J.				

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)	RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED FOR LABORATORY BY (SIGNATURE)	DATE/TIME	REMARKS

Distribution: Original accompanies shipment; copy to coordinator field files

APPENDIX B

FIELD DATA SHEET

MALCOLM PIRNIE

WATER SAMPLING
FIELD DATA SHEET

LOCATION NO: MW-2~~B~~A
LAB SAMPLE NO: 2A

PROJECT: MArillA St. Landfill
CLIENT: LTV Steel
JOB NO: 0848-12-9
SAMPLER: RHO/RHF

Date: 5/3 Time: 955
Weather Conditions: Sunny
Air Temperature: 50's
Type of Sample: GW

WELL DATA: Date: 5/2 Time: 9:55
Casing Diameter: 2" Casing Material: ______
Screen Diameter: 2" Screen Material: ______
Static Water Level: 3.16 Bottom Depth: 6.27 Casing Volume: ______
Datum: ___ Top of Protective Casing ___ Top of Well Casing ___ Other: ______

PURGING DATA: Date: 5/3 Time: Start ______ Finish 10:10
Method: Bail
Is Pumping Equipment Dedicated to Sample Location? ___ Yes [✓ No]
Pumping Rate: ______ Elapsed Time: ______ Volume Purged 4gal
Was Well Evacuated? [✓ Yes] ___ No Well Volumes Purged ______

SAMPLING DATA: Date: 5/3 Time: Start ______ Finish 3:08
Method: Bailer
Is Pumping Equipment Dedicated to Sample Location? ___ Yes [✓ No]
Depth of Sample: ______

PRESERVATION DATA: Date: 5/3
Filtered: ___ Yes ___ No Time: 3:30
Preservative: [✓ H_2SO_4] [✓ HNO_3] ___ NaOH ___ Other ______ [✓ Cool to 4°C]

PHYSICAL & CHEMICAL DATA:
Appearance: ___ Clear ___ Turbid ___ Color: ______ ___ Contains Sediment ______
___ Contains Immiscible Liquid ___ Other: ______
Odor: ___ Yes: ______ ___ No
Temperature: 11.5°c Ph: 7.8 Spec. Cond: 740
Other: ______

Remarks:

MALCOLM PIRNIE

WATER SAMPLING
FIELD DATA SHEET

LOCATION NO: MW-2B
LAB SAMPLE NO: 2B

PROJECT: LTU - ~~Marti~~ Marilla St
CLIENT: LTU Steel
JOB NO: 0848-12-9
SAMPLER: RHO/MK

Date: 5/3 Time:
Weather Conditions: Sunny
Air Temperature: 50's
Type of Sample: GW

WELL DATA: Date: 5/2 Time: 9:54
Casing Diameter: 2"
Casing Material: PVC
Screen Diameter: 2"
Screen Material: PVC
Static Water Level: 3.52 Bottom Depth: 26.64 Casing Volume:
Datum: __ Top of Protective Casing __ Top of Well Casing X Other:

PURGING DATA: Date: 5/3 Time: Start Finish 10:16
Method:
Is Pumping Equipment Dedicated to Sample Location? __ Yes X No
Pumping Rate: Elapsed Time: Volume Purged 3/4 gal
Was Well Evacuated? X Yes __ No Well Volumes Purged

SAMPLING DATA: Date: 5/3 Time: Start Finish 3:11
Method:
Is Pumping Equipment Dedicated to Sample Location? __ Yes __ No
Depth of Sample:

PRESERVATION DATA: Date: 5/3
Filtered: __ Yes __ No Time:
Preservative: __ H_2SO_4 __ HNO_3 __ NaOH __ Other __ Cool to 4°C

PHYSICAL & CHEMICAL DATA:
Appearance: __ Clear __ Turbid __ Color: __ Contains Sediment
__ Contains Immiscible Liquid __ Other:
Odor: __ Yes: __ No
Temperature: ~~15°~~ 10°C Ph: 11.8 Spec. Cond: 2200
Other:

Remarks:

MALCOLM PIRNIE

WATER SAMPLING FIELD DATA SHEET

LOCATION NO: MW-3A
LAB SAMPLE NO:

PROJECT: Marilla St. Landfill
CLIENT: LTV Steel
JOB NO: 0848-02-9
SAMPLER: RHO/RHF

Date: 5/2 Time: 9:2
Weather Conditions:
Air Temperature:
Type of Sample: GW

WELL DATA: Date: 5/2 Time: 9:34
Casing Diameter: Casing Material:
Screen Diameter: Screen Material:
Static Water Level: 2.45 Bottom Depth: 16.9 Casing Volume: ?
Datum: __ Top of Protective Casing __ Top of Well Casing __ Other:

PURGING DATA: Date: Time: Start Finish
Method: bail

Is Pumping Equipment Dedicated to Sample Location? __ Yes __ No
Pumping Rate: Elapsed Time: Volume Purged
Was Well Evacuated? __ Yes __ No Well Volumes Purged

SAMPLING DATA: Date: 5/3 Time: Start Finish 2:20
Method:

Is Pumping Equipment Dedicated to Sample Location? __ Yes X No
Depth of Sample:

PRESERVATION DATA: Date: 5/3
Filtered: X Yes __ No Time: 2:35
Preservative: X H_2SO_4 X HNO_3 __ NaOH __ Other X Cool to 4°C

PHYSICAL & CHEMICAL DATA:
Appearance: __ Clear X Turbid X Color: Grey X Contains Sediment SILT
__ Contains Immiscible Liquid __ Other:
Odor: __ Yes: __ No
Temperature: 10°C Ph: 6.85 Spec. Cond: 1480 umhos/cm
Other:

Remarks:

MALCOLM PIRNIE

WATER SAMPLING
FIELD DATA SHEET

LOCATION NO: WEST POND
LAB SAMPLE NO: WP-1

PROJECT: MarillA St. Landfill
CLIENT: LTV Steel
JOB NO: 0848-12-9
SAMPLER: RHO/MK

Date: 5/3 Time: 2 Pm
Weather Conditions:
Air Temperature:
Type of Sample: 6.W.

WELL DATA: Date: Time:
Casing Diameter:
Casing Material:
Screen Diameter:
Screen Material:
Static Water Level: Bottom Depth: Casing Volume:
Datum: __ Top of Protective Casing __ Top of Well Casing __ Other:

PURGING DATA: Date: Time: Start Finish
Method:

Is Pumping Equipment Dedicated to Sample Location? __ Yes __ No
Pumping Rate: Elapsed Time: Volume Purged
Was Well Evacua __ Yes __ No Well Volumes Purged

SAMPLING DATA: Date: 5/3 Time: Start 2 Finish 2:00
Method:

Is Pumping Equipment Dedicated to Sample Location? __ Yes __ No
Depth of Sample:

PRESERVATION DATA: Date: 5/3
Filtered: __Yes __ No Time: 2:15
Preservative: __ H_2SO_4 __ HNO_3 __ NaOH __Other __ Cool to 4°C

PHYSICAL & CHEMICAL DATA:
Appearance: __ Clear __ Turbid __ Color: __ Contains Sediment
__ Contains Immiscible Liquid __ Other:
Odor: __ Yes: __ No
Temperature: 15°C Ph: 9.35, 9.35 Spec. Cond: 1150 1150
Other: 9.40, 9.40 1140 1150

Remarks: ~~Run~~ Flowing water near Well 3B is 11.1 pH, cond 1050
T°C, PH, and Cond. were measured at four points
along the ~~wat~~ pond banks west of mw-3B.

MALCOLM PIRNIE

WATER SAMPLING
FIELD DATA SHEET

LOCATION NO: MW-4A
LAB SAMPLE NO: 4A

PROJECT: LTV SPRING SAMPLING
CLIENT: LTV
JOB NO: 0848-12-9
SAMPLER: RHO/RHF

Date: 5/2 Time: ___
Weather Conditions: sunny
Air Temperature: 60's
Type of Sample: GW

WELL DATA: Date: 5/2 Time: 1:30
Casing Diameter: 2" Casing Material: PVC
Screen Diameter: 2" Screen Material: PVC
Static Water Level: 6.52 Bottom Depth: 21.05 Casing Volume: ___
Datum: ___ Top of Protective Casing X Top of Well Casing ___ Other: ___

PURGING DATA: Date: 5/2 Time: Start ___ Finish 1:40
Method: Centrifugal Pump

Is Pumping Equipment Dedicated to Sample Location? ___ Yes X No
Pumping Rate: ___ Elapsed Time: ___ Volume Purged 10 gal
Was Well Evacuated? ___ Yes X No Well Volumes Purged ___

SAMPLING DATA: Date: 5/2 Time: Start 2:00 Finish 2:10
Method: Teflon bailer

Is Pumping Equipment Dedicated to Sample Location? ___ Yes X No
Depth of Sample: ___

PRESERVATION DATA: Date: 5/2
Filtered: X Yes ___ No Time: 3:10
Preservative: X H_2SO_4 X HNO_3 ___ NaOH ___ Other ___ X Cool to 4°C

PHYSICAL & CHEMICAL DATA:
Appearance: X Clear ___ Turbid ___ Color: ___ ___ Contains Sediment ___
___ Contains Immiscible Liquid ___ Other: ___
Odor: X Yes: H_2S ___ No
Temperature: 13°C Ph: 7.3 Spec. Cond: 750
Other: ___

Remarks:

MALCOLM PIRNIE

WATER SAMPLING
FIELD DATA SHEET

LOCATION NO: MW-4B
LAB SAMPLE NO: 4B

PROJECT: LTV SPRING SAMPLING
Date: 5/2
Time:
CLIENT: LTV STEEL
Weather Conditions: Sunny
JOB NO: 0848-12-9
Air Temperature: 60's
SAMPLER: RHO/RHF
Type of Sample: GW

WELL DATA:
Date: 5/2
Time: 1:28
Casing Diameter: 2"
Casing Material: PVC
Screen Diameter: 2"
Screen Material: PVC
Static Water Level: 4.32
Bottom Depth: 13.05
Casing Volume:
Datum: ___ Top of Protective Casing X Top of Well Casing ___ Other:

PURGING DATA:
Date: 5/2
Time: Start Finish 1:30
Method: Bail

Is Pumping Equipment Dedicated to Sample Location? ___ Yes X No
Pumping Rate:
Elapsed Time:
Volume Purged 2gal
Was Well Evacuated? X Yes ___ No
Well Volumes Purged

SAMPLING DATA:
Date: 5/2
Time: Start 2:00 Finish 2:15
Method: Teflon bailer

Is Pumping Equipment Dedicated to Sample Location? ___ Yes X No
Depth of Sample:

PRESERVATION DATA:
Date: 5/2
Filtered: X Yes ___ No
Time: 3:10
Preservative: X H_2SO_4 X HNO_3 ___ NaOH ___ Other X Cool to 4°C

PHYSICAL & CHEMICAL DATA:
Appearance: ___ Clear ___ Turbid ___ Color: ___ Contains Sediment
___ Contains Immiscible Liquid ___ Other:
Odor: ___ Yes: ___ No
Temperature: 14°C
Ph: 8.6, 8.6 ~~8.7, 8.6~~
Spec. Cond: 1210, 1180 ~~1070, 1100~~
Other:

Remarks:

MALCOLM PIRNIE

WATER SAMPLING
FIELD DATA SHEET

LOCATION NO: MW-5A
LAB SAMPLE NO: ___

PROJECT: Marilla St. Landfill
CLIENT: LTV Steel
JOB NO: 0848-12-9
SAMPLER: RHO - RHF

Date: 5-2-88 Time: ___
Weather Conditions: Sunny
Air Temperature: 50's
Type of Sample: G.W.

WELL DATA: Date: 5/2 Time: 10:00 AM
Casing Diameter: 2" Casing Material: ___
Screen Diameter: 2" Screen Material: ___
Static Water Level: 2.85 Bottom Depth: 20' Casing Volume: ___
Datum: ___ Top of Protective Casing ___ Top of Well Casing ✓ Other: ___

PURGING DATA: Date: 5/2 Time: Start 10:04 Finish 10:14
Method: ___

Is Pumping Equipment Dedicated to Sample Location? ___ Yes ___ No
Pumping Rate: ___ Elapsed Time: ___ Volume Purged 3.5 g
Was Well Evacuated? X Yes ___ No Well Volumes Purged ___

SAMPLING DATA: Date: 5/3 Time: Start 10:25 Finish ___
Method: ___

Is Pumping Equipment Dedicated to Sample Location? ___ Yes ___ No
Depth of Sample: wl 11.35

PRESERVATION DATA: Date: 5/3
Filtered: ___ Yes ___ No Time: 11:00
Preservative: ___ H_2SO_4 ___ HNO_3 ___ NaOH ___ Other ___ ___ Cool to 4°C

PHYSICAL & CHEMICAL DATA:
Appearance: ___ Clear ___ Turbid ___ Color: ___ ___ Contains Sediment ___
___ Contains Immiscible Liquid ___ Other: ___
Odor: ___ Yes: ___ ___ No
Temperature: 12° Ph: 7.35 Spec. Cond: 1340
Other: ___

Remarks: wl 10:25

MALCOLM PIRNIE

WATER SAMPLING
FIELD DATA SHEET

LOCATION NO: MW-5B
LAB SAMPLE NO: ________

PROJECT: Mitilla St Landfill
CLIENT: LTV
JOB NO: 0848-12-9
SAMPLER: RHO + RHF

Date: 5-2 Time: 10:00
Weather Conditions: Sunny
Air Temperature: 55
Type of Sample: G.W.

WELL DATA: Date: 5-2 Time: 10:00 Am
Casing Diameter: ________ Casing Material: ________
Screen Diameter: ________ Screen Material: ________
Static Water Level: 2.3 Bottom Depth: 6.8' Casing Volume: ________
Datum: __ Top of Protective Casing __ Top of Well Casing ✓ Other: ________

PURGING DATA: Date: 5/2 Time: Start Finish 10:00
Method: Bail

Is Pumping Equipment Dedicated to Sample Location? __ Yes X No
Pumping Rate: ________ Elapsed Time: ________ Volume Purged 3 qts
Was Well Evacuated? X Yes __ No Well Volumes Purged ________

SAMPLING DATA: Date: 5/3 Time: Start Finish 10:45
Method: ________

Is Pumping Equipment Dedicated to Sample Location? __ Yes X No
Depth of Sample: wl 3.75 10:29

PRESERVATION DATA: Date: 5/3
Filtered: __ Yes __ No Time: 11:00
Preservative: __ H_2SO_4 __ HNO_3 __ NaOH __ Other ________ __ Cool to 4°C

PHYSICAL & CHEMICAL DATA:
Appearance: __ Clear __ Turbid __ Color: ________ __ Contains Sediment ________
__ Contains Immiscible Liquid __ Other: ________
Odor: __ Yes: ________ __ No
Temperature: 9° Ph: 7.25 Spec. Cond: 2450
Other: ________

Remarks:

MALCOLM PIRNIE

WATER SAMPLING
FIELD DATA SHEET

LOCATION NO: MW-6A
LAB SAMPLE NO:

PROJECT: LTV SPRING SAMPLING
CLIENT: LTV STEEL
JOB NO: 0848-12-9
SAMPLER: RHO

Date: 5-2 Time:
Weather Conditions: Sunny
Air Temperature: 50's
Type of Sample: G.W.

WELL DATA: Date: 5/2 Time: 11:17
Casing Diameter: 2" Casing Material:
Screen Diameter: 2" Screen Material:
Static Water Level: 10.31 Bottom Depth: 26.45 Casing Volume:
Datum: __ Top of Protective Casing __ Top of Well Casing X Other:

PURGING DATA: Date: 5/3 Time: Start 8:34 Finish 8:55
Method: Bail

Is Pumping Equipment Dedicated to Sample Location? __ Yes X No
Pumping Rate: Elapsed Time: Volume Purged 6 gal
Was Well Evacuated? X Yes __ No Well Volumes Purged

SAMPLING DATA: Date: 5/3 Time: Start 1:10 Finish 1:30
Method:

Is Pumping Equipment Dedicated to Sample Location? __ Yes __ No
Depth of Sample: wl 22.4

PRESERVATION DATA: Date: 5/3
Filtered: __ Yes __ No Time: 1:30
Preservative: __ H_2SO_4 __ HNO_3 __ NaOH __ Other __ Cool to 4°C

PHYSICAL & CHEMICAL DATA:
Appearance: __ Clear __ Turbid __ Color: __ Contains Sediment
__ Contains Immiscible Liquid __ Other:
Odor: __ Yes: __ No
Temperature: 12°c Ph: 7.45 Spec. Cond: 1410
Other:

Remarks: well bailed down to≈26 ft - stays constant at bailing rate used.

MALCOLM PIRNIE

WATER SAMPLING FIELD DATA SHEET

LOCATION NO: MW-6B
LAB SAMPLE NO: ______

PROJECT: Marilla St. Landfill
CLIENT: LTV Steel
JOB NO: 0848-12-9
SAMPLER: RHO/MK

Date: ______ Time: ______
Weather Conditions: ______
Air Temperature: ______
Type of Sample: ______

WELL DATA: Date: 5/2 Time: 1:14
Casing Diameter: 2" Casing Material: Pvc
Screen Diameter: 2" Screen Material: Pvc
Static Water Level: 10.38 Bottom Depth: 15.65 Casing Volume: ______
Datum: __ Top of Protective Casing X Top of Well Casing __ Other: ______

PURGING DATA: Date: 5/2 Time: Start ______ Finish 1:20
Method: bail
Is Pumping Equipment Dedicated to Sample Location? __ Yes X No
Pumping Rate: ______ Elapsed Time: ______ Volume Purged 2gal
Was Well Evacuated? X Yes __ No. Well Volumes Purged ______

SAMPLING DATA: Date: 5/3 Time: Start 8:59 Finish 9:20
Method: ______
Is Pumping Equipment Dedicated to Sample Location? __ Yes __ No
Depth of Sample: wl 10.4

PRESERVATION DATA: Date: 5/3
Filtered: X Yes __ No Time: 9:45
Preservative: X H_2SO_4 X HNO_3 __ NaOH __ Other ______ X Cool to 4°C

PHYSICAL & CHEMICAL DATA:
Appearance: __ Clear __ Turbid __ Color: ______ __ Contains Sediment ______
__ Contains Immiscible Liquid __ Other: ______
Odor: __ Yes: ______ __ No
Temperature: 13° Ph: 7.~~8~~ 15, 7.~~X~~ 2, 7.2, 7.2 Spec. Cond: 1680, 1700 1710, 1725
Other: ______

Remarks: α, β, Ra and Fecal Coliform Sampled at 1:25 5/3

MALCOLM PIRNIE

WATER SAMPLING
FIELD DATA SHEET

LOCATION NO: MW-7A
LAB SAMPLE NO: 7A

PROJECT: LTV SPRING SAMPLING
CLIENT: LTV STEEL
JOB NO: 0848-12-9
SAMPLER: RHO/RHF
Date: 5/2 Time: ____
Weather Conditions: SUNNY
Air Temperature: 60's
Type of Sample: GW

WELL DATA: Date: 5/2 Time: 10:37
Casing Diameter: 2" Casing Material: PVC
Screen Diameter: 2" Screen Material: PVC
Static Water Level: 25.85 Bottom Depth: 42.05 Casing Volume: ____
Datum: __ Top of Protective Casing X Top of Well Casing __ Other: ____

PURGING DATA: Date: 5/2 Time: Start 3:40 Finish 3:54
Method: Bail
Is Pumping Equipment Dedicated to Sample Location? __ Yes X No
Pumping Rate: ____ Elapsed Time: ____ Volume Purged 8 gal
Was Well Evacuated? __ Yes X No Well Volumes Purged ____

SAMPLING DATA: Date: 5/2 Time: Start ____ Finish 4:00
Method: Teflon bailer
Is Pumping Equipment Dedicated to Sample Location? __ Yes X No
Depth of Sample: ____

PRESERVATION DATA: Date: 5/2
Filtered: __ Yes __ No Time: 5:15
Preservative: __ H_2SO_4 __ HNO_3 __ NaOH __ Other ____ __ Cool to 4°C

PHYSICAL & CHEMICAL DATA:
Appearance: __ Clear X Turbid __ Color: Dk. Bown __ Contains Sediment ____
__ Contains Immiscible Liquid __ Other: ____
Odor: ✓ Yes: H_2S __ No
Temperature: 14°C Ph: 7.1, 7.2 Spec. Cond: 1025 1025
Other: ____ 7.1, 7.1 1050 1060

Remarks:

MALCOLM PIRNIE

WATER SAMPLING
FIELD DATA SHEET

LOCATION NO: MW-7B
LAB SAMPLE NO:

PROJECT: LTU SPRING SAMPLING
CLIENT: LTU STEEL
JOB NO: 0848-12-9
SAMPLER: RHO/RHF

Date: 5/2 Time: 10^{30}
Weather Conditions: Sunny
Air Temperature: 55
Type of Sample: G.W.

WELL DATA: Date: 5/2 Time: 10:32
Casing Diameter: 2" Casing Material: PVC
Screen Diameter: 2" Screen Material: PVC
Static Water Level: 21.23 Bottom Depth: 30.6 Casing Volume:
Datum: __ Top of Protective Casing __ Top of Well Casing X Other:

PURGING DATA: Date: 5/2 Time: Start Finish 10:50
Method: Bail

Is Pumping Equipment Dedicated to Sample Location? __ Yes X No
Pumping Rate: Elapsed Time: Volume Purged 13/4 g
Was Well Evacuated? X Yes __ No Well Volumes Purged

SAMPLING DATA: Date: 5/3 Time: Start 11:15 Finish 11:30
Method:

Is Pumping Equipment Dedicated to Sample Location? __ Yes __ No
Depth of Sample: w.l. 2.3 11:15

PRESERVATION DATA: Date: 5/3
Filtered: __ Yes __ No Time: 11:45
Preservative: __ H_2SO_4 __ HNO_3 __ NaOH __ Other __ Cool to 4°C

PHYSICAL & CHEMICAL DATA:
Appearance: __ Clear __ Turbid __ Color: YELLOW __ Contains Sediment
__ Contains Immiscible Liquid __ Other:
Odor: __ Yes: __ No
Temperature: 15°C Ph: 12.6, 12.65, 12.65 12.64 Spec. Cond: 9650, 9900, 9900, 9800
Other:

Remarks: Filtration did not change color; and did cause ~~bu~~ bubbles to evolve from water

MALCOLM PIRNIE

WATER SAMPLING
FIELD DATA SHEET

LOCATION NO: MW-9B
LAB SAMPLE NO: 9B

PROJECT: LTU SPRING SAMPLING
CLIENT: LTV STEEL
JOB NO: 0848-12-9
SAMPLER: RHO/RHF

Date: 5/2 Time: 11^{10}
Weather Conditions: sunny
Air Temperature: 60's
Type of Sample: GW

WELL DATA: Date: 5/2 Time: 11:10
Casing Diameter: 2" Casing Material: PVC
Screen Diameter: 2" Screen Material: PVC
Static Water Level: 31.28 Bottom Depth: 35.25 Casing Volume: ___
Datum: ___ Top of Protective Casing ___ Top of Well Casing X Other: ___

PURGING DATA: Date: 5/2 Time: Start 11:10 Finish
Method: Bail

Is Pumping Equipment Dedicated to Sample Location? ___ Yes X No
Pumping Rate: ___ Elapsed Time: ___ Volume Purged 3 gal
Was Well Evacuated? ___ Yes X No Well Volumes Purged ___

SAMPLING DATA: Date: ___ Time: Start Finish 11:58
Method: Teflon bailer

Is Pumping Equipment Dedicated to Sample Location? ___ Yes X No
Depth of Sample: ___

PRESERVATION DATA: Date: 5/2
Filtered: X Yes ___ No Time: 3:15
Preservative: X H_2SO_4 X HNO_3 ___ NaOH ___ Other ___ X Cool to 4°C

PHYSICAL & CHEMICAL DATA:
Appearance: ___ Clear ___ Turbid ___ Color: ___ ___ Contains Sediment ___
___ Contains Immiscible Liquid ___ Other: ___
Odor: ✓ Yes: ___ ___ No
Temperature: 13°C Ph: 6.7, 6.7 ~~6.7, 6.8~~ Spec. Cond: 2250, 2250 2250, 2500
Other: ___

Remarks:

MALCOLM PIRNIE

WATER SAMPLING
FIELD DATA SHEET

LOCATION NO: MW-13B
LAB SAMPLE NO: 13 B

PROJECT: LTV ~~STE~~ SPRING SAMPLING
Date: 5/2
Time: 2^{15}
CLIENT: LTV STEEL
Weather Conditions: Sunny
JOB NO: 0848-12-9
Air Temperature: 60's
SAMPLER: RHO/RHF
Type of Sample: GW

WELL DATA:
Date: 5/2
Time: 2:15
Casing Diameter: 2"
Casing Material: PVC
Screen Diameter: 2"
Screen Material: PVC
Static Water Level: 6.38
Bottom Depth: 12.85
Casing Volume:
Datum: ☐ Top of Protective Casing ☒ Top of Well Casing ☐ Other:

PURGING DATA:
Date: 5/2
Time: Start 2:15 Finish
Method: Bail

Is Pumping Equipment Dedicated to Sample Location? ☐ Yes ☒ No
Pumping Rate:
Elapsed Time:
Volume Purged 3.5 gal
Was Well Evacuated? ☐ Yes ☒ No
Well Volumes Purged

SAMPLING DATA:
Date: 5/2
Time: Start Finish 2:30
Method: Teflon Bailer

Is Pumping Equipment Dedicated to Sample Location? ☐ Yes ☒ No
Depth of Sample:

PRESERVATION DATA:
Date: 5/2
Filtered: ☒ Yes ☐ No
Time: 3:10
Preservative: ☒ H_2SO_4 ☒ HNO_3 ☐ NaOH ☐ Other ☒ Cool to 4°C

PHYSICAL & CHEMICAL DATA:
Appearance: ☐ Clear ☒ Turbid ☒ Color: Yell Brn ☐ Contains Sediment
☐ Contains Immiscible Liquid ☐ Other: Slight oily sheen
Odor: ☐ Yes: ☐ No
Temperature: 13°C
Ph: 7.2 7.3 7.2 7.2
Spec. Cond: 2000, 1900 1900, 1800
Other:

Remarks:

MALCOLM PIRNIE

WATER SAMPLING FIELD DATA SHEET

LOCATION NO: MW-14B
LAB SAMPLE NO: 14B

PROJECT: LTU SPRING SAMPLING
CLIENT: LTV STEEL
JOB NO: 0848-12-9
SAMPLER: RHO / RHF
Date: 5/2 Time: 10^{25}
Weather Conditions: Sunny
Air Temperature: 60's
Type of Sample: GW

WELL DATA: Date: 5/2 Time: 10:25
Casing Diameter: 2" Casing Material: PVC
Screen Diameter: 2" Screen Material: PVC
Static Water Level: 30.78 Bottom Depth: 44.4 Casing Volume: ____
Datum: ___ Top of Protective Casing X Top of Well Casing ___ Other: ____

PURGING DATA: Date: 5/2 Time: Start 10:26 Finish ____
Method: Bail
Is Pumping Equipment Dedicated to Sample Location? ___ Yes X No
Pumping Rate: ____ Elapsed Time: ____ Volume Purged 3gal
Was Well Evacuated? X Yes ___ No Well Volumes Purged ____

SAMPLING DATA: Date: 5/2 Time: Start 4:00 Finish 4:18
Method: Teflon bailer
Is Pumping Equipment Dedicated to Sample Location? ___ Yes X No
Depth of Sample: ____

PRESERVATION DATA: Date: 5/2
Filtered: X Yes ___ No Time: 5:15
Preservative: X H_2SO_4 X HNO_3 ___ NaOH ___ Other ____ X Cool to 4°C

PHYSICAL & CHEMICAL DATA:
Appearance: X Clear ___ Turbid ___ Color: ____ ___ Contains Sediment ____
___ Contains Immiscible Liquid ___ Other: ____
Odor: Yes: ____ X No
Temperature: 15°C Ph: 9.5 9.6 Spec. Cond: 2250 2250
Other: ____ 9.6 9.5 2300 2300

Remarks: W.L. 4pm 5/2 31.5'

APPENDIX C

STATISTICAL CALCULATIONS

```
PROJECT NAME: LTV STEEL                                     TEST DATE: 5/02/88
                          WELL NUMBER: MW-4B

                           PARAMETER: pH

LEVEL OF SIGNIFICANCE = 0.005
NUMBER OF BACKGROUND MEASUREMENTS (Nb)  16
BACKGROUND MEAN (Xb)  6.9
BACKGROUND VARIANCE (S2b)  .3
BACKGROUND CRITICAL VALUE (tb)  2.947

                              NEW DATA
   Xm           S2m          Nm          tm              t*        tc
----------------------------------------------------------------------
   8.63         0.0          4         5.841          12.39     3.040

                           PARAMETER: SPECIFIC CONDUCTIVITY

LEVEL OF SIGNIFICANCE = 0.01
NUMBER OF BACKGROUND MEASUREMENTS (Nb)  16
BACKGROUND MEAN (Xb)  1503
BACKGROUND VARIANCE (S2b)  62823
BACKGROUND CRITICAL VALUE (tb)  2.602

                              NEW DATA
   Xm           S2m          Nm          tm              t*        tc
----------------------------------------------------------------------
1140.00      4333.3          4         4.541          -5.13     3.021

                           PARAMETER: TOC

LEVEL OF SIGNIFICANCE = 0.01
NUMBER OF BACKGROUND MEASUREMENTS (Nb)  16
BACKGROUND MEAN (Xb)  33
BACKGROUND VARIANCE (S2b)  514
BACKGROUND CRITICAL VALUE (tb)  2.602

                              NEW DATA
   Xm           S2m          Nm          tm              t*        tc
----------------------------------------------------------------------
  14.75        11.6          4         4.541          -3.08     2.762

                           PARAMETER: TOX

LEVEL OF SIGNIFICANCE = 0.01
NUMBER OF BACKGROUND MEASUREMENTS (Nb)  16
BACKGROUND MEAN (Xb)  39
BACKGROUND VARIANCE (S2b)  231
BACKGROUND CRITICAL VALUE (tb)  2.602

                              NEW DATA
   Xm           S2m          Nm          tm              t*        tc
----------------------------------------------------------------------
  10.25         0.1          4         4.541          -7.56     2.607
```

PPROJECT NAME: LTV STEEL

TEST DATE: 5/03/88

WELL NUMBER: MW-6B

PARAMETER: pH

LEVEL OF SIGNIFICANCE = 0.005
NUMBER OF BACKGROUND MEASUREMENTS (Nb) 16
BACKGROUND MEAN (Xb) 6.9
BACKGROUND VARIANCE (S2b) .3
BACKGROUND CRITICAL VALUE (tb) 2.947

NEW DATA

Xm	S2m	Nm	tm	t*	tc
7.18	0.0	4	5.841	1.98	3.040

PARAMETER: SPECIFIC CONDUCTIVITY

LEVEL OF SIGNIFICANCE = 0.01
NUMBER OF BACKGROUND MEASUREMENTS (Nb) 16
BACKGROUND MEAN (Xb) 1503
BACKGROUND VARIANCE (S2b) 62823
BACKGROUND CRITICAL VALUE (tb) 2.602

NEW DATA

Xm	S2m	Nm	tm	t*	tc
1703.75	356.3	4	4.541	3.17	2.645

PARAMETER: TOC

LEVEL OF SIGNIFICANCE = 0.01
NUMBER OF BACKGROUND MEASUREMENTS (Nb) 16
BACKGROUND MEAN (Xb) 33
BACKGROUND VARIANCE (S2b) 514
BACKGROUND CRITICAL VALUE (tb) 2.602

NEW DATA

Xm	S2m	Nm	tm	t*	tc
11.50	50.2	4	4.541	-3.22	3.146

PARAMETER: TOX

LEVEL OF SIGNIFICANCE = 0.01
NUMBER OF BACKGROUND MEASUREMENTS (Nb) 16
BACKGROUND MEAN (Xb) 39
BACKGROUND VARIANCE (S2b) 231
BACKGROUND CRITICAL VALUE (tb) 2.602

NEW DATA

Xm	S2m	Nm	tm	t*	tc
21.25	61.2	4	4.541	-3.26	3.599

PROJECT NAME: LTV STEEL

TEST DATE: 5/02/88

WELL NUMBER: MW-7A

PARAMETER: pH

LEVEL OF SIGNIFICANCE = 0.005
NUMBER OF BACKGROUND MEASUREMENTS (Nb) 16
BACKGROUND MEAN (Xb) 6.9
BACKGROUND VARIANCE (S2b) .3
BACKGROUND CRITICAL VALUE (tb) 2.947

NEW DATA

Xm	S2m	Nm	tm	t*	tc
7.13	0.0	4	5.841	1.62	3.040

PARAMETER: SPECIFIC CONDUCTIVITY

LEVEL OF SIGNIFICANCE = 0.01
NUMBER OF BACKGROUND MEASUREMENTS (Nb) 16
BACKGROUND MEAN (Xb) 1503
BACKGROUND VARIANCE (S2b) 62823
BACKGROUND CRITICAL VALUE (tb) 2.602

NEW DATA

Xm	S2m	Nm	tm	t*	tc
1037.50	208.3	4	4.541	-7.38	2.627

PARAMETER: TOC

LEVEL OF SIGNIFICANCE = 0.01
NUMBER OF BACKGROUND MEASUREMENTS (Nb) 16
BACKGROUND MEAN (Xb) 33
BACKGROUND VARIANCE (S2b) 514
BACKGROUND CRITICAL VALUE (tb) 2.602

NEW DATA

Xm	S2m	Nm	tm	t*	tc
17.00	64.7	4	4.541	-2.30	3.251

PARAMETER: TOX

LEVEL OF SIGNIFICANCE = 0.01
NUMBER OF BACKGROUND MEASUREMENTS (Nb) 16
BACKGROUND MEAN (Xb) 39
BACKGROUND VARIANCE (S2b) 231
BACKGROUND CRITICAL VALUE (tb) 2.602

NEW DATA

Xm	S2m	Nm	tm	t*	tc
15.95	117.9	4	4.541	-3.48	3.904

PROJECT NAME: LTV STEEL

TEST DATE: 5/03/88

WELL NUMBER: MW-7B

PARAMETER: pH

LEVEL OF SIGNIFICANCE = 0.005
NUMBER OF BACKGROUND MEASUREMENTS (Nb) 16
BACKGROUND MEAN (Xb) 6.9
BACKGROUND VARIANCE (S2b) .3
BACKGROUND CRITICAL VALUE (tb) 2.947

NEW DATA

Xm	S2m	Nm	tm	t*	tc
12.60	0.0	4	5.841	41.63	2.947

PARAMETER: SPECIFIC CONDUCTIVITY

LEVEL OF SIGNIFICANCE = 0.01
NUMBER OF BACKGROUND MEASUREMENTS (Nb) 16
BACKGROUND MEAN (Xb) 1503
BACKGROUND VARIANCE (S2b) 62823
BACKGROUND CRITICAL VALUE (tb) 2.602

NEW DATA

Xm	S2m	Nm	tm	t*	tc
9812.50	%13958.3	4	4.541	96.49	3.514

PARAMETER: TOC

LEVEL OF SIGNIFICANCE = 0.01
NUMBER OF BACKGROUND MEASUREMENTS (Nb) 16
BACKGROUND MEAN (Xb) 33
BACKGROUND VARIANCE (S2b) 514
BACKGROUND CRITICAL VALUE (tb) 2.602

NEW DATA

Xm	S2m	Nm	tm	t*	tc
209.75	382.3	4	4.541	15.64	4.053

PROJECT NAME: LTV STEEL
WELL NUMBER: MW-9B
TEST DATE: 5/02/88

PARAMETER: pH

LEVEL OF SIGNIFICANCE = 0.005
NUMBER OF BACKGROUND MEASUREMENTS (Nb) 16
BACKGROUND MEAN (Xb) 6.9
BACKGROUND VARIANCE (S2b) .3
BACKGROUND CRITICAL VALUE (tb) 2.947

NEW DATA

Xm	S2m	Nm	tm	t*	tc
6.72	0.0	4	5.841	-1.26	3.040

PARAMETER: SPECIFIC CONDUCTIVITY

LEVEL OF SIGNIFICANCE = 0.01
NUMBER OF BACKGROUND MEASUREMENTS (Nb) 16
BACKGROUND MEAN (Xb) 1503
BACKGROUND VARIANCE (S2b) 62823
BACKGROUND CRITICAL VALUE (tb) 2.602

NEW DATA

Xm	S2m	Nm	tm	t*	tc
2312.50	%15625.0	4	4.541	9.15	3.569

PARAMETER: TOC

LEVEL OF SIGNIFICANCE = 0.01
NUMBER OF BACKGROUND MEASUREMENTS (Nb) 16
BACKGROUND MEAN (Xb) 33
BACKGROUND VARIANCE (S2b) 514
BACKGROUND CRITICAL VALUE (tb) 2.602

NEW DATA

Xm	S2m	Nm	tm	t*	tc
35.00	827.3	4	4.541	0.13	4.280

PARAMETER: TOX

LEVEL OF SIGNIFICANCE = 0.01
NUMBER OF BACKGROUND MEASUREMENTS (Nb) 16
BACKGROUND MEAN (Xb) 39
BACKGROUND VARIANCE (S2b) 231
BACKGROUND CRITICAL VALUE (tb) 2.602

NEW DATA

Xm	S2m	Nm	tm	t*	tc
18.25	103.1	4	4.541	-3.27	3.845

```
PROJECT NAME: LTV STEEL
                                                      TEST DATE: 5/02/88
                               WELL NUMBER: MW-13B

                                PARAMETER: pH

LEVEL OF SIGNIFICANCE = 0.005
NUMBER OF BACKGROUND MEASUREMENTS (Nb)  16
BACKGROUND MEAN (Xb)  6.9
BACKGROUND VARIANCE (S2b)  .3
BACKGROUND CRITICAL VALUE (tb)  2.947

                                    NEW DATA
   Xm          S2m            Nm           tm               t*        tc
-----------------------------------------------------------------------
   7.23        0.0            4           5.841            2.33      3.040

                                PARAMETER: SPECIFIC CONDUCTIVITY

LEVEL OF SIGNIFICANCE = 0.01
NUMBER OF BACKGROUND MEASUREMENTS (Nb)  16
BACKGROUND MEAN (Xb)  1503
BACKGROUND VARIANCE (S2b)  62823
BACKGROUND CRITICAL VALUE (tb)  2.602

                                    NEW DATA
   Xm          S2m            Nm           tm               t*        tc
-----------------------------------------------------------------------
1900.00     6666.7            4           4.541            5.31      3.180

                                PARAMETER: TOC

LEVEL OF SIGNIFICANCE = 0.01
NUMBER OF BACKGROUND MEASUREMENTS (Nb)  16
BACKGROUND MEAN (Xb)  33
BACKGROUND VARIANCE (S2b)  514
BACKGROUND CRITICAL VALUE (tb)  2.602

                                    NEW DATA
   Xm          S2m            Nm           tm               t*        tc
-----------------------------------------------------------------------
  67.25      668.9            4           4.541            2.43      4.229

                                PARAMETER: TOX

LEVEL OF SIGNIFICANCE = 0.01
NUMBER OF BACKGROUND MEASUREMENTS (Nb)  16
BACKGROUND MEAN (Xb)  39
BACKGROUND VARIANCE (S2b)  231
BACKGROUND CRITICAL VALUE (tb)  2.602

                                    NEW DATA
   Xm          S2m            Nm           tm               t*        tc
-----------------------------------------------------------------------
  22.50      401.0            4           4.541           -1.54      4.297
```

```
PROJECT NAME: LTV STEEL                                        TEST DATE: 5/02/88
                              WELL NUMBER: MW-14B

                               PARAMETER: pH

LEVEL OF SIGNIFICANCE = 0.005
NUMBER OF BACKGROUND MEASUREMENTS (Nb)  16
BACKGROUND MEAN (Xb)  6.9
BACKGROUND VARIANCE (S2b)  .3
BACKGROUND CRITICAL VALUE (tb)  2.947

                                 NEW DATA
   Xm           S2m            Nm          tm             t*        tc
----------------------------------------------------------------------
   9.55         0.0             4          5.841         18.94     3.070

                               PARAMETER: SPECIFIC CONDUCTIVITY

LEVEL OF SIGNIFICANCE = 0.01
NUMBER OF BACKGROUND MEASUREMENTS (Nb)  16
BACKGROUND MEAN (Xb)  1503
BACKGROUND VARIANCE (S2b)  62823
BACKGROUND CRITICAL VALUE (tb)  2.602

                                 NEW DATA
   Xm           S2m            Nm          tm             t*        tc
----------------------------------------------------------------------
2275.00        833.3            4          4.541         12.01     2.700

                               PARAMETER: TOC

LEVEL OF SIGNIFICANCE = 0.01
NUMBER OF BACKGROUND MEASUREMENTS (Nb)  16
BACKGROUND MEAN (Xb)  33
BACKGROUND VARIANCE (S2b)  514
BACKGROUND CRITICAL VALUE (tb)  2.602

                                 NEW DATA
   Xm           S2m            Nm          tm             t*        tc
----------------------------------------------------------------------
  18.50         9.0             4          4.541         -2.47     2.729

                               PARAMETER: TOX

LEVEL OF SIGNIFICANCE = 0.01
NUMBER OF BACKGROUND MEASUREMENTS (Nb)  16
BACKGROUND MEAN (Xb)  39
BACKGROUND VARIANCE (S2b)  231
BACKGROUND CRITICAL VALUE (tb)  2.602

                                 NEW DATA
   Xm           S2m            Nm          tm             t*        tc
----------------------------------------------------------------------
  20.20        163.0            4          4.541         -2.53     4.034
```

PROJECT NAME: LTV STEEL

TEST DATE: 5/03/88

WELL NUMBER: WP-1

PARAMETER: pH

LEVEL OF SIGNIFICANCE = 0.005
NUMBER OF BACKGROUND MEASUREMENTS (Nb) 16
BACKGROUND MEAN (Xb) 6.9
BACKGROUND VARIANCE (S2b) .3
BACKGROUND CRITICAL VALUE (tb) 2.947

NEW DATA

Xm	S2m	Nm	tm	t*	tc
9.35	0.0	4	5.841	17.51	3.070

PARAMETER: SPECIFIC CONDUCTIVITY

LEVEL OF SIGNIFICANCE = 0.01
NUMBER OF BACKGROUND MEASUREMENTS (Nb) 16
BACKGROUND MEAN (Xb) 1503
BACKGROUND VARIANCE (S2b) 62823
BACKGROUND CRITICAL VALUE (tb) 2.602

NEW DATA

Xm	S2m	Nm	tm	t*	tc
1147.50	25.0	4	4.541	-5.67	2.605

PARAMETER: TOC

LEVEL OF SIGNIFICANCE = 0.01
NUMBER OF BACKGROUND MEASUREMENTS (Nb) 16
BACKGROUND MEAN (Xb) 33
BACKGROUND VARIANCE (S2b) 514
BACKGROUND CRITICAL VALUE (tb) 2.602

NEW DATA

Xm	S2m	Nm	tm	t*	tc
7.38	8.6	4	4.541	-4.38	2.723

PARAMETER: TOX

LEVEL OF SIGNIFICANCE = 0.01
NUMBER OF BACKGROUND MEASUREMENTS (Nb) 16
BACKGROUND MEAN (Xb) 39
BACKGROUND VARIANCE (S2b) 231
BACKGROUND CRITICAL VALUE (tb) 2.602

NEW DATA

Xm	S2m	Nm	tm	t*	tc
32.90	738.6	4	4.541	-0.43	4.400

APPENDIX D

STATISTICAL PROCEDURES

[OMB No.2000-0423; 1/31/84]

GROUND-WATER MONITORING
GUIDANCE FOR OWNERS
AND OPERATORS OF INTERIM STATUS
FACILITIES

Instructions for complying with 40 CFR Part 265, Subpart F.

OFFICE OF SOLID WASTE AND EMERGENCY RESPONSE

U.S. Environmental Protection Agency
Washington, D.C.

1983

2.5.2 Statistical Analysis

The owner or operator of a facility must perform a statistical analysis of the concentrations or values of the indicator parameters, as determined from the sampling and analysis of the required monitoring wells. If the analytical results for Total Organic Carbon and TOX are reported by the laboratory as below detection limits, then the owner or operator should use values of one milligram per liter for Total Organic Carbon and five micrograms per liter for TOX in the statistical analysis.

Section 265.92(c)(2) on sampling and analysis requires that the initial background mean and variance for each indicator parameter be determined by pooling the replicate measurements for the respective parameter concentrations in samples obtained from the upgradient well(s) during the first year. Replicate analyses are not required for downgradient wells during the first year.

After the first year of monitoring, §265.92(d)(2) on sampling and analysis and §265.93(b) on preparation, evaluation, and response require the owner or operator to analyze for and calculate the mean and variance of each indicator parameter (i.e., pH, Specific Conductance, Total Organic Carbon, and Total Organic Halogen), based on at least four replicate measurements on each sample, for each well in the monitoring system. Results for each indicator parameter from each sampling event (for each and every well in the monitoring system) must be compared with the initial background mean (i.e., that established for the upgradient well(s) during the first year). The student's t-test at the 0.01 level of significance must be used to determine statistically significant increases (or decreases also, in the case of pH) over the initial background values.

First Year Statistical Analysis

During the first year, the initial background mean and variance for each indicator parameter must be determined for samples from upgradient wells.

Arithmetic Mean

In order to perform the t-test, the raw data from the background and monitoring wells must be reduced to specific summary measures. These measures are the mean (an average) and the variance (a measure of variability of the data). For any set of data the mean ($\overline{X}$) is equal to the sum of the measurements divided by the number of measurements (n).

The indicator parameter values for all four quarters of the first year are used to calculate the mean. If more than one upgradient well is being used, the owner or operator must calculate the overall mean value (of each indicator parameter) for all of the upgradient wells. This can be accomplished by summing the data from all of the upgradient wells and dividing this sum by the total number of measurements for each parameter. These first-year upgradient mean values are important since they establish the initial background concentrations to which all subsequent upgradient and downgradient concentrations or values will be compared.

Variance

The variance is an average of the squares of the differences between the actual value and the mean, and is a measure of variability. The mean and variance are used in the Student's t-test to determine whether any changes in the concentration of the indicator parameters are statistically significant. In this context, the variance may be defined as: the sum of the squares of the differences of the individual measurements and the mean, divided by one less than the number of measurements. Symbolically, the sample variance is calculated as follows:

$$s^2 = \frac{\sum_{i=1}^{n} (X_i - \overline{X})^2}{n - 1}$$

where s^2 = sample variance;

X_i = value of each measurement;

$\overline{X}$ = mean of the measurements;

Σ = "the sum of" a set of numbers from the first value (where i = 1) to the last value (where i = n). In this case, the squared differences of the measurements and the mean are added; and

n = the number of measurements.

For example, in determining the sample variance of the background value of the pH of an upgradient well for the first year, the owner or operator would proceed in the following manner:

- Substract the mean pH value (e.g., 6.4) from each pH measurement, square this value, and sum the squared differences as follows:

	Measurement	Mean	Difference	Squared Difference
1st Quarter	5.7	6.4	-0.7	0.49
	6.3	6.4	-0.1	0.01
	6.8	6.4	0.4	0.16
	4.8	6.4	-1.6	2.56
2nd Quarter	7.5	6.4	1.1	1.21
	8.2	6.4	1.8	3.24
	6.9	6.4	0.5	0.24
	6.1	6.4	-0.3	0.09
3rd Quarter	5.7	6.4	-.07	0.49
	4.3	6.4	-2.1	4.41
	5.5	6.4	-0.9	0.81
	6.2	6.4	-0.2	0.04
4th Quarter	4.7	6.4	-1.7	2.89
	8.6	6.4	2.2	4.84
	8.9	6.4	2.5	6.25
	6.0	6.4	-0.4	0.16
			Total	27.90;

- Divide the sum of the squared differences by the number of measurements minus one, as follows:

$$\text{Sample Variance} = s^2 = \frac{27.9}{n-1} = \frac{27.9}{16-1} = 1.86; \text{ and}$$

- Keep at least two decimal places for accuracy in calculations.

The variance for specific conductance, total organic carbon, and total organic halogen can be calculated in a similar manner. If more than one upgradient well is being used, the sample variance can be calculated by pooling all the measurements (for each indicator parameter) to determine the mean, subtracting the mean from each measurement, squaring and summing the differences as in the first step above, and dividing this sum by the number of measurements minus one, as in the second step above.

Subsequent Statistical Analysis (after the first year)

After determining initial background values during the first year, the owner or operator must, at least semi-annually, calculate the sample mean and sample variance for four replicate measures (necessitating four aliquots from the same sample for any destructive analyses) of pH, specific conductance, total organic carbon, and total organic halogen, for each upgradient and downgradient ground-water monitoring well. (The regulations allow for a greater sampling and analysis frequency than the minimum, hence providing an opportunity to lessen the prospect of false positive indications of facility impact on ground water.) These values should be determined in the manner described previously. The mean of each of these indicator parameters for each upgradient and downgradient well must be individually compared to the initial background mean for each indicator parameter by using the Student's t-test at the 0.01 level of significance. This provides a determination of statistically significant increases (or decreases also for pH) over the initial background level.

Student's t-test

[Note: The methodology for application of the Student's t-test presented in this guidance document differs from that offered in the May 2, 1980, background document for ground-water monitoring. Although both methods could be appropriate, the one recommended in this guidance document is preferred.]

The Student's t-test is a statistical method used to determine the significance of a change between initial background and subsequent parameter values and must be calculated at least semi-annually for each well for each indicator parameter. Using all the available background data (n_b readings), calculate the background mean ($\overline{X}_b$) and background variance (s^2_b). For the single monitoring well under investigation (n_m readings), calculate the monitoring mean ($\overline{X}_m$) and monitoring variance (s^2_m).

The t-test uses these data summary measures to calculate a t-statistic (t*) and a comparison t-statistic (t_c). The t* value is compared to the t_c value and a conclusion reached as to whether there has been a statistically significant change in the indicator parameter value.

The t-test for the difference of two groups is given by:

$$t^* = \frac{\overline{X}_m - \overline{X}_b}{\sqrt{\frac{s^2_m}{n_m} + \frac{s^2_b}{n_b}}}$$

If the t* is negative (except for pH), then there is no significant difference between the monitoring data and background data.

The t-statistic (t_c) against which t* will be compared, necessitates finding t_b and t_m from Table 2-4 where,

t_b = Table 2-4 with (n_b-1) degrees of freedom, 0.01 level of significance; and

t_m = Table 2-4 with (n_m-1) degrees of freedom, 0.01 level of significance.

[NB: if pH is being examined, use 0.005 as the level of significance]. Finally, the special weightings W_b and W_m are defined as:

$$W_b = \frac{s_b^2}{n_b} \quad \text{and} \quad W_m = \frac{s_m^2}{n_m},$$

and so the comparison t-statistic is

$$t_c = \frac{W_b t_b + W_m t_m}{W_b + W_m}.$$

The t-statistic (t*) is now compared with the comparison t-statistic (t_c) using the following decision-rule:

If t* is equal to or larger that t_c, then conclude that there most likely has been an increase in indicator parameter. [In the case for pH, it is decrease if the t* as originally calculated was negative, and increase if the original t* was positive.]

If t*is less than t_c, then conclude that most likely there has not been a change in indicator parameter.

The procedure described above is known as Cochrans' Approximation to the Behrens-Fisher solution of the comparison of two independent samples with unequal population variances. For further information, see Snedecor and Cochran (1967) or Steel and Torrie (1960).

Example of the t-test

These readings represent TOC values collected from a hazardous waste disposal facility. Background well samples

Table 2-4

The Critical t-values at the 0.01 and 0.005 Levels of Significance

Degrees of Freedom	Level of Significance = 0.01	Level of Significance = 0.005
1	31.821	63.657
2	6.965	9.925
3	4.541	5.841
4	3.747	4.604
5	3.365	4.032
6	3.143	3.707
7	2.998	3.499
8	2.896	3.355
9	2.821	3.250
10	2.764	3.169
11	2.718	3.106
12	2.681	3.055
13	2.650	3.012
14	2.624	2.977
15	2.602	2.947
16	2.583	2.921
17	2.567	2.898
18	2.552	2.878
19	2.539	2.861
20	2.528	2.845
21	2.518	2.831
22	2.508	2.819
23	2.500	2.807
24	2.492	2.797
25	2.485	2.787
26	2.479	2.779
27	2.473	2.771
28	2.467	2.763
29	2.462	2.756
30	2.457	2.750
40	2.423	2.704
60	2.390	2.660
120	2.358	2.617
	2.326	2.576

Adapted from Table III, Statistical Tables for Biological, Agricultural and Medical Research, Fisher and Yates, 1963.

were collected quarterly and four determinations made on each quarterly sample. For the purposes of this example, only one monitoring well will be considered.

BACKGROUND WELL				
1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	MONITORING WELL
20	12	15	6	42
15	12	16	9	43
15	13	14	10	38
19	13	15	9	36

For the background data the mean ($\overline{X}_b$) is,

$$\overline{X}_b = \frac{20 + 12 + 15 \ldots + 9}{16} \text{ , or}$$

$$\overline{X}_b = 13.31$$

and the background variance (s_b^2) is,

$$s_b^2 = \frac{(20-13.31)^2 + (12-13.31)^2 \ldots + (9-13.31)^2}{16 - 1} ,$$

or

$$s_b^2 = 13.43$$

For the monitoring data, the mean ($\overline{X}_m$) is,

$$\overline{X}_m = \frac{42 + 43 + 38 + 36}{4} \text{ , or}$$

$$\overline{X}_m = 39.75$$

and the monitoring variance (s_m) is

$$s_m^2 = \frac{(42-39.75)^2 + (43-39.75)^2 + (38-39.75)^2 + (36-39.75)^2}{4 - 1} \text{ , or}$$

$$s_m^2 = 10.92$$

$$t^* = \frac{\overline{X}_m - \overline{X}_b}{\sqrt{\frac{s_m^2}{n_m} + \frac{s_b^2}{n_b}}}$$, and for this example,

$$t^* = \frac{39.75 - 13.31}{\sqrt{\frac{10.92}{4} + \frac{13.43}{16}}} \text{, or}$$

$$t^* = 13.99$$

Now, from Table 2-4

t_b = Table 2-4 with 15 degree of freedom, significance level = 0.01,

t_b = 2.602,

t_m = Table 2-4 with 3 degree of freedom, significance level = 0.01,

t_m = 4.541.

The weights are:

$$W_m = \frac{s_m^2}{n_m} = \frac{10.92}{4} = 2.7300,$$

and

$$W_b = \frac{s_b^2}{n_b} = \frac{13.43}{16} = 0.8394$$

Therefore,

$$t_c = \frac{W_b t_b + W_m t_m}{W_b + W_m} \text{, and for this example,}$$

$$t_c = \frac{(0.8394 \times 2.602) + (2.7300 \times 4.541)}{(0.8394 + 2.7300)} ,$$

giving $t_c = 4.085$.

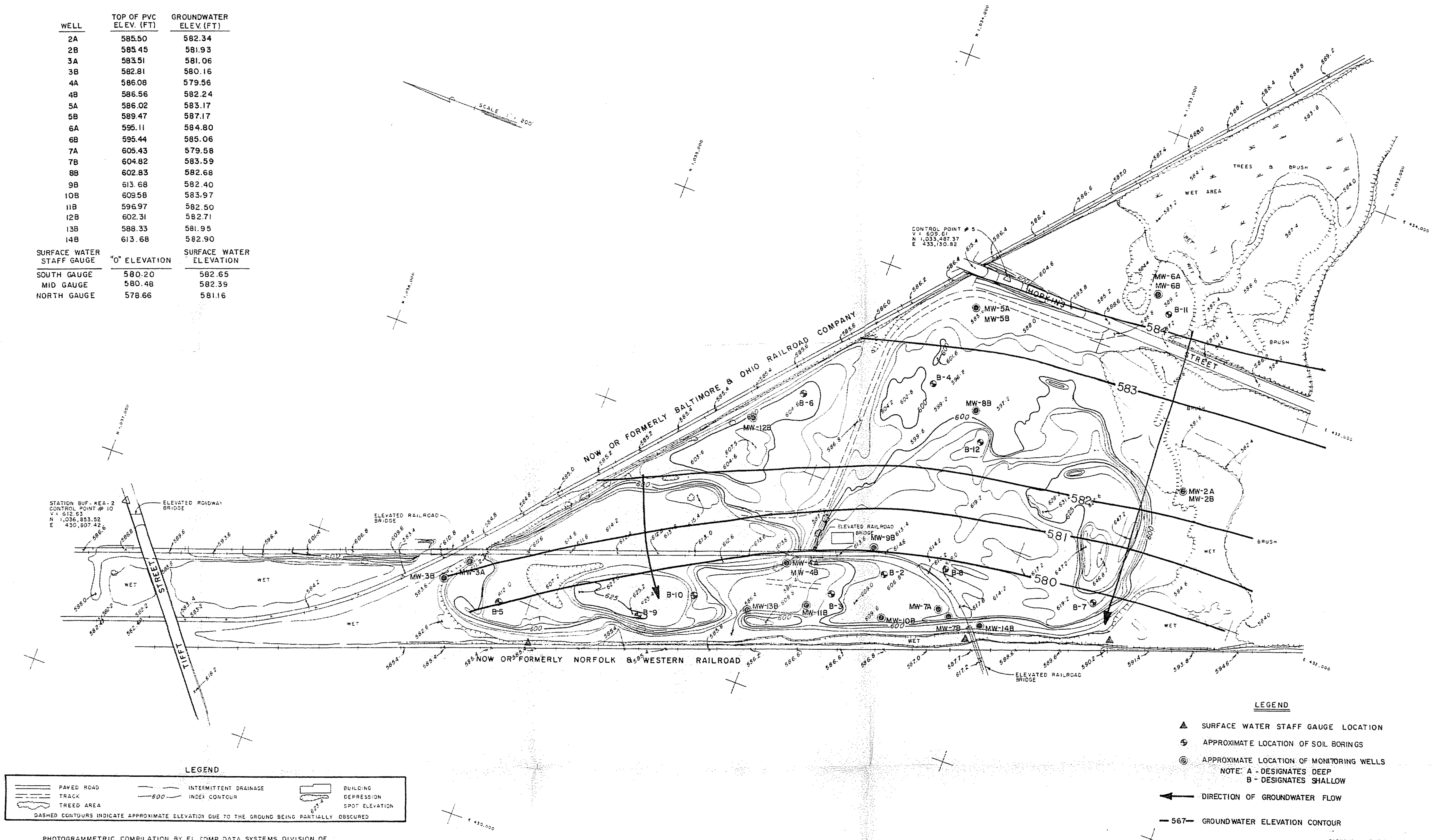
As t^* (=13.99) is larger than t_c (=4.085), the conclusion is that there has been a statistically significant increase in TOC level.

PLATE 2

PROJECT NO. 0848-12-9

WELL	TOP OF PVC ELEV. (FT)	GROUNDWATER ELEV. (FT)
2A	585.50	582.34
2B	585.45	581.93
3A	583.51	581.06
3B	582.81	580.16
4A	586.08	579.56
4B	586.56	582.24
5A	586.02	583.17
5B	589.47	587.17
6A	595.11	584.80
6B	595.44	585.06
7A	605.43	579.58
7B	604.82	583.59
8B	602.83	582.68
9B	613.68	582.40
10B	609.58	583.97
11B	596.97	582.50
12B	602.31	582.71
13B	588.33	581.95
14B	613.68	582.90

SURFACE WATER STAFF GAUGE	"O" ELEVATION	SURFACE WATER ELEVATION
SOUTH GAUGE	580.20	582.65
MID GAUGE	580.48	582.39
NORTH GAUGE	578.66	581.16



LEGEND

═══	PAVED ROAD	— · —	INTERMITTENT DRAINAGE	▭	BUILDING
═ ═ ═	TRACK	—600—	INDEX CONTOUR	⬭	DEPRESSION
☁	TREED AREA			623.4	SPOT ELEVATION

DASHED CONTOURS INDICATE APPROXIMATE ELEVATION DUE TO THE GROUND BEING PARTIALLY OBSCURED

PHOTOGRAMMETRIC COMPILATION BY EL COMP DATA SYSTEMS DIVISION OF
McINTOSH & McINTOSH, INC. JOB NO. 2187
DATE OF PHOTOGRAPHY: APRIL 18, 1985
CONTOUR INTERVAL: 5 FEET, U.S.G.S. DATUM, NEW YORK STATE WEST ZONE COORDINATE SYSTEMS

LEGEND

▲	SURFACE WATER STAFF GAUGE LOCATION
⊕	APPROXIMATE LOCATION OF SOIL BORINGS
◎	APPROXIMATE LOCATION OF MONITORING WELLS NOTE: A - DESIGNATES DEEP B - DESIGNATES SHALLOW
←	DIRECTION OF GROUNDWATER FLOW
—567—	GROUNDWATER ELEVATION CONTOUR

WARNING - IT IS A VIOLATION OF NEW YORK EDUCATION LAW, SECTION 7209.2, FOR ANY PERSON, UNLESS HE IS ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER OR LAND SURVEYOR, TO ALTER THIS DOCUMENT IN ANY WAY. IF ALTERED, THE ALTERING PERSON SHALL COMPLY WITH THE REQUIREMENTS OF NEW YORK EDUCATION LAW, SECTION 7209.2.

MALCOLM PIRNIE

REVISIONS

NO	BY	DATE	REMARKS
	J.A.B.	8/26/85	SPOT ELEVATIONS ADDED ON RAILROADS
	J.A.B.	8/26/85	WET AREAS ADDED

DES
DWN JCA
CKD

LTV STEEL COMPANY
CLEVELAND, OHIO

MARILLA STREET LANDFILL, BUFFALO, NEW YORK

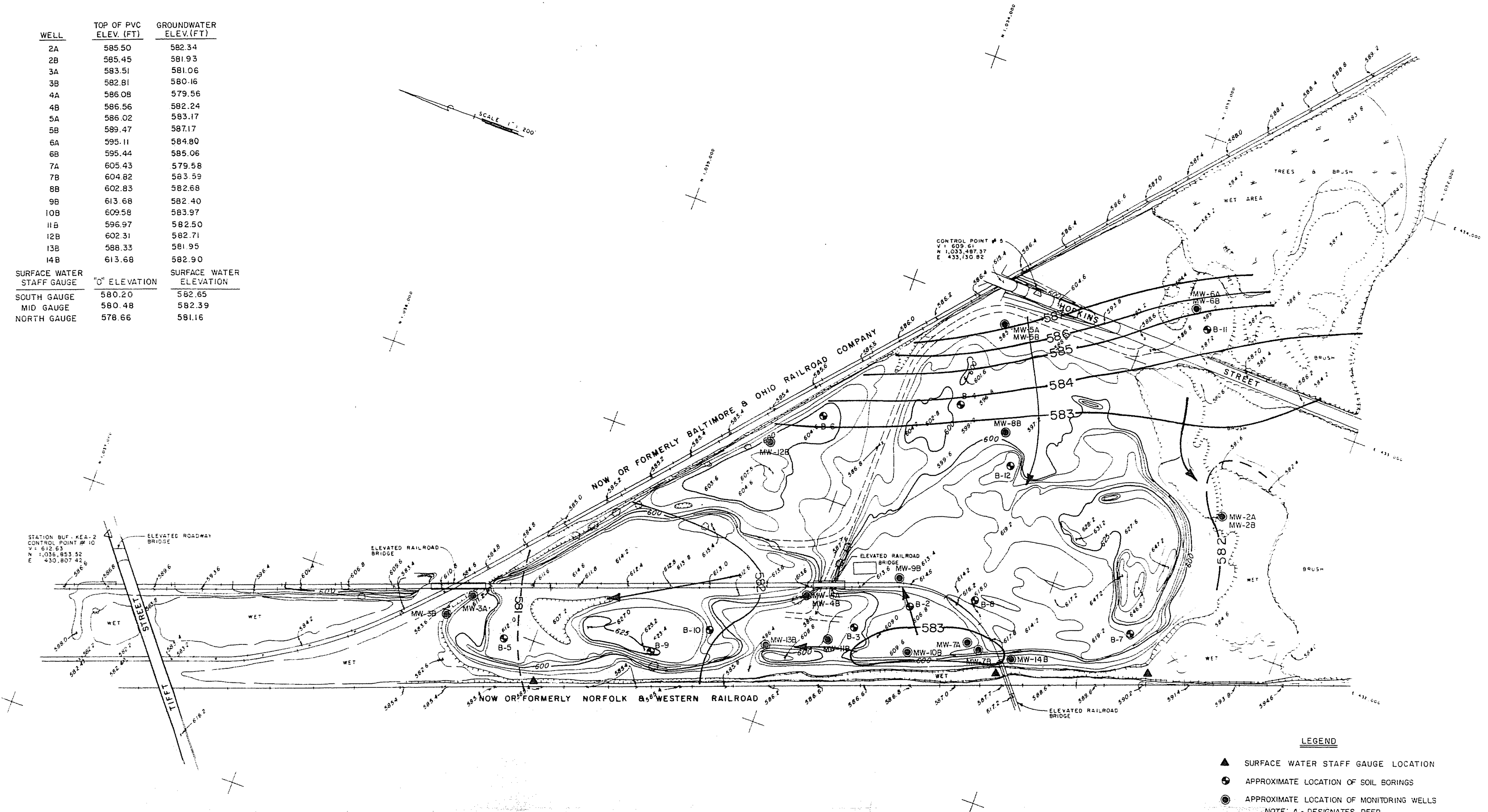
GROUNDWATER ISOPOTENTIAL MAP FOR DEEP WELLS (5/02/88)

MALCOLM PIRNIE, INC.
DATE ....
SHEET ...... OF ......
DWG NO. ....

59603

WELL	TOP OF PVC ELEV. (FT)	GROUNDWATER ELEV.(FT)
2A	585.50	582.34
2B	585.45	581.93
3A	583.51	581.06
3B	582.81	580.16
4A	586.08	579.56
4B	586.56	582.24
5A	586.02	583.17
5B	589.47	587.17
6A	595.11	584.80
6B	595.44	585.06
7A	605.43	579.58
7B	604.82	583.59
8B	602.83	582.68
9B	613.68	582.40
10B	609.58	583.97
11B	596.97	582.50
12B	602.31	582.71
13B	588.33	581.95
14B	613.68	582.90

SURFACE WATER STAFF GAUGE	"0" ELEVATION	SURFACE WATER ELEVATION
SOUTH GAUGE	580.20	582.65
MID GAUGE	580.48	582.39
NORTH GAUGE	578.66	581.16



LEGEND

▲	SURFACE WATER STAFF GAUGE LOCATION
⊕	APPROXIMATE LOCATION OF SOIL BORINGS
◉	APPROXIMATE LOCATION OF MONITORING WELLS

NOTE: A - DESIGNATES DEEP
B - DESIGNATES SHALLOW

←	DIRECTION OF GROUNDWATER FLOW
—567—	GROUNDWATER ELEVATION CONTOUR

LEGEND

PAVED ROAD	INTERMITTENT DRAINAGE	BUILDING
TRACK	INDEX CONTOUR	DEPRESSION
TREED AREA		SPOT ELEVATION

DASHED CONTOURS INDICATE APPROXIMATE ELEVATION DUE TO THE GROUND BEING PARTIALLY OBSCURED

PHOTOGRAMMETRIC COMPILATION BY EL COMP DATA SYSTEMS DIVISION OF
McINTOSH & McINTOSH, INC JOB NO. 2187
DATE OF PHOTOGRAPHY APRIL 18, 1985
CONTOUR INTERVAL 5 FEET, U.S.G.S. DATUM, NEW YORK STATE WEST ZONE COORDINATE SYSTEMS

MALCOLM PIRNIE

REVISIONS

NO	BY	DATE	REMARKS
	J.A.B.	8/26/85	SPOT ELEVATIONS ADDED ON RAILROADS
	J.A.B.	8/26/85	WET AREAS ADDED

DES
DWN JCA
CKD

LTV STEEL COMPANY
CLEVELAND, OHIO

MARILLA STREET LANDFILL, BUFFALO, NEW YORK

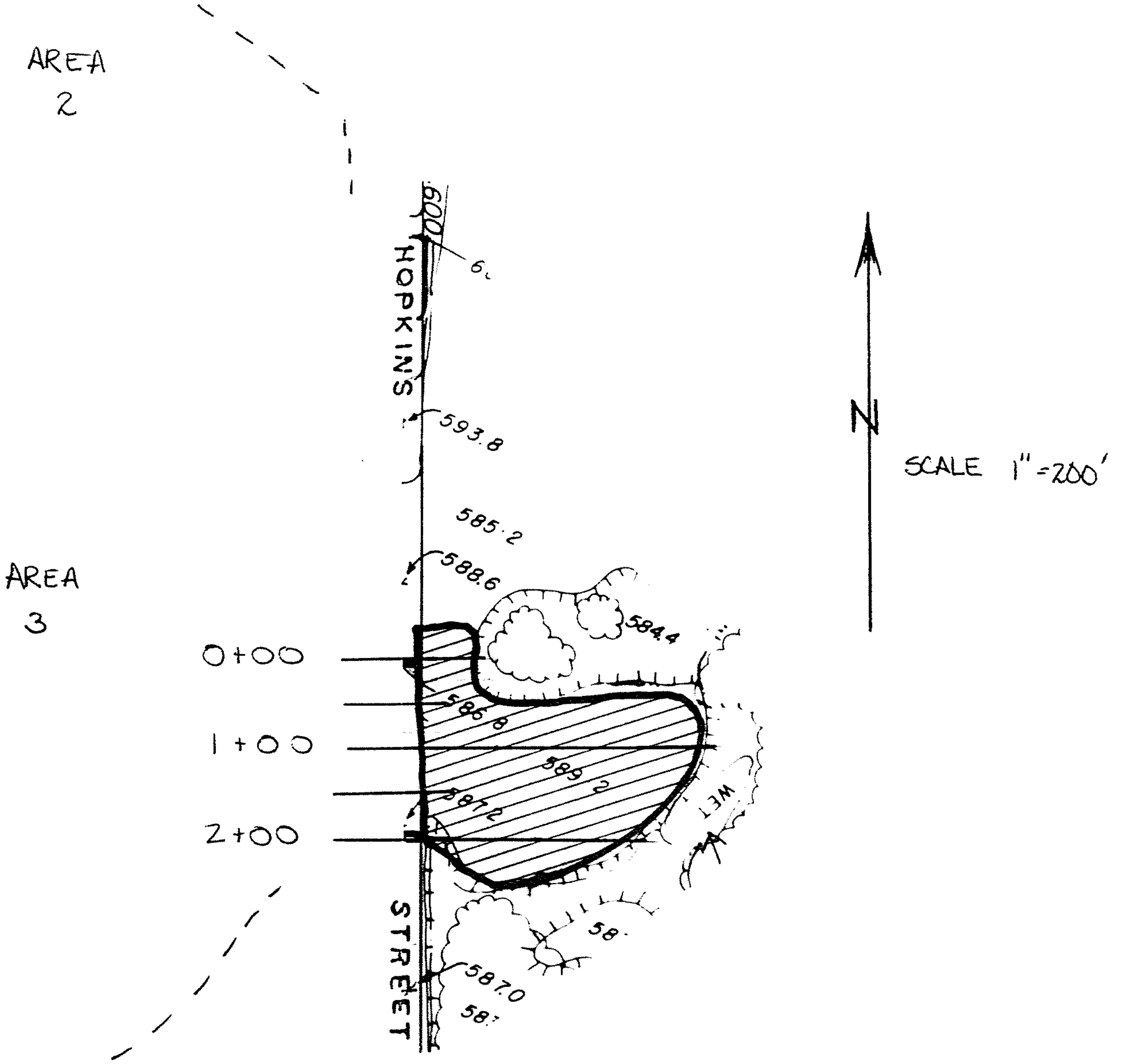
GROUNDWATER ISOPOTENTIAL MAP FOR SHALLOW WELLS (5/02/88)

MALCOLM PIRNIE, INC.
DATE
SHEET OF
DWG NO.

MALCOLM PIRNIE

APPENDIX E

CUT AND FILL CALCULATIONS
FOR
MISCELLANEOUS DEBRIS/FINE REFUSE AREA
FINE REFUSE AREA
RAILROAD FILL AREA



STATION LOCATIONS
RAILROAD FILL (AREA 4)
LTV STEEL

```
 ** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

 ROJECT: RRF.LTV
         STATION                 0.0 FT

     EXISTING PROFILE DATA                        PROPOSED PROFILE DATA
     POINT    X-VALUE    Y-VALUE                  POINT    X-VALUE    Y-VALUE
     -----    -------    -------                  -----    -------    -------
         1       0.00     585.00                      1       0.00     580.00
         2      60.00     585.00                      2      60.00     580.00

AREA IN CUT                 300.0 FT^2
 REA IN FILL                  0.0 FT^2

VOL  CUT THIS REACH           0.0 YD^3
 OL FILL THIS REACH           0.0 YD^3

VOL  CUT TOTAL                0.0 YD^3
 OL FILL TOTAL                0.0 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***    CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: RRF.LTV
        STATION            50.0 FT

    EXISTING PROFILE DATA                         PROPOSED PROFILE DATA
    POINT   X-VALUE   Y-VALUE                     POINT   X-VALUE   Y-VALUE
    -----   -------   -------                     -----   -------   -------
       1       0.00    585.00                        1       0.00    580.00
       2      65.00    585.00                        2      15.00    580.00
       3      65.00    580.00                        3      32.50    585.00
       4     200.00    580.00                        4      50.00    580.00
       5     200.00    585.00                        5      65.00    580.00
       6     320.00    585.00                        6     320.00    580.00

AREA IN CUT                837.5 FT^2
AREA IN FILL                 0.0 FT^2

VOL  CUT THIS REACH       1053.2 YD^3
VOL FILL THIS REACH          0.0 YD^3

VOL  CUT TOTAL            1053.2 YD^3
VOL FILL TOTAL               0.0 YD^3
```

```
* CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

OJECT: RRF.LTV
       STATION          100.0 FT

    EXISTING PROFILE DATA                        PROPOSED PROFILE DATA
    POINT    X-VALUE    Y-VALUE                  POINT    X-VALUE    Y-VALUE
    -----    -------    -------                  -----    -------    -------
        1       0.00     585.00                      1       0.00     580.00
        2     150.00     586.00                      2      15.00     580.00
        3     330.00     585.00                      3      30.00     585.00
                                                     4      50.00     587.30
                                                     5      80.00     585.00
                                                     6     120.00     584.60
                                                     7     160.00     585.00
                                                     8     215.00     590.00
                                                     9     245.00     590.00
                                                    10     275.00     590.00
                                                    11     300.00     585.00
                                                    12     315.00     580.00
                                                    13     330.00     580.00

EA IN CUT                316.5 FT^2
EA IN FILL               468.0 FT^2

L   CUT THIS REACH       1068.5 YD^3
L FILL THIS REACH         433.3 YD^3

OL   CUT TOTAL           2121.7 YD^3
L FILL TOTAL              433.3 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***    CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: RRF.LTV
        STATION             150.0 FT

    EXISTING PROFILE DATA
    POINT    X-VALUE    Y-VALUE                 PROPOSED PROFILE DATA
    -----    -------    -------                 POINT    X-VALUE    Y-VALUE
        1       0.00     585.00                 -----    -------    -------
        2     165.00     589.20                     1       0.00     580.00
        3     320.00     585.00                     2      15.00     580.00
                                                    3      60.00     595.00
                                                    4     230.00     595.00
                                                    5     250.00     590.00
                                                    6     295.00     580.00
                                                    7     320.00     580.00

AREA IN CUT                 341.0 FT^2
AREA IN FILL               1431.5 FT^2

VOL  CUT THIS REACH          608.7 YD^3
VOL FILL THIS REACH         1758.7 YD^3

VOL  CUT TOTAL              2730.5 YD^3
VOL FILL TOTAL              2192.0 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***    CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: RRF.LTV
         STATION           200.0 FT

     EXISTING PROFILE DATA
     POINT    X-VALUE    Y-VALUE                   PROPOSED PROFILE DATA
     -----    -------    -------                   POINT    X-VALUE    Y-VALUE
                                                   -----    -------    -------
         1       0.00     585.00
         2     164.00     587.80                       1       0.00     580.00
         3     270.00     585.00                       2      35.00     580.00
                                                       3      75.00     590.00
                                                       4      90.00     595.00
                                                       5     160.00     595.00
                                                       6     205.00     590.00
                                                       7     250.00     580.00
                                                       8     270.00     580.00

AREA IN CUT               436.0 FT^2
AREA IN FILL              933.0 FT^2

VOL  CUT THIS REACH        719.5 YD^3
VOL FILL THIS REACH       2189.4 YD^3

VOL  CUT TOTAL            3449.9 YD^3
VOL FILL TOTAL            4381.4 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***    CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: RRF.LTV
         STATION           250.0 FT

     EXISTING PROFILE DATA
     POINT   X-VALUE   Y-VALUE                PROPOSED PROFILE DATA
     -----   -------   -------                POINT    X-VALUE   Y-VALUE
         1     45.00    585.00                -----    -------   -------
         2    235.00    585.00                    1      45.00    580.00
                                                  2      65.00    580.00
                                                  3     120.00    582.60
                                                  4     170.00    580.00
                                                  5     235.00    580.00

AREA IN CUT                813.5 FT^2
AREA IN FILL                 0.0 FT^2

VOL  CUT THIS REACH       1157.0 YD^3
VOL FILL THIS REACH        863.9 YD^3

VOL  CUT TOTAL            4606.9 YD^3
VOL FILL TOTAL            5245.3 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: RRF.LTV
         STATION            277.0 FT

     EXISTING PROFILE DATA                         PROPOSED PROFILE DATA
     POINT    X-VALUE    Y-VALUE                   POINT    X-VALUE    Y-VALUE
     -----    -------    -------                   -----    -------    -------
         1      70.00     585.00                       1      70.00     580.00
         2     150.00     585.00                       2     150.00     580.00

AREA IN CUT                 400.0 FT^2
AREA IN FILL                  0.0 FT^2

VOL  CUT THIS REACH          606.8 YD^3
VOL FILL THIS REACH            0.0 YD^3

VOL  CUT TOTAL              5213.7 YD^3
VOL FILL TOTAL              5245.3 YD^3
```

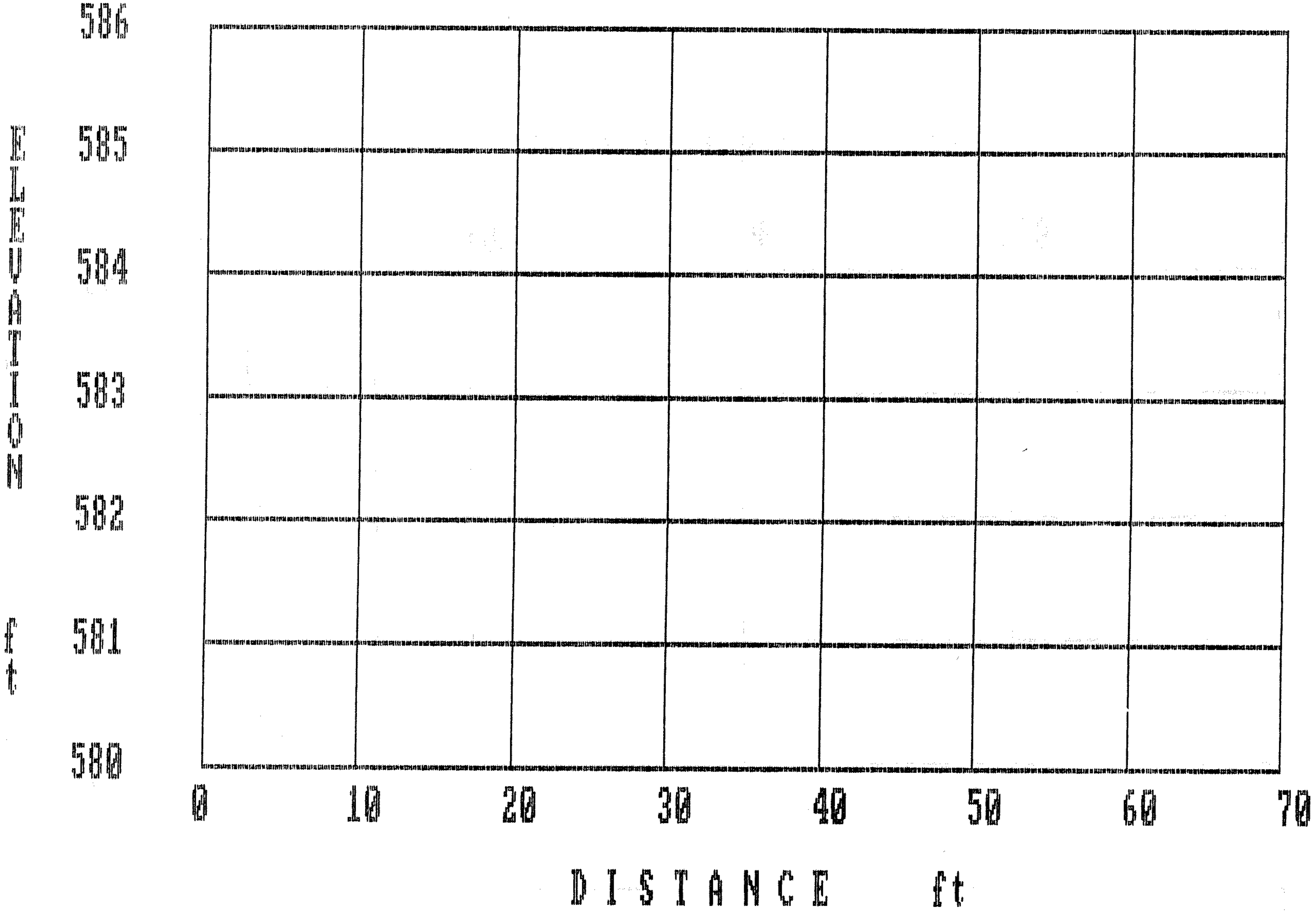
```
*** CUT & FILL BY AVERAGE END AREA METHOD ***    CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: RRF.LTV


                              S U M M A R Y   T A B L E
                              = = = = = = =   = = = = =

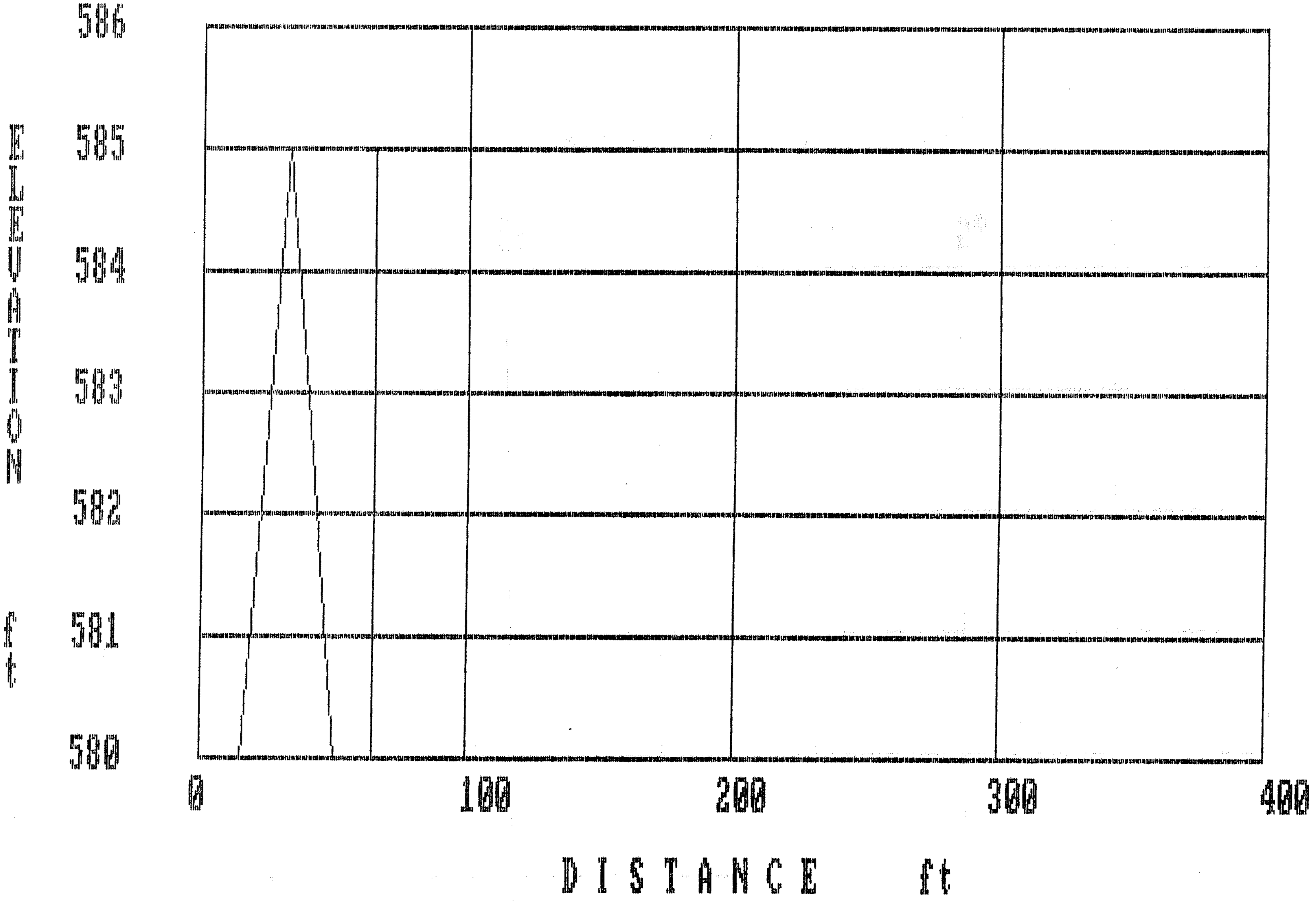

UNITS:    SECTION DATA  -- SQFT           STATION  -- FT
            REACH DATA  -- CUYD
            TOTAL DATA  -- CUYD
              NET DATA  -- CUYD

         -----------------------------------------------------------------
         !     SECTION      !       REACH        !       TOTAL       !      !
---------------------------------------------------------------------  NET  !
! STATION!    CUT  !  FILL  !   CUT  !   FILL  !   CUT  !   FILL  !  MASS  !
---------------------------------------------------------------------------
!       0!     300!       0!       0!       0!       0!       0!       0!
!      50!     838!       0!    1053!       0!    1053!       0!   -1053!
!     100!     316!     468!    1068!     433!    2122!     433!   -1688!
!     150!     341!    1431!     609!    1759!    2730!    2192!    -538!
!     200!     436!     933!     719!    2189!    3450!    4381!     931!
---------------------------------------------------------------------------
       250!     814!       0!    1157!     864!    4607!    5245!     638!
       277!     400!       0!     607!       0!    5214!    5245!      32!
---------------------------------------------------------------------------
```

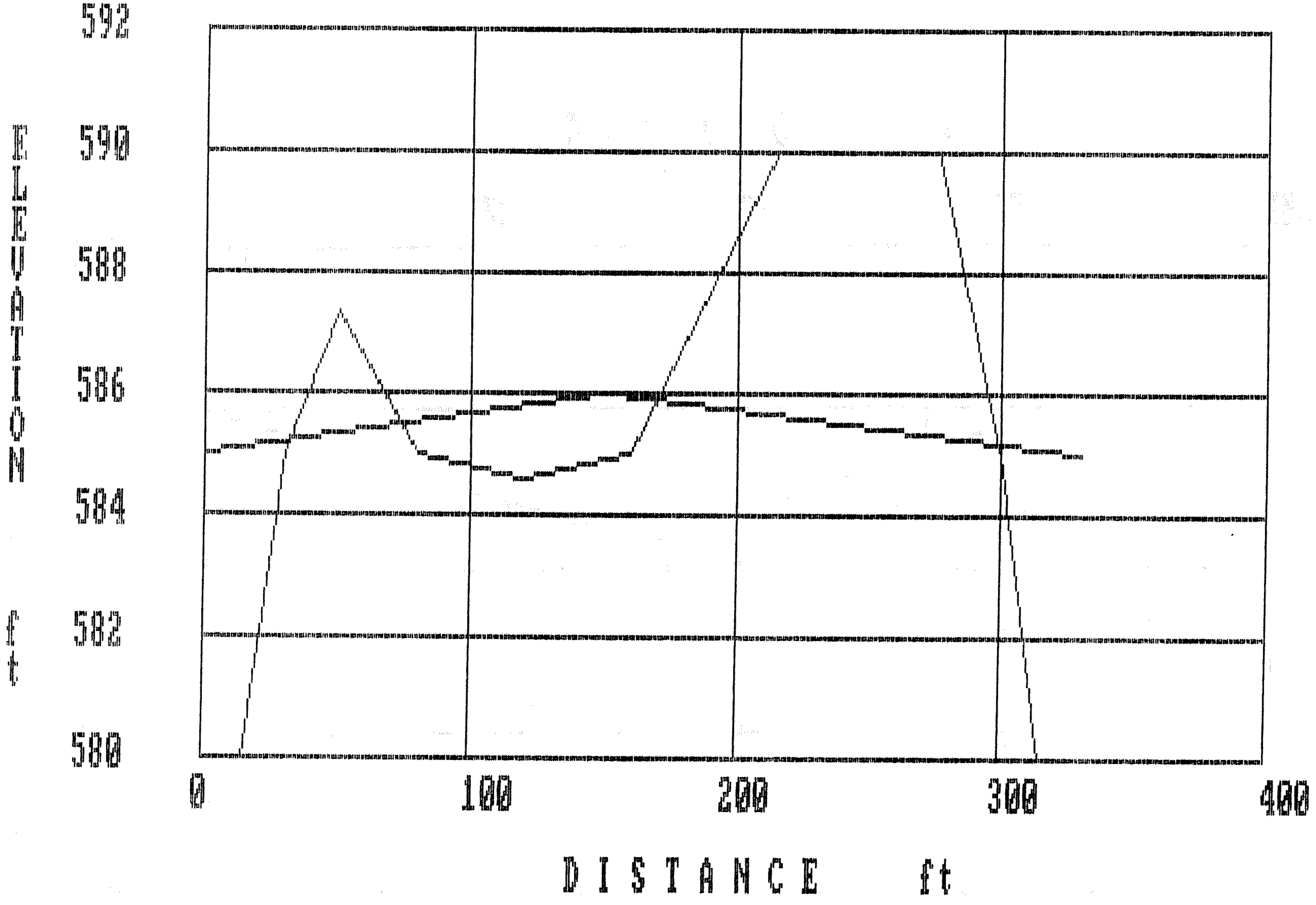

STATION: 0

586
585
584
583
582
581
580
ELEVATION ft
0
10
20
30
40
50
60
70
DISTANCE ft

STATION: 50


586
585
584
583
582
581
580
E L E V A T I O N ft
0
100
200
300
400
D I S T A N C E ft

STATION: 100


ELEVATION ft
592
590
588
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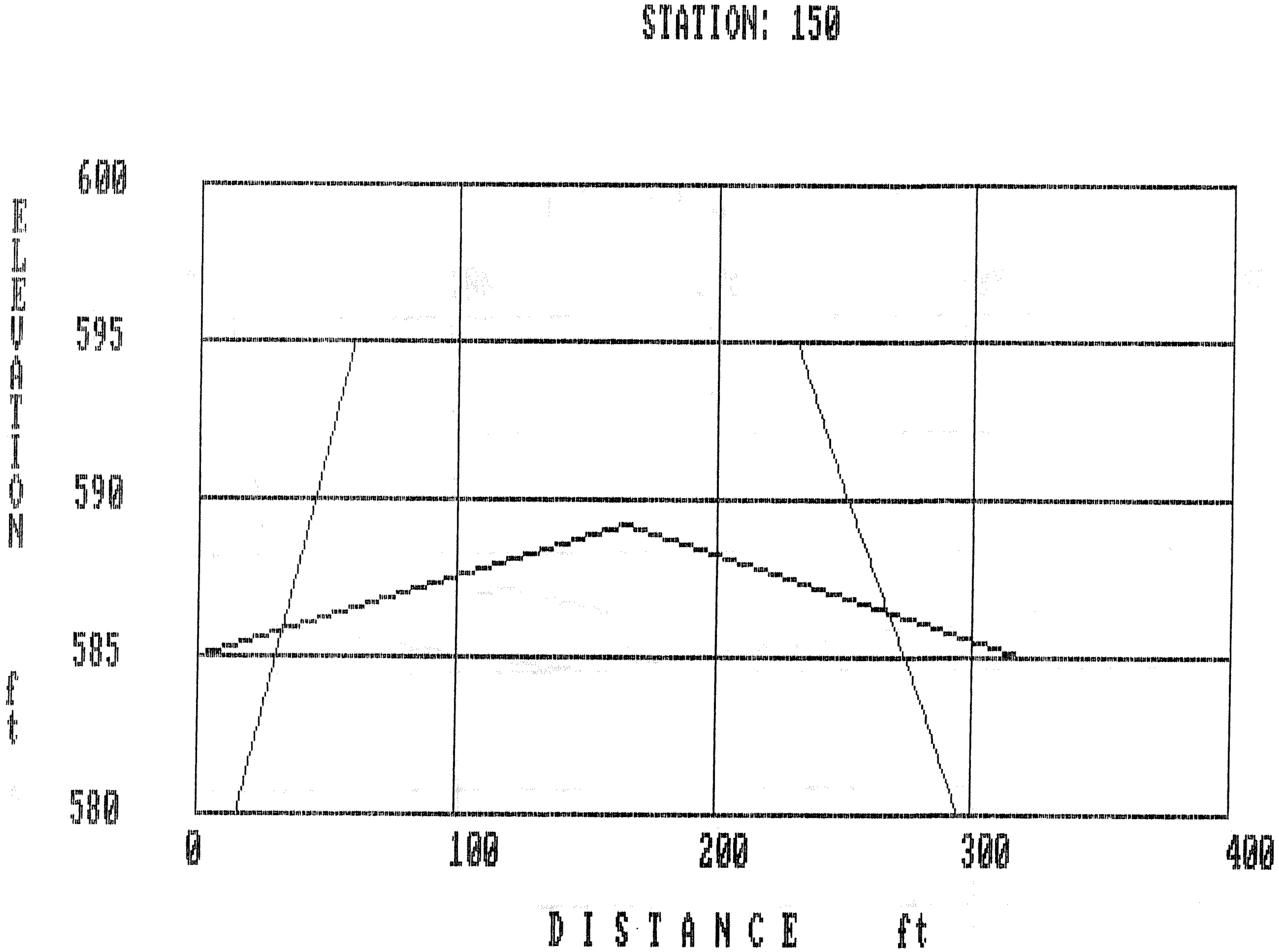
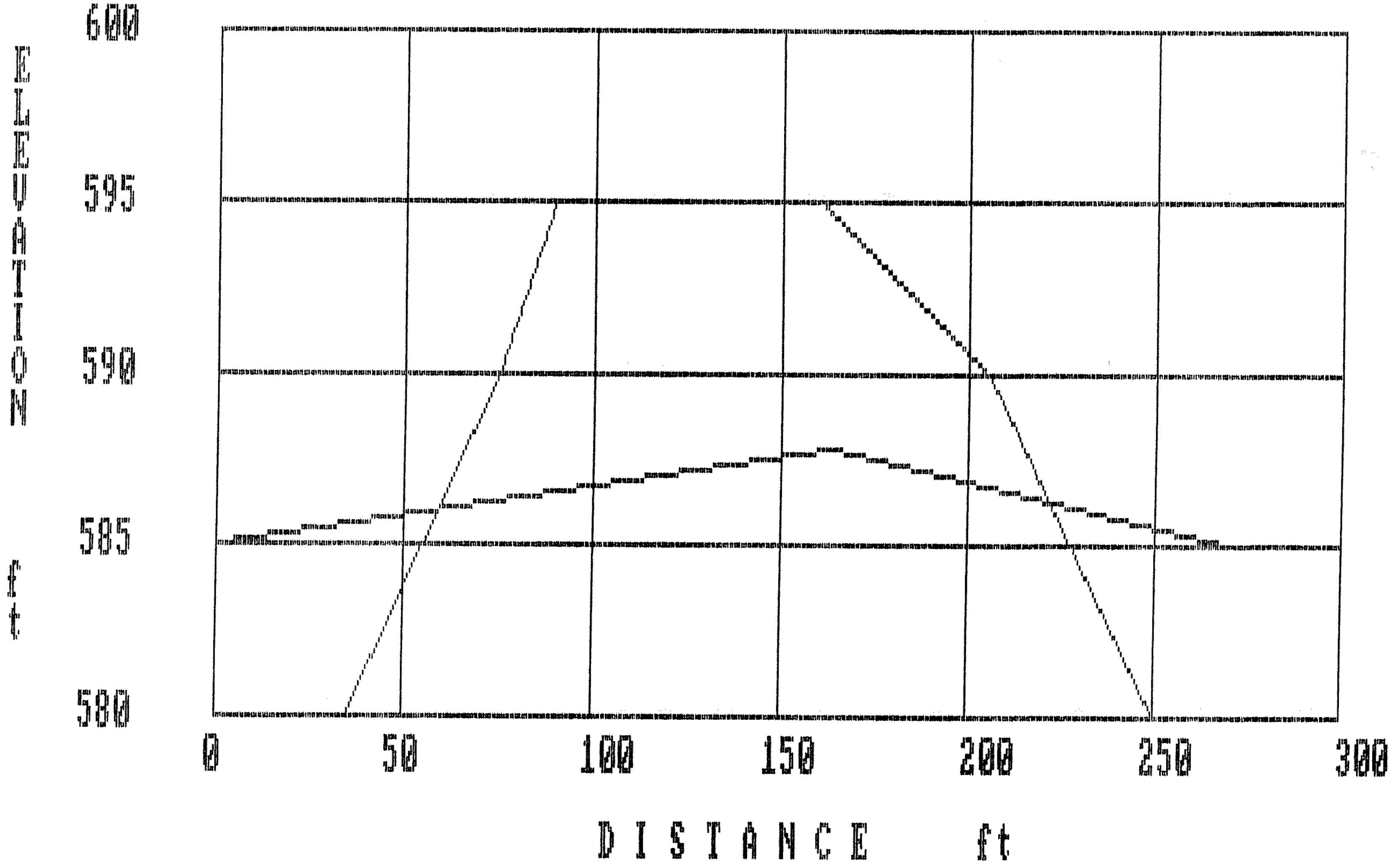
584
582
580
0
100
200
300
400
DISTANCE ft

