

Comprehensive Coastal Management Plan Update

Palm Beach Island, Florida

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PREFACE

This report has been prepared in two editions: a summary report and a technical report. The former is a synopsis of the full technical report and includes an overview of the detailed findings and recommendations presented in the technical report. The technical report comprises a complete discussion of the proposed Shoreline Management Plan for Palm Beach Island. The report includes chapters discussing specific management initiatives, coastal structures inventories, an Island sediment budget, recommended monitoring plan, regulatory requirements and estimated costs. Additionally, the report includes six appendices and copies of technical peer review comments received on draft versions of the report.

While the summary report will be more convenient to most readers, those individuals with a greater interest in the technical details associated with the recommended management initiatives are directed to the complete technical report with appendices.

TABLE OF CONTENTS

Section		Page
1.0	Introduction	
1.1	Authorization	1-1
1.2	Purpose and Scope of the Comprehensive Coastal Management Plan (CCMP).....	1-1
1.3	Report Organization	1-3
2.0	Physical Features and Management Practices Affecting the Palm Beach Island Shoreline	
2.1	Shoreline Erosion of Palm Beach Island	2-1
2.2	Coastal Structures.....	2-2
2.3	Beach Restoration.....	2-3
2.4	Dune Restoration/Enhancement	2-4
2.5	South Lake Worth (Boynton) Inlet.....	2-4
3.0	Coastal Structures Inventory	
3.1	Summary and Methodology.....	3-1
3.2	General Structure Descriptions and Conditions.....	3-1
3.3	Descriptive Areas (North to South).....	3-12
4.0	Island Sediment Budget	
4.1	Methodology.....	4-1
4.2	Results for Palm Beach Island	4-1
4.3	Updated Lake Worth Inlet Sediment Budget.....	4-5
5.0	Sand Sources for Beach Restoration and Renourishment	
5.1	Methodology.....	5-1
5.2	Previous Sand Source Studies and Investigations Performed Offshore of Palm Beach Island.....	5-1
5.3	Potential Sources of Sand for Beach Restoration and Renourishment on Palm Beach Island	5-5

TABLE OF CONTENTS
(Continued)

6.0	Shoreline Reach Identification and Characterization	
6.1	Methodology	6-1
6.2	Coastal Processes and Current Shoreline Condition	6-19
6.3	Land Use Designation	6-23
6.4	Constructability/Mitigation Required	6-26
6.5	Shoreline Reach Designation	6-26
7.0	Proposed Shoreline Management Improvement and Protection Plan	
7.1	Methodology	7-1
7.2	Shoreline Management of Reach One	7-2
7.3	Establishment of Shoreline Management "Baseline" Design Criteria for Beachfill Projects and Groin Fields	7-6
7.4	Shoreline Management of Reach 2	7-8
7.5	Shoreline Management of Reaches 3 and 4	7-9
7.6	Shoreline Management of Reach 5	7-10
7.7	Shoreline Management of Reach 6	7-11
7.8	Shoreline Management of Reach 7	7-12
7.9	Shoreline Management of Reach 8	7-13
7.10	Shoreline Management of Reaches 9 and 10	7-13
7.11	Shoreline Management of Reach 11	7-14
7.12	Projection of Beachfill and Groin Field Construction Costs Over 30- and 50- Year Planning Horizons	7-14
7.13	Recommendations	7-15
8.0	Regulatory Requirements and Constraints	
8.1	Federal Agency Permit Authorizations	8-1
8.2	State of Florida Permit Authorizations	8-2
9.0	Estimated Benefits for Recommended Beach Restoration Projects	
9.1	Benefit Categories	9-3
9.2	Data Compilation and Benefits Methodology	9-4
9.3	Storm Protection Benefits	9-5
9.4	Total Storm Protection Benefits	9-8

TABLE OF CONTENTS
(Continued)

9.5	Recreational Benefits	9-8
9.6	Public Beach Access on Palm Beach Island	9-10
10.0	Comprehensive Monitoring Program	
10.1	Purpose and Overview	10-1
10.2	Tier 1: Island-Wide Baseline Monitoring	10-2
10.3	Tier 2: Performance Assessment of Specific Projects.....	10-12

References

Appendices

Appendix A –Coastal Structures Inventory

Appendix B – Palm Beach Island Beach Profile Comparisons

Appendix C –Palm Beach Island Bathymetry

**Appendix D – Palm Beach County,
Coast of Florida Erosion and Storm Effects Study**

**Appendix E –Shoreline Profiles
Reaches 2, 3, 4, 5, 7, 8, 9 and 10**

Appendix F – Basis for Economic Analysis

Peer Review Comments

LIST OF TABLES

Table	Page
3-1	Palm Beach Island Coastal Structures Inventory..... 3-5
4-1	Volumetric and Shoreline Changes for Palm Beach Island 4-2
4-2	1990 – 1997 Sediment Budget, Annual Volume Change Rates by Reach Designation 4-4
5-1	Preliminary Ranking by Category of Previously Identified and Potential Offshore Borrow Areas, Palm Beach Island 5-8
6-1	Established Shoreline Reach Boundaries on Palm Beach Island..... 6-16
6-2	Coastal Processes Zones on Palm Beach Island..... 6-24
6-3	Land Use Zones on Palm Beach Island 6-25
6-4	Constructability/Mitigation Required Zones on Palm Beach Island..... 6-27
6-5	Established Shoreline Reach Boundaries on Palm Beach Island..... 6-28
7-1	Proposed Palm Beach Island Beach Restoration Project Template Volumes, Shoreline Reach 2 7-30
7-2	Proposed Palm Beach Island Beach Restoration Project Fill Template Volumes Shoreline Reaches 3 and 4..... 7-31
7-3	Proposed Palm Beach Island Beach Restoration Project Fill Template Volumes Shoreline Reach 5..... 7-32
7-4	Proposed Palm Beach Island Beach Restoration Project Fill Template Volumes Shoreline Reach 7..... 7-33
7-5	Proposed Palm Beach Island Beach Restoration Project Fill Template Volumes Shoreline Reache 8..... 7-34
7-6	Proposed Palm Beach Island Beach Restoration Project Fill Template Volumes Shoreline Reaches 9 and 10..... 7-35
7-7	Estimated Quantities and Construction Costs for Proposed Groin Fields 7-36
7-8	30-Year Cost Projections for Recommended Shoreline Management Solutions by Reach..... 7-38
9-1	Summary of Storm Protection Benefits to Oceanfront Properties by Reach Designation along Palm Beach Island..... 9-6
9-2	Public Beach Accesses on Palm Beach Island 9-11
10-1	Proposed Surficial Sand Sampling Transects for Palm Beach Island 10-5

SECTION 1

1.0 INTRODUCTION

1.1 AUTHORIZATION

On March 17, 1997, the Town Council of the Town of Palm Beach authorized Applied Technology and Management, Inc. (ATM) to prepare an update to the existing "Comprehensive Coastal Management Plan for the Town of Palm Beach" (Cubit Engineering, Ltd., August 1986). With funding support from the Palm Beach Civic Association, staff authorized ATM to prepare a comprehensive plan update to encompass the entire Atlantic Ocean shoreline of Palm Beach Island. The approximately 15.7 mile long Island extends from Lake Worth Inlet to South Lake Worth (Boynton) Inlet and includes the municipalities of the Town of Palm Beach, the City of Lake Worth, the Town of South Palm Beach, the Town of Lantana and the Town of Manalapan.

1.2 PURPOSE AND SCOPE OF THE COMPREHENSIVE COASTAL MANAGEMENT PLAN (CCMP)

The purpose of the Comprehensive Coastal Management Plan (CCMP) update is to identify the necessity, sequencing and requisite actions by the Town of Palm Beach and the neighboring municipalities to effectively manage the shoreline of Palm Beach Island. Proper sand management practices at the inlets which separate Palm Beach Island from the neighboring shorelines are critical to ensure that the Island's beaches are afforded the proper level of storm protection. In addition, identification and proper siting of suitable sand resources to conduct beach restoration/renourishment activities on the Island is essential to the long-term success of the comprehensive program.