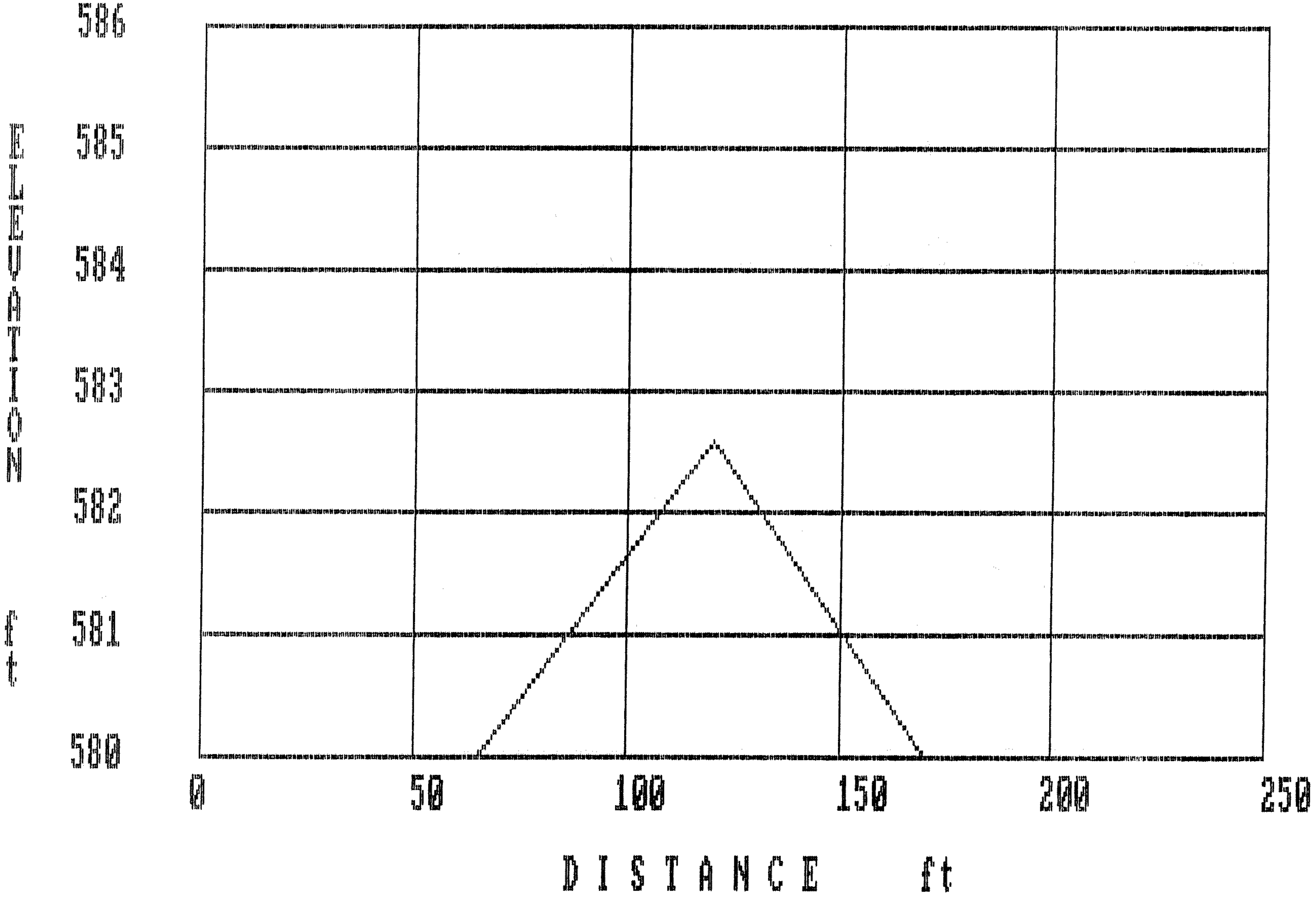

STATION: 150
600
595
590
585
580
ELEVATION
ft
0
100
200
300
400
DISTANCE ft

STATION: 200

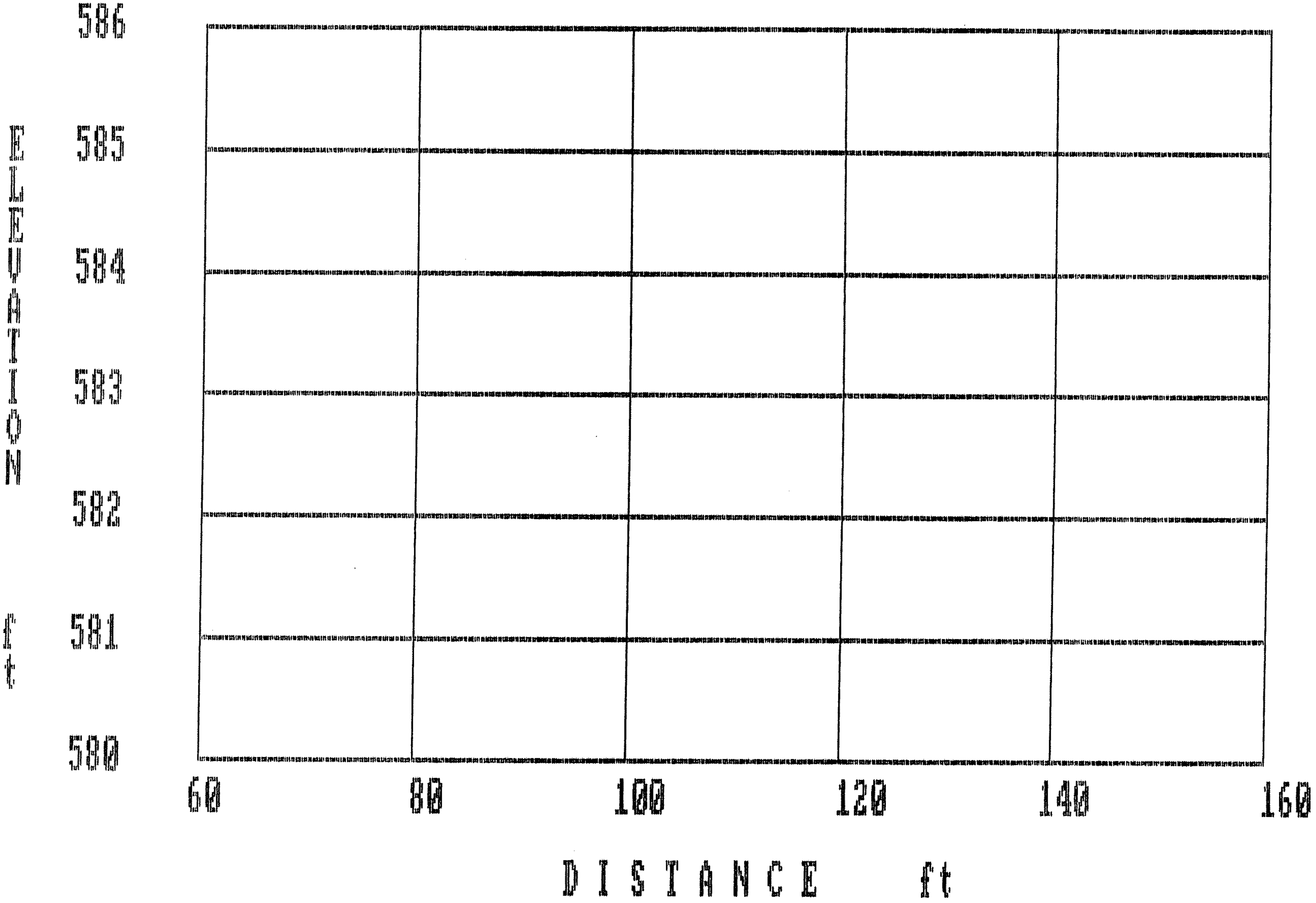


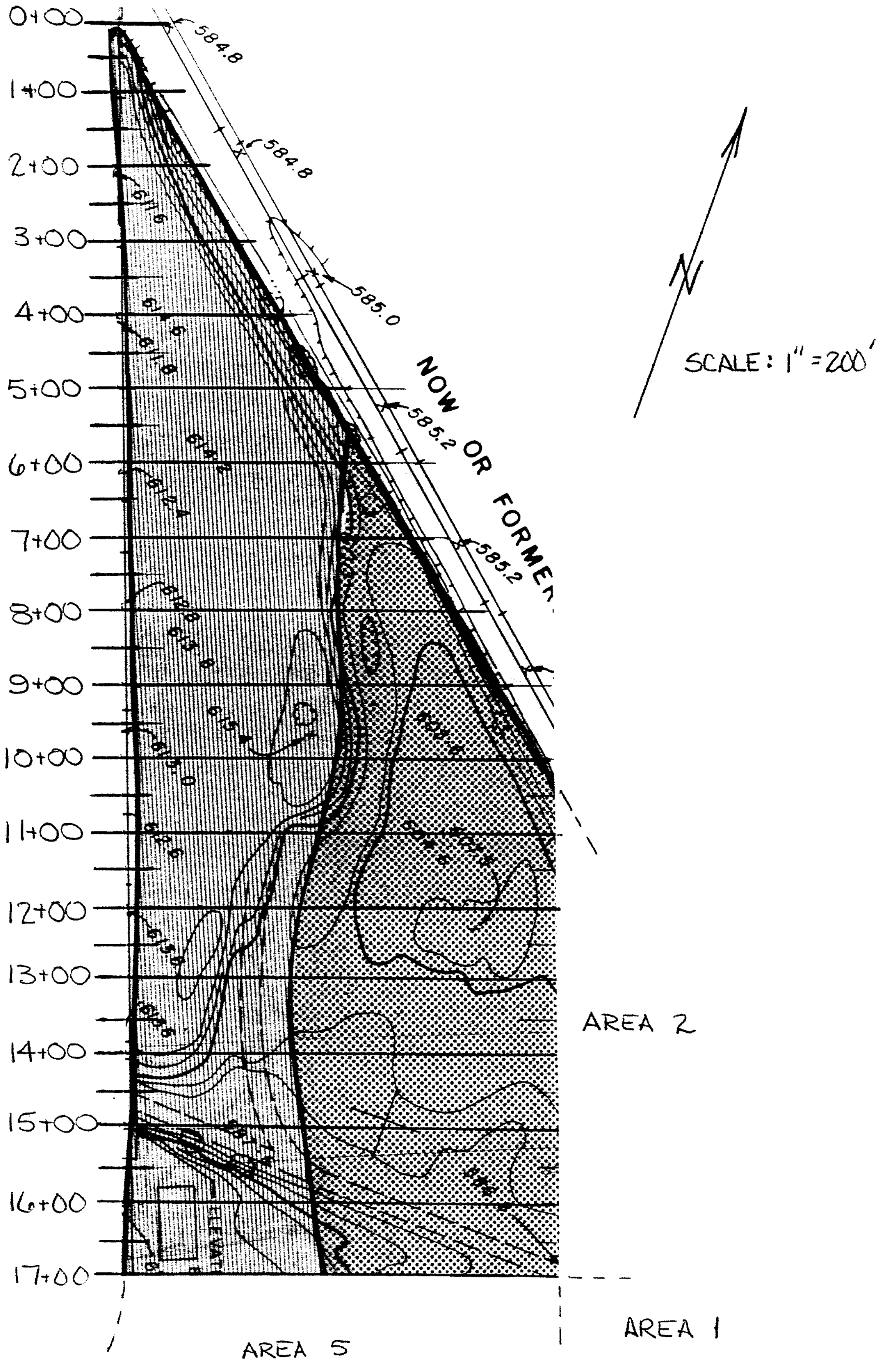
600
595
590
585
580
ELEVATION
ft
0
50
100
150
200
250
300
DISTANCE ft

STATION: 250


586
585
584
583
582
581
580
ELEVATION ft
0
50
100
150
200
250
DISTANCE ft

STATION: 277


586
585
584
583
582
581
580
ELEVATION ft
60
80
100
120
140
160
DISTANCE ft



AREA 1
STATION LOCATIONS
MISC. DEBRIS/FINE REFUSE
LTV STEEL

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR1.LTV
         STATION              0.0 FT

     EXISTING PROFILE DATA                        PROPOSED PROFILE DATA
     POINT    X-VALUE    Y-VALUE                  POINT    X-VALUE    Y-VALUE
     -----    -------    -------                  -----    -------    -------
         1      20.00     585.00                      1      20.00     580.00
         2      21.00     585.00                      2      21.00     580.00

AREA IN CUT                  5.0 FT^2
AREA IN FILL                 0.0 FT^2

VOL  CUT THIS REACH           0.0 YD^3
VOL FILL THIS REACH           0.0 YD^3

VOL  CUT TOTAL                0.0 YD^3
VOL FILL TOTAL                0.0 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR1.LTV
         STATION              50.0 FT

     EXISTING PROFILE DATA                        PROPOSED PROFILE DATA
     POINT    X-VALUE    Y-VALUE                  POINT    X-VALUE    Y-VALUE
     -----    -------    -------                  -----    -------    -------
         1      20.00     610.00                      1      20.00     581.40
         2      30.00     605.00                      2      35.00     580.00
         3      45.00     600.00                      3      50.00     580.00
         4      50.00     585.00

AREA IN CUT                  664.5 FT^2
AREA IN FILL                   0.0 FT^2

VOL  CUT THIS REACH            619.9 YD^3
VOL FILL THIS REACH              0.0 YD^3

VOL  CUT TOTAL                 619.9 YD^3
VOL FILL TOTAL                   0.0 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***    CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR1.LTV
         STATION           100.0 FT

     EXISTING PROFILE DATA                    PROPOSED PROFILE DATA
     POINT   X-VALUE   Y-VALUE                POINT   X-VALUE   Y-VALUE
     -----   -------   -------                -----   -------   -------
         1     20.00    611.45                    1     20.00    587.00
         2     40.00    610.00                    2     33.00    585.00
         3     50.00    605.00                    3     55.00    580.00
         4     55.00    600.00                    4     75.00    580.00
         5     60.00    595.00
         6     65.00    590.00
         7     75.00    585.00

AREA IN CUT              1094.0 FT^2
AREA IN FILL                0.0 FT^2

VOL  CUT THIS REACH       1628.2 YD^3
VOL FILL THIS REACH          0.0 YD^3

VOL  CUT TOTAL            2248.1 YD^3
VOL FILL TOTAL               0.0 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***    CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR1.LTV
         STATION           150.0 FT

     EXISTING PROFILE DATA
     POINT   X-VALUE   Y-VALUE                PROPOSED PROFILE DATA
     -----   -------   -------                POINT   X-VALUE   Y-VALUE
         1     20.00    611.50                -----   -------   -------
         2     50.00    610.00                    1     20.00    595.00
         3     60.00    605.00                    2     40.00    590.00
         4     70.00    600.00                    3     60.00    585.00
         5     75.00    595.00                    4     78.00    580.00
         6     80.00    590.00                    5     90.00    580.00
         7     90.00    585.00

AREA IN CUT              1202.5 FT^2
AREA IN FILL                0.0 FT^2

VOL  CUT THIS REACH       2126.4 YD^3
VOL FILL THIS REACH          0.0 YD^3

VOL  CUT TOTAL            4374.5 YD^3
VOL FILL TOTAL               0.0 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR1.LTV
        STATION             200.0 FT

     EXISTING PROFILE DATA                           PROPOSED PROFILE DATA
     POINT    X-VALUE    Y-VALUE                     POINT    X-VALUE    Y-VALUE
     -----    -------    -------                     -----    -------    -------
         1      20.00     611.60                         1      20.00     603.00
         2      70.00     610.00                         2      36.00     600.00
         3      80.00     605.00                         3      45.00     595.00
         4      90.00     600.00                         4      70.00     590.00
         5      95.00     595.00                         5      90.00     585.00
         6     105.00     590.00                         6     105.00     580.00
         7     120.00     585.00                         7     120.00     580.00

AREA IN CUT                 1363.5 FT^2
AREA IN FILL                   0.0 FT^2

VOL  CUT THIS REACH          2375.9 YD^3
VOL FILL THIS REACH             0.0 YD^3

VOL  CUT TOTAL               6750.5 YD^3
VOL FILL TOTAL                  0.0 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR1.LTV
         STATION          250.0 FT

     EXISTING PROFILE DATA                         PROPOSED PROFILE DATA
     POINT   X-VALUE   Y-VALUE                     POINT   X-VALUE   Y-VALUE
     -----   -------   -------                     -----   -------   -------
         1     20.00    611.65                         1     20.00    610.00
         2    100.00    610.00                         2     30.00    610.00
         3    110.00    605.00                         3     45.00    605.00
         4    112.00    600.00                         4     65.00    600.00
         5    125.00    595.00                         5     83.00    595.00
         6    135.00    590.00                         6     98.00    590.00
         7    155.00    585.00                         7    118.00    585.00
                                                       8    133.00    580.00
                                                       9    155.00    580.00

AREA IN CUT              1436.0 FT^2
AREA IN FILL                0.0 FT^2

VOL  CUT THIS REACH       2592.1 YD^3
VOL FILL THIS REACH          0.0 YD^3

VOL  CUT TOTAL            9342.6 YD^3
VOL FILL TOTAL               0.0 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***    CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR1.LTV
         STATION          300.0 FT

     EXISTING PROFILE DATA                      PROPOSED PROFILE DATA
     POINT    X-VALUE    Y-VALUE                POINT    X-VALUE    Y-VALUE
     -----    -------    -------                -----    -------    -------
         1      20.00     611.70                    1      20.00     610.00
         2     120.00     610.00                    2      60.00     610.00
         3     130.00     605.00                    3      77.00     605.00
         4     135.00     600.00                    4      93.00     600.00
         5     150.00     595.00                    5     111.00     595.00
         6     165.00     590.00                    6     127.00     590.00
         7     180.00     585.00                    7     146.00     585.00
                                                    8     162.00     580.00
                                                    9     180.00     580.00

AREA IN CUT               1310.0 FT^2
AREA IN FILL                 0.0 FT^2

VOL  CUT THIS REACH        2542.6 YD^3
VOL FILL THIS REACH           0.0 YD^3

VOL  CUT TOTAL            11885.2 YD^3
VOL FILL TOTAL                0.0 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***    CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR1.LTV
         STATION           350.0 FT

     EXISTING PROFILE DATA                          PROPOSED PROFILE DATA
     POINT    X-VALUE    Y-VALUE                    POINT    X-VALUE    Y-VALUE
     -----    -------    -------                    -----    -------    -------
         1      20.00     611.75                        1      20.00     610.00
         2     150.00     610.00                        2      86.00     610.00
         3     160.00     605.00                        3     104.00     605.00
         4     170.00     600.00                        4     121.00     600.00
         5     180.00     595.00                        5     138.00     595.00
         6     190.00     590.00                        6     150.00     590.00
         7     205.00     585.00                        7     174.00     585.00
                                                        8     190.00     580.00
                                                        9     205.00     580.00

AREA IN CUT               1401.3 FT^2
AREA IN FILL                 0.0 FT^2

VOL  CUT THIS REACH        2510.4 YD^3
VOL FILL THIS REACH           0.0 YD^3

VOL  CUT TOTAL            14395.6 YD^3
VOL FILL TOTAL                0.0 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR1.LTV
        STATION             400.0 FT

     EXISTING PROFILE DATA                        PROPOSED PROFILE DATA
     POINT    X-VALUE    Y-VALUE                  POINT    X-VALUE    Y-VALUE
     -----    -------    -------                  -----    -------    -------
         1      20.00     611.80                      1      20.00     610.00
         2     175.00     610.00                      2     115.00     610.00
         3     185.00     605.00                      3     132.00     605.00
         4     195.00     600.00                      4     150.00     600.00
         5     205.00     595.00                      5     166.00     595.00
         6     220.00     590.00                      6     183.00     590.00
         7     235.00     585.00                      7     201.00     585.00
                                                      8     217.00     580.00
                                                      9     235.00     580.00

AREA IN CUT                 1374.5 FT^2
AREA IN FILL                   0.0 FT^2

VOL  CUT THIS REACH          2570.1 YD^3
VOL FILL THIS REACH             0.0 YD^3

VOL  CUT TOTAL              16965.7 YD^3
VOL FILL TOTAL                  0.0 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR1.LTV
        STATION            450.0 FT

     EXISTING PROFILE DATA
     POINT   X-VALUE   Y-VALUE                  PROPOSED PROFILE DATA
     -----   -------   -------                  POINT   X-VALUE   Y-VALUE
                                                -----   -------   -------
         1     20.00    611.95
         2    205.00    610.00                      1     20.00    610.00
         3    230.00    600.00                      2    145.00    610.00
         4    245.00    595.00                      3    160.00    605.00
         5    260.00    590.00                      4    178.00    600.00
         6    265.00    585.00                      5    196.00    595.00
                                                    6    213.00    590.00
                                                    7    230.00    585.00
                                                    8    246.00    580.00
                                                    9    265.00    580.00

AREA IN CUT                1580.4 FT^2
AREA IN FILL                  0.0 FT^2

VOL  CUT THIS REACH        2736.0 YD^3
VOL FILL THIS REACH           0.0 YD^3

VOL  CUT TOTAL            19701.7 YD^3
VOL FILL TOTAL                0.0 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***    CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR1.LTV
         STATION              500.0 FT

     EXISTING PROFILE DATA                          PROPOSED PROFILE DATA
     POINT    X-VALUE    Y-VALUE                    POINT    X-VALUE    Y-VALUE
     -----    -------    -------                    -----    -------    -------
         1      20.00     612.10                        1      20.00     610.00
         2     235.00     610.00                        2     170.00     610.00
         3     250.00     600.00                        3     187.00     605.00
         4     260.00     595.00                        4     205.00     600.00
         5     275.00     590.00                        5     222.00     595.00
         6     295.00     585.00                        6     240.00     590.00
                                                        7     257.00     585.00
                                                        8     272.00     580.00
                                                        9     295.00     580.00

AREA IN CUT                1503.3 FT^2
AREA IN FILL                  0.0 FT^2

VOL  CUT THIS REACH         2855.2 YD^3
VOL FILL THIS REACH            0.0 YD^3

VOL  CUT TOTAL             22556.9 YD^3
VOL FILL TOTAL                 0.0 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***    CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR1.LTV
         STATION            550.0 FT

     EXISTING PROFILE DATA                     PROPOSED PROFILE DATA
     POINT    X-VALUE    Y-VALUE               POINT    X-VALUE    Y-VALUE
     -----    -------    -------               -----    -------    -------

         1      20.00     612.25                   1      20.00     610.00
         2     255.00     610.00                   2     198.00     610.00
         3     265.00     605.00                   3     215.00     605.00
         4     280.00     600.00                   4     232.00     600.00
         5     290.00     595.00                   5     250.00     595.00
         6     302.00     590.00                   6     266.00     590.00
         7     330.00     585.00                   7     285.00     585.00
                                                   8     300.00     580.00
                                                   9     330.00     580.00

AREA IN CUT                 1576.9 FT^2
AREA IN FILL                   0.0 FT^2

VOL  CUT THIS REACH          2852.0 YD^3
VOL FILL THIS REACH             0.0 YD^3

VOL  CUT TOTAL              25408.9 YD^3
VOL FILL TOTAL                  0.0 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR1.LTV
        STATION           600.0 FT

     EXISTING PROFILE DATA                          PROPOSED PROFILE DATA
     POINT    X-VALUE   Y-VALUE                     POINT    X-VALUE    Y-VALUE
     -----    -------   -------                     -----    -------    -------
         1      20.00    612.40                         1      20.00     610.00
         2     280.00    610.00                         2     225.00     610.00
         3     293.00    605.00                         3     243.00     605.00
         4     310.00    600.00                         4     262.00     600.00
         5     318.00    595.00                         5     270.00     595.00
         6     335.00    590.00                         6     295.00     590.00
         7     360.00    585.00                         7     312.00     585.00
                                                        8     330.00     580.00
                                                        9     360.00     580.00

AREA IN CUT                1694.5 FT^2
AREA IN FILL                  0.0 FT^2

VOL  CUT THIS REACH         3029.1 YD^3
VOL FILL THIS REACH            0.0 YD^3

VOL  CUT TOTAL             28438.0 YD^3
VOL FILL TOTAL                 0.0 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR1.LTV
         STATION          650.0 FT

     EXISTING PROFILE DATA                     PROPOSED PROFILE DATA
     POINT    X-VALUE    Y-VALUE               POINT    X-VALUE    Y-VALUE
     -----    -------    -------               -----    -------    -------
         1      20.00     612.50                   1      20.00     610.00
         2     290.00     610.00                   2     127.00     615.00
         3     305.00     605.00                   3     146.00     615.00
         4     325.00     600.00                   4     253.00     610.00
         5     340.00     595.00                   5     272.00     605.00
         6     380.00     590.00                   6     290.00     600.00
         7     390.00     585.00                   7     306.00     595.00
                                                   8     323.00     590.00
                                                   9     340.00     585.00
                                                  10     367.00     580.00
                                                  11     390.00     580.00

AREA IN CUT               1258.7 FT^2
AREA IN FILL               356.2 FT^2

VOL  CUT THIS REACH        2734.5 YD^3
VOL FILL THIS REACH         329.8 YD^3

VOL  CUT TOTAL            31172.4 YD^3
VOL FILL TOTAL              329.8 YD^3
```

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*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

ROJECT: MDFR1.LTV
         STATION          700.0 FT

      EXISTING PROFILE DATA                   PROPOSED PROFILE DATA
      POINT   X-VALUE   Y-VALUE               POINT   X-VALUE   Y-VALUE
      -----   -------   -------               -----   -------   -------
          1     20.00    612.60                   1     20.00    610.00
          2    285.00    610.00                   2    127.00    615.00
          3    300.00    605.00                   3    150.00    616.30
          4    320.00    600.00                   4    173.00    615.00
          5    335.00    595.00                   5    280.00    610.00
          6    350.00    595.00                   6    297.00    605.00
          7    410.00    590.00                   7    316.00    600.00
          8    420.00    585.00                   8    335.00    595.00
                                                  9    350.00    590.00
                                                 10    367.00    585.00
                                                 11    385.00    580.00
                                                 12    420.00    580.00

AREA IN CUT              797.4 FT^2
REA IN FILL              510.3 FT^2

VOL  CUT THIS REACH      1903.8 YD^3
OL FILL THIS REACH        802.4 YD^3

VOL  CUT TOTAL          33076.3 YD^3
OL FILL TOTAL            1132.2 YD^3
```

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*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR1.LTV
         STATION              750.0 FT

     EXISTING PROFILE DATA
     POINT    X-VALUE    Y-VALUE                     PROPOSED PROFILE DATA
     -----    -------    -------                     POINT    X-VALUE    Y-VALUE
                                                     -----    -------    -------
         1      20.00     612.70
         2     280.00     610.00                         1      20.00     610.00
         3     295.00     605.00                         2     127.00     615.00
         4     310.00     600.00                         3     164.00     617.00
         5     320.00     595.00                         4     202.00     615.00
         6     345.00     595.00                         5     310.00     610.00
         7     425.00     595.00                         6     325.00     605.00
         8     435.00     590.00                         7     345.00     600.00
         9     445.00     585.00                         8     360.00     595.00
                                                         9     380.00     590.00
                                                        10     395.00     585.00
                                                        11     415.00     580.00
                                                        12     445.00     580.00

AREA IN CUT                  826.3 FT^2
AREA IN FILL                1200.3 FT^2

VOL  CUT THIS REACH          1503.5 YD^3
VOL FILL THIS REACH          1583.9 YD^3

VOL  CUT TOTAL              34579.7 YD^3
VOL FILL TOTAL               2716.2 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118    VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR1.LTV
         STATION             800.0 FT

     EXISTING PROFILE DATA                        PROPOSED PROFILE DATA
     POINT    X-VALUE    Y-VALUE                  POINT    X-VALUE    Y-VALUE
     -----    -------    -------                  -----    -------    -------
       1       20.00     612.80                      1       20.00     610.00
       2      285.00     610.00                      2      127.00     615.00
       3      295.00     600.00                      3      210.00     615.00
       4      310.00     595.00                      4      315.00     610.00
       5      360.00     595.00                      5      332.00     605.00
       6      450.00     595.00                      6      350.00     600.00
       7      460.00     590.00                      7      366.00     595.00
       8      480.00     585.00                      8      383.00     590.00
                                                     9      400.00     585.00
                                                    10      420.00     580.00
                                                    11      480.00     580.00

AREA IN CUT              1213.4 FT^2
AREA IN FILL             1342.4 FT^2

VOL  CUT THIS REACH       1888.6 YD^3
VOL FILL THIS REACH       2354.4 YD^3

VOL  CUT TOTAL           36468.4 YD^3
VOL FILL TOTAL            5070.5 YD^3
```

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*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR1.LTV
         STATION            850.0 FT

     EXISTING PROFILE DATA                     PROPOSED PROFILE DATA
     POINT    X-VALUE    Y-VALUE               POINT    X-VALUE    Y-VALUE
     -----    -------    -------               -----    -------    -------
         1      20.00     612.87                   1      20.00     610.00
         2     245.00     615.00                   2     127.00     615.00
         3     290.00     615.00                   3     190.00     615.00
         4     300.00     610.00                   4     300.00     610.00
         5     310.00     600.00                   5     316.00     605.00
         6     325.00     595.00                   6     332.00     600.00
         7     380.00     595.00                   7     350.00     595.00
         8     415.00     600.00                   8     366.00     590.00
         9     460.00     600.00                   9     385.00     585.00
        10     480.00     595.00                  10     402.00     585.00
        11     490.00     590.00                  11     420.00     590.00
        12     505.00     585.00                  12     434.00     590.00
                                                  13     455.00     585.00
                                                  14     470.00     580.00
                                                  15     505.00     580.00

AREA IN CUT                 2001.2 FT^2
AREA IN FILL                 298.3 FT^2

VOL  CUT THIS REACH          2976.5 YD^3
VOL FILL THIS REACH          1519.2 YD^3

VOL  CUT TOTAL              39444.9 YD^3
VOL FILL TOTAL               6589.7 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118    VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR1.LTV
         STATION            900.0 FT

     EXISTING PROFILE DATA                        PROPOSED PROFILE DATA
     POINT    X-VALUE   Y-VALUE                   POINT    X-VALUE    Y-VALUE
     -----    -------   -------                   -----    -------    -------
         1      20.00    612.35                       1      20.00     610.00
         2     235.00    615.00                       2     127.00     615.00
         3     305.00    615.00                       3     178.00     615.00
         4     315.00    610.00                       4     285.00     610.00
         5     320.00    605.00                       5     301.00     605.00
         6     330.00    600.00                       6     316.00     600.00
         7     340.00    595.00                       7     332.00     595.00
         8     385.00    595.00                       8     350.00     590.00
         9     400.00    600.00                       9     365.00     585.00
        10     490.00    600.00                      10     385.00     590.00
        11     515.00    595.00                      11     407.00     595.00
        12     525.00    590.00                      12     446.00     595.00
        13     530.00    585.00                      13     465.00     590.00
                                                     14     482.00     585.00
                                                     15     500.00     580.00
                                                     16     530.00     580.00

AREA IN CUT               2416.9 FT^2
AREA IN FILL                81.8 FT^2

VOL  CUT THIS REACH        4090.8 YD^3
VOL FILL THIS REACH         351.9 YD^3

VOL  CUT TOTAL            43535.7 YD^3
VOL FILL TOTAL             6941.7 YD^3
```

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*** CUT & FILL BY AVERAGE END AREA METHOD ***    CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

   ECT: MDFR1.LTV
        STATION          950.0 FT

    EXISTING PROFILE DATA                          PROPOSED PROFILE DATA
    POINT    X-VALUE   Y-VALUE                     POINT    X-VALUE   Y-VALUE
    -----    -------   -------                     -----    -------   -------
        1      20.00    613.00                         1      20.00    610.00
        2     220.00    615.00                         2     127.00    615.00
        3     305.00    615.00                         3     162.00    615.00
        4     310.00    610.00                         4     268.00    610.00
        5     315.00    605.00                         5     286.00    605.00
        6     330.00    600.00                         6     301.00    600.00
        7     335.00    595.00                         7     317.00    595.00
        8     375.00    595.00                         8     334.00    590.00
        9     385.00    600.00                         9     348.00    590.00
       10     495.00    600.00                        10     370.00    595.00
       11     520.00    595.00                        11     460.00    600.00
       12     535.00    590.00                        12     475.00    595.00
       13     560.00    585.00                        13     495.00    590.00
                                                      14     510.00    585.00
                                                      15     525.00    580.00
                                                      16     560.00    580.00

AREA IN CUT               2204.4 FT^2
AREA IN FILL                41.9 FT^2

VOL  CUT THIS REACH        4279.0 YD^3
VOL FILL THIS REACH         114.6 YD^3

VOL  CUT TOTAL            47814.7 YD^3
VOL FILL TOTAL             7056.2 YD^3
```

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*** CUT & FILL BY AVERAGE END AREA METHOD ***    CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR1.LTV
        STATION          1000.0 FT

     EXISTING PROFILE DATA                    PROPOSED PROFILE DATA
     POINT    X-VALUE    Y-VALUE              POINT    X-VALUE    Y-VALUE
     -----    -------    -------              -----    -------    -------
         1      20.00     613.12                  1      20.00     610.00
         2     210.00     615.00                  2     127.00     615.00
         3     300.00     615.00                  3     146.00     615.00
         4     315.00     610.00                  4     252.00     610.00
         5     320.00     605.00                  5     270.00     605.00
         6     330.00     600.00                  6     285.00     600.00
         7     345.00     595.00                  7     300.00     595.00
         8     370.00     595.00                  8     315.00     591.00
         9     380.00     600.00                  9     331.00     595.00
        10     530.00     600.00                 10     424.00     600.00
        11     550.00     595.00                 11     485.00     600.00
        12     560.00     590.00                 12     505.00     595.00
        13     565.00     585.00                 13     520.00     590.00
                                                 14     535.00     585.00
                                                 15     555.00     580.00
                                                 16     565.00     580.00

AREA IN CUT               2231.2 FT^2
AREA IN FILL                67.8 FT^2

VOL  CUT THIS REACH        4107.0 YD^3
VOL FILL THIS REACH         101.6 YD^3

VOL  CUT TOTAL            51921.7 YD^3
VOL FILL TOTAL             7157.8 YD^3
```

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*** CUT & FILL BY AVERAGE END AREA METHOD ***    CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR1.LTV
         STATION          1050.0 FT

     EXISTING PROFILE DATA                        PROPOSED PROFILE DATA
     POINT    X-VALUE    Y-VALUE                  POINT    X-VALUE    Y-VALUE
     -----    -------    -------                  -----    -------    -------
         1      20.00     613.24                      1      20.00     610.00
         2     240.00     615.00                      2     130.00     615.00
         3     270.00     615.00                      3     236.00     610.00
         4     290.00     610.00                      4     254.00     605.00
         5     300.00     605.00                      5     270.00     600.00
         6     315.00     600.00                      6     285.00     595.00
         7     330.00     595.00                      7     295.00     595.00
         8     365.00     595.00                      8     385.00     600.00
         9     375.00     600.00                      9     500.00     605.00
        10     560.00     600.00                     10     515.00     600.00
        11     565.00     598.00                     11     530.00     595.00
                                                     12     547.00     590.00
                                                     13     565.00     585.00

AREA IN CUT               1645.2 FT^2
AREA IN FILL               466.3 FT^2

VOL  CUT THIS REACH        3589.2 YD^3
VOL FILL THIS REACH         494.5 YD^3

VOL  CUT TOTAL            55511.0 YD^3
VOL FILL TOTAL             7652.3 YD^3
```

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*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR1.LTV
         STATION          1100.0 FT

      EXISTING PROFILE DATA
      POINT    X-VALUE    Y-VALUE                  PROPOSED PROFILE DATA
      -----    -------    -------                  POINT    X-VALUE    Y-VALUE
                                                   -----    -------    -------
         1      20.00     613.36
         2     210.00     610.00                      1      20.00     610.00
         3     230.00     600.00                      2     220.00     610.00
         4     290.00     595.00                      3     235.00     605.00
         5     345.00     595.00                      4     250.00     600.00
         6     360.00     600.00                      5     265.00     597.00
         7     565.00     600.50                      6     350.00     600.00
                                                      7     470.00     605.00
                                                      8     525.00     605.00
                                                      9     540.00     600.00
                                                     10     560.00     595.00
                                                     11     565.00     593.00

AREA IN CUT               411.3 FT^2
AREA IN FILL             1035.8 FT^2

VOL  CUT THIS REACH       1904.2 YD^3
VOL FILL THIS REACH       1390.9 YD^3

VOL  CUT TOTAL           57415.1 YD^3
VOL FILL TOTAL            9043.2 YD^3
```

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*** CUT & FILL BY AVERAGE END AREA METHOD ***    CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR1.LTV
        STATION          1150.0 FT

     EXISTING PROFILE DATA                     PROPOSED PROFILE DATA
     POINT   X-VALUE   Y-VALUE                 POINT   X-VALUE   Y-VALUE
     -----   -------   -------                 -----   -------   -------
         1     20.00    613.48                     1     20.00    610.00
         2    170.00    610.00                     2    180.00    610.00
         3    205.00    605.00                     3    200.00    605.00
         4    220.00    600.00                     4    220.00    600.00
         5    255.00    595.00                     5    240.00    595.00
         6    325.00    595.00                     6    310.00    600.00
         7    335.00    600.00                     7    435.00    605.00
         8    540.00    605.00                     8    555.00    605.00
         9    565.00    605.00                     9    565.00    601.00

AREA IN CUT               329.8 FT^2
AREA IN FILL              611.3 FT^2

VOL  CUT THIS REACH        686.2 YD^3
VOL FILL THIS REACH       1525.1 YD^3

VOL  CUT TOTAL           58101.3 YD^3
VOL FILL TOTAL           10568.3 YD^3
```

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*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR1.LTV
        STATION             1200.0 FT

     EXISTING PROFILE DATA                        PROPOSED PROFILE DATA
     POINT    X-VALUE    Y-VALUE                  POINT    X-VALUE    Y-VALUE
     -----    -------    -------                  -----    -------    -------
         1      20.00     613.60                      1      20.00     610.00
         2     130.00     615.00                      2     145.00     610.00
         3     145.00     615.00                      3     165.00     605.00
         4     155.00     610.00                      4     183.00     600.00
         5     190.00     605.00                      5     200.00     595.00
         6     200.00     600.00                      6     223.00     595.00
         7     240.00     595.00                      7     291.00     600.00
         8     305.00     595.00                      8     395.00     605.00
         9     325.00     600.00                      9     521.00     610.00
        10     410.00     605.00                     10     565.00     610.00
        11     565.00     605.00

AREA IN CUT                 901.3 FT^2
AREA IN FILL                940.8 FT^2

VOL  CUT THIS REACH        1139.9 YD^3
VOL FILL THIS REACH        1437.1 YD^3

VOL  CUT TOTAL            59241.3 YD^3
VOL FILL TOTAL            12005.5 YD^3
```

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*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR1.LTV
         STATION          1250.0 FT

     EXISTING PROFILE DATA                  PROPOSED PROFILE DATA
     POINT    X-VALUE    Y-VALUE            POINT    X-VALUE    Y-VALUE
     -----    -------    -------            -----    -------    -------
         1      20.00     613.60                1      20.00     610.00
         2      95.00     615.00                2     108.00     610.00
         3     135.00     615.00                3     126.00     605.00
         4     145.00     610.00                4     145.00     600.00
         5     155.00     605.00                5     160.00     595.00
         6     170.00     600.00                6     180.00     590.00
         7     255.00     595.00                7     190.00     590.00
         8     335.00     600.00                8     206.00     595.00
         9     410.00     605.00                9     275.00     600.00
        10     565.00     605.00               10     370.00     605.00
                                               11     480.00     610.00
                                               12     565.00     610.00

AREA IN CUT              1248.5 FT^2
AREA IN FILL             1183.5 FT^2

VOL  CUT THIS REACH       1990.6 YD^3
VOL FILL THIS REACH       1967.0 YD^3

VOL  CUT TOTAL           61231.8 YD^3
VOL FILL TOTAL           13972.4 YD^3
```

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 *** CUT & FILL BY AVERAGE END AREA METHOD ***    CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singnofen, P.E.

 ROJECT: MDFR1.LTV
        STATION           1300.0 FT

     EXISTING PROFILE DATA                              PROPOSED PROFILE DATA
     POINT    X-VALUE    Y-VALUE                        POINT    X-VALUE    Y-VALUE
     -----    -------    -------                        -----    -------    -------
         1      20.00     613.60                            1      20.00     610.00
         2      80.00     615.00                            2      75.00     610.00
         3     105.00     615.00                            3      90.00     605.00
         4     130.00     610.00                            4     110.00     600.00
         5     140.00     605.00                            5     130.00     595.00
         6     150.00     600.00                            6     145.00     590.00
         7     480.00     600.00                            7     160.00     587.00
         8     565.00     600.00                            8     175.00     590.00
                                                            9     192.00     595.00
                                                           10     260.00     600.00
                                                           11     355.00     605.00
                                                           12     446.00     610.00
                                                           13     565.00     615.00

 REA IN CUT               1738.0 FT^2
 REA IN FILL              2407.5 FT^2

 OL  CUT THIS REACH        2765.3 YD^3
 OL FILL THIS REACH        3325.0 YD^3

 OL  CUT TOTAL            63997.1 YD^3
 OL FILL TOTAL            17297.4 YD^3
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*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR1.LTV
         STATION          1350.0 FT

     EXISTING PROFILE DATA                          PROPOSED PROFILE DATA
     POINT   X-VALUE   Y-VALUE                      POINT   X-VALUE   Y-VALUE
     -----   -------   -------                      -----   -------   -------
         1     20.00    613.60                          1     20.00    600.00
         2    120.00    610.00                          2     75.00    600.00
         3    130.00    605.00                          3     90.00    595.00
         4    140.00    600.00                          4    106.00    590.00
         5    310.00    595.00                          5    126.00    585.00
         6    365.00    595.00                          6    140.00    585.00
         7    565.00    598.00                          7    155.00    590.00
                                                        8    175.00    595.00
                                                        9    245.00    600.00
                                                       10    335.00    605.00
                                                       11    430.00    610.00
                                                       12    575.00    615.00
                                                       13    565.00    615.00

AREA IN CUT               2295.2 FT^2
AREA IN FILL              3910.2 FT^2

VOL  CUT THIS REACH        3734.4 YD^3
VOL FILL THIS REACH        5849.7 YD^3

VOL  CUT TOTAL            67731.5 YD^3
VOL FILL TOTAL            23147.1 YD^3
```

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*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR1.LTV
         STATION           1400.0 FT

     EXISTING PROFILE DATA                          PROPOSED PROFILE DATA
     POINT    X-VALUE    Y-VALUE                    POINT    X-VALUE    Y-VALUE
     -----    -------    -------                    -----    -------    -------
         1      20.00     605.00                        1      20.00     584.00
         2      90.00     605.00                        2     125.00     585.00
         3     120.00     600.00                        3     145.00     590.00
         4     150.00     595.00                        4     165.00     595.00
         5     170.00     595.00                        5     230.00     600.00
         6     195.00     595.00                        6     320.00     605.00
         7     375.00     595.00                        7     415.00     610.00
         8     565.00     597.00                        8     510.00     615.00
                                                        9     565.00     616.50

AREA IN CUT                2302.5 FT^2
AREA IN FILL               4638.8 FT^2

VOL  CUT THIS REACH         4257.1 YD^3
VOL FILL THIS REACH         7915.7 YD^3

VOL  CUT TOTAL             71988.6 YD^3
VOL FILL TOTAL             31062.8 YD^3
```

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*** CUT & FILL BY AVERAGE END AREA METHOD ***    CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR1.LTV
         STATION            1450.0 FT

        EXISTING PROFILE DATA                      PROPOSED PROFILE DATA
        POINT    X-VALUE    Y-VALUE                POINT    X-VALUE    Y-VALUE
        -----    -------    -------                -----    -------    -------
          1       20.00     585.00                   1       20.00     580.00
          2      250.00     590.00                   2      125.00     580.00
          3      385.00     595.00                   3      165.00     585.00
          4      500.00     595.00                   4      205.00     590.00
          5      565.00     594.00                   5      250.00     595.00
                                                     6      290.00     600.00
                                                     7      330.00     605.00
                                                     8      400.00     610.00
                                                     9      495.00     615.00
                                                    10      565.00     610.00

AREA IN CUT                  901.6 FT^2
AREA IN FILL                4671.7 FT^2

VOL  CUT THIS REACH          2966.8 YD^3
VOL FILL THIS REACH          8620.7 YD^3

VOL  CUT TOTAL              74955.4 YD^3
VOL FILL TOTAL              39683.5 YD^3
```

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*** CUT & FILL BY AVERAGE END AREA METHOD ***    CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR1.LTV
         STATION          1500.0 FT

     EXISTING PROFILE DATA                    PROPOSED PROFILE DATA
     POINT    X-VALUE    Y-VALUE              POINT    X-VALUE    Y-VALUE
     -----    -------    -------              -----    -------    -------
         1      20.00     610.00                  1      20.00     590.00
         2      40.00     600.00                  2      70.00     585.00
         3      75.00     595.00                  3     115.00     580.00
         4      80.00     590.00                  4     255.00     580.00
         5     280.00     590.00                  5     295.00     585.00
         6     515.00     590.00                  6     335.00     590.00
         7     540.00     590.00                  7     380.00     595.00
         8     565.00     592.00                  8     420.00     600.00
                                                  9     460.00     605.00
                                                 10     500.00     610.00
                                                 11     565.00     610.00

AREA IN CUT             2837.5 FT^2
AREA IN FILL            2887.5 FT^2

VOL  CUT THIS REACH      3462.2 YD^3
VOL FILL THIS REACH      6999.2 YD^3

VOL  CUT TOTAL          78417.6 YD^3
VOL FILL TOTAL          46682.7 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR1.LTV
         STATION           1550.0 FT

     EXISTING PROFILE DATA                        PROPOSED PROFILE DATA
     POINT    X-VALUE    Y-VALUE                  POINT    X-VALUE    Y-VALUE
     -----    -------    -------                  -----    -------    -------
         1      20.00     613.60                      1      20.00     606.00
         2     130.00     610.00                      2      35.00     605.00
         3     150.00     605.00                      3      75.00     600.00
         4     160.00     600.00                      4     115.00     595.00
         5     180.00     595.00                      5     155.00     590.00
         6     195.00     590.00                      6     195.00     585.00
         7     375.00     590.00                      7     240.00     580.00
         8     420.00     590.00                      8     375.00     580.00
         9     530.00     590.00                      9     420.00     585.00
        10     565.00     592.00                     10     460.00     590.00
                                                     11     500.00     595.00
                                                     12     540.00     600.00
                                                     13     565.00     603.00

AREA IN CUT               4153.0 FT^2
AREA IN FILL               652.5 FT^2

VOL  CUT THIS REACH        6472.7 YD^3
VOL FILL THIS REACH        3277.8 YD^3

VOL  CUT TOTAL            84890.3 YD^3
VOL FILL TOTAL            49960.5 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR1.LTV
         STATION           1600.0 FT

     EXISTING PROFILE DATA                         PROPOSED PROFILE DATA
     POINT   X-VALUE   Y-VALUE                     POINT   X-VALUE   Y-VALUE
     -----   -------   -------                     -----   -------   -------
         1     20.00    613.60                         1     20.00    610.00
         2    160.00    610.00                         2    120.00    610.00
         3    210.00    605.00                         3    165.00    605.00
         4    240.00    600.00                         4    202.00    600.00
         5    275.00    595.00                         5    245.00    595.00
         6    305.00    590.00                         6    285.00    590.00
         7    545.00    590.00                         7    325.00    585.00
         8    565.00    591.00                         8    365.00    580.00
                                                       9    505.00    580.00
                                                      10    545.00    585.00
                                                      11    565.00    587.00

AREA IN CUT                3157.0 FT^2
AREA IN FILL                  0.0 FT^2

VOL  CUT THIS REACH         6768.5 YD^3
VOL FILL THIS REACH          604.2 YD^3

VOL  CUT TOTAL             91658.8 YD^3
VOL FILL TOTAL             50564.7 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR1.LTV
         STATION           1650.0 FT

     EXISTING PROFILE DATA                          PROPOSED PROFILE DATA
     POINT   X-VALUE   Y-VALUE                      POINT   X-VALUE   Y-VALUE
     -----   -------   -------                      -----   -------   -------
         1     20.00    613.60                          1     20.00    610.00
         2    180.00    610.00                          2    245.00    610.00
         3    270.00    605.00                          3    290.00    605.00
         4    310.00    600.00                          4    330.00    600.00
         5    370.00    595.00                          5    370.00    595.00
         6    420.00    590.00                          6    410.00    590.00
         7    565.00    588.00                          7    450.00    585.00
                                                        8    490.00    580.00
                                                        9    565.00    580.00

AREA IN CUT               1318.0 FT^2
AREA IN FILL               362.5 FT^2

VOL  CUT THIS REACH        4143.5 YD^3
VOL FILL THIS REACH         335.6 YD^3

VOL  CUT TOTAL            95802.3 YD^3
VOL FILL TOTAL            50900.3 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***    CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR1.LTV
         STATION          1700.0 FT

     EXISTING PROFILE DATA                       PROPOSED PROFILE DATA
     POINT   X-VALUE    Y-VALUE                  POINT    X-VALUE    Y-VALUE
     -----   -------    -------                  -----    -------    -------
        1      20.00     613.60                     1       20.00     610.00
        2     230.00     610.00                     2      370.00     610.00
        3     300.00     605.00                     3      410.00     605.00
        4     310.00     600.00                     4      450.00     600.00
        5     340.00     595.00                     5      490.00     595.00
        6     455.00     590.00
        7     565.00     585.00

AREA IN CUT               378.0 FT^2
AREA IN FILL             2465.3 FT^2

VOL  CUT THIS REACH       1570.4 YD^3
VOL FILL THIS REACH       2618.4 YD^3

VOL  CUT TOTAL           97372.7 YD^3
VOL FILL TOTAL           53518.7 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR1.LTV


                                 S U M M A R Y   T A B L E
                                 = = = = = = =   = = = = =


UNITS:   SECTION DATA  -- SQFT          STATION  -- FT
           REACH DATA  -- CUYD
           TOTAL DATA  -- CUYD
             NET DATA  -- CUYD

            ---------------------------------------------------------------
            ¦     SECTION      ¦      REACH       ¦      TOTAL       ¦     ¦
---------------------------------------------------------------------      ¦
¦ STATION¦    CUT  ¦   FILL  ¦    CUT  ¦   FILL  ¦    CUT  ¦   FILL  ¦  NET    ¦
                                                                      MASS    ¦
----------------------------------------------------------------------------
¦       0¦        5¦        0¦        0¦        0¦        0¦        0¦       0¦
¦      50¦      665¦        0¦      620¦        0¦      620¦        0¦    -620¦
¦     100¦     1094¦        0¦     1628¦        0¦     2248¦        0¦   -2248¦
¦     150¦     1203¦        0¦     2126¦        0¦     4375¦        0¦   -4375¦
¦     200¦     1364¦        0¦     2376¦        0¦     6750¦        0¦   -6750¦
----------------------------------------------------------------------------
¦     250¦     1436¦        0¦     2592¦        0¦     9343¦        0¦   -9343¦
¦     300¦     1310¦        0¦     2543¦        0¦    11885¦        0¦  -11885¦
¦     350¦     1401¦        0¦     2510¦        0¦    14396¦        0¦  -14396¦
¦     400¦     1375¦        0¦     2570¦        0¦    16966¦        0¦  -16966¦
¦     450¦     1580¦        0¦     2736¦        0¦    19702¦        0¦  -19702¦
----------------------------------------------------------------------------
¦     500¦     1503¦        0¦     2855¦        0¦    22557¦        0¦  -22557¦
¦     550¦     1577¦        0¦     2852¦        0¦    25409¦        0¦  -25409¦
¦     600¦     1695¦        0¦     3029¦        0¦    28438¦        0¦  -28438¦
¦     650¦     1259¦      356¦     2734¦      330¦    31172¦      330¦  -30843¦
¦     700¦      797¦      510¦     1904¦      802¦    33076¦     1132¦  -31944¦
----------------------------------------------------------------------------
¦     750¦      826¦     1200¦     1503¦     1584¦    34580¦     2716¦  -31864¦
¦     800¦     1213¦     1342¦     1889¦     2354¦    36468¦     5071¦  -31398¦
¦     850¦     2001¦      298¦     2976¦     1519¦    39445¦     6590¦  -32855¦
¦     900¦     2417¦       82¦     4091¦      352¦    43536¦     6942¦  -36594¦
¦     950¦     2204¦       42¦     4279¦      115¦    47815¦     7056¦  -40759¦
----------------------------------------------------------------------------
¦    1000¦     2231¦       68¦     4107¦      102¦    51922¦     7158¦  -44764¦
¦    1050¦     1645¦      466¦     3589¦      495¦    55511¦     7652¦  -47859¦
¦    1100¦      411¦     1036¦     1904¦     1391¦    57415¦     9043¦  -48372¦
¦    1150¦      330¦      611¦      686¦     1525¦    58101¦    10568¦  -47533¦
¦    1200¦      901¦      941¦     1140¦     1437¦    59241¦    12005¦  -47236¦
----------------------------------------------------------------------------
¦    1250¦     1249¦     1184¦     1991¦     1967¦    61232¦    13972¦  -47259¦
¦    1300¦     1738¦     2408¦     2765¦     3325¦    63997¦    17297¦  -46700¦
¦    1350¦     2295¦     3910¦     3734¦     5850¦    67732¦    23147¦  -44584¦
¦    1400¦     2303¦     4639¦     4257¦     7916¦    71989¦    31063¦  -40926¦
¦    1450¦      902¦     4672¦     2967¦     8621¦    74955¦    39684¦  -35272¦
----------------------------------------------------------------------------
```

```
** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

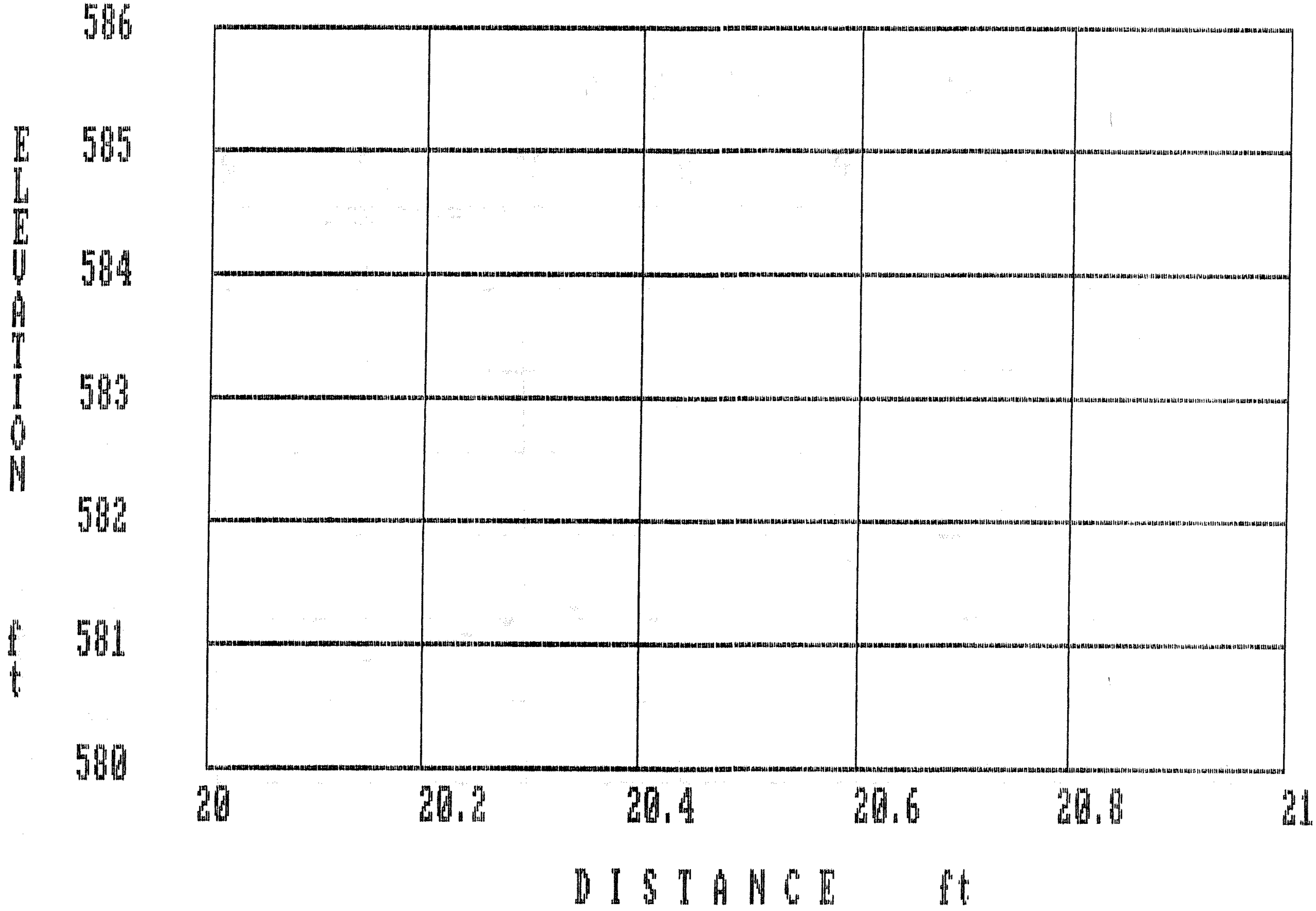
ROJECT: MDFR1.LTV


                               S U M M A R Y   T A B L E
                               = = = = = = =   = = = = =


 NITS:   SECTION DATA  -- SQFT           STATION  -- FT
           REACH DATA  -- CUYD
           TOTAL DATA  -- CUYD
             NET DATA  -- CUYD

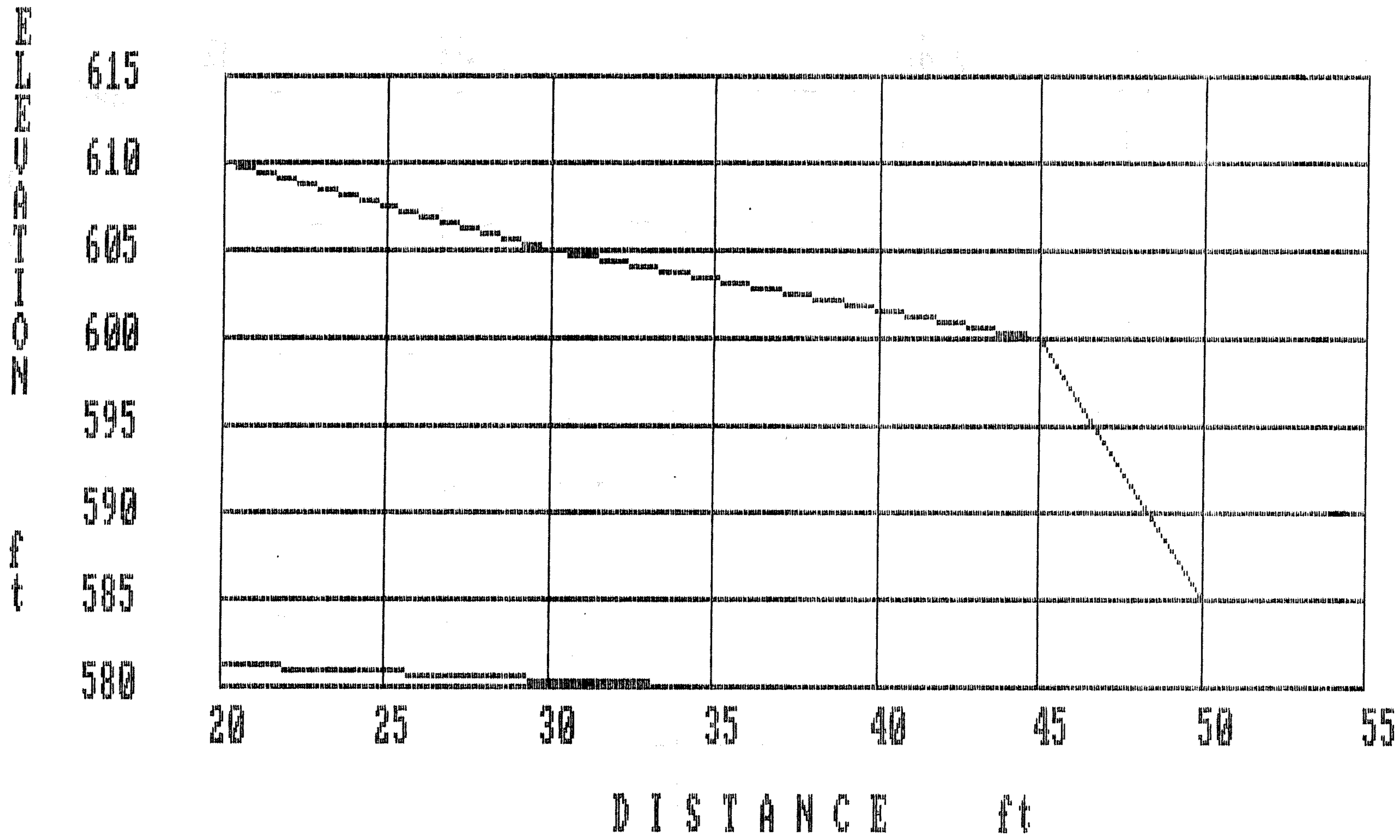
         ----------------------------------------------------------------
         |     SECTION     |      REACH      |      TOTAL      |        |
---------------------------------------------------------------
                                                                  NET   |
| STATION|   CUT  |  FILL  |   CUT  |  FILL  |   CUT  |  FILL  |  MASS  |
-------------------------------------------------------------------------
     1500|    2838|    2888|    3462|    6999|   78418|   46683|  -31735|
     1550|    4153|     653|    6473|    3278|   84890|   49961|  -34930|
     1600|    3157|       0|    6769|     604|   91659|   50565|  -41094|
     1650|    1318|     362|    4144|     336|   95802|   50900|  -44902|
     1700|     378|    2465|    1570|    2618|   97373|   53519|  -43854|
-------------------------------------------------------------------------
```

STATION: 0

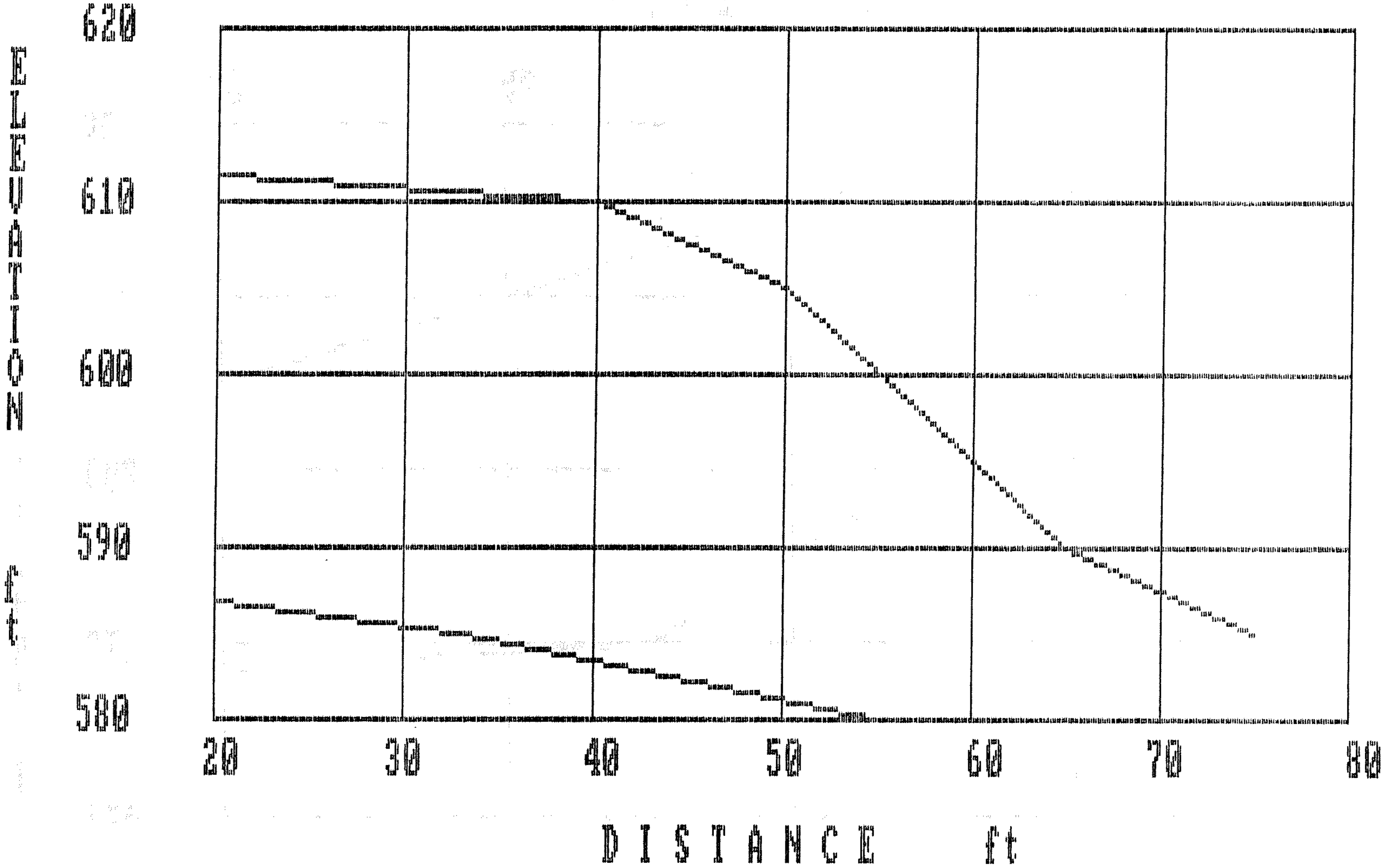


586
585
584
583
582
581
580
ELEVATION ft
20
20.2
20.4
20.6
20.8
21
DISTANCE ft

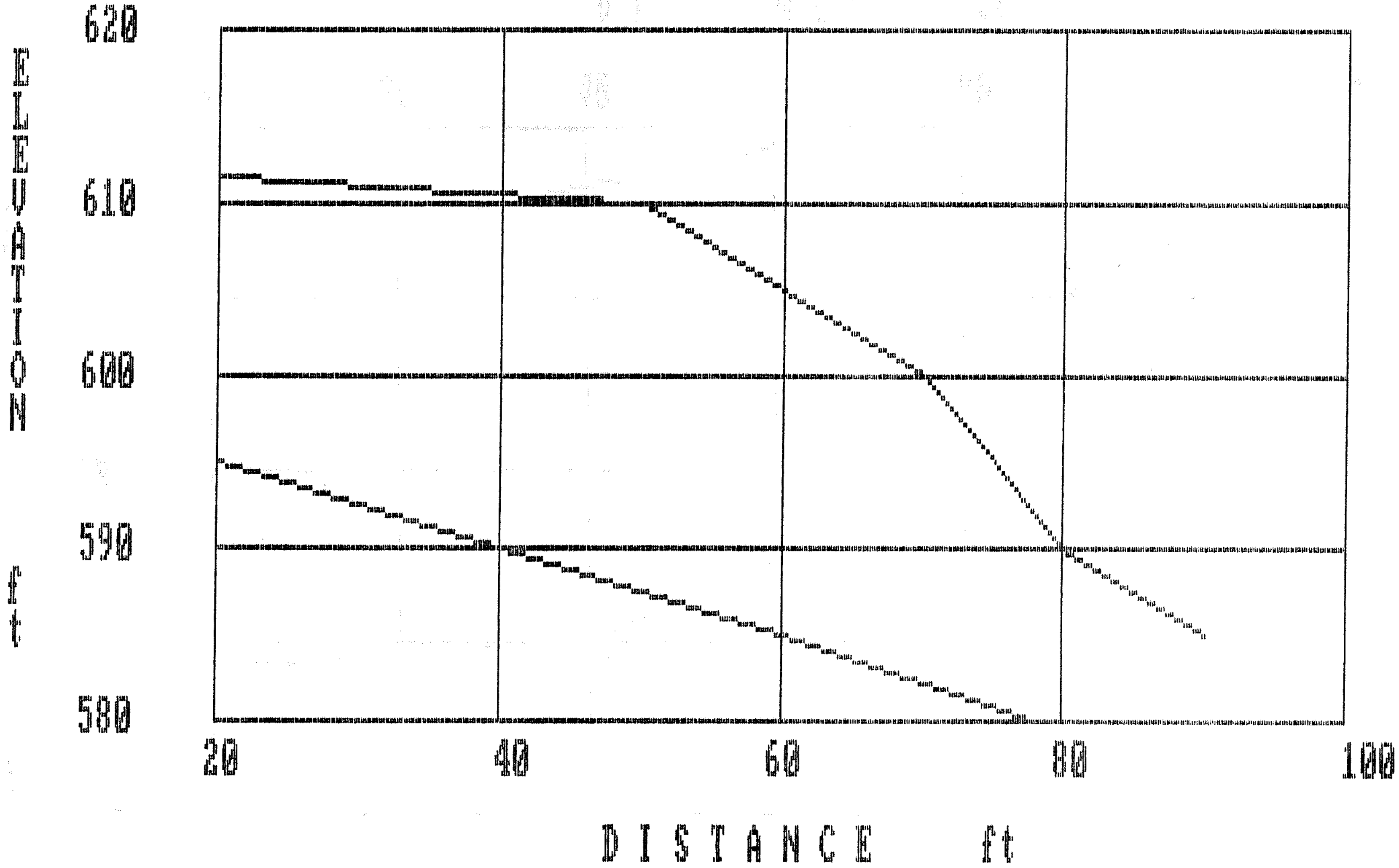
STATION: 50


ELEVATION ft
615
610
605
600
595
590
585
580
20
25
30
35
40
45
50
55
DISTANCE ft

STATION: 100


620
610
600
590
580
ELEVATION ft
20
30
40
50
60
70
80
DISTANCE ft

STATION: 150



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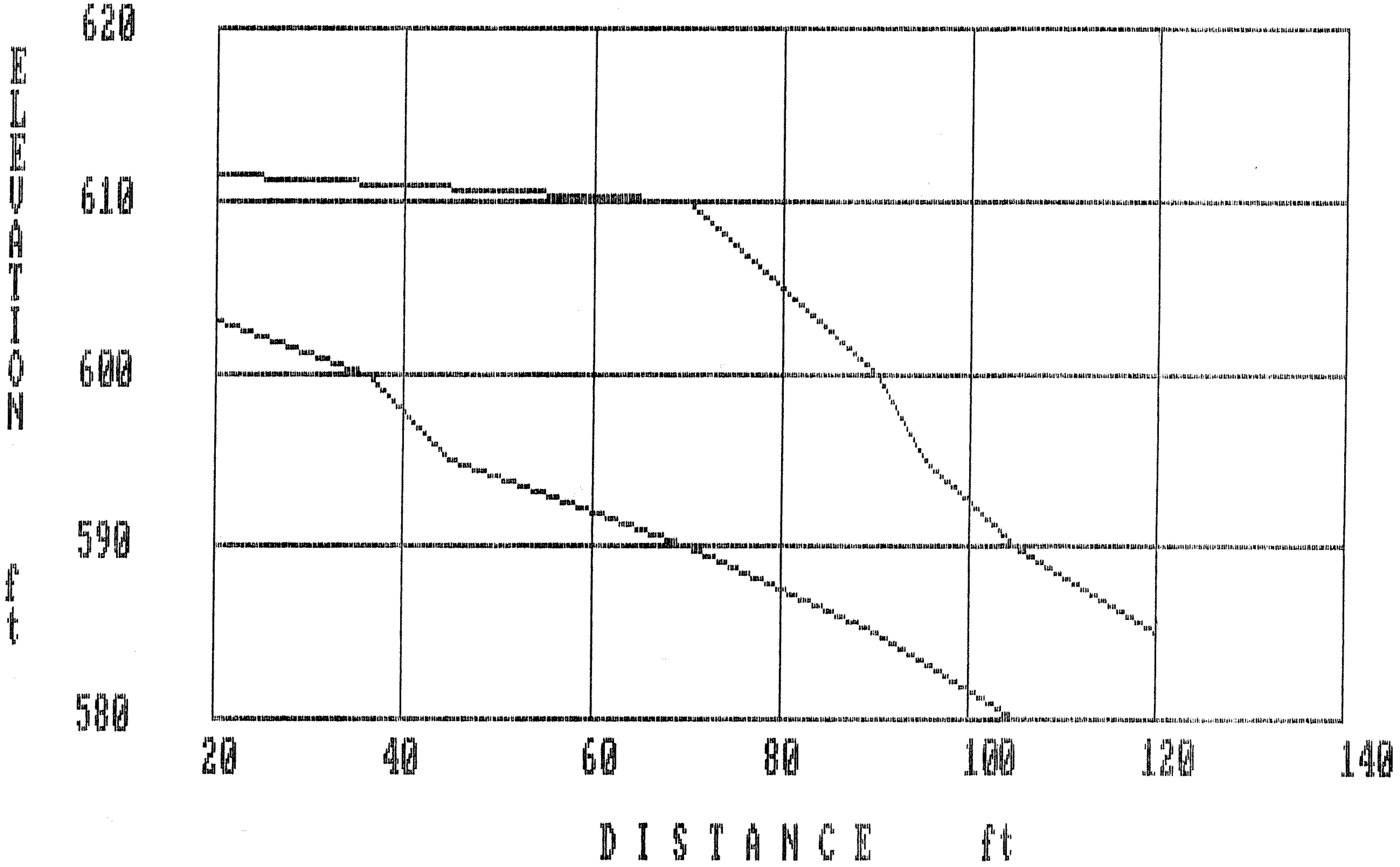
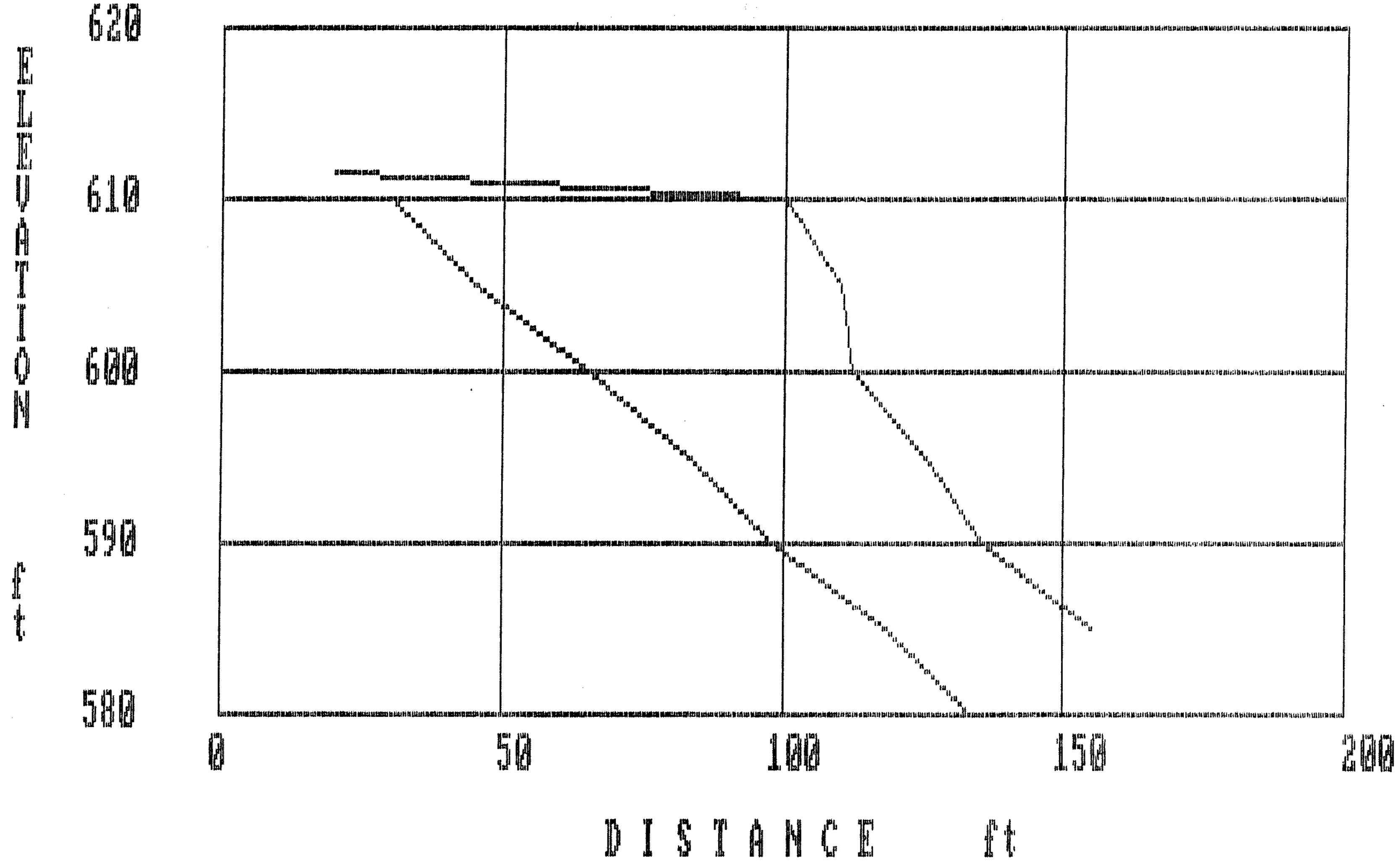

620
610
600
590
580
ELEVATION ft
20
40
60
80
100
120
140
DISTANCE ft

STATION: 250



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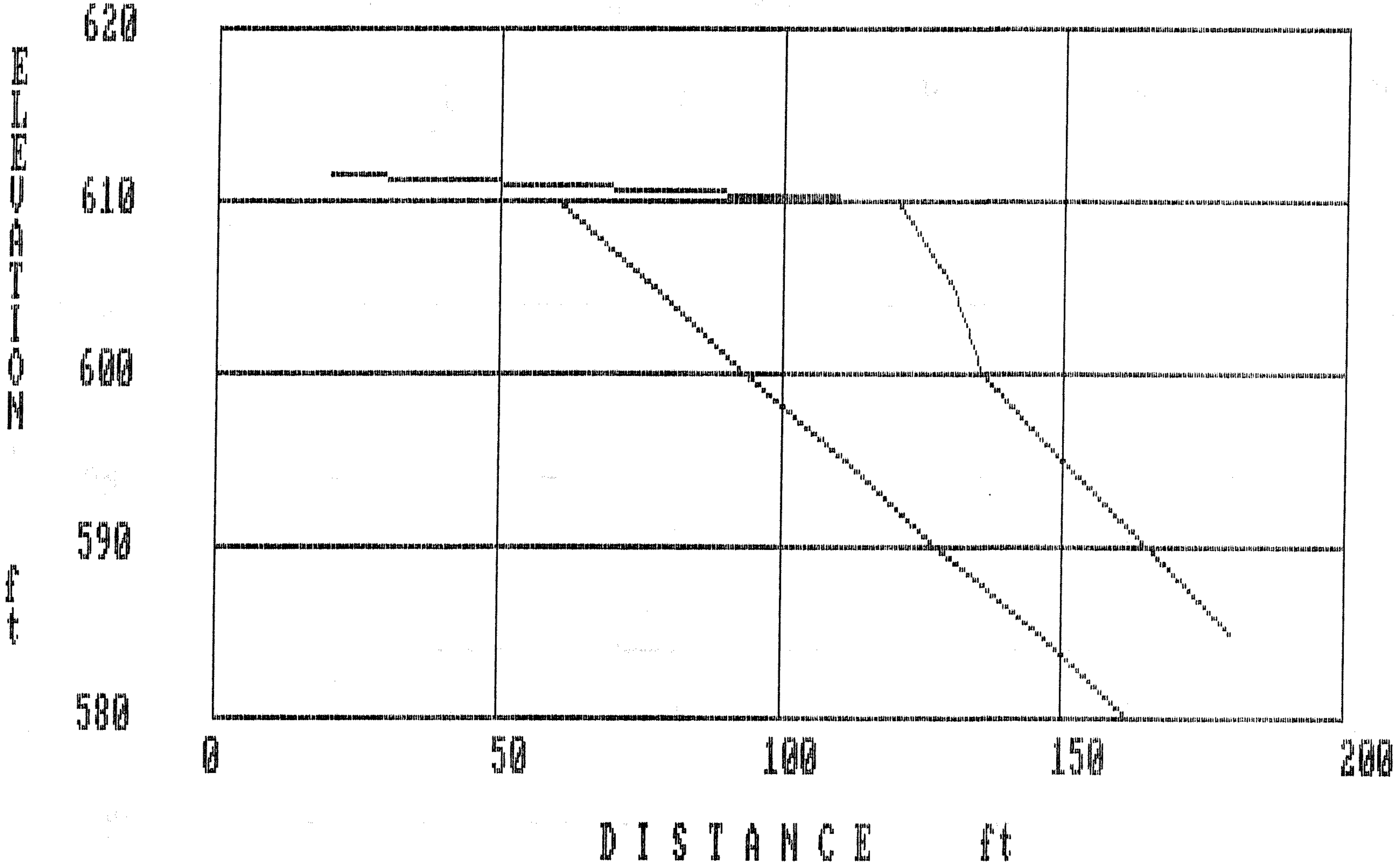

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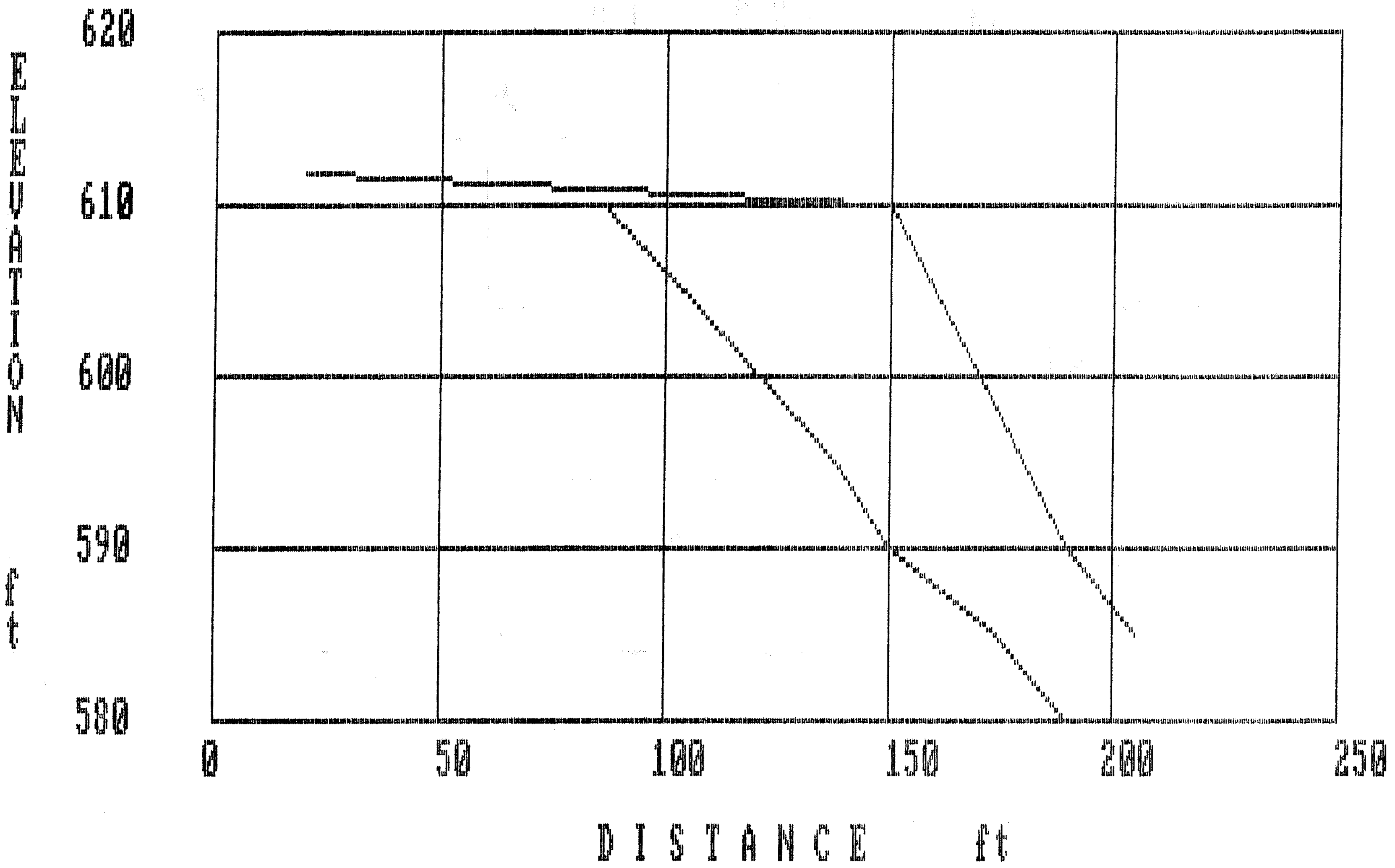
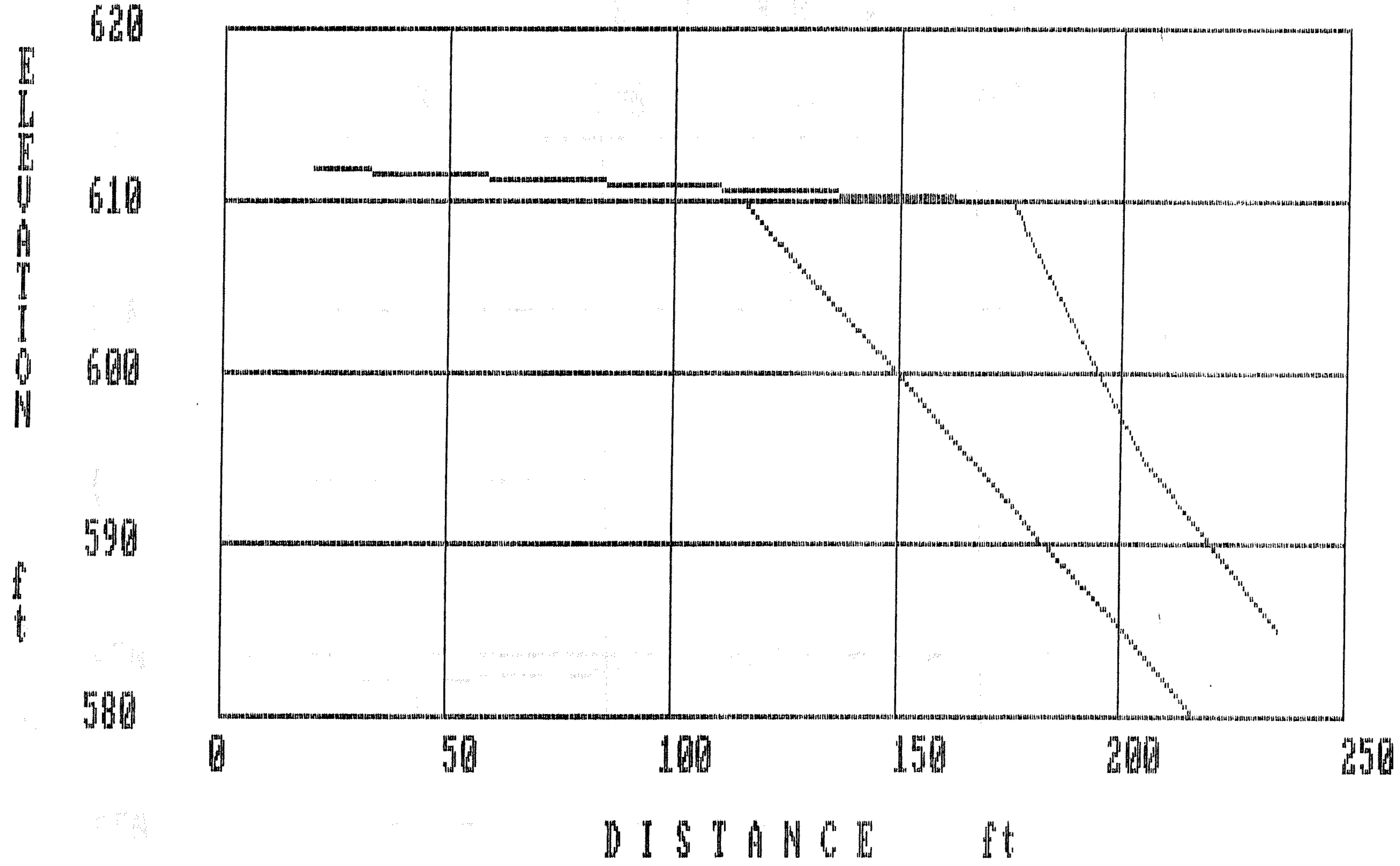


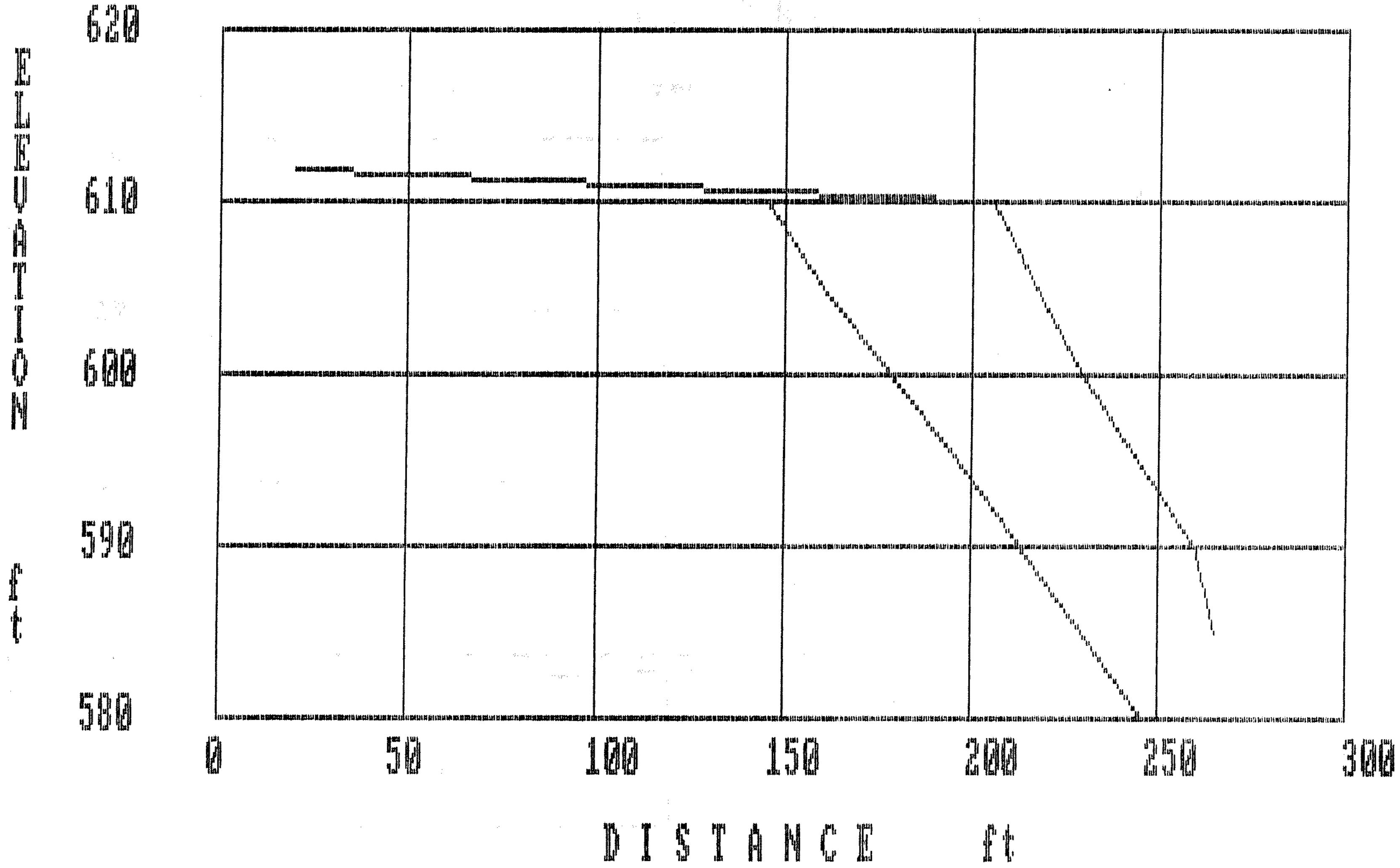
620
610
600
590
580
ELEVATION ft
0
50
100
150
200
250
DISTANCE ft

STATION: 400

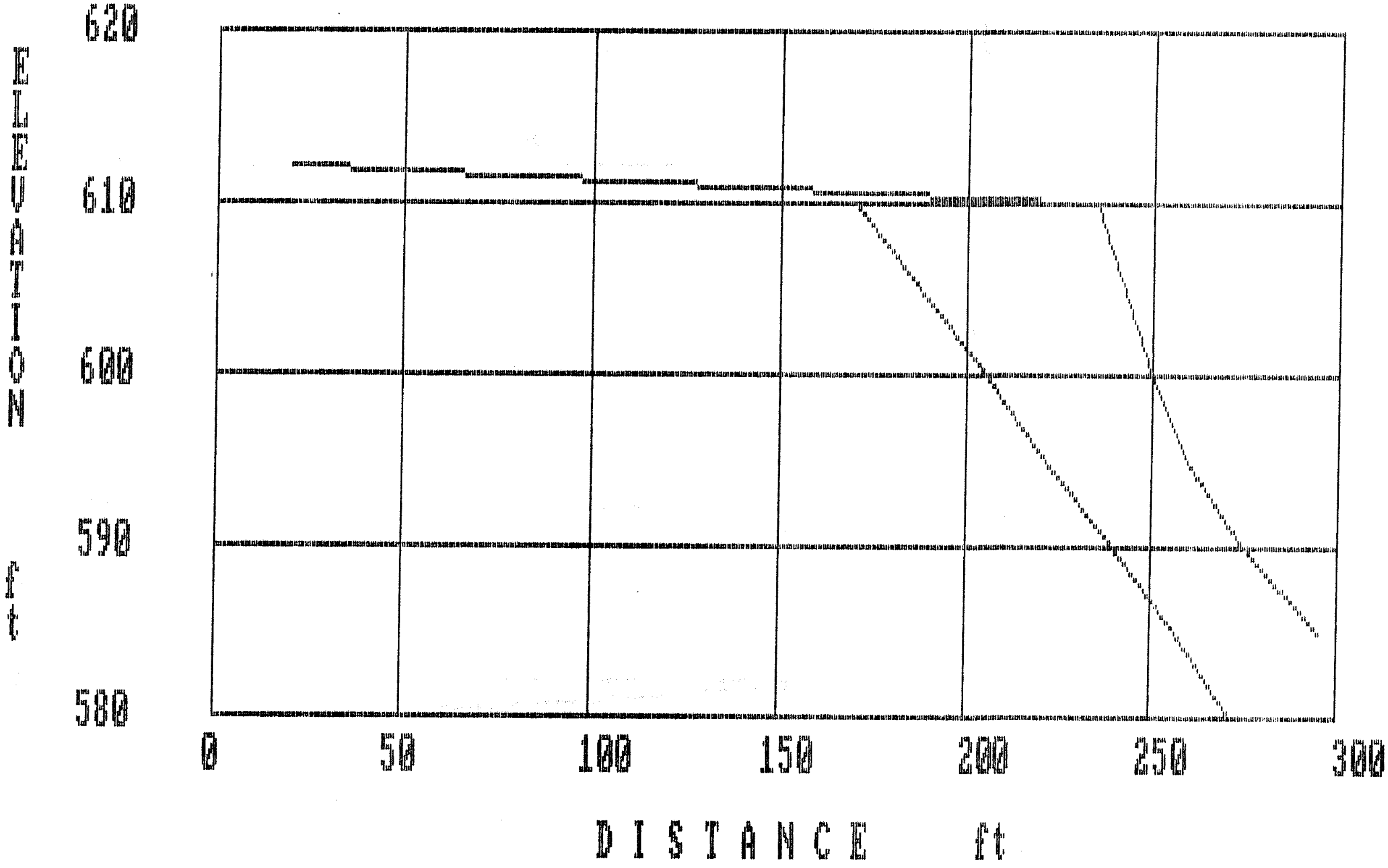


ELEVATION ft
620
610
600
590
580
0
50
100
150
200
250
DISTANCE ft

STATION: 450

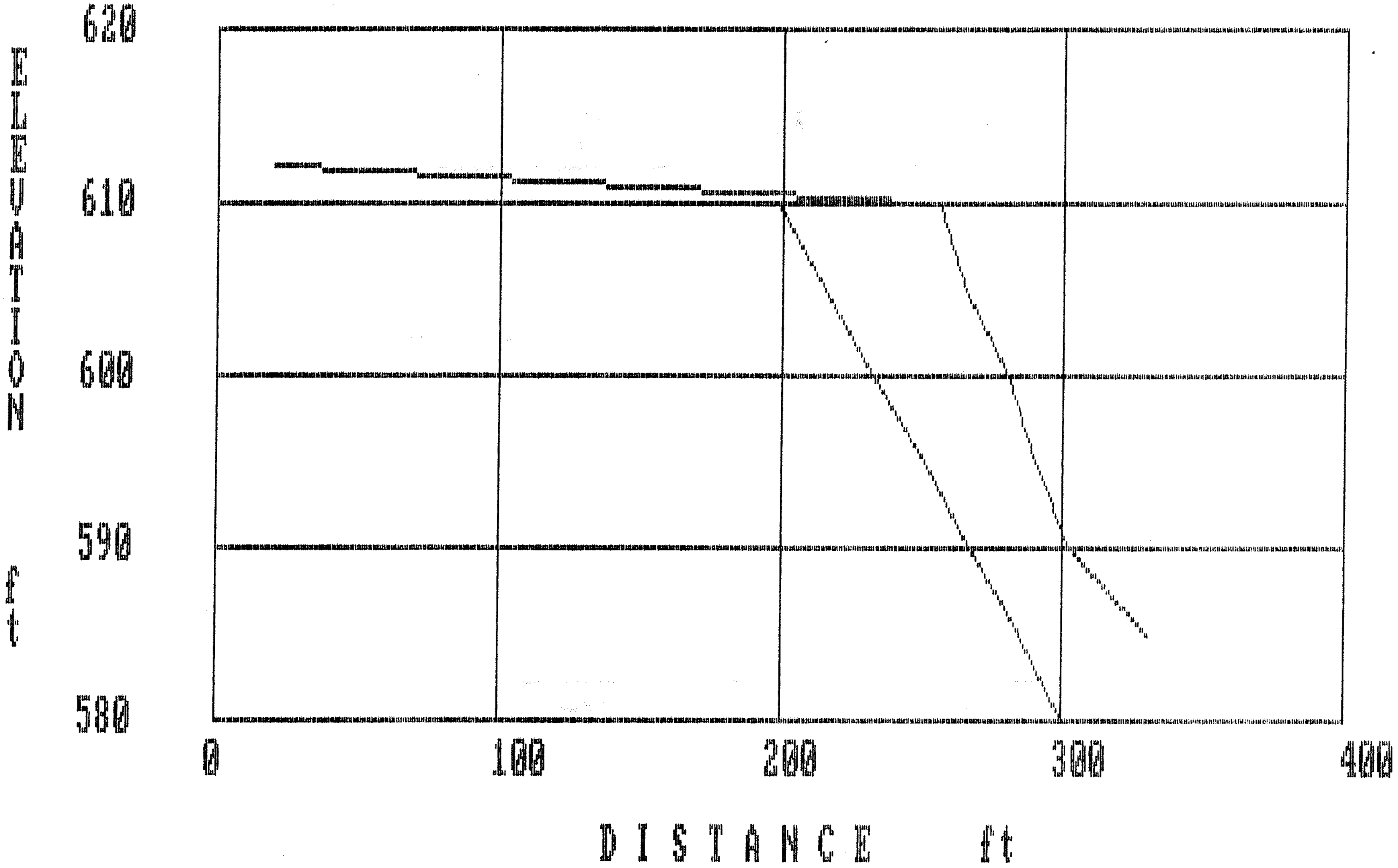

ELEVATION ft
620
610
600
590
580
0
50
100
150
200
250
300
DISTANCE ft

STATION: 500



620
610
600
590
580
ELEVATION ft
0
50
100
150
200
250
300
DISTANCE ft

STATION: 550



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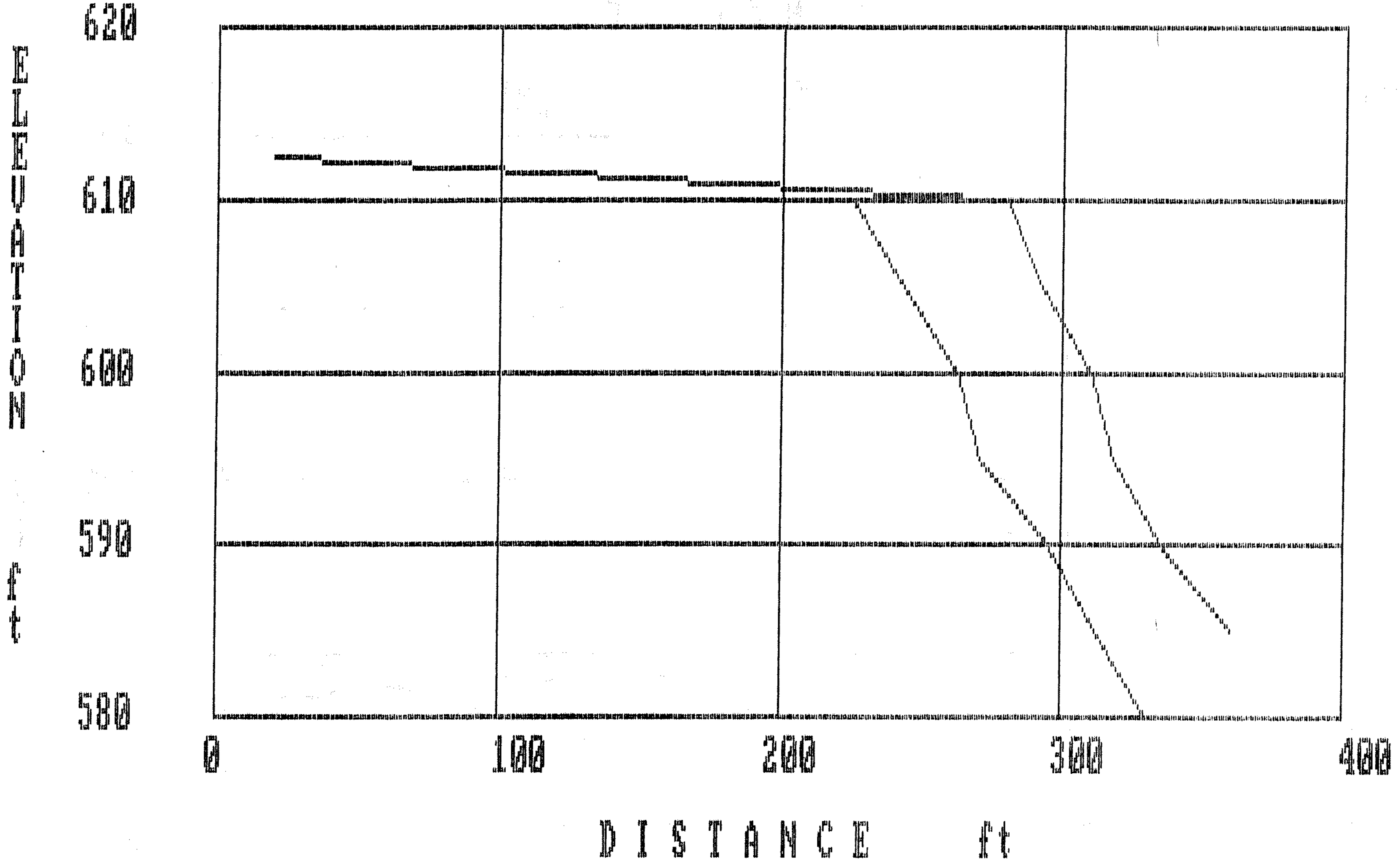

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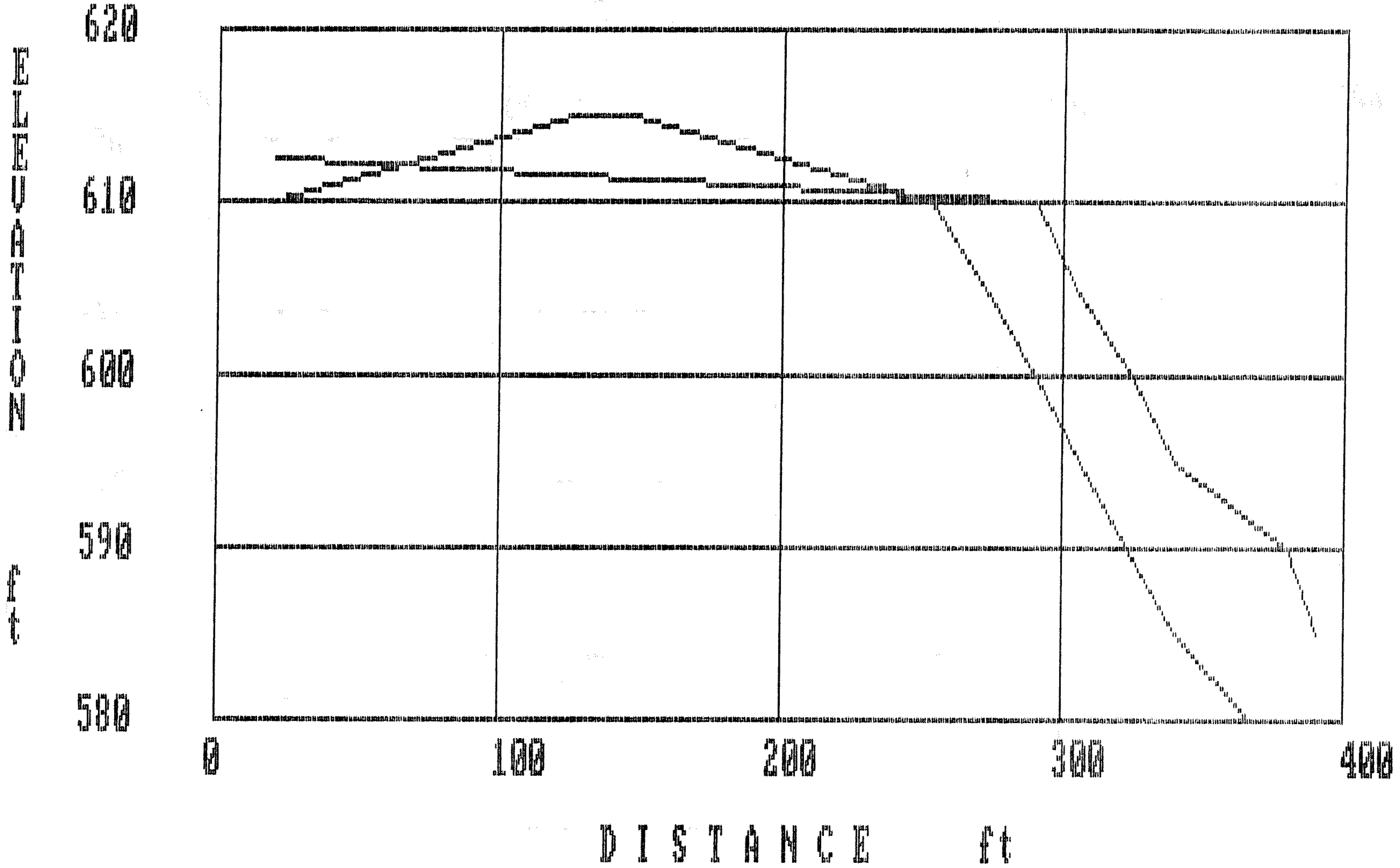

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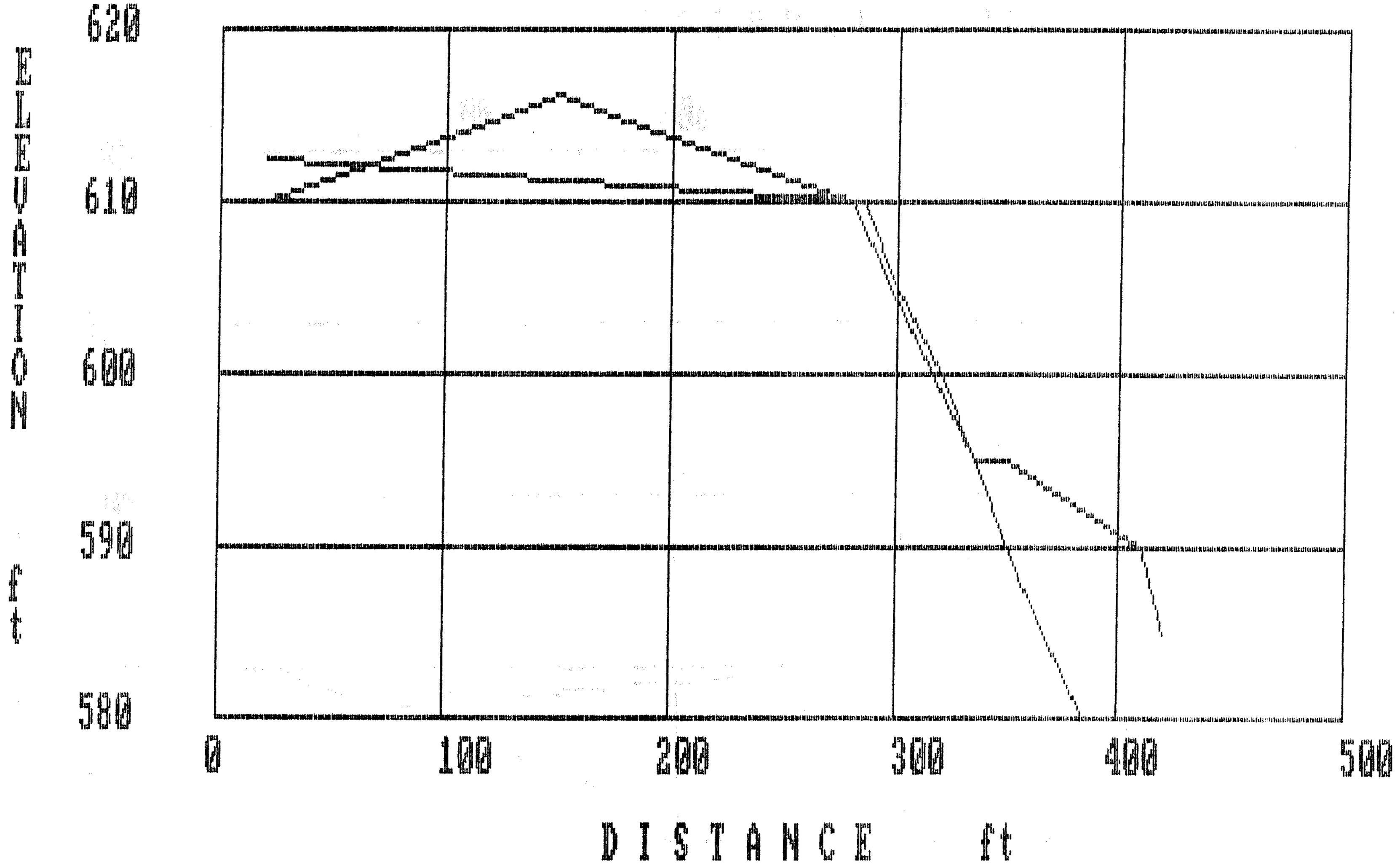
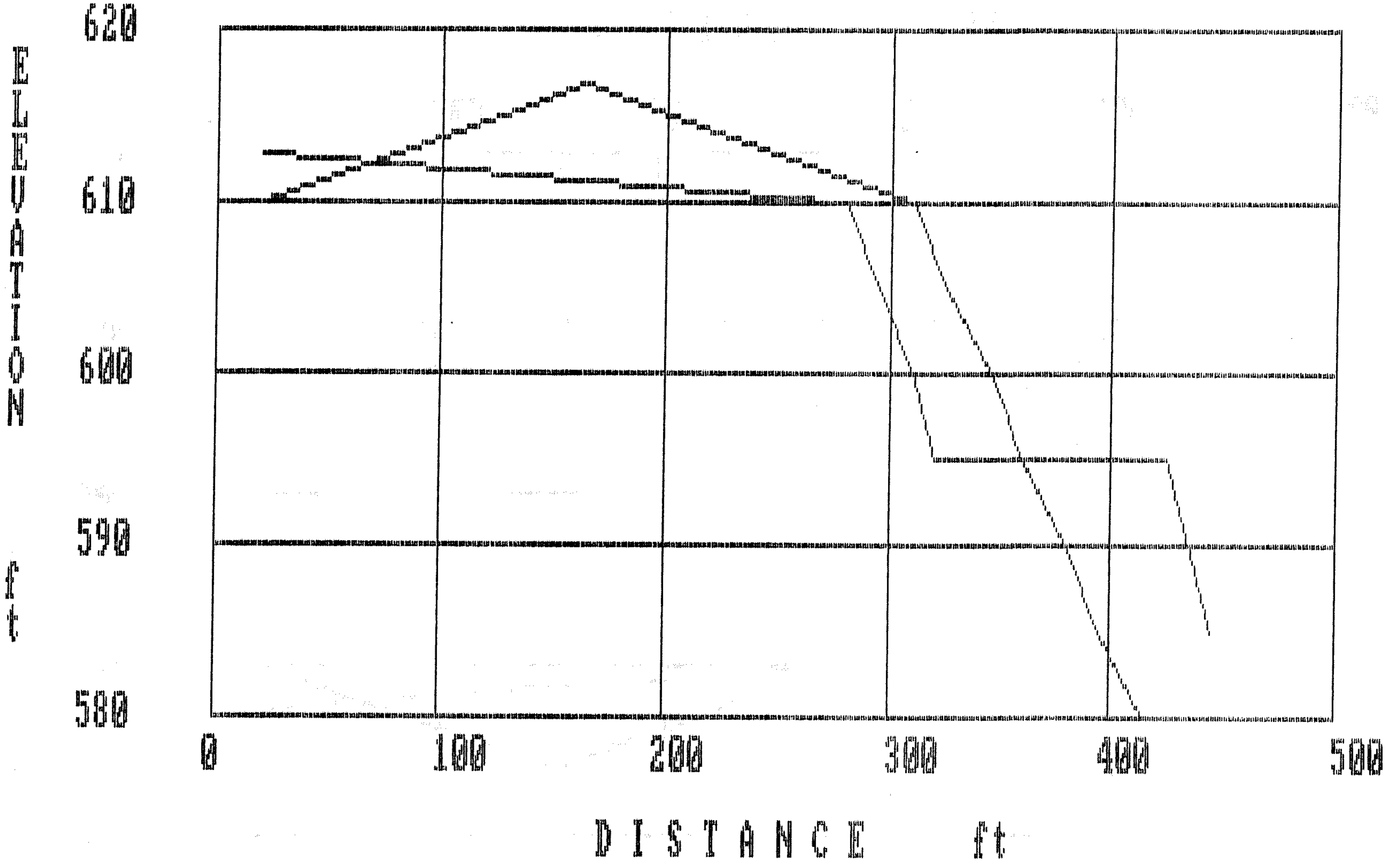
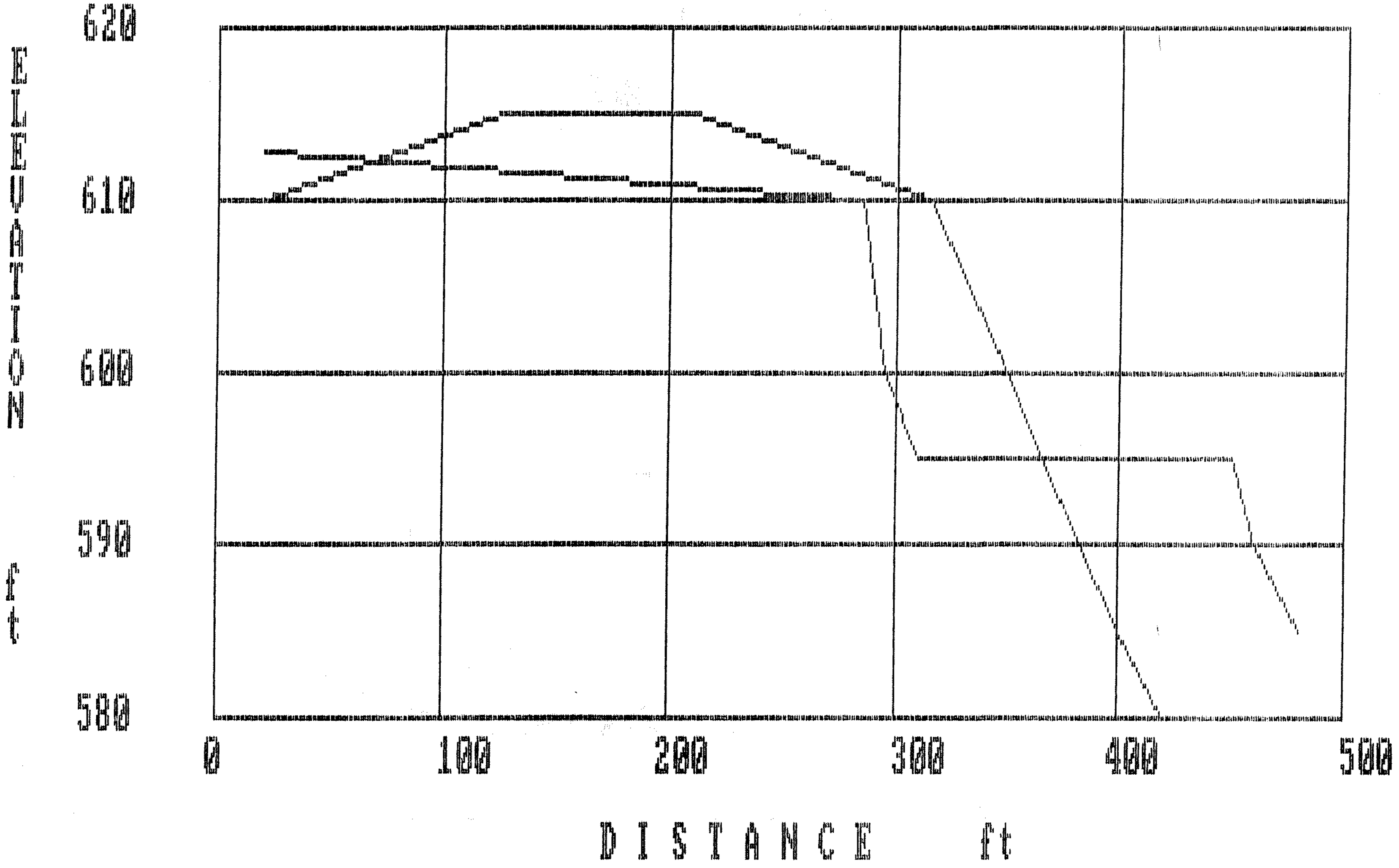

620
610
600
590
580
ELEVATION ft
0
100
200
300
400
500
DISTANCE ft

STATION: 750

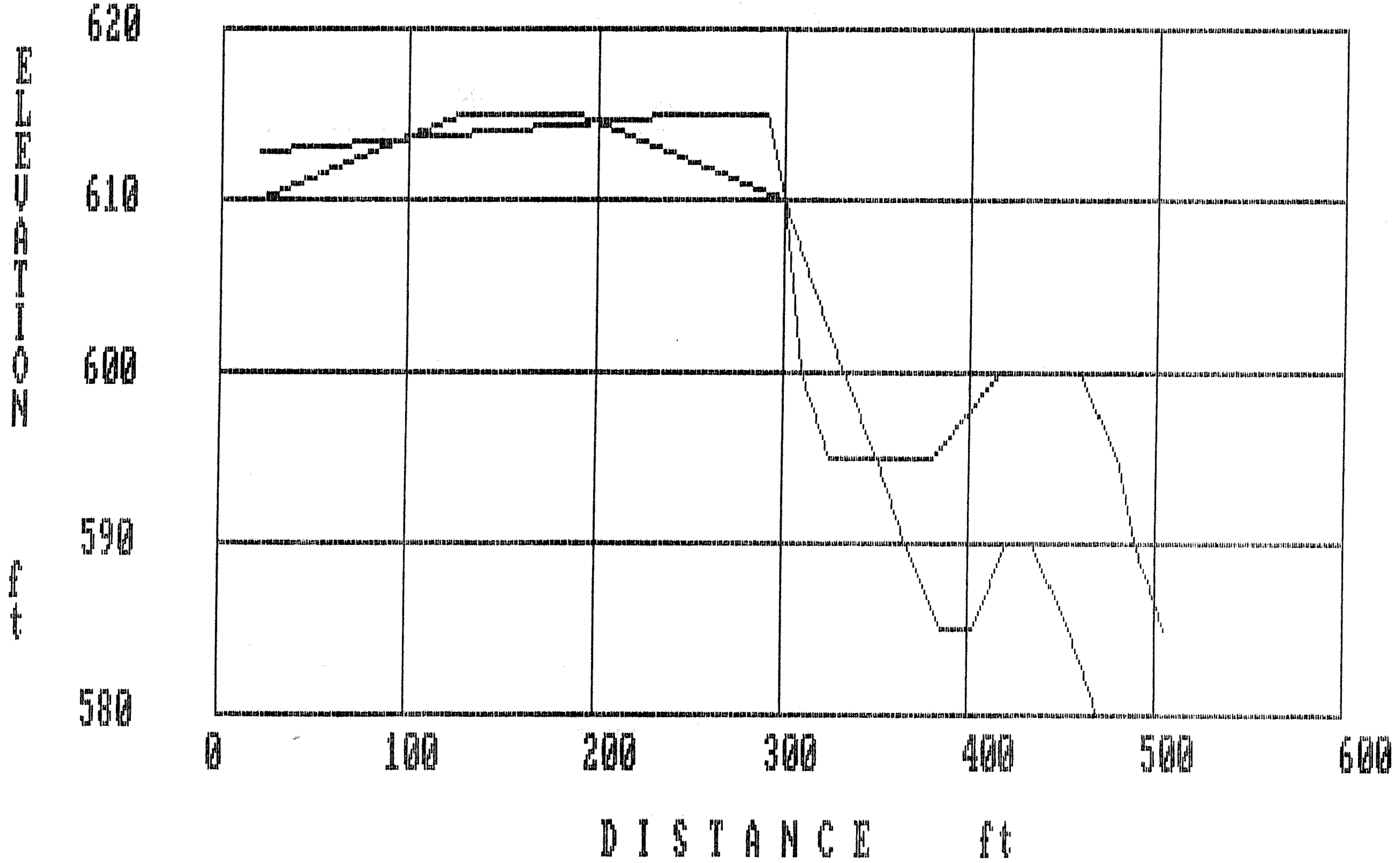


620
610
600
590
580
ELEVATION ft
0
100
200
300
400
500
DISTANCE ft


STATION: 800

620
610
600
590
580
ELEVATION ft
0
100
200
300
400
500
DISTANCE ft

STATION: 850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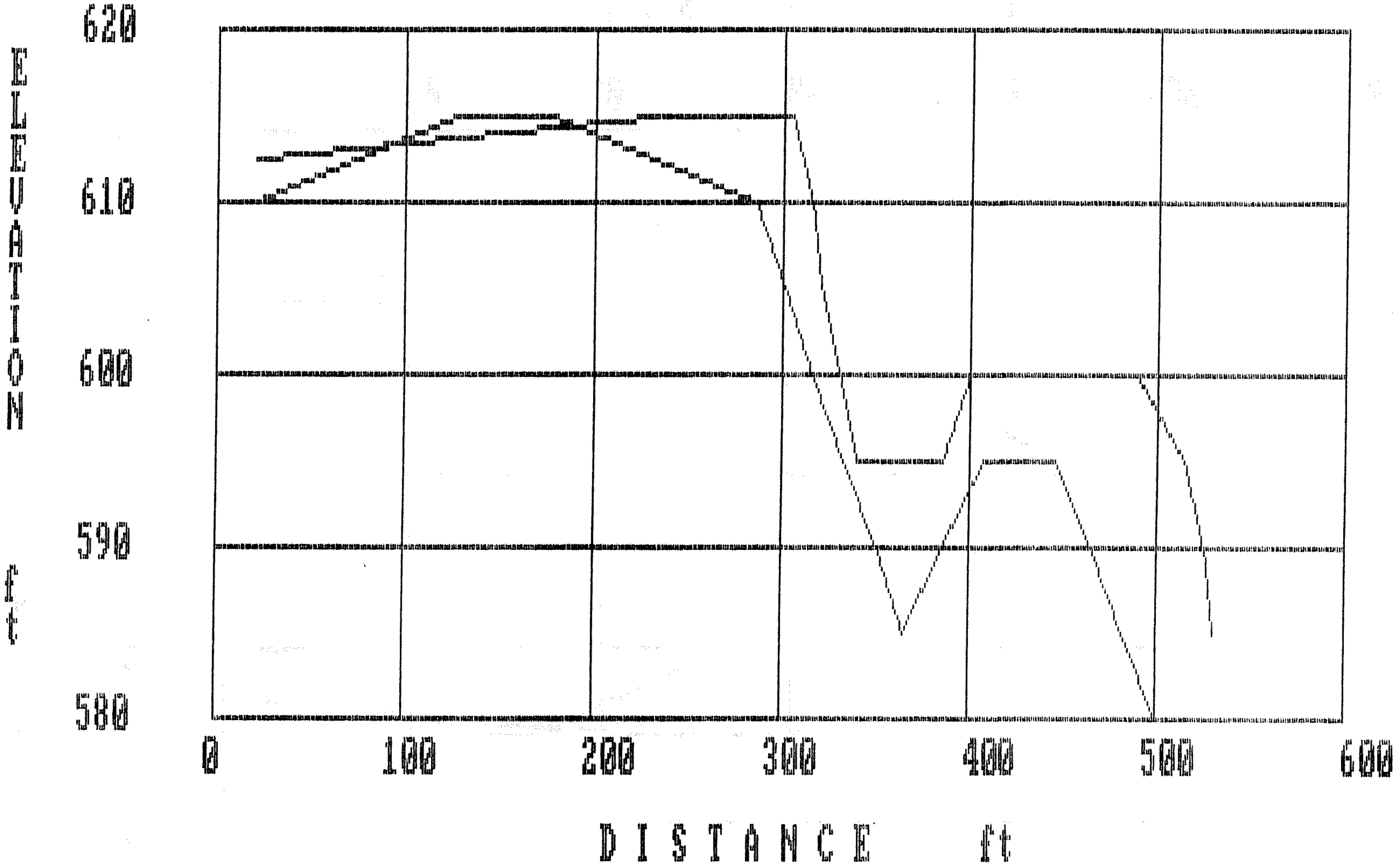
600
590
580
ELEVATION ft
0
100
200
300
400
500
600
DISTANCE ft

STATION: 900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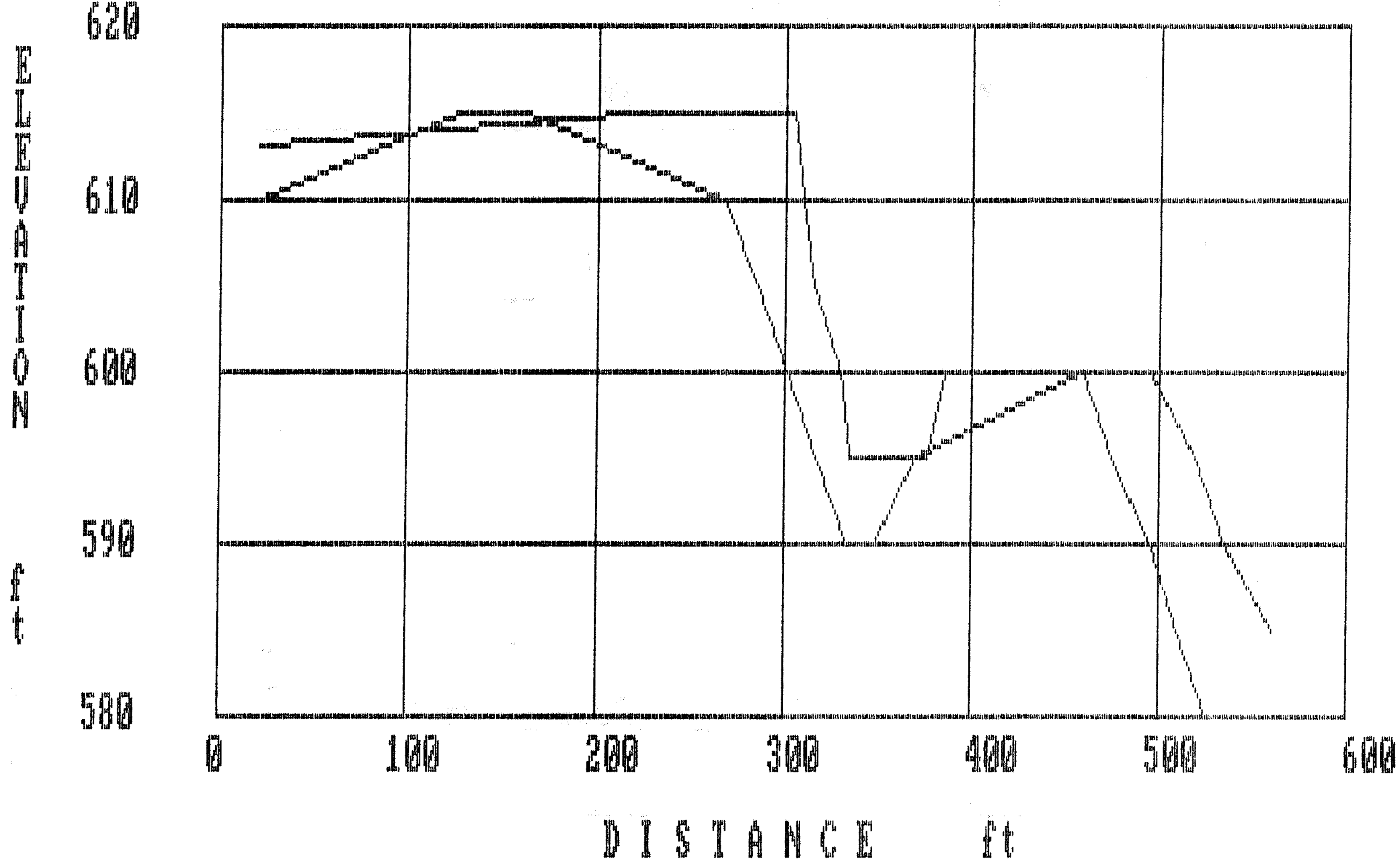
600
590
580
ELEVATION ft
0
100
200
300
400
500
600
DISTANCE ft

STATION: 950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100
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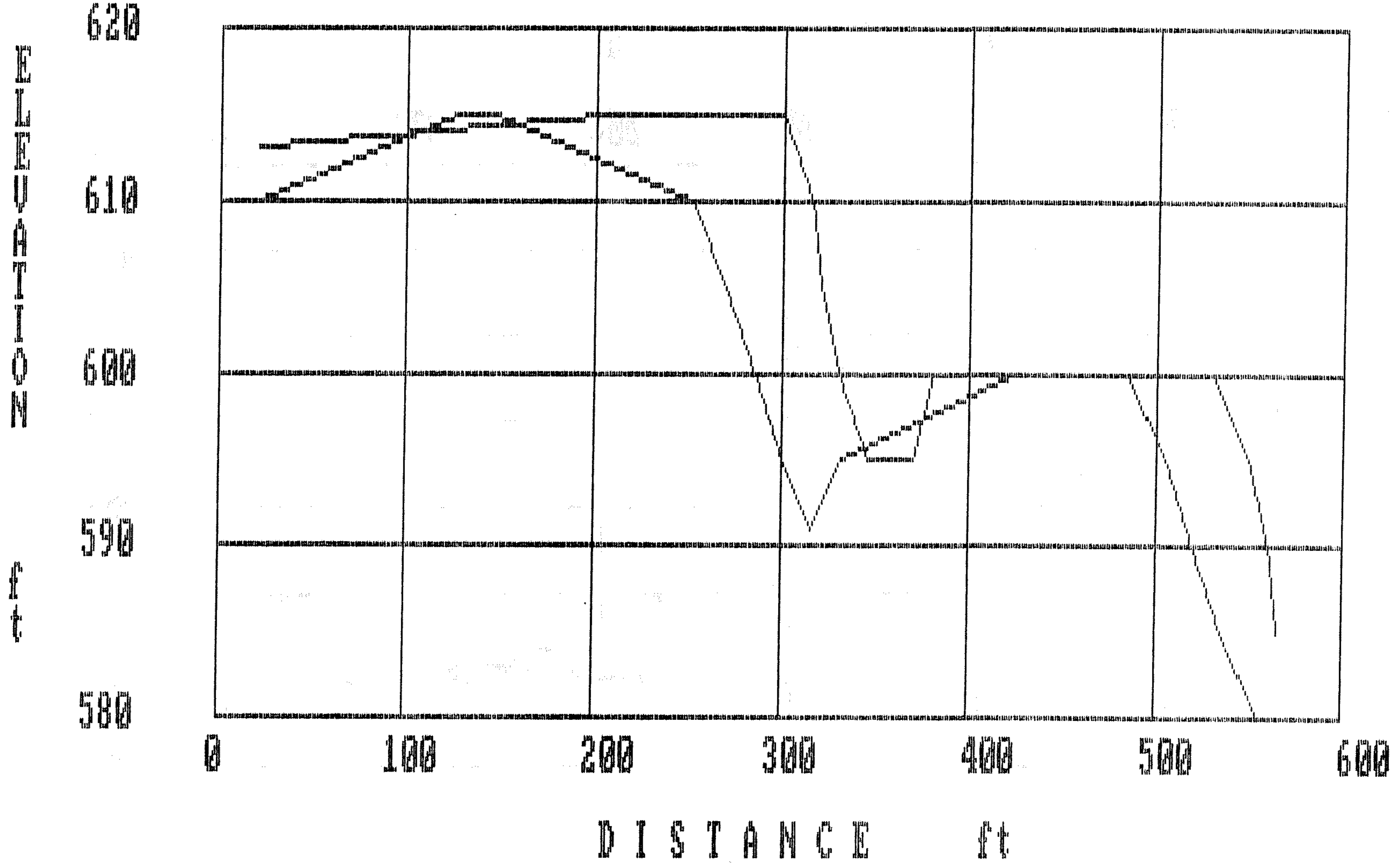
300
400
500
600
DISTANCE ft

STATION: 1000



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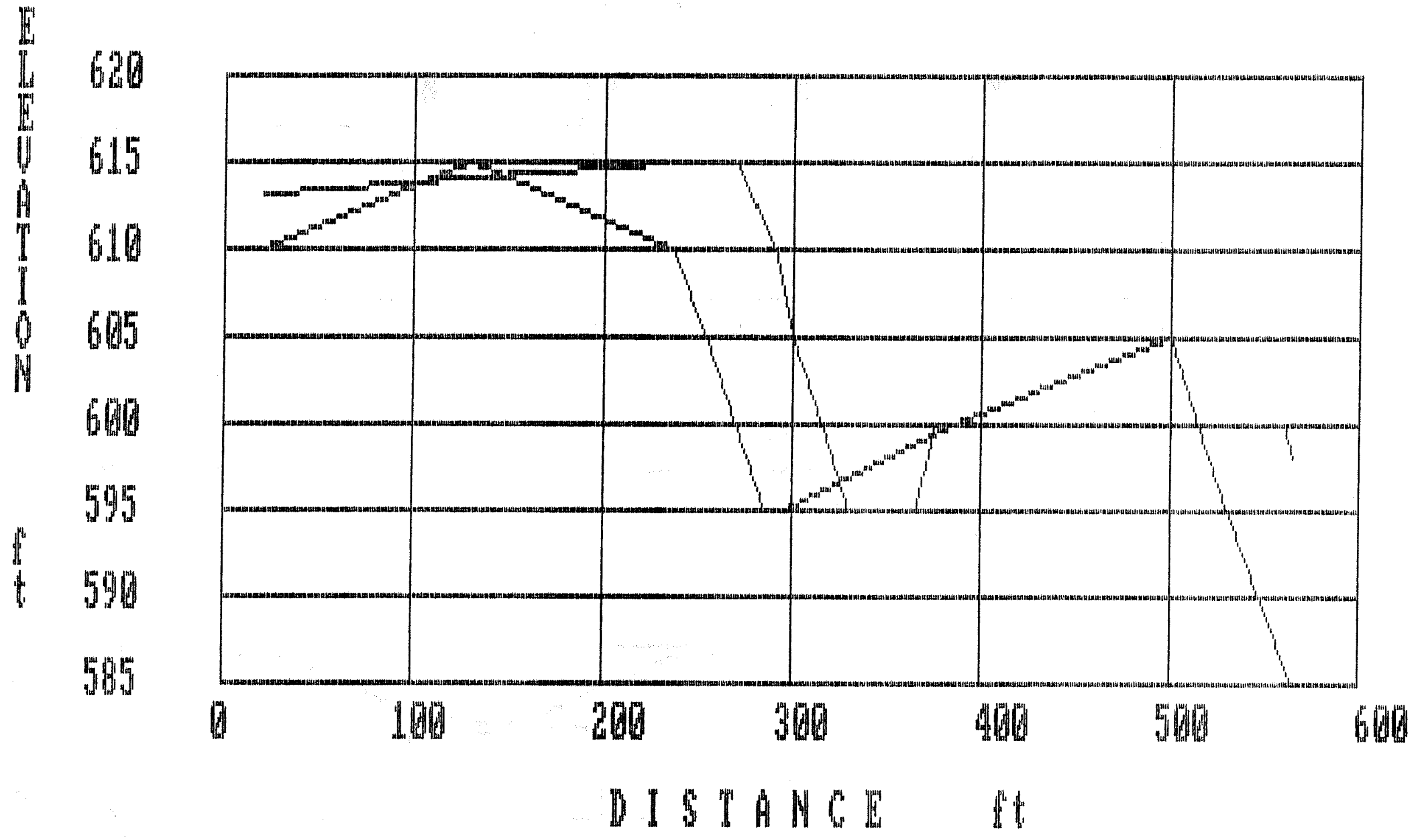

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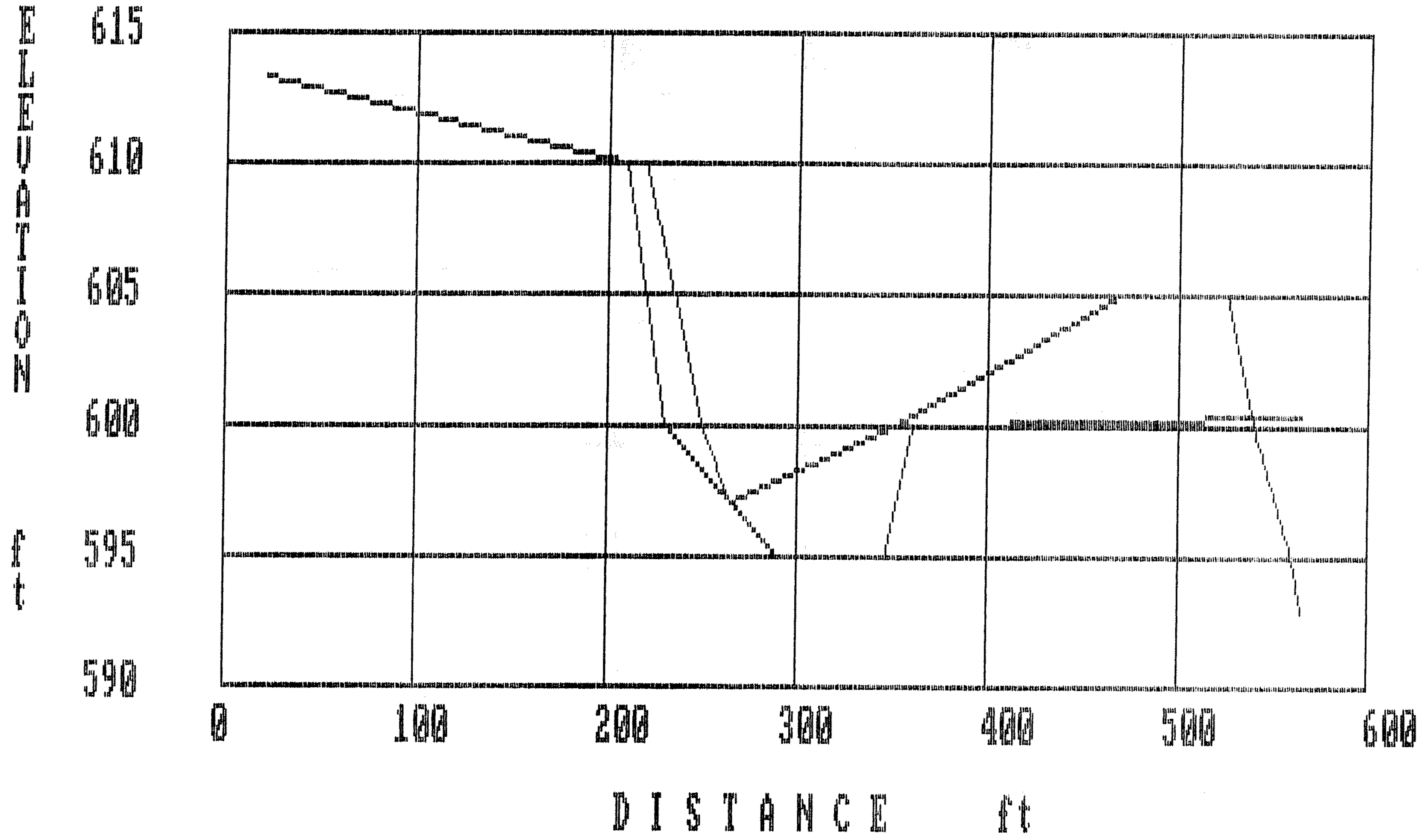
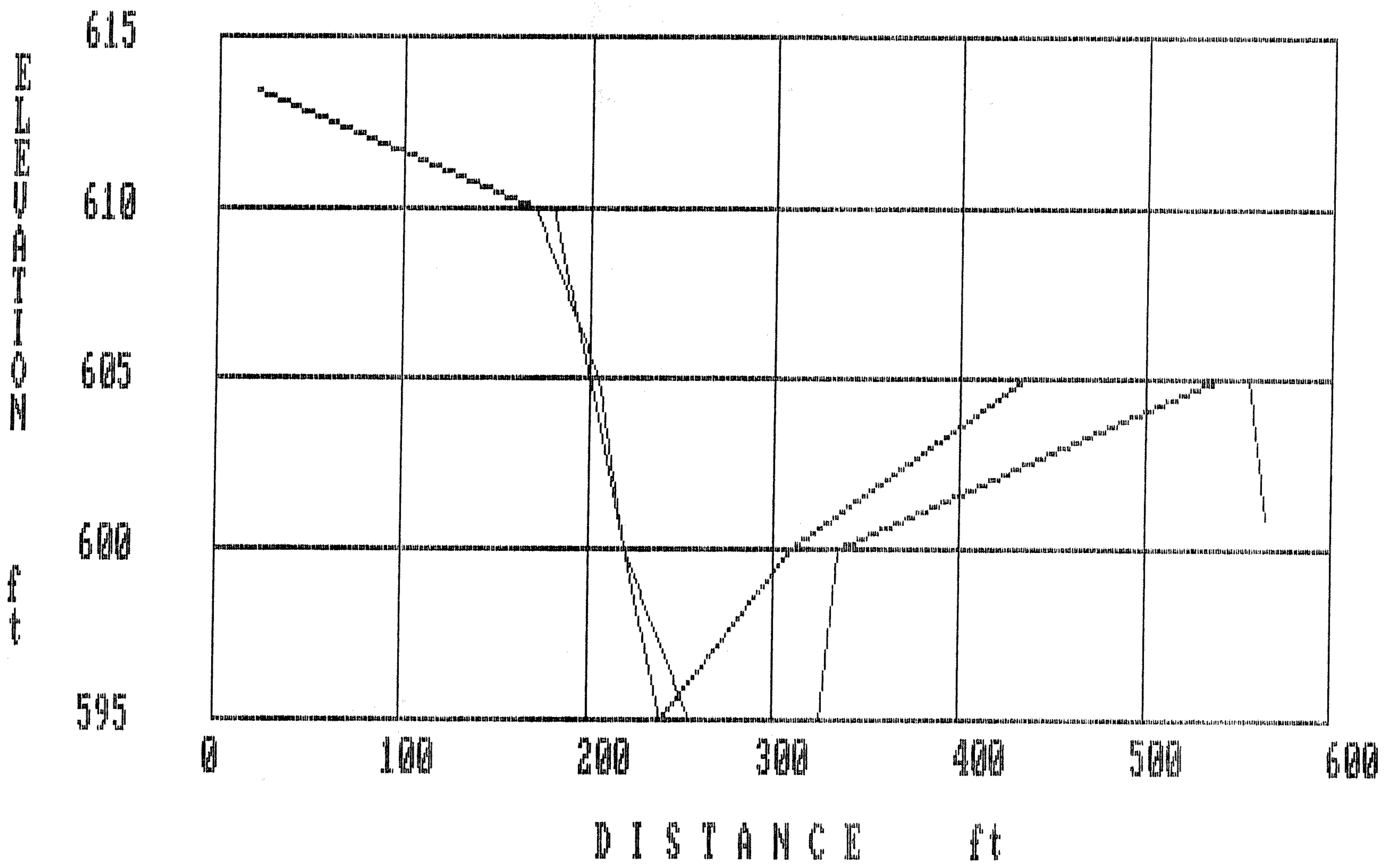
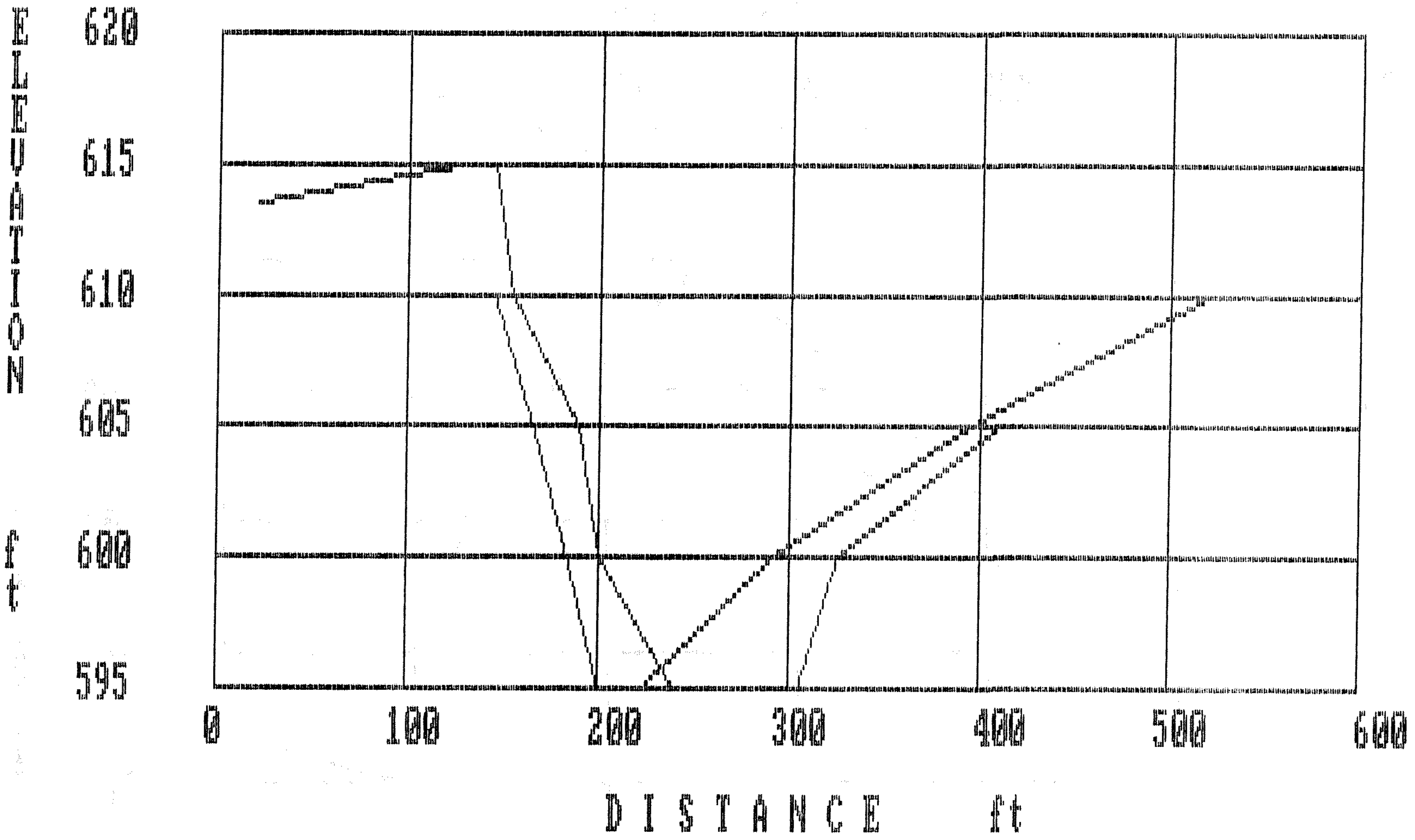


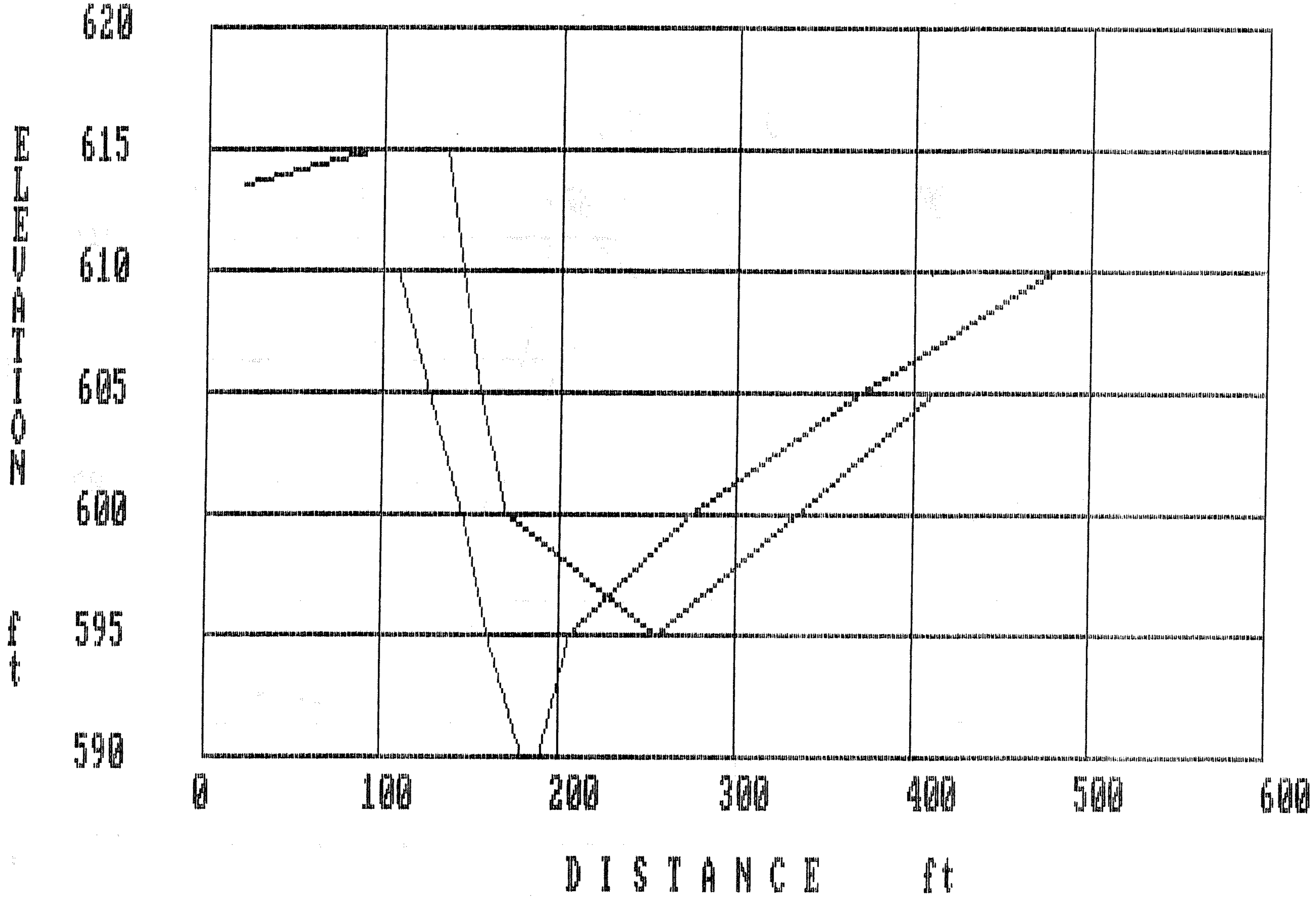
STATION: 1150



STATION: 1200



STATION: 1250



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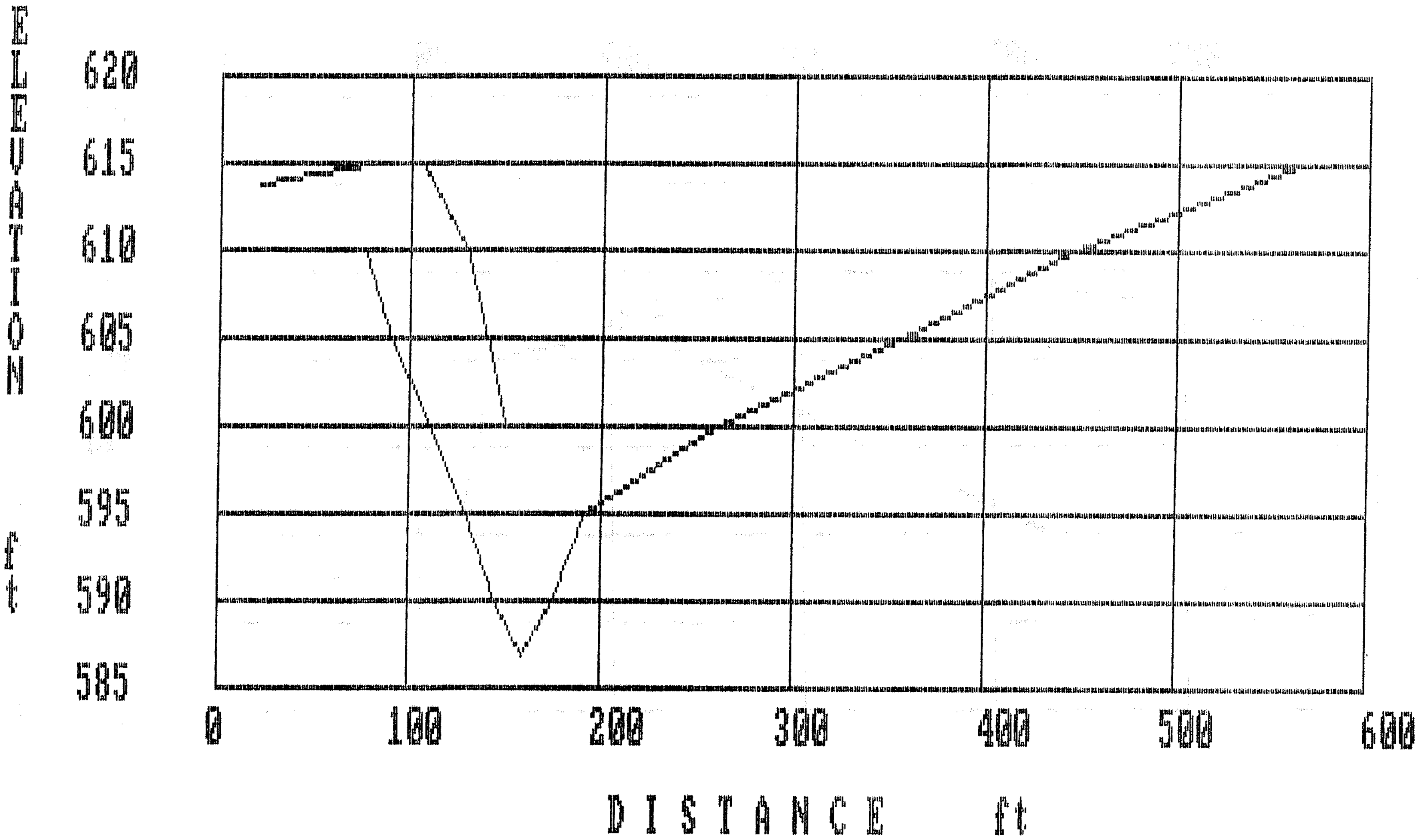

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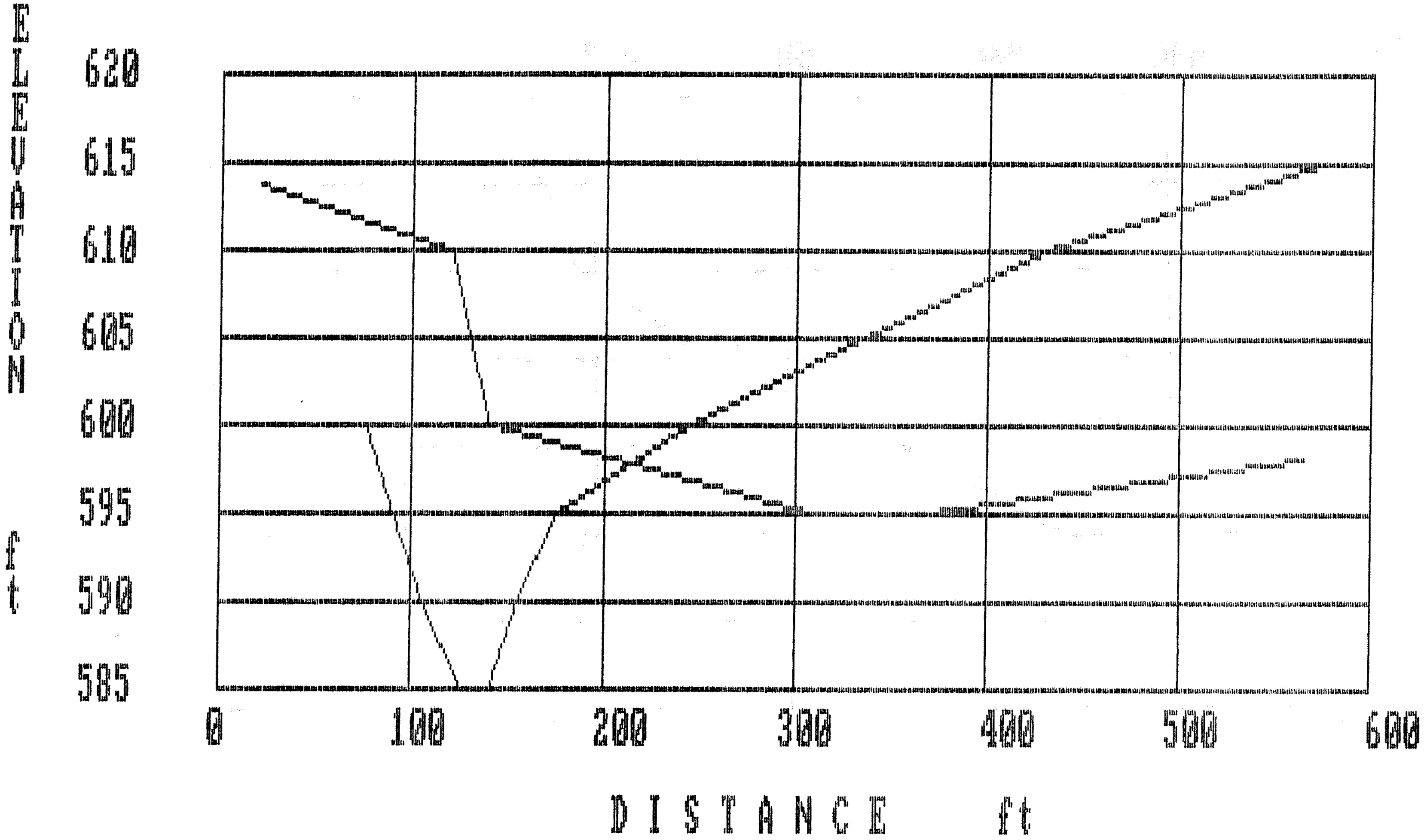

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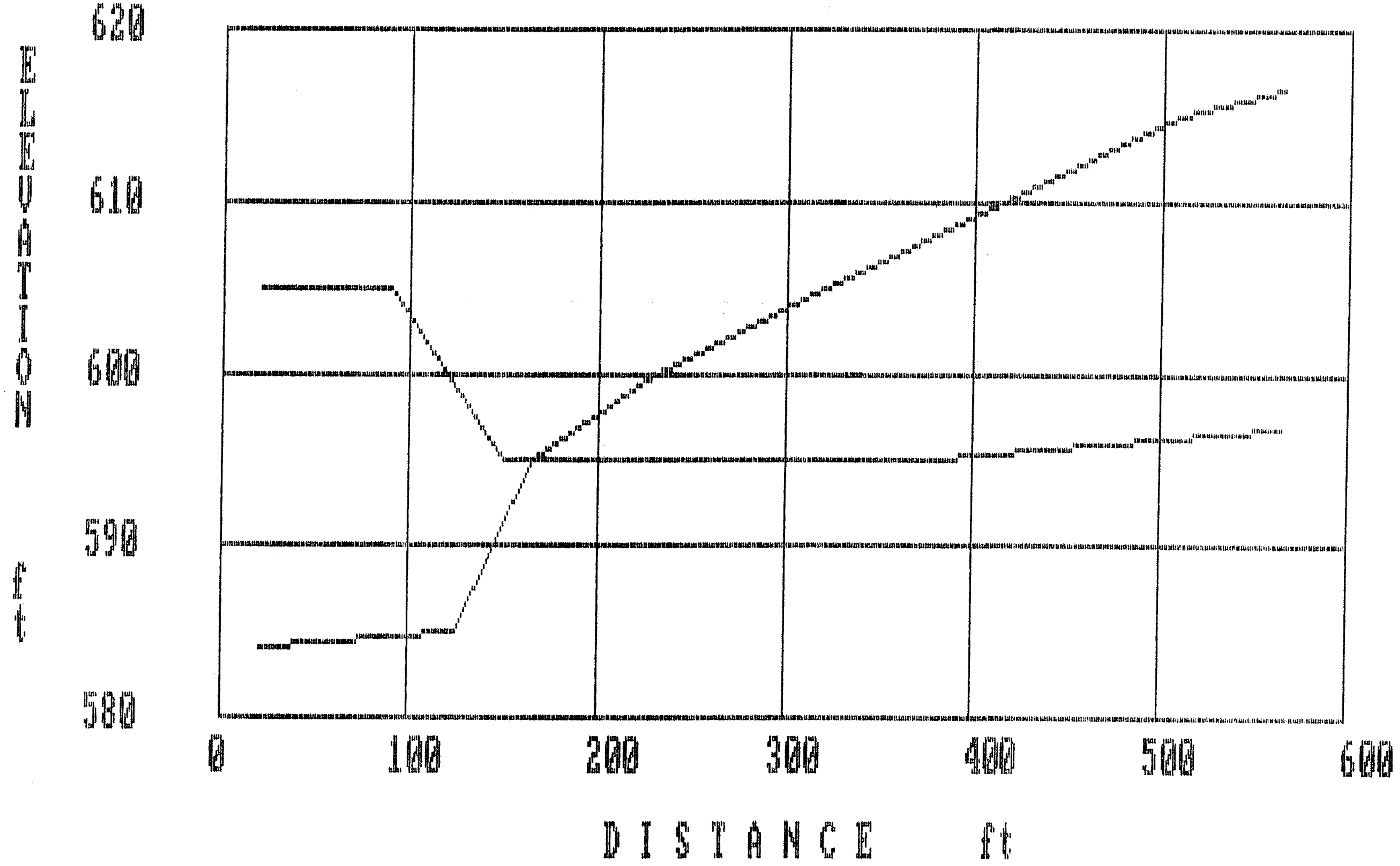

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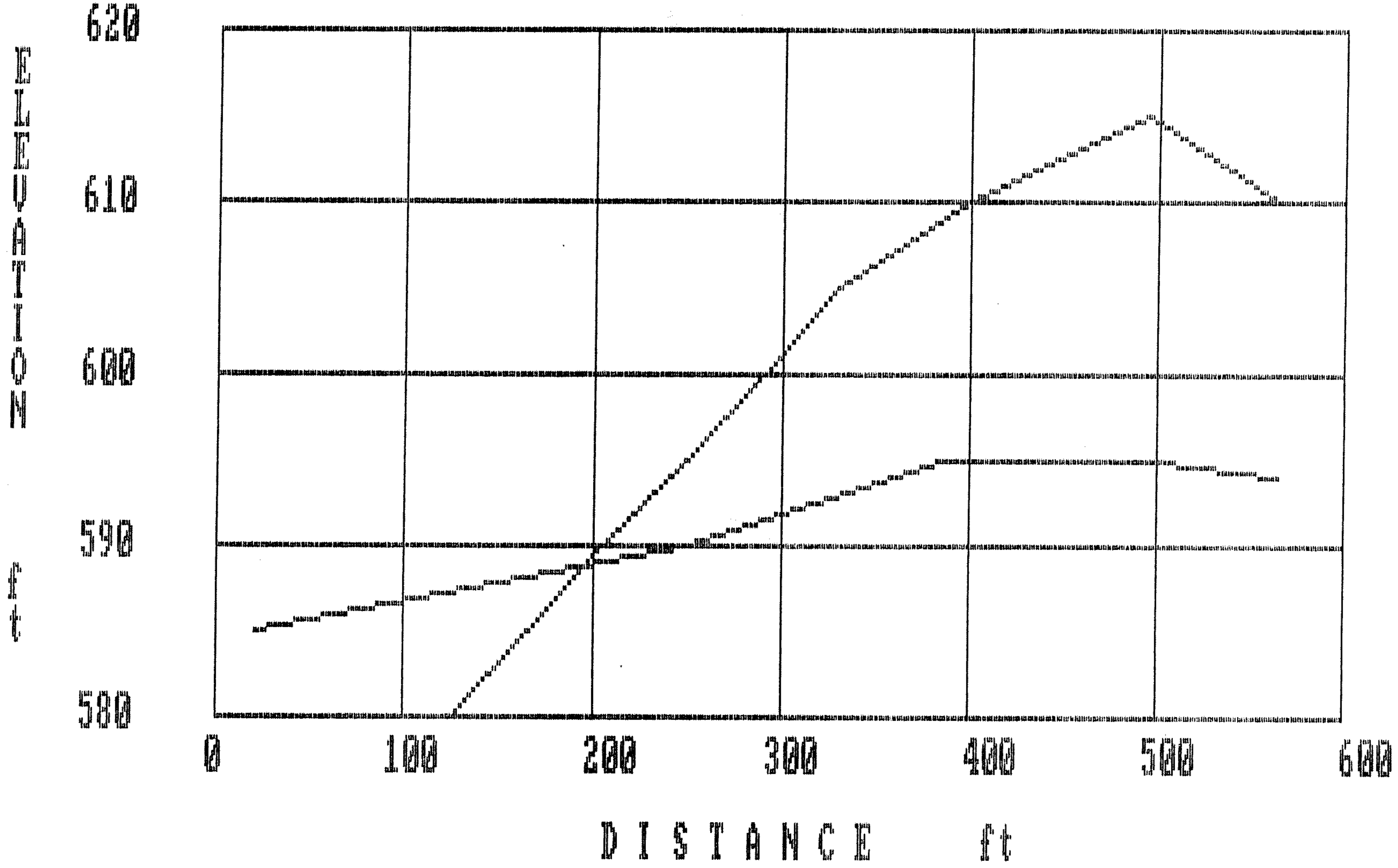

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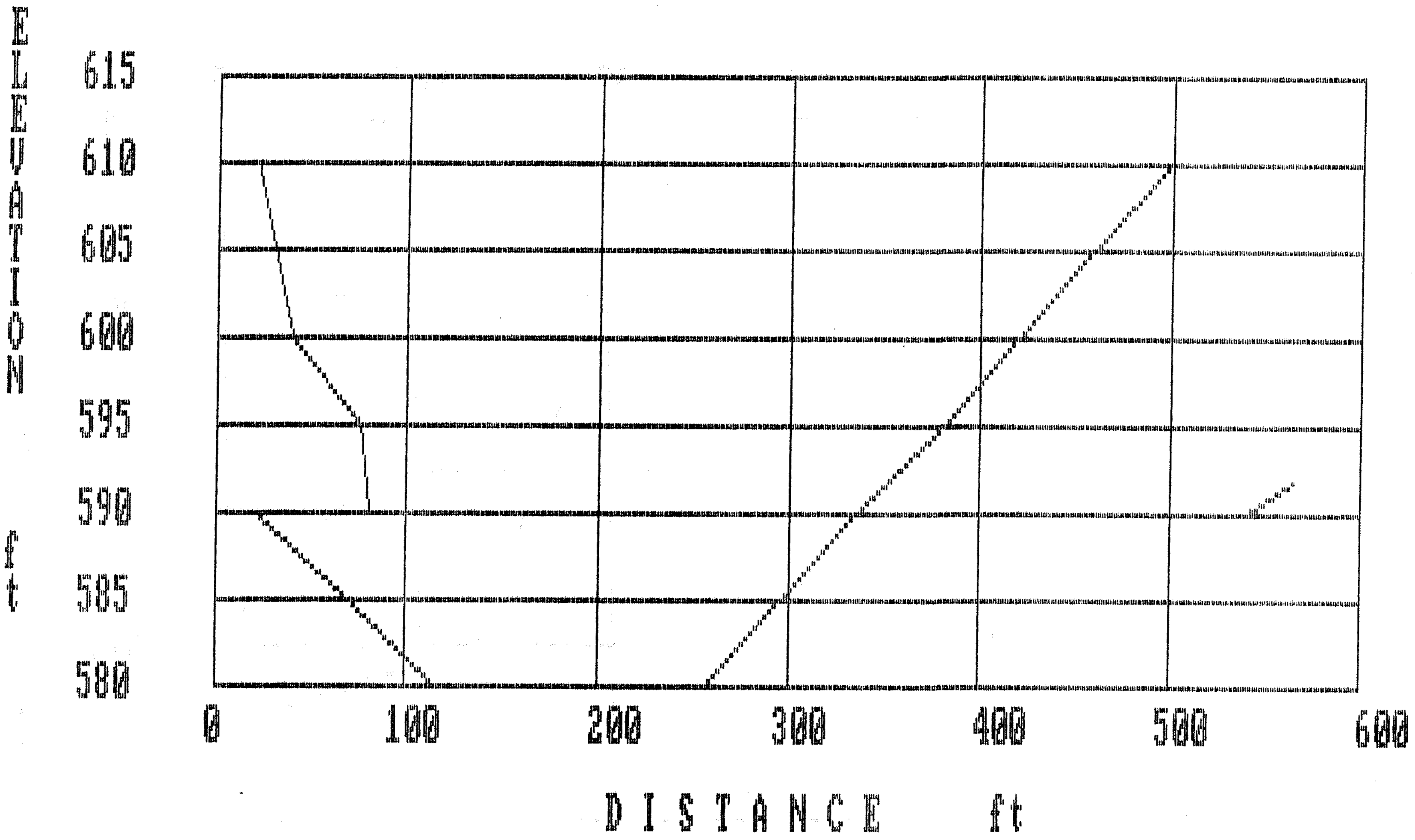

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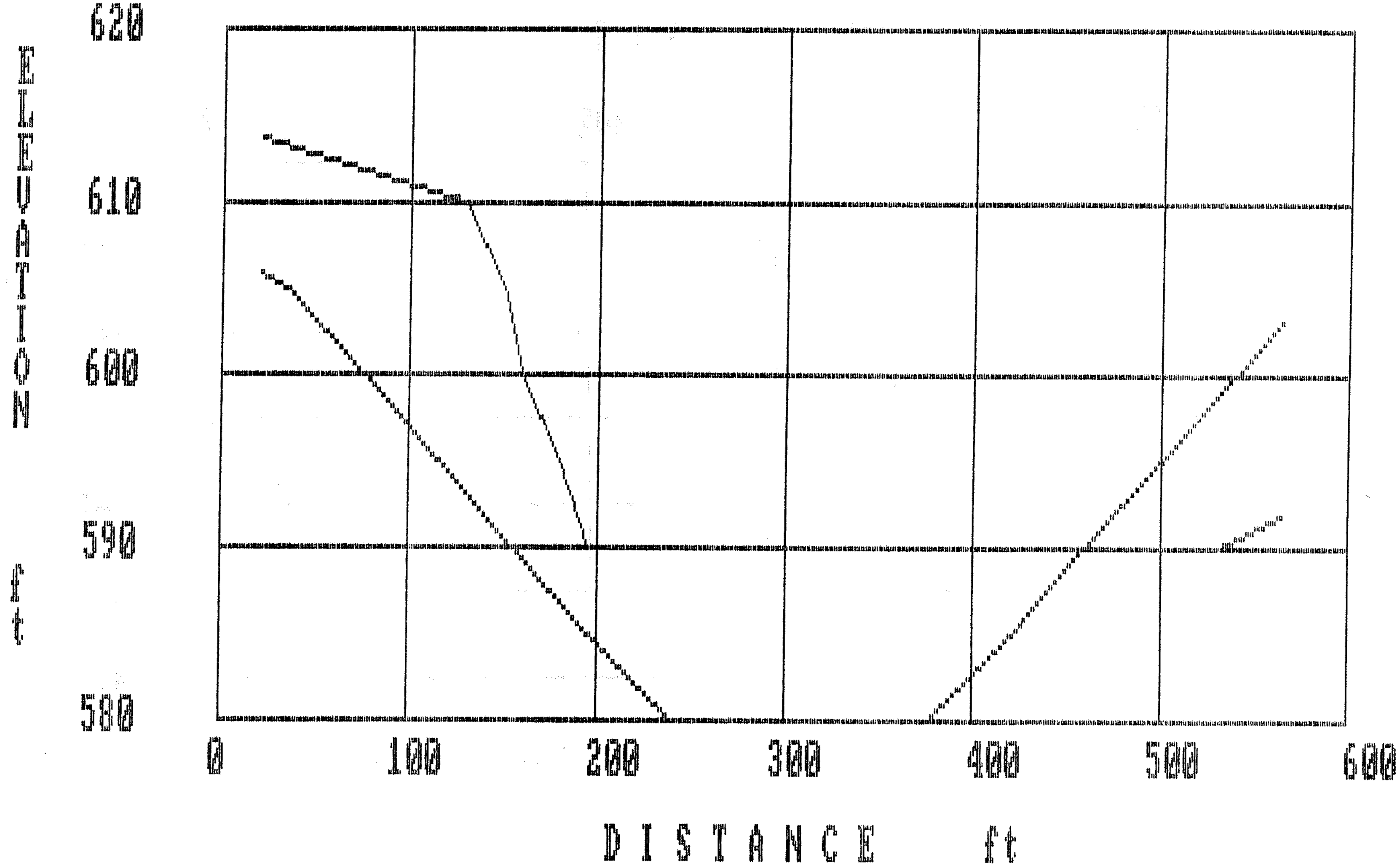

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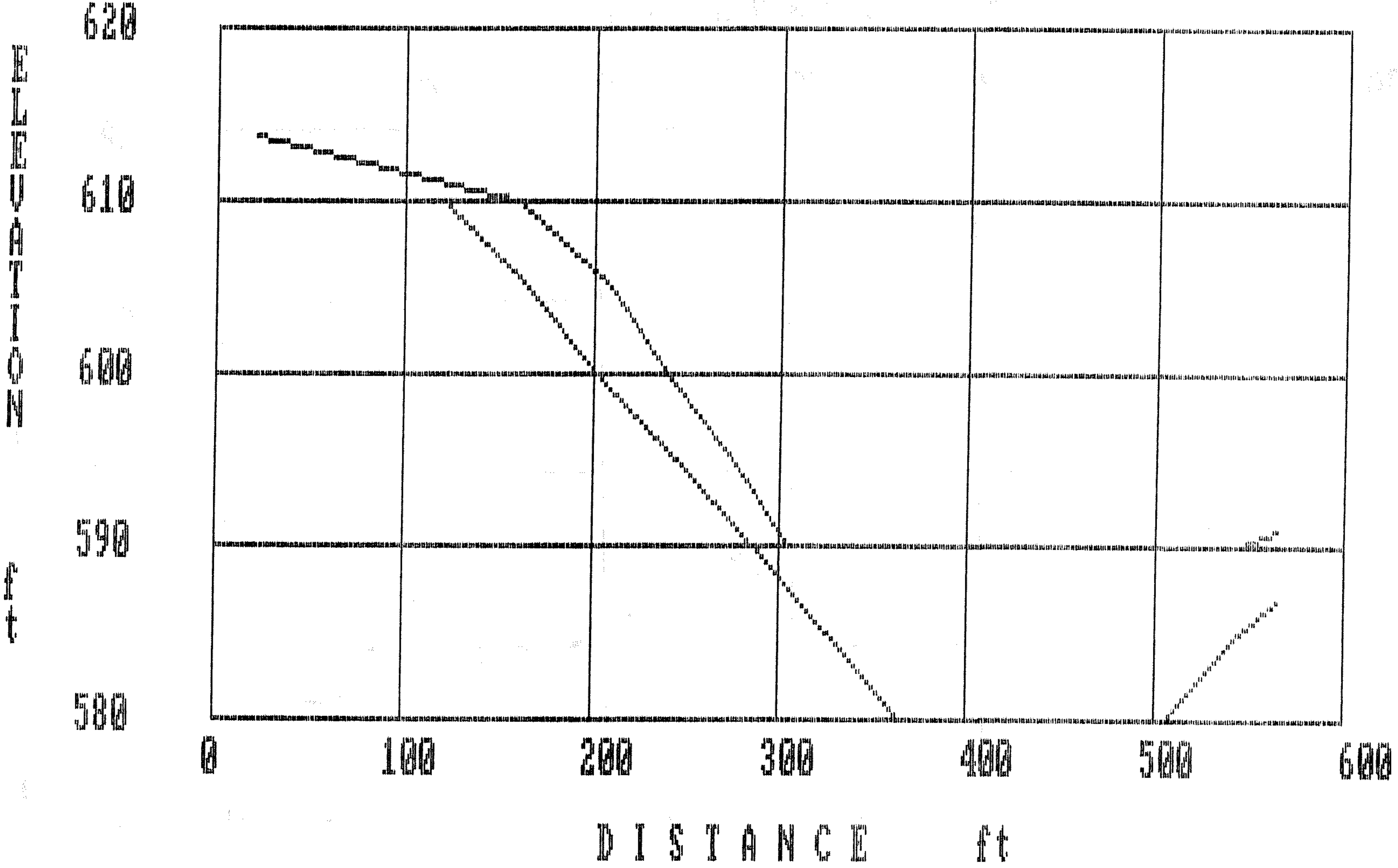

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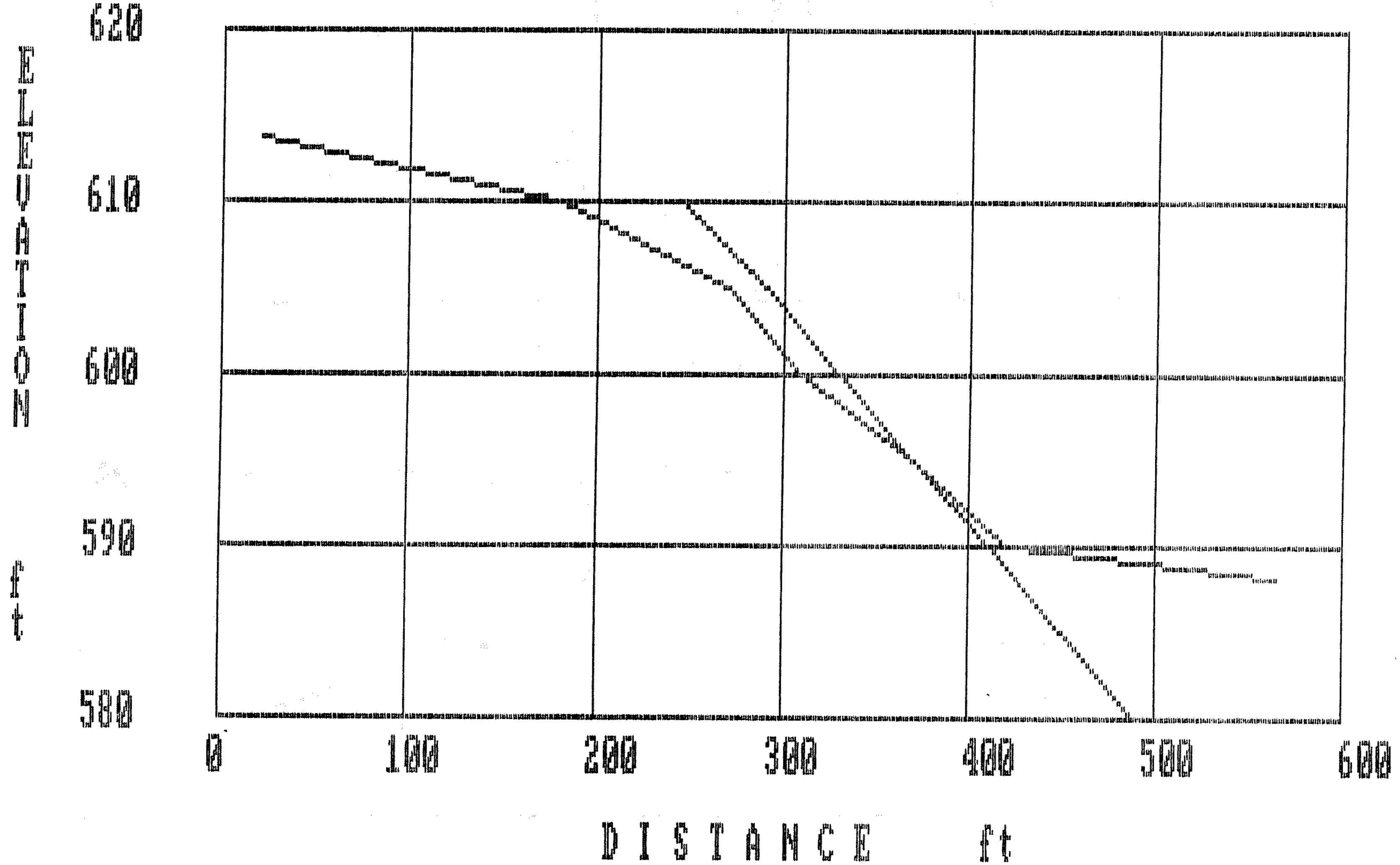
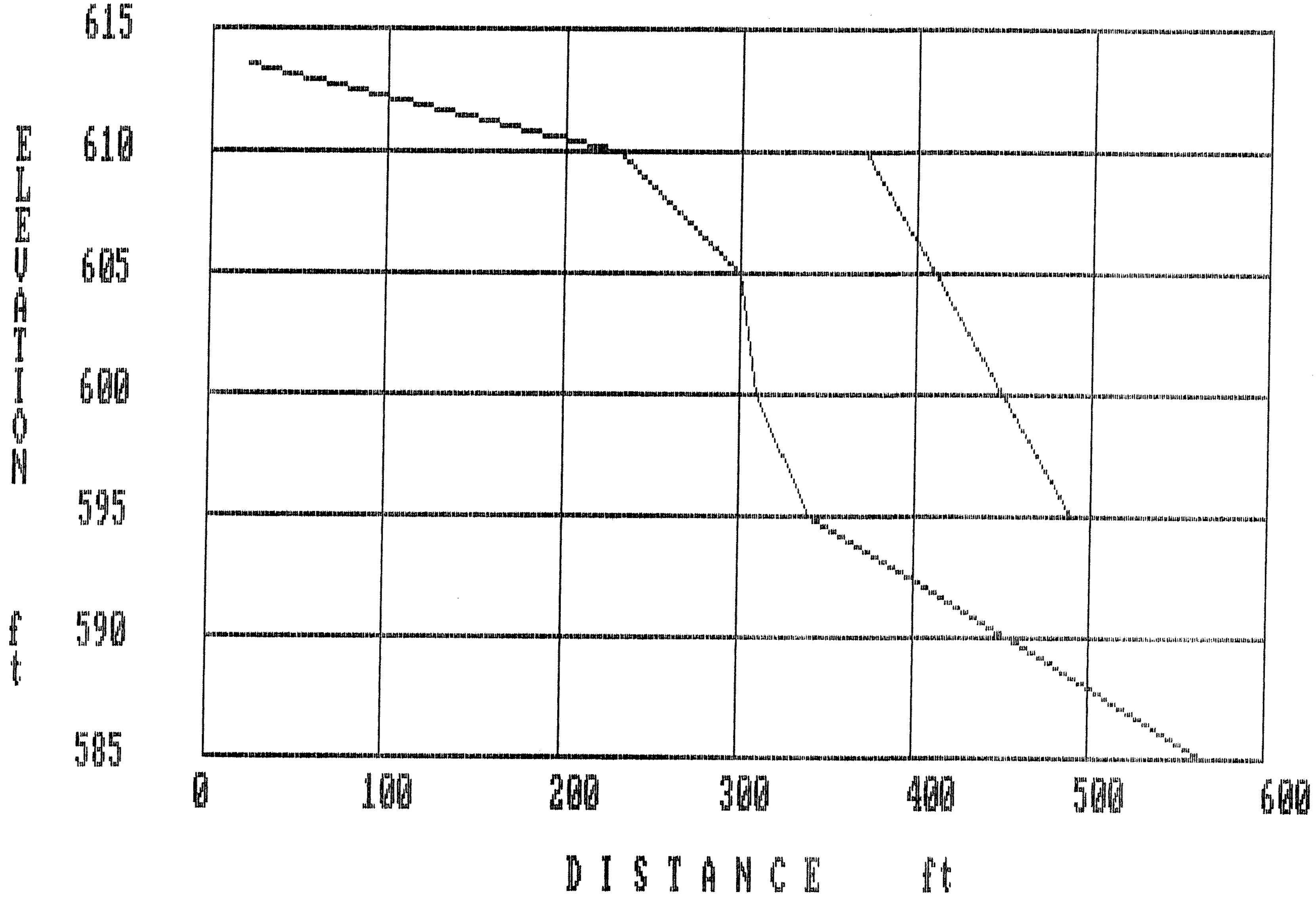
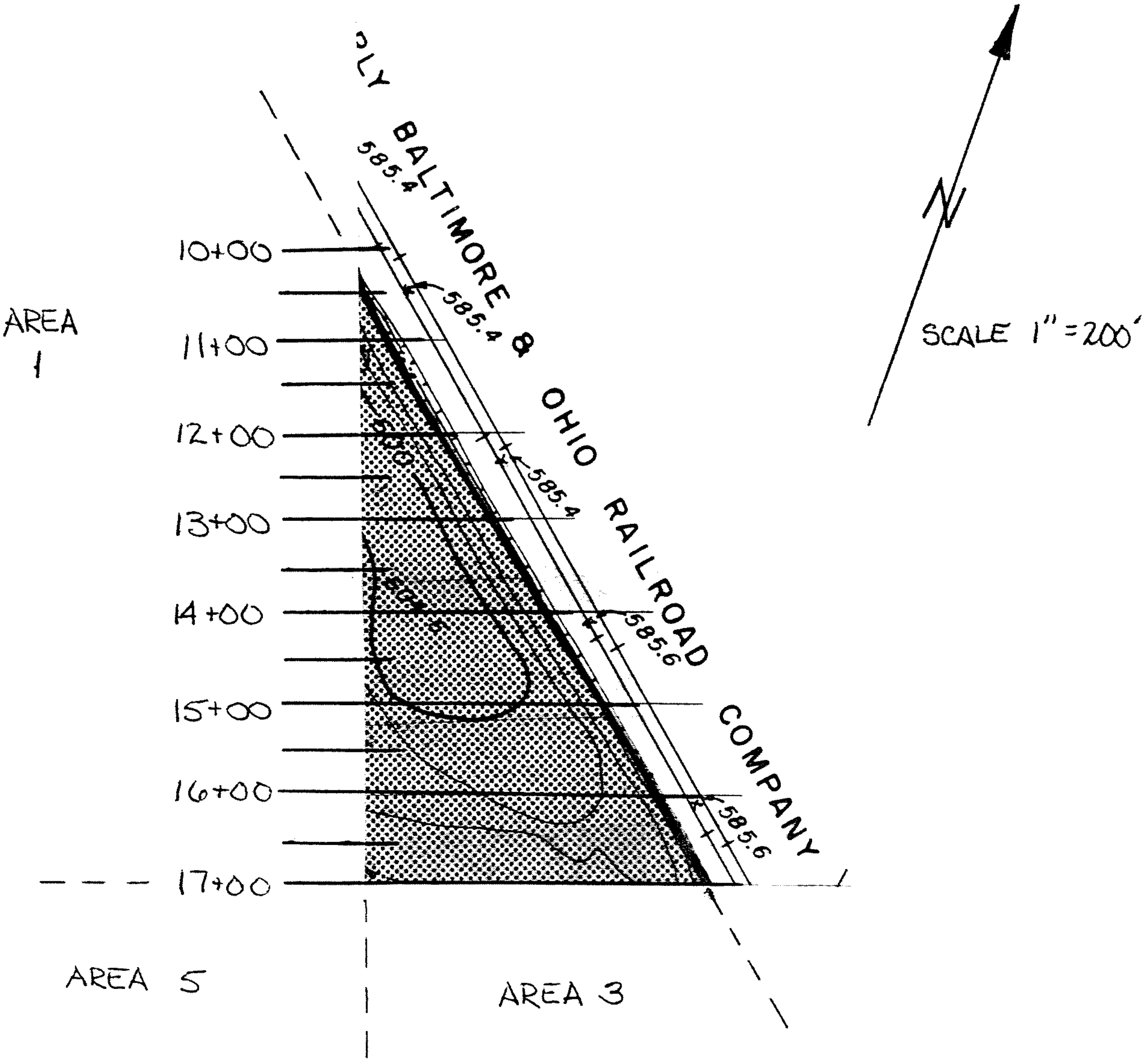


STATION: 1700





AREA 2

STATION LOCATIONS

MISC. DEBRIS/FINE REFUSE

LTV STEEL

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***    CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR2.LTV
         STATION          950.0 FT

     EXISTING PROFILE DATA                   PROPOSED PROFILE DATA
     POINT   X-VALUE   Y-VALUE               POINT   X-VALUE   Y-VALUE
     -----   -------   -------               -----   -------   -------
         1      0.00    585.00                   1      0.00    580.00
         2      1.00    585.00                   2      1.00    580.00

AREA IN CUT                5.0 FT^2
AREA IN FILL               0.0 FT^2

VOL  CUT THIS REACH         0.0 YD^3
VOL FILL THIS REACH         0.0 YD^3

VOL  CUT TOTAL              0.0 YD^3
VOL FILL TOTAL              0.0 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR2.LTV
         STATION            1000.0 FT

     EXISTING PROFILE DATA                   PROPOSED PROFILE DATA
     POINT    X-VALUE    Y-VALUE             POINT    X-VALUE    Y-VALUE
     -----    -------    -------             -----    -------    -------
         1       0.00     593.00                 1       0.00     580.00
         2      25.00     585.00                 2      25.00     580.00

AREA IN CUT                225.0 FT^2
AREA IN FILL                 0.0 FT^2

VOL  CUT THIS REACH         213.0 YD^3
VOL FILL THIS REACH           0.0 YD^3

VOL  CUT TOTAL              213.0 YD^3
VOL FILL TOTAL                0.0 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR2.LTV
         STATION           1050.0 FT

     EXISTING PROFILE DATA                        PROPOSED PROFILE DATA
     POINT    X-VALUE    Y-VALUE                  POINT    X-VALUE    Y-VALUE
     -----    -------    -------                  -----    -------    -------
         1       0.00     598.00                      1       0.00     585.00
         2      20.00     595.00                      2      15.00     580.00
         3      30.00     590.00                      3      50.00     580.00
         4      50.00     585.00

AREA IN CUT                567.5 FT^2
AREA IN FILL                 0.0 FT^2

VOL  CUT THIS REACH        733.8 YD^3
VOL FILL THIS REACH          0.0 YD^3

VOL  CUT TOTAL             946.8 YD^3
VOL FILL TOTAL               0.0 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR2.LTV
        STATION           1100.0 FT

        EXISTING PROFILE DATA                          PROPOSED PROFILE DATA
        POINT    X-VALUE    Y-VALUE                    POINT    X-VALUE    Y-VALUE
        -----    -------    -------                    -----    -------    -------
            1       0.00     603.00                        1       0.00     593.00
            2      20.00     600.00                        2       8.00     590.00
            3      40.00     595.00                        3      26.00     585.00
            4      55.00     590.00                        4      44.00     580.00
            5      80.00     585.00                        5      80.00     580.00

AREA IN CUT               883.0 FT^2
AREA IN FILL                0.0 FT^2

VOL  CUT THIS REACH      1343.1 YD^3
VOL FILL THIS REACH         0.0 YD^3

VOL  CUT TOTAL           2289.8 YD^3
VOL FILL TOTAL              0.0 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***    CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR2.LTV
         STATION          1150.0 FT

     EXISTING PROFILE DATA                       PROPOSED PROFILE DATA
     POINT    X-VALUE    Y-VALUE                 POINT    X-VALUE    Y-VALUE
     -----    -------    -------                 -----    -------    -------
         1       0.00     605.00                     1       0.00     601.00
         2      35.00     600.00                     2       5.00     600.00
         3      60.00     595.00                     3      20.00     595.00
         4      75.00     590.00                     4      40.00     590.00
         5     100.00     585.00                     5      55.00     585.00
                                                     6      70.00     580.00
                                                     7     100.00     580.00

AREA IN CUT                835.0 FT^2
AREA IN FILL                 0.0 FT^2

VOL  CUT THIS REACH        1590.7 YD^3
VOL FILL THIS REACH           0.0 YD^3

VOL  CUT TOTAL             3880.6 YD^3
VOL FILL TOTAL                0.0 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***    CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR2.LTV
         STATION          1200.0 FT

     EXISTING PROFILE DATA
     POINT    X-VALUE    Y-VALUE                  PROPOSED PROFILE DATA
     -----    -------    -------                  POINT    X-VALUE    Y-VALUE
                                                  -----    -------    -------
         1       0.00     605.00
         2      70.00     600.00                      1       0.00     595.00
         3      85.00     595.00                      2      15.00     605.00
         4     100.00     590.00                      3      30.00     600.00
         5     130.00     585.00                      4      50.00     595.00
                                                      5      65.00     590.00
                                                      6      82.00     585.00
                                                      7     100.00     580.00
                                                      8     130.00     580.00

AREA IN CUT              905.5 FT^2
AREA IN FILL               3.0 FT^2

VOL  CUT THIS REACH     1611.5 YD^3
VOL FILL THIS REACH        2.7 YD^3

VOL  CUT TOTAL          5492.1 YD^3
VOL FILL TOTAL             2.7 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR2.LTV
         STATION          1250.0 FT

     EXISTING PROFILE DATA                     PROPOSED PROFILE DATA
     POINT   X-VALUE   Y-VALUE                 POINT   X-VALUE   Y-VALUE
     -----   -------   -------                 -----   -------   -------
         1      0.00    603.00                     1      0.00    610.00
         2    110.00    600.00                     2     25.00    610.00
         3    130.00    595.00      ,              3     45.00    605.00
         4    145.00    590.00                     4     60.00    600.00
         5    165.00    585.00                     5     80.00    595.00
                                                   6     95.00    590.00
                                                   7    110.00    585.00
                                                   8    130.00    580.00
                                                   9    165.00    580.00

AREA IN CUT                 1024.6 FT^2
AREA IN FILL                 309.6 FT^2

VOL  CUT THIS REACH          1787.1 YD^3
VOL FILL THIS REACH           289.4 YD^3

VOL  CUT TOTAL               7279.2 YD^3
VOL FILL TOTAL                292.2 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR2.LTV
         STATION           1300.0 FT

    EXISTING PROFILE DATA                          PROPOSED PROFILE DATA
    POINT    X-VALUE    Y-VALUE                    POINT    X-VALUE    Y-VALUE
    -----    -------    -------                    -----    -------    -------
        1       0.00     603.00                        1       0.00     595.00
        2      40.00     600.00                        2      55.00     610.00
        3     130.00     600.00                        3      70.00     605.00
        4     155.00     595.00                        4      90.00     600.00
        5     170.00     590.00                        5     105.00     595.00
        6     190.00     585.00                        6     122.00     590.00
                                                       7     140.00     585.00
                                                       8     155.00     580.00
                                                       9     190.00     580.00

AREA IN CUT              1019.5 FT^2
AREA IN FILL              332.0 FT^2

VOL  CUT THIS REACH       1892.7 YD^3
VOL FILL THIS REACH        594.1 YD^3

VOL  CUT TOTAL            9172.0 YD^3
VOL FILL TOTAL             886.3 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***    CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR2.LTV
         STATION        1350.0 FT

     EXISTING PROFILE DATA                   PROPOSED PROFILE DATA
     POINT   X-VALUE   Y-VALUE               POINT   X-VALUE   Y-VALUE
     -----   -------   -------               -----   -------   -------
         1      0.00    598.00                   1      0.00    615.00
         2     45.00    600.00                   2     85.00    610.00
         3    160.00    600.00                   3    100.00    605.00
         4    180.00    595.00                   4    120.00    600.00
         5    200.00    590.00                   5    135.00    595.00
         6    220.00    585.00                   6    150.00    590.00
                                                 7    165.00    585.00
                                                 8    182.00    580.00
                                                 9    220.00    580.00

AREA IN CUT              945.0 FT^2
AREA IN FILL            1270.0 FT^2

VOL  CUT THIS REACH      1819.0 YD^3
VOL FILL THIS REACH      1483.4 YD^3

VOL  CUT TOTAL          10991.0 YD^3
VOL FILL TOTAL           2369.7 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR2.LTV
         STATION          1400.0 FT

     EXISTING PROFILE DATA                     PROPOSED PROFILE DATA
     POINT   X-VALUE   Y-VALUE                 POINT   X-VALUE   Y-VALUE
     -----   -------   -------                 -----   -------   -------
         1      0.00    597.00                     1      0.00    616.50
         2     40.00    600.00                     2    110.00    610.00
         3    195.00    600.00                     3    130.00    605.00
         4    215.00    595.00                     4    145.00    600.00
         5    235.00    590.00                     5    160.00    595.00
         6    250.00    585.00                     6    180.00    590.00
                                                   7    195.00    585.00
                                                   8    215.00    580.00
                                                   9    250.00    580.00

AREA IN CUT              1037.5 FT^2
AREA IN FILL             1705.0 FT^2

VOL  CUT THIS REACH       1835.6 YD^3
VOL FILL THIS REACH       2754.6 YD^3

VOL  CUT TOTAL           12826.6 YD^3
VOL FILL TOTAL            5124.3 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***    CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR2.LTV
        STATION         1450.0 FT

     EXISTING PROFILE DATA                    PROPOSED PROFILE DATA
     POINT   X-VALUE   Y-VALUE                POINT   X-VALUE   Y-VALUE
     -----   -------   -------                -----   -------   -------
         1      0.00    594.00                    1      0.00    595.00
         2     50.00    600.00                    2    100.00    610.00
         3    210.00    600.00                    3    155.00    605.00
         4    230.00    595.00                    4    170.00    600.00
         5    250.00    590.00                    5    190.00    595.00
         6    280.00    585.00                    6    205.00    590.00
                                                  7    220.00    585.00
                                                  8    240.00    580.00
                                                  9    280.00    580.00

AREA IN CUT             925.0 FT^2
AREA IN FILL            850.0 FT^2

VOL  CUT THIS REACH     1817.1 YD^3
VOL FILL THIS REACH     2365.7 YD^3

VOL  CUT TOTAL         14643.7 YD^3
VOL FILL TOTAL          7490.1 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR2.LTV
         STATION          1500.0 FT

     EXISTING PROFILE DATA                    PROPOSED PROFILE DATA
     POINT    X-VALUE    Y-VALUE              POINT    X-VALUE    Y-VALUE
     -----    -------    -------              -----    -------    -------
       1        0.00     592.00                 1        0.00     610.00
       2       70.00     595.00                 2       50.00     610.00
       3      160.00     600.00                 3      185.00     605.00
       4      280.00     595.00                 4      200.00     600.00
       5      295.00     590.00                 5      218.00     595.00
       6      310.00     585.00                 6      235.00     590.00
                                                7      250.00     585.00
                                                8      270.00     580.00
                                                9      310.00     580.00

AREA IN CUT               949.2 FT^2
AREA IN FILL             2269.2 FT^2

VOL  CUT THIS REACH       1735.4 YD^3
VOL FILL THIS REACH       2888.2 YD^3

VOL  CUT TOTAL           16379.1 YD^3
VOL FILL TOTAL           10378.2 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***    CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR2.LTV
         STATION            1550.0 FT

     EXISTING PROFILE DATA                    PROPOSED PROFILE DATA
     POINT   X-VALUE   Y-VALUE                POINT   X-VALUE   Y-VALUE
     -----   -------   -------                -----   -------   -------
         1      0.00    592.00                    1      0.00    595.00
         2    120.00    595.00                    2     20.00    605.00
         3    300.00    595.00                    3    145.00    605.00
         4    325.00    590.00                    4    230.00    600.00
         5    335.00    585.00                    5    245.00    595.00
                                                  6    260.00    590.00
                                                  7    275.00    585.00
                                                  8    295.00    580.00
                                                  9    335.00    580.00

AREA IN CUT                 862.5 FT^2
AREA IN FILL               2205.0 FT^2

VOL  CUT THIS REACH         1677.5 YD^3
VOL FILL THIS REACH         4142.8 YD^3

VOL  CUT TOTAL             18056.6 YD^3
VOL FILL TOTAL             14521.0 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***    CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR2.LTV
       STATION         1600.0 FT

    EXISTING PROFILE DATA                        PROPOSED PROFILE DATA
    POINT   X-VALUE   Y-VALUE                    POINT   X-VALUE   Y-VALUE
    -----   -------   -------                    -----   -------   -------
        1      0.00    589.00                        1      0.00    587.00
        2    190.00    590.00                        2     25.00    590.00
        3    230.00    595.00                        3     67.00    595.00
        4    275.00    595.00                        4    107.00    600.00
        5    355.00    590.00                        5    232.00    600.00
        6    365.00    585.00                        6    270.00    595.00
                                                     7    290.00    590.00
                                                     8    305.00    585.00
                                                     9    325.00    580.00
                                                    10    365.00    580.00

AREA IN CUT             754.9 FT^2
AREA IN FILL           1714.9 FT^2

VOL  CUT THIS REACH     1497.6 YD^3
VOL FILL THIS REACH     3629.6 YD^3

VOL  CUT TOTAL         19554.3 YD^3
VOL FILL TOTAL         18150.6 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR2.LTV
         STATION          1650.0 FT

     EXISTING PROFILE DATA                        PROPOSED PROFILE DATA
     POINT    X-VALUE    Y-VALUE                  POINT    X-VALUE    Y-VALUE
     -----    -------    -------                  -----    -------    -------
         1       0.00     588.00                      1       0.00     580.00
         2     210.00     590.00                      2      70.00     580.00
         3     360.00     595.00                      3     115.00     585.00
         4     390.00     585.00                      4     155.00     590.00
                                                      5     195.00     595.00
                                                      6     300.00     595.00
                                                      7     315.00     590.00
                                                      8     330.00     585.00
                                                      9     345.00     580.00
                                                     10     390.00     580.00

AREA IN CUT                1751.1 FT^2
AREA IN FILL                511.0 FT^2

VOL  CUT THIS REACH         2320.4 YD^3
VOL FILL THIS REACH         2061.1 YD^3

VOL  CUT TOTAL             21874.6 YD^3
VOL FILL TOTAL             20211.7 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR2.LTV
         STATION          1700.0 FT

     EXISTING PROFILE DATA                     PROPOSED PROFILE DATA
     POINT    X-VALUE    Y-VALUE               POINT    X-VALUE    Y-VALUE
     -----    -------    -------               -----    -------    -------

         1       0.00     585.00                   1       0.00     586.00
         2     325.00     590.00                   2      10.00     585.00
         3     370.00     590.00                   3      50.00     580.00
         4     400.00     585.00                   4     195.00     580.00
                                                   5     235.00     585.00
                                                   6     275.00     590.00
                                                   7     285.00     590.00
                                                   8     320.00     585.00
                                                   9     340.00     580.00
                                                  10     400.00     580.00

AREA IN CUT              2160.2 FT^2
AREA IN FILL               15.2 FT^2

VOL  CUT THIS REACH       3621.5 YD^3
VOL FILL THIS REACH        487.2 YD^3

VOL  CUT TOTAL           25496.1 YD^3
VOL FILL TOTAL           20698.9 YD^3
```