The work components identified as necessary to update the existing Comprehensive Plan are as follows:

1. Acquire and evaluate existing aerial photography, beach profile, sand source and environmental resource data for Palm Beach Island, and perform beach profiles of those segments of shoreline not currently being measured in association with the monitoring of the Mid-Town Beach Restoration Project;
2. Update the coastal structures inventory along the Town of Palm Beach shoreline and identify structures on the remainder of the Island's beaches;

3. Revise the sediment budget for Palm Beach Island to reflect existing management practices (i.e., sand quantities bypassed and added via nourishment) by considering the performance of the Mid-Town Beach Restoration Project, inlet maintenance dredging projects and operation of inlet sand transfer facilities and their respective effects on the overall sediment budget;
4. Identify distinct shoreline segments from Lake Worth Inlet to South Lake Worth Inlet (Boynton Inlet) according to dominant coastal processes, upland development and environmental resources. Thereafter, develop improvement/management plan concepts, and prioritize shoreline segments by identifying the relative need for remedial measures;
5. Determine the location, comparative quality, and environmental constraints associated with existing (identified) sand sources for both immediate and long-term requirements;
6. Provide an estimate of probable costs to construct the identified shore protection improvements;
7. Evaluate regulatory requirements and potential constraints associated with the beach restoration/management objectives;
8. Examine alternative beachfill template volumes, potential structural improvements (e.g., groin fields with beachfill) and environmental resource impacts to develop design concepts and order of magnitude construction cost estimates for the identified project segment(s);
9. Develop a recommended coastal monitoring program which will enable the continued assessment of erosion/accretion trends, environmental resources, sand migration, inlet sand management, and beach restoration project performance;
10. Prepare a proposed implementation schedule for the requisite field investigations, permitting, funding allocation, construction, and subsequent

monitoring to ensure that the beaches of Palm Beach Island are restored and maintained utilizing a managed systems approach;

11. Participate in meetings with Town of Palm Beach representatives at plan development milestones; and,
12. Prepare and present the final Plan to the Mayor and Town Council.

1.3 REPORT ORGANIZATION

This Comprehensive Plan is organized into ten major sections. The first four sections provide background information on the Island shoreline and affects which dictate its current condition. The remaining six sections focus on a plan of improvement for the beaches and recommended implementation schedules as well as projected costs to undertake the improvements.

Appended to the Plan are reference materials utilized in preparing this document: beach profile data analyzed to determine the current trends and (hence) the need for corrective action; a compilation of the data collected during the coastal structures inventory; the proposed Improvement Plan for management of the Atlantic Ocean shoreline of Palm Beach Island; and economic data acquired for project benefit calculations. The general format of the CCMP is as follows:

1.0 INTRODUCTION

Background information describing the authorization, purpose and scope, and organization of the Plan document and its appendices.

2.0 PHYSICAL FEATURES AND MANAGEMENT PRACTICES AFFECTING THE PALM BEACH ISLAND SHORELINE

A description of the inlets which bound Palm Beach Island, historic actions undertaken to armor or otherwise protect the shoreline, beach restoration, inlet sand transfer and maintenance dredge disposal operations are briefly summarized to identify the need for a comprehensive approach to shoreline restoration and management.

3.0 COASTAL STRUCTURES INVENTORY

By means of a comprehensive filed survey utilizing DGPS to accurately locate all structures, the location, orientation and extent of existing shore protection structures (seawalls, revetments, groins, and jetties) and vegetated dunes was completed in May 1997. A summary of construction materials, structure condition and apparent effectiveness is also provided.

4.0 SEDIMENT BUDGET

Beach profile data analysis, utilizing the Florida Department of Environmental Protection (FDEP) shoreline monitoring data base, is extended over the Island. Historic shoreline data utilized includes the 1974, 1990, and 1995 surveys conducted by the Bureau of Beaches and Coastal Systems, as well as performance monitoring reports of the borrow area and beachfill project site in conjunction with the Mid-Town Beach Restoration Project (August 1996 and April 1997). Beach profiles were measured along the remainder of the Island shoreline in May 1997 to establish an up to date inlet-to-inlet data base.

5.0 SAND SOURCES

A overview of previously completed offshore sand resources investigations undertaken by the Town of Palm Beach, Palm Beach County Department of Environmental Resource Management (PBCERM), and the U. S. Army Corps of Engineers (USACOE), Jacksonville District was accomplished. These investigations were in association with project initiatives at Mid-Town, Palm Beach/South Palm Beach, and the Coast of Florida Erosion and Storm Effects Study. A preliminary assessment of *potential* offshore borrow areas warranting additional investigation for specific project implementation is also provided.

6.0 SHORELINE REACH IDENTIFICATION AND CHARACTERIZATION

Delineation of specific segments of shoreline on the Island was completed considering shoreline character (natural vs. artificially stabilized, armoring type and extent, shoreline orientation, erosion rate/trends), upland land use designations, environmental resources mitigation requirements and shoreline restoration and maintenance requirements.

7.0 PROPOSED IMPROVEMENT PLAN

Presentation of alternatives for shoreline restoration and maintenance related to beach condition, need for storm protection, environmental impact mitigation requirements and fiscal viability. Cost estimates are provided for the proposed improvements. Additionally, this section presents the recommended action items considering a 20-year planning horizon to establish and maintain priorities for study, design, permitting, assessment and establishment of cost-share allocation, construction, maintenance, and monitoring of the Island's beaches.

8.0 REGULATORY REQUIREMENTS AND CONSTRAINTS

This section identifies state and federal policies, rules and regulations associated with shoreline restoration and preservation efforts.

9.0 PROJECT CONSTRUCTION BENEFITS AND COSTS

Included is an assessment of project costs and storm damage reduction/recreational use benefits on a project-specific basis. Consideration is also given to project funding mechanisms and options.

10.0 COMPREHENSIVE MONITORING PROGRAM

An Island-wide monitoring plan is recommended in this section including an assessment of shoreline change, beach nourishment/renourishment and shore protection project performance, inlet sand transfer target vs. actual annual rates, and environmental resource impacts.

The CCMP is structured to provide a clear indication of the extent of shoreline erosional stress currently being placed on the beaches of Palm Beach Island, to identify shoreline erosion control solutions (provide storm damage protection), and to establish a feasible schedule and estimate of costs to accomplish the responsible restoration and maintenance of the shoreline.

SECTION 2

2.0 PHYSICAL FEATURES AND MANAGEMENT PRACTICES AFFECTING THE PALM BEACH ISLAND SHORELINE

2.1 SHORELINE EROSION OF PALM BEACH ISLAND

Lake Worth Inlet

Lake Worth Inlet, while serving navigational interests to the Port of Palm Beach and recreational use of the Intracoastal Waterway and Atlantic Ocean, has exacerbated the erosional process on Palm Beach Island. Impoundment of sand against the north jetty, deepening of the entrance channel, and a 6-year cessation of operation of the sand transfer plant have all contributed to the erosion stress on the shoreline south of Lake Worth Inlet. The spatial extent of the Inlet's influence on the Palm Beach Island shoreline will be determined as a component of the implementation of the Lake Worth Inlet Management Plan (ATM, April 1995).

Lake Worth Inlet Sand Transfer Plant

A fixed sand bypassing plant located immediately north of the Lake Worth Inlet north jetty was commissioned in August 1958 and ceased operations in May 1990. During the approximately 32-year period of operation, the plant transferred an estimated 2,292,550 cubic yards of sand to Palm Beach Island. PBCERM recently revised the hourly bypassing volume from 120 cubic yards per hour to 130 cubic yards per hour. Based on the hours of operation (17,635) multiplied by the hourly production rate (130 cubic yards per hour), the bypassed quantity of 2,292,550 cubic yards is obtained (Clinton W. Thomas, P.E., personal communication).

Palm Beach County and the Town of Palm Beach completed rehabilitation of the sand transfer plant in May 1996, during which the pump motor and discharge pipeline were upgraded to allow for a higher output capacity. PBCERM has maintained an accurate log of operating hours since startup. The plant operated a total of 1,138.5 hours between May 1996 and the end of April 1997. A pump test was conducted in 1996, during which a test pit was excavated and measured to determine its storage capacity. The transfer plant initiated pumping and discharged to the test pit. Following a set period of operation, the pit area was resurveyed. Based on the results of the survey, PBCERM has calculated a discharge volume of 230 cubic yards per hour. Therefore, the approximate sand volume bypassed to Palm Beach Island from May 1996 through April 1997 was 261,855 cubic yards (Clinton W. Thomas, P.E., personal communication). It is anticipated that future pump tests will be conducted to refine the hourly discharge volume estimates.

Federal Navigation Channel Maintenance Dredging

The Jacksonville District U. S. Army Corps of Engineers (USACOE) has the responsibility of maintaining the Entrance Channel at Lake Worth Inlet. Since initiation of maintenance dredging in 1928, approximately 7,187,000 million cubic yards of sand have been removed from the Inlet (modified from ATM, April 1995). Of that total, approximately 1,721,002 cubic yards of sand have been placed on the upland, beach and nearshore areas within a designated 3,000 feet. disposal site located at the north end of the island since 1970 (modified from USACOE, 1996). The disposal area extends from the Lake Worth Inlet south jetty to a terminus east of the intersection of North Ocean Boulevard and Reef Road. Current restrictions on the permit limit the placement to below the Mean High Water (MHW) line.