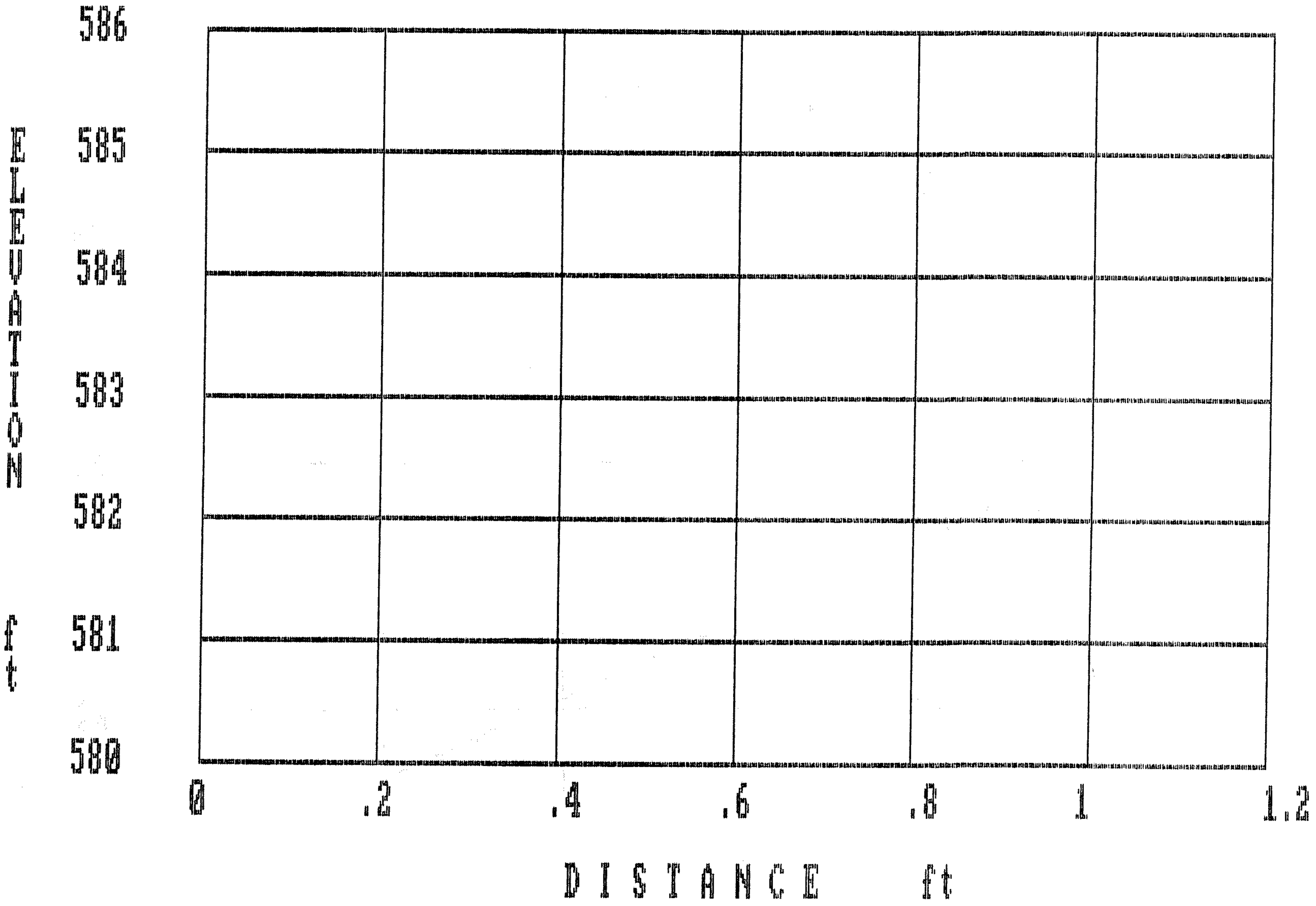
```
*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR2.LTV


                                S U M M A R Y   T A B L E
                                = = = = = = =   = = = = =

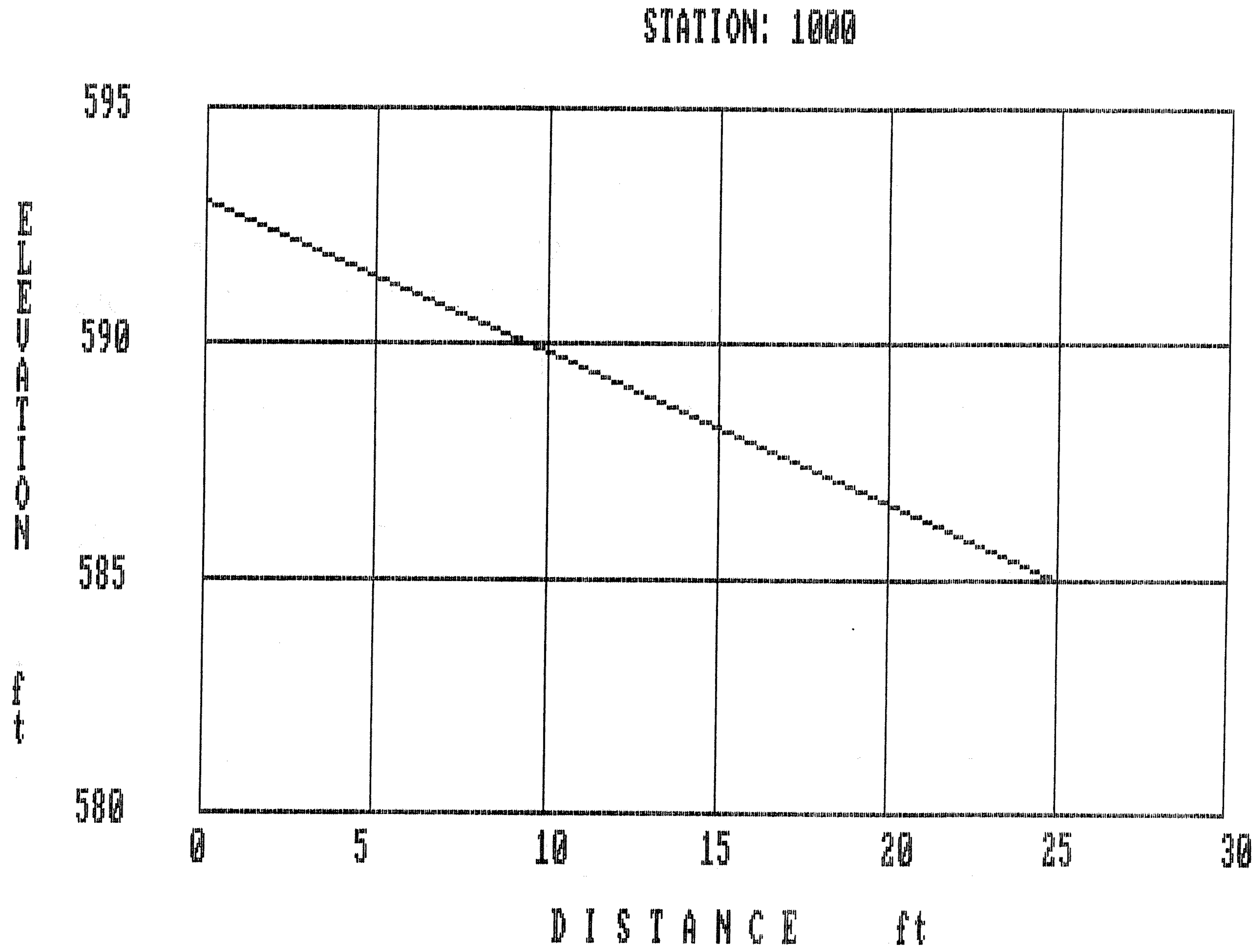
UNITS:    SECTION DATA  -- SQFT           STATION  -- FT
            REACH DATA  -- CUYD
            TOTAL DATA  -- CUYD
              NET DATA  -- CUYD

         ---------------------------------------------------------------------
         !     SECTION      !       REACH       !       TOTAL       !         !
 ----------------------------------------------------------------------  NET  !
 ! STATION!   CUT   !  FILL   !   CUT   !  FILL   !   CUT   !  FILL   !  MASS  !
 -----------------------------------------------------------------------------
 !     950!        5!        0!        0!        0!        0!        0!        0!
 !    1000!      225!        0!      213!        0!      213!        0!     -213!
 !    1050!      568!        0!      734!        0!      947!        0!     -947!
 !    1100!      883!        0!     1343!        0!     2290!        0!    -2290!
 !    1150!      835!        0!     1591!        0!     3881!        0!    -3881!
 -----------------------------------------------------------------------------
 !    1200!      905!        3!     1612!        3!     5492!        3!    -5489!
 !    1250!     1025!      310!     1787!      289!     7279!      292!    -6987!
 !    1300!     1020!      332!     1893!      594!     9172!      886!    -8286!
 !    1350!      945!     1270!     1819!     1483!    10991!     2370!    -8621!
 !    1400!     1038!     1705!     1836!     2755!    12827!     5124!    -7702!
 -----------------------------------------------------------------------------
 !    1450!      925!      850!     1817!     2366!    14644!     7490!    -7154!
 !    1500!      949!     2269!     1735!     2888!    16379!    10378!    -6001!
 !    1550!      863!     2205!     1678!     4143!    18057!    14521!    -3536!
 !    1600!      755!     1715!     1498!     3630!    19554!    18151!    -1404!
 !    1650!     1751!      511!     2320!     2061!    21875!    20212!    -1663!
 -----------------------------------------------------------------------------
 !    1700!     2160!       15!     3621!      487!    25496!    20699!    -4797!
 -----------------------------------------------------------------------------
```



STATION: 950

586
585
584
583
582
581
580
ELEVATION ft
0
.2
.4
.6
.8
1
1.2
DISTANCE ft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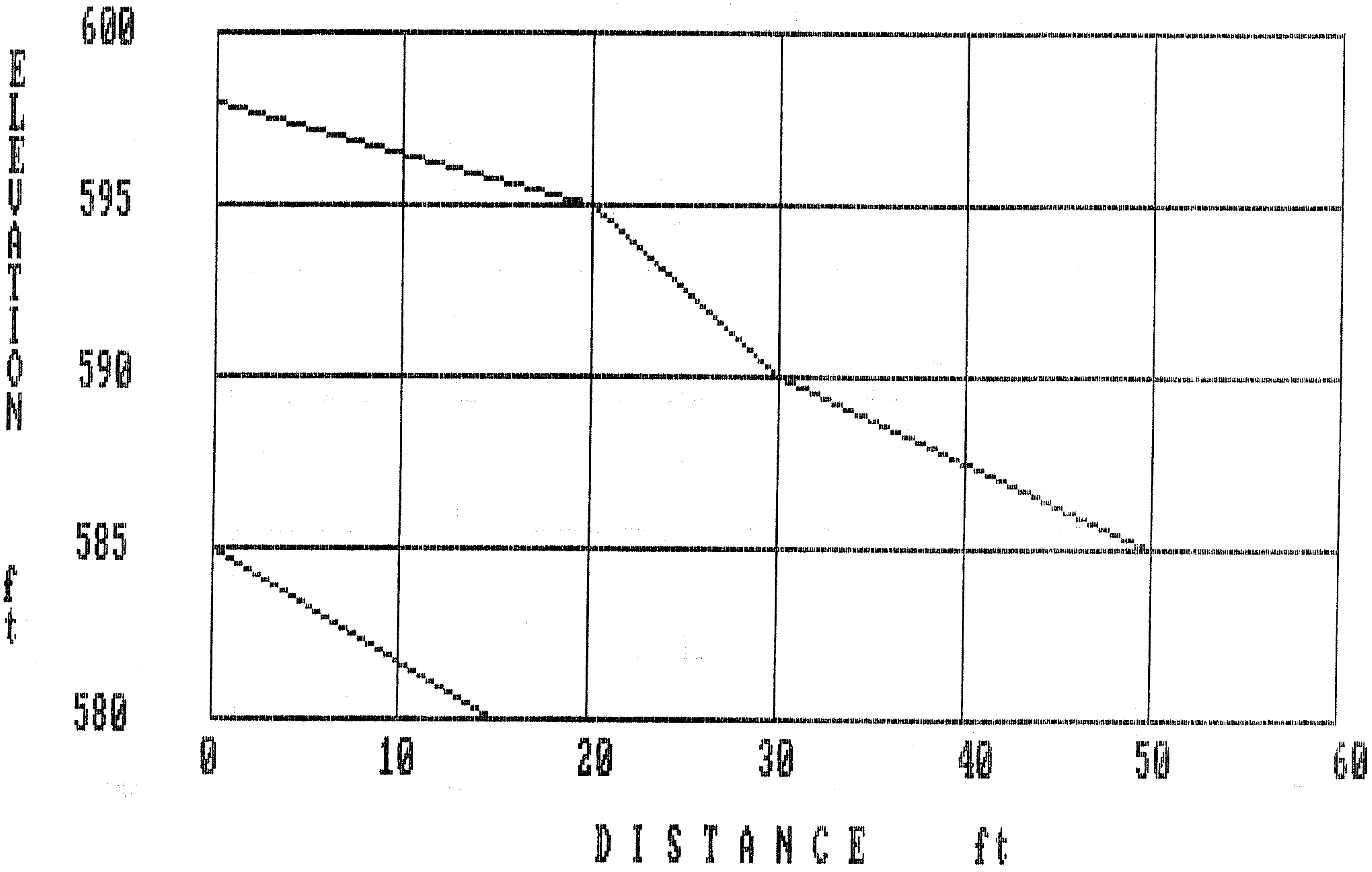
590
585
580
ELEVATION ft
0
5
10
15
20
25
30
DISTANCE ft

STATION: 1050



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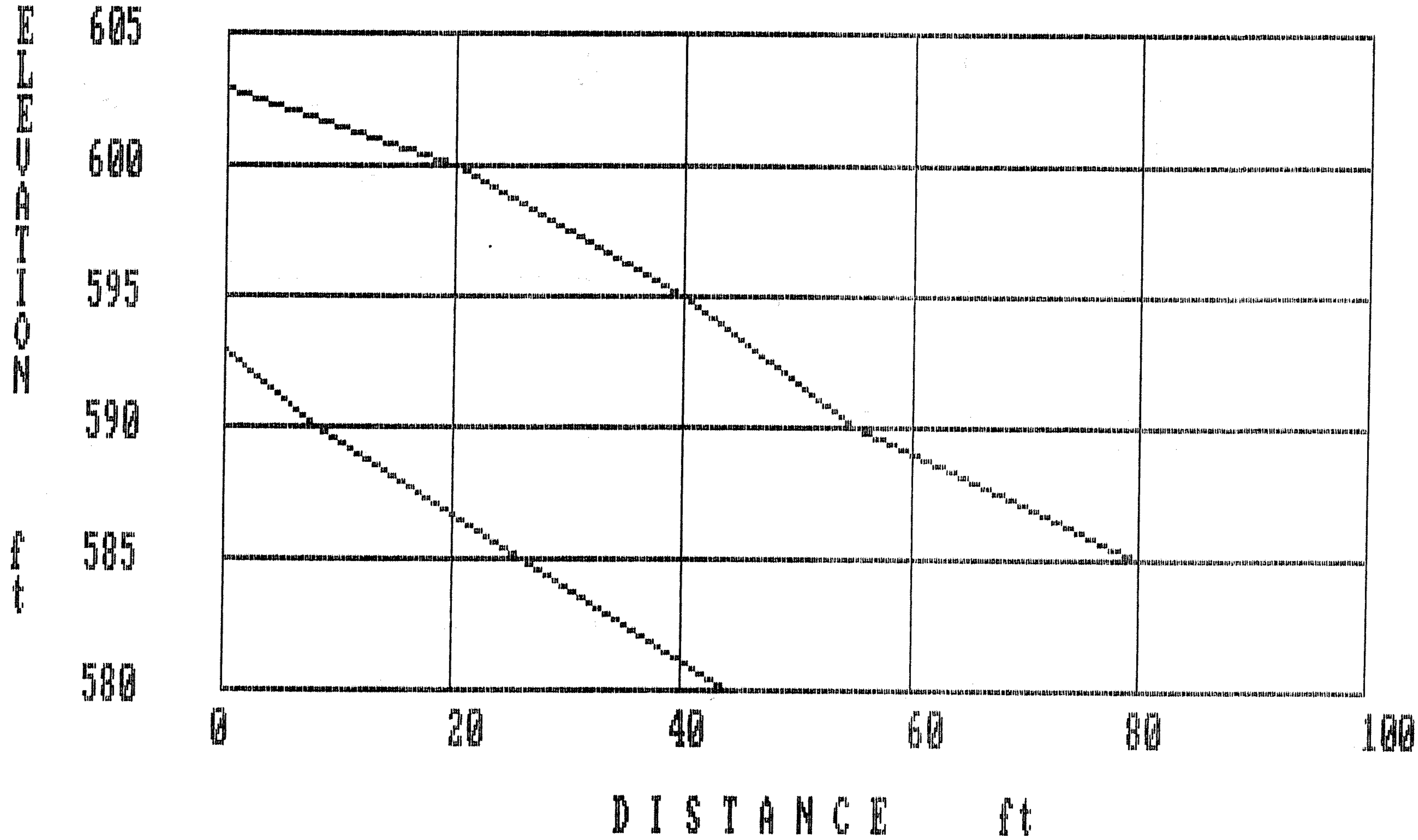

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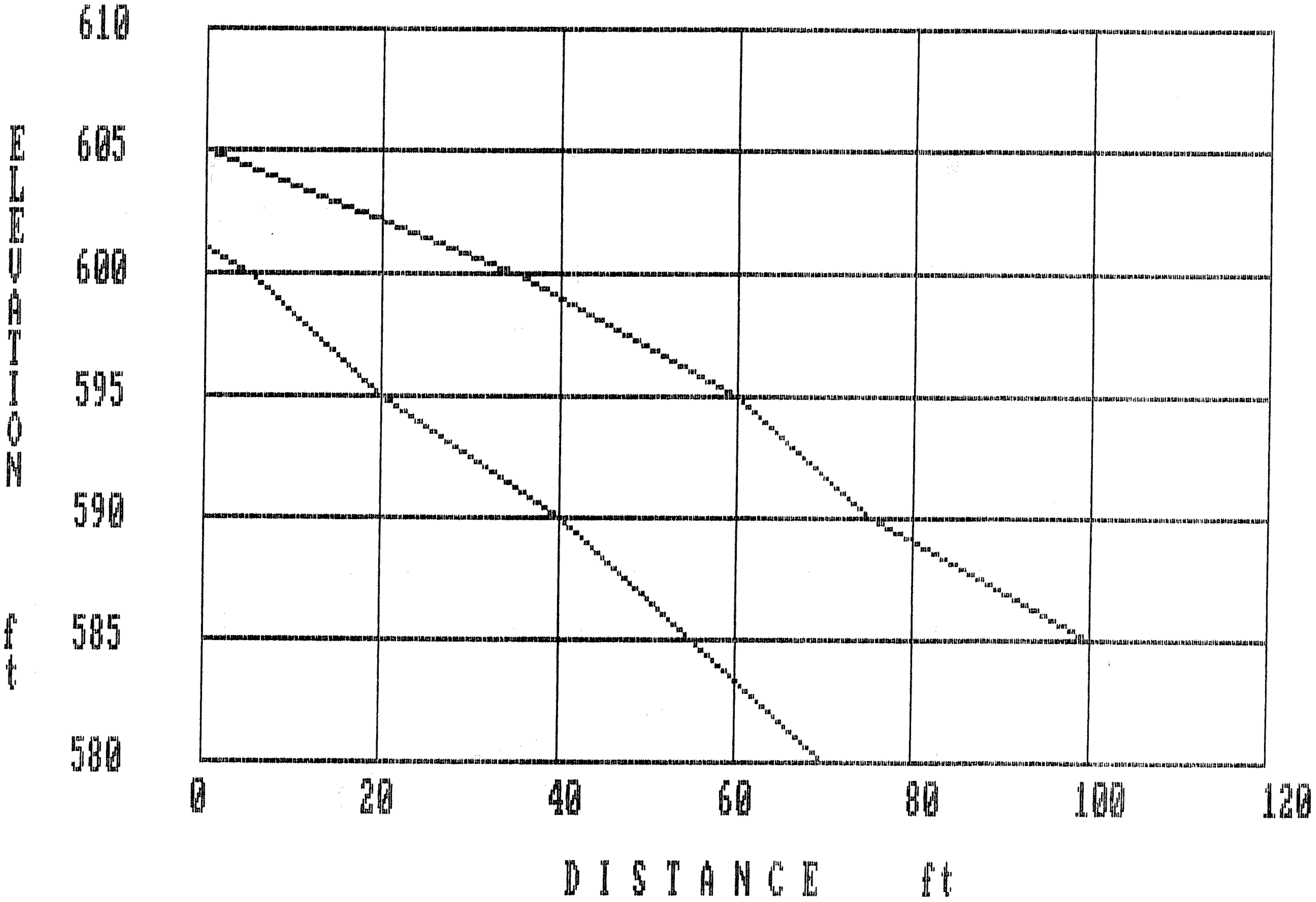

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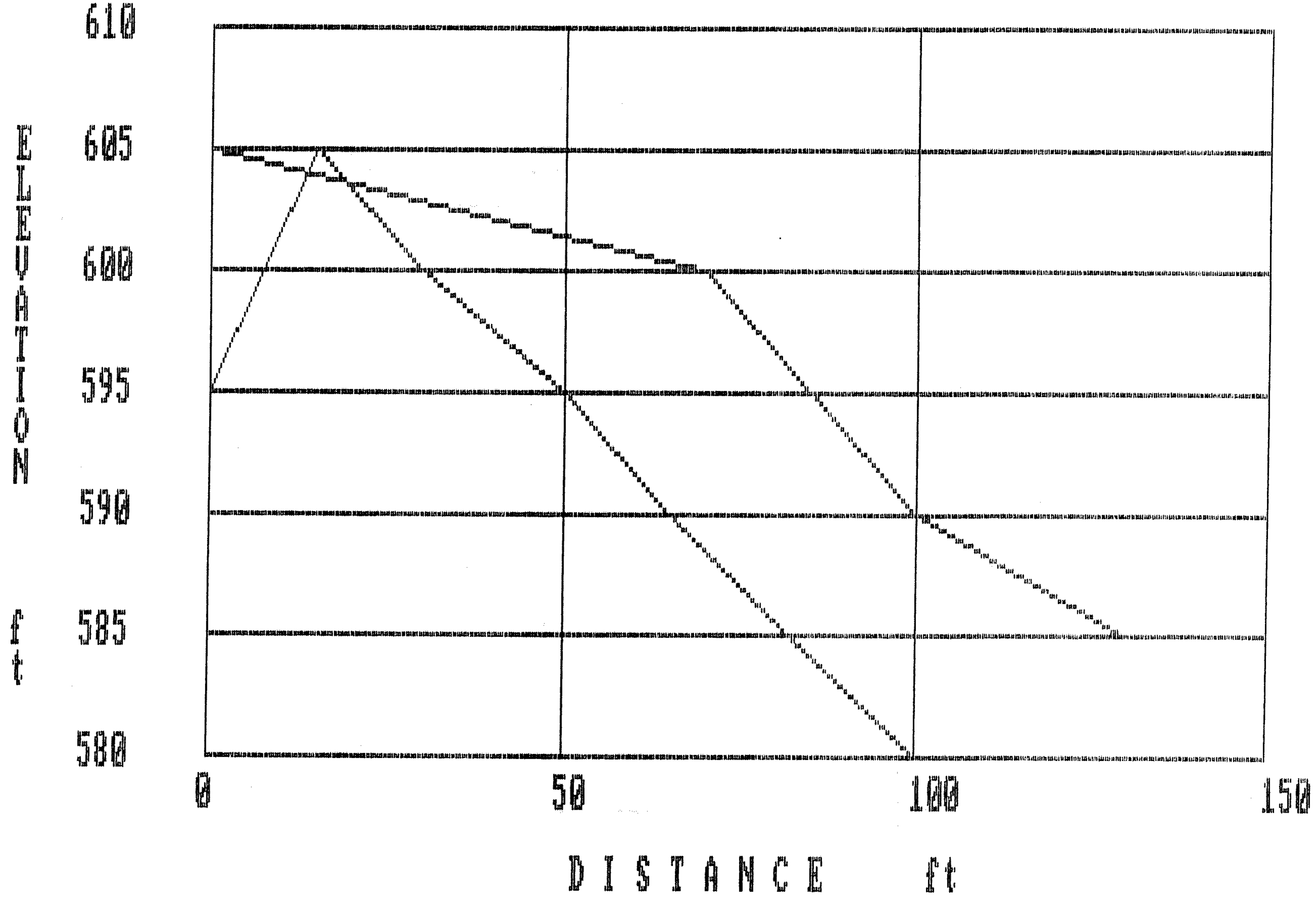

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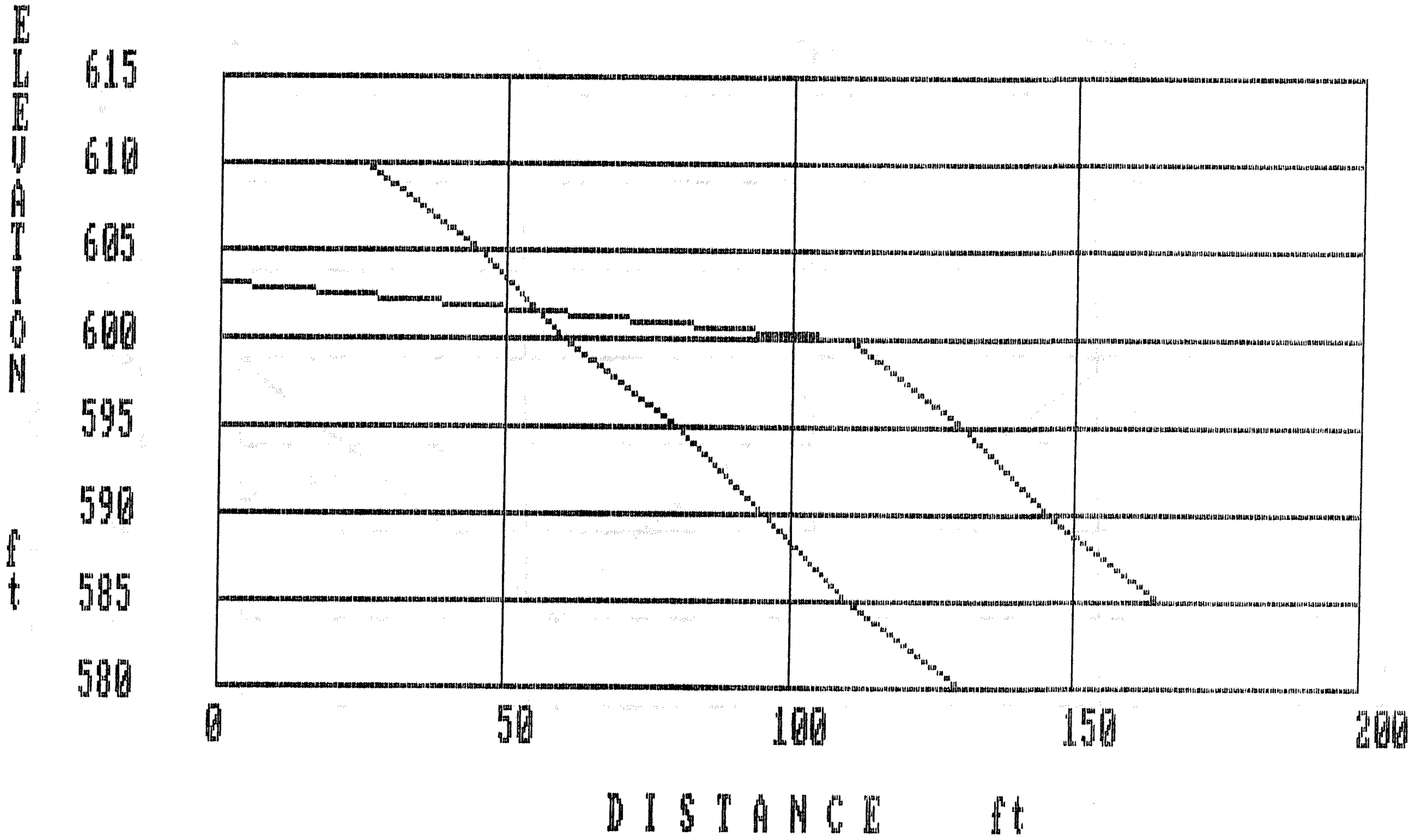

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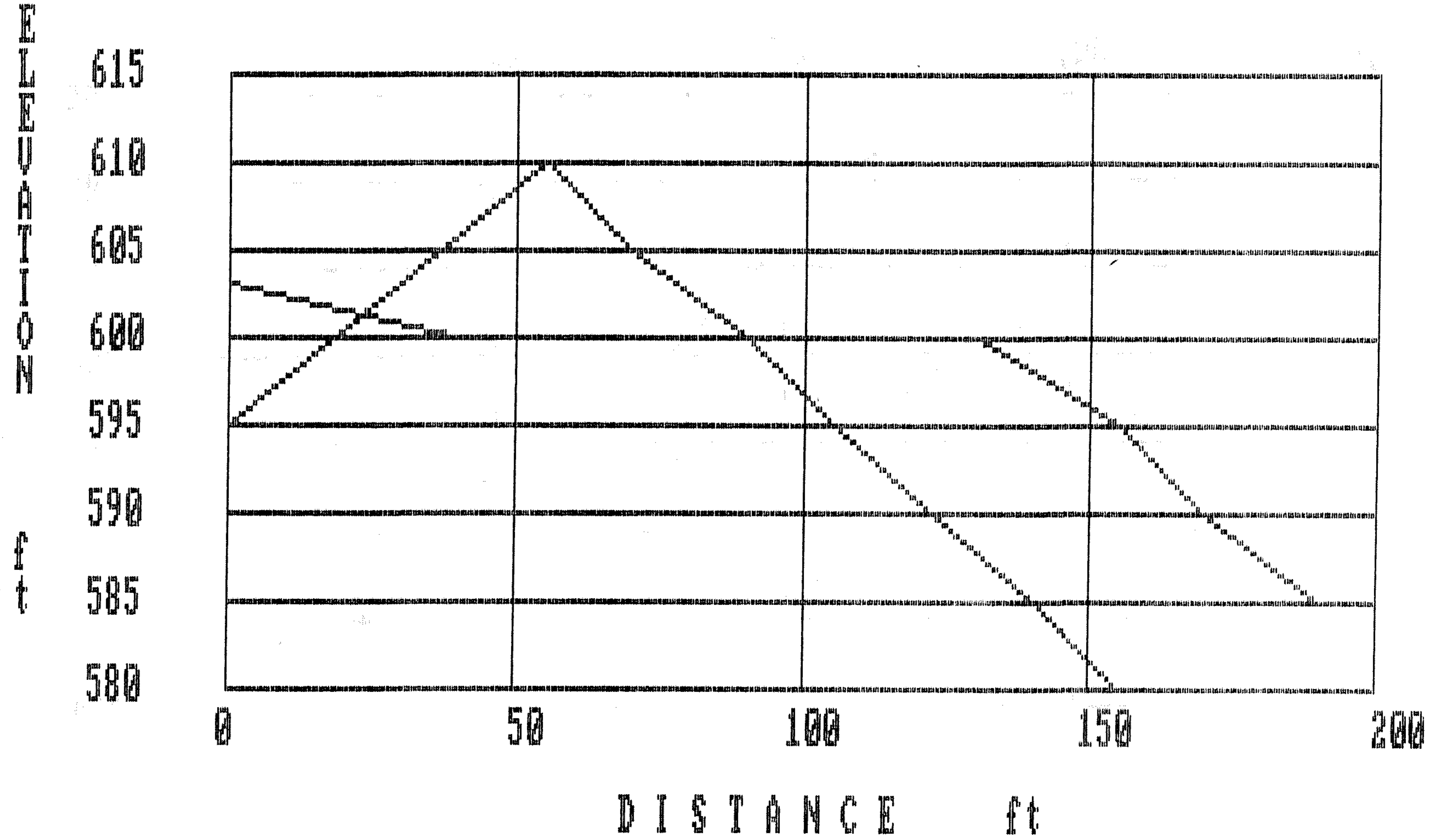

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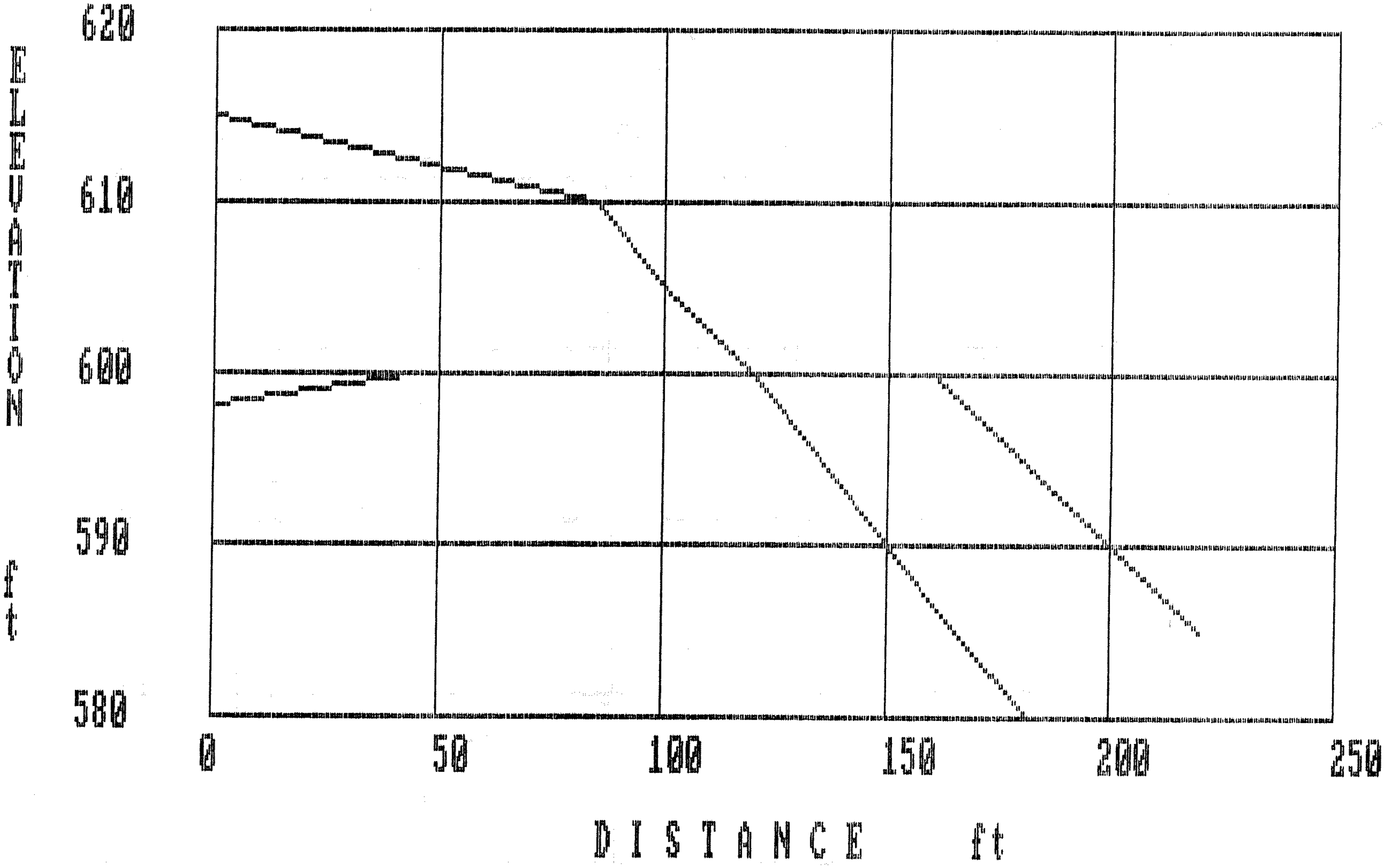

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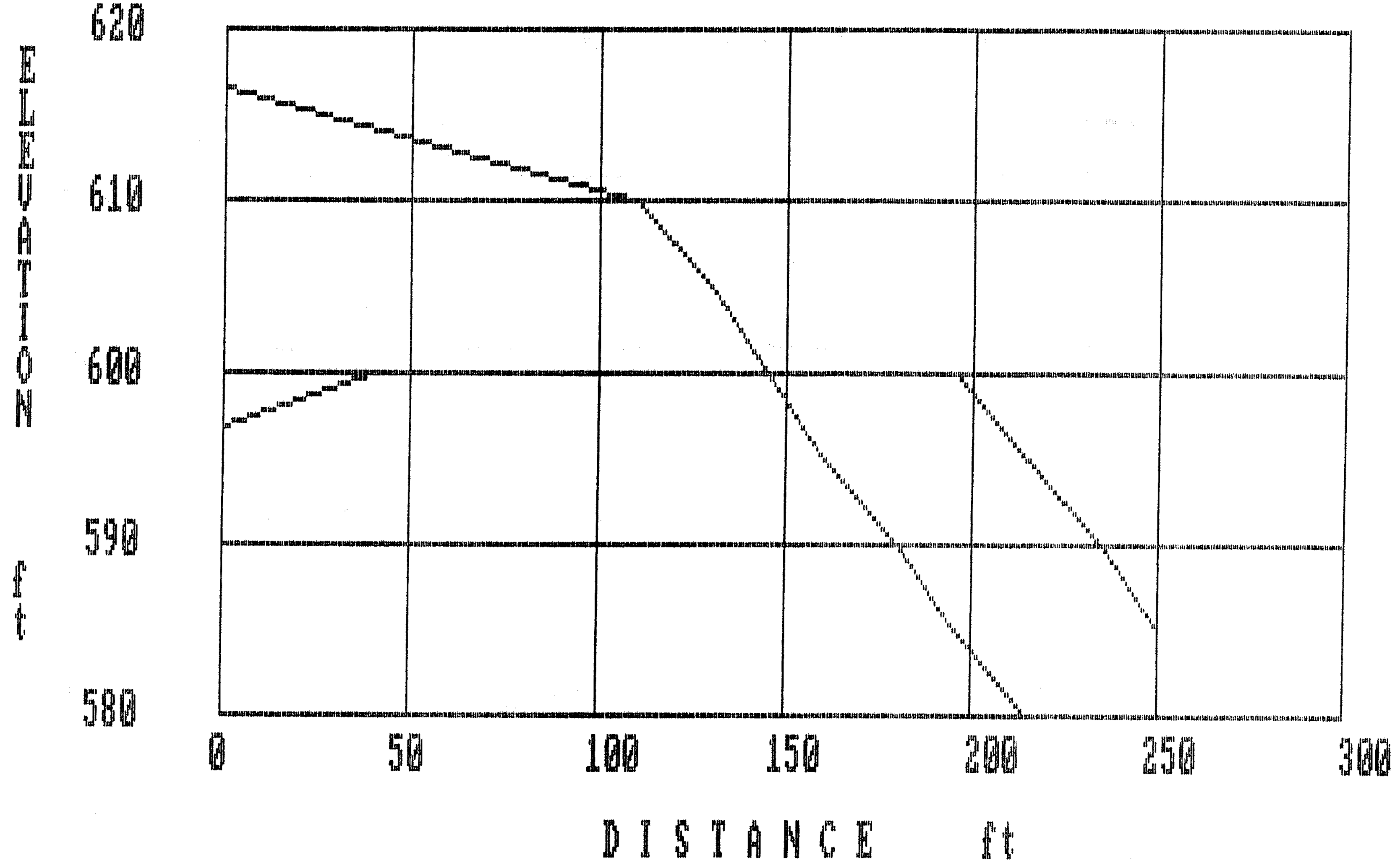

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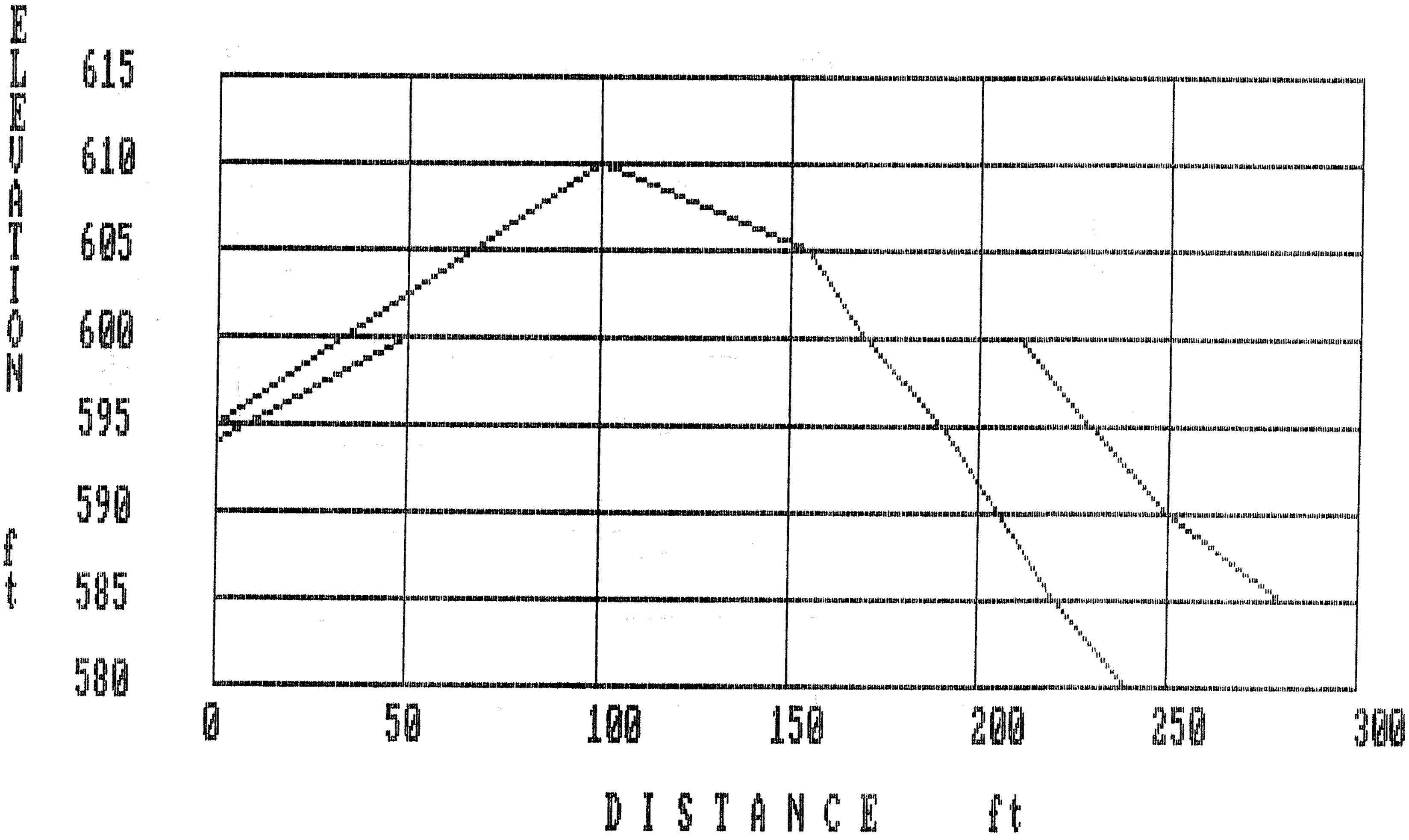

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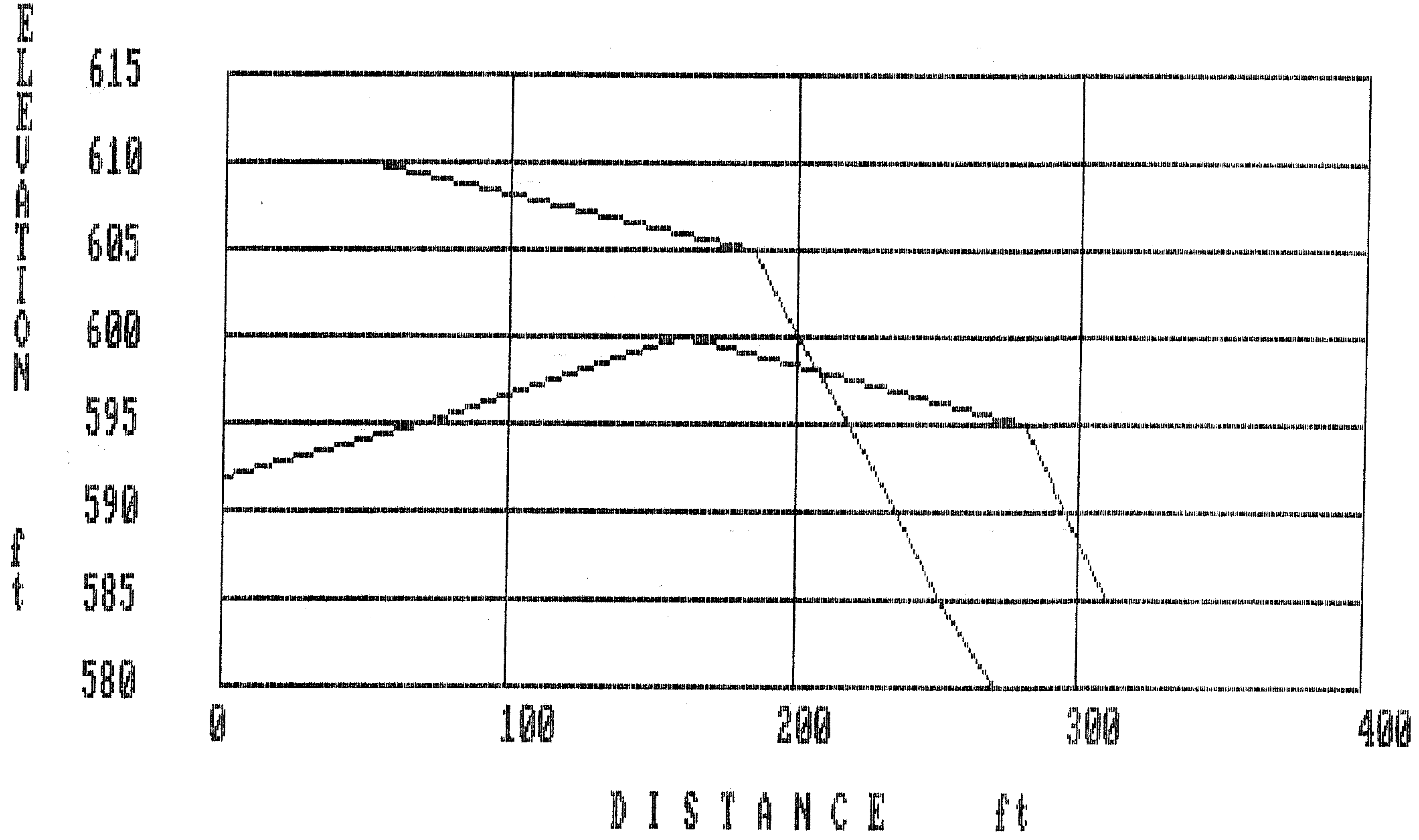

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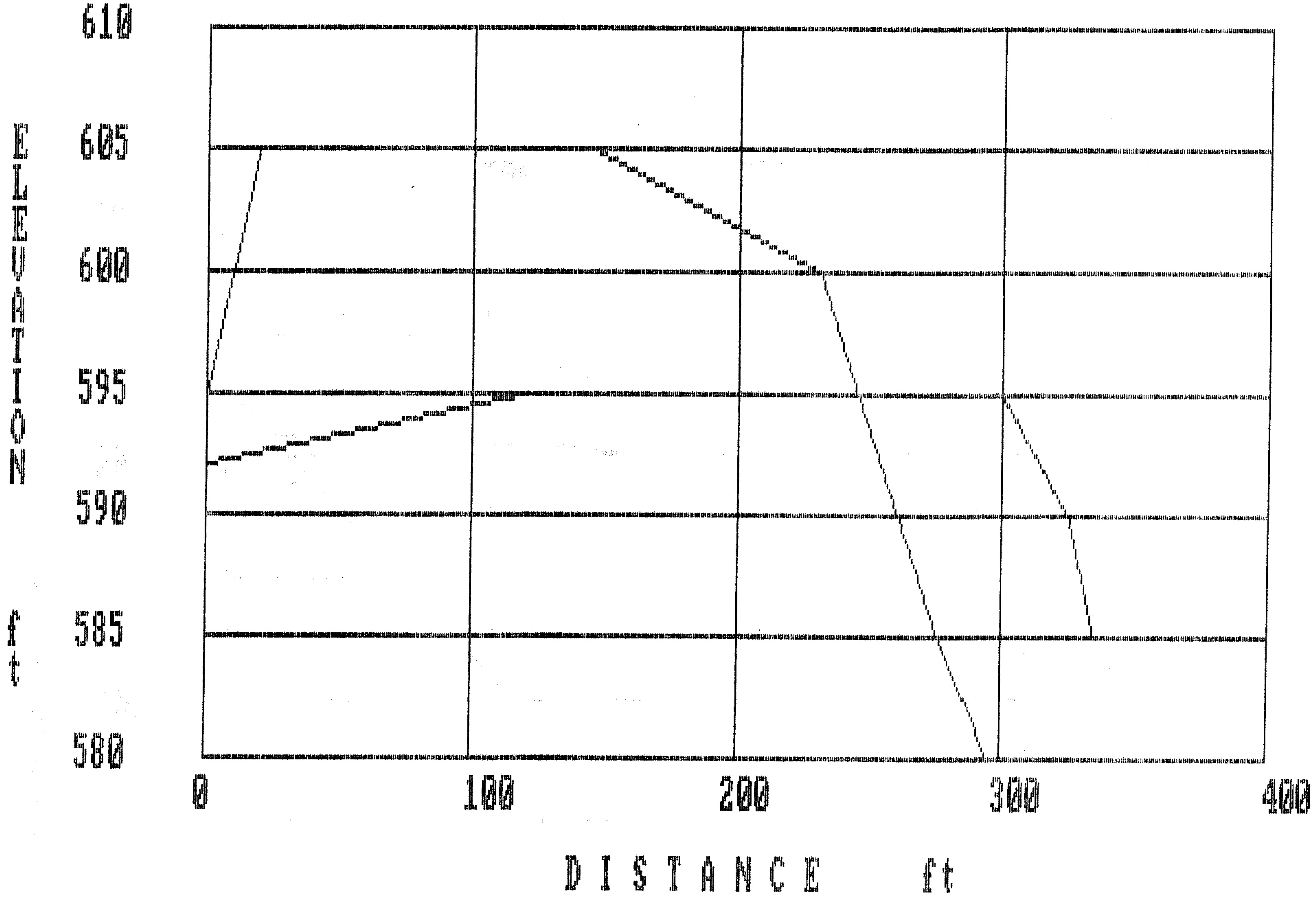

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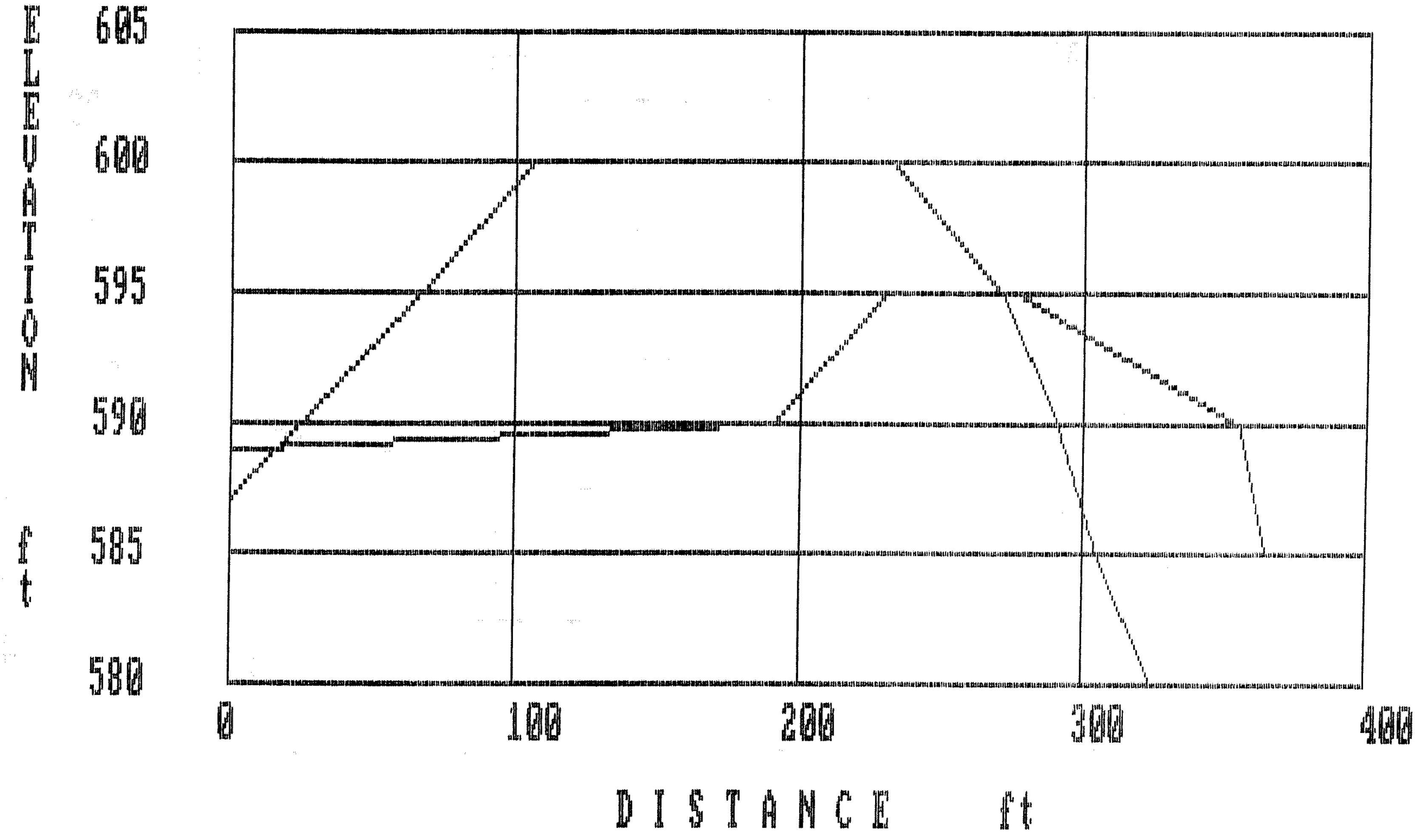

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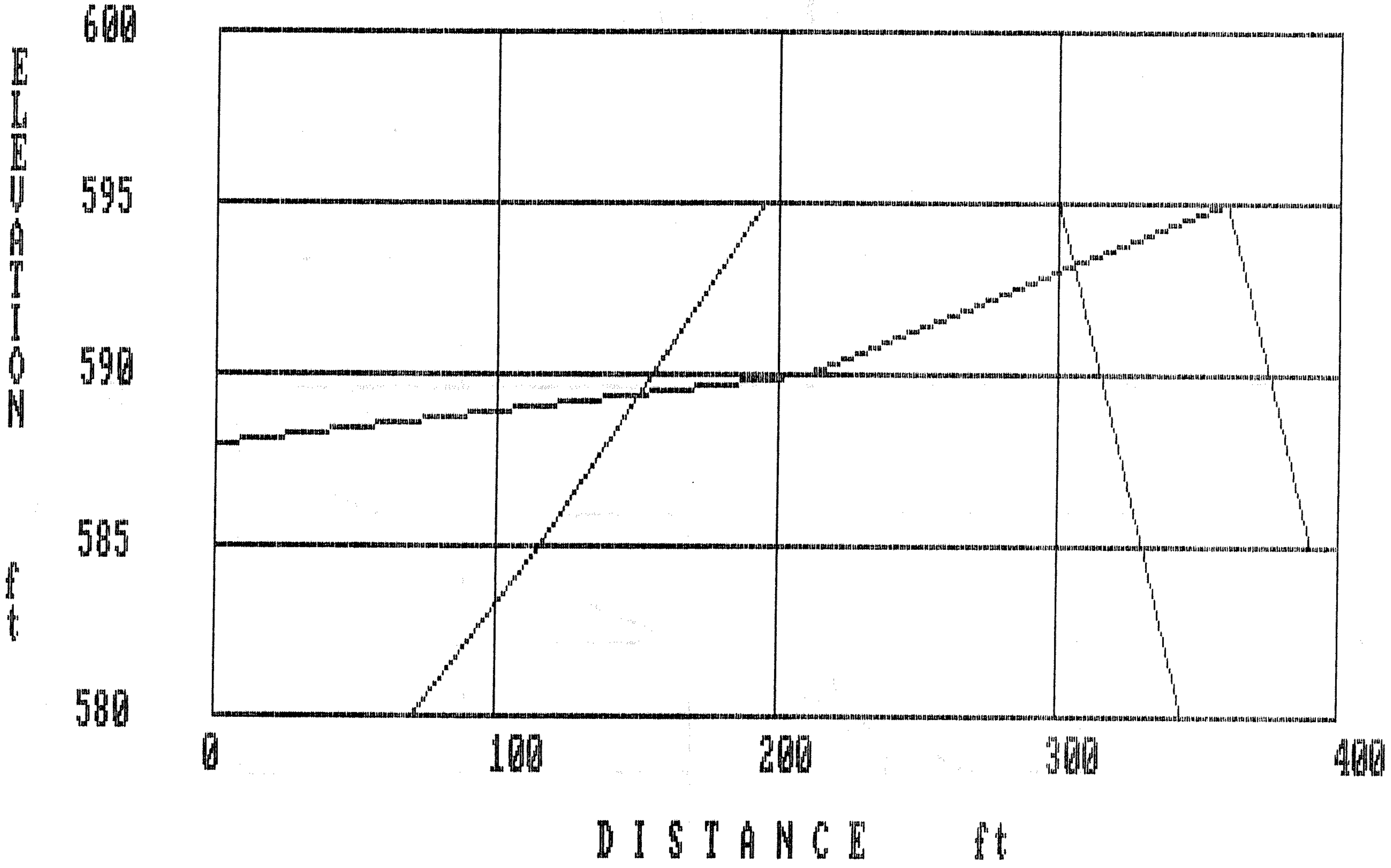

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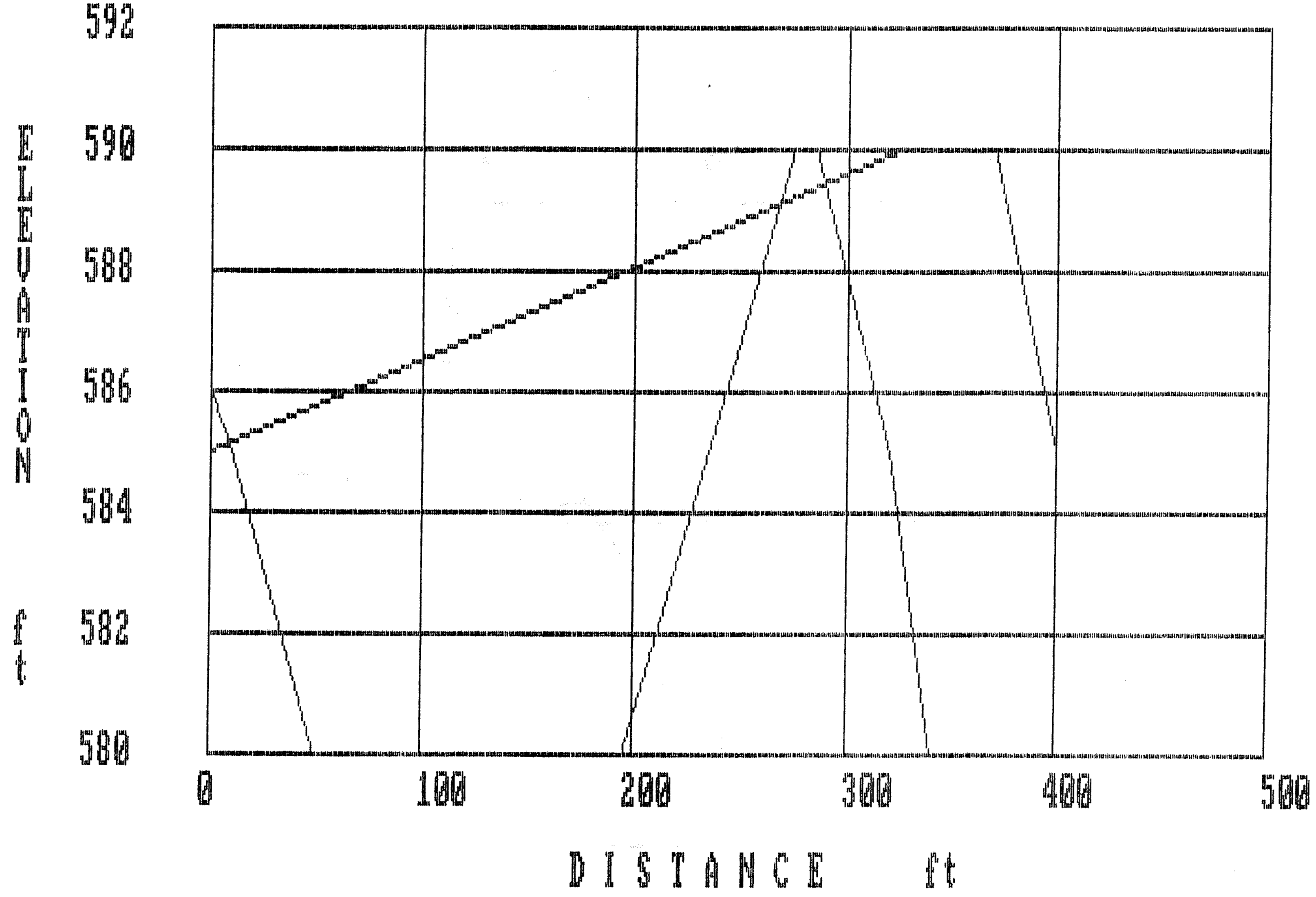
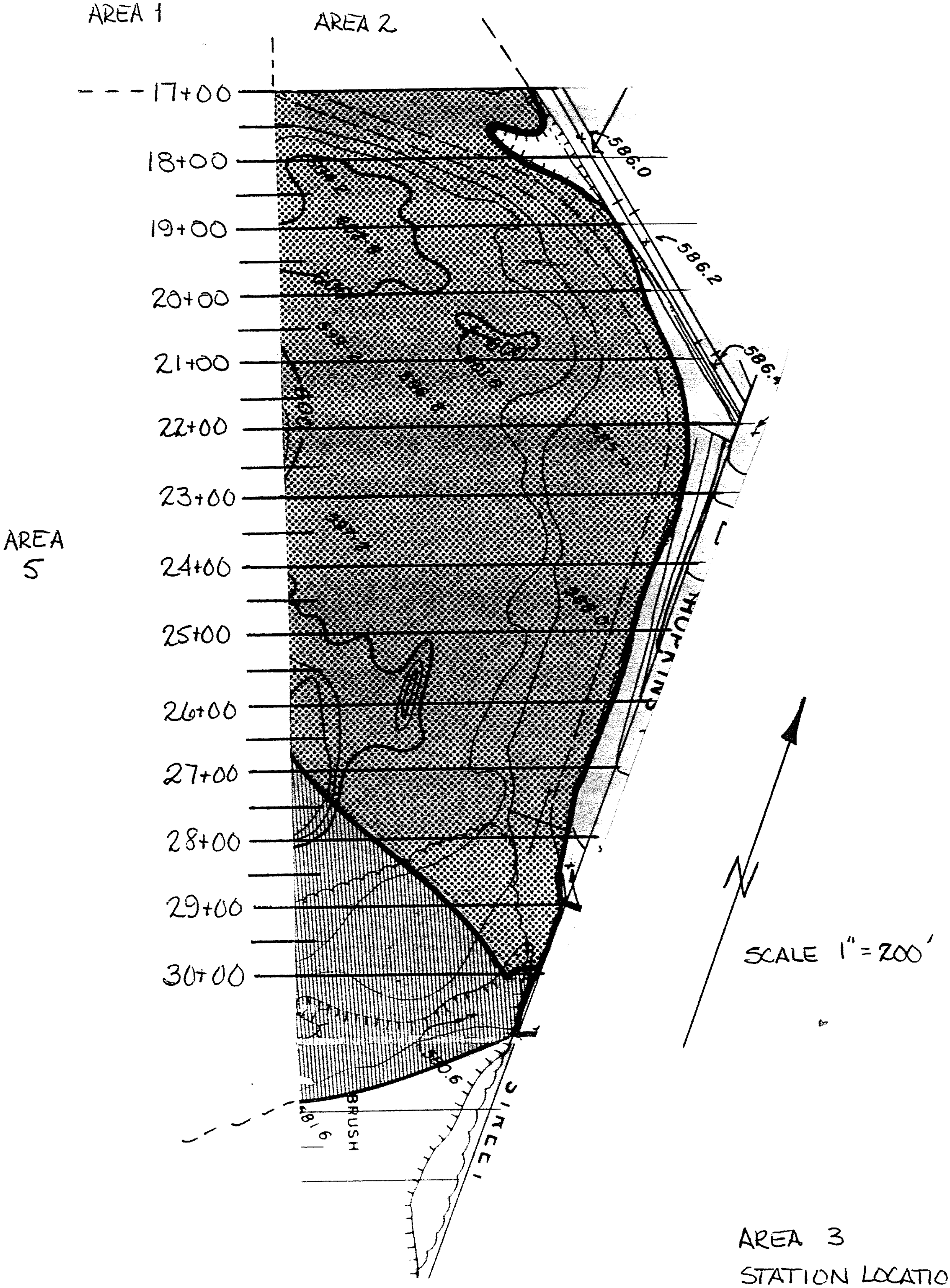




AREA 3
STATION LOCATIONS
MISC. DEBRIS/FINE REFUSE
LTY STEEL

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR3.LTV
        STATION          1700.0 FT

     EXISTING PROFILE DATA                            PROPOSED PROFILE DATA
     POINT    X-VALUE    Y-VALUE                      POINT    X-VALUE    Y-VALUE
     -----    -------    -------                      -----    -------    -------
         1       0.00     585.00                          1       0.00     586.00
         2      90.00     587.00                          2      54.00     580.00
         3     150.00     587.00                          3     190.00     580.00
         4     400.00     585.00                          4     235.00     585.00
                                                          5     285.00     590.00
                                                          6     325.00     585.00
                                                          7     345.00     580.00
                                                          8     400.00     580.00

AREA IN CUT               1612.5 FT^2
AREA IN FILL               152.0 FT^2

VOL  CUT THIS REACH           0.0 YD^3
VOL FILL THIS REACH           0.0 YD^3

VOL  CUT TOTAL                0.0 YD^3
VOL FILL TOTAL                0.0 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***    CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR3.LTV
        STATION          1750.0 FT

     EXISTING PROFILE DATA                          PROPOSED PROFILE DATA
     POINT    X-VALUE    Y-VALUE                    POINT    X-VALUE    Y-VALUE
     -----    -------    -------                    -----    -------    -------
       1        0.00     595.00                       1        0.00     602.50
       2      150.00     595.00                       2      153.00     580.00
       3      153.00     590.00                       3      365.00     580.00
       4      155.00     585.00
       5      205.00     585.00
       6      365.00     585.00

AREA IN CUT               1522.5 FT^2
AREA IN FILL               228.8 FT^2

VOL  CUT THIS REACH        2902.7 YD^3
VOL FILL THIS REACH         352.5 YD^3

VOL  CUT TOTAL             2902.7 YD^3
VOL FILL TOTAL              352.5 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen  P.E.

PROJECT: [illegible]
          STATION             [illegible] FT

       EXISTING PROFILE DATA                           PROPOSED PROFILE DATA
       POINT   X-VALUE    Y-VALUE                      POINT     X-VALUE      Y-VALUE
       -----   -------    -------                      -----     -------      -------
          1       0.00    [illegible]                    1     [illegible]    613.50
          2     122.00    [illegible]                    2     [illegible]    610.00
          3     170.00    600.00                         3     [illegible]    605.00
          4     250.00    595.00                         4     310.00       580.00
          5     265.00    590.00                         5     450.00       560.00
          6     345.00    585.00
          7     450.00    585.00

AREA IN CUT                 1552.5 FT^2
AREA IN FILL                1072.0 FT^2

VOL  CUT THIS REACH          2347.2 YD^3
VOL FILL THIS REACH          1204.4 YD^3

VOL  CUT TOTAL               5750.0 YD^3
VOL FILL TOTAL               1556.9 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR3.LTV
        STATION           1850.0 FT

      EXISTING PROFILE DATA                                PROPOSED PROFILE DATA
      POINT    X-VALUE    Y-VALUE                          POINT     X-VALUE     Y-VALUE
      ------   --------   --------                         ------    --------    --------
          1       0.00     601.00                              1        0.00      614.00
          2     180.00     600.00                              2       75.00      610.00
          3     235.00     595.00                              3      172.00      605.00
          4     335.00     590.00                              4      260.00      600.00
          5     435.00     585.00                              5      320.00      595.00
          6     505.00     585.00                              6      360.00      590.00
                                                               7      410.00      580.00
                                                               8      505.00      580.00

AREA IN CUT               620.8 FT^2
AREA IN FILL             2285.6 FT^2

VOL  CUT THIS REACH       2012.3 YD^3
VOL FILL THIS REACH       3109.1 YD^3

VOL  CUT TOTAL            7762.3 YD^3
VOL FILL TOTAL            4666.0 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR3.LTV
         STATION            1900.0 FT

      EXISTING PROFILE DATA                            PROPOSED PROFILE DATA
      POINT    X-VALUE    Y-VALUE                      POINT    X-VALUE    Y-VALUE
      -----    -------    -------                      -----    -------    -------
          1       0.00     601.00                          1       0.00     613.50
          2      65.00     600.00                          2      70.00     610.00
          3     100.00     600.00                          3     170.00     605.00
          4     160.00     600.00                          4     275.00     600.00
          5     235.00     595.00                          5     345.00     595.00
          6     430.00     595.00                          6     395.00     590.00
          7     490.00     585.00                          7     440.00     585.00
          8     545.00     585.00                          8     480.00     580.00
                                                           9     545.00     580.00

AREA IN CUT                1087.5 FT^2
AREA IN FILL               2365.0 FT^2

VOL  CUT THIS REACH         1581.8 YD^3
VOL FILL THIS REACH         4306.3 YD^3

VOL  CUT TOTAL              9344.1 YD^3
VOL FILL TOTAL              8972.3 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR3.LTV
         STATION           1950.0 FT

     EXISTING PROFILE DATA                          PROPOSED PROFILE DATA
     POINT    X-VALUE    Y-VALUE                    POINT    X-VALUE    Y-VALUE
     -----    -------    -------                    -----    -------    -------
         1       0.00     599.00                        1       0.00     613.00
         2      70.00     600.00                        2      55.00     610.00
         3     200.00     600.00                        3     160.00     605.00
         4     255.00     595.00                        4     270.00     600.00
         5     360.00     590.00                        5     345.00     595.00
         6     375.00     585.00                        6     415.00     590.00
         7     580.00     585.00                        7     465.00     585.00
                                                        8     515.00     580.00
                                                        9     580.00     580.00

AREA IN CUT                450.0 FT^2
AREA IN FILL              2855.0 FT^2

VOL  CUT THIS REACH       1423.6 YD^3
VOL FILL THIS REACH       4833.3 YD^3

VOL  CUT TOTAL           10767.7 YD^3
VOL FILL TOTAL           13805.7 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF8611G   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR3.LTV
         STATION          2000.0 FT

      EXISTING PROFILE DATA                          PROPOSED PROFILE DATA
      POINT    X-VALUE    Y-VALUE                    POINT    X-VALUE    Y-VALUE
      -----    -------    -------                    -----    -------    -------
          1       0.00     605.00                        1       0.00     612.00
          2      15.00     600.00                        2      35.00     610.00
          3      45.00     599.00                        3     145.00     605.00
          4      70.00     600.00                        4     250.00     600.00
          5     135.00     600.00                        5     335.00     595.00
          6     275.00     595.00                        6     420.00     590.00
          7     320.00     590.00                        7     480.00     585.00
          8     330.00     585.00                        8     540.00     580.00
          9     535.00     585.00                        9     603.00     585.00
         10     603.00     585.00

AREA IN CUT                 307.5 FT^2
AREA IN FILL               2925.0 FT^2

VOL  CUT THIS REACH         701.4 YD^3
VOL FILL THIS REACH        5351.9 YD^3

VOL  CUT TOTAL            11469.1 YD^3
VOL FILL TOTAL            19157.5 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***    CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR3.LTV
         STATION             2050.0 FT

     EXISTING PROFILE DATA                         PROPOSED PROFILE DATA
     POINT    X-VALUE    Y-VALUE                   POINT    X-VALUE    Y-VALUE
     -----    -------    -------                   -----    -------    -------

         1       0.00     611.00                       1       0.00     611.00
         2       6.00     610.00                       2      15.00     610.00
         3      30.00     605.00                       3     125.00     605.00
         4      45.00     600.00                       4     230.00     600.00
         5      75.00     599.00                       5     325.00     595.00
         6     100.00     600.00                       6     415.00     590.00
         7     135.00     600.00                       7     490.00     585.00
         8     275.00     595.00                       8     570.00     580.00
         9     280.00     590.00                       9     585.00     580.00
        10     285.00     585.00                      10     585.00     589.00
        11     530.00     585.00                      11     610.00     587.00
        12     585.00     589.00                      12     630.00     585.00
        13     610.00     587.00
        14     630.00     585.00

AREA IN CUT                385.0 FT^2
AREA IN FILL              2667.0 FT^2

VOL  CUT THIS REACH          641.2 YD^3
VOL FILL THIS REACH         5177.8 YD^3

VOL  CUT TOTAL             12110.3 YD^3
VOL FILL TOTAL             24335.3 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR3.LTV
         STATION          2100.0 FT

      EXISTING PROFILE DATA                            PROPOSED PROFILE DATA
      POINT    X-VALUE    Y-VALUE                      POINT    X-VALUE    Y-VALUE
      -----    -------    -------                      -----    -------    -------
          1       0.00     613.00                          1       0.00     609.70
          2      20.00     610.00                          2     105.00     605.00
          3      50.00     605.00                          3     210.00     600.00
          4      60.00     600.00                          4     312.00     595.00
          5     140.00     600.00                          5     405.00     590.00
          6     260.00     595.00                          6     495.00     585.00
          7     264.00     590.00                          7     585.00     580.00
          8     267.00     585.00                          8     605.00     580.00
          9     485.00     585.00                          9     603.00     587.00
         10     600.00     587.00                         10     630.00     587.00
         11     625.00     587.00                         11     660.00     585.00
         12     660.00     585.00

 AREA IN CUT                493.1 FT^2
 AREA IN FILL              2319.4 FT^2

 VOL  CUT THIS REACH        813.1 YD^3
 VOL FILL THIS REACH       4617.1 YD^3

 VOL  CUT TOTAL           12923.4 YD^3
 VOL FILL TOTAL           28952.3 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR3.LTV
          STATION              2150.0 FT

     EXISTING PROFILE DATA                            PROPOSED PROFILE DATA
     POINT    X-VALUE    Y-VALUE                      POINT    X-VALUE    Y-VALUE
     -----    -------    -------                      -----    -------    -------

         1       0.00     612.00                          1       0.00     609.00
         2      10.00     615.00                          2      80.00     605.00
         3      30.00     610.00                          3     190.00     600.00
         4      45.00     605.00                          4     295.00     595.00
         5      50.00     600.00                          5     395.00     590.00
         6     130.00     600.00                          6     495.00     585.00
         7     255.00     595.00                          7     590.00     580.00
         8     265.00     590.00                          8     605.00     580.00
         9     270.00     585.00                          9     605.00     587.00
        10     410.00     585.00                         10     630.00     587.00
        11     605.00     587.00                         11     690.00     585.00
        12     630.00     587.00
        13     690.00     585.00

AREA IN CUT                     645.3 FT^2
AREA IN FILL                   2005.3 FT^2

VOL  CUT THIS REACH             1054.1 YD^3
VOL FILL THIS REACH             4004.3 YD^3

VOL  CUT TOTAL                 13977.5 YD^3
VOL FILL TOTAL                 32956.7 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118    VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR3.LTV
          STATION             2200.0 FT

      EXISTING PROFILE DATA                           PROPOSED PROFILE DATA
      POINT    X-VALUE    Y-VALUE                     POINT    X-VALUE    Y-VALUE
      -----    -------    -------                     -----    -------    -------
          1       0.00     615.00                         1       0.00     608.00
          2       5.00     610.00                         2      60.00     605.00
          3      10.00     605.00                         3     170.00     600.00
          4      15.00     600.00                         4     280.00     595.00
          5     215.00     595.00                         5     380.00     590.00
          6     275.00     590.00                         6     480.00     585.00
          7     280.00     585.00                         7     585.00     580.00
          8     410.00     585.00                         8     600.00     580.00
          9     600.00     587.00                         9     600.00     587.00
         10     625.00     587.00                        10     625.00     587.00
         11     690.00     605.00                        11     690.00     605.00

AREA IN CUT                532.0 FT^2
AREA IN FILL              2294.5 FT^2

VOL CUT THIS REACH         1090.1 YD^3
VOL FILL THIS REACH        3981.3 YD^3

VOL CUT TOTAL             15067.6 YD^3
VOL FILL TOTAL            36937.9 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR3.LTV
        STATION          2250.0 FT

    EXISTING PROFILE DATA                           PROPOSED PROFILE DATA
    POINT    X-VALUE    Y-VALUE                     POINT    X-VALUE    Y-VALUE
    -----    -------    -------                     -----    -------    -------
        1       0.00     599.00                         1       0.00     607.00
        2     210.00     595.00                         2      40.00     605.00
        3     285.00     590.00                         3     145.00     600.00
        4     290.00     585.00                         4     255.00     595.00
        5     430.00     585.00                         5     360.00     590.00
        6     590.00     587.00                         6     465.00     585.00
        7     615.00     587.00                         7     570.00     580.00
        8     670.00     605.00                         8     590.00     580.00
                                                        9     590.00     587.00
                                                       10     615.00     587.00
                                                       11     670.00     605.00

AREA IN CUT                 516.4 FT^2
AREA IN FILL               2001.4 FT^2

VOL  CUT THIS REACH          970.8 YD^3
VOL FILL THIS REACH         3977.7 YD^3

VOL  CUT TOTAL             16038.3 YD^3
VOL FILL TOTAL             40915.6 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR3.LTV
         STATION          2300.0 FT

      EXISTING PROFILE DATA                            PROPOSED PROFILE DATA
      POINT    X-VALUE    Y-VALUE                      POINT    X-VALUE    Y-VALUE
      -----    -------    -------                      -----    -------    -------

          1       0.00     598.00                          1       0.00     606.00
          2     290.00     595.00                          2      20.00     605.00
          3     303.00     590.00                          3     125.00     600.00
          4     306.00     585.00                          4     235.00     595.00
          5     400.00     585.00                          5     340.00     590.00
          6     570.00     587.00                          6     450.00     585.00
          7     595.00     587.00                          7     555.00     580.00
          8     650.00     600.00                          8     570.00     580.00
                                                           9     570.00     587.00
                                                          10     595.00     587.00
                                                          11     650.00     600.00

 AREA IN CUT                 598.3 FT^2
 AREA IN FILL               1335.8 FT^2

 VOL  CUT THIS REACH         1032.1 YD^3
 VOL FILL THIS REACH         3090.0 YD^3

 VOL  CUT TOTAL             17070.5 YD^3
 VOL FILL TOTAL             44005.6 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhoten, P.E.

PROJECT: MDFR3.LTV
         STATION          2350.0 FT

        EXISTING PROFILE DATA                                   PROPOSED PROFILE DATA
        POINT    X-VALUE    Y-VALUE                             POINT    X-VALUE    Y-VALUE
        -----    -------    -------                             -----    -------    -------
            1       0.00     599.00                                 1       0.00     605.00
            2     135.00     595.00                                 2     105.00     600.00
            3     300.00     590.00                                 3     212.00     595.00
            4     315.00     585.00                                 4     320.00     590.00
            5     340.00     585.00                                 5     425.00     585.00
            6     375.00     590.00                                 6     535.00     580.00
            7     405.00     590.00                                 7     550.00     580.00
            8     550.00     587.00                                 8     550.00     587.00
            9     580.00     587.00                                 9     580.00     587.00
           10     630.00     600.00                                10     630.00     600.00

AREA IN CUT                  966.0 FT^2
AREA IN FILL                1223.5 FT^2

VOL  CUT THIS REACH          1448.4 YD^3
VOL FILL THIS REACH          2369.7 YD^3

VOL  CUT TOTAL              18518.9 YD^3
VOL FILL TOTAL              46375.3 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR3.LTV
         STATION            2400.0 FT

      EXISTING PROFILE DATA                              PROPOSED PROFILE DATA
      POINT    X-VALUE    Y-VALUE                        POINT     X-VALUE     Y-VALUE
      -----    -------    -------                        -----     -------     -------

          1       0.00     603.00                            1         0.00     603.50
          2      80.00     600.00                            2        65.00     600.00
          3     205.00     595.00                            3       190.00     595.00
          4     295.00     590.00                            4       300.00     590.00
          5     320.00     590.00                            5       410.00     585.00
          6     345.00     595.00                            6       515.00     590.00
          7     365.00     595.00                            7       530.00     580.00
          8     390.00     590.00                            8       530.00     587.00
          9     530.00     587.00                            9       555.00     587.00
         10     555.00     587.00                           10       610.00     600.00
         11     610.00     600.00

  AREA IN CUT                741.3 FT^2
  AREA IN FILL                92.5 FT^2

  VOL  CUT THIS REACH       1580.8 YD^3
  VOL FILL THIS REACH       1218.5 YD^3

  VOL  CUT TOTAL           20099.7 YD^3
  VOL FILL TOTAL           47593.8 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR3.LTV
         STATION          2450.0 FT

     EXISTING PROFILE DATA                             PROPOSED PROFILE DATA
     POINT   X-VALUE   Y-VALUE                         POINT    X-VALUE    Y-VALUE
     -----   -------   -------                         -----    -------    -------
         1      0.00    602.00                             1       0.00     602.50
         2     50.00    600.00                             2      65.00     600.00
         3    310.00    595.00                             3     175.00     595.00
         4    330.00    590.00                             4     280.00     590.00
         5    510.00    587.00                             5     390.00     585.00
         6    535.00    587.00                             6     495.00     580.00
         7    590.00    600.00                             7     510.00     580.00
                                                           8     510.00     587.00
                                                           9     535.00     587.00
                                                          10     590.00     600.00

AREA IN CUT               1708.7 FT^2
AREA IN FILL                35.0 FT^2

VOL  CUT THIS REACH        2268.5 YD^3
VOL FILL THIS REACH         118.1 YD^3

VOL  CUT TOTAL            22368.2 YD^3
VOL FILL TOTAL            47711.9 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118    VER 1.2
 (C) Copyright 1983, Peter J. Singnofen, P.E.

PROJECT: MDFR3.LTV
         STATION          2500.0 FT

      EXISTING PROFILE DATA                        PROPOSED PROFILE DATA
      POINT    X-VALUE    Y-VALUE                  POINT     X-VALUE    Y-VALUE
      -----    -------    -------                  -----     -------    -------
          1       0.00     601.00                      1        0.00     602.00
          2      30.00     600.00                      2       35.00     600.00
          3     265.00     595.00                      3      150.00     595.00
          4     280.00     590.00                      4      260.00     590.00
          5     490.00     587.00                      5      370.00     585.00
          6     520.00     587.00                      6      475.00     580.00
          7     575.00     595.00                      7      490.00     580.00
                                                       8      490.00     487.00
                                                       9      520.00     587.00
                                                      10      575.00     595.00

AREA IN CUT                 3010.5 FT^2
AREA IN FILL                  20.5 FT^2

VOL  CUT THIS REACH          4369.7 YD^3
VOL FILL THIS REACH            51.4 YD^3

VOL  CUT TOTAL              26737.9 YD^3
VOL FILL TOTAL              47763.3 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***     L.36118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR3.LTV
        STATION          2550.0 FT

     EXISTING PROFILE DATA                     PROPOSED PROFILE DATA
     POINT    X-VALUE    Y-VALUE               POINT    X-VALUE    Y-VALUE
     -----    -------    -------               -----    -------    -------
         1       0.00     610.00                   1       0.00     601.00
         2      35.00     605.00                   2      25.00     600.00
         3      45.00     600.00                   3     135.00     595.00
         4      95.00     598.00                   4     240.00     590.00
         5     135.00     600.00                   5     350.00     585.00
         6     165.00     605.00                   6     455.00     580.00
         7     215.00     605.00                   7     470.00     580.00
         8     220.00     600.00                   8     470.00     587.00
         9     225.00     595.00                   9     500.00     587.00
        10     260.00     590.00                  10     550.00     590.00
        11     470.00     587.00
        12     500.00     587.00
        13     550.00     590.00

AREA IN CUT              2407.5 FT^2
AREA IN FILL                0.0 FT^2

VOL  CUT THIS REACH       5016.7 YD^3
VOL FILL THIS REACH         19.0 YD^3

VOL  CUT TOTAL           31754.6 YD^3
VOL FILL TOTAL           47782.3 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR3.LTV
         STATION            2600.0 FT

      EXISTING PROFILE DATA                        PROPOSED PROFILE DATA
      POINT    X-VALUE    Y-VALUE                  POINT    X-VALUE    Y-VALUE
      -----    -------    -------                  -----    -------    -------
          1       0.00     612.00                      1       0.00     600.50
          2      85.00     610.00                      2       5.00     600.00
          3     210.00     605.00                      3     110.00     595.00
          4     215.00     600.00                      4     220.00     590.00
          5     220.00     595.00                      5     330.00     585.00
          6     252.00     585.00                      6     435.00     580.00
          7     450.00     587.00                      7     450.00     580.00
          8     475.00     587.00                      8     450.00     587.00
          9     530.00     590.00                      9     475.00     587.00
                                                      10     530.00     590.00

AREA IN CUT                  3515.9 FT^2
AREA IN FILL                  136.7 FT^2

VOL  CUT THIS REACH           5484.7 YD^3
VOL FILL THIS REACH            126.5 YD^3

VOL  CUT TOTAL               37239.2 YD^3
VOL FILL TOTAL               47908.9 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***    CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR3.LTV
        STATION            2650.0 FT

    EXISTING PROFILE DATA                              PROPOSED PROFILE DATA
    POINT    X-VALUE    Y-VALUE                        POINT     X-VALUE    Y-VALUE
    -----    -------    -------                        -----     -------    -------
        1       0.00     613.00
        2     100.00     610.00                            1        0.00     599.50
        3     115.00     605.00                            2       90.00     595.00
        4     135.00     600.00                            3      195.00     590.00
        5     170.00     595.00                            4      305.00     585.00
        6     230.00     595.00                            5      410.00     580.00
        7     250.00     590.00                            6      430.00     580.00
        8     430.00     587.00                            7      430.00     587.00
        9     460.00     587.00                            8      460.00     587.00
       10     510.00     590.00                            9      510.00     590.00

AREA IN CUT               3352.5 FT^2
AREA IN FILL                 0.0 FT^2

VOL  CUT THIS REACH        6359.7 YD^3
VOL FILL THIS REACH         126.5 YD^3

VOL  CUT TOTAL            43598.9 YD^3
VOL FILL TOTAL            48035.4 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR3.LTV
         STATION          2700.0 FT

      EXISTING PROFILE DATA                        PROPOSED PROFILE DATA
      POINT    X-VALUE    Y-VALUE                  POINT     X-VALUE     Y-VALUE
      -----    -------    -------                  -----     -------     -------
          1       0.00     614.00                      1        0.00      599.00
          2      90.00     610.00                      2       70.00      595.00
          3     110.00     605.00                      3      175.00      590.00
          4     125.00     600.00                      4      235.00      585.00
          5     155.00     595.00                      5      395.00      580.00
          6     275.00     590.00                      6      415.00      580.00
          7     415.00     587.00                      7      415.00      587.00
          8     440.00     587.00                      8      440.00      587.00
          9     490.00     587.00                      9      490.00      587.00

AREA IN CUT               3380.0 FT^2
AREA IN FILL                 0.0 FT^2

VOL  CUT THIS REACH        6233.8 YD^3
VOL FILL THIS REACH           0.0 YD^3

VOL  CUT TOTAL            49832.7 YD^3
VOL FILL TOTAL            48035.4 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR3.LTV
         STATION          2750.0 FT

     EXISTING PROFILE DATA                            PROPOSED PROFILE DATA
     POINT    X-VALUE    Y-VALUE                      POINT    X-VALUE    Y-VALUE
     -----    -------    -------                      -----    -------    -------

         1       0.00     612.00                          1       0.00     597.00
         2      70.00     610.00                          2      50.00     595.00
         3      85.00     605.00                          3     155.00     590.00
         4     130.00     600.00                          4     265.00     585.00
         5     140.00     595.00                          5     375.00     580.00
         6     315.00     590.00                          6     390.00     580.00
         7     390.00     587.00                          7     390.00     587.00
         8     475.00     588.00                          8     475.00     588.00

AREA IN CUT               3382.5 FT^2
AREA IN FILL                 0.0 FT^2

VOL  CUT THIS REACH       6261.6 YD^3
VOL FILL THIS REACH          0.0 YD^3

VOL  CUT TOTAL           56094.3 YD^3
VOL FILL TOTAL           48035.4 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR3.LTV
         STATION          2800.0 FT

      EXISTING PROFILE DATA                       PROPOSED PROFILE DATA
      POINT    X-VALUE    Y-VALUE                 POINT     X-VALUE     Y-VALUE
      -----    -------    -------                 -----     -------     -------
          1       0.00     604.00                     1        0.00      596.00
          2     150.00     600.00                     2       50.00      595.00
          3     220.00     595.00                     3      135.00      590.00
          4     355.00     590.00                     4      245.00      585.00
          5     410.00     587.00                     5      360.00      580.00
          6     450.00     588.00                     6      410.00      580.00
                                                      7      410.00      587.00
                                                      8      450.00      588.00

 AREA IN CUT               3790.0 FT^2
 AREA IN FILL                 0.0 FT^2

 VOL  CUT THIS REACH       6641.2 YD^3
 VOL FILL THIS REACH          0.0 YD^3

 VOL  CUT TOTAL           62735.5 YD^3
 VOL FILL TOTAL           48035.4 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***    CF86118   VER 1.2
(C) Copyright 1983, Peter J. Eingnofen, P.E.

PROJECT: MDFR3.LTV
         STATION            2850.0 FT

     EXISTING PROFILE DATA                            PROPOSED PROFILE DATA
     POINT    X-VALUE    Y-VALUE                      POINT    X-VALUE    Y-VALUE
     -----    -------    -------                      -----    -------    -------
         1       0.00     598.00                          1       0.00     596.00
         2     145.00     595.00                          2      10.00     595.00
         3     360.00     590.00                          3     115.00     590.00
         4     435.00     588.00                          4     230.00     585.00
                                                          5     335.00     580.00
                                                          6     360.00     580.00
                                                          7     360.00     590.00
                                                          8     435.00     588.00

AREA IN CUT                2487.5 FT^2
AREA IN FILL                  0.0 FT^2

VOL  CUT THIS REACH        5812.5 YD^3
VOL FILL THIS REACH           0.0 YD^3

VOL  CUT TOTAL            68548.0 YD^3
VOL FILL TOTAL            48035.4 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118    VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR3.LTV
        STATION           2900.0 FT

     EXISTING PROFILE DATA                    PROPOSED PROFILE DATA
     POINT    X-VALUE   Y-VALUE               POINT    X-VALUE    Y-VALUE
     -----    -------   -------               -----    -------    -------
         1       0.00    597.00                   1       0.00     594.50
         2      90.00    595.00                   2     100.00     590.00
         3     305.00    590.00                   3     210.00     585.00
         4     410.00    588.00                   4     320.00     580.00
                                                  5     410.00     580.00

AREA IN CUT              2747.5 FT^2
AREA IN FILL                0.0 FT^2

VOL  CUT THIS REACH       4847.2 YD^3
VOL FILL THIS REACH          0.0 YD^3

VOL  CUT TOTAL           73395.2 YD^3
VOL FILL TOTAL           48035.4 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR3.LTV
         STATION            2950.0 FT

     EXISTING PROFILE DATA                        PROPOSED PROFILE DATA
     POINT    X-VALUE    Y-VALUE                  POINT    X-VALUE    Y-VALUE
     -----    -------    -------                  -----    -------    -------

         1       0.00     593.00                      1       0.00     590.00
         2     270.00     590.00                      2      55.00     585.00
         3     340.00     585.00                      3     140.00     580.00
                                                      4     340.00     580.00

AREA IN CUT                2855.0 FT^2
AREA IN FILL                  0.0 FT^2

VOL  CUT THIS REACH         5187.5 YD^3
VOL FILL THIS REACH            0.0 YD^3

VOL  CUT TOTAL             78582.7 YD^3
VOL FILL TOTAL             48035.4 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR3.LTV
         STATION           3000.0 FT

    EXISTING PROFILE DATA                       PROPOSED PROFILE DATA
    POINT    X-VALUE    Y-VALUE                 POINT    X-VALUE    Y-VALUE
    -----    -------    -------                 -----    -------    -------
        1       0.00     586.00                     1       0.00     580.00
        2      20.00     585.00                     2 -   250.00     580.00
        3      20.00     580.00
        4      60.00     580.00
        5      60.00     585.00
        6     250.00     585.00

AREA IN CUT                1060.0 FT^2
AREA IN FILL                  0.0 FT^2

VOL  CUT THIS REACH         3625.0 YD^3
VOL FILL THIS REACH            0.0 YD^3

VOL  CUT TOTAL             82207.7 YD^3
VOL FILL TOTAL             48035.4 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***    CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

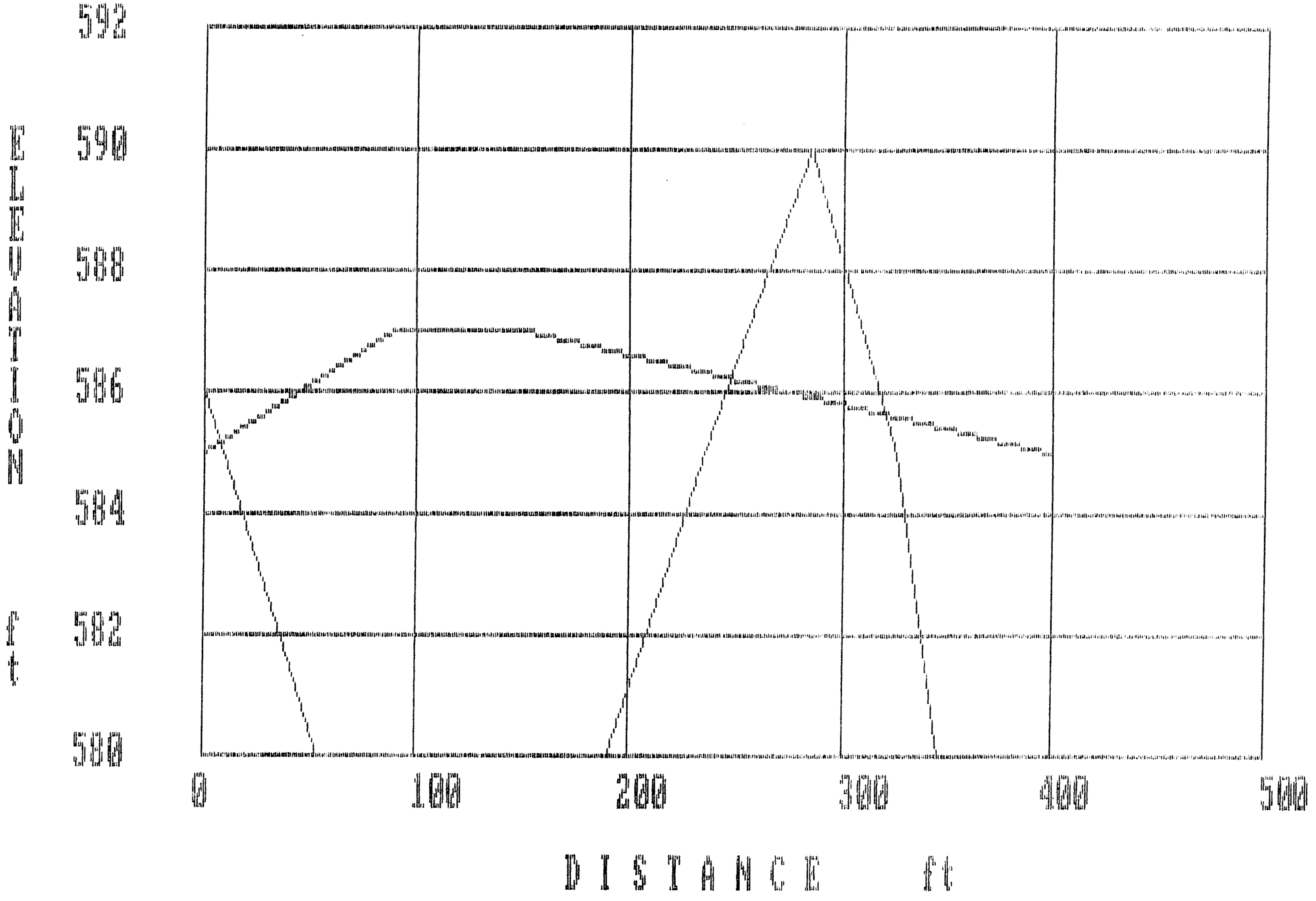
PROJECT: MDFR3.LTV


                              S U M M A R Y   T A B L E
                              = = = = = = =   = = = = =

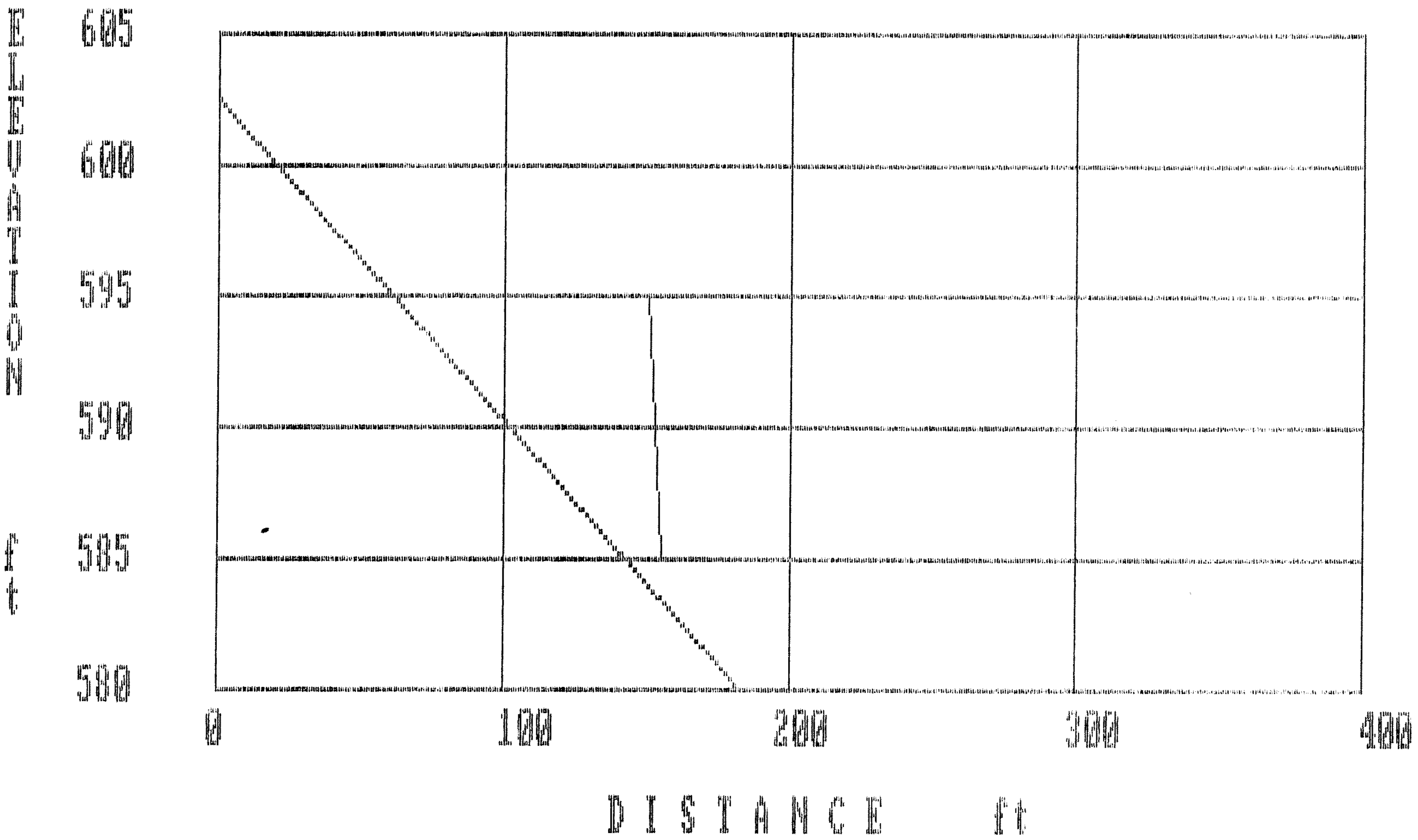

UNITS:    SECTION DATA  -- SQFT           STATION  -- FT
            REACH DATA  -- CUYD
            TOTAL DATA  -- CUYD
              NET DATA  -- CUYD

          -----------------------------------------------------------------
          ¦      SECTION      ¦       REACH       ¦       TOTAL       ¦         ¦
---------------------------------------------------------------------    NET   ¦
¦ STATION¦    CUT  ¦   FILL  ¦    CUT  ¦   FILL  ¦    CUT  ¦   FILL  ¦   MASS  ¦
---------------------------------------------------------------------------------
¦     1700¦     1612¦      152¦        0¦        0¦        0¦        0¦        0¦
¦     1750¦     1523¦      229¦     2903¦      353¦     2903¦      353¦    -2550¦
¦     1800¦     1553¦     1072¦     2847¦     1204¦     5750¦     1557¦    -4193¦
¦     1850¦      621¦     2286¦     2012¦     3109¦     7762¦     4666¦    -3096¦
¦     1900¦     1088¦     2365¦     1582¦     4306¦     9344¦     8972¦     -372¦
---------------------------------------------------------------------------------
¦     1950¦      450¦     2855¦     1424¦     4833¦    10768¦    13806¦     3038¦
¦     2000¦      308¦     2925¦      701¦     5352¦    11469¦    19158¦     7688¦
¦     2050¦      385¦     2667¦      641¦     5178¦    12110¦    24335¦    12225¦
¦     2100¦      493¦     2319¦      813¦     4617¦    12923¦    28952¦    16029¦
¦     2150¦      645¦     2005¦     1054¦     4004¦    13978¦    32957¦    18979¦
---------------------------------------------------------------------------------
¦     2200¦      532¦     2294¦     1090¦     3981¦    15068¦    36938¦    21870¦
¦     2250¦      516¦     2001¦      971¦     3978¦    16038¦    40916¦    24877¦
¦     2300¦      598¦     1336¦     1032¦     3090¦    17070¦    44006¦    26935¦
¦     2350¦      966¦     1223¦     1448¦     2370¦    18519¦    46375¦    27856¦
¦     2400¦      741¦       93¦     1581¦     1219¦    20100¦    47594¦    27494¦
---------------------------------------------------------------------------------
¦     2450¦     1709¦       35¦     2269¦      118¦    22368¦    47712¦    25344¦
¦     2500¦     3011¦       21¦     4370¦       51¦    26738¦    47763¦    21025¦
¦     2550¦     2408¦        0¦     5017¦       19¦    31755¦    47782¦    16028¦
¦     2600¦     3516¦      137¦     5485¦      127¦    37239¦    47909¦    10670¦
¦     2650¦     3353¦        0¦     6360¦      127¦    43599¦    48035¦     4437¦
---------------------------------------------------------------------------------
¦     2700¦     3380¦        0¦     6234¦        0¦    49833¦    48035¦    -1797¦
¦     2750¦     3383¦        0¦     6262¦        0¦    56094¦    48035¦    -8059¦
¦     2800¦     3790¦        0¦     6641¦        0¦    62735¦    48035¦   -14700¦
¦     2850¦     2488¦        0¦     5813¦        0¦    68548¦    48035¦   -20513¦
¦     2900¦     2748¦        0¦     4847¦        0¦    73395¦    48035¦   -25360¦
---------------------------------------------------------------------------------
¦     2950¦     2855¦        0¦     5188¦        0¦    78583¦    48035¦   -30547¦
¦     3000¦     1060¦        0¦     3625¦        0¦    82208¦    48035¦   -34172¦
---------------------------------------------------------------------------------
```

STATION: 1700



STATION: 1750



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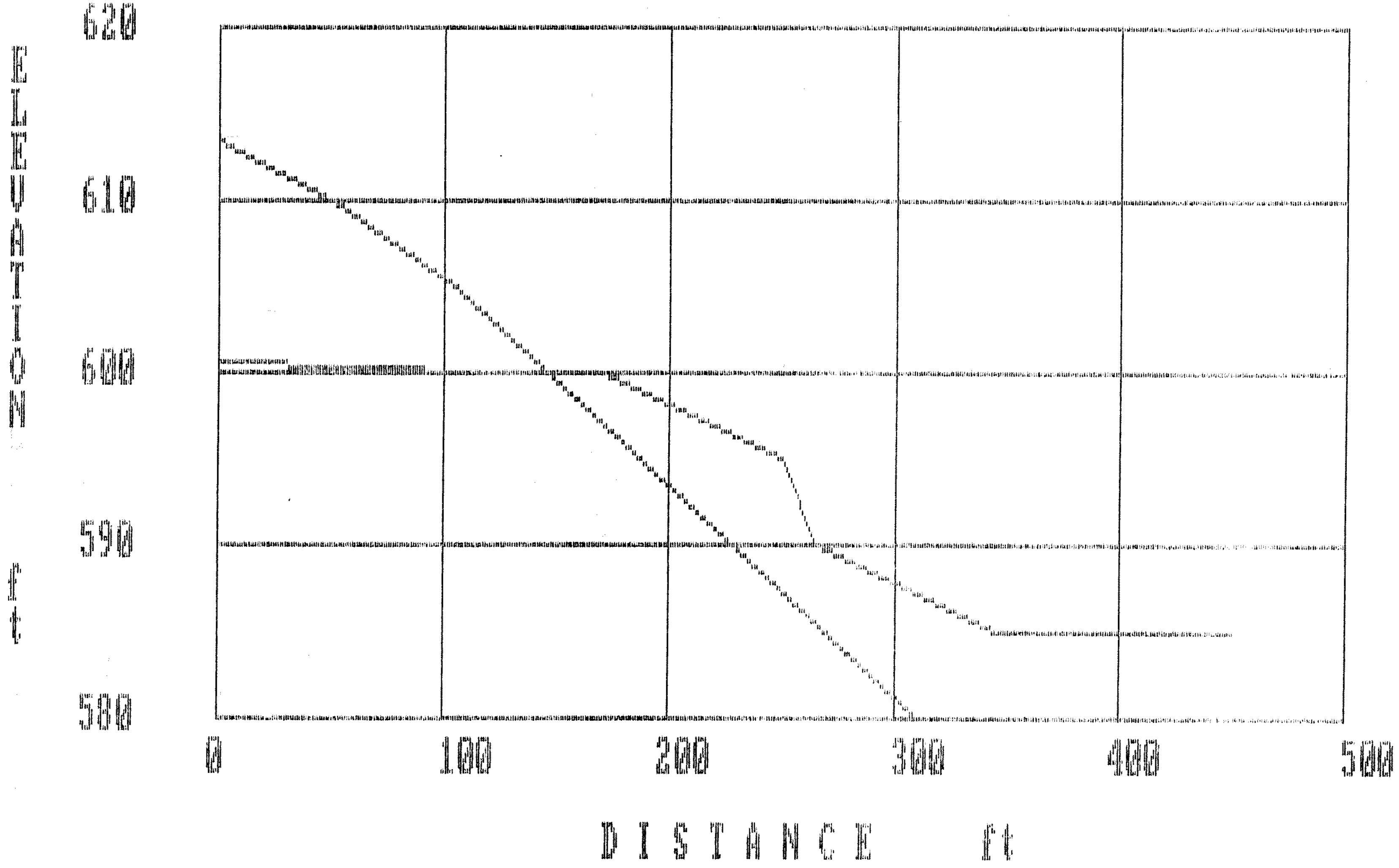

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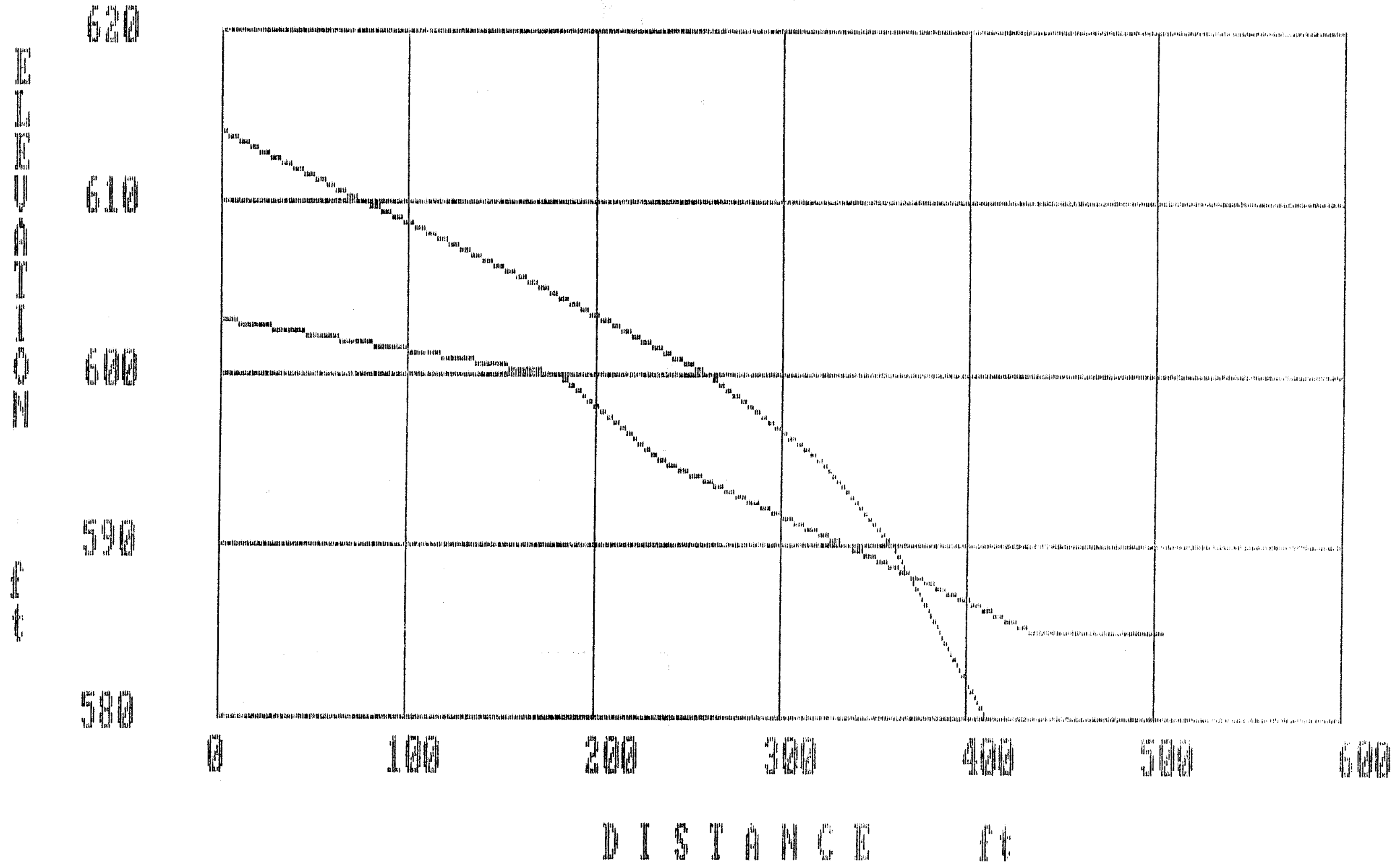

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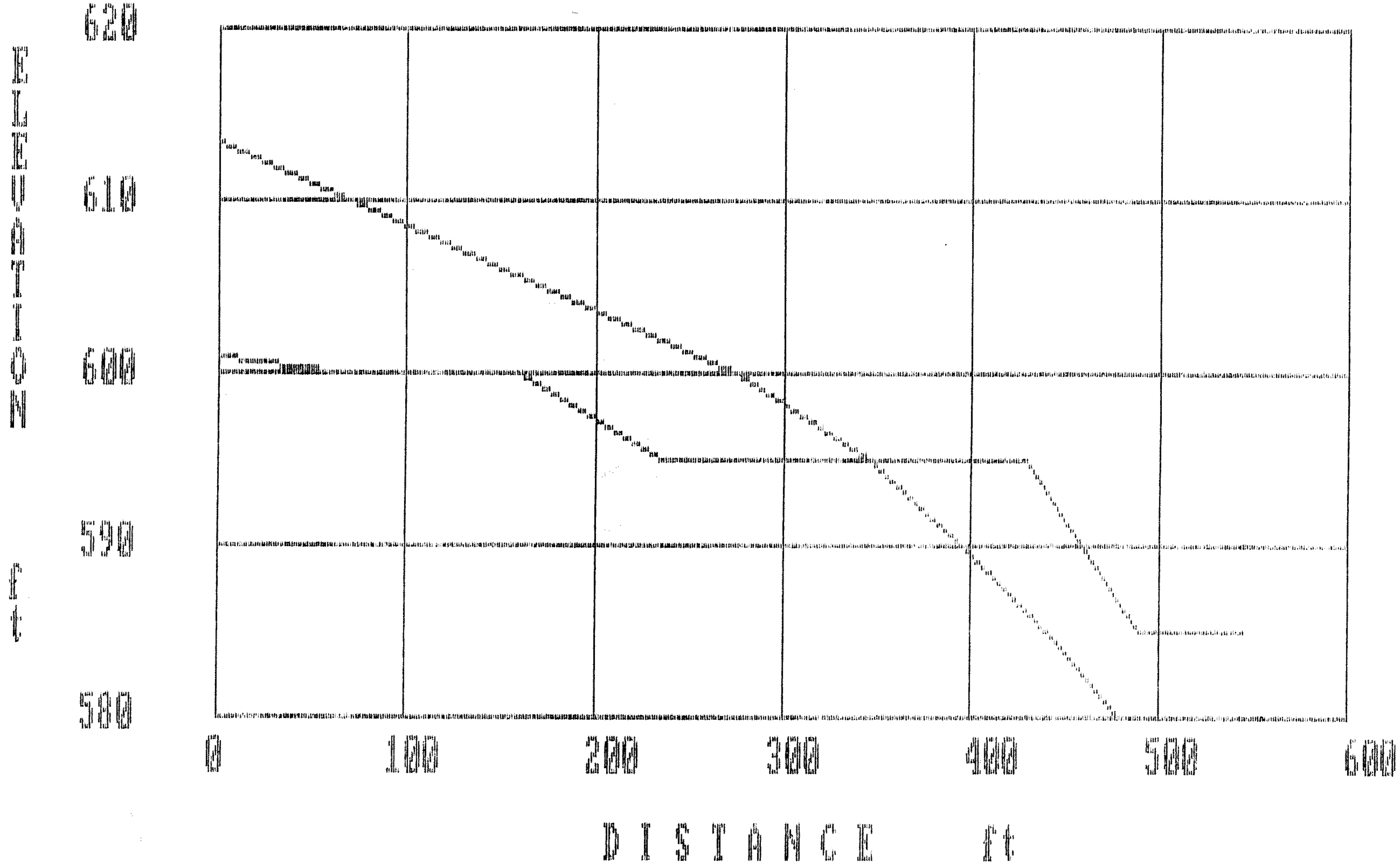
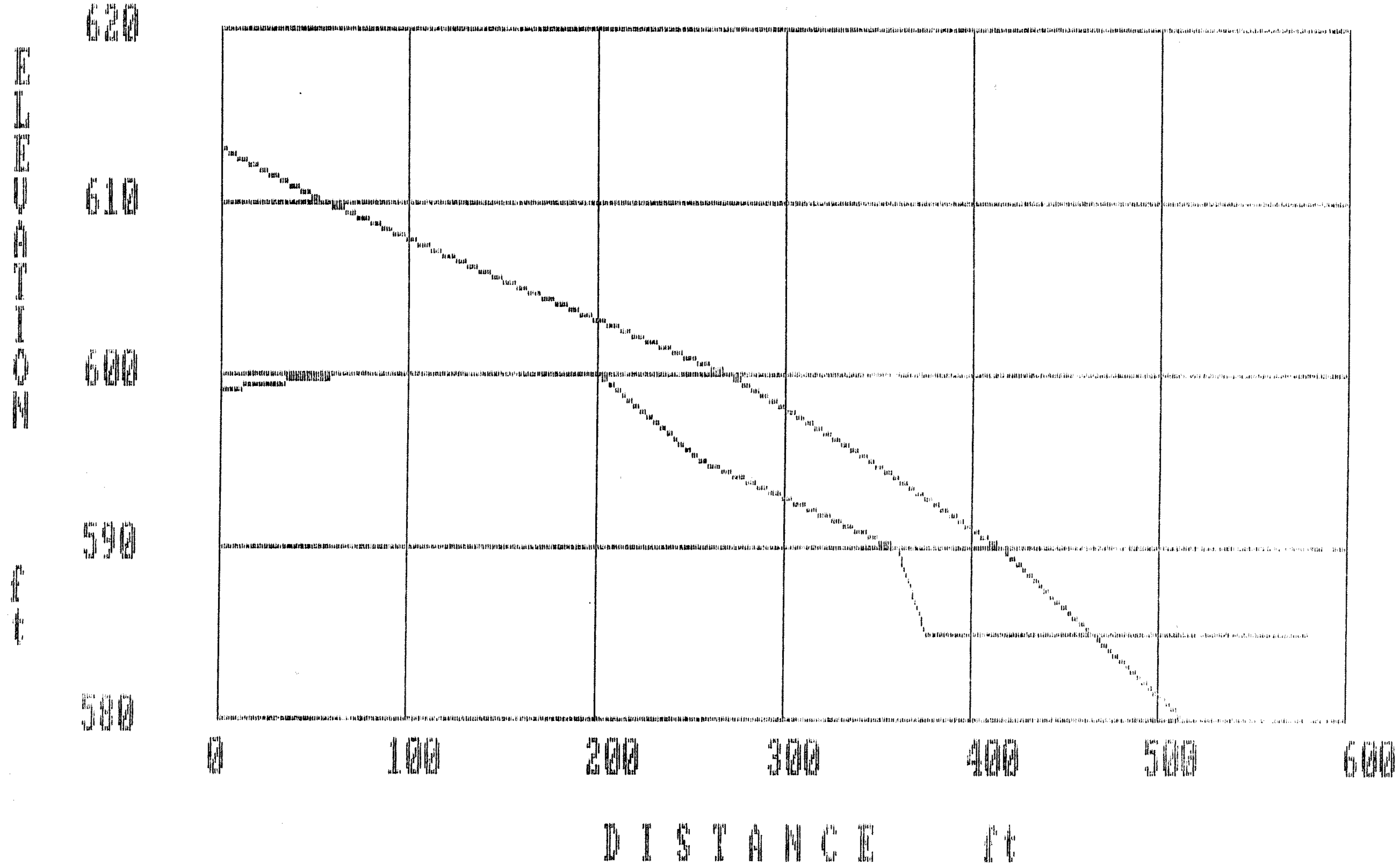


STATION: 1950



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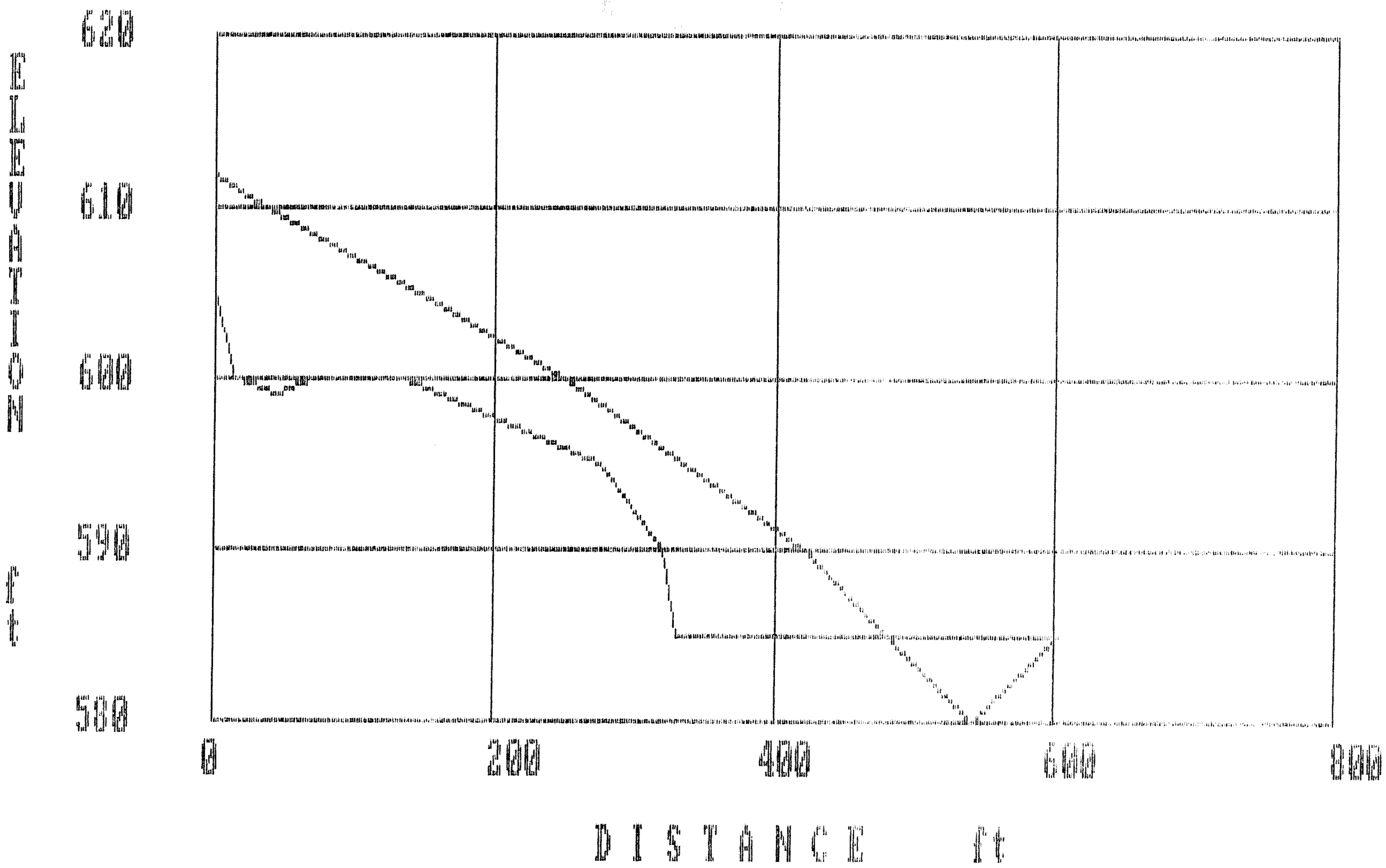

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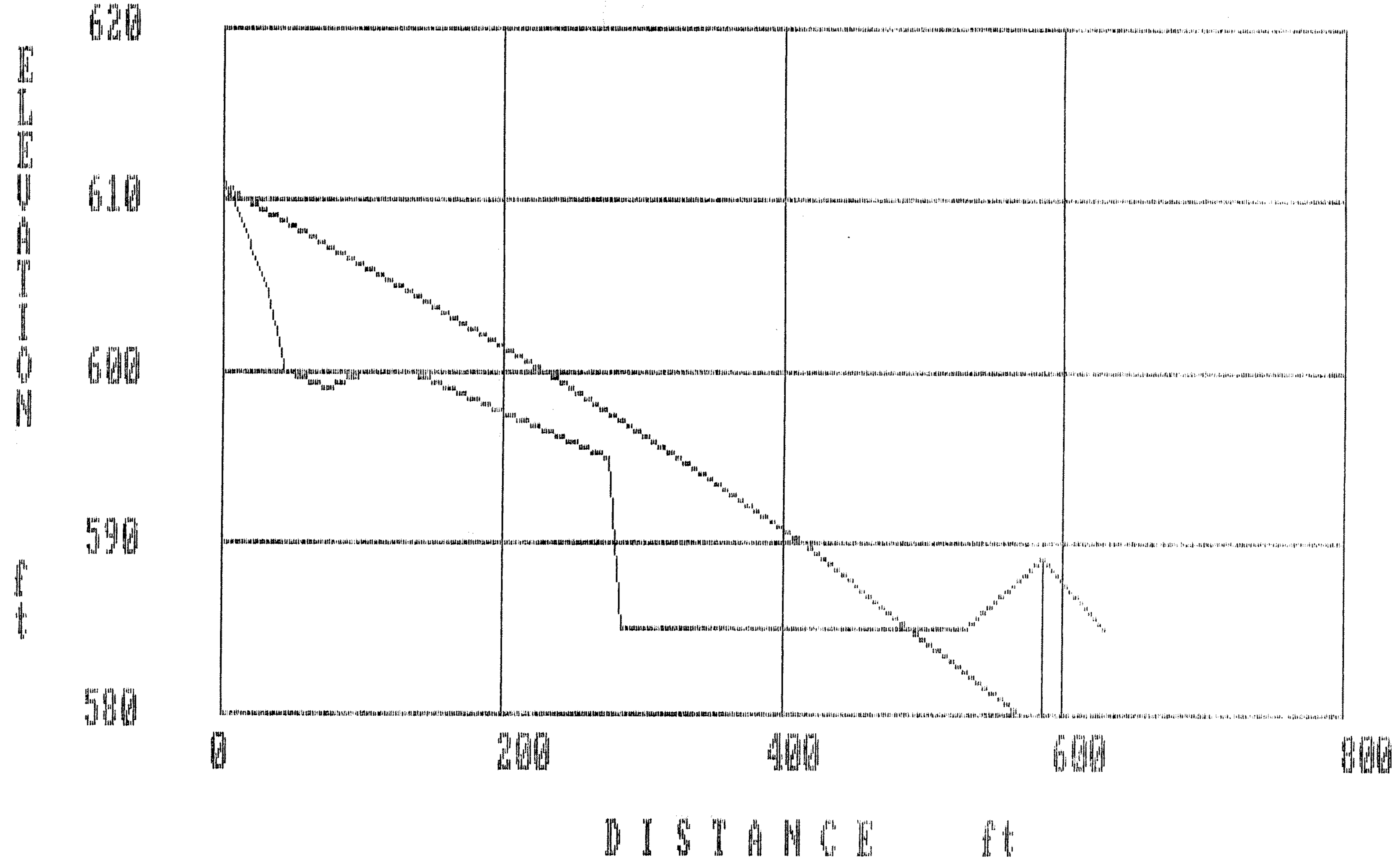

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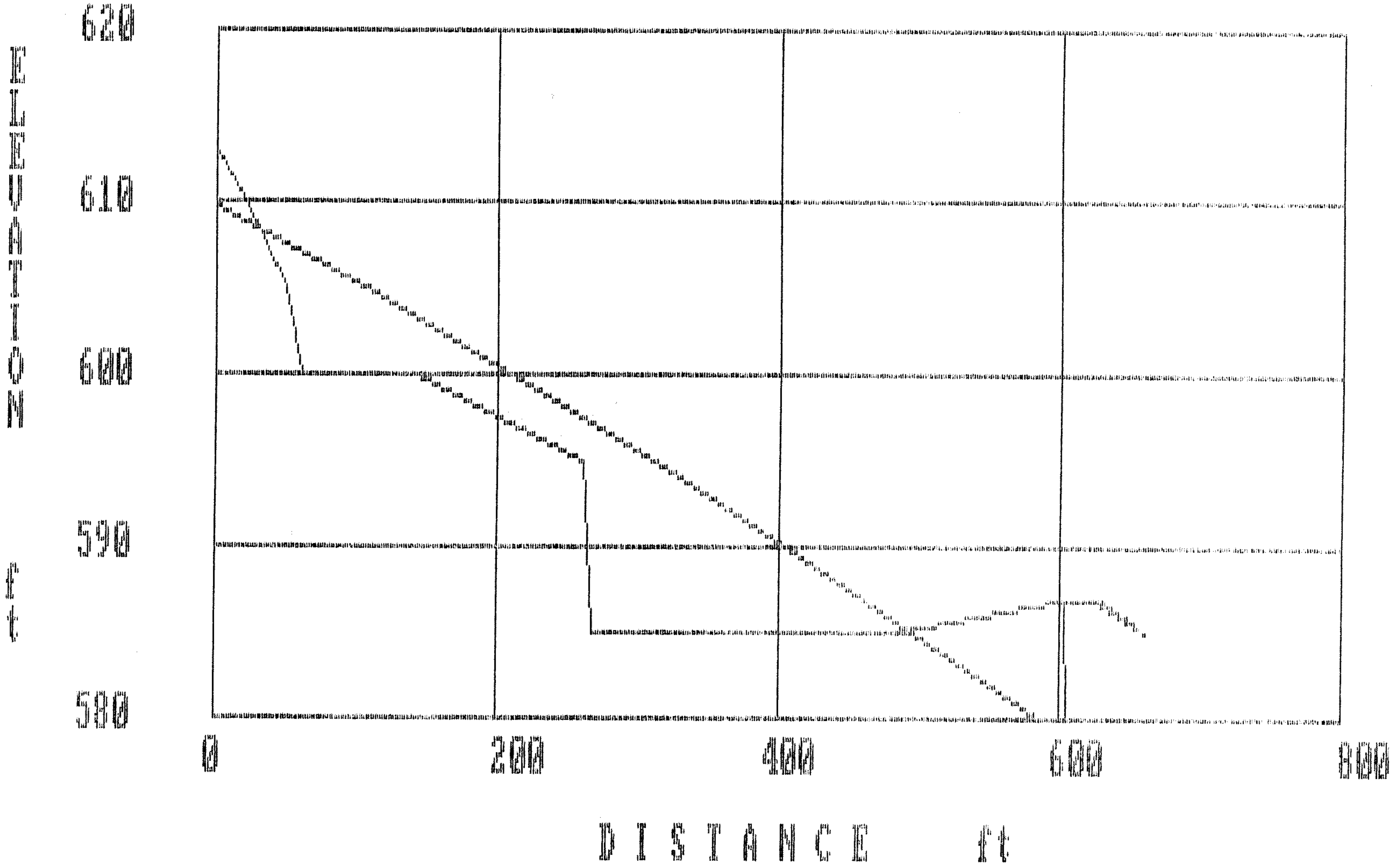
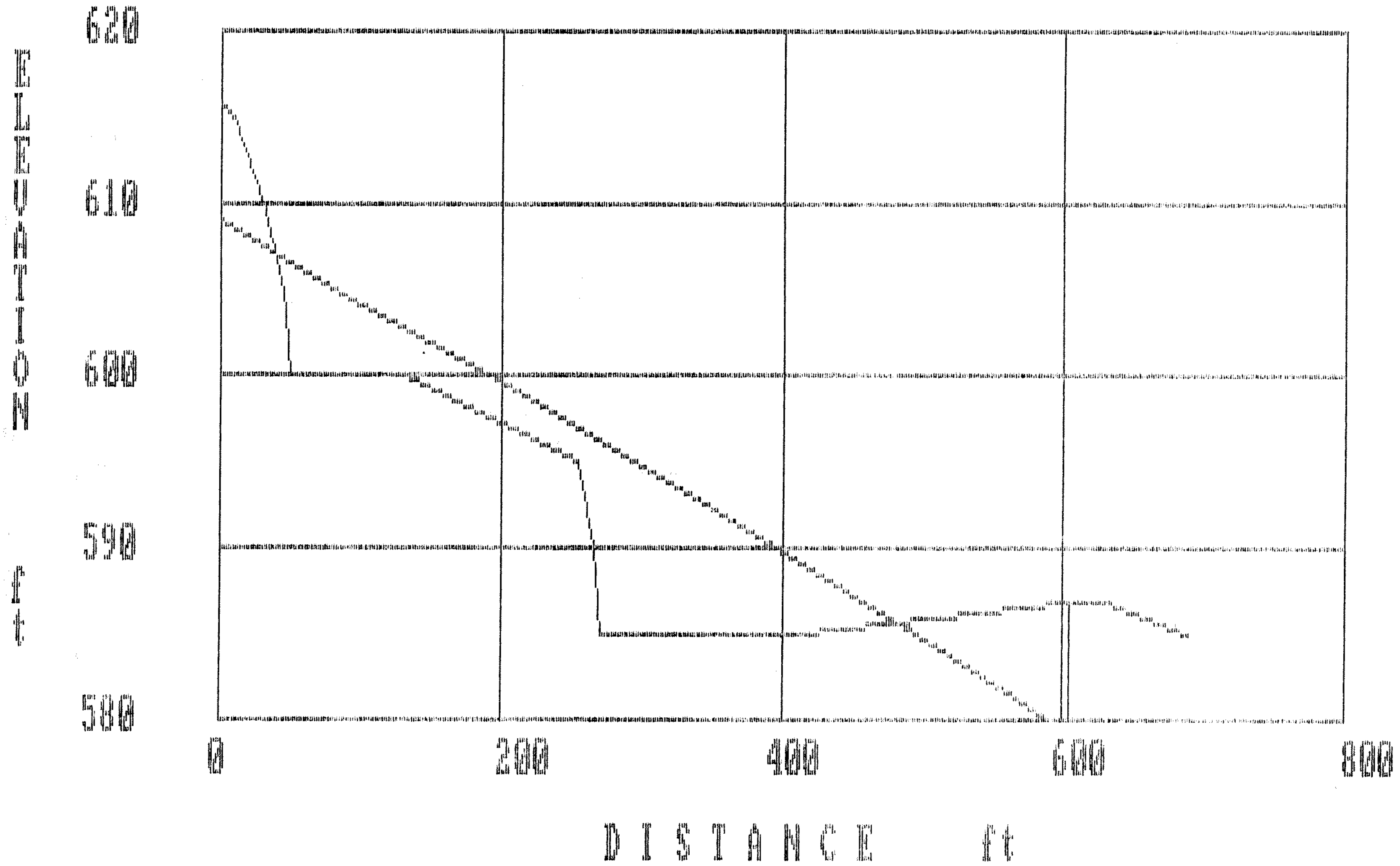
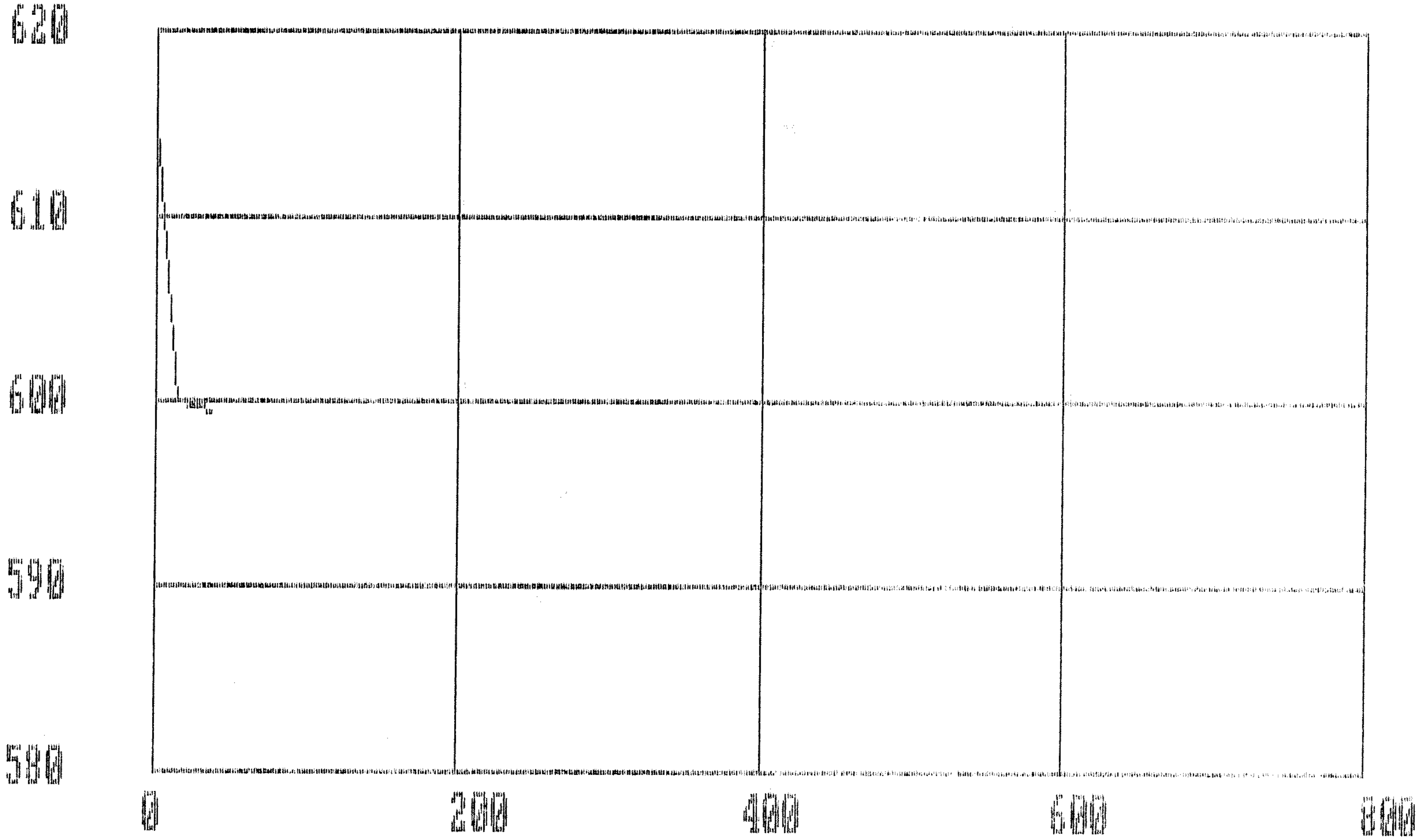
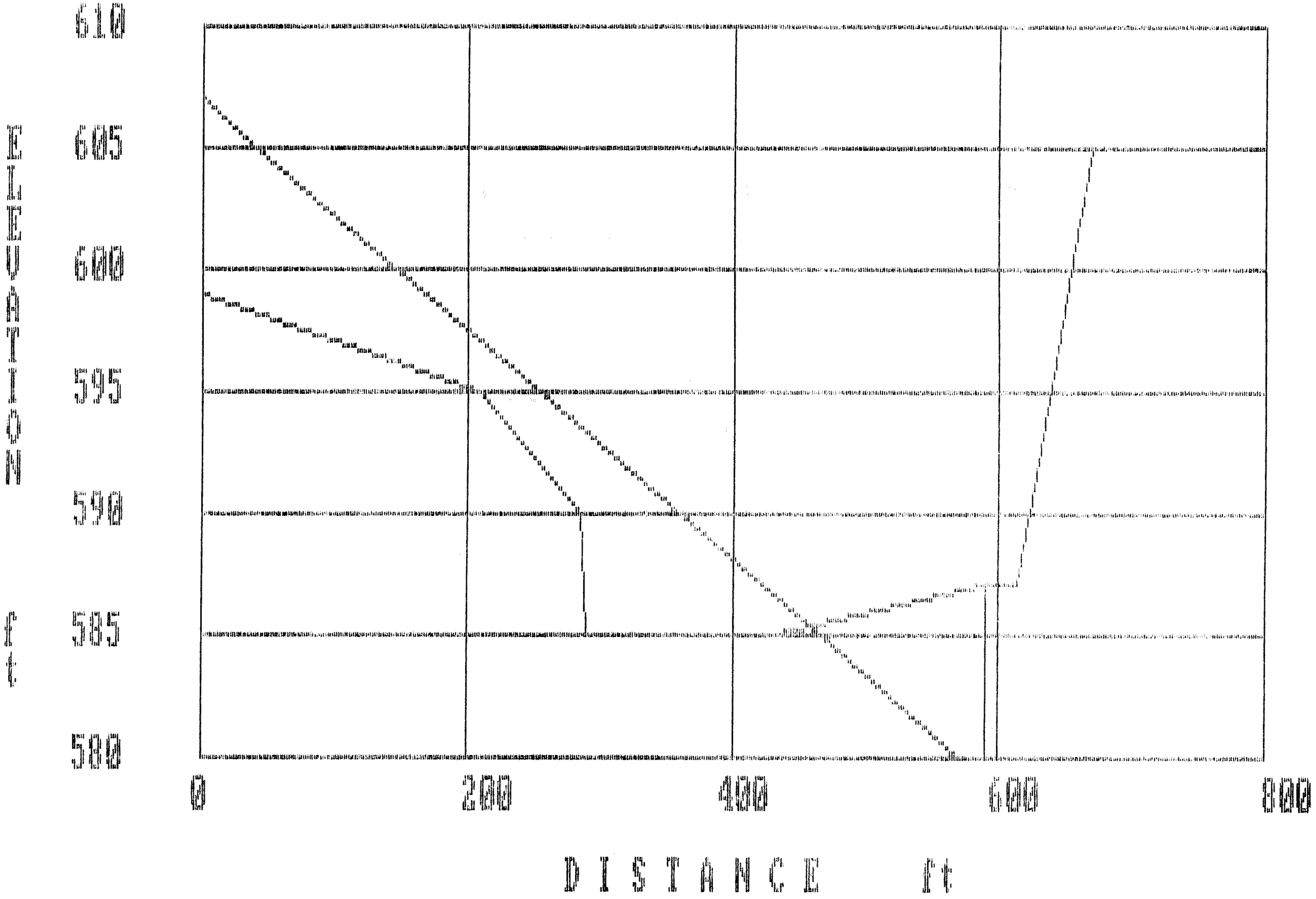


STATION: 2150

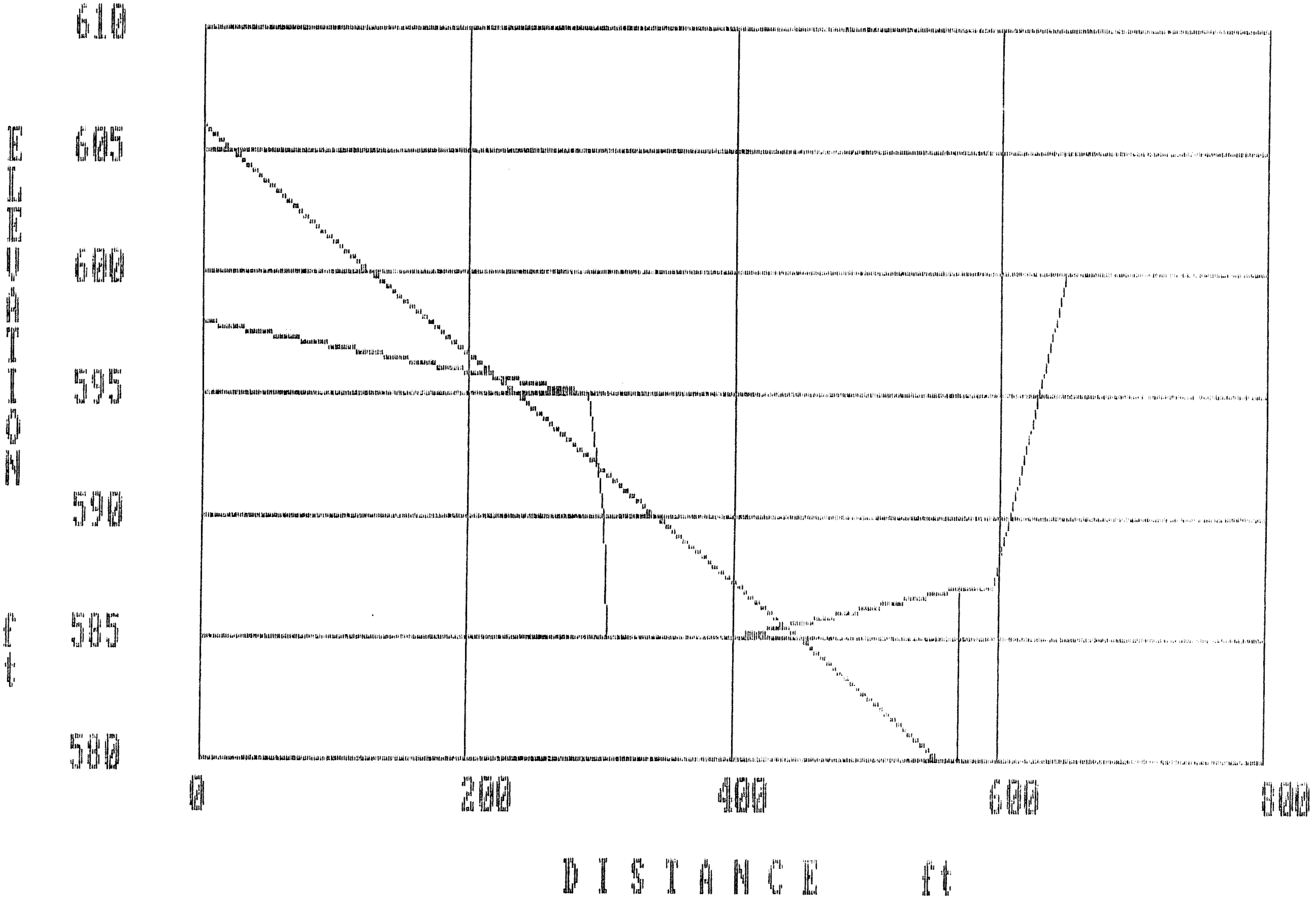


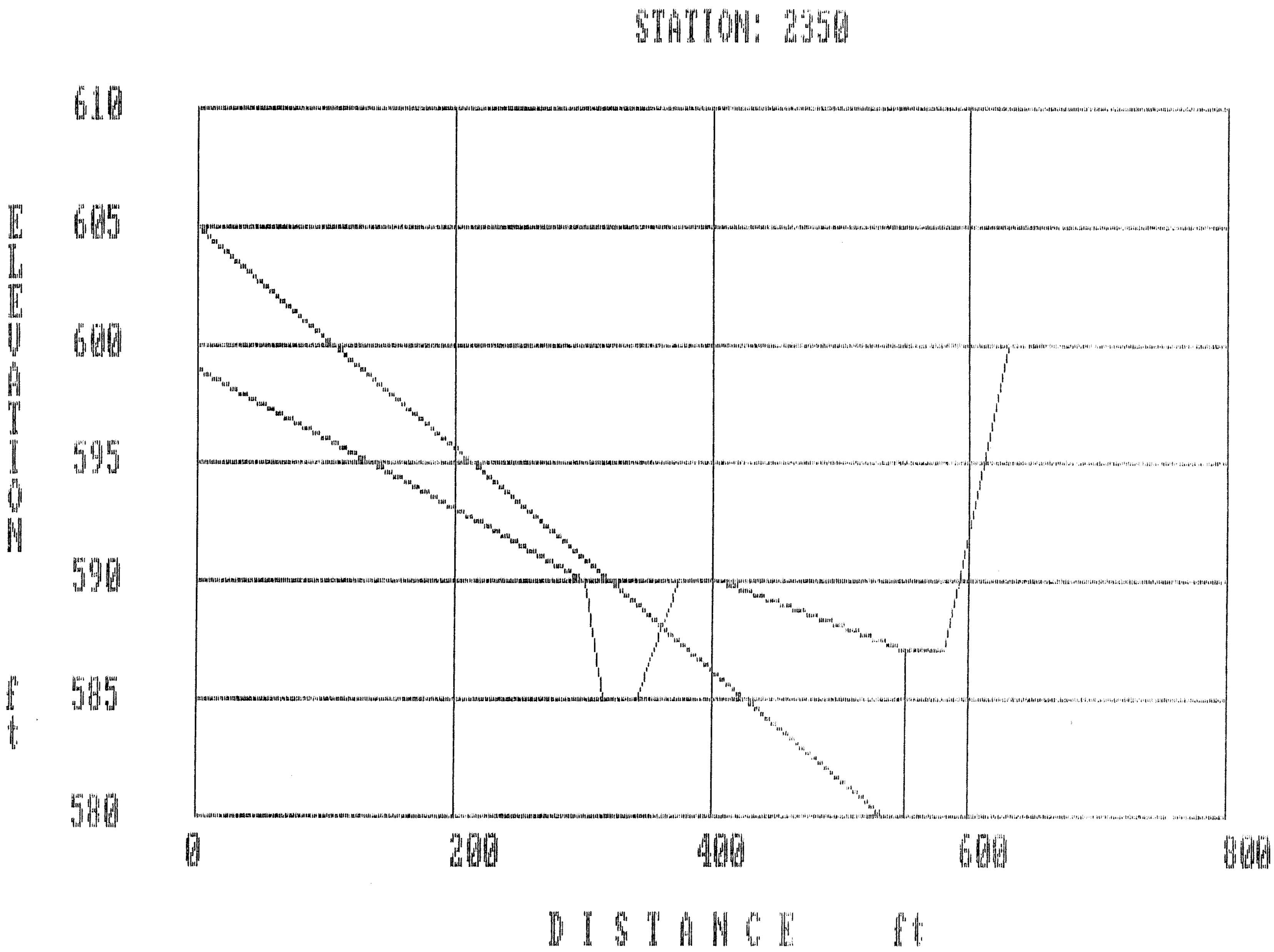

620
610
600
590
580
0
200
400
600
800

STATION: 2250

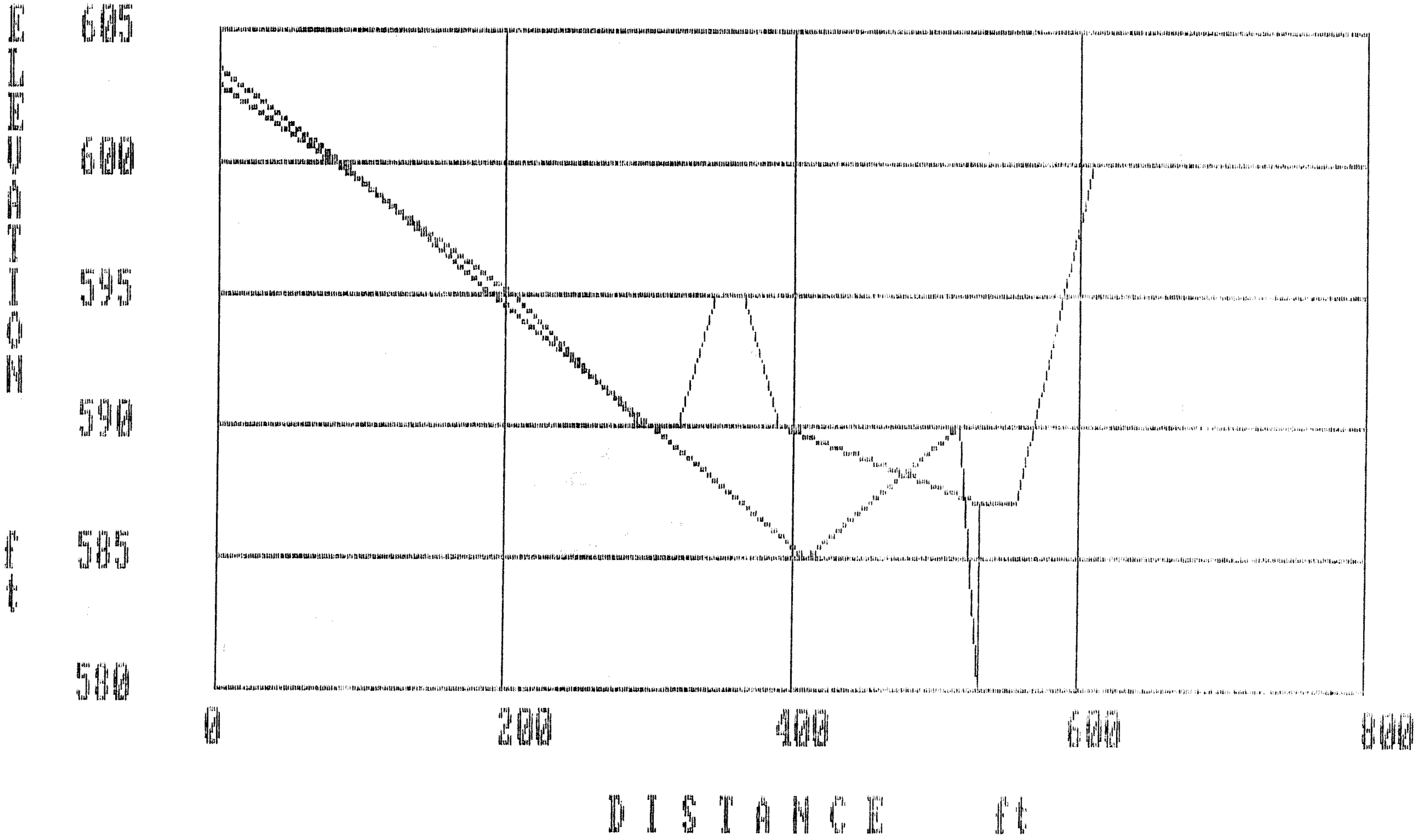


STATION: 2300

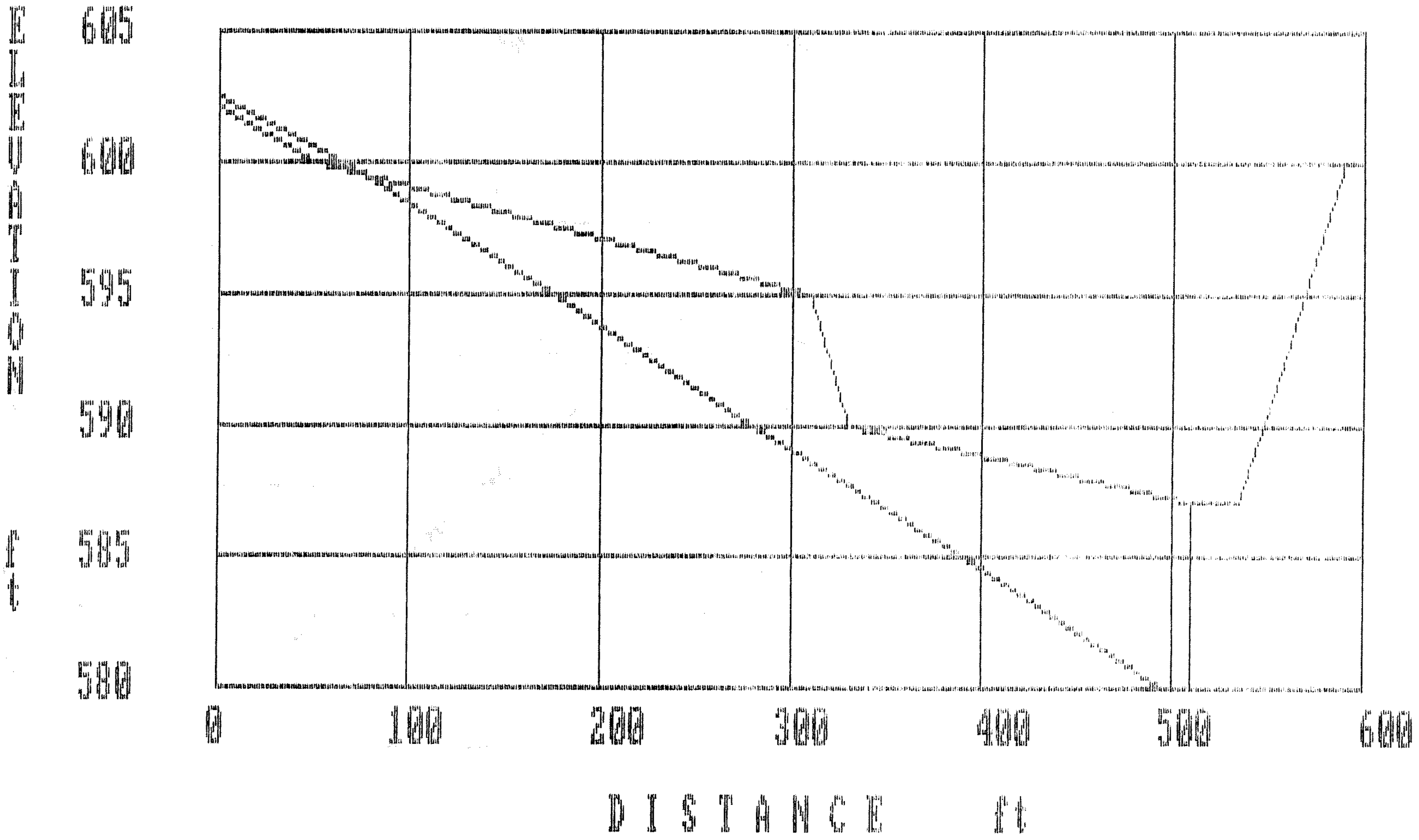



STATION: 2350
ELEVATION ft
610
605
600
595
590
585
580
0
200
400
600
800
DISTANCE ft

STATION: 2400



STATION: 2450



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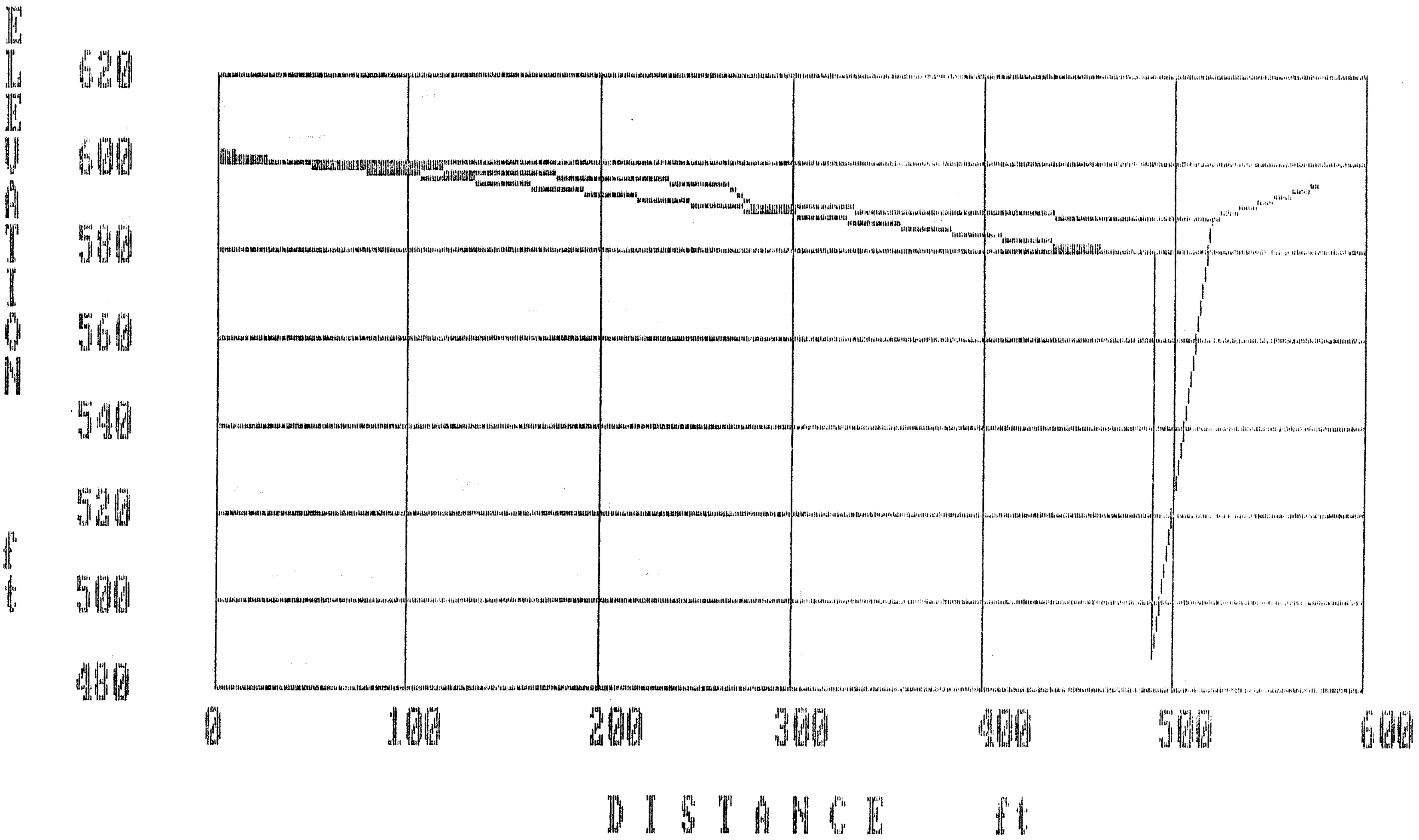
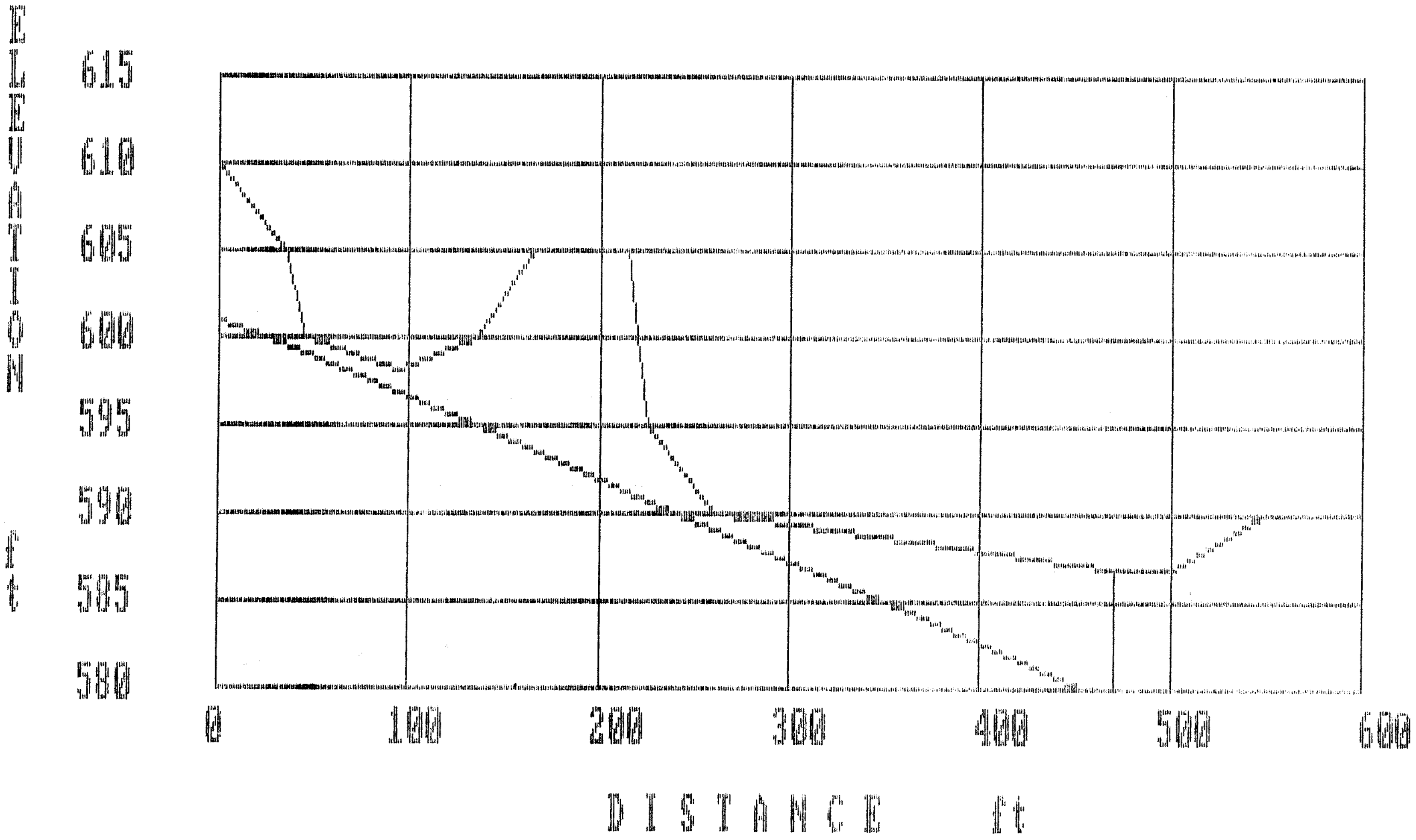


STATION: 2550



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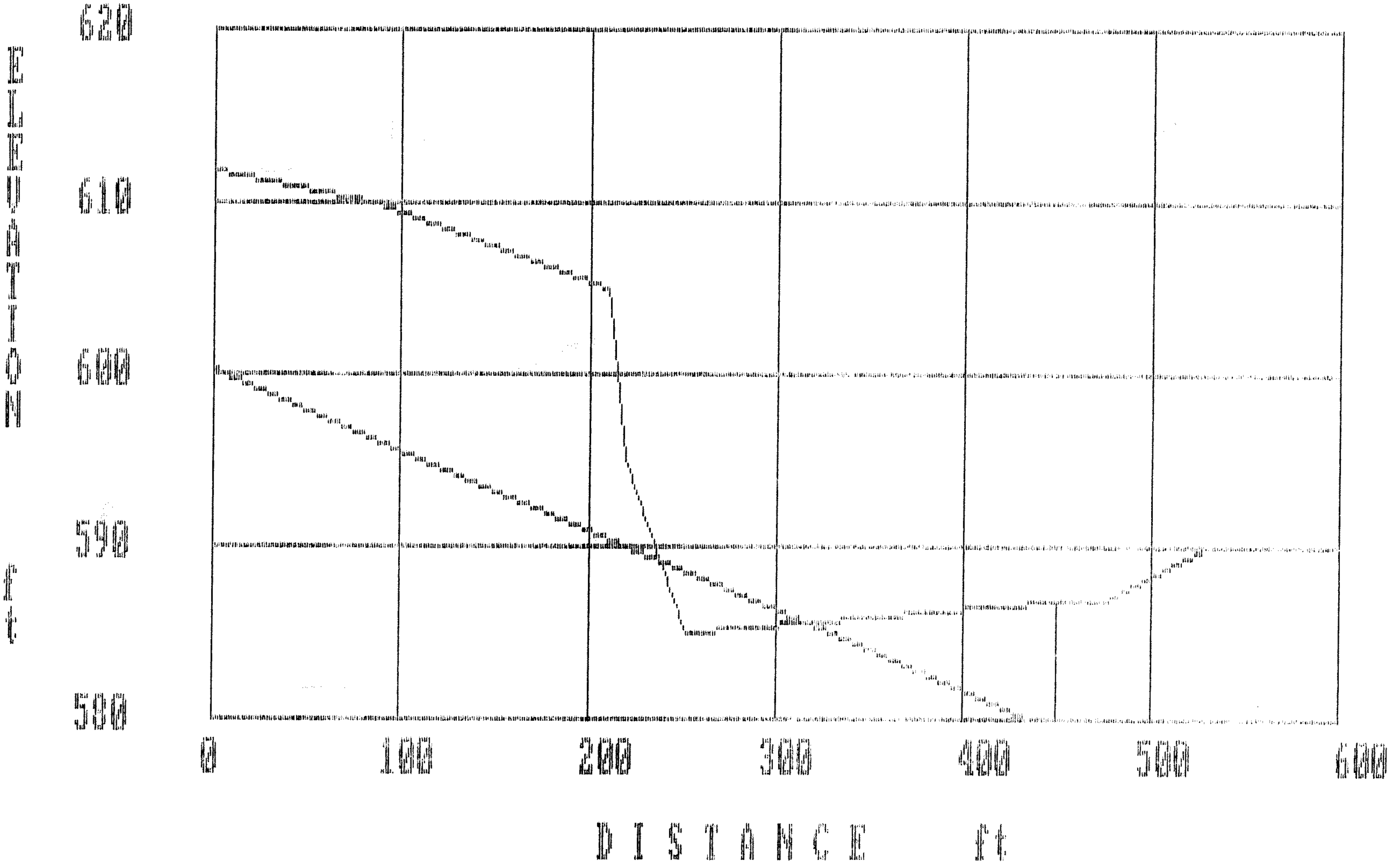
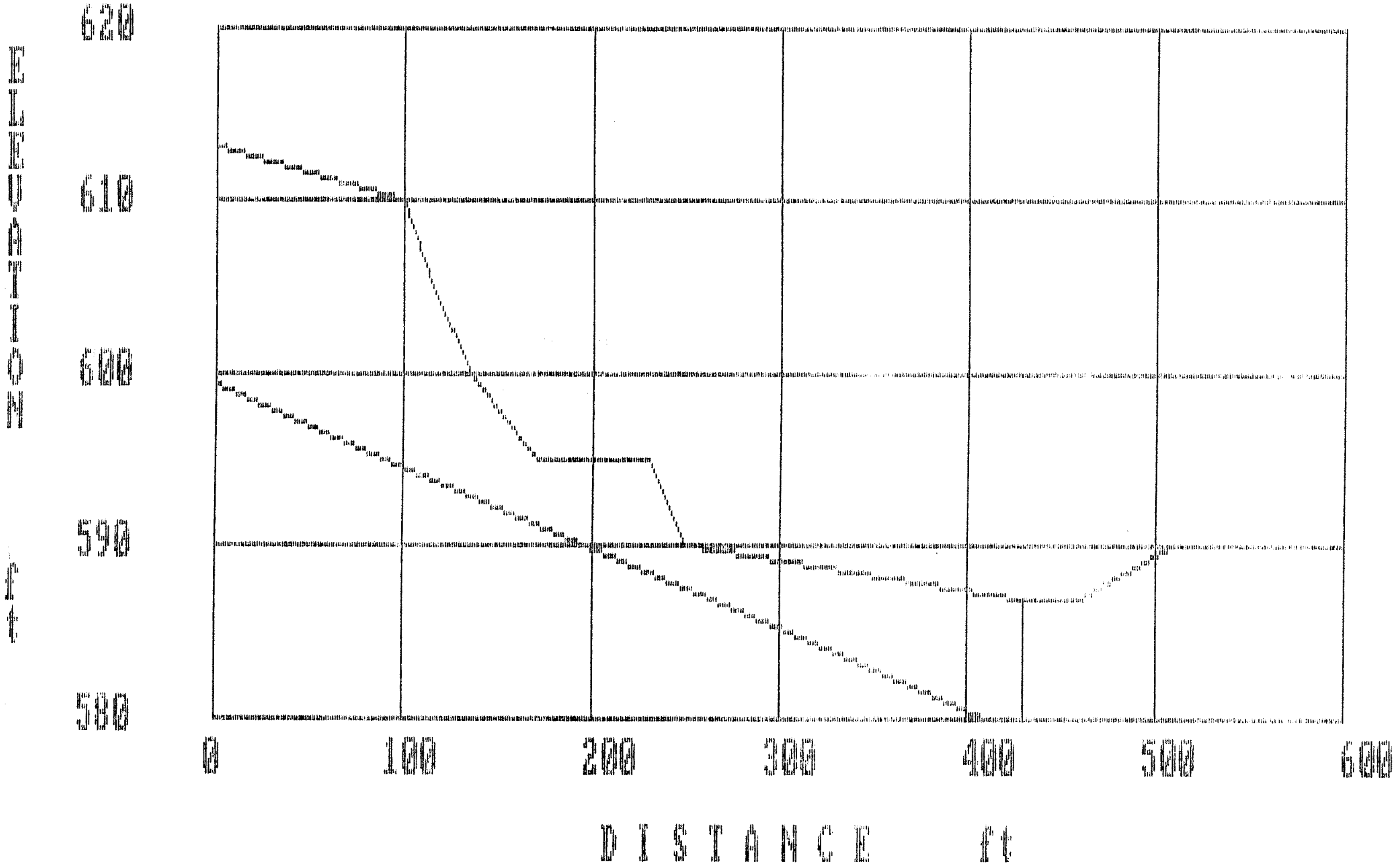
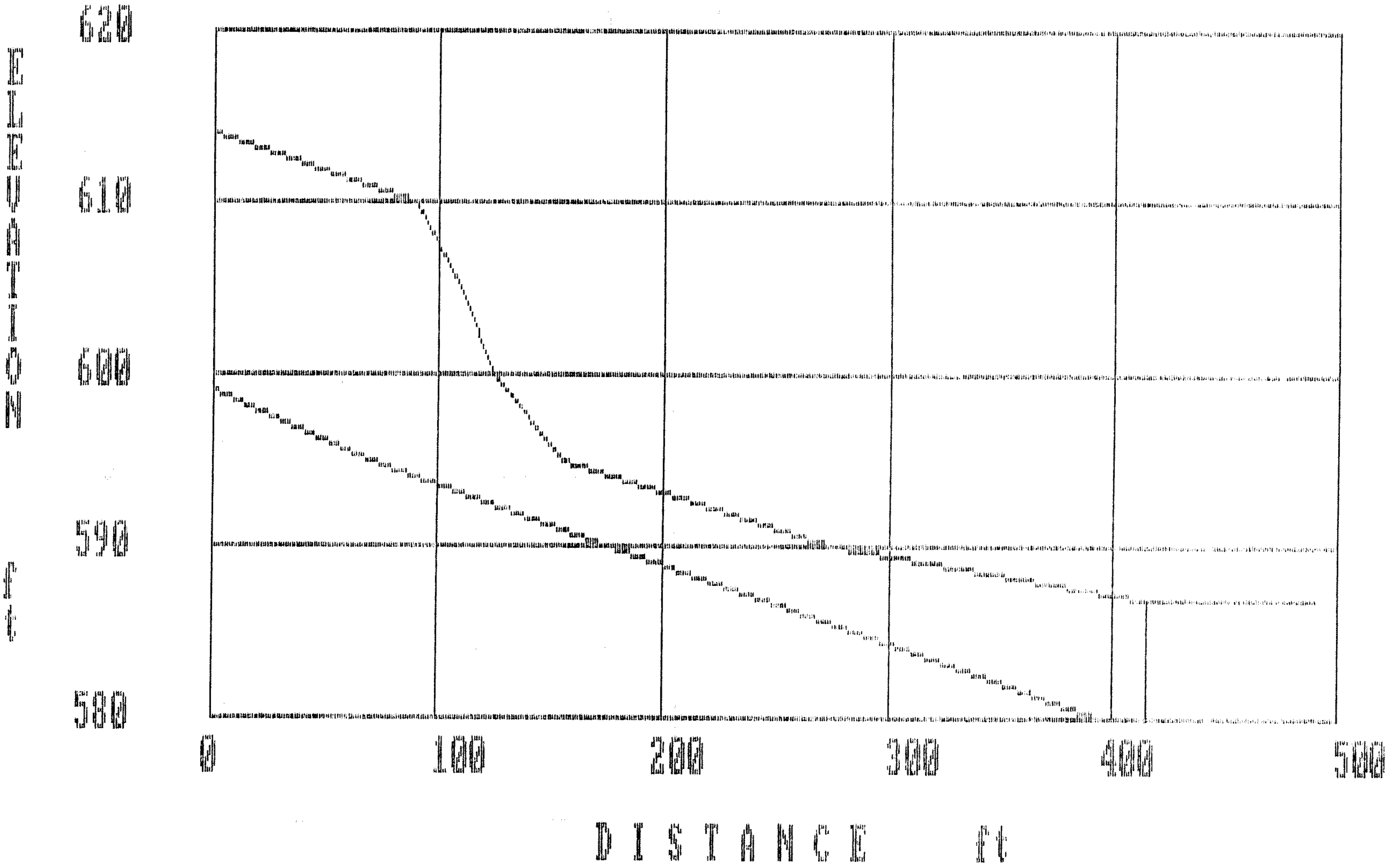


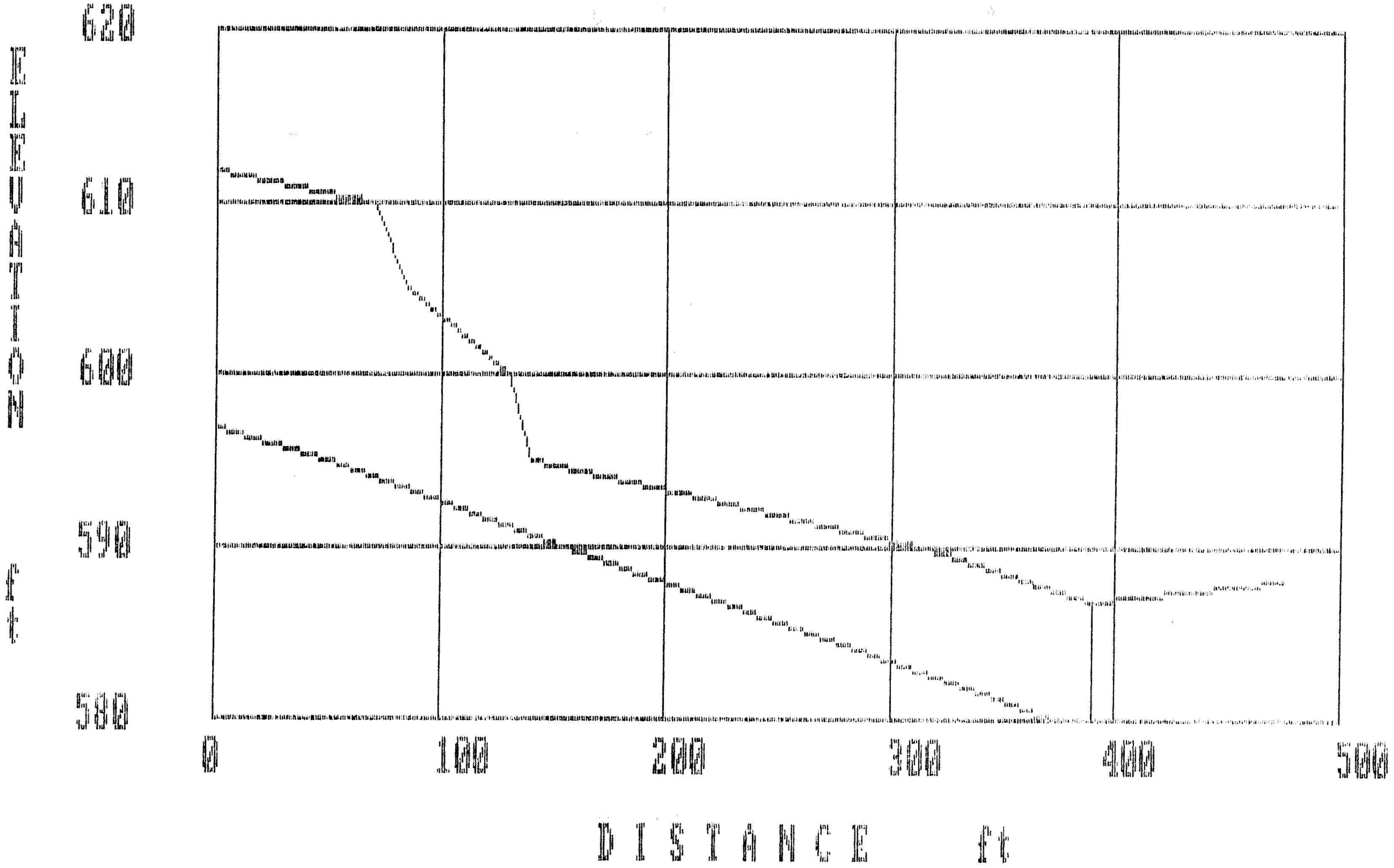
STATION: 2650



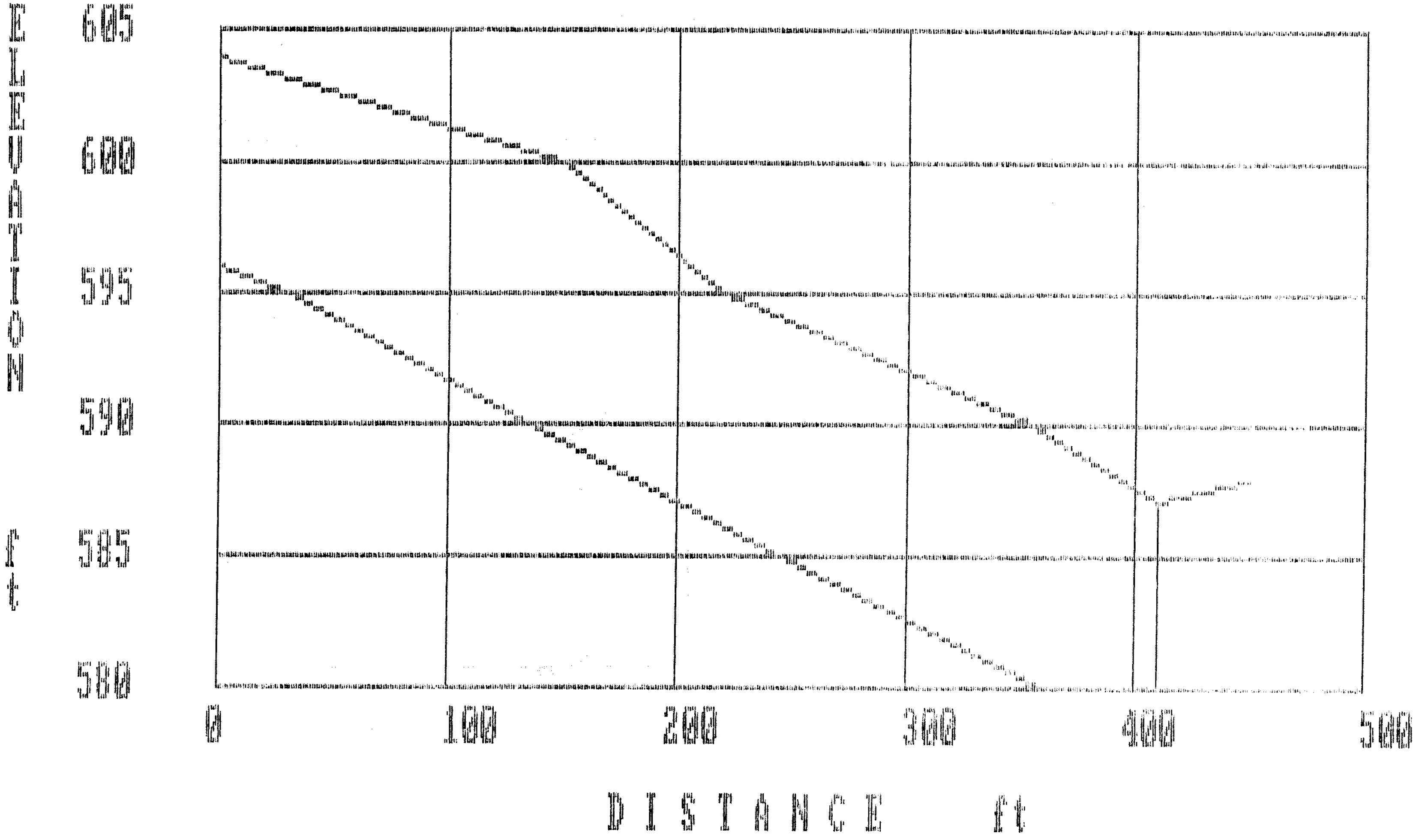
STATION: 2700



STATION: 2750



STATION: 2800



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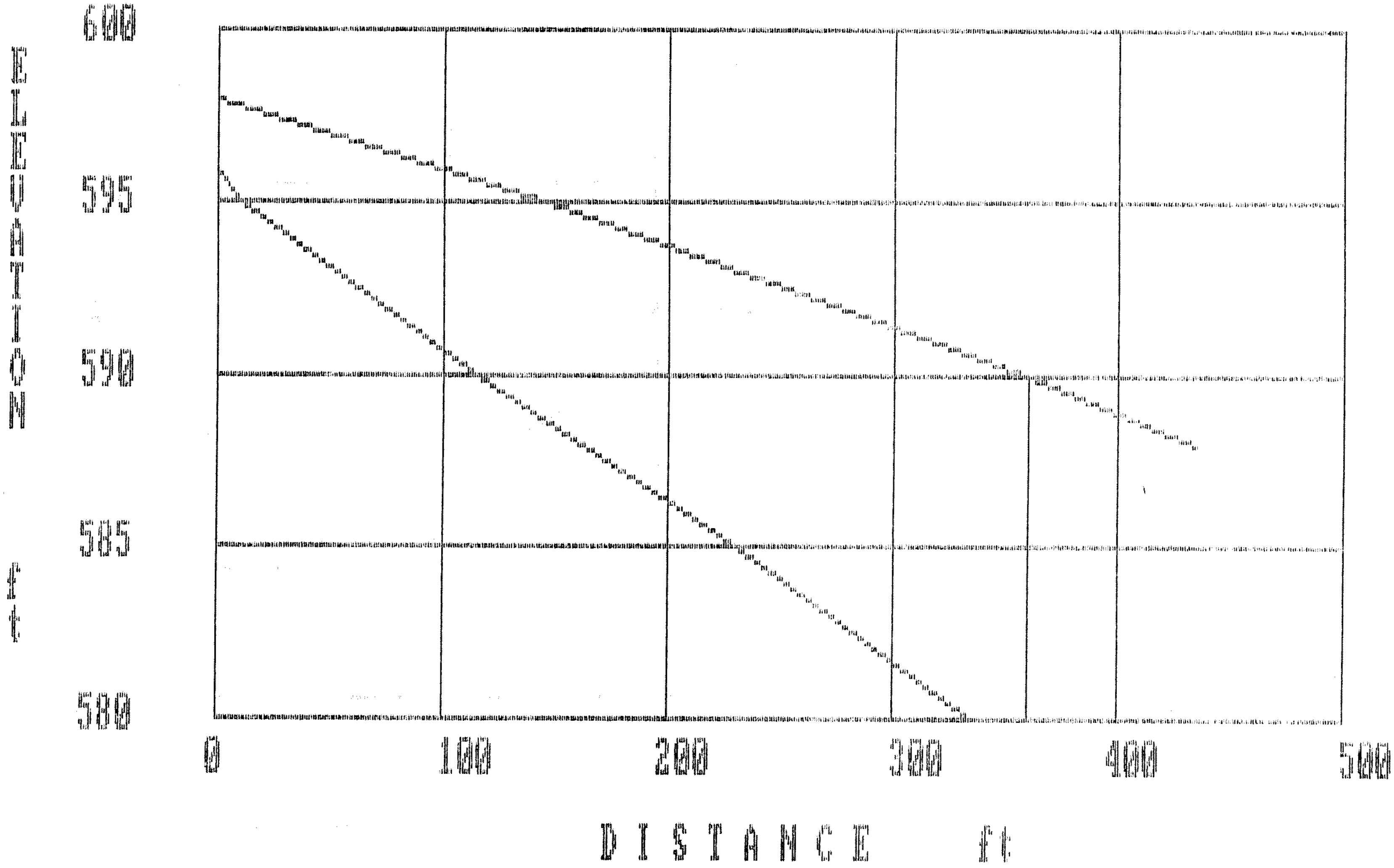

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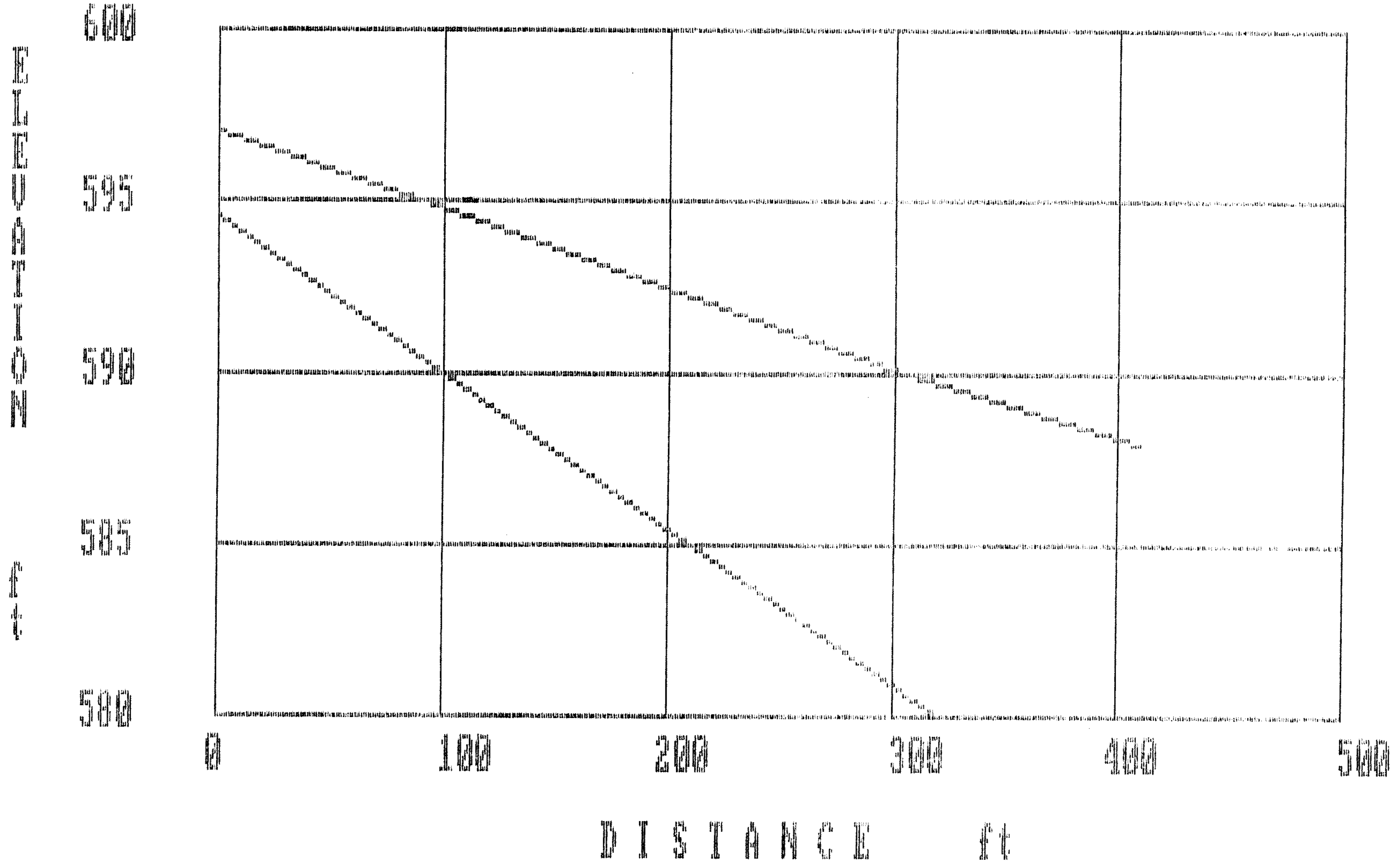
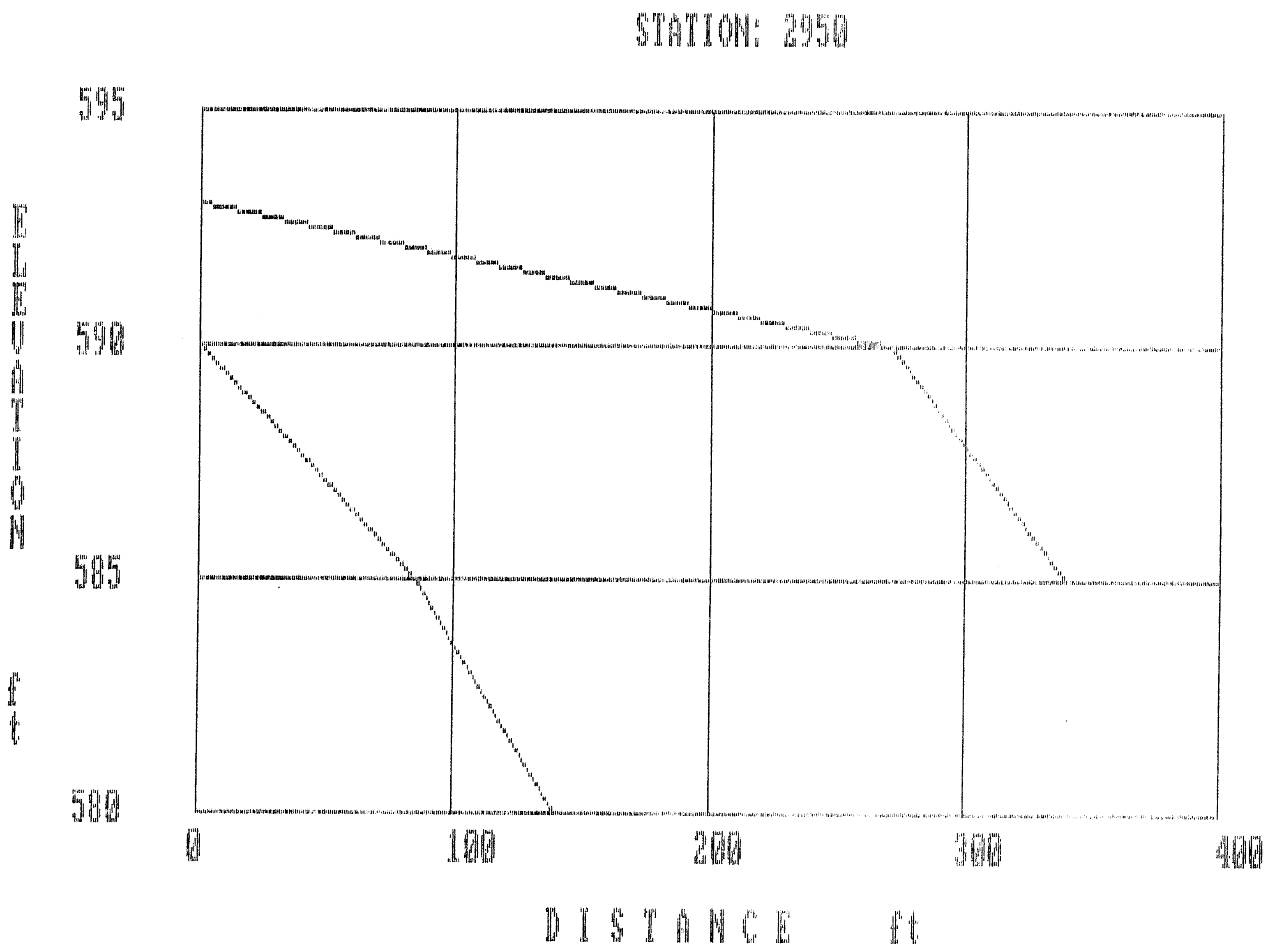
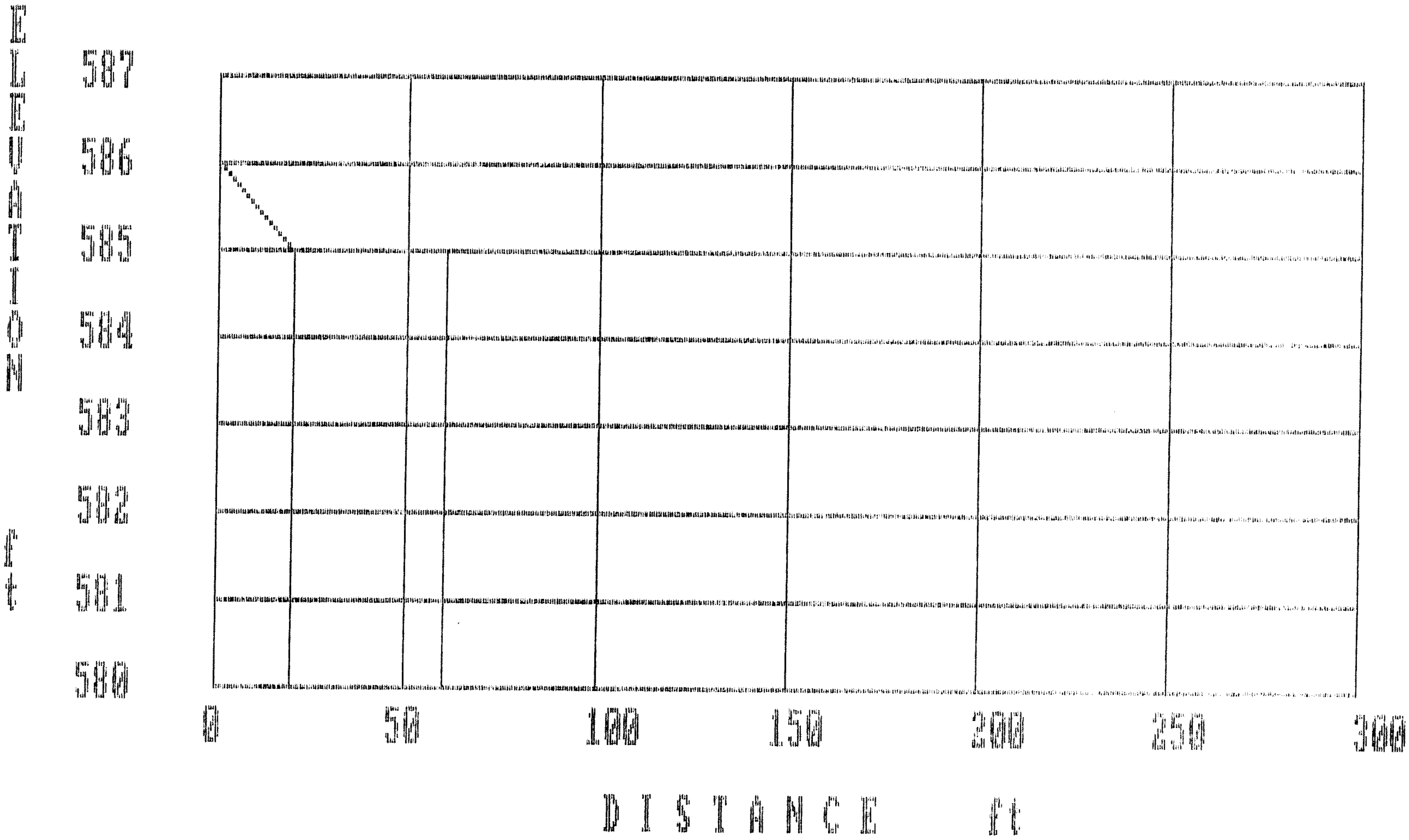
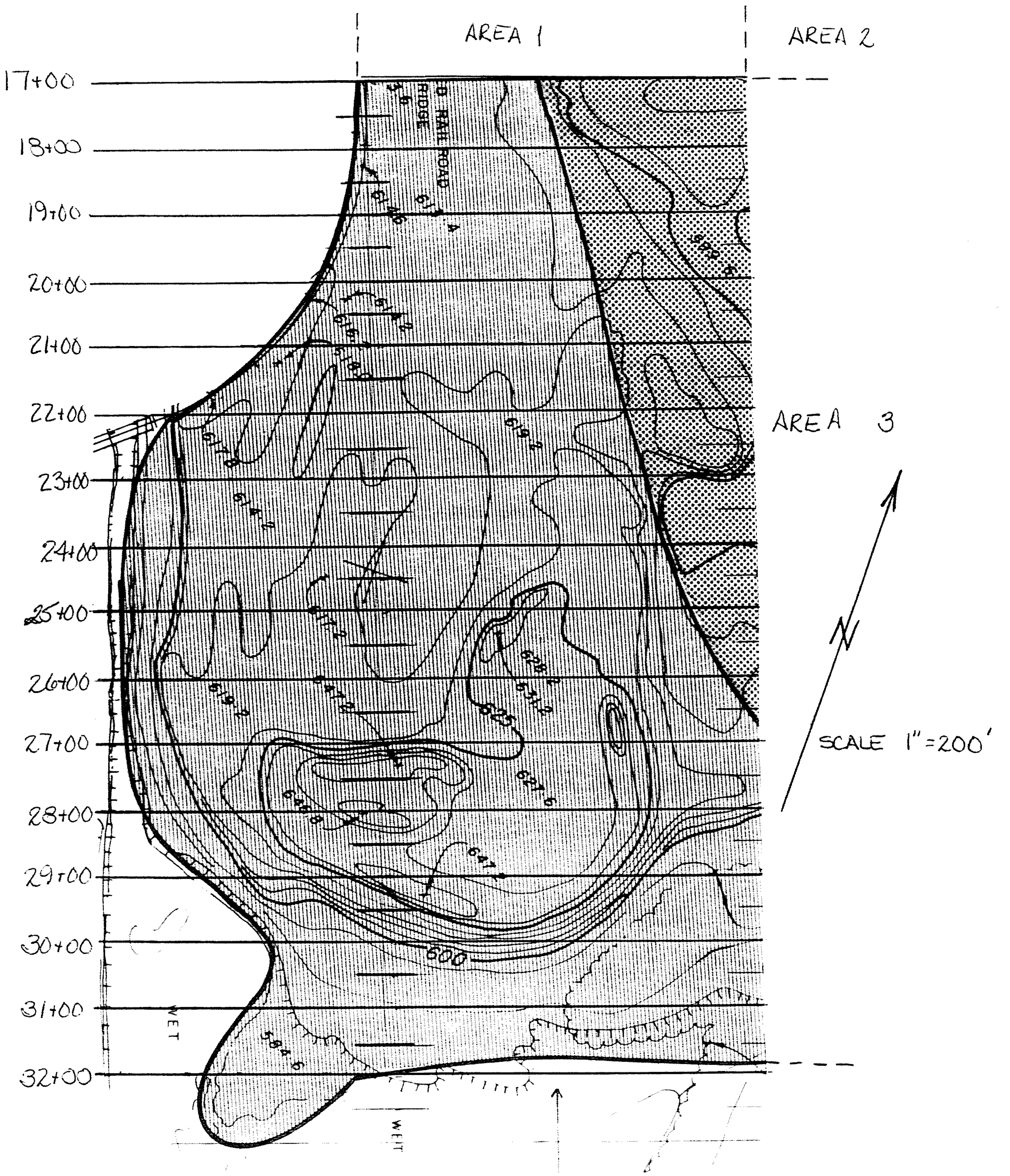



STATION: 2950
ELEVATION ft
595
590
585
580
0
100
200
300
400
DISTANCE ft

STATION: 3000





AREA 5
STATION LOCATIONS
MISC. DEBRIS/ FINE REFUSE
LTV STEEL

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR5.LTV
         STATION          1700.0 FT

     EXISTING PROFILE DATA                        PROPOSED PROFILE DATA
     POINT   X-VALUE   Y-VALUE                    POINT   X-VALUE   Y-VALUE
     -----   -------   -------                    -----   -------   -------
         1     20.00    613.60                        1     20.00    615.00
         2    225.00    610.00                        2    120.00    620.00
         3    310.00    605.00                        3    220.00    625.00
         4    325.00    600.00                        4    250.00    625.00
         5    353.00    595.00                        5    290.00    620.00
         6    447.00    590.00                        6    330.00    615.00
         7    565.00    588.00                        7    565.00    586.00

AREA IN CUT                18.8 FT^2
AREA IN FILL             5465.3 FT^2

VOL  CUT THIS REACH          0.0 YD^3
VOL FILL THIS REACH          0.0 YD^3

VOL  CUT TOTAL               0.0 YD^3
VOL FILL TOTAL               0.0 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***    CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR5.LTV
        STATION          1750.0 FT

    EXISTING PROFILE DATA                         PROPOSED PROFILE DATA
    POINT   X-VALUE   Y-VALUE                     POINT    X-VALUE    Y-VALUE
    -----   -------   -------                     -----    -------    -------
        1     20.00    614.00                         1      20.00     615.00
        2    220.00    610.00                         2     120.00     620.00
        3    340.00    605.00                         3     220.00     625.00
        4    348.00    600.00                         4     295.00     626.50
        5    405.00    595.00                         5     370.00     625.00
        6    565.00    595.00                         6     435.00     620.00
                                                      7     460.00     615.00
                                                      8     565.00     602.50

AREA IN CUT                 0.0 FT^2
AREA IN FILL             8303.8 FT^2

VOL  CUT THIS REACH         17.4 YD^3
VOL FILL THIS REACH      12749.1 YD^3

VOL  CUT TOTAL              17.4 YD^3
VOL FILL TOTAL           12749.1 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR5.LTV
         STATION          1800.0 FT

      EXISTING PROFILE DATA                           PROPOSED PROFILE DATA
      POINT   X-VALUE    Y-VALUE                      POINT     X-VALUE    Y-VALUE
      -----   -------    -------                      -----     -------    -------
          1     20.00     614.00                          1       20.00     615.00
          2    265.00     610.00                          2      115.00     620.00
          3    380.00     605.00                          3      215.00     625.00
          4    435.00     600.00                          4      280.00     627.90
          5    540.00     600.00                          5      365.00     625.00
          6    565.00     600.00                          6      470.00     620.00
                                                          7      540.00     615.00
                                                          8      565.00     613.50

AREA IN CUT                 0.0 FT^2
AREA IN FILL             7883.8 FT^2

VOL  CUT THIS REACH          0.0 YD^3
VOL FILL THIS REACH      14988.4 YD^3

VOL  CUT TOTAL              17.4 YD^3
VOL FILL TOTAL           27737.5 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***    CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR5.LTV
         STATION         1850.0 FT

     EXISTING PROFILE DATA                   PROPOSED PROFILE DATA
     POINT   X-VALUE   Y-VALUE               POINT   X-VALUE   Y-VALUE
     -----   -------   -------               -----   -------   -------
        1      0.00    614.00                   1      0.00    615.00
        2    305.00    610.00                   2    105.00    620.00
        3    405.00    605.00                   3    205.00    625.00
        4    565.00    603.00                   4    270.00    627.90
                                                5    345.00    625.00
                                                6    450.00    620.00
                                                7    550.00    615.00
                                                8    565.00    614.00

AREA IN CUT                0.0 FT^2
AREA IN FILL            7070.5 FT^2

VOL  CUT THIS REACH         0.0 YD^3
VOL FILL THIS REACH     13846.5 YD^3

VOL  CUT TOTAL             17.4 YD^3
VOL FILL TOTAL          41584.1 YD^3
```

```
* * CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR5.LTV
         STATION          1900.0 FT

     EXISTING PROFILE DATA                        PROPOSED PROFILE DATA
     POINT    X-VALUE   Y-VALUE                   POINT    X-VALUE    Y-VALUE
     -----    -------   -------                   -----    -------    -------

         1     -20.00    614.50                       1     -20.00     615.00
         2     352.00    610.00                       2      90.00     620.00
         3     445.00    605.00                       3     195.00     625.00
         4     565.00    602.00                       4     260.00     627.90
                                                      5     320.00     625.00
                                                      6     430.00     620.00
                                                      7     540.00     615.00
                                                      8     565.00     613.50

AREA IN CUT                    0.0 FT^2
AREA IN FILL                6675.5 FT^2

VOL  CUT THIS REACH             0.0 YD^3
VOL FILL THIS REACH         12727.8 YD^3

VOL  CUT TOTAL                 17.4 YD^3
VOL FILL TOTAL              54311.8 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***    CF86118    VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR5.LTV
         STATION         1950.0 FT

     EXISTING PROFILE DATA               PROPOSED PROFILE DATA
     POINT   X-VALUE   Y-VALUE           POINT   X-VALUE   Y-VALUE
     -----   -------   -------           -----   -------   -------
         1    -50.00    615.00               1    -50.00    615.00
         2    405.00    610.00               2     70.00    620.00
         3    530.00    605.00               3    177.00    625.00
         4    550.00    600.00               4    240.00    627.90
         5    565.00    598.50               5    303.00    625.00
                                             6    410.00    620.00
                                             7    578.00    615.00
                                             8    565.00    613.00

AREA IN CUT                0.0 FT^2
AREA IN FILL            6141.5 FT^2

VOL  CUT THIS REACH         0.0 YD^3
VOL FILL THIS REACH     11867.5 YD^3

VOL  CUT TOTAL             17.4 YD^3
VOL FILL TOTAL          66179.4 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***    CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR5.LTV
         STATION         2000.0 FT

     EXISTING PROFILE DATA                   PROPOSED PROFILE DATA
     POINT   X-VALUE   Y-VALUE               POINT   X-VALUE   Y-VALUE
     -----   -------   -------               -----   -------   -------
         1    -70.00     65.00                   1    -70.00    615.00
         2    -20.00    615.00                   2     35.00    620.00
         3    515.00    610.00                   3    155.00    625.00
         4    565.00    605.00                   4    220.00    628.00
                                                 5    280.00    625.00
                                                 6    390.00    620.00
                                                 7    500.00    610.00
                                                 8    565.00    612.00

AREA IN CUT                0.4 FT^2
AREA IN FILL           18627.8 FT^2

VOL  CUT THIS REACH          0.3 YD^3
VOL FILL THIS REACH      22934.5 YD^3

VOL  CUT TOTAL              17.7 YD^3
VOL FILL TOTAL           89113.9 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR5.LTV
         STATION          2050.0 FT

     EXISTING PROFILE DATA                        PROPOSED PROFILE DATA
     POINT    X-VALUE    Y-VALUE                  POINT    X-VALUE    Y-VALUE
     -----    -------    -------                  -----    -------    -------
         1    -115.00     617.00                      1    -115.00     615.00
         2      33.00     615.00                      2      15.00     620.00
         3     190.00     614.00                      3     132.00     625.00
         4     328.00     615.00                      4     195.00     628.00
         5     405.00     615.00                      5     260.00     625.00
         6     565.00     610.50                      6     370.00     620.00
                                                      7     480.00     615.00
                                                      8     565.00     611.00

AREA IN CUT                 38.5 FT^2
AREA IN FILL              4002.5 FT^2

VOL  CUT THIS REACH           36.0 YD^3
VOL FILL THIS REACH        20954.0 YD^3

VOL  CUT TOTAL                53.7 YD^3
VOL FILL TOTAL            110067.9 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR5.LTV
         STATION          2100.0 FT

     EXISTING PROFILE DATA                    PROPOSED PROFILE DATA
     POINT    X-VALUE    Y-VALUE              POINT    X-VALUE    Y-VALUE
     -----    -------    -------              -----    -------    -------
         1    -170.00     617.00                  1    -170.00     615.00
         2      95.00     615.00                  2     -22.00     620.00
         3     290.00     615.00                  3     100.00     625.00
         4     530.00     615.00                  4     170.00     628.00
         5     565.00     612.00                  5     240.00     625.00
                                                  6     350.00     620.00
                                                  7     457.00     615.00
                                                  8     560.00     610.00
                                                  9     565.00     609.70

AREA IN CUT                 279.1 FT^2
AREA IN FILL               3770.9 FT^2

VOL  CUT THIS REACH          294.1 YD^3
VOL FILL THIS REACH         7197.6 YD^3

VOL  CUT TOTAL               347.6 YD^3
VOL FILL TOTAL            117265.5 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR5.LTV
         STATION          2150.0 FT

     EXISTING PROFILE DATA                         PROPOSED PROFILE DATA
     POINT    X-VALUE    Y-VALUE                   POINT    X-VALUE    Y-VALUE
     -----    -------    -------                   -----    -------    -------
         1    -260.00     618.00                       1    -260.00     600.00
         2     170.00     615.00                       2    -210.00     615.00
         3     300.00     620.00                       3     -74.00     620.00
         4     480.00     620.00                       4      65.00     625.00
         5     565.00     616.00                       5     145.00     628.50
                                                       6     220.00     625.00
                                                       7     327.00     620.00
                                                       8     435.00     615.00
                                                       9     545.00     610.00
                                                      10     565.00     609.00

AREA IN CUT               1731.6 FT^2
AREA IN FILL              3122.9 FT^2

VOL  CUT THIS REACH        1861.8 YD^3
VOL FILL THIS REACH        6383.1 YD^3

VOL  CUT TOTAL             2209.6 YD^3
VOL FILL TOTAL           123648.6 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***    CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR5.LTV
         STATION         2200.0 FT

     EXISTING PROFILE DATA                      PROPOSED PROFILE DATA
     POINT   X-VALUE   Y-VALUE                  POINT   X-VALUE   Y-VALUE
     -----   -------   -------                  -----   -------   -------
         1   -335.00    585.00                      1   -335.00    580.00
         2   -325.00    590.00                      2   -315.00    580.00
         3   -295.00    595.00                      3   -210.00    615.00
         4   -280.00    600.00                      4   -136.00    620.00
         5   -275.00    615.00                      5     20.00    625.00
         6    215.00    620.00                      6    110.00    628.75
         7    410.00    620.00                      7    200.00    625.00
         8    565.00    615.00                      8    307.00    620.00
                                                    9    415.00    615.00
                                                   10    520.00    610.00
                                                   11    540.00    608.00

AREA IN CUT             2317.8 FT^2
AREA IN FILL            2635.4 FT^2

VOL  CUT THIS REACH      3749.5 YD^3
VOL FILL THIS REACH      5331.7 YD^3

VOL  CUT TOTAL           5959.1 YD^3
VOL FILL TOTAL         128980.4 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***    CF86119    VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR5.LTV
         STATION         2250.0 FT

     EXISTING PROFILE DATA                   PROPOSED PROFILE DATA
     POINT   X-VALUE   Y-VALUE               POINT    X-VALUE   Y-VALUE
     -----   -------   -------               -----    -------   -------
         1   -340.00    585.00                   1    -340.00    560.00
         2   -330.00    590.00                   2    -315.00    580.00
         3   -290.00    595.00                   3    -210.00    615.00
         4   -280.00    600.00                   4    -193.00    620.00
         5   -270.00    615.00                   5     -35.00    625.00
         6    205.00    620.00                   6      70.00    629.00
         7    255.00    620.00                   7     180.00    625.00
         8    290.00    615.00                   8     287.00    620.00
         9    405.00    610.00                   9     375.00    615.00
        10    490.00    610.00                  10     505.00    610.00
        11    510.00    605.00                  11     565.00    607.00
        12    520.00    600.00
        13    565.00    598.00

AREA IN CUT             1307.1 FT^2
AREA IN FILL            4317.1 FT^2

VOL  CUT THIS REACH      3356.4 YD^3
VOL FILL THIS REACH      6437.5 YD^3

VOL  CUT TOTAL           9315.5 YD^3
VOL FILL TOTAL         135417.9 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118    VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT. MDFRS.LTV
          STATION          2300.0 FT

     EXISTING PROFILE DATA                    PROPOSED PROFILE DATA
     POINT    X-VALUE    Y-VALUE              POINT    X-VALUE    Y-VALUE
     -----    -------    -------              -----    -------    -------
         1    -350.00     585.00                  1    -350.00     580.00
         2    -335.00     590.00                  2    -320.00     580.00
         3    -290.00     595.00                  3    -200.00     620.00
         4    -275.00     600.00                  4    -110.00     625.00
         5    -265.00     615.00                  5      70.00     629.50
         6     210.00     620.00                  6     160.00     625.00
         7     260.00     620.00                  7     265.00     620.00
         8     300.00     615.00                  8     375.00     615.00
         9     365.00     610.00                  9     480.00     610.00
        10     390.00     605.00                 10     565.00     606.00
        11     505.00     600.00
        12     565.00     598.00

AREA IN CUT                1138.6 FT^2
AREA IN FILL               5448.6 FT^2

VOL  CUT THIS REACH         2264.6 YD^3
VOL FILL THIS REACH         9042.3 YD^3

VOL  CUT TOTAL             11580.1 YD^3
VOL FILL TOTAL            144460.2 YD^3
```

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*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR5.LTV
         STATION          2350.0 FT

     EXISTING PROFILE DATA                    PROPOSED PROFILE DATA
     POINT    X-VALUE   Y-VALUE               POINT    X-VALUE   Y-VALUE
     -----    -------   -------               -----    -------   -------
         1    -350.00    585.00                   1    -350.00    580.00
         2    -335.00    590.00                   2    -320.00    580.00
         3    -290.00    595.00                   3    -180.00    625.00
         4    -275.00    600.00                   4       0.00    630.00
         5    -265.00    615.00                   5      30.00    630.00
         6     220.00    620.00                   6     140.00    625.00
         7     295.00    620.00                   7     245.00    620.00
         8     340.00    615.00                   8     352.00    615.00
         9     400.00    610.00                   9     462.00    610.00
        10     470.00    605.00                  10     565.00    605.00
        11     530.00    600.00
        12     565.00    599.00

AREA IN CUT               1309.3 FT^2
AREA IN FILL              4621.8 FT^2

VOL  CUT THIS REACH        2266.6 YD^3
VOL FILL THIS REACH        9324.5 YD^3

VOL  CUT TOTAL            13846.7 YD^3
VOL FILL TOTAL           153784.7 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF66118    VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR5.LTV
         STATION           2400.0 FT

     EXISTING PROFILE DATA                              PROPOSED PROFILE DATA
     POINT     X-VALUE    Y-VALUE                       POINT     X-VALUE    Y-VALUE
     -----     -------    -------                       -----     -------    -------
         1     -350.00     585.00                           1     -350.00     580.00
         2     -335.00     590.00                           2     -324.00     580.00
         3     -300.00     595.00                           3     -189.00     625.00
         4     -280.00     600.00                           4      -80.00     630.00
         5     -270.00     615.00                           5      -32.00     632.00
         6      210.00     620.00                           6       10.00     630.00
         7      385.00     620.00                           7      120.00     625.00
         8      420.00     615.00                           8      225.00     620.00
         9      485.00     610.00                           9      335.00     615.00
        10      520.00     605.00                          10      443.00     610.00
        11      565.00     603.00                          11      551.00     605.00
                                                           12      565.00     603.50

AREA IN CUT               2126.9 FT^2
AREA IN FILL              3921.4 FT^2

VOL  CUT THIS REACH        3181.7 YD^3
VOL FILL THIS REACH        7910.4 YD^3

VOL  CUT TOTAL            17028.4 YD^3
VOL FILL TOTAL           161695.1 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhoten, P.E.

PROJECT: MDFR5.LTV
        STATION           2450.0 FT

     EXISTING PROFILE DATA                      PROPOSED PROFILE DATA
     POINT    X-VALUE    Y-VALUE                POINT    X-VALUE    Y-VALUE
     -----    -------    -------                -----    -------    -------
         1    -350.00     585.00                    1    -350.00     580.00
         2    -335.00     590.00                    2    -325.00     580.00
         3    -315.00     595.00                    3    -190.00     625.00
         4    -285.00     600.00                    4     -90.00     630.00
         5    -275.00     615.00                    5     -50.00     632.00
         6     180.00     620.00                    6     -10.00     630.00
         7     190.00     625.00                    7      97.00     625.00
         8     330.00     625.00                    8     206.00     620.00
         9     410.00     620.00                    9     315.00     615.00
        10     440.00     615.00                   10     424.00     610.00
        11     482.00     610.00                   11     532.00     605.00
        12     520.00     605.00                   12     565.00     602.50
        13     565.00     603.00

AREA IN CUT               3582.1 FT^2
AREA IN FILL              3583.4 FT^2

VOL  CUT THIS REACH        5286.1 YD^3
VOL FILL THIS REACH        6948.8 YD^3

VOL  CUT TOTAL            22314.5 YD^3
VOL FILL TOTAL           168643.9 YD^3
```

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** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

ROJECT: MDFR5.LTV
        STATION           2500.0 FT

     EXISTING PROFILE DATA                      PROPOSED PROFILE DATA
     POINT    X-VALUE    Y-VALUE                POINT    X-VALUE    Y-VALUE
     -----    -------    -------                -----    -------    -------
        1     -360.00     585.00                   1     -350.00     580.00
        2     -340.00     590.00                   2     -328.00     580.00
        3     -320.00     595.00                   3     -193.00     625.00
        4     -300.00     600.00                   4      -90.00     630.00
        5     -290.00     615.00                   5      -60.00     631.50
        6      150.00     620.00                   6      -30.00     630.00
        7      160.00     625.00                   7       75.00     625.00
        8      345.00     625.00                   8      185.00     620.00
        9      415.00     620.00                   9      294.00     615.00
       10      445.00     615.00                  10      402.00     610.00
       11      485.00     610.00                  11      510.00     605.00
       12      520.00     605.00                  12      565.00     602.00
       13      565.00     602.00

REA IN CUT               4380.9 FT^2
AREA IN FILL             3245.9 FT^2

OL   CUT THIS REACH       7373.1 YD^3
OL  FILL THIS REACH       6323.4 YD^3

OL   CUT TOTAL           29687.7 YD^3
OL  FILL TOTAL          174967.3 YD^3
```

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*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR5.LTV
         STATION          2550.0 FT

     EXISTING PROFILE DATA                           PROPOSED PROFILE DATA
     POINT    X-VALUE   Y-VALUE                      POINT    X-VALUE   Y-VALUE
     -----    -------   -------                      -----    -------   -------
         1    -360.00    585.00                          1    -360.00    580.00
         2    -345.00    590.00                          2    -330.00    580.00
         3    -325.00    595.00                          3    -195.00    625.00
         4    -310.00    615.00                          4     -95.00    630.00
         5     130.00    620.00                          5     -75.00    631.00
         6     140.00    625.00                          6     -55.00    630.00
         7     350.00    625.00                          7      55.00    625.00
         8     418.00    620.00                          8     165.00    620.00
         9     455.00    615.00                          9     270.00    615.00
        10     525.00    610.00                         10     380.00    610.00
        11     565.00    610.00                         11     490.00    605.00
                                                        12     565.00    601.00

AREA IN CUT              5857.0 FT^2
AREA IN FILL             2962.0 FT^2

VOL  CUT THIS REACH       9479.5 YD^3
VOL FILL THIS REACH       5748.0 YD^3

VOL  CUT TOTAL           39167.2 YD^3
VOL FILL TOTAL          180715.3 YD^3
```

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*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR5.LTV
         STATION           2600.0 FT

     EXISTING PROFILE DATA                       PROPOSED PROFILE DATA
     POINT    X-VALUE    Y-VALUE                 POINT    X-VALUE    Y-VALUE
     -----    -------    -------                 -----    -------    -------
         1    -360.00     585.00                     1    -360.00     580.00
         2    -350.00     590.00                     2    -330.00     580.00
         3    -325.00     595.00                     3    -195.00     625.00
         4    -310.00     600.00                     4     -95.00     630.00
         5    -305.00     615.00                     5     -75.00     630.00
         6      85.00     620.00                     6      35.00     625.00
         7     120.00     625.00                     7     145.00     620.00
         8     300.00     625.00                     8     251.00     615.00
         9     395.00     620.00                     9     361.00     610.00
        10     470.00     615.00                    10     470.00     605.00
        11     565.00     613.00                    11     565.00     600.50

AREA IN CUT               6289.3 FT^2
AREA IN FILL              2605.6 FT^2

VOL  CUT THIS REACH      11246.6 YD^3
VOL FILL THIS REACH       5155.2 YD^3

VOL  CUT TOTAL           50413.8 YD^3
VOL FILL TOTAL          185870.5 YD^3
```

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*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
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PROJECT: MDFR5.LTV
        STATION          2650.0 FT

     EXISTING PROFILE DATA                       PROPOSED PROFILE DATA
     POINT   X-VALUE    Y-VALUE                  POINT   X-VALUE    Y-VALUE
     -----   -------    -------                  -----   -------    -------
         1   -350.00     585.00                      1   -350.00     580.00
         2   -338.00     590.00                      2   -326.00     580.00
         3   -318.00     595.00                      3   -190.00     625.00
         4   -295.00     600.00                      4    -88.00     629.00
         5   -290.00     615.00                      5     15.00     625.00
         6   -170.00     620.00                      6    125.00     620.00
         7   -125.00     625.00                      7    230.00     615.00
         8    -70.00     620.00                      8    340.00     610.00
         9      0.00     620.00                      9    450.00     605.00
        10     65.00     625.00                     10    555.00     600.00
        11    220.00     625.00                     11    565.00     599.50
        12    300.00     620.00
        13    510.00     615.00
        14    565.00     614.00

AREA IN CUT               6176.4 FT^2
AREA IN FILL              1304.0 FT^2

VOL  CUT THIS REACH      11542.4 YD^3
VOL FILL THIS REACH       3620.0 YD^3

VOL  CUT TOTAL           61956.2 YD^3
VOL FILL TOTAL          189490.5 YD^3
```

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*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR5.LTV
         STATION           2700.0 FT

     EXISTING PROFILE DATA                        PROPOSED PROFILE DATA
     POINT    X-VALUE    Y-VALUE                  POINT    X-VALUE    Y-VALUE
     -----    -------    -------                  -----    -------    -------
         1    -340.00     585.00                      1    -340.00     580.00
         2    -325.00     590.00                      2    -315.00     580.00
         3    -305.00     595.00                      3    -160.00     625.00
         4    -280.00     600.00                      4     -77.00     626.00
         5    -270.00     615.00                      5      -5.00     625.00
         6    -190.00     620.00                      6     102.00     620.00
         7    -160.00     625.00                      7     210.00     615.00
         8    -145.00     630.00                      8     320.00     610.00
         9     155.00     630.00                      9     430.00     605.00
        10     250.00     625.00                     10     540.00     600.00
        11     295.00     620.00                     11     565.00     599.00
        12     565.00     615.00

AREA IN CUT               8757.5 FT^2
AREA IN FILL                 0.0 FT^2

/OL  CUT THIS REACH       13827.7 YD^3
/OL FILL THIS REACH        1207.4 YD^3

/OL  CUT TOTAL            75783.9 YD^3
/OL FILL TOTAL           190697.9 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR5.LTV
         STATION           2750.0 FT

     EXISTING PROFILE DATA                          PROPOSED PROFILE DATA
     POINT    X-VALUE    Y-VALUE                    POINT    X-VALUE    Y-VALUE
     -----    -------    -------                    -----    -------    -------

         1    -330.00     585.00                        1    -330.00     580.00
         2    -305.00     590.00                        2    -295.00     580.00
         3    -285.00     595.00                        3    -110.00     625.00
         4    -255.00     600.00                        4     -25.00     625.00
         5    -245.00     610.00                        5      80.00     620.00
         6    -240.00     615.00                        6     190.00     615.00
         7    -210.00     620.00                        7     300.00     610.00
         8    -155.00     625.00                        8     410.00     605.00
         9    -145.00     630.00                        9     520.00     600.00
        10     125.00     630.00                       10     565.00     597.00
        11     265.00     625.00
        12     315.00     620.00
        13     390.00     620.00
        14     555.00     615.00
        15     565.00     614.00

AREA IN CUT             10637.5 FT^2
AREA IN FILL                0.0 FT^2

VOL  CUT THIS REACH      17958.3 YD^3
VOL FILL THIS REACH          0.0 YD^3

VOL  CUT TOTAL           93742.2 YD^3
VOL FILL TOTAL          190697.9 YD^3
```

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*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

 OJECT: MDFR5.LTV
        STATION          2800.0 FT

     EXISTING PROFILE DATA                     PROPOSED PROFILE DATA
     POINT   X-VALUE   Y-VALUE                 POINT    X-VALUE    Y-VALUE
     -----   -------   -------                 -----    -------    -------
         1   -315.00    585.00                     1    -315.00     580.00
         2   -270.00    590.00                     2    -250.00     580.00
         3   -255.00    595.00                     3     -85.00     620.00
         4   -220.00    600.00                     4     -50.00     625.00
         5   -210.00    610.00                     5      60.00     620.00
         6   -195.00    615.00                     6     170.00     615.00
         7   -155.00    620.00                     7     277.00     610.00
         8   -135.00    625.00                     8     390.00     605.00
         9   -116.00    630.00                     9     500.00     600.00
        10    105.00    630.00                    10     565.00     596.50
        11    610.00    625.00
        12    395.00    620.00
        13    457.00    615.00
        14    493.00    610.00
        15    518.00    605.00
        16    565.00    602.00

 EA IN CUT               8903.8 FT^2
 EA IN FILL                 0.0 FT^2

 L  CUT THIS REACH      18093.8 YD^3
 L FILL THIS REACH          0.0 YD^3

OL  CUT TOTAL          111836.0 YD^3
 L FILL TOTAL          190697.9 YD^3
```

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*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR5.LTV
         STATION          2850.0 FT

     EXISTING PROFILE DATA                         PROPOSED PROFILE DATA
     POINT    X-VALUE    Y-VALUE                   POINT    X-VALUE    Y-VALUE
     -----    -------    -------                   -----    -------    -------
         1    -255.00     585.00                       1    -255.00     580.00
         2    -210.00     590.00                       2    -200.00     580.00
         3    -200.00     595.00                       3     -35.00     620.00
         4    -190.00     600.00                       4      40.00     620.00
         5    -184.00     605.00                       5     150.00     615.00
         6    -176.00     610.00                       6     260.00     610.00
         7    -130.00     615.00                       7     370.00     605.00
         8     -95.00     620.00                       8     480.00     600.00
         9     -65.00     625.00                       9     565.00     596.00
        10     -50.00     630.00
        11      85.00     630.00
        12     320.00     625.00
        13     365.00     620.00
        14     445.00     615.00
        15     485.00     610.00
        16     507.00     605.00
        17     565.00     602.00

AREA IN CUT              10850.5 FT^2
AREA IN FILL                 0.0 FT^2

VOL  CUT THIS REACH       18291.0 YD^3
VOL FILL THIS REACH           0.0 YD^3

VOL  CUT TOTAL           130127.0 YD^3
VOL FILL TOTAL           190697.9 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR5.LTV
         STATION          2900.0 FT

     EXISTING PROFILE DATA                              PROPOSED PROFILE DATA
     POINT     X-VALUE    Y-VALUE                       POINT     X-VALUE    Y-VALUE
     -----     -------    -------                       -----     -------    -------
         1     -185.00     585.00                           1     -185.00     580.00
         2     -175.00     590.00                           2     -135.00     580.00
         3     -159.00     595.00                           3      -10.00     615.00
         4     -122.00     600.00                           4       15.00     620.00
         5      -78.00     605.00                           5      130.00     615.00
         6      -57.00     610.00                           6      240.00     610.00
         7      -30.00     615.00                           7      350.00     605.00
         8        0.00     620.00                           8      460.00     600.00
         9       40.00     625.00                           9      565.00     594.50
        10       55.00     630.00
        11      170.00     630.00
        12      260.00     625.00
        13      312.00     620.00
        14      415.00     615.00
        15      480.00     610.00
        16      504.00     605.00
        17      561.00     600.00
        18      565.00     595.00

AREA IN CUT                8803.8 FT^2
AREA IN FILL                  0.0 FT^2

VOL  CUT THIS REACH       18198.4 YD^3
VOL FILL THIS REACH           0.0 YD^3

VOL  CUT TOTAL           148325.3 YD^3
VOL FILL TOTAL           190697.9 YD^3
```

```
*** CUT & FILL BY AVERAGE END AREA METHOD ***    CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR5.LTV
         STATION         3150.0 FT

     EXISTING PROFILE DATA                   PROPOSED PROFILE DATA
     POINT   X-VALUE   Y-VALUE               POINT   X-VALUE   Y-VALUE
     -----   -------   -------               -----   -------   -------
         1      0.00    585.00                   1      0.00    580.00
         2    230.00    585.00                   2    230.00    580.00

AREA IN CUT             1150.0 FT^2
AREA IN FILL               0.0 FT^2

VOL  CUT THIS REACH      3514.1 YD^3
VOL FILL THIS REACH         0.0 YD^3

VOL  CUT TOTAL         171604.7 YD^3
VOL FILL TOTAL         202837.2 YD^3
```

```
* * CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR5.LTV
        STATION          3200.0 FT

    EXISTING PROFILE DATA                       PROPOSED PROFILE DATA
    POINT   X-VALUE   Y-VALUE                   POINT    X-VALUE   Y-VALUE
    -----   -------   -------                   -----    -------   -------
        1    214.00    585.00                       1     214.00    580.00
        2    215.00    585.00                       2     215.00    580.00

AREA IN CUT                5.0 FT^2
AREA IN FILL               0.0 FT^2

VOL  CUT THIS REACH     1069.4 YD^3
VOL FILL THIS REACH        0.0 YD^3

VOL  CUT TOTAL        172674.2 YD^3
VOL FILL TOTAL        202837.2 YD^3
```

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*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF8o118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

PROJECT: MDFR5.LTV


                         S U M M A R Y   T A B L E
                         = = = = = = =   = = = = =


UNITS:    SECTION DATA  -- SQFT           STATION  -- FT
            REACH DATA  -- CUYD
            TOTAL DATA  -- CUYD
              NET DATA  -- CUYD

         ------------------------------------------------------------------------
         |      SECTION      |        REACH        |        TOTAL       |       |
 -----------------------------------------------------------------------   NET  |
 STATION|   CUT  |   FILL   |   CUT  |   FILL   |   CUT   |   FILL   |  MASS   |
 ---------------------------------------------------------------------------------
|   1700|      19|     5465|       0|        0|        0|        0|        0|
|   1750|       0|     8304|      17|    12749|       17|    12749|    12732|
|   1800|       0|     7884|       0|    14988|       17|    27738|    27720|
|   1850|       0|     7071|       0|    13847|       17|    41584|    41567|
|   1900|       0|     6676|       0|    12728|       17|    54312|    54294|
 ---------------------------------------------------------------------------------
    1950|       0|     6141|       0|    11868|       17|    66179|    66162|
    2000|       0|    18628|       0|    22935|       18|    89114|    89096|
    2050|      38|     4002|      36|    20954|       54|   110068|   110014|
    2100|     279|     3771|     294|     7198|      348|   117266|   116918|
    2150|    1732|     3123|    1862|     6383|     2210|   123649|   121439|
 ---------------------------------------------------------------------------------
    2200|    2318|     2635|    3749|     5332|     5959|   128980|   123021|
    2250|    1307|     4317|    3356|     6438|     9316|   135418|   126102|
    2300|    1139|     5449|    2265|     9042|    11580|   144460|   132880|
    2350|    1309|     4622|    2267|     9324|    13847|   153785|   139938|
    2400|    2127|     3921|    3182|     7910|    17028|   161695|   144667|
 ---------------------------------------------------------------------------------
    2450|    3582|     3583|    5286|     6949|    22315|   168644|   146329|
    2500|    4381|     3246|    7373|     6323|    29688|   174967|   145280|
    2550|    5857|     2962|    9480|     5748|    39167|   180715|   141548|
    2600|    6289|     2606|   11247|     5155|    50414|   185871|   135457|
    2650|    6176|     1304|   11542|     3620|    61956|   189490|   127534|
 ---------------------------------------------------------------------------------
    2700|    8758|        0|   13828|     1207|    75784|   190698|   114914|
    2750|   10636|        0|   17958|        0|    93742|   190698|    96956|
    2800|    8904|        0|   18094|        0|   111836|   190698|    78862|
    2850|   10851|        0|   18291|        0|   130127|   190698|    60571|
    2900|    8804|        0|   18198|        0|   148325|   190698|    42373|
 ---------------------------------------------------------------------------------
    2950|    1403|     1855|    9451|     1718|   157776|   192416|    34639|
    3000|    1234|     4117|    2424|     5530|   160200|   197946|    37745|
    3050|    2331|      581|    3283|     4352|   163483|   202297|    38814|
    3100|    2647|        0|    4606|      540|   168090|   202837|    34747|
    3150|    1150|        0|    3514|        0|   171604|   202837|    31233|
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*** CUT & FILL BY AVERAGE END AREA METHOD ***     CF86118   VER 1.2
(C) Copyright 1983, Peter J. Singhofen, P.E.

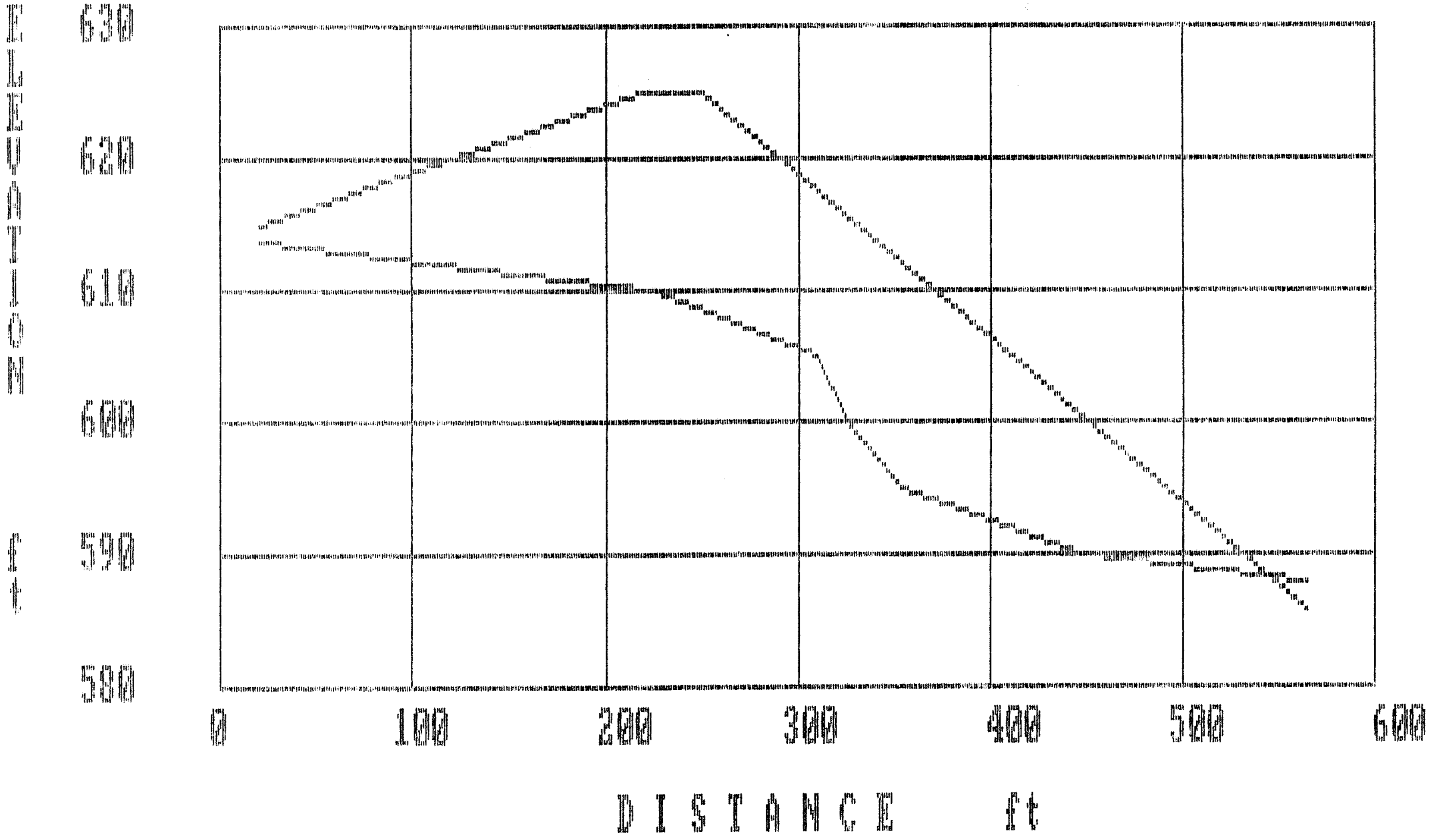
PROJECT: MDFR5.LTV


                              S U M M A R Y   T A B L E
                              = = = = = = =   = = = = =


UNITS:    SECTION DATA  --- SQFT          STATION  --- FT
            REACH DATA  --- CUYD
            TOTAL DATA  --- CUYD
              NET DATA  --- CUYD

         ------------------------------------------------------------------
         |     SECTION      |       REACH       |       TOTAL       |        |
--------------------------------------------------------------------  NET   |
| STATION|   CUT   |  FILL  |   CUT   |  FILL   |   CUT   |  FILL   |  MASS  |
----------------------------------------------------------------------------
|    3200|        5|       0|     1069|        0|   172674|   202837|   30163|
----------------------------------------------------------------------------
```

STATION: 1700



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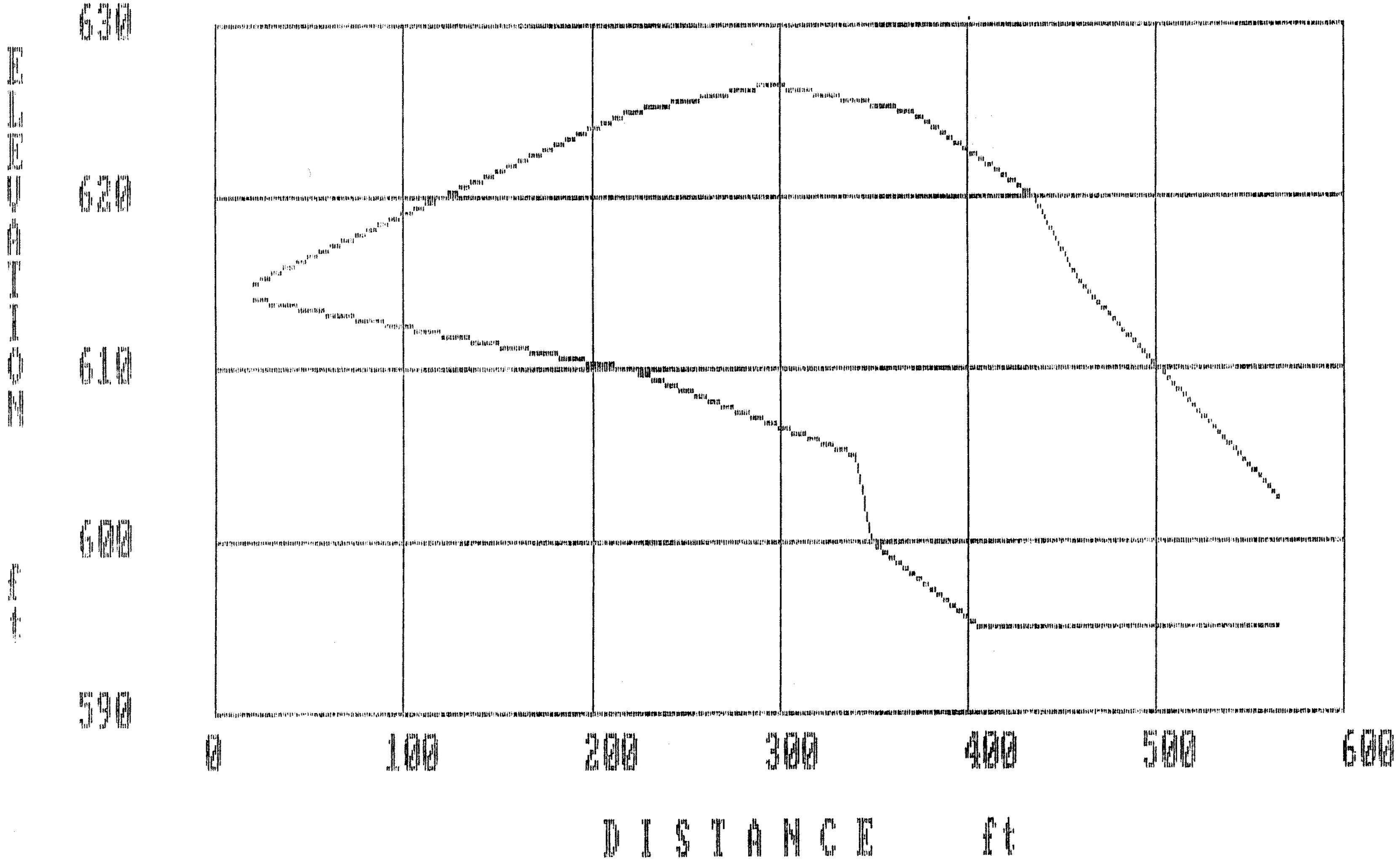

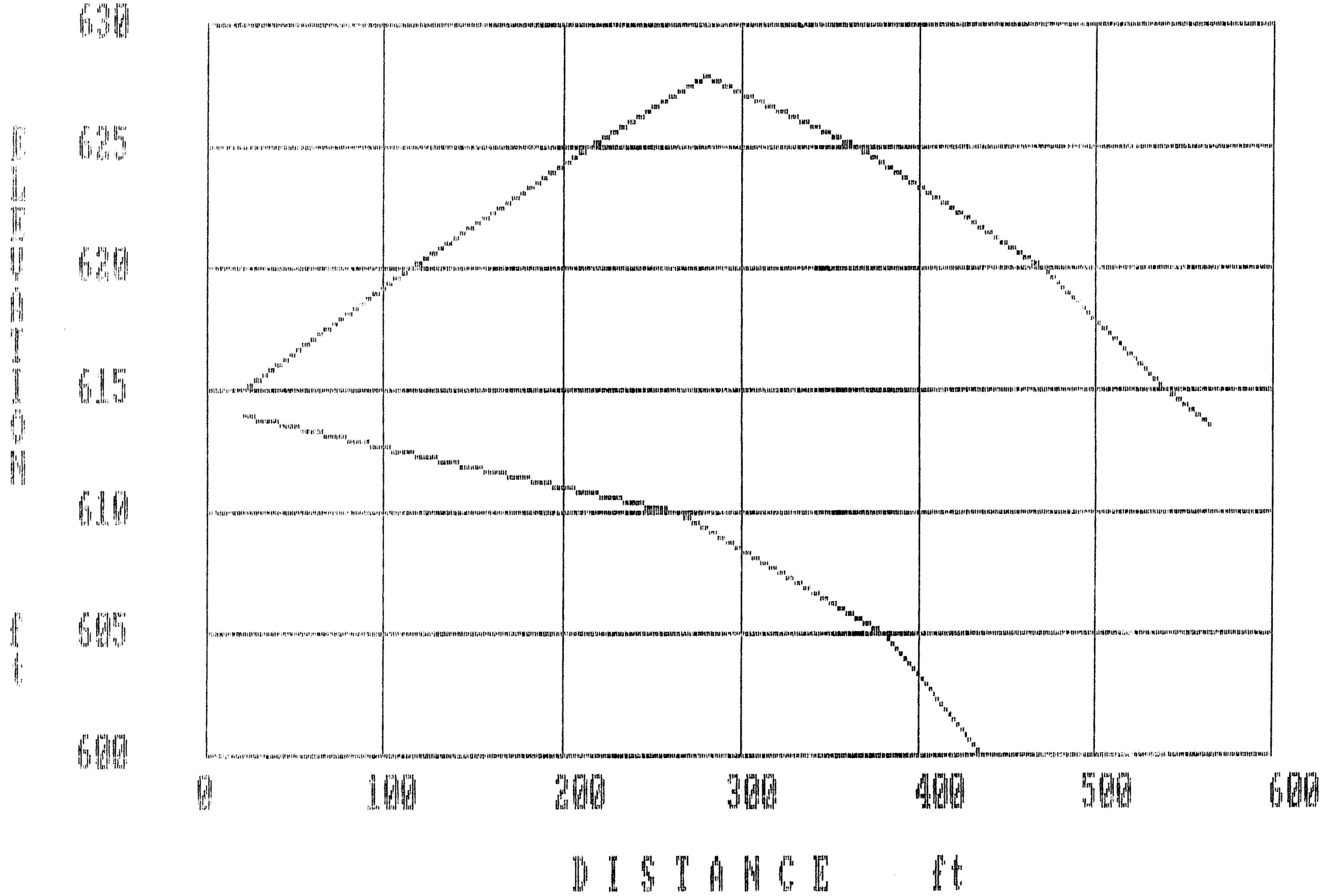

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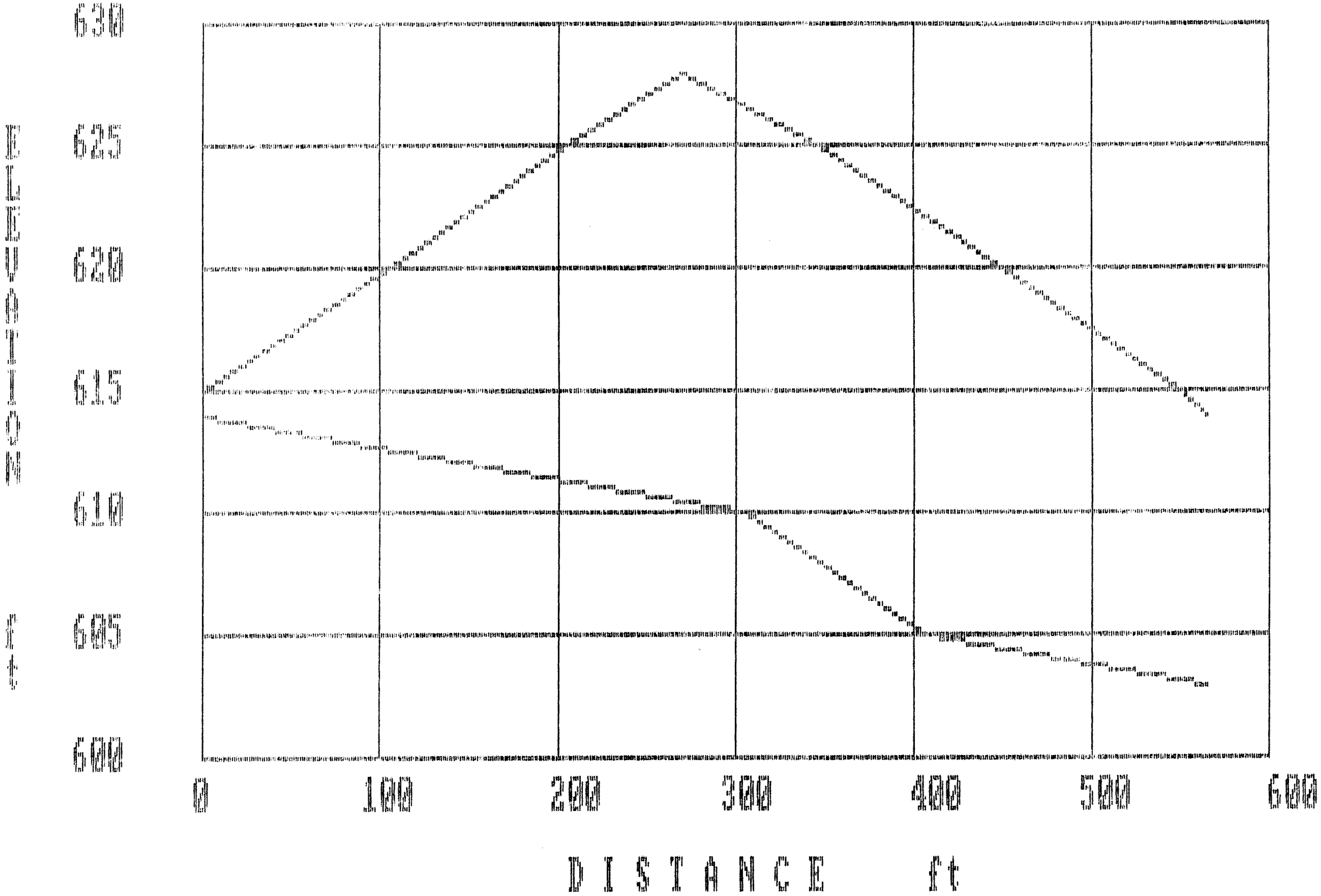
STATION: 1850



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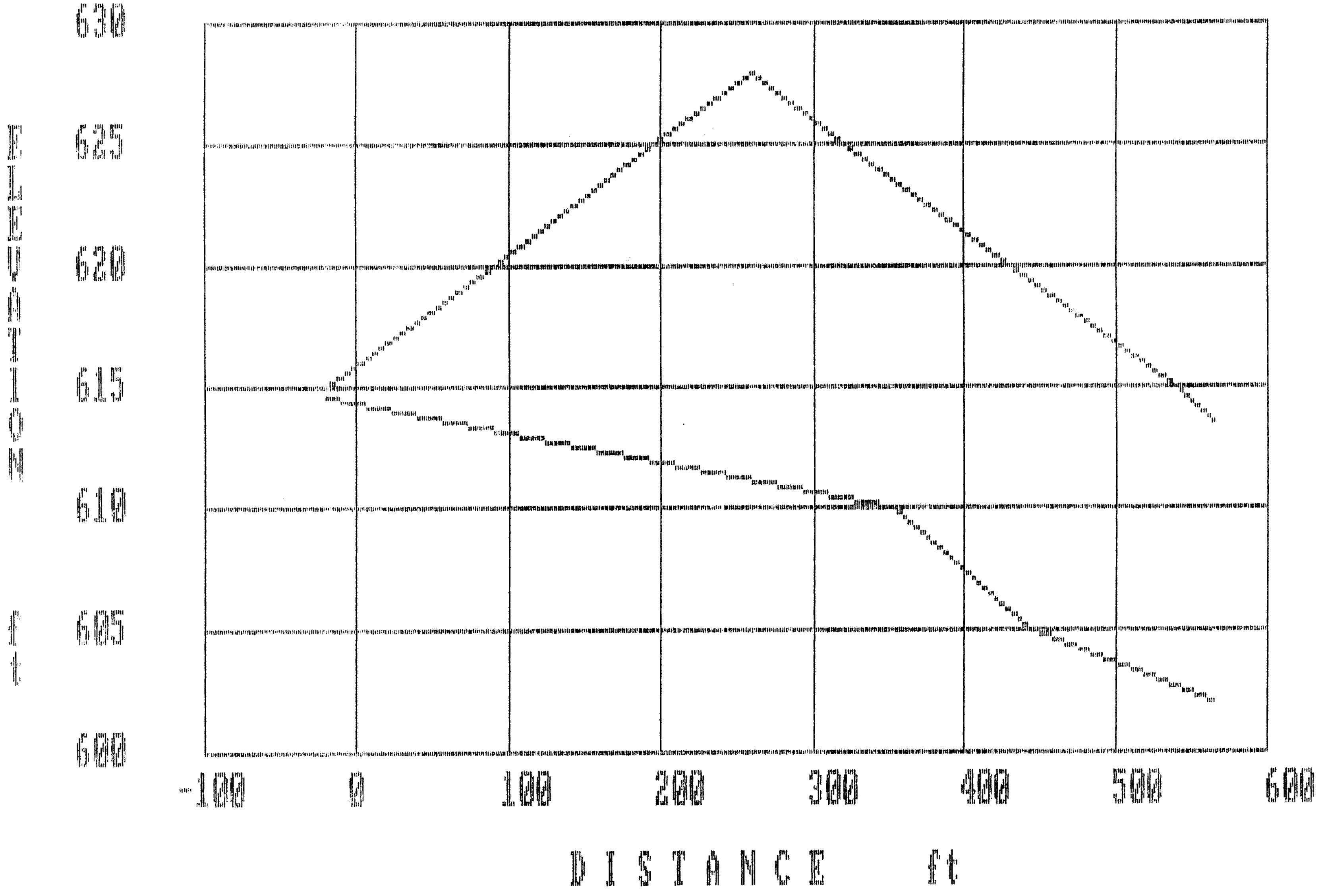

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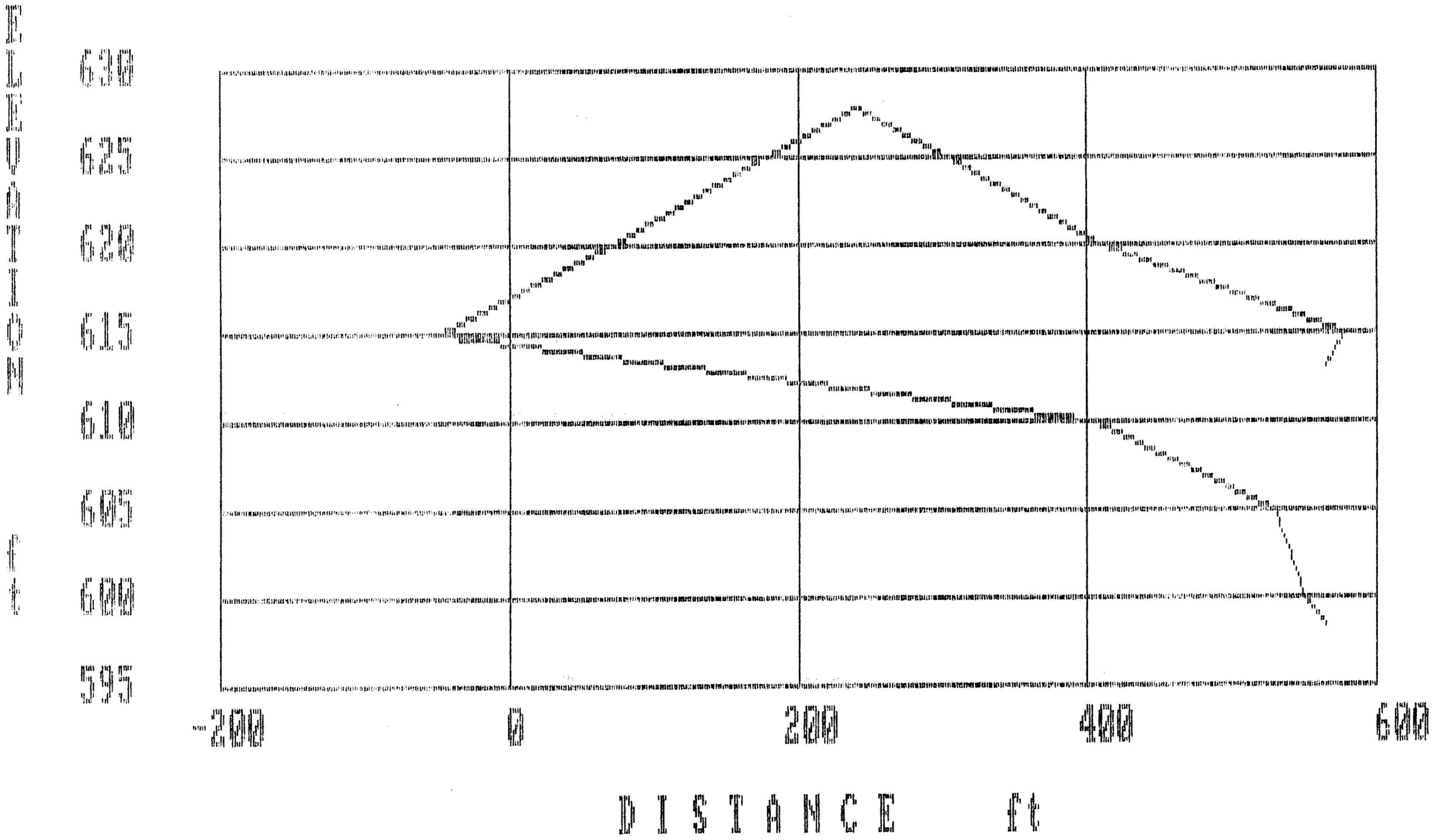

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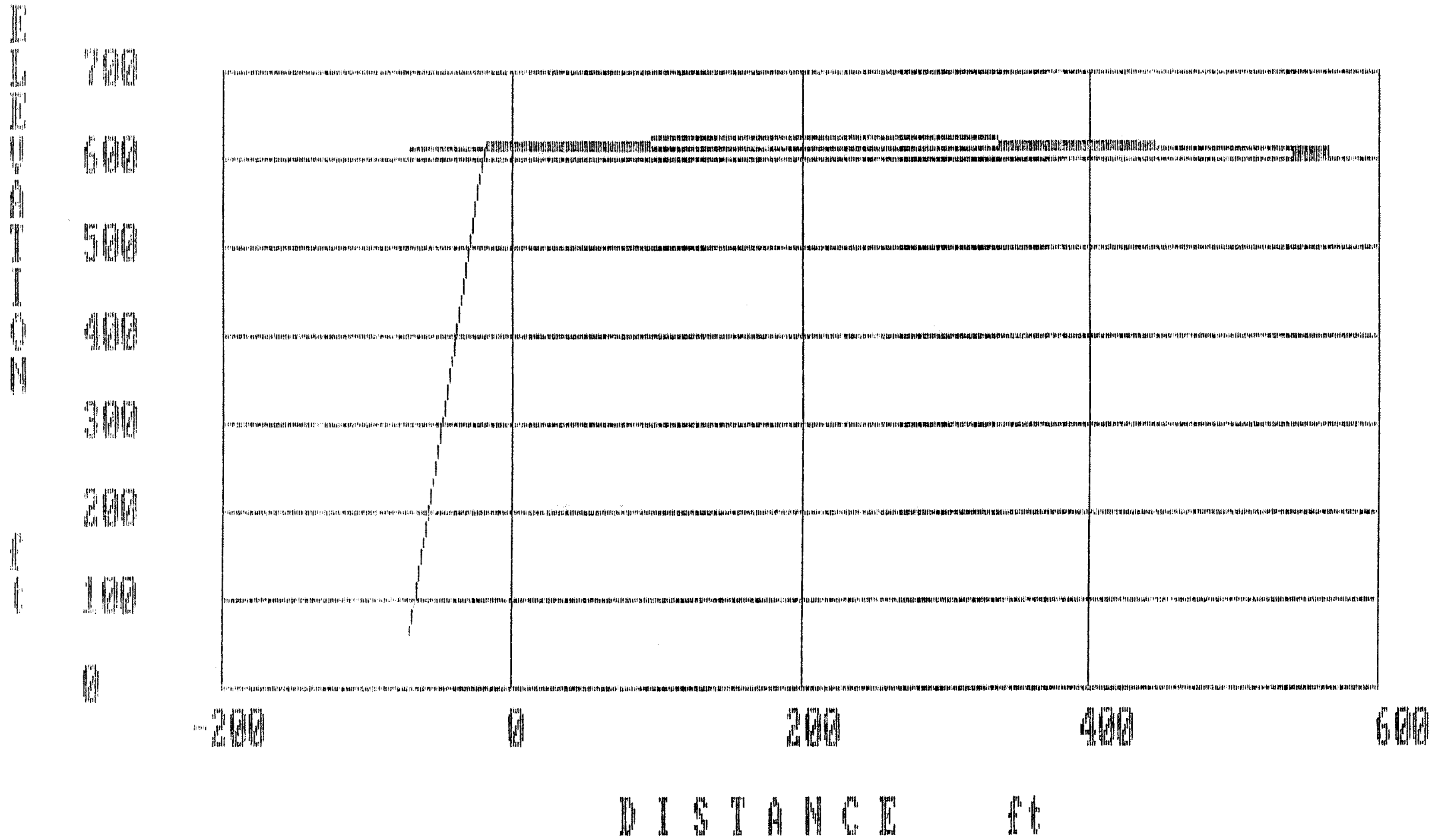

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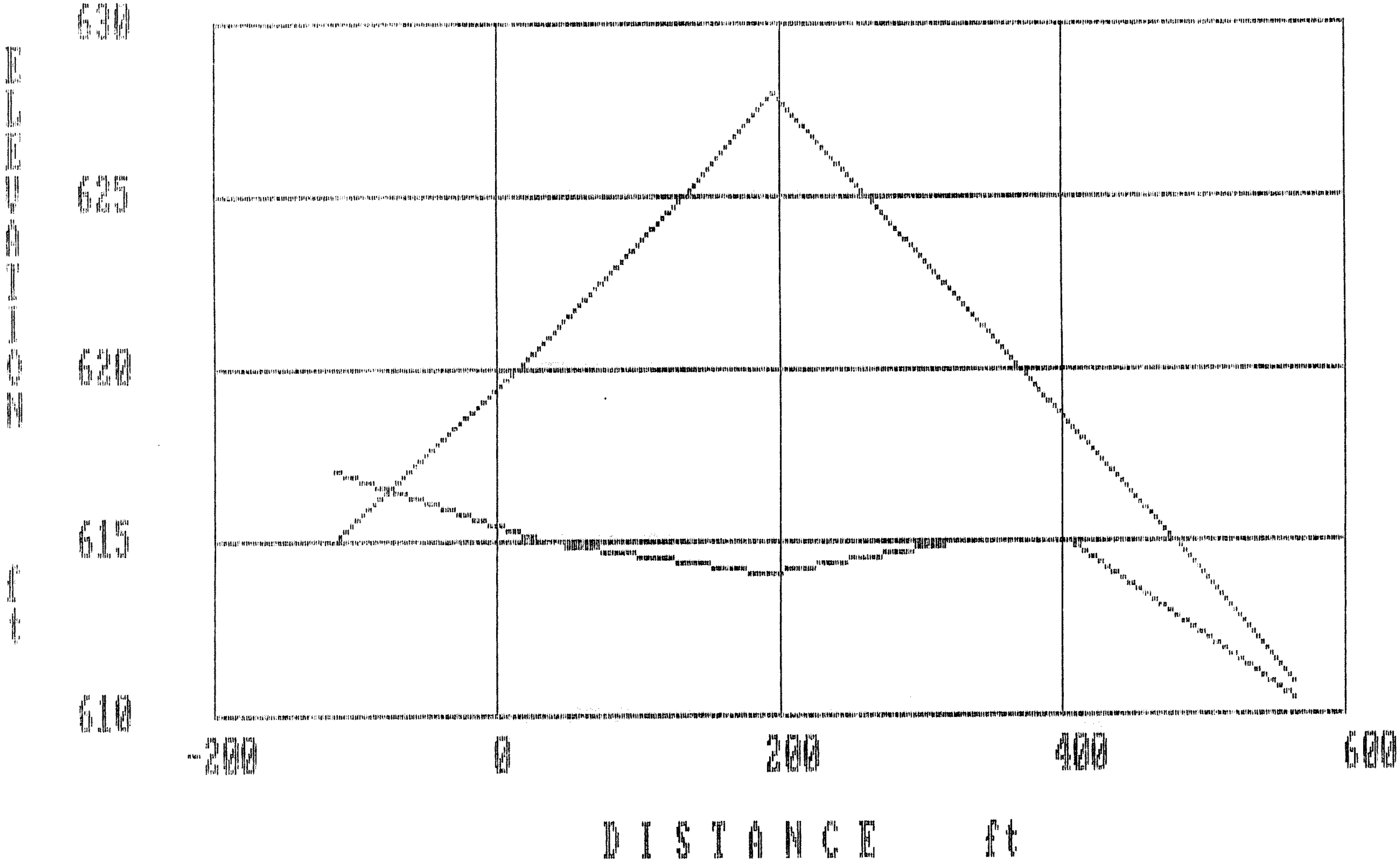

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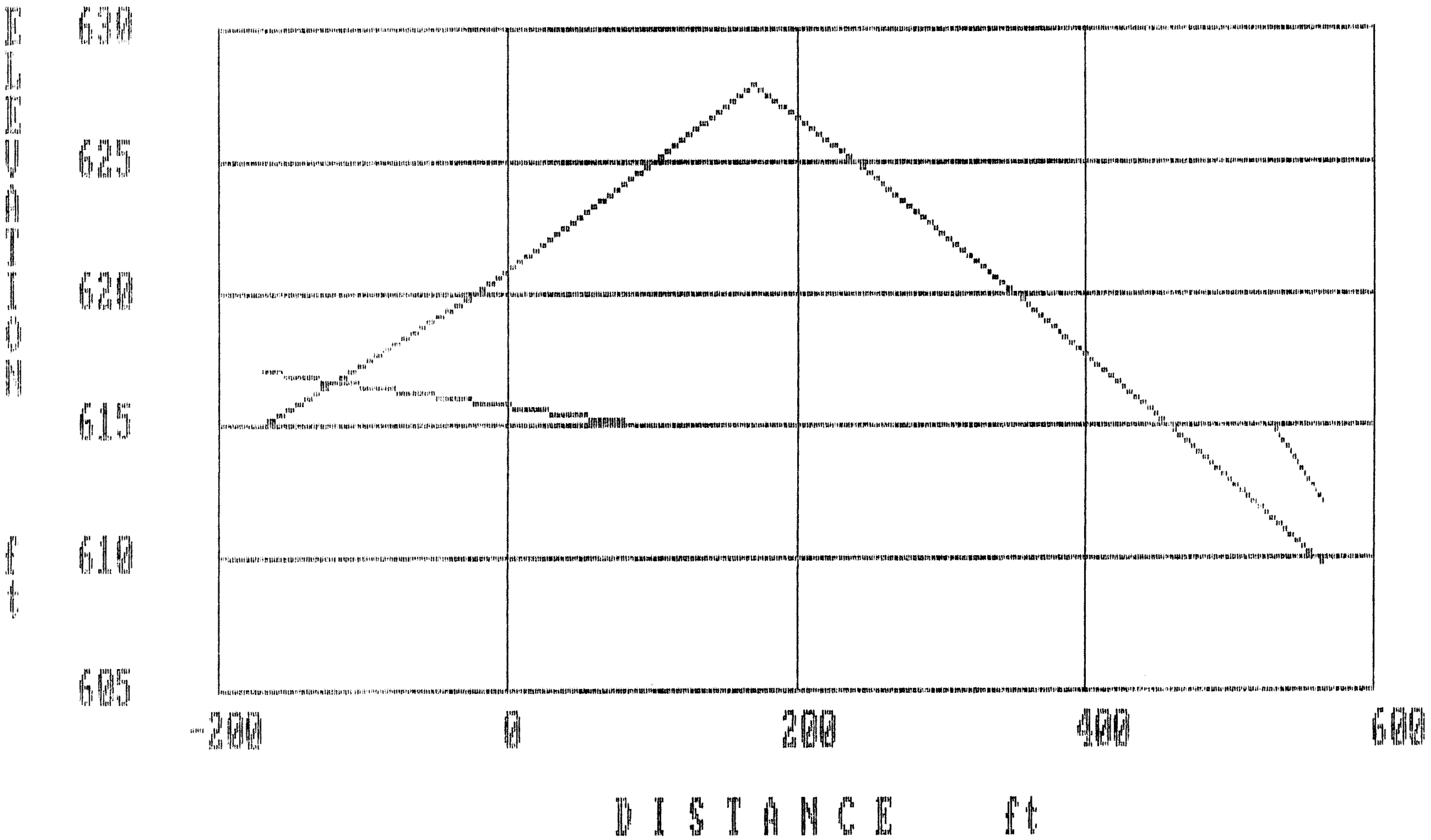

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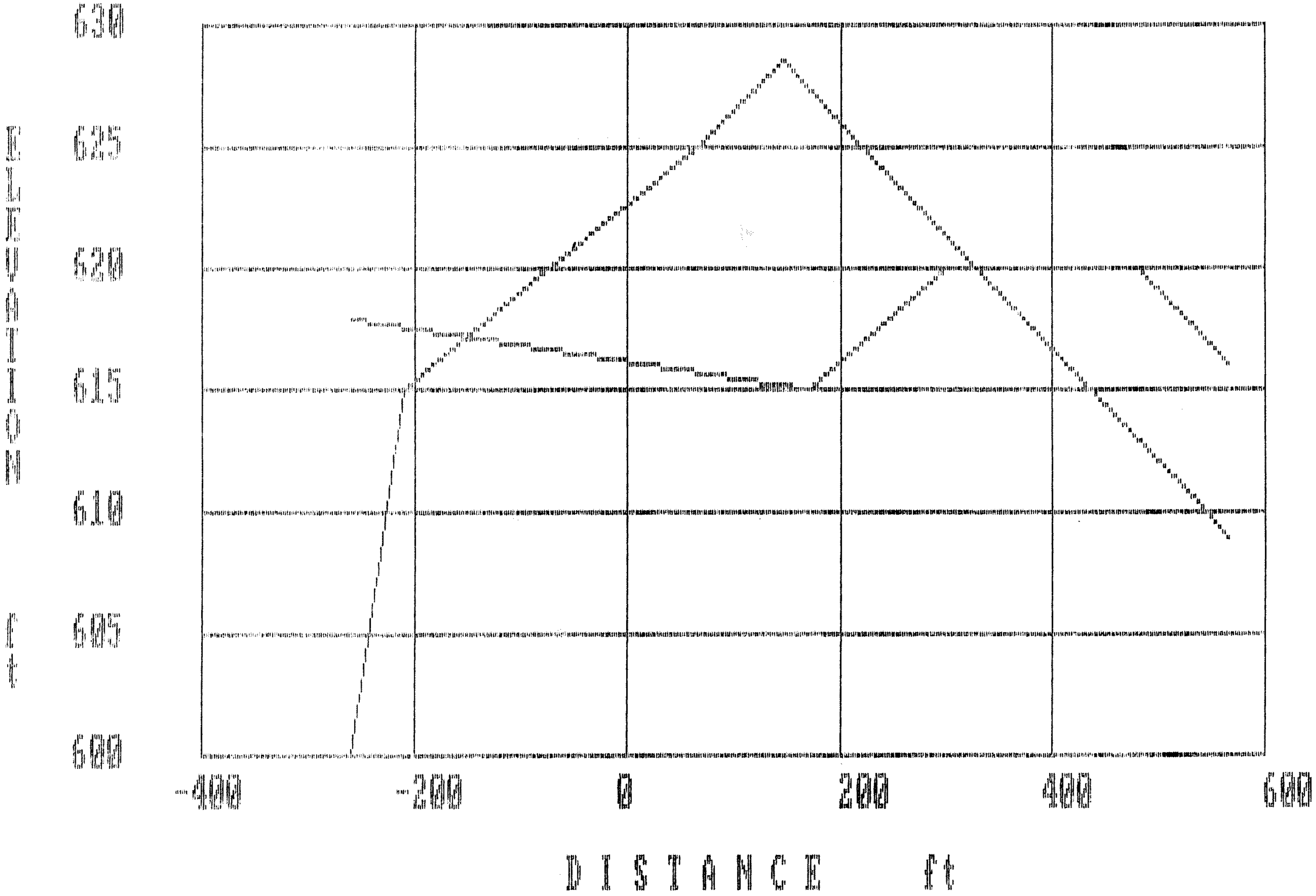

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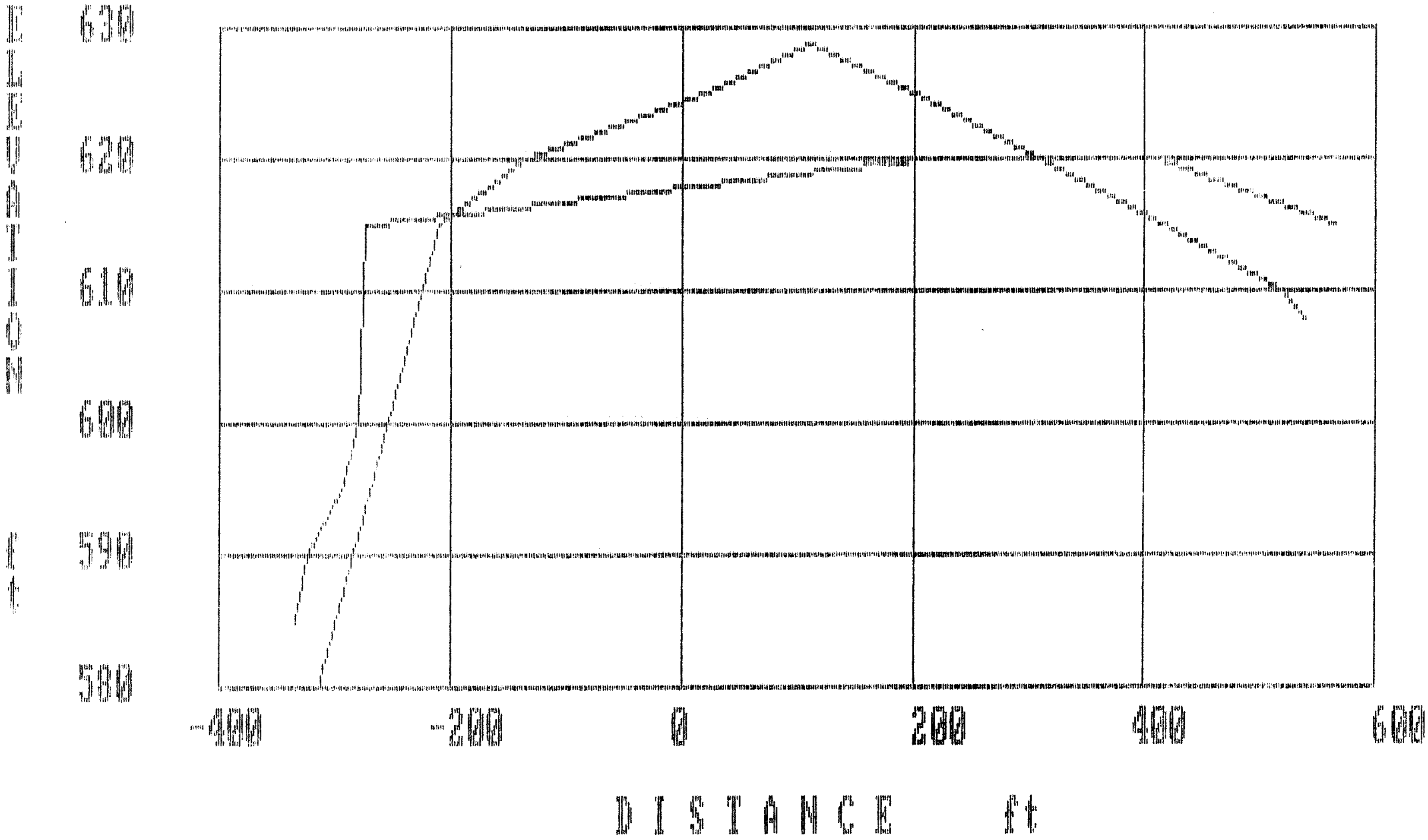

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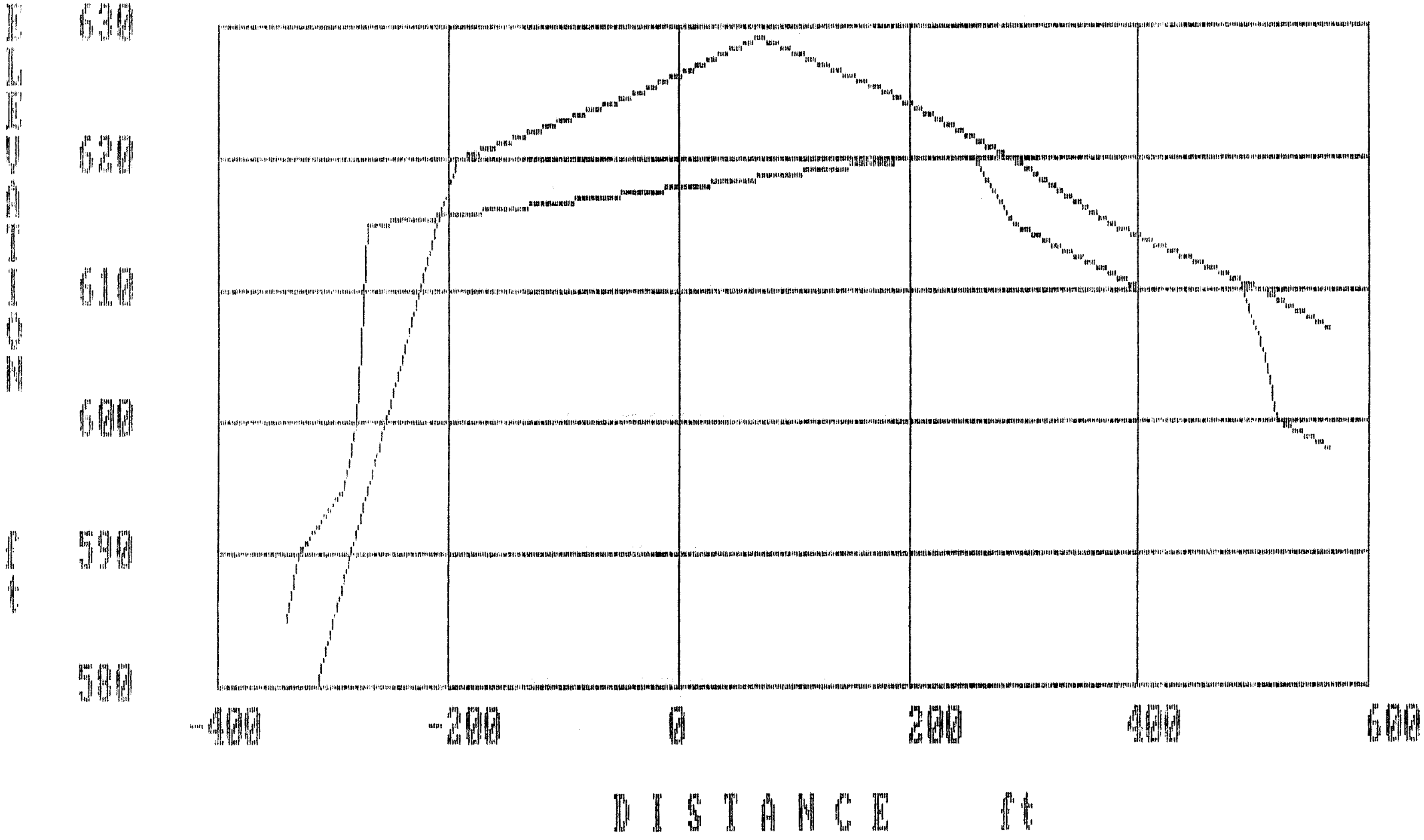

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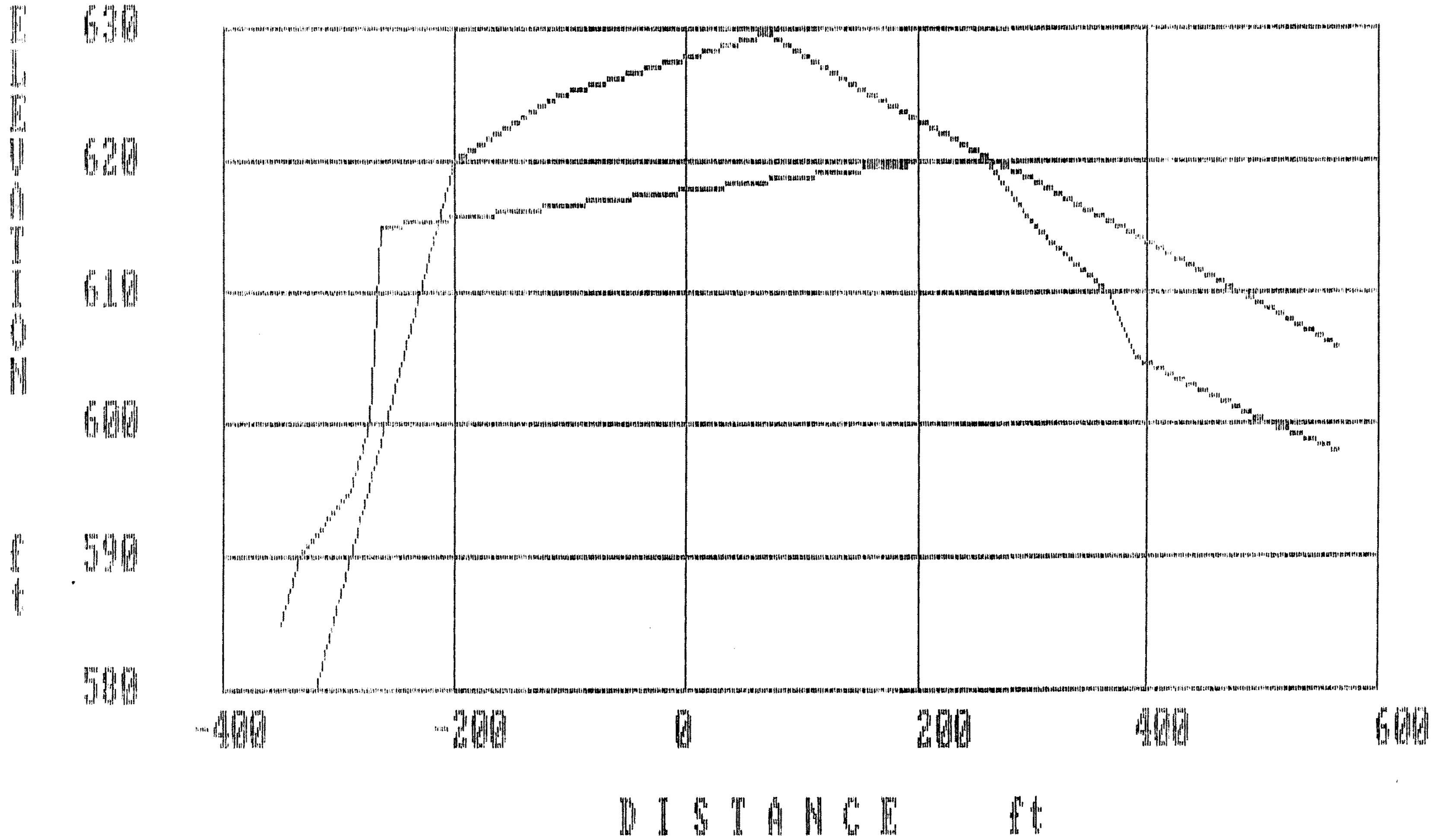

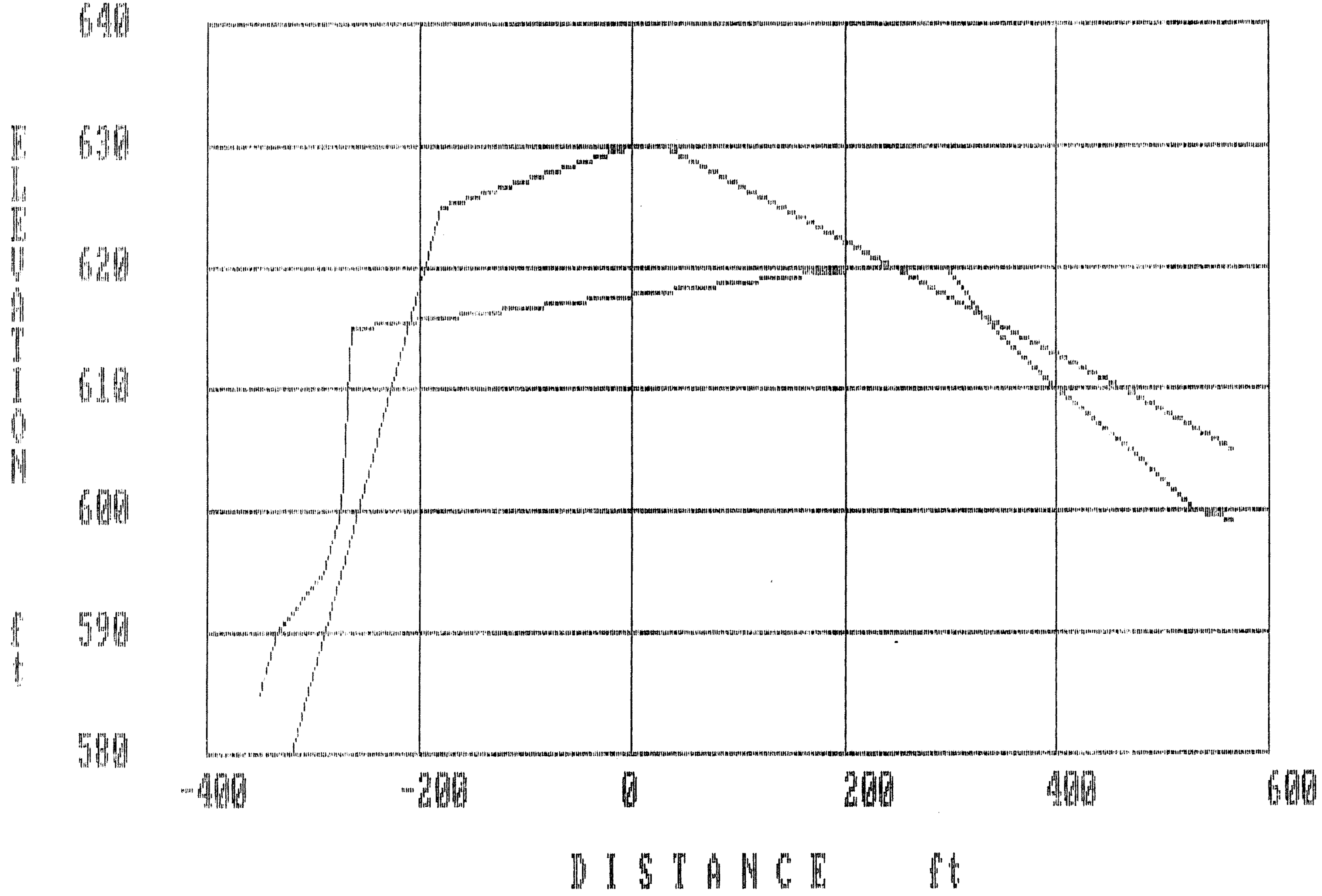

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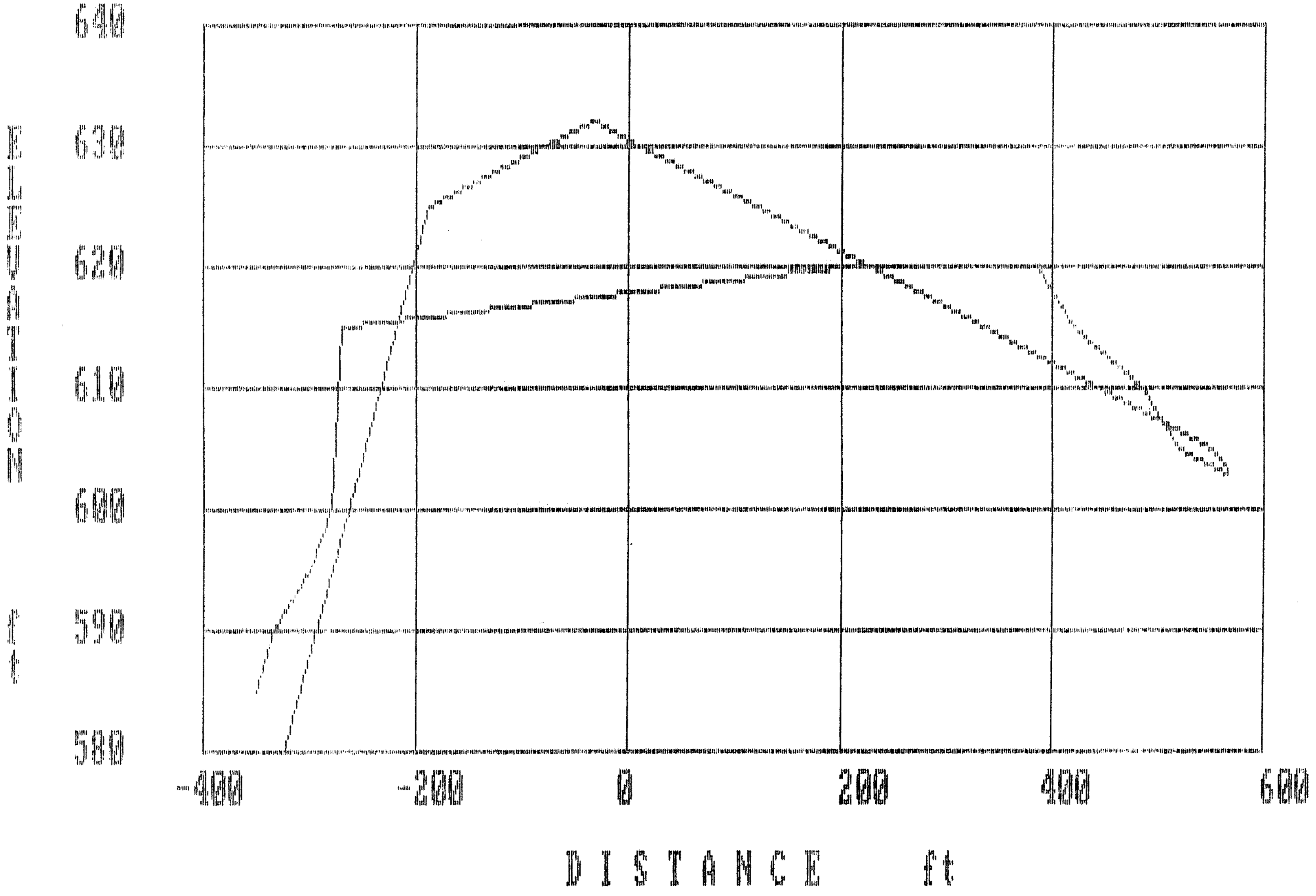
STATION: 2400



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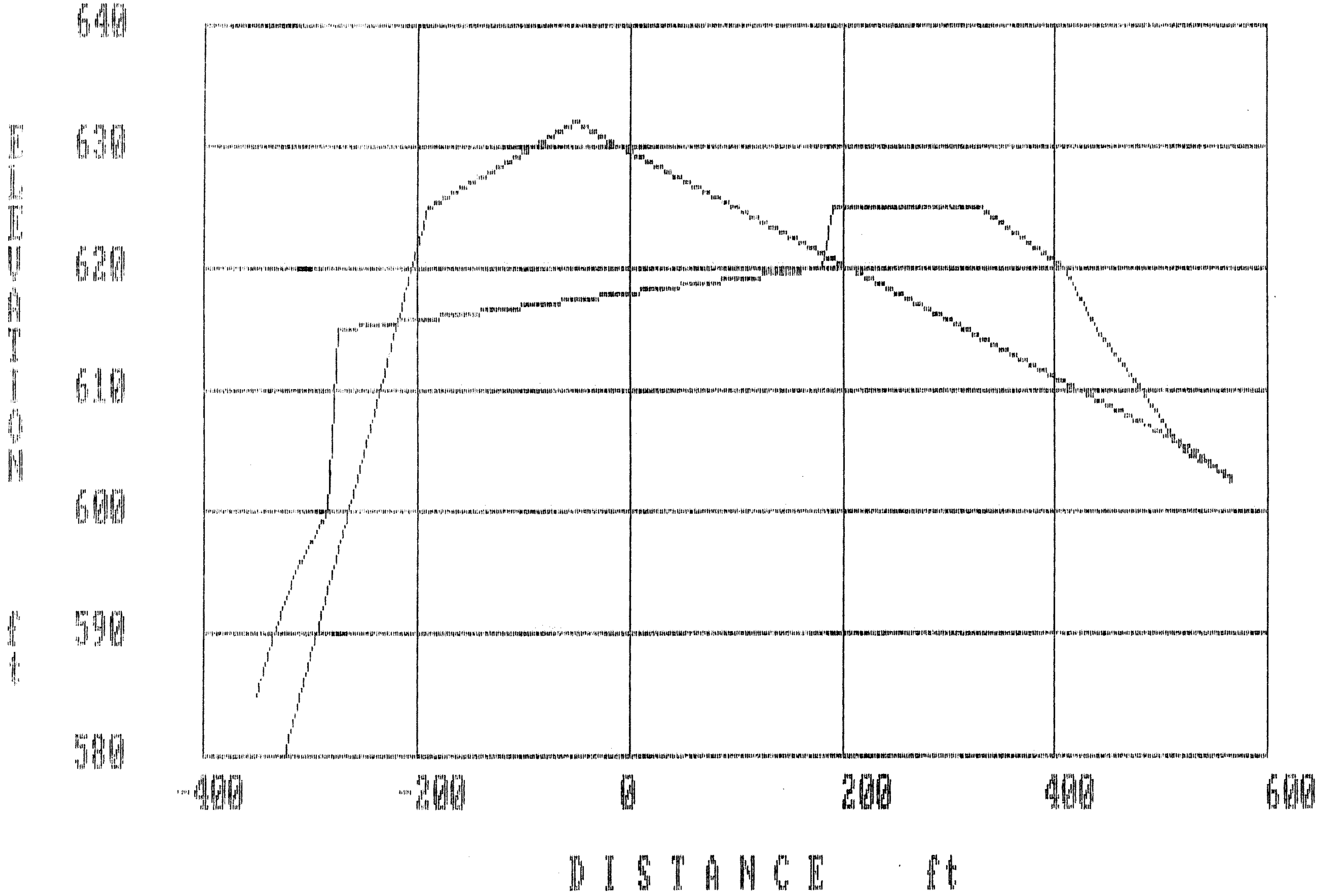

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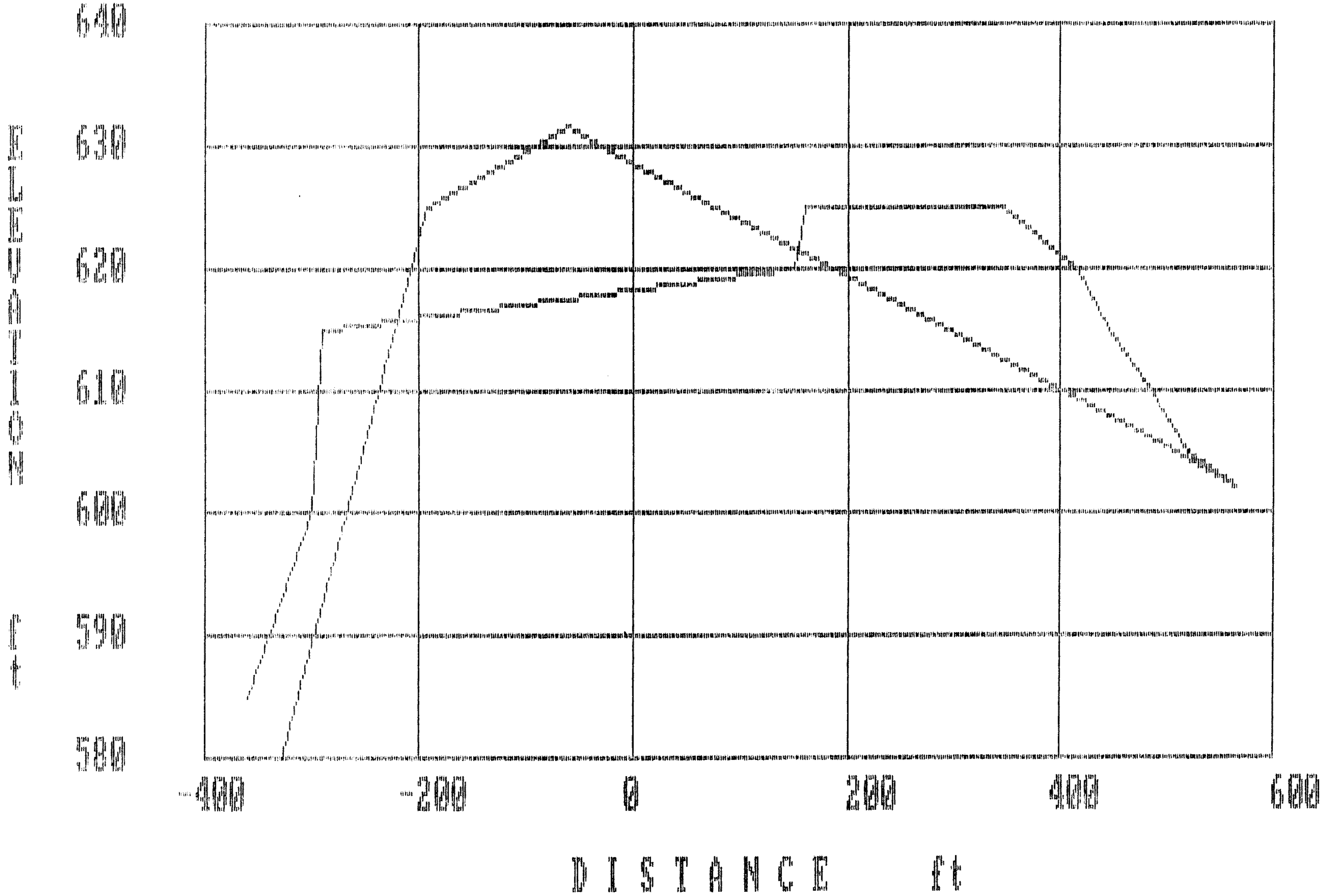

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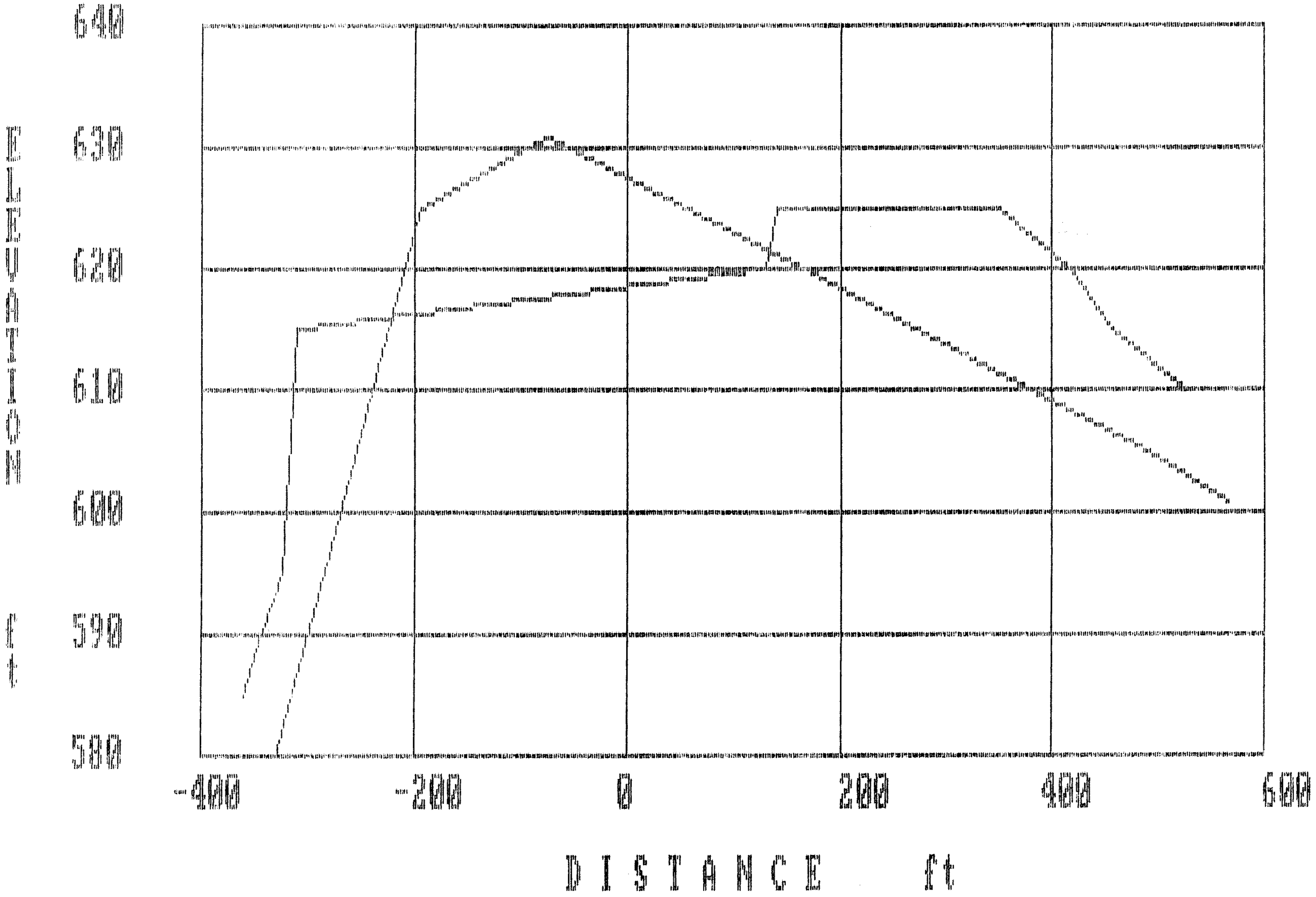

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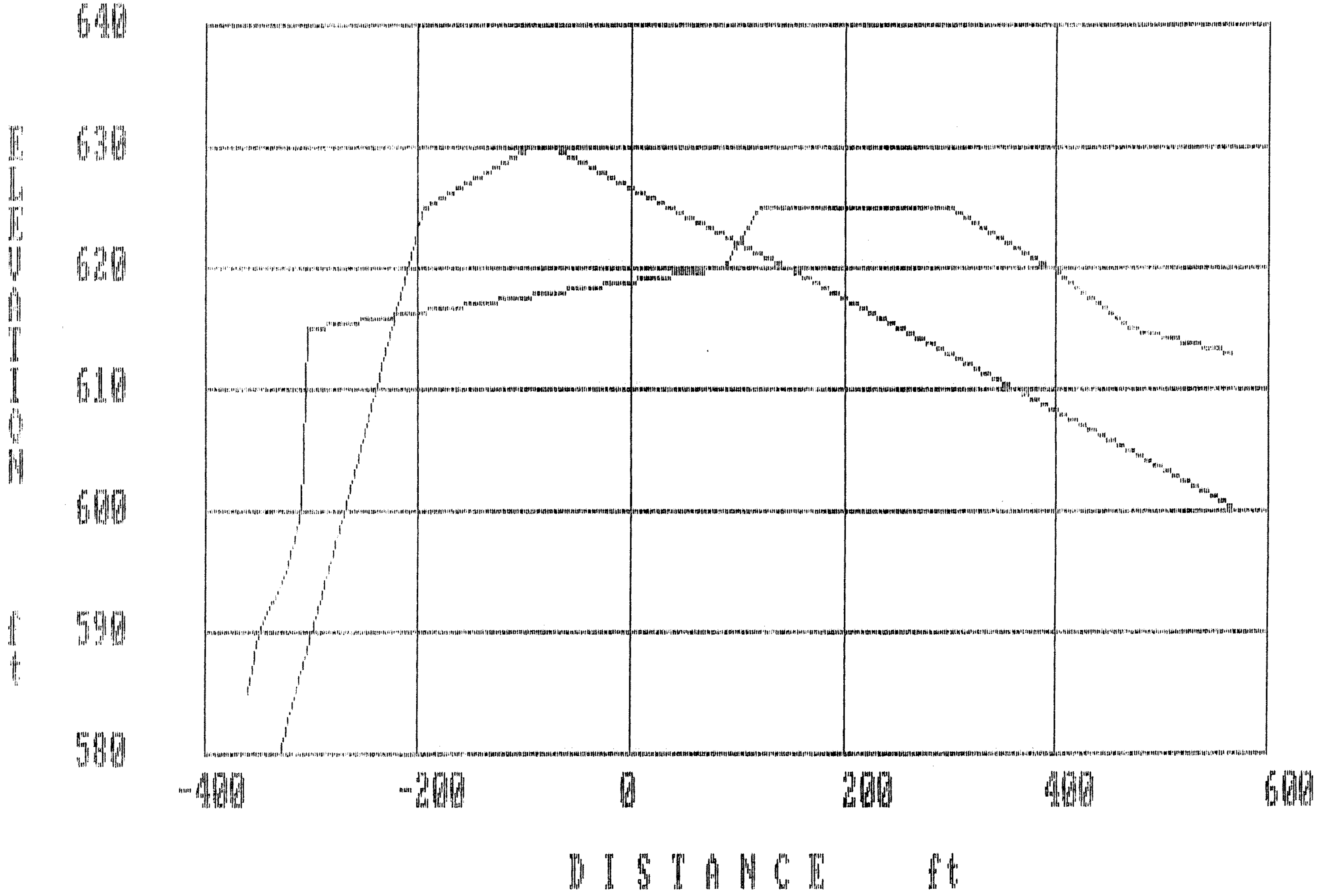

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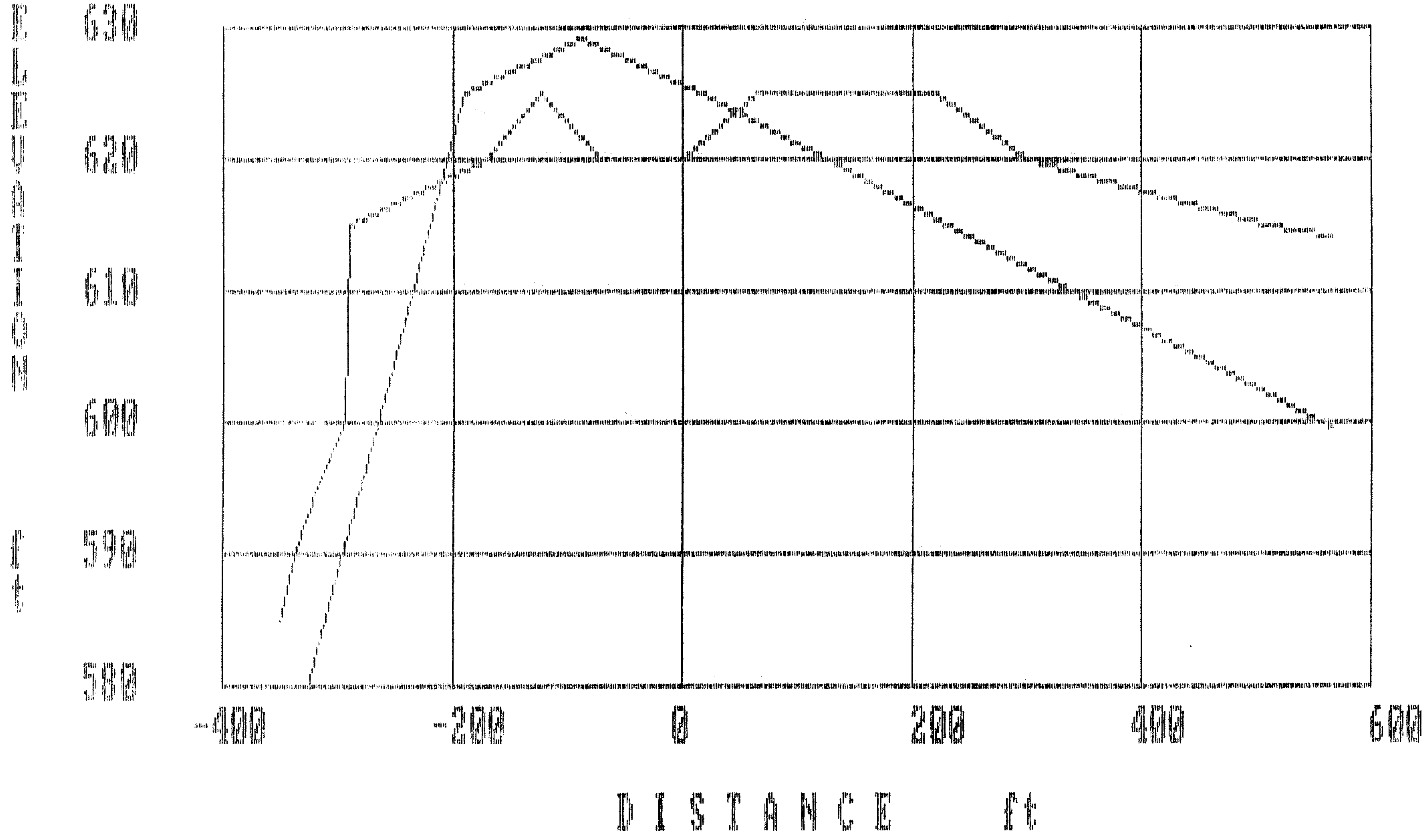

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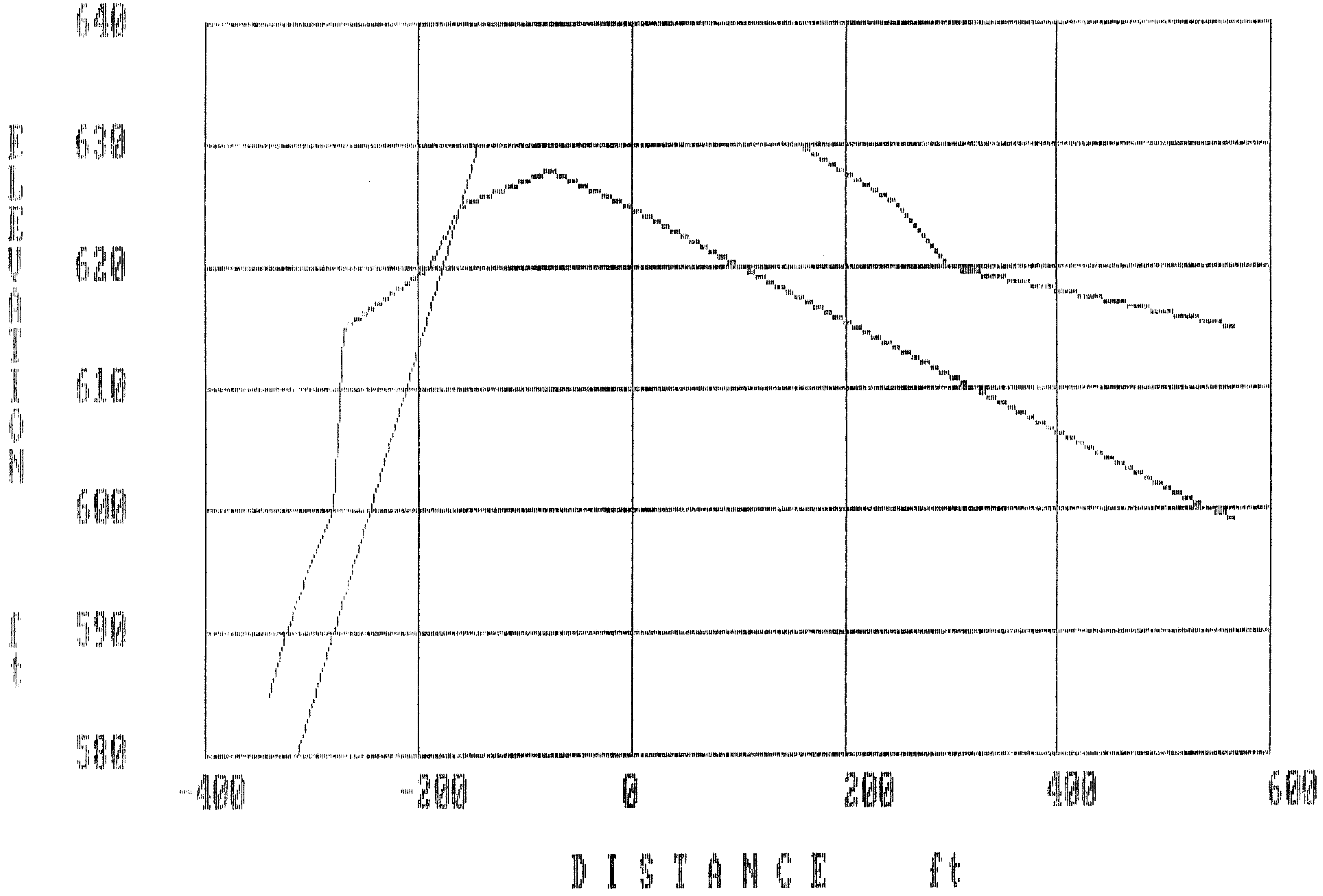

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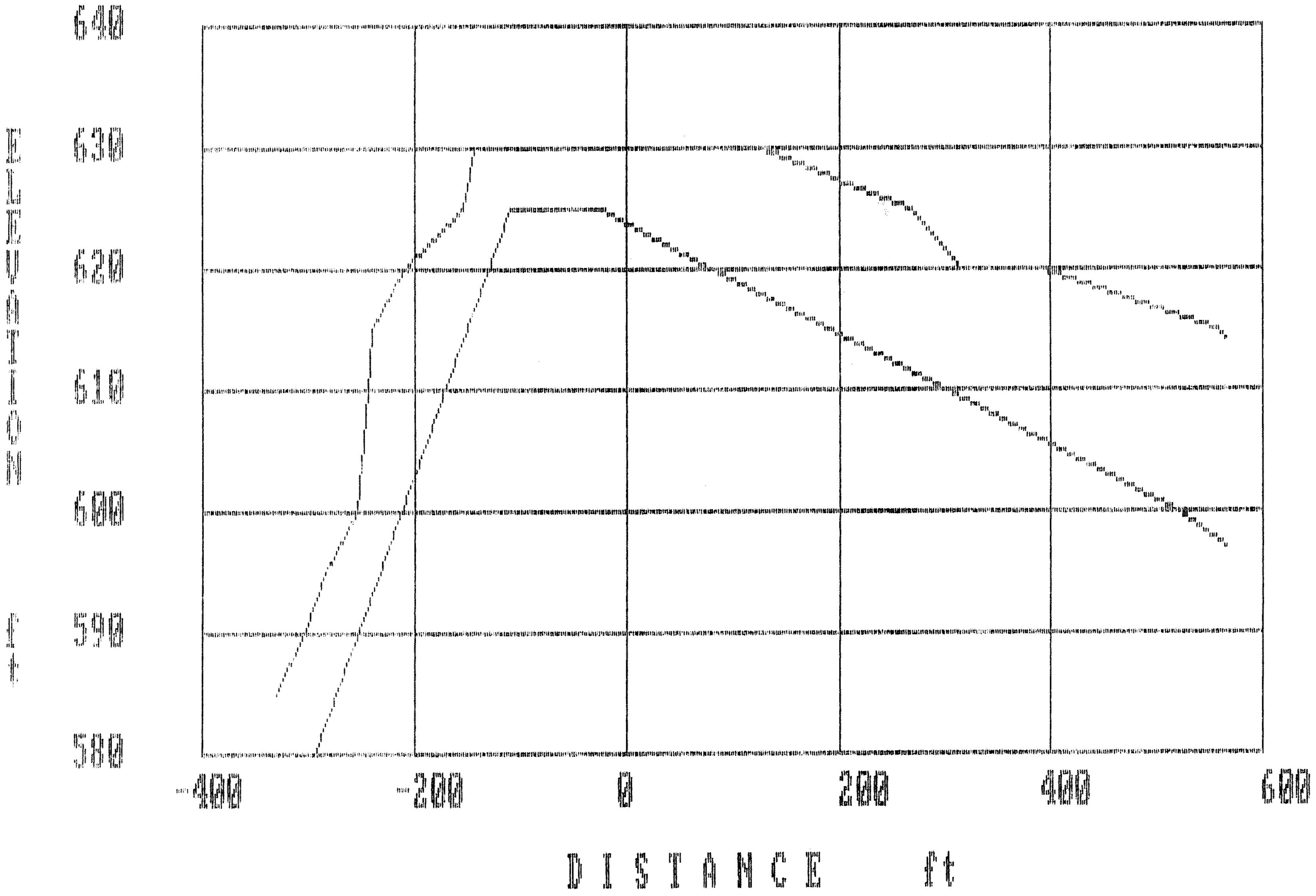

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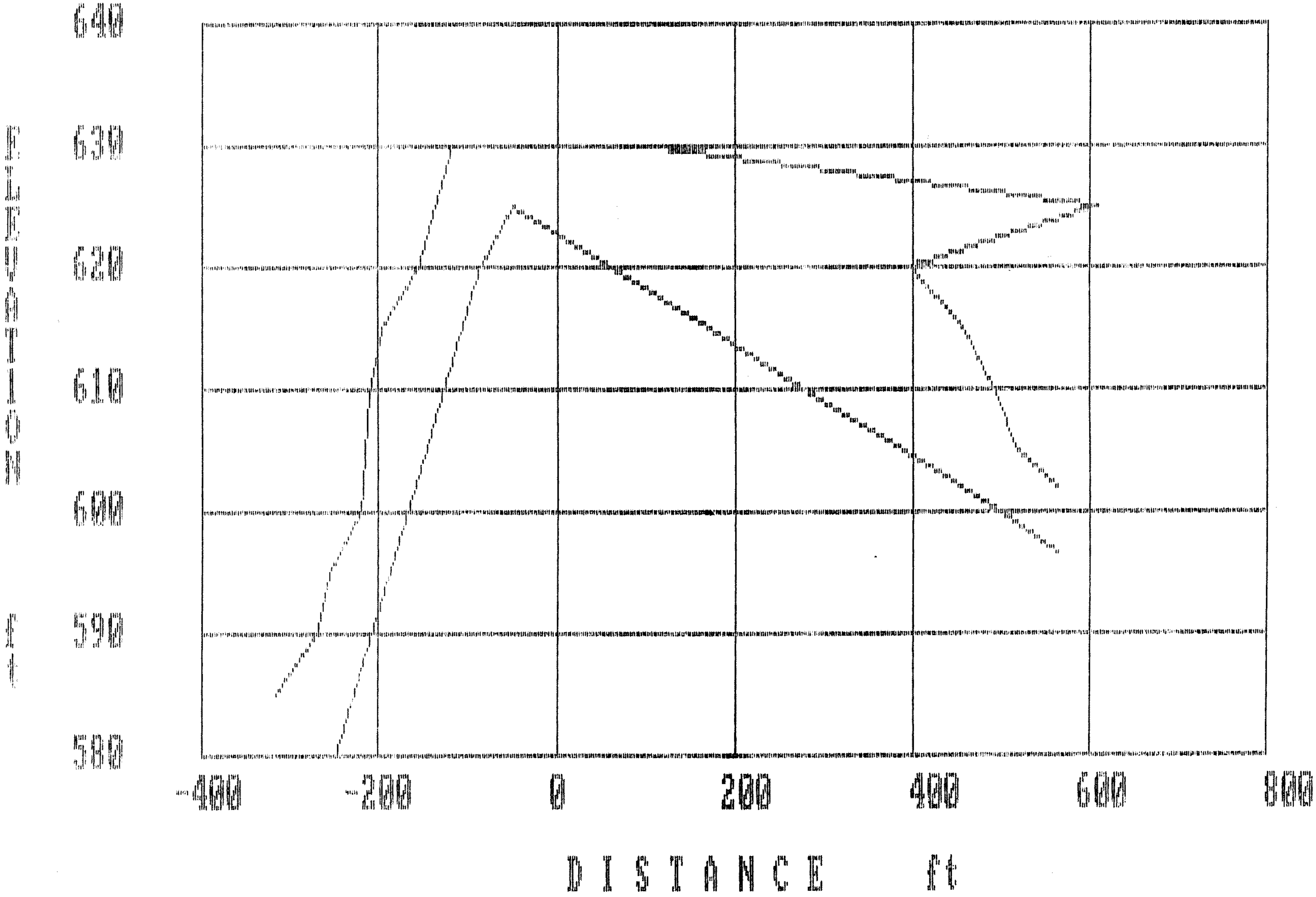

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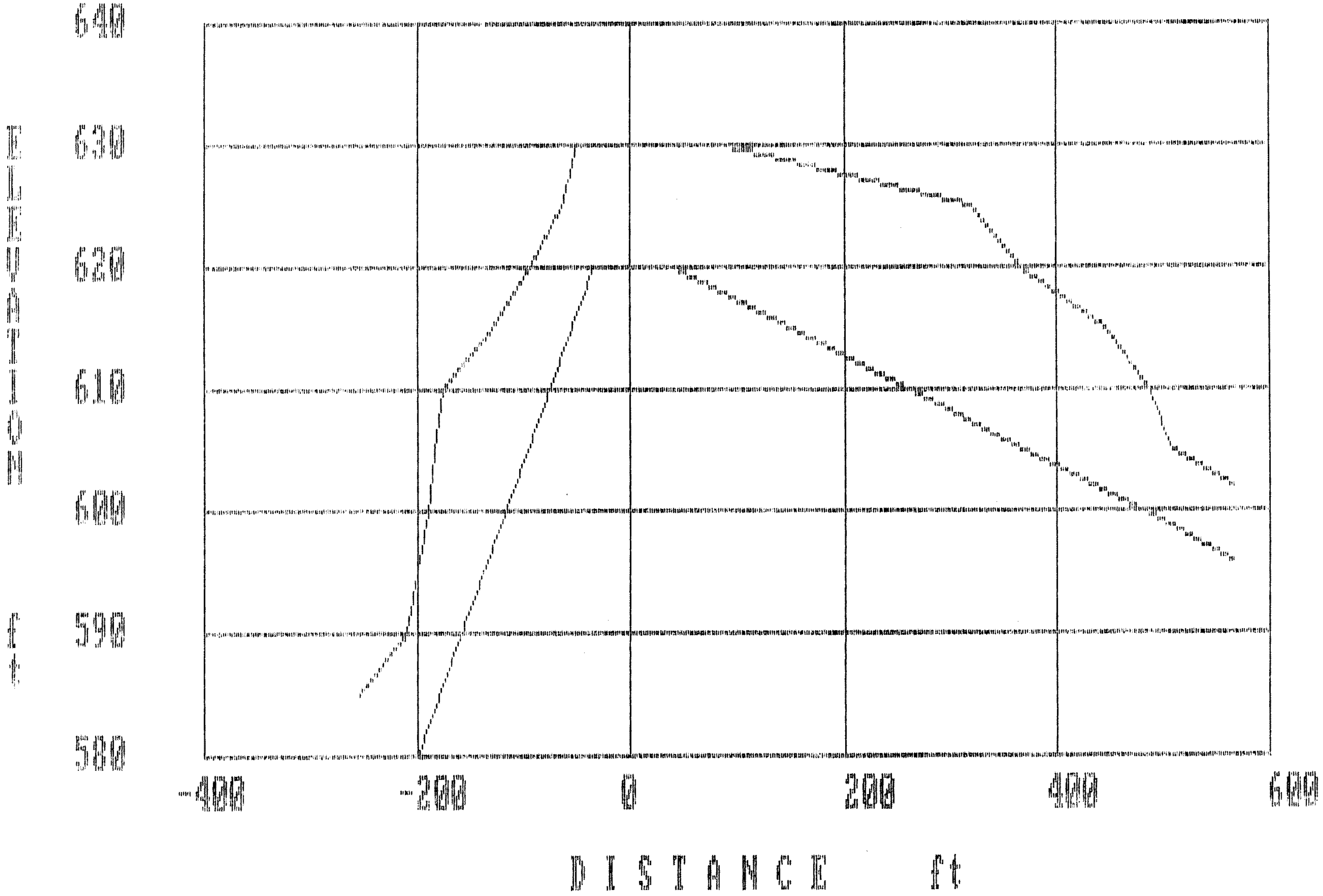

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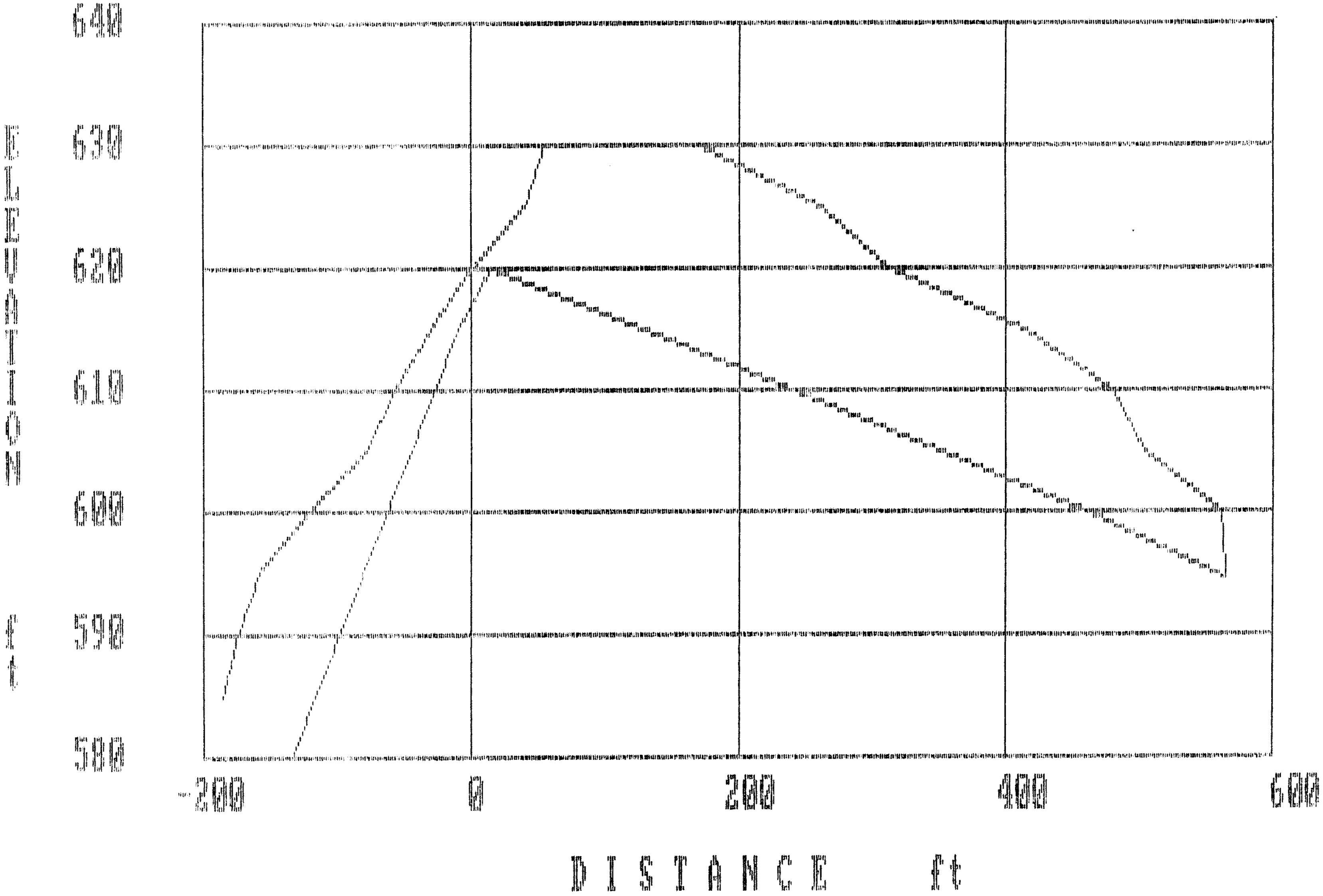

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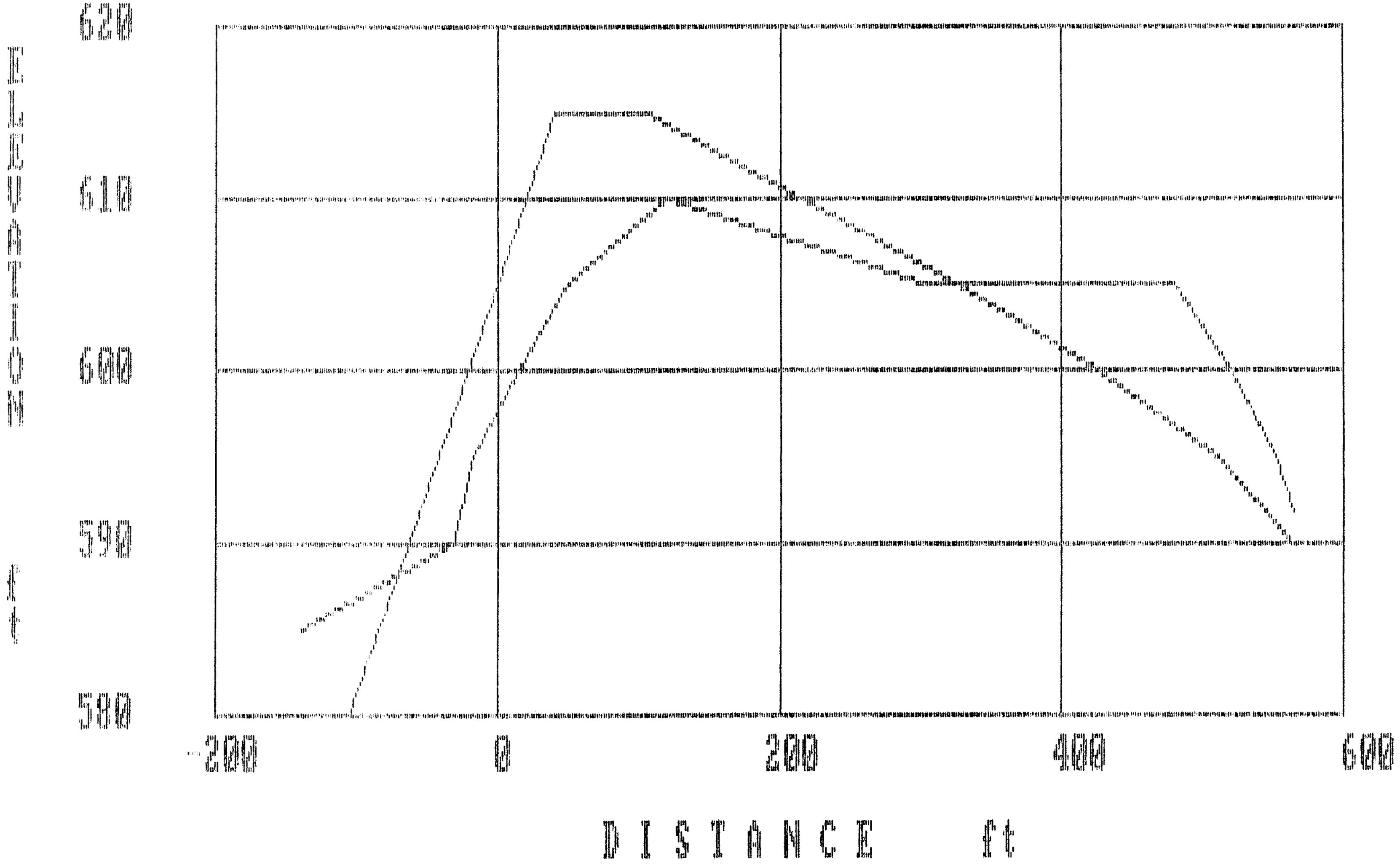
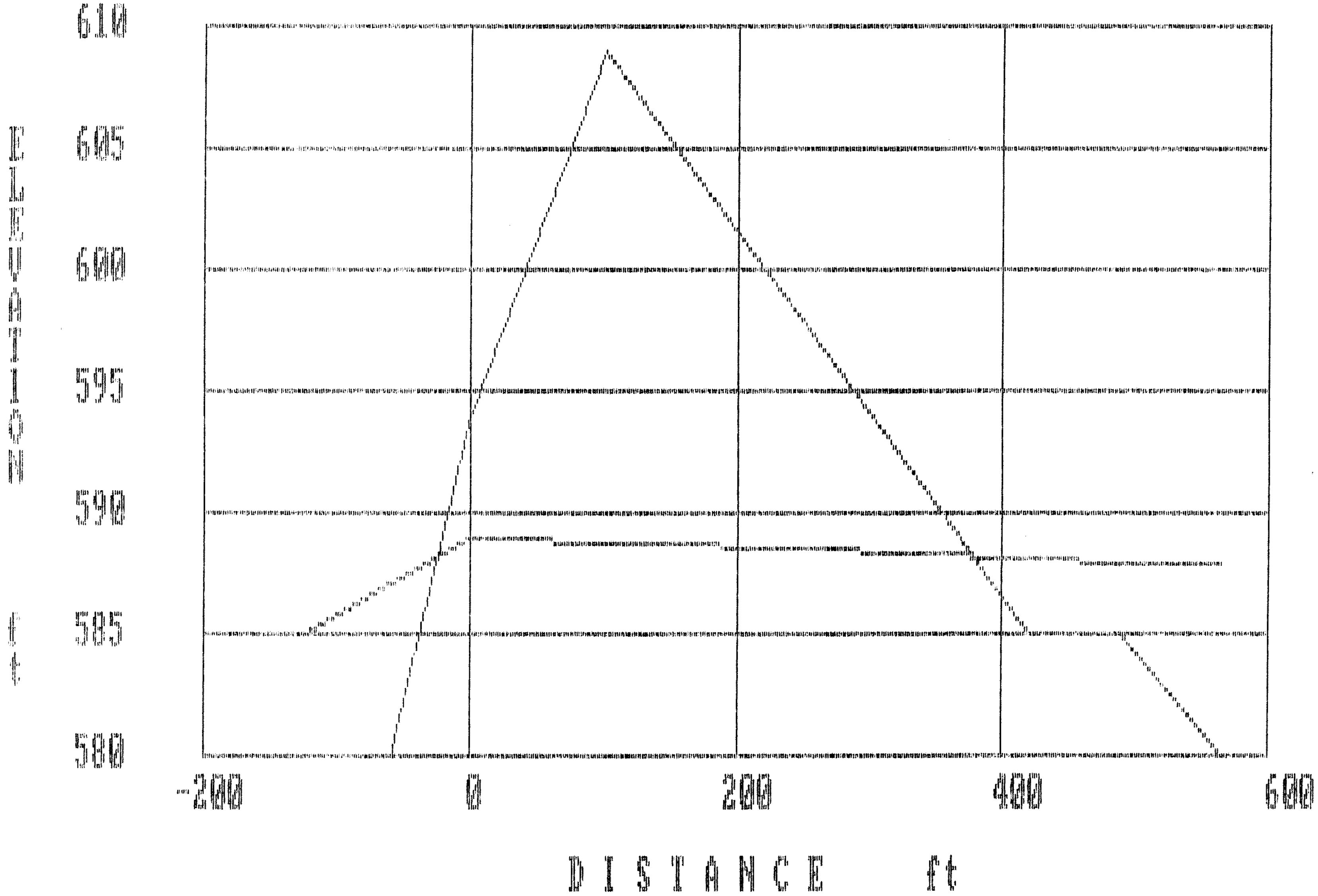
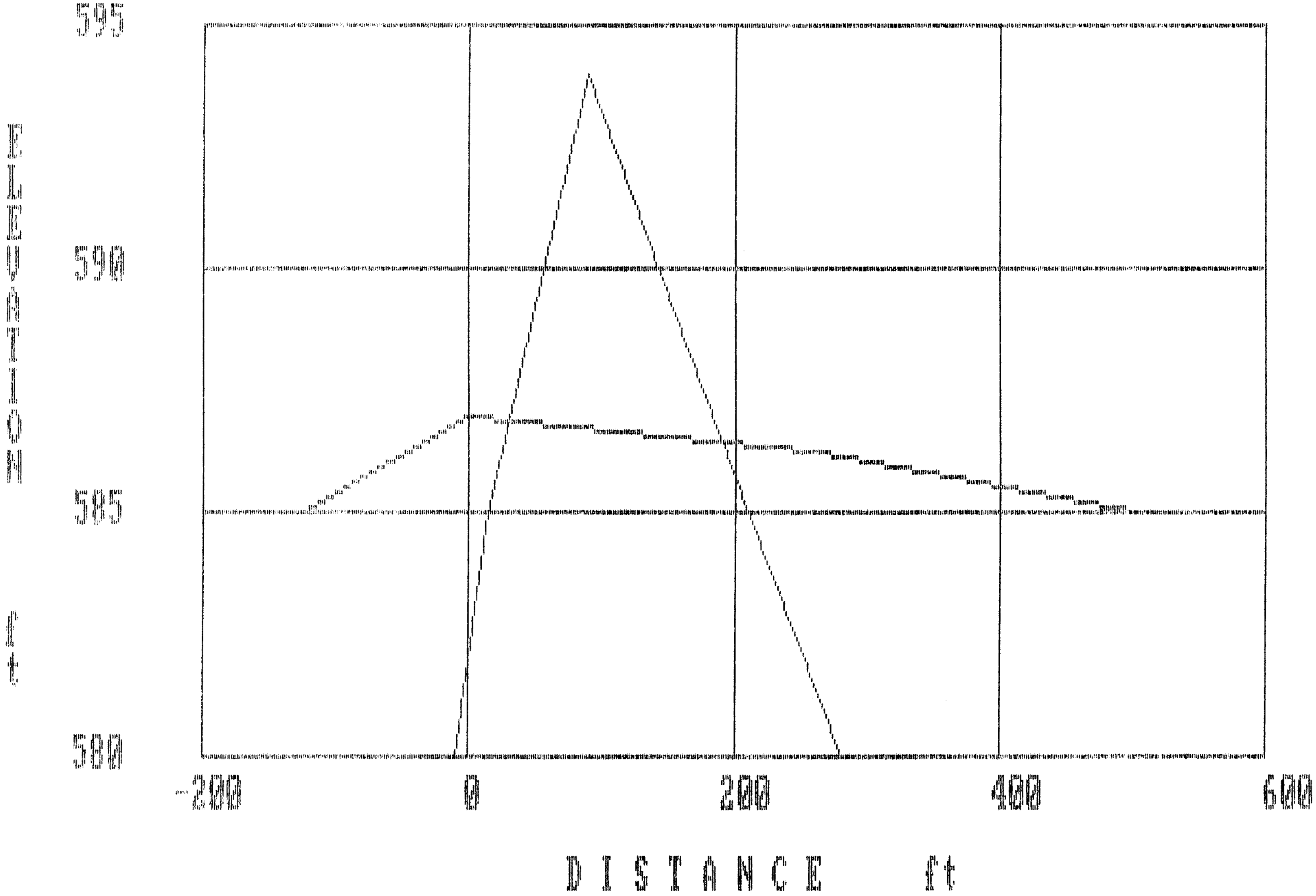


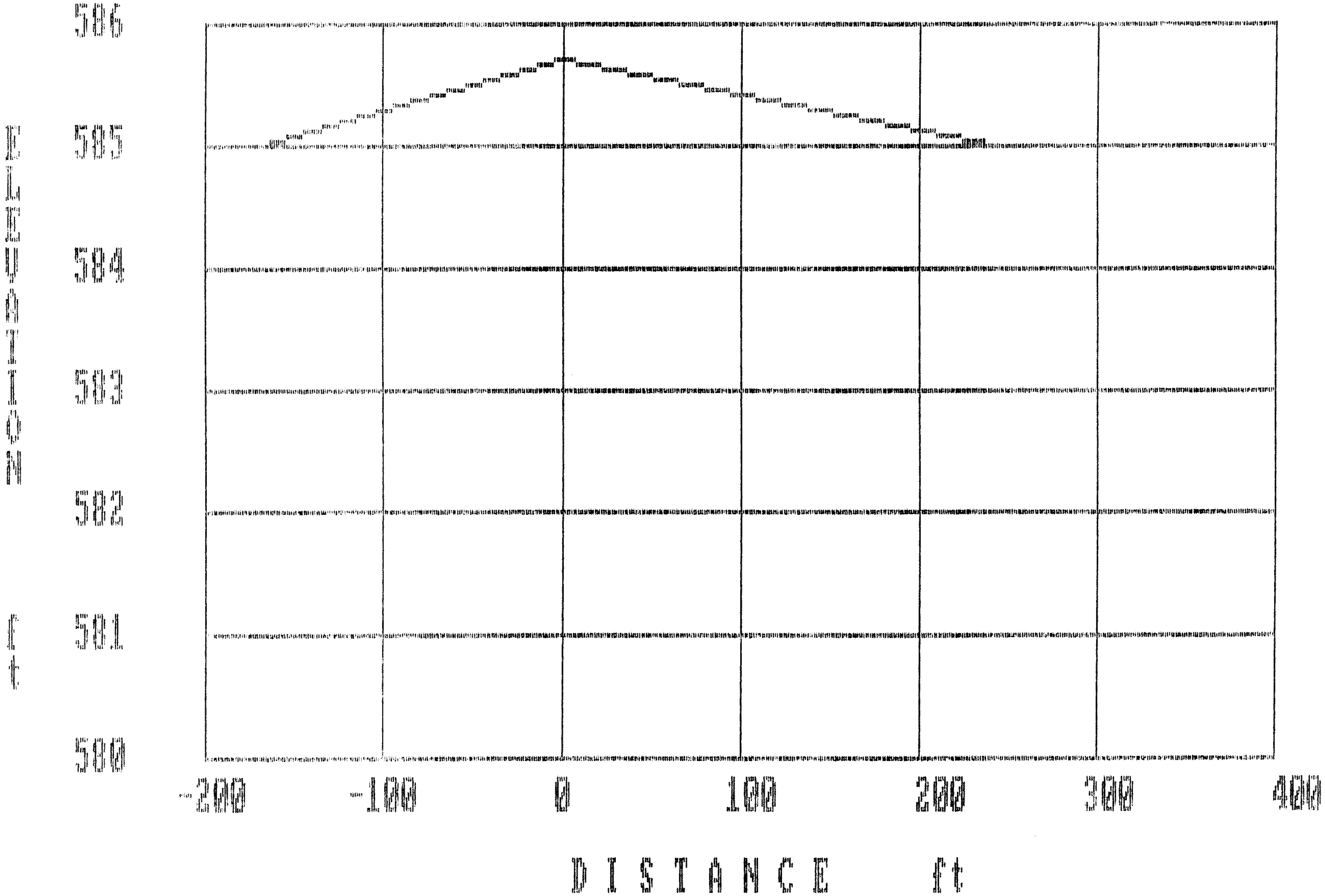


STATION: 3000

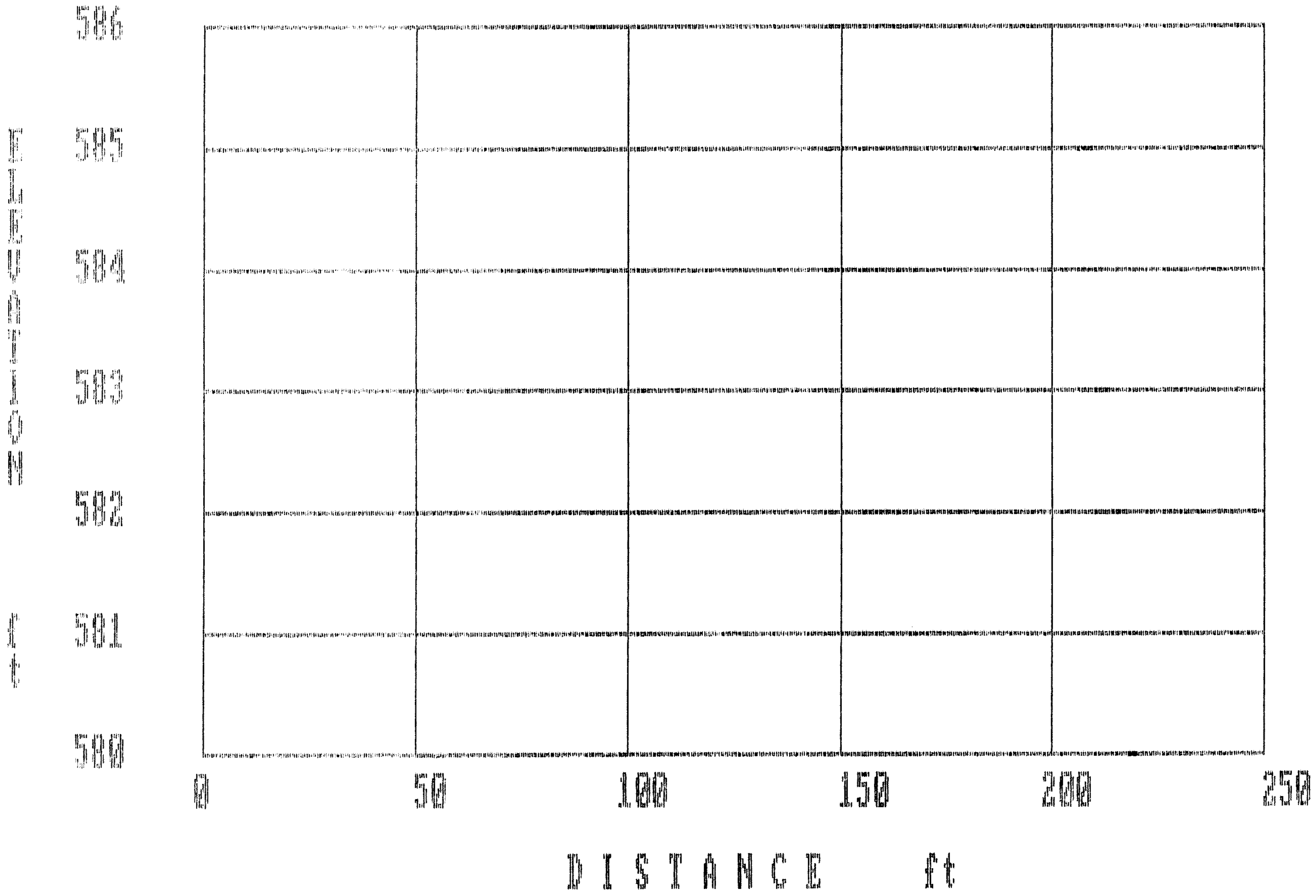
STATION: 3050



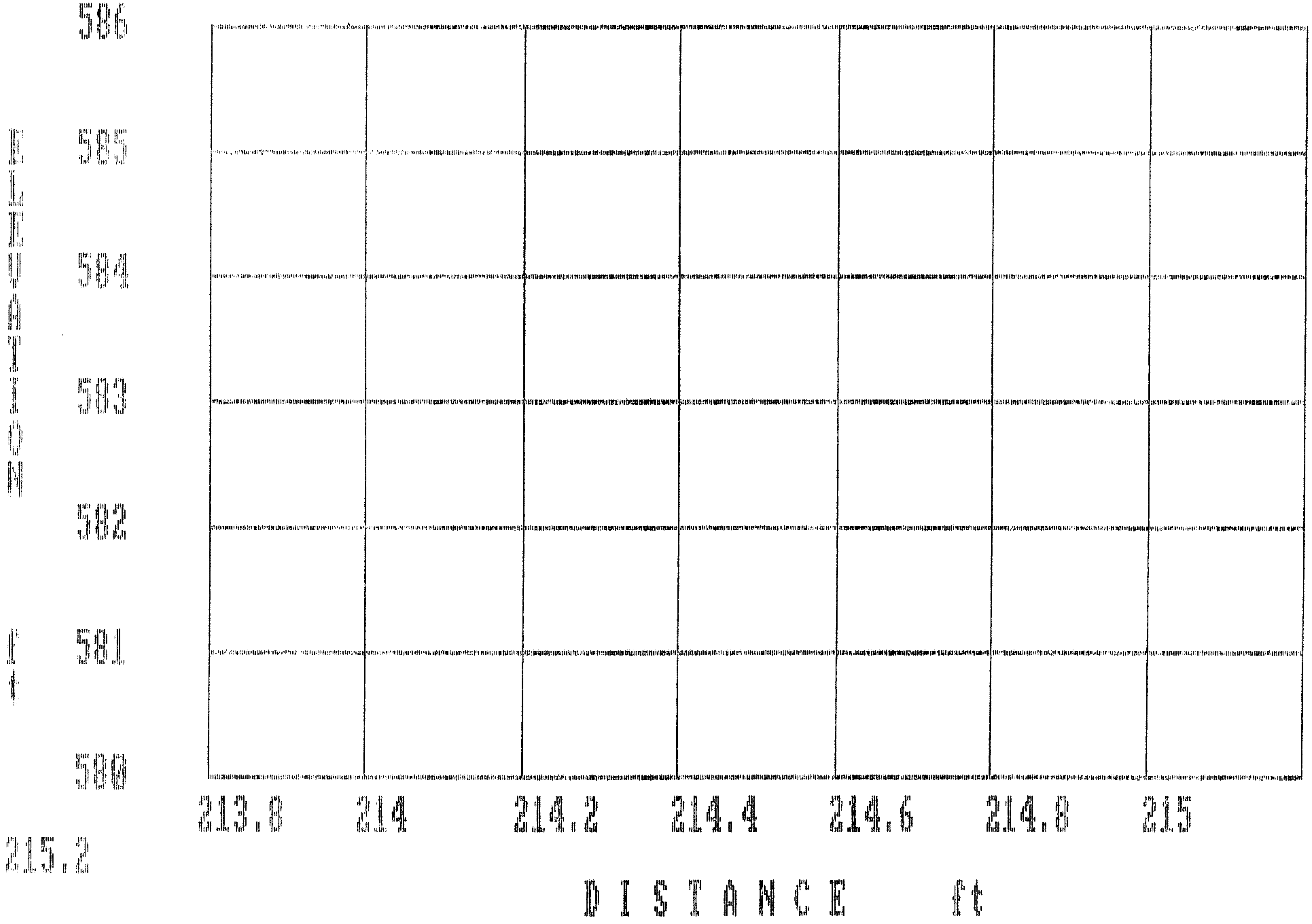
STATION: 3100



STATION: 3150



STATION: 3200



APPENDIX F

WATER QUALITY SAMPLING AND ANALYSIS GUIDELINES

Ⓔ SAMPLE PRESERVATION

Complete and unequivocal preservation of samples, either domestic sewage, industrial wastes, or natural waters, is a practical impossibility. Regardless of the nature of the sample, complete stability for every constituent can never be achieved. At best, preservation techniques can only retard the chemical and biological changes that inevitably continue after the sample is removed from the parent source. The changes that take place in a sample are either chemical or biological. In the former case, certain changes occur in the chemical structure of the constituents that are a function of physical conditions. Metal cations may precipitate as hydroxides or form complexes with other constituents: cations or anions may change valence states under certain reducing or oxidizing conditions: other constituents may dissolve or volatilize with the passage of time. Metal cations may also adsorb onto surfaces (glass, plastic, quartz, etc.), such as, iron and lead. Biological changes taking place in a sample may change the valence of an element or a radical to a different valence. Soluble constituents may be converted to organically bound materials in cell structures, or cell lysis may result in release of cellular material into solution. The well known nitrogen and phosphorus cycles are examples of biological influence on sample composition. Therefore, as a general rule, it is best to analyze the samples as soon as possible after collection. This is especially true when the analyte concentration is expected to be in the low *ug*/l range.

Methods of preservation are relatively limited and are intended generally to (1) retard biological action, (2) retard hydrolysis of chemical compounds and complexes, (3) reduce volatility of constituents, and (4) reduce absorption effects. Preservation methods are generally limited to pH control, chemical addition, refrigeration, and freezing.

The recommended preservative for various constituents is given in Table 1. These choices are based on the accompanying references and on information supplied by various Quality Assurance Coordinators. As more data become available, these recommended holding times will be adjusted to reflect new information. Other information provided in the table is an estimation of the volume of sample required for the analysis, the suggested type of container, and the maximum recommended holding times for samples properly preserved.

EXCERPTED FROM USEPA MANUAL 600/4-79-020,
REVISED MARCH 1983, "METHODS FOR CHEMICAL
ANALYSIS OF WATER AND WASTES."

TABLE 1

RECOMMENDATION FOR SAMPLING AND PRESERVATION OF SAMPLES ACCORDING TO MEASUREMENT(1)

Measurement	Vol. Req. (ml)	Container^2	Preservative^{3,4}	Holding Time^5
100 Physical Properties				
Color	50	P,G	Cool, 4°C	48 Hrs.
Conductance	100	P,G	Cool, 4°C	28 Days
Hardness	100	P,G	HNO_3 to $pH < 2$	6 Mos.
Odor	200	G only	Cool, 4°C	24 Hrs.
pH	25	P,G	None Req.	Analyze Immediately
Residue				
Filterable	100	P,G	Cool, 4°C	7 Days
Non-Filterable	100	P,G	Cool, 4°C	7 Days
Total	100	P,G	Cool, 4°C	7 Days
Volatile	100	P,G	Cool, 4°C	7 Days
Settleable Matter	1000	P,G	Cool, 4°C	48 Hrs.
Temperature	1000	P,G	None Req.	Analyze Immediately
Turbidity	100	P,G	Cool, 4°C	48 Hrs.
200 Metals				
Dissolved	200	P,G	Filter on site HNO_3 to $pH < 2$	6 Mos.
Suspended	200		Filter on site	6 Mos.(8)
Total	100	P,G	HNO_3 to $pH < 2$	6 Mos.

TABLE 1 (CONT)

Measurement	Vol. Req. (ml)	Container[2]	Preservative[3,4]	Holding Time[5]
Chromium^{+6}	200	P,G	Cool, 4°C	24 Hrs.
Mercury				
Dissolved	100	P,G	Filter HNO_3 to $pH < 2$	28 Days
Total	100	P,G	HNO_3 to $pH < 2$	28 Days
300 Inorganics, Non-Metallics				
Acidity	100	P,G	Cool, 4°C	14 Days
Alkalinity	100	P,G	Cool, 4°C	14 Days
Bromide	100	P,G	None Req.	28 Days
Chloride	50	P,G	None Req.	28 Days
Chlorine	200	P,G	None Req.	Analyze Immediately
Cyanides	500	P,G	Cool, 4°C NaOH to $pH > 12$ 0.6g ascorbic acid[6]	14 Days[7]
Fluoride	300	P,G	None Req.	28 Days
Iodide	100	P,G	Cool, 4°C	24 Hrs.
Nitrogen				
Ammonia	400	P,G	Cool,4°C H_2SO_4 to $pH < 2$	28 Days
Kjeldahl, Total	500	P,G	Cool, 4°C H_2SO_4 to $pH < 2$	28 Days
Nitrate plus Nitrite	100	P,G	Cool, 4°C H_2SO_4 to $pH < 2$	28 Days
Nitrate[8]	100	P,G	Cool, 4°C	48 Hrs.
Nitrite	50	P,G	Cool, 4°C	48 Hrs.

TABLE 1 (CONT)

Measurement	Vol. Req. (ml)	Container[2]	Preservative[3,4]	Holding Time[5]
Dissolved Oxygen				
Probe	300	G bottle and top	None Req.	Analyze Immediately
Winkler	300	G bottle and top	Fix on site and store in dark	8 Hours
Phosphorus				
Ortho-phosphate, Dissolved	50	P,G	Filter on site Cool, 4°C	48 Hrs.
Hydrolyzable	50	P,G	Cool, 4°C H_2SO_4 to $pH < 2$	28 Days
Total	50	P,G	Cool, 4°C H_2SO_4 to $pH < 2$	28 Days
Total, Dissolved	50	P,G	Filter on site Cool, 4°C H_2SO_4 to $pH < 2$	24 Hrs.
Silica	50	P only	Cool, 4°C	28 Days
Sulfate	50	P,G	Cool, 4°C	28 Days
Sulfide	500	P,G	Cool, 4°C add 2 ml zinc acetate plus NaOH to $pH > 9$	7 Days
Sulfite	50	P,G	None Req.	Analyze Immediately
400 Organics				
BOD	1000	P,G	Cool, 4°C	48 Hrs.
COD	50	P,G	Cool, 4°C H_2SO_4 to $pH < 2$	28 Days
Oil & Grease	1000	G only	Cool, 4°C H_2SO_4 to $pH < 2$	28 Days
Organic carbon	25	P,G	Cool, 4°C H_2SO_4 or HCl to $pH < 2$	28 Days
Phenolics	500	G only	Cool, 4°C H_2SO_4 to $pH < 2$	28 Days

TABLE 1 (CONT)

Measurement	Vol. Req. (ml)	Container[2]	Preservative[3,4]	Holding Time[5]
MBAS	250	P,G	Cool, 4°C	48 Hrs.
NTA	50	P,G	Cool, 4°C	24 Hrs.

1. More specific instructions for preservation and sampling are found with each procedure as detailed in this manual. A general discussion on sampling water and industrial wastewater may be found in ASTM, Part 31, p. 72-82 (1976) Method D-3370.

2. Plastic (P) or Glass (G). For metals, polyethylene with a polypropylene cap (no liner) is preferred.

3. Sample preservation should be performed immediately upon sample collection. For composite samples each aliquot should be preserved at the time of collection. When use of an automated sampler makes it impossible to preserve each aliquot, then samples may be preserved by maintaining at 4°C until compositing and sample splitting is completed.

4. When any sample is to be shipped by common carrier or sent through the United States Mails, it must comply with the Department of Transportation Hazardous Materials Regulations (49 CFR Part 172). The person offering such material for transportation is responsible for ensuring such compliance. For the preservation requirements of Table 1, the Office of Hazardous Materials, Materials Transportation Bureau, Department of Transportation has determined that the Hazardous Materials Regulations do not apply to the following materials: Hydrochloric acid (HCl) in water solutions at concentrations of 0.04% by weight or less (pH about 1.96 or greater); Nitric acid (HNO_3) in water solutions at concentrations of 0.15% by weight or less (pH about 1.62 or greater); Sulfuric acid (H_2SO_4) in water solutions at concentrations of 0.35% by weight or less (pH about 1.15 or greater); Sodium hydroxide (NaOH) in water solutions at concentrations of 0.080% by weight or less (pH about 12.30 or less).

5. Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before analysis and still considered valid. Samples may be held for longer periods only if the permittee, or monitoring laboratory, has data on file to show that the specific types of sample under study are stable for the longer time, and has received a variance from the Regional Administrator. Some samples may not be stable for the maximum time period given in the table. A permittee, or monitoring laboratory, is obligated to hold the sample for a shorter time if knowledge exists to show this is necessary to maintain sample stability.

6. Should only be used in the presence of residual chlorine.

7. Maximum holding time is 24 hours when sulfide is present. Optionally, all samples may be tested with lead acetate paper before the pH adjustment in order to determine if sulfide is present. If sulfide is present, it can be removed by the addition of cadmium nitrate powder until a negative spot test is obtained. The sample is filtered and then NaOH is added to pH 12.

8. Samples should be filtered immediately on-site before adding preservative for dissolved metals.

9. For samples from non-chlorinated drinking water supplies conc. H_2SO_4 should be added to lower sample pH to less than 2. The sample should be analyzed before 14 days.

TABLE IA.—LIST OF APPROVED BIOLOGICAL TEST PROCEDURES

Parameter and units	Method[1]	EPA[2]	Reference (Method Number or Page)		
			Standard Methods 15th Ed.	ASTM	USGS
Bacteria:					
1. Coliform (fecal) number per 100 ml.	MPN, 5 tube, 3 dilution; or, membrane filter (MF)[4], single step.	Page 132.	908C		
2. Coliform (fecal) in presence of chlorine number per 100 ml.	MPN, 5 tube, 3 dilution; or, MF[4], single step.[4a]	Page 124.	909		B-0050-77
3. Coliform (total, number per 100 ml.	MPN, 5 tube, 3 dilution; or, MF[4] single step or two step.	p. 114	908A		
4. Coliform (total) in presence of chlorine, number per 100 ml.	MPN, 5 tube, dilution; or MF[4] with enrichment.	p. 108 p. 114	909A 908A		B-0025-77
5. Fecal streptococci, number per 100 ml.	MPN, 5 tube, 3 dilution; MF[4]; or, plate count.	p. 111 p. 139	909 (A+A.5c) 910A		
	p. 136		910B		B0055-77[5]
	p. 143		910C		

Table IA Notes

[1] The method used must be specified when results are reported.

[2] "Microbiological Methods for Monitoring the Environment, Water and Waste, 1978", EPA-600/8-78-017, U.S Environmental Protection Agency.

[3] Greeson, P.E., *et al.*, "Methods for Collection and Analysis of Aquatic Biological and Microbiological Samples, "US Geological Survey, Techniques of Water-Resources Investigations, Book 5, Chapter A4, Laboratory Analysis, 1977

[4] 0.45 μm membrane filter or other pore size certified by the manufacturer to fully retain organisms to be cultivated, and free of extractables which could interfere with their growth and development.

[4a] Since the membrane filter technique usually yields low and variable recovery from chlorinated wastewaters, the MPN method will be required to resolve any controversies.

[5] Approved only if dissolution of the KF Streptococcus Agar (Section 5.1, USGS Method 8-0055-77) is made in a boiling water bath to avoid scorching of the medium.

TABLE IB.—LIST OF APPROVED INORGANIC TEST PROCEDURES

Parameter, units, and method	Reference (method No. or page)				
	EPA 1979	Standard methods 15th Ed.	ASTM	USGS [1]	Other
1. Acidity, as $CaCO_3$, mg/L: Electrometric end point or phenolphthalein end point.	305.1	402(4 d)	D1067-70(E)		
2. Alkalinity, as $CaCO_3$, mg/L: Electrometric or colorimetric:					
Titration to pH 4.5, manual	310.1	403	D1067(B)	I-1030-78	P. 548.[2]
Or automated	310.2			I-2030-78	
3. Aluminum—Total [3] mg/L: Digestion [3] followed by:					
AA direct aspiration	202.1	303C		I-3051-78	
AA furnace	202.2	304			
Inductively coupled plasma					Method 200.7.[4]
Or colorimetric (Eriochrome cyanine R)		306B			
4. Ammonia (as N), mg/L: Manual distillation [5] (at pH 9.5):					
Followed by	350.2	417A			
Nesslerization	350.2	417B	D1426-79(A)	I-3520-78	P. 553.[2]
Titration	350.2	417D			
Electrode	350.3		D1426-79(D)		
Automated phenate, or	350.1	417F	D1426-79(C)	I-4523-78	
Automated electrode					[6].
5. Antimony—Total [3], mg/L: Digestion [3] followed by:					
AA direct aspiration	204.1	303A			
AA furnace, or	204.2	304			
Inductively coupled plasma					Method 200.7.[4]
6. Arsenic—Total [3], mg/L:					
Digestion [3] followed by	206.5				
AA (gaseous hydride)	206.3	303E	D2972-78(B)	I-3062-78	
AA furnace	206.2	304			
Inductively coupled plasma					Method 200.7.[4]
Or, colorimetric (SDDC)	206.4	307B	D2972-78(A)	I-3060-78	
7. Barium—Total [3], mg/L: Digestion [3] followed by:					
AA direct aspiration	208.1	303C		I-3084-78	
AA furnace, or	208.2	304			
Inductively coupled plasma					Method 200.7[4]
8. Beryllium—Total [3], mg/L: Digestion [3] followed by:					
AA direct aspiration	210.1	303C	D3645-78	I-3095-78	
AA furnace	210.2	304			
Inductively coupled plasma					Method 200.7.[4]
Or colorimetric (aluminon)		309B			
9. Biochemical oxygen demand (BOD_5), mg/L:					
Winkler (Azide modification)	405.1	507		I-1578-78	P. 17.[9]
Or electrode method					P. 548.[2]
10. Boron—Total, mg/L:					
Colorimetric (curcumin) or	212.3	404A		I-3112-78	
Inductively coupled plasma					Method 200.7.[4]
11. Bromide, mg/L: Titrimetric	320.1		D1246-77(C)	I-1125-78	P. 544[2,5]
12. Cadmium—Total [3], mg/L: Digestion[3] followed by:					
AA direct aspiration	213.2	303A or 303B.	D3557-78 (A or B).	I-3135-78 or I-3136-78.	Pg. 557.[2]
AA furnace	213.2	304			P. 37.[9]
Inductively coupled plasma					Method 200.7.[4]
Voltammetry[9] or			D3557-78(C)		
Colorimetric (Dithizone)		310B			
13. Calcium—Total [3] mg/L: Digestion[3] followed by:					
Atomic absorption	215.1	303A	D511-77(C)	I3152-78	
Inductively coupled plasma					Method 200.7.[4]
Or EDTA titration	215.2	311C	D511-77(B)		
14. Carbonaceous Biochemical oxygen demand ($CBOD_5$), mg/L: Winkler (Azide modification) or electrode method with nitrification inhibitor.		507(5 e 6)			

TABLE IB.—LIST OF APPROVED INORGANIC TEST PROCEDURES—Continued

Parameter, units, and method	Reference (method No. or page)				
	EPA 1979	Standard methods 15th Ed.	ASTM	USGS[1]	Other
15. Chemical oxygen demand (COD), mg/L:					
Titrimetric colorimetric	410.1	508A	D1252-78	I-3560-78	P. 550[4] and
Manual or	410.2			I-3562-78	P. 17[5] and
	410.3			I-3561-78	(10)
Automated	410.4				
Spectrophotometric					(11)
16. Chloride, mg/L:					
Titrimetric (silver nitrate) or		407A	D512-67(B)	I-1183-78	
Mercuric nitrate	325.3	407B	D512-67(A)	I-1184-78	P. 554[4]
Colorimetric (ferricyanide) manual or			D512-67(C)	I-1187-78	
Automated	325.1 or 325.2.	407D		I-2187-78	
17. Chlorine—Total residual, mg/L:					
Iodometric titrimetric12,					
amperometric direct, or,	330.1	408C	D1253- 76(A)		
Starch-iodine end point	330.3	408A	D1253- 76(B)		
DPD-FAS	330.4	408D			
Spectrophotometric, DPD; or	330.5	408E			
Electrode					(12)
18. Chromium VI dissolved, mg/L: 0.45 micron filtration with:					
Extraction and atomic absorption, or	218.4	303B		I-1232-78	
Colorimetric (Diphenylcarbazide)				I-1230-78	
19. Chromium—Total[3], mg/L:					
Digestion[3] (optional extraction) followed by.	218.3				
AA direct aspiration	218.1	303A or 303B.	D1687-77(D)	I-3236-78	P. 557[4]
AA furnace	218.2	304			
Inductively coupled plasma					Method 200.7[6]
Or colorimetric (Diphenylcarbazide)		312A	D1687-77(A)		
20. Cobalt—Total[3], mg/L: Digestion[3] followed by:					
AA direct aspiration	219.1	303A or 303B.	D3558-77 (A or B).	I-3240-78 or I-3239-78	P. 37[5]
AA furnace, or	219.2	304			
Inductively coupled plasma					Method 200.7[6]
21. Color, platinum Cobalt units or dominant wavelength hue, luminance, purity:					
Colorimetric, ADMI	110.1	204D			(13)
Platinum cobalt; or	110.2	204A		I-1250-78	
Spectrophotometric	110.3	204B			
22. Copper—Total[3], mg/L: Digestion[3] followed by:					
AA direct aspiration	220.1	303A or 303B.	D1688-77 (D or E).	I-3271-78 or I-3270-78.	P. 557[4] and P. 37[5]
AA furnace	220.2	304			
Inductively coupled plasma					Method 200.7[6]
Colorimetric (Neocuproine)		313B	D1688-77(A)		
Bicinchoninate					(14)
23. Cyanide—Total mg/L:					
Manual distillation with $MgCl_2$	335.2	412D			
Followed by titrimetric	335.2	412B			P. 22[5]
Manual or	335.2	412C	D2036-75(A)		
Automated[15] spectrophotometric	335.3	412D	D2036-75(A)	I-3300-78	
24. Cyanide amenable to chlorination, mg/L: Manual distillation with $MgCl_2$: Followed by titrimetric, manual or automated[15] spectrophotometric.	335.1	412F	D2036-75(B)		
25. Fluoride—Total, mg/L:					
Manual distillation[6]		413A			
Followed by manual or	340.2	413B	D1179-72(B)		
Automated electrode				I-4327-78	
SPADNS	340.1	413C	D1179-72(A)		
Or automated complexone	340.3	413E			
26. Gold—Total[3], mg/L: Digestion[3] followed by:					
AA direct aspiration	231.1	303A			

TABLE IB.—LIST OF APPROVED INORGANIC TEST PROCEDURES—Continued

Parameter, units, and method	Reference (method No. or page)				
	EPA 1979	Standard methods 15th Ed.	ASTM	USGS [1]	Other
Or AA furnace	231.2	304			
27. Hardness—Total as $CaCo_3$, mg/L:					
Automated colorimetric	130.1				
EDTA titration	130.2	314B	D1126-67(B)	I-1338-78	P. 556 [2]
Inductively coupled plasma					Method 200.7 [4]
Or atomic absorption (sum of Ca and Mg as their respective carbonates)	215.1 + 242.1	303A		I-3153-78 + I-3448-78	
28. Hydrogen ion (pH), pH units:					
Electrometric	150.1	423	D1293-78(A) or D1293-78(B).	I-1586-78	P. 547 [2]
Measurements: or automated electrode					(14)
29. Indium—Total [3], mg/L: Digestion [3] followed by:					
AA direct aspiration	235.1	303A			
Or AA furnace	235.2	304			
30. Iron—Total [3], mg/L:					
Digestion [3] followed by		303A or 303B.	D1068-77		
AA direct aspiration	236.1	303B	(C or D)	I-3381-78	P. 557.[2]
AA furnace	236.2	304			
Inductively coupled plasma					Method 200.7.[4]
Or colorimetric (Phenanthroline)		315B	D1068-77(A)		(17)
31. Kjeldahl nitrogen—Total (as N), mg/L:					
Digestion and distillation	351.3	420A or B			P. 552.[2]
Followed by titration	351.3	417D	D3590-77		
Nesslerization or	351.3	417B			
Electrode	351.3	417E			
Automated phenate	351.1			I-4551-78	
Semi-automated block digestor	351.2			I-4552-78	
Or potentiometric	351.4				
32. Lead—Total [3], mg-L: Digestion [3] followed by:					
AA direct aspiration	239.1	303A or 303B.	D3559-78 (A or B).	I-3399-78	P. 557.[2]
AA furnace	239.2	304			
Inductively coupled plasma					Method 200.7.[4]
Voltametry [4] or			D3559-78(C)		
Colorimetric (Dithizone)		316B			
33. Magnesium—Total [3], mg/L: Digestion [3] followed by:					
Atomic absorption	242.1	303A	D511-77(B)	I-3447-78	P. 557.[2]
Inductively coupled plasma					Method 200.7.[4]
Or gravimetric		318B	D511-77(A)		
34. Manganese—Total [3], mg/L: Digestion [3] followed by:					
AA direct aspiration	243.1	303A or 303B.	D858-77 (B or C).	I-3454-78	P. 557.[2]
AA furnace	243.2	304			
Inductively coupled plasma					Method 200.7.[4]
Or colorimetric (Persulfate)		319B	D858-77(A)		P. 564 [2]
Periodate					18, P. 227 [2,8]
35. Mercury—Total [3], mg/L:					
Cold vapor, manual or	245.1	303F	D3223-79	I-3462-78	P. 559 [2]
Automated	245.2				
36. Molybdenum—Total [3], mg/L: Digestion [3] followed by:					
AA direct aspiration	246.1	303C		I-3490-78	
AA furnace, or	246.2	304			
Inductively coupled plasma					Method 200.7.[4]
37. Nickel—Total [3], mg/L: Digestion [3] followed by:					
AA direct aspiration	249.1	303A or 303B	D1886-77 (C or D)	I-3499-78	
AA furnace	249.2	304			
Inductively coupled plasma					Method 200.7 [4]

TABLE IB.—LIST OF APPROVED INORGANIC TEST PROCEDURES—Continued

Parameter, units, and method	Reference (method No. or page)				
	EPA 1979	Standard methods 15th Ed.	ASTM	USGS[1]	Other
Or colorimetric (Heptoxime)		321B			
38. Nitrate (as N), mg/L:					
Brucine sulfate, or	352.1		D092-71	I-1540-78	P. 554 [4], P 427 [28]
Nitrate-nitrite N minus Nitrite N	See parameters 39 and 40.	See parameters 39 and 40.	See parameters 39 and 40.	See parameters 39 and 40.	P. 28 [8]
39. Nitrate-nitrite (as N), mg/L:					
Cadmium reduction, manual	353.3	418C	D3867-79(B)		
Or automated; or	353.2	418F	D3867-79(A)	I-4545-78	
Automated hydrazine	353.1				
40. Nitrite (as N), mg/L:					
Spectrophotometric, manual or	354.1	419	D1254-67		19.
Automated (Diazotization)				I-4540-78	
41. Oil and grease—Total recoverable, mg/L: Gravimetric (extraction).	413.1	503A			
42. Organic carbon—Total (TOC), mg/L: Combustion or oxidation.	415.1	505	D2579-78(A) or D2579-78(B).		P. 551 [2] and P 4 [20]
43. Organic nitrogen (as N), mg/L: Total Kjeldahl N minus ammonia N.	See parameters 31 and 4.	420A	D3590-77 minus D1426-79(A).	See parameters 31 and 4.	PP 552-53 [2]
44. Orthophosphate (as P), mg/L: Ascorbic acid method, automated	365.1	424G		I-4601-78	
Or manual single reagent or	365.2	424F	D515-78(A)		P. 561 [2]
Manual two reagent	365.3				
45. Osmium—Total [3], mg/L: Digestion [3] followed by:					
AA direct aspiration, or	252.1	303C			
AA furnace	252.2	304			
46. Oxygen, dissolved, mg/L:					
Winkler (Azide modification)	360.2	421B	D1589-60(A)	I-1575-78	P. 550 [2]
Or electrode	360.1	421F		I-1576-78	
47. Palladium—Total [3], mg/L: Digestion [3] followed by:					
AA direct aspiration	253.1				P. S27 [23]
Or AA furnace	253.2				P. S28 [23]
48. Phenols, mg/L:					
Manual distillation	420.1		D1783-70 (A or B).		26.
Followed by manual	420.1				26
Or automated [18] colorimetric (4AAP)	420.2				
49. Phosphorus (elemental), mg/L: Gas-liquid chromatography.					21.
50. Phosphorus—Total, mg/L:					
Persulfate digestion	365.2	424C (III)			P. 561 [2]
Followed by manual or	365.2 or 365.3.	424F	D515-78(A)		
Automated ascorbic acid	365.1	424G		I-4600-78	
Reduction; or semi-automated block digestor.	365.4			I-4603-78	
51. Platinum—Total [3], mg/L: Digestion [3] followed by:					
AA direct aspiration	255.1	303A			
Or AA furnace	255.2	304			
52. Potassium—Total [3], mg/L: Digestion [3] followed by:					
Atomic absorption	258.1	303A		I-3630-78	P. 560 [2]
Inductively coupled plasma					Method 200.7 [6]
Flame photometric, or		322B	D1428-64(A)		
Colorimetric (Cobaltinitrite)					P. 235 [28]
53. Residue—total, mg/L: Gravimetric, 103-105°C.	160.3	209A		I-3750-78	
54. Residue—filterable, mg/L: Gravimetric, 180°C.	160.1	209B		I-1750-78	

TABLE IB.—LIST OF APPROVED INORGANIC TEST PROCEDURES—Continued

Parameter, units, and method	Reference (method No. or page)				
	EPA 1979	Standard methods 15th Ed.	ASTM	USGS[1]	Other
55. Residue—nonfilterable, (TSS), mg/L: Gravimetric, 103–105°C post washing of residue.	160.2	209D		I-3765-78	
56. Residue—settleable, mg/L: Volumetric (Imhoff cone) or gravimetric.	160.5	209F			
57. Residue—volatile, mg/L: Gravimetric, 550°C	160.4	209E		I-3753-78	
58. Rhodium—Total[3], mg/L: Digestion[3] followed by:					
AA direct aspiration	265.1	303A			
Or AA furnace	267.2	304			
59. Ruthenium—Total[3], mg/L: Digestion[3] followed by:					
AA direct aspiration	267.1	303A			
Or AA furnace	267.2	304			
60. Selenium—Total[3] mg/L: Digestion[3] followed by:					
AA furnance	270.2	304			
Inductively coupled plasma					Method 200.7.[4]
Or AA (gaseous hydride)	270.3	303E	D3859-79	I-3667-78	
61. Silica—Dissolved, mg/L: 0.45 micron filtration:					
Followed by manual or	370.1	425C	D859-68(B)	I-1700-78	
Automated colorimetric (Molybdosilicate), or.				I-2700-78	
Inductively coupled plasma					Method 200.7.[4]
62. Silver—Total[22] mg/L: Digestion[3] followed by:					
AA direct aspiration	272.1	303A or 303B.		I-3720-78	P. 557[2] and p. 37.[8]
AA furnace	272.1	304			
Colorimetric (Dithizone), or		324B			
Inductively coupled plasma					Method 200.7.[4]
63. Sodium—Total[3], mg/L: Digestion[3] followed by:					
Atomic absorption	273.1	303A		I-3735-78	P. 561.[2]
Inductively coupled plasma					Method 200.7[4]
Or flame photometric		325B	D1428-64(A)		
64. Specific conductance, mhos/cm: Wheatstone bridge.	120.1	205	D1125-77(A)	I-1780-78	P. 547.[2]
65. Sulfate (as SO_4), mg/L:					
Automated colorimetric (barium chloroanilate).	375.1				
Gravimetric, or	375.3	426A or 426B.	D516-68(A)		PP 562-63.[2]
Turbidimetric	375.4	426C	D516-68(B)		
66. Sulfide (as S), mg/L:					
Titrimetric (iodine) or	376.1	427D		I-3840-78	
Colorimetric (methylene blue)	376.2	427C			
67. Sulfite (as SO_4), mg/L: Titrimetric (iodine iodate).	377.1	428F	D1339-78(C)		
68. Surfactants, mg/L: Colorimetric (methylene blue).	425.1	512A	D2330-68(A)		
69. Temperature, °C., Thermometric	170.1	212			(23)
70. Thallium—Total,[3] mg/L: Digestion[3] followed by:					
AA direct aspiration	279.1	303A			
AA furnace, or	279.2	304			
Inductively coupled plasma					Method 200.7.[4]
71. Tin—Total,[3] mg/L: Digestion[3] followed by:					
AA direct aspiration or	282.1	303A		I-3850-78	
AA furnace	282.2	304			
72. Titanium—Total,[3] mg/L. Digestion[3] followed by.					
AA direct aspiration or	283.1	303C			
AA furnace	283.2	304			
73. Turbidity, NTU: Nephelometric	180.1	214A	D1889-71	I-3860-78	

TABLE IB.—LIST OF APPROVED INORGANIC TEST PROCEDURES—Continued

Parameter, units, and method	Reference (method No. or page)				
	EPA 1979	Standard methods 15th Ed.	ASTM	USGS [1]	Other
74 Vanadium—Total,[3] mg/L: Digestion [3] followed by:					
AA direct aspiration	286.1	303C			
AA furnace	286.2	304			
Inductively coupled plasma					Method 200.7 [4]
Or colorimetric (Gallic acid)		327B	D3373-75		
75. Zinc—Total,[3] mg/L: Digestion [3] followed by:					
AA direct aspirationb	289.1	303A or 303B.	D1691-77(D)	I-3900-78	P. 557 [2]
AA furnace	289.2	304	D1691-77(C)		P. 37 [9]
Inductively coupled plasma					Method 200.7 [4]
Colorimetric (Dithizone)		328C			
Or colorimetric (Zincon)					[24].

Table IB Notes

[1] "Methods for Analysis of Inorganic Substances in Water and Fluvial Sediments," U.S. Department of the Interior, U.S. Geological Survey, Open-File Report 78–679, or "Methods for Determination of Inorganic Substances in Water and Fluvial Sediments," N.W. Skougstad, *et al.*, U.S. Geological Survey, Techniques of Water-Resources Investigation, Book 5, Chapter A1, 1979.

[2] "Official Methods of Analysis of the Association of Official Analytical Chemists" methods manual, 13th ed. (1980).

[3] For the determination of total metals the sample is not filtered before processing. A digestion procedure is required to solubilize suspended material and to destroy possible organic-metal complexes. Two digestion procedures are given in "Methods for Chemical Analysis of Water and Wastes, 1979." One (section 4.1.3), is a vigorous digestion using nitric acid. A less vigorous digestion using nitric and hydrochloric acids (section 4.1.4) is preferred; however, the analyst should be cautioned that this mild digestion may not suffice for all sample types. Particularly, if a colorimetric procedure is to be employed, it is necessary to ensure that all organo-metallic bonds be broken so that the metal is in a reactive state. In those situations, the vigorous digestion is to be preferred making certain that at no time does the sample go to dryness. Samples containing large amounts of organic materials would also benefit by this vigorous digestion. Use of the graphite furnace technique, inductively coupled plasma, as well as determinations for certain elements such as arsenic, the noble metals, mercury, selenium, and titanium require a modified digestion and in all cases the method write-up should be consulted for specific instructions and/or cautions.

Note: If the digestion procedure for direct aspiration or graphite furnace atomic absorption analysis included in one of the other approved references is different than the above, the EPA procedure must be used.

Dissolved metals are defined as those constituents which will pass through a 0.45 micron membrane filter. Following filtration of the sample, the referenced procedure for total metals must be followed. Sample digestion of the filtrate for dissolved metals, or digestion of the original sample solution for total metals may be omitted for AA (direct aspiration or graphite furnace) and ICP analyses provided the sample has a low COD and the filtrate meets the following criteria:

(a) Is visibly transparent

(b) Has no perceptible odor, and

(c) Is free of particulate or suspended matter following acidification.

[4] The full text of Method 200.7, "Inductively Coupled Plasma Atomic Emission Spectrometric Method for Trace Element Analysis of Water and Wastes," is given at Appendix C of this Part 136.

[5] Manual distillation is not required if comparability data on representative effluent samples are on company file to show that this preliminary distillation step is not necessary; however, manual distillation will be required to resolve any controversies.

[6] Ammonia, Automated Electrode Method, Industrial Method Number 379–75WE, dated February 19, 1976, Technicon AutoAnalyzer II, Technicon Industrial Systems, Tarrytown, New York 10591.

[7] Carbonaceous biochemical oxygen demand ($CBOD_5$) must not be confused with the traditional BOD_5 test which measures "total BOD". The addition of the nitrification inhibitor is not a procedural option, but must be included to report the $CBOD_5$ parameter. A discharger whose permit requires reporting the traditional BOD_5 may not use a nitrification inhibitor in the procedure for reporting the results. Only when a discharger's permit specifically states $CBOD_5$ is required can the permittee report data obtained using the nitrification inhibitor.

[8] American National Standard on Photographic Processing Effluents, Apr. 2, 1975. Available from ANSI, 1430 Broadway, New York, NY 10018.

[9] The use of normal and differential pulse voltage ramps to increase sensitivity and resolution is acceptable.

[10] Chemical Oxygen Demand, Method 8000, Hach Handbook of Water Analysis, 1979, Hach Chemical Company, P.O. Box 389, Loveland, Colorado 80537.

[11] COD Method, Oceanography International Corporation, 512 West Loop, P.O. Box 2980, College Station, Texas 77840.

[12] The back titration method will be used to resolve controversy.

[13] National Council of the Paper Industry for Air and Stream Improvement, Inc., Technical Bulletin 253, December 1971.

[14] Copper, Bicinchoninate Method, Method 8506, Hach Handbook of Water Analysis, 1979, Hach Chemical Company, P.O. Box 389, Loveland, Colorado 80537.

[15] After the manual distillation is completed, the auto-analyzer manifolds in EPA Methods 335.03 (Cyanide) or 420.2 (phenols) are simplified by connecting the re-sample line directly to the sampler. When using the manifold setup shown in Method 335, the buffer 6.2 should be replaced with the buffer 7.6 found in Method 335.2.

[16] Hydrogen Ion (pH) Automated Electrode Method, Industrial Method Number 378–75WA, October 1976, Technicon AutoAnalyzer II, Technicon Industrial Systems, Tarrytown, New York 10591.

[17] Iron, 1,10-Phenanthroline Method, Method 8008, 1980, Hach Chemical Company, P.O. Box 389, Loveland, Colorado 80537.

[18] Manganese, Periodate Oxidation Method, Method 8034, Hach Handbook of Wastewater Analysis, 1979, pages 2-113 and 2-117, Hach Chemical Company, Loveland, Colorado 80537.

[19] Nitrogen, Nitrite, Method 8507, Hach Chemical Company, P.O. Box 389, Loveland, Colorado 80537.

[20] Goerlitz, D., Brown, E., "Methods for Analysis of Organic Substances in Water," U.S. Geological Survey, Techniques of Water-Resources Investigations, Book 5, Chapter A3, p.4 (1972).

Table 1C. *List of approved test procedures for organic compounds*

Parameter[1]	EPA Method Number[2]			
	GC	GC/MS	HPLC	Other
1. Acenaphthene	610	625	610	- -
2. Acenaphthalene	610	625	610	- -
3. Acrolein	603	624[4]	- -	- -
4. Acrylonitrile	603	624[4]	- -	- -
5. Anthracene	610	625	610	- -
6. Benzene	602	624	- -	- -
7. Benzidine	- -	625[5]	605	Note 3, p. 1; Note 6, p. S48
8. Benzo(a)anthracene	610	625	610	- -
9. Benzo(a)pyrene	610	625	610	- -
10. Benzo(b)fluoranthene	610	625	610	- -
11. Benzo(ghi)perylene	610	625	610	- -
12. Benzo(k)fluoranthene	610	625	610	- -
13. Benzyl Chloride	- -	- -	- -	Note 3, p. 130; Note 6, p.S102
14. Benzyl Butyl Phthalate	606	625	- -	- -
15. Bis(2-chloroethyl) ether	611	625	- -	- -
16. Bis(2-chloroethoxy) methane	611	625	- -	- -
17. Bis(2-chloroisopropyl) ether	611	625	- -	- -
18. Bis(2-ethylhexyl) phthalate	606	625	- -	- -
19. Bromodichloromethane	601	624	- -	- -
20. Bromoform	601	624	- -	- -
21. Bromoethane	601	624	- -	- -
22. 4-Bromophenylphenyl ether	611	625	- -	- -
23. Carbon tetrachloride	601	624	- -	Note 3, p. 130; Note 6, p.S102
24. 4-Chloro-3-methylphenol	604	625	- -	- -
25. Chlorobenzene	601,602	624	- -	Note 3, p.130; Note 6, p. S102
26. Chloroethane	601	624	- -	- -
27. 2-Chloroethylvinyl ether	601	624	- -	- -
28. Chloroform	601	624	- -	Note 3, p. 130; Note 6, p.S102
29. Chloromethane	601	624	- -	- -
30. 2-Chloronaphthalene	612	625	- -	- -
31. 2-Chlorophenol	604	625	- -	- -
32. 4-Chlorophenylphenyl ether	611	625	- -	- -
33. Chrysene	610	625	610	- -
34. Dibenzo(a,h)anthracene	610	625	610	- -
35. Dibromochloromethane	601	624	- -	- -
36. 1,2-Dichlorobenzene	601, 602, 612	624, 625	- -	- -
37. 1,3-Dichlorobenzene	601, 602, 612	624, 625	- -	- -
38. 1,4-Dichlorobenzene	601, 601, 612	624, 625	- -	- -
39. 3,3'-Dichlorobenzidine	- -	625	605	- -
40. Dichlorodifluoromethane	601	- -	- -	- -
41. 1,1-Dichloroethane	601	624	- -	- -
42. 1,2-Dichloroethane	601	624	- -	- -
43. Dichloroethene	601	624	- -	- -
44. trans-1,2-Dichloroethene	601	624	- -	- -
45. 2,4-Dichlorophenol	604	625	- -	- -
46. 1,2-Dichloropropane	601	624	- -	
47. cis-1,3-Dichloropropene	601	624	- -	- -
48. trans-1,3-Dichoropropene	601	624	- -	- -
49. Diethyl phthalate	606	625	- -	- -
50. 2,4-Dimethylphenol	604	625	- -	- -
51. Dimethyl phthalate	606	625	- -	- -
52. Di-n-butyl phthalate	606	625	- -	- -
53. Di-n-octyl phthalate	606	625	- -	- -
54. 2,4-Dinitrophenol	604	625	- -	- -
55. 2,4-Dinitrotoluene	609	625	- -	- -
56. 2,6-Dinitrotoluene	609	625	- -	- -

Table 1C. *Continued*

Parameter^1	EPA Method Number^2 GC	GC/MS	HPLC	Other
57. Epichlorohydrin	- -	- -	- -	Note 3, p.130; Note 6, p.S102
58. Ethylbenzene	602	624	- -	- -
59. Fluoranthene	610	625	610	- -
60. Fluorene	610	625	610	- -
61. Hexachlorobenzene	612	625	- -	- -
62. Hexachlorobutadiene	612	625	- -	- -
63. Hexachlorocyclopentadiene	612	625^5	- -	- -
64. Hexachloroethane	612	625	- -	- -
65. Ideno(1,2,3-cd)pyrene	610	625	610	- -
66. Isophorone	609	625	- -	- -
67. Methylene chloride	601	624	- -	Note 3, p. 130; Note 6, p.S102
68. 2-Methyl-4,6-dinitrophenol	604	625	- -	- -
69. Naphthalene	610	625	- -	- -
70. Nitrobenzene	609	625	- -	- -
71. 2-Nitrophenol	604	625	- -	- -
72. 4-Nitrophenol	604	625	- -	- -
73. N-Nitrosodimethylamine	607	625^5	- -	- -
74. N-Nitrosodi-n-propylamine	607	625	- -	- -
75. N-Nitrosodiphenylamine	607	625^5	- -	- -
76. PCB-1016	608	625	- -	Note 3, p. 43; Note 6, p. S78
77. PCB-1221	608	625	- -	Note 3, p. 43; Note 6, p. S78
78. PCB-1232	608	625	- -	Note 3, p. 43; Note 6, p.S78
79. PCB-1242	608	625	- -	Note 3, p. 43; Note 6, p. S78
80. PCB-1248	608	625	- -	Note 3, p. 43; Note 6, p. S78
81. PCB-1254	608	625	- -	Note 3, p.43; Note 6, p. S78
82. PCB-1260	608	625	- -	Note 3, p. 43; Note 6, p. S78
83. Pentachlorophenol	604	625	- -	Note 3, p. 140; Note 6, p. S50
84. Phenanthrene	610	625	610	- -
85. Phenol	604	625	- -	- -
86. Pyrene	610	625	610	- -
87. 2,3,7,8-Tetrachloro-dibenzo-p-dioxin	- -	613	- -	- -
88. 1,1,2,2-Tetrachloroethane	601	624	- -	Note 3, p. 130; Note 6, p. S102
89. Tetrachloroethene	601	624	- -	Note 3, p. 130 Note 6, p. S102
90. Toluene	602	624	- -	- -
91. 1,2,4-Trichlorobenzene	612	625	- -	Note 3, p. 130; Note 6, p. S102
92. 1,1,1-Trichloroethane	601	624	- -	- -
93. 1,1,2-Trichloroethane	601	624	- -	Note 3, p. 130; Note 6, p.S102
94. Trichloroethene	601	624	- -	- -
95. Trichlorofluoromethane	601	624	- -	- -
96. 2,4,6-Trichlorophenol	604	625	- -	- -
97. Vinyl Chloride	601	624	- -	- -

Table 1C. *Notes*

[1] *All parameter concentrations are expressed in micrograms per liter (µg/L).*

[2] *"Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater." USEPA. July 1982.*

[3] *"Methods for Benzidine. Chlorinated Organic Compounds. Pentachlorophenol and Pesticides in Water and Wastewater." USEPA. September 1978.*

[4] *Method 624 may be extended to screen samples for acrolein and acrylonitrile. However. when they are known to be present. the preferred method for these two compounds is Method 603.*

[5] *Method 625 may be extended to include benzidine. hexachlorocyclopentadiene. N-nitrosodimethylamine. and N-nitrosodiphenylamine. However. when they are known to be present. Method 605. 612. 607. and 607. respectively. are the preferred methods for these compound.*

[6] *"Selected Analytical Methods Approved and Cited by the United States Environmental Protection Agency." Supplement to the Fifteenth Edition of Standard Methods for the Examination of Water and Wastewater (1981).*

40 C.F.R. Part 136. § 136.3

Table 1D. *List of approved test procedures for pesticides.*[1]

Parameter (µg/L)	Method	EPA[2]	Std. Methods 15th Ed.	ASTM	Other
1. Aldrin	GC	608	509A	D3086	Note 3. p. 7; Note 4. p. 30
	GC/MS	625	----	----	
2. Ametryn	GC	---	----	----	Note 3. p. 83; Note 6. p. S68
3. Aminocarb	TLC	---	----	----	Note 3. p. 94; Note 6. p. S16
4. Atraton	GC	---	----	----	Note 3. p. 83; Note 6. p. S68
5. Atrazine	GC	---	----	----	Note 3. p. 83; Note 6. p. S68
6. Azinphos methyl	gc	---	----	----	Note 3. p. 25; Note 6. p.S51
7. Barban	TLC	---	----	---- ----	znote 3. p. 104; Note 6. p. S64
8. α-BHC	GC	608	509A	D3086	Note 3. p. 7
	GC/MS	625^5	----	----	----
9. β-BHC	GC	608	----	D3086	---
	GC/MS	625	---	----	----
10. δ-BHC	GC	608	----	D3086	----
	GC/MS	625^5	----	----	----
11. δ-BHC (Lindane)	GC	608	509A	D3086	Note 3. p. 7; Note 4. p. 30. Note 6. p. S73
	GC/MS	625	----	----	----
12. Captan	GC	---	509A	----	Note 3. p. 7
13. Carbaryl	TLC	---	----	----	Note 3. p. 94; Note 6. p. S73
14. Carbophenothion	GC	---	----	----	Note 4. p. 30; Note 6. p. S73
15. Chlordane	GC	608	509A	D3086	Note 3. p. 7
	GC/MS	625	----	----	----
16. Chlorpropham	TLC	---	----	----	Note 3. p. 104; Note 6. p.S64
17. .2,4-D	GC	---	509B	----	Note 3. p. 115; Note 4. p. 35
18. 4,4'-DDD	GC	608	509A	D3086	Note 3. p. 7; Note 4. p. 30
	GC/MS	625	----	----	----
19. 4,4'-DDE	GC	608	509A	D3086	Note 3. p. 7; Note 4. p. 30
	GC/MS	625	----	----	----
20. 4,4'-DDT	GC	608	509A	D3086	Note 3. p. 7; Note 4. p. 30
	GC/MS	625	----	----	----
21. Demeton-O	GC	---	----	----	Note 3. p. 25; Note 6. p. S51

Table 1D. *Continued*

Parameter (µg/L)	Method	EPA^1	Std. Methods 15th Ed.	ASTM	Other
22. Demeton-S	GC	---	----	----	Note 3, p. 25; Note 6, p. S51
23. Diazinon	GC	---	----	----	Note 3, p. 25; Note 4, p. 30; Note 6, p. S51
24. Dicamba	GC	---	----	----	Note 3, p. 115
25. Dichlofenthion	GC	---	----	----	Note 4, p. 30; Note 6, p. S73
26. Dichloran	GC	---	509A	----	Note 3, p. 7
27. Dicofol	GC	---	----	D3086	----
28. Dieldrin	GC	608	509A	----	Note 3, p. 7; Note 4, p. 30 Note 6, p. S73
	GC/MS	625	----	----	----
29. Dioxathion	GC	---	----	----	Note 4, p. 30; Note 6, p. S73
30. Disulfoton	GC	---	----	----	Note 3, p. 25; Note 6, p. S51
31. Diuron	TLC	---	----	----	Note 3, p. 104; Note 6, p.S64
32. Endosulfan I	GC	608	509A	D3086	Note 3, p. 7
	GC/MS	625^5	----	----	----
33. Endosulfan II	GC	608	509A	D3086	Note 3, p. 7
	GC/MS	625^5	----	----	----
34. Endosulfan sulfate	GC	608	----	----	----
	GC/MS	625	----	----	----
35. Endrin	GC	608	509A	D3086	Note 3, p. 7; Note 4, p. 30
	GC/MS	625^5	----	----	----
36. Endrin aldehyde	GC	608	----	----	----
	GC/MS	625	----	----	----
37. Ethion	GC	---	----	----	Note 4, p. 30; Note 6, p. S64
38. Fenuron	TLC	---	----	----	Note 3, p. 104; Note 6, p. S64
39. Fenuron-TCA	TLC	---	----	----	Note 3, p. 104; Note 6, p. S64
40. Heptachlor	GC	608	509A	D3086	Note 3, p. 7; Note 4, p. 40
	GC/MS	625	----	----	----
41. Heptachlor epoxide	GC	608	509A	D3086	Note 3, p. 7; Note 4, p. 30; Note 6, p. S73
	GC/MS	625	----	----	----
42. Isodrin	GC	---	----	----	Note 4, p. 30; Note 6, p. S73
43. Linuron	TLC	---	----	----	Note 3, p. 104; Note 6, p. S64
44. Malathion	GC	---	509A	----	Note 3, p. 25; Note 4, p. 30; Note 6, p. S51
45. Methiocarb	TLC	---	----	----	Note 3, p. 94; Note 6, p. S60
46. Methoxychlor	GC	---	509A	D3086	Note 3, p. 7; Note 4, p. 30
47. Mexacarbate	TLC	---	----	----	Note 3, p. 94; Note 6, p. S60
48. Mirex	GC	---	509A	----	Note 3, p. 7
49. Monuron	TLC	---	----	----	Note 3, p. 104; Note 6, p. S64
40. Monuron-TCA	TLC	---	----	----	Note 3, p. 104; Note 6, p. S64

Table 1D. *Continued*

Parameter (µg/L)	Method	EPA[2]	Std. Methods 15th Ed	ASTM	Other
51. Neburon	TLC	---	----	----	Note 3, p. 104; Note 6, p. S64
52. Parathion methyl	GC	---	509A	----	Note 3, p. 25; Note 4, p. 30
53. Parathion ethyl	GC	---	509A	----	Note 3, p. 25
54. PCNB	GC	---	509A	----	Note 3, p. 7
55. Perthane	GC	---	----	D3086	----
56. Prometon	GC	---	----	----	Note 3, p. 83; Note 6, p. S68
57. Prometryn	GC	---	----	----	Note 3, p. 83; Note 6, p. S68
58. Propazine	GC	---	----	----	Note 3, p. 83; Note 6, p. S68
59. Propham	TLC	---	----	----	Note 3, p. 104; Note 6, p. S64
60. Propoxur	TLC	---	----	----	Note 3, p. 94; Note 6, p. S60
61. Secbumeton	TLC	---	----	----	Note 3, p. 83; Note 6, p. S68
62. Siduron	TLC	---	----	----	Note 3, p. 104; Note 6, p. S64
63. Simazine	GC	---	----	----	Note 3, p. 83; Note 6, p. S68
64. Strobane	GC	---	509A	----	Note 3, p. 7
65. Swep	TLC	---	----	----	Note 3, p. 104; Note 6, p. S64
66. 2,4,5-T	GC	---	509B	----	Note 3, p. 115; Note 4, p. 35
67. 2,4,5-tp (Silvex)	GC	---	509B	----	Note 3, p. 83; Note 6, p. S68
68. Terbuthylazine	GC	---	----	----	Note 3, p. 83; Note 6, p. S68
69. Toxaphene	GC	608	509A	D3086	Note 3, p. 7; Note 4, p. 30
	GC/MS	625	----	----	----
70. Trifluralin	GC	---	----	----	Note 3, p. 7

---

[1] Pesticides are listed in this table by common name for the convenience of the reader. Additional pesticides may be found under Table 1C, where entries are listed by chemical name.

[2] "Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater." USEPA, July 1982.

[3] "Methods for Benzidine, Chlorinated Organic Compounds, Pentachlorophenol and Pesticides in Water and Wastewater." USEPA, September 1978.

[4] Methods for Analysis of Organic Substances in Water. U.S. Geological Survey Techniques of Water Resources Inv., Book 5, Ch. A3 (1972), p. 30.

[5] The method may be extended to screen samples for α-BHC, and δ-BHC, endosulfan I, endosulfan II, and endrin. However, when they are known to be present, the referenced gas chromatographic procedures are the preferred methods.

[6] "Selected Analytical Methods Approved and Cited by the United States Environmental Protection Agency," Supplement to the Fifteenth Edition of Standard Methods for the Examination of Water and Wastewater (1981).

TABLE IE.—LIST OF APPROVED RADIOLOGICAL TEST PROCEDURES

Parameter and units	Methods	EPA[1]	Reference (method No. or page)		
			Standard Methods 15th Ed.	ASTM	USGS[2]
1 Alpha-Total, pCi per liter	Proportional or scintillation counter.	900.0	703	D1943-66	pp. 75 and 78.[3]
2 Alpha-Counting error, pCi per liter.	Proportional or scintillation counter.	Appendix B	703	D1943-66	p. 79.
3 Alpha-Counting error, pCi per liter.	Proportional counter	900.0	703	D1890-66	pp. 75 and 78.[3]
4 Beta-Counting error, pCi per liter.	Proportional counter	Appendix B	703	D1890-66	p. 79.
5 (a) Radium-Total, pCi per liter.	Proportional counter	903.0	705	D2460-70	
(b) ^{226}Ra, pCi per liter	Scintillation counter	903.1	706	D3454-79	p. 81.

Table IE Notes

[1] "Prescribed Procedures for Measurement of Radioactivity in Drinking Water," EPA-600/4-80-032 (1980 update), U.S. Environmental Protection Agency, August 1980.

[2] Fishman, M.J. and Brown, Eugene, "Selected Methods of the U.S. Geological Survey of Analysis of Wastewaters," U.S. Geological Survey, Open-File Report 76-177 (1976).

[3] The method found on p. 75 measures only the dissolved portion while the method on p. 78 measures only the suspended portion. Therefore, the two results must be added to obtain the "total."

APPENDIX G

SITE MAINTENANCE INSPECTION CHECKLIST

SITE INSPECTION CHECKLIST

Date:

Inspected By:

	CONDITION: (Check)				
	Acceptable	Not Acceptable	Present	Not Present	REMARKS
1) Vegetative Cover					
a) Landfill Site	___	___			
b) Mining Area	___	___			
c) Drainage Ditches	___	___			
d) Leachate Collection System	___	___			
2) Integrity of Drainage Ditches					
a) sediment build-up	___	___			
b) pooling or ponding	___	___			
c) slope integrity	___	___			
d) overall adequacy	___	___			
e) anti-erosion matting	___	___			
f) lining	___	___			
3) Integrity of Gas Vents	___	___			
4) Condition of Access Road					
a) road condition	___	___			
b) gates/locks	___	___			
5) Integrity of Groundwater Monitoring Wells	___	___			
6) Integrity of Landfill Cap					
a) erosion damage			___	___	
b) leachate breakthrough			___	___	
c) settlement			___	___	
d) cracking			___	___	

SITE INSPECTION CHECKLIST - continued

Date:

Inspected By:

	CONDITION: (Check)				
	Acceptable	Not Acceptable	Present	Not Present	REMARKS
7) Leachate Collection System					
a) flow in pipe	—	—			
b) sediment in pipe			—	—	
c) storage tank - structural integrity	—	—			
d) high water level in leachate storage tank			—	—	
8) Other (e.g. litter, unauthorized dumping, etc.					

MAINTENANCE SCHEDULE

Date:

MAINTENANCE PERFORMED (check)	ITEM	REMARKS
___	1) Vegetative Cover:	
___	a) seeding	
___	b) fertilizing	
___	c) topsoil replaced	
___	d) removal of undesirable vegetation	
	2) Drainage Ditches:	
___	a) excavation	
___	b) landfill cap replacement	
___	c) fill	
___	d) regrading	
___	e) vegetative cover placement	
___	f) stone lining replacement	
___	g) anti-erosion matting replacement	
	3) Leachate Collection System	
___	a) collection pipe flushing	
___	b) sediment removal	
	c) repair/replacement:	
___	i) collection piping	
___	ii) excavation	
___	iii) gravel backfill	
___	iv) non-woven filter fabric	
___	v) fill/cover	
___	vi) vegetative cover	
___	vii) storage tank	
	4) Access Road	
___	a) fill	
___	b) grading	
	c) Repair/Replacement:	
___	i) gate	
___	ii) locks	
___	iii) signs	

MAINTENANCE SCHEDULE - continued

Date:

MAINTENANCE PERFORMED (check)	ITEM	REMARKS
	5) Repair/Replacement:	
	a) Gas Vents	
___	i) excavation	
___	ii) gravel fill	
___	iii) vent pipe	
___	iv) screen	
___	v) cover	
___	vi) vegetative cover	
	b) Landfill Cap	
___	i) excavation	
___	ii) cover	
___	iii) compaction	
___	iv) testing	
___	v) grading	
___	vi) vegetative cover	
	c) Groundwater Monitoring Wells	
___	i) drilling	
___	ii) screening	
___	iii) casing	
___	iv) pipe	
___	v) fill/grout	
___	vi) cap	

APPENDIX H

DRAINAGE DITCH DESIGN CALCULATIONS

MALCOLM PIRNIE

MALCOLM PIRNIE, INC.

BY BTH DATE 8-1-88 SHEET NO. 1 OF

CHKD. BY KRM DATE 8-22-88 JOB NO. 0348-10-1

SUBJECT LTY STEEL - MISC DEBRIS/FINE REFUSE AR

DRAINAGE DITCH DESIGN

REFERENCE - "Storm Drainage Design Manual"

Erie and Niagara Counties Regional Planning Board

A. MAXIMUM RATE OF RUNOFF (AREA SOUTH WEST OF MARILLA ST)

RATIONAL METHOD : $Q = CIA$

C, RUNOFF COEFFICIENT - FROM EXHIBIT III - 2 :

SOIL GROUP D, SLOPE 6%$^+$ AND OPEN SPACE

$C = 0.39$

TIME OF CONCENTRATION

DISTANCE = 2305 ft (D)

SLOPE = 0.5% (S)

USING EXHIBIT III - 3,

$$T_c = \frac{1.8(1.1 - C) D^{\frac{1}{2}}}{S^{1/3}}$$

WHERE T_c IS THE TIME OF CONCENTRATION

$$T_c = \frac{1.8(1.1 - 0.39)(2305)^{\frac{1}{2}}}{.5^{1/3}}$$

T_c = 77.3 minutes

RAINFALL INTENSITY:

PART 360 REGULATIONS DICTATE A 25 YEAR, 24 HOUR STORM

FROM EXHIBIT III-6 AND USING 77 MINUTES FOR RAINFALL DURATION:

i = 1.75 INCHES PER HOUR

MALCOLM PIRNIE

MALCOLM PIRNIE, INC.

BY BJH DATE 8-1-88 SHEET NO. 2 OF

CHKD. BY KRm DATE 8-22-88 JOB NO. 0848-10-1

SUBJECT LTV STEEL – MISC DEBRIS/FINE REFUSE AR

AREA:

ASSUME FOR DESIGN PURPOSES THAT THE ENTIRE LANDFILL AREA (IE. SOUTH WEST OF MARILLA STREET) CONTRIBUTES TO ONE DITCH.

$$\text{AREA} = \frac{1660+1020}{2}(1010) + \frac{1155-465}{2}(360) = 1{,}645{,}000 \text{ ft}^2$$

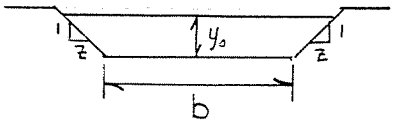
AREA = 37.8 ACRES

PEAK RUNOFF FLOW RATE:

$$Q = C\,i\,A = (0.39)(1.75 \text{ INCHES/HOUR})(37.8 \text{ ACRES}) = 26.0 \text{ cfs}$$

B. NORMAL DEPTH

CHANNEL CROSS-SECTION:



z = 1

b = 2 ft

slope = 0.005 ft/ft

CHANNEL "FRICTION", n = 0.027 (GRASS-LINED) FROM TABLE 5-6

USING MANNING'S EQUATION: $Q = \frac{1.49}{n} AR^{2/3} S_o^{1/2}$

.375

$$Qn/b^{8/3} S_o^{1/2} = (26.0 \text{ cfs})(0.027)/(2^{8/3}\ 0.005^{1/2}) = 1.56$$

USING EXHIBIT Y-1,

$$y_0/b = 0.90$$

$$y_0 = 0.90(2) = 1.80 \text{ ft} = 21.6''$$

∴ 3 ft DEPTH IN DITCH IS OKAY

MALCOLM PIRNIE

MALCOLM PIRNIE, INC.

BY BJH DATE 8-1-88 SHEET NO. 3 OF

CHKD. BY KEM DATE 8-22-88 JOB NO. 0848-10-1

SUBJECT LTV STEEL - MISC DEBRIS / FINE REFUSE

DRAINAGE DITCH DESIGN (CON'T)

A. MAXIMUM RATE OF RUNOFF (AREA NORTH OF MARILLA ST)

RATIONAL METHOD: $Q = CiA$

C, RUNOFF COEFFICIENT - FROM EXHIBIT III-2

SOIL GROUP D, SLOPE 6%+ AND OPEN SPACE

$C = 0.39$

TIME OF CONCENTRATION

DISTANCE = 1910 (D)
SLOPE = 0.5% (S)

USING EXHIBIT III-3,

$$T_c = \frac{1.8(1.1 - C)\,D^{1/2}}{S^{1/3}}$$

WHERE T_c IS THE TIME OF CONCENTRATION

$$T_c = \frac{1.8(1.1-0.39)(1910)^{1/2}}{.5^{1/3}}$$

$T_c = 32.7$ minutes

RAINFALL INTENSITY:

PART 360 REGULATIONS DICTATE A 25 YEAR, 24 HOUR STORM

FROM EXHIBIT III-6 AND USING 32.7 MINUTES FOR RAINFALL DURATION:

$i = 3.7$ INCHES PER HOUR

BY BJH DATE 8-1-88 SHEET NO. 4 OF

CHKD. BY KEM DATE 8-22-88 JOB NO. 0343-12-1

SUBJECT LTV STEEL MISC DEBRIS/FINE REFUSE AREA

AREA :

ASSUME FOR DESIGN PURPOSES THAT THE ENTIRE LANDFILL AREA (ie. NORTH OF MARILLA STREET) CONTRIBUTES TO ONE DITCH

$$\text{AREA} = \frac{1}{2}(1910)(700) = 668500 \text{ ft}^2$$

AREA = 15.3 ACRES

PEAK RUNOFF FLOWRATE :

$$Q = CiA = (0.39)\left(3.7 \,{}^{\text{INCHES}}\!/_{\text{HOUR}}\right)(15.3 \text{ ACRES}) = 22.3 \text{ cfs}$$

B. NORMAL DEPTH

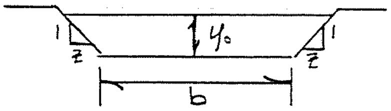
CHANNEL CROSS-SECTION :

$z = 1$

$b = 2$ ft

slope = 0.005 ft/ft

CHANNEL "FRICTION", $n = 0.027$ (GRASS-LINED) FROM TABLE 5-6



USING MANNING'S EQUATION :

$$Q = \frac{1.49}{n} A R^{2/3} S_o^{1/2}$$

$$Qn / b^{8/3} S_o^{1/2} = (22.3)(0.027) / (2^{8/3}\, 0.005^{1/2}) = 1.34$$

USING EXHIBIT V-1,

$$y_o/b = 0.83$$

$$y_o = 0.83(2) = 1.66 \text{ ft} = 19.92''$$

∴ 3 ft DEPTH IN DITCH IS OKAY

EXHIBIT III-2

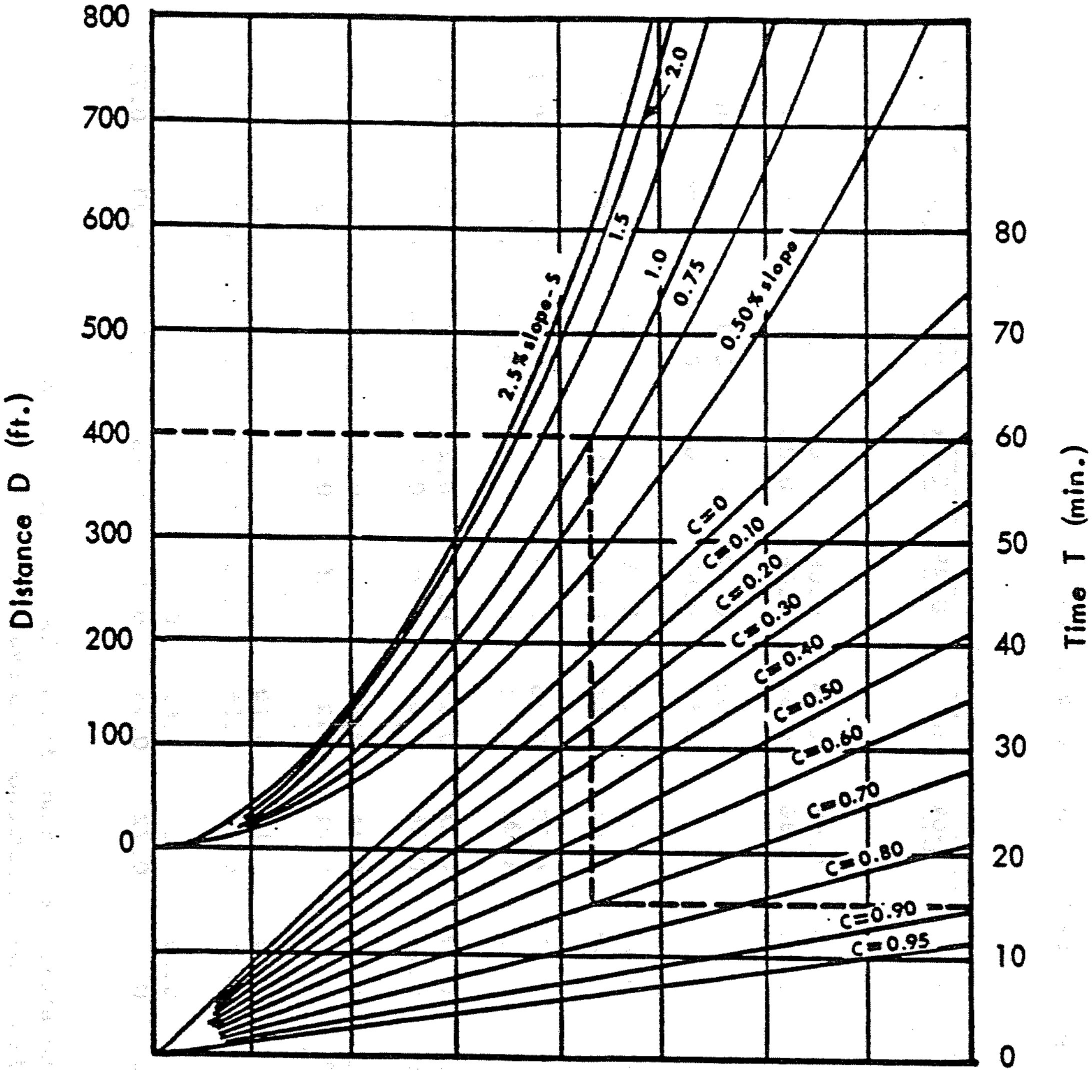
RUNOFF COEFFICIENTS
FOR USE IN THE RATIONAL FORMULA

Hydrologic Soil Group	A			B			C			D		
Slope Range	0-2%	2-6%	6%+	0-2%	2-6%	6%+	0-2%	2-6%	6%+	0-2%	2-6%	6%+
LAND USE												
Industrial	0.67[1]	0.68	0.68	0.68	0.68	0.69	0.68	0.69	0.69	0.69	0.69	0.70
	0.85[2]	0.85	0.86	0.85	0.86	0.86	0.86	0.86	0.87	0.86	0.86	0.88
Commercial	0.71	0.71	0.72	0.71	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72
	0.88	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.90	0.89	0.89	0.90
High Density[3] Residential	0.47	0.49	0.50	0.48	0.50	0.52	0.49	0.51	0.54	0.51	0.53	0.56
	0.58	0.60	0.61	0.59	0.61	0.64	0.60	0.62	0.66	0.62	0.64	0.69
Medium Density[4] Residential	0.25	0.28	0.31	0.27	0.30	0.35	0.30	0.33	0.38	0.33	0.36	0.42
	0.33	0.37	0.40	0.35	0.39	0.44	0.38	0.42	0.49	0.41	0.45	0.54
Low Density[5] Residential	0.14	0.19	0.22	0.17	0.21	0.26	0.20	0.25	0.31	0.24	0.28	0.35
	0.22	0.26	0.29	0.24	0.28	0.34	0.28	0.32	0.40	0.31	0.35	0.46
Agricultural	0.08	0.13	0.16	0.11	0.15	0.21	0.14	0.19	0.26	0.18	0.23	0.31
	0.14	0.18	0.22	0.16	0.21	0.28	0.20	0.25	0.34	0.24	0.29	0.41
Open Space	0.05	0.10	0.14	0.08	0.13	0.19	0.12	0.17	0.24	0.16	0.21	0.28
	0.11	0.16	0.20	0.14	0.19	0.26	0.18	0.23	0.32	0.22	0.27	0.39
Freeways and Expressways	0.57	0.59	0.60	0.58	0.60	0.61	0.59	0.61	0.63	0.60	0.62	0.64
	0.70	0.71	0.72	0.71	0.72	0.74	0.72	0.73	0.76	0.73	0.75	0.78

1/ Lower runoff coefficients for use with storm recurrence intervals less than 25 years.
2/ Higher runoff coefficients for use with storm recurrence intervals of 25-years or more.
3/ High Density Residential - greater than 15 dwelling units per acre
4/ Medium Density Residential - 4 to 15 dwelling units per acre
5/ Low Density Residential - 1 to 4 dwelling units per acre

EXHIBIT III - 3

OVERLAND TIME OF FLOW



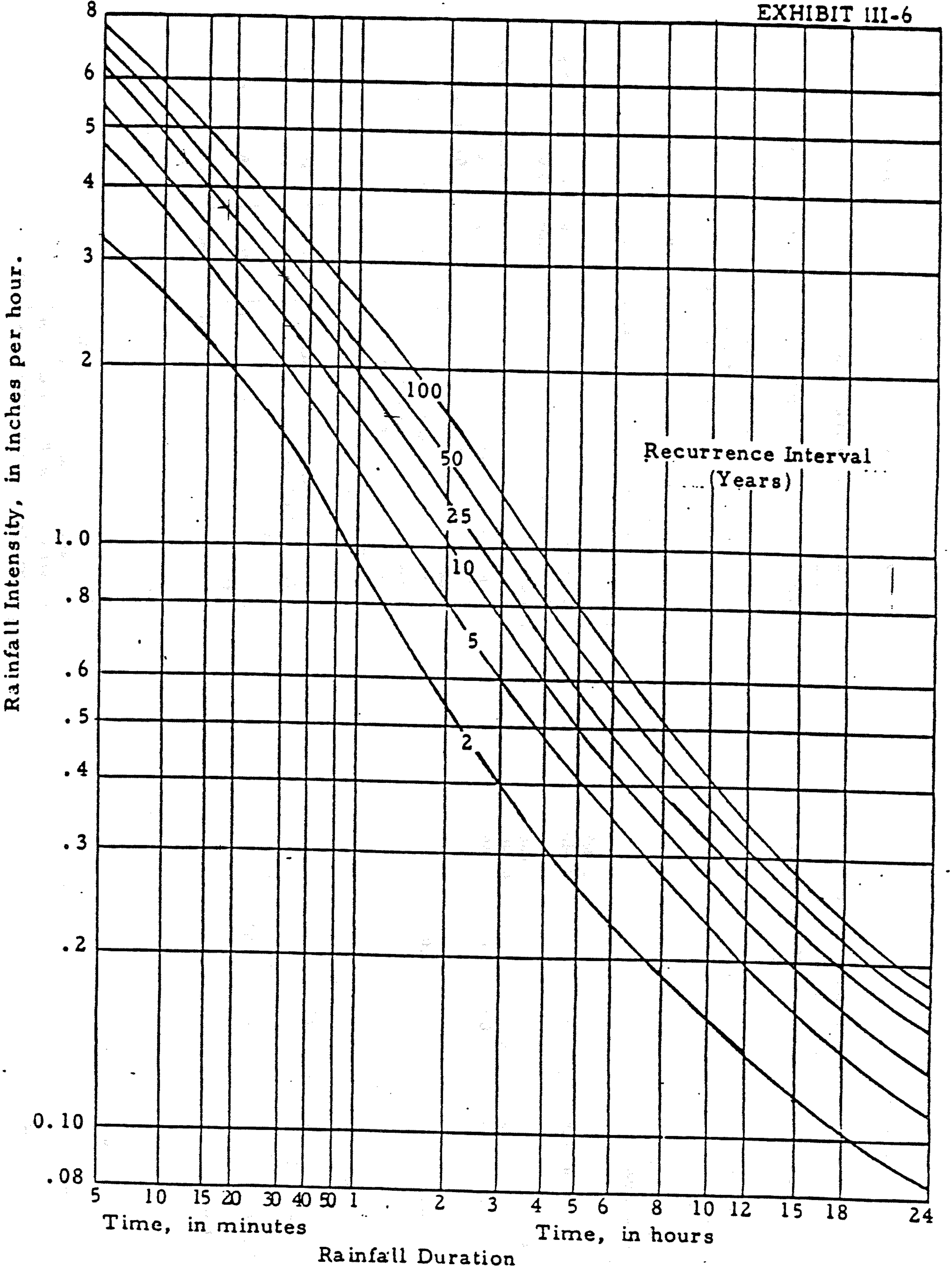
SOURCE: Airport Drainage Federal Aviation Agency
Department of Transportation Circular-AC 150-5320-5B
Washington, D.C., 1970

Where: T = time - minutes
D = distance - feet
S = slope - percentage
C = runoff coefficient

$$T = \frac{1.8\,(1.1-C)\,D^{1/2}}{S^{1/3}}$$

The printing of this report was financially aided through a federal grant from the Department of Housing and Urban Development under the Comprehensive Planning Assistance Program authorized by Section 701 of the Federal Housing Act of 1954, as amended. This report was printed under the Comprehensive Planning Assistance Program for the New York State Department of State. It was financed in part by the State of New York and Erie and Niagara Counties.

EXHIBIT III-6



ERIE AND NIAGARA COUNTIES
REGIONAL PLANNING BOARD

REGIONAL STORM-SURFACE WATER
DRAINAGE MANAGEMENT STUDY

RAINFALL INTENSITY-DURATION-FREQUENCY, BUFFALO, NEW YORK

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Source: U.S. Weather Bureau

HARZA ENGINEERING COMPANY, APRIL 1972

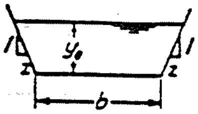
ATTACHMENT NO. 6

TABLE 5-6. VALUES OF THE ROUGHNESS COEFFICIENT *n* (*continued*)

Type of channel and description	Minimum	Normal	Maximum
C. EXCAVATED OR DREDGED			
a. Earth, straight and uniform			
1. Clean, recently completed	0.016	0.018	0.020
2. Clean, after weathering	0.018	0.022	0.025
3. Gravel, uniform section, clean	0.022	0.025	0.030
4. With short grass, few weeds	0.022	0.027	0.033
b. Earth, winding and sluggish			
1. No vegetation	0.023	0.025	0.030
2. Grass, some weeds	0.025	0.030	0.033
3. Dense weeds or aquatic plants in deep channels	0.030	0.035	0.040
4. Earth bottom and rubble sides	0.028	0.030	0.035
5. Stony bottom and weedy banks	0.025	0.035	0.040
6. Cobble bottom and clean sides	0.030	0.040	0.050
c. Dragline-excavated or dredged			
1. No vegetation	0.025	0.028	0.033
2. Light brush on banks	0.035	0.050	0.060
d. Rock cuts			
1. Smooth and uniform	0.025	0.035	0.040
2. Jagged and irregular	0.035	0.040	0.050
e. Channels not maintained, weeds and brush uncut			
1. Dense weeds, high as flow depth	0.050	0.080	0.120
2. Clean bottom, brush on sides	0.040	0.050	0.080
3. Same, highest stage of flow	0.045	0.070	0.110
4. Dense brush, high stage	0.080	0.100	0.140
D. NATURAL STREAMS			
D-1. Minor streams (top width at flood stage <100 ft)			
a. Streams on plain			
1. Clean, straight, full stage, no rifts or deep pools	0.025	0.030	0.033
2. Same as above, but more stones and weeds	0.030	0.035	0.040
3. Clean, winding, some pools and shoals	0.033	0.040	0.045
4. Same as above, but some weeds and stones	0.035	0.045	0.050
5. Same as above, lower stages, more ineffective slopes and sections	0.040	0.048	0.055
6. Same as 4, but more stones	0.045	0.050	0.060
7. Sluggish reaches, weedy, deep pools	0.050	0.070	0.080
8. Very weedy reaches, deep pools, or floodways with heavy stand of timber and underbrush	0.075	0.100	0.150
b. Mountain streams, no vegetation in channel, banks usually steep, trees and brush along banks submerged at high stages			
1. Bottom: gravels, cobbles, and few boulders	0.030	0.040	0.050
2. Bottom: cobbles with large boulders	0.040	0.050	0.070
D-2. Flood plains			
a. Pasture, no brush			
1. Short grass	0.025	0.030	0.035
2. High grass	0.030	0.035	0.050
b. Cultivated areas			
1. No crop	0.020	0.030	0.040
2. Mature row crops	0.025	0.035	0.045
3. Mature field crops	0.030	0.040	0.050
c. Brush			
1. Scattered brush, heavy weeds	0.035	0.050	0.070
2. Light brush and trees, in winter	0.035	0.050	0.060
3. Light brush and trees, in summer	0.040	0.060	0.080
4. Medium to dense brush, in winter	0.045	0.070	0.110
5. Medium to dense brush, in summer	0.070	0.100	0.160
d. Trees			
1. Dense willows, summer, straight	0.110	0.150	0.200
2. Cleared land with tree stumps, no sprouts	0.030	0.040	0.050
3. Same as above, but with heavy growth of sprouts	0.050	0.060	0.080
4. Heavy stand of timber, a few down trees, little undergrowth, flood stage below branches	0.080	0.100	0.120
5. Same as above, but with flood stage reaching branches	0.100	0.120	0.160
D-3. Major streams (top width at flood stage >100 ft). The *n* value is less than that for minor streams of similar description, because banks offer less effective resistance.			
a. Regular section with no boulders or brush	0.025	.....	0.060
b. Irregular and rough section	0.035	.....	0.100

EXHIBIT Ⅴ-1

UNIFORM FLOW IN TRAPEZOIDAL CHANNELS BY MANNING FORMULA



$\frac{y_0}{b}$	Values of $\frac{Qn}{b^{8/3}S_0^{1/2}}$										
	z = 0	z = $\frac{1}{4}$	z = $\frac{1}{2}$	z = $\frac{3}{4}$	z = 1	z = $1\frac{1}{4}$	z = $1\frac{1}{2}$	z = 2	z = $2\frac{1}{2}$	z = 3	z = 4
0.02	0.00213	0.00215	0.00216	0.00217	0.00218	0.00219	0.00220	0.00221	0.00222	0.00223	0.00225
0.03	0.00414	0.00419	0.00423	0.00426	0.00429	0.00431	0.00433	0.00437	0.00440	0.00443	0.00449
0.04	0.00661	0.00670	0.00679	0.00685	0.00690	0.00696	0.00700	0.00707	0.00715	0.00722	0.00735
0.05	0.00947	0.00964	0.00980	0.00991	0.0100	0.0101	0.0102	0.0103	0.0104	0.0106	0.0109
0.06	0.0127	0.0130	0.0132	0.0134	0.0136	0.0137	0.0138	0.0141	0.0143	0.0145	0.0149
0.07	0.0162	0.0166	0.0170	0.0173	0.0176	0.0177	0.0180	0.0183	0.0186	0.0190	0.0196
0.08	0.0200	0.0206	0.0211	0.0215	0.0219	0.0222	0.0225	0.0231	0.0235	0.0240	0.0250
0.09	0.0240	0.0249	0.0256	0.0262	0.0267	0.0271	0.0275	0.0282	0.0289	0.0296	0.0310
0.10	0.0283	0.0294	0.0305	0.0311	0.0318	0.0324	0.0329	0.0339	0.0348	0.0358	0.0375
0.11	0.0329	0.0342	0.0354	0.0364	0.0373	0.0380	0.0387	0.0400	0.0413	0.0424	0.0448
0.12	0.0376	0.0393	0.0408	0.0420	0.0431	0.0441	0.0450	0.0466	0.0482	0.0497	0.0527
0.13	0.0425	0.0446	0.0464	0.0480	0.0493	0.0505	0.0516	0.0537	0.0556	0.0575	0.0613
0.14	0.0476	0.0501	0.0524	0.0542	0.0559	0.0573	0.0587	0.0612	0.0636	0.0659	0.0705
0.15	0.0528	0.0559	0.0585	0.0608	0.0628	0.0645	0.0662	0.0692	0.0721	0.0749	0.0805
0.16	0.0582	0.0619	0.0650	0.0676	0.0699	0.0720	0.0740	0.0776	0.0811	0.0845	0.0912
0.17	0.0638	0.0680	0.0717	0.0748	0.0775	0.0800	0.0823	0.0867	0.0907	0.0947	0.103
0.18	0.0695	0.0744	0.0786	0.0822	0.0854	0.0883	0.0910	0.0961	0.101	0.105	0.115
0.19	0.0753	0.0809	0.0857	0.0900	0.0936	0.0970	0.100	0.106	0.112	0.117	0.128
0.20	0.0813	0.0875	0.0932	0.0979	0.102	0.106	0.110	0.116	0.123	0.129	0.141
0.21	0.0873	0.0944	0.101	0.106	0.111	0.115	0.120	0.127	0.134	0.142	0.156
0.22	0.0935	0.101	0.109	0.115	0.120	0.125	0.130	0.139	0.147	0.155	0.171
0.23	0.0997	0.109	0.117	0.124	0.130	0.135	0.141	0.151	0.160	0.169	0.187
0.24	0.106	0.116	0.125	0.133	0.139	0.146	0.152	0.163	0.173	0.184	0.204
0.25	0.113	0.124	0.133	0.142	0.150	0.157	0.163	0.176	0.187	0.199	0.222
0.26	0.119	0.131	0.142	0.152	0.160	0.168	0.175	0.189	0.202	0.215	0.241
0.27	0.126	0.139	0.151	0.162	0.171	0.180	0.188	0.203	0.218	0.232	0.260
0.28	0.133	0.147	0.160	0.172	0.182	0.192	0.201	0.217	0.234	0.249	0.281
0.29	0.139	0.155	0.170	0.182	0.193	0.204	0.214	0.232	0.250	0.267	0.302
0.30	0.146	0.163	0.179	0.193	0.205	0.217	0.227	0.248	0.267	0.286	0.324
0.31	0.153	0.172	0.189	0.204	0.217	0.230	0.242	0.264	0.285	0.306	0.347
0.32	0.160	0.180	0.199	0.215	0.230	0.243	0.256	0.281	0.304	0.327	0.371
0.33	0.167	0.189	0.209	0.227	0.243	0.257	0.271	0.298	0.323	0.348	0.396
0.34	0.174	0.198	0.219	0.238	0.256	0.272	0.287	0.315	0.343	0.369	0.422
0.35	0.181	0.207	0.230	0.251	0.270	0.287	0.303	0.334	0.363	0.392	0.450
0.36	0.190	0.216	0.241	0.263	0.283	0.302	0.319	0.353	0.384	0.416	0.477
0.37	0.196	0.225	0.251	0.275	0.297	0.317	0.336	0.372	0.406	0.440	0.507
0.38	0.203	0.234	0.263	0.289	0.311	0.333	0.354	0.392	0.429	0.465	0.536
0.39	0.210	0.244	0.274	0.301	0.326	0.349	0.371	0.412	0.452	0.491	0.568
0.40	0.218	0.254	0.286	0.314	0.341	0.366	0.389	0.433	0.476	0.518	0.600
0.41	0.225	0.263	0.297	0.328	0.357	0.383	0.408	0.455	0.501	0.545	0.634
0.42	0.233	0.279	0.310	0.342	0.373	0.401	0.427	0.478	0.526	0.574	0.668
0.43	0.241	0.282	0.321	0.356	0.389	0.418	0.447	0.501	0.553	0.604	0.703
0.44	0.249	0.292	0.334	0.371	0.405	0.437	0.467	0.524	0.579	0.634	0.739
0.45	0.256	0.303	0.346	0.385	0.422	0.455	0.487	0.548	0.607	0.665	0.778
0.46	0.263	0.313	0.359	0.401	0.439	0.475	0.509	0.574	0.635	0.696	0.816
0.47	0.271	0.323	0.371	0.417	0.457	0.494	0.530	0.600	0.665	0.729	0.856
0.48	0.279	0.333	0.384	0.432	0.475	0.514	0.552	0.626	0.695	0.763	0.897
0.49	0.287	0.345	0.398	0.448	0.492	0.534	0.575	0.652	0.725	0.797	0.939
0.50	0.295	0.356	0.411	0.463	0.512	0.556	0.599	0.679	0.755	0.833	0.983
0.52	0.310	0.377	0.435	0.496	0.548	0.599	0.646	0.735	0.820	0.906	1.07
0.54	0.327	0.398	0.468	0.530	0.590	0.644	0.696	0.795	0.891	0.984	1.17
0.56	0.343	0.421	0.496	0.567	0.631	0.690	0.748	0.856	0.963	1.07	1.27
0.58	0.359	0.444	0.526	0.601	0.671	0.739	0.802	0.922	1.04	1.15	1.37
0.60	0.375	0.468	0.556	0.640	0.717	0.789	0.858	0.988	1.12	1.24	1.49
0.62	0.391	0.492	0.590	0.679	0.763	0.841	0.917	1.06	1.20	1.33	1.60
0.64	0.408	0.516	0.620	0.718	0.809	0.894	0.976	1.13	1.28	1.43	1.72

Source :"Engineering Hydraulics", H. Rouse

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ERIE AND NIAGARA COUNTIES
REGIONAL PLANNING BOARD

REGIONAL STORM-SURFACE WATER
DRAINAGE MANAGEMENT STUDY

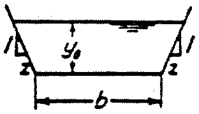
NORMAL DEPTH FOR UNIFORM FLOW

$$\frac{Y_0}{b} = 0.02 \text{ to } 0.64$$

EXHIBIT V - 2

UNIFORM FLOW IN TRAPEZOIDAL CHANNELS BY MANNING FORMULA

Values of $\frac{Qn}{b^{8/3}S_0^{1/2}}$



$\frac{y_0}{b}$	z = 0	z = ¼	z = ½	z = ¾	z = 1	z = 1¼	z = 1½	z = 2	z = 2½	z = 3	z = 4
0.66	0.424	0.541	0.653	0.759	0.858	0.951	1.04	1.21	1.37	1.53	1.85
0.68	0.441	0.566	0.687	0.801	0.908	1.01	1.10	1.29	1.47	1.64	1.98
0.70	0.457	0.591	0.722	0.842	0.958	1.07	1.17	1.37	1.56	1.75	2.12
0.72	0.474	0.617	0.757	0.887	1.01	1.13	1.24	1.45	1.66	1.87	2.27
0.74	0.491	0.644	0.793	0.932	1.07	1.19	1.31	1.55	1.77	1.98	2.41
0.76	0.508	0.670	0.830	0.981	1.12	1.26	1.39	1.64	1.88	2.11	2.57
0.78	0.525	0.698	0.868	1.03	1.18	1.32	1.46	1.73	1.98	2.24	2.73
0.80	0.542	0.725	0.906	1.08	1.24	1.40	1.54	1.83	2.10	2.37	2.90
0.82	0.559	0.753	0.945	1.13	1.30	1.47	1.63	1.93	2.22	2.51	3.07
0.84	0.576	0.782	0.985	1.18	1.36	1.54	1.71	2.03	2.34	2.65	3.25
0.86	0.593	0.810	1.03	1.23	1.43	1.61	1.79	2.14	2.47	2.80	3.44
0.88	0.610	0.839	1.07	1.29	1.49	1.69	1.88	2.25	2.60	2.95	3.63
0.90	0.627	0.871	1.11	1.34	1.56	1.77	1.98	2.36	2.74	3.11	3.83
0.92	0.645	0.898	1.15	1.40	1.63	1 86	2.07	2.48	2.88	3.27	4.04
0.94	0.662	0.928	1.20	1.46	1.70	1.94	2.16	2.60	3.03	3.43	4.25
0.96	0.680	0.960	1.25	1.52	1.78	2.03	2.27	2.73	3.17	3.61	4.48
0.98	0.697	0.991	1.29	1.58	1.85	2.11	2.37	2.85	3.33	3.79	4.70
1.00	0.714	1.02	1.33	1.64	1.93	2.21	2.47	2.99	3.48	3.97	4.93
1.05	0.759	1.10	1.46	1.80	2.13	2.44	2.75	3.33	3.90	4.45	5.55
1.10	0.802	1.19	1.58	1.97	2.34	2.69	3.04	3.70	4.34	4.96	6.21
1.15	0.846	1.27	1.71	2.14	2.56	2.96	3.34	4.09	4.82	5.52	6.91
1.20	0.891	1.36	1.85	2.33	2.79	3.24	3.68	4.50	5.32	6.11	7.68
1.25	0.936	1.45	1.99	2.52	3.04	3.54	4.03	4.95	5.86	6.73	8.48
1.30	0.980	1.54	2.14	2.73	3.30	3.85	4.39	5.42	6.42	7.39	9.34
1.35	1.02	1.64	2.29	2.94	3.57	4.18	4.76	5.90	7.01	8.10	10.2
1.40	1.07	1.74	2.45	3.16	3.85	4.52	5.18	6.43	7.65	8.83	11.2
1.45	1.11	1.84	2.61	3.39	4.15	4.88	5.60	6.98	8.30	9.62	12.2
1.50	1.16	1.94	2.78	3.63	4.46	5.26	6.04	7.55	9.02	10.4	13.3
1.55	1.20	2.05	2.96	3.88	4.78	5.65	6.50	8.14	9.74	11.3	14.4
1.60	1.25	2.15	3.14	4.14	5.12	6.06	6.99	8.79	10.5	12.2	15.6
1.65	1.30	2.27	3.33	4.41	5.47	6.49	7.50	9.42	11.3	13.2	16.8
1.70	1.34	2.38	3.52	4.69	5.83	6.94	8.02	10.1	12.2	14.2	18.1
1.75	1.39	2.50	3.73	4.98	6.21	7.41	8.57	10.9	13.0	15.2	19.5
1.80	1.43	2.62	3.93	5.28	6.60	7.89	9.13	11.6	14.0	16.3	20.9
1.85	1.48	2.74	4.15	5.59	7.01	8.40	9.75	12.4	15.0	17.4	22.4
1.90	1.52	2.86	4.36	5.91	7.43	8.91	10.4	13.2	15.9	18.7	24.0
1.95	1.57	2.99	4.59	6.24	7.87	9.46	11.0	14.0	17.0	19.9	25.6
2.00	1.61	3.12	4.83	6.58	8.32	10.0	11.7	14.9	18.0	21.1	27.2
2.10	1.71	3.39	5.31	7.30	9.27	11.2	13.1	16.8	20.3	23.9	30.8
2.20	1.79	3.67	5.82	8.06	10.3	12.5	14.6	18.7	22.8	26.8	34.7
2.30	1.89	3.96	6.36	8.86	11.3	13.8	16.2	20.9	25.4	30.0	38.8
2.40	1.98	4.26	6.93	9.72	12.5	15.3	17.9	23.1	28.3	33.4	43.3
2.50	2.07	4.58	7.52	10.6	13.7	16.8	19.8	25.6	31.3	37.0	48.0
2.60	2.16	4.90	8.14	11.6	15.0	18.4	21.7	28.2	34.5	40.8	53.0
2.70	2.26	5.24	8.80	12.6	16.3	20.1	23.8	31.0	37.9	44.8	58.4
2.80	2.35	5.59	9.49	13.6	17.8	21.9	25.9	33.8	41.6	49.1	64.0
2.90	2.44	5.95	10.2	14.7	19.3	23.8	28.2	36.9	45.3	53.7	70.1
3.00	2.53	6.33	11.0	15.9	20.9	25.8	30.6	40.1	49.4	58.4	76.4
3.20	2.72	7.12	12.5	18.3	24.2	30.1	35.8	47.1	58.0	68.9	90.3
3.40	2.90	7.97	14.2	21.0	27.9	34.8	41.5	54.6	67.7	80.2	105
3.60	3.09	8.86	16.1	24.0	32.0	39.9	47.8	63.0	78.2	92.8	122
3.80	3.28	9.81	18.1	27.1	36.3	45.5	54.6	72.4	89.6	107	141
4.00	3.46	10.8	20.2	30.5	41.1	51.6	61.9	82.2	102	122	160
4.50	3.92	13.5	26.2	40.1	54.5	68.8	82.9	111	136	164	217
5.00	4.39	16.7	33.1	51.5	70.3	89.2	108	145	181	216	287

Source: "Engineering Hydraulics", H. Rouse

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$\frac{Y_0}{b} = 0.66 \text{ to } 5.00$

HARZA ENGINEERING COMPANY, APRIL 1972