An alternative disposal location which has been approved by the FDEP will permit placement of beachfill at the Mid-Town Beach Restoration Project site. A pipeline access corridor was identified by the Town of Palm Beach and submitted to the FDEP by the USACOE Jacksonville District. Modification of FDEP Permit Number 50-2141369 will allow the USACOE dredging contractor to place a submerged pipeline across the ephemeral hardbottom within the access corridor, which is located approximately due east of Seaspray Avenue.

The USACOE, the Port of Palm Beach, Palm Beach County, and the Town of Palm Beach are currently considering modifications to the permitted disposal area to allow for beachfill placement *above* the Mean High Water line. The USACOE will process the permit modification request with the FDEP in summer 1997. Approval from the FDEP will enable the USACOE dredge contractor to place sand to elevation +7 National Geodetic Vertical Datum of 1929 (NGVD). Maintenance dredging of the Inlet is anticipated to occur in November 1997. The USACOE is finalizing the beachfill template configuration as of this writing.

2.2 COASTAL STRUCTURES

The majority of the shoreline from Lake Worth Inlet to Sloan's Curve has realized the construction of varied forms of shoreline stabilization structures. Approximately 70 percent of the shoreline over this 8.5 mile reach is backed by seawalls of differing construction and placement relative to the present-day shoreline, with groin fields in evidence in the vicinity of North County Road, the Breakers Hotel, Mid-Town and Banyan Road to Sloan's Curve. In

addition, the Florida Department of Transportation (FDOT) constructed a 6,800-foot segment of rock revetment from Widener's Curve to Sloan's Curve to provide storm protection to Ocean Boulevard (State Road A1A).

South of Sloan's Curve, seawalls provide the primary means of storm protection to upland property, most notably those fronting R.G. Kreusler Memorial Park and Lake Worth Municipal Beach, the Patrician, Claridges East and La Bonne' Vie. Along the Town of South Palm Beach shoreline, seawalls further protect upland development over the majority of the Town's approximately 2,815 feet of Atlantic Ocean frontage. The southernmost 150 feet of frontage within the City of Lantana marks the northern terminus of a vertical seawall fronting the Ritz-Carlton Hotel, with continuous seawall protection provided from that point and progressing south along the privately owned upland properties from the Ritz-Carlton south to Chillingsworth Curve. Total frontage of the last oceanfront seawalls on Palm Beach Island within the municipal boundaries of the Town of Manalapan is approximately 8,510 feet.

A detailed coastal structures inventory was performed in May 1997, during which all shore protection structures which were visible and accessible at the time of the survey were located, conditions noted and (many of which were) photographed. Complete results of the inventory are presented in Section 3 of this Plan.

2.3 BEACH RESTORATION

Introduction of sand to the Island sediment budget has occurred since the mid-1940s. Beach nourishment projects were performed along the shorelines in the vicinity of Eden Road, Tangier Avenue, Banyan Road and Sloan's Curve in 1948-1949, resulting in a total placement volume of 2.22 million cubic yards. The beach in the vicinity of Chilean Avenue received approximately 86,000 cubic yards of sand in 1977, and an additional 234,000 cubic yards of sand were placed along the Sloan's Curve shoreline between 1953 and 1987 (Olsen Associates, Inc., 1987).

In March 1996, the Town of Palm Beach completed the Mid-Town Beach Restoration Project, resulting in the removal of the Prefabricated Erosion Prevention (PEP) Reef and derelict structures located offshore of the shoreline area between Clarke Avenue Beach and the

vicinity of Gulfstream Road. Following this effort, the 5,400 feet of shoreline within the permitted project limits was restored by placing approximately 880,000 cubic yards of beachfill and constructing 11 modular groins of variable length.

2.4 DUNE RESTORATION/ENHANCEMENT

Several segments of the Island Shoreline have benefited from dune restoration and/or enhancement projects. Publicly accessible shorelines such as Mid-Town, Phipps Ocean Park, R.G. Kreusler Memorial Park, Lake Worth Municipal Beach, and Lantana Municipal Beach all appear to have been subjected to dune restoration and vegetative plantings. An active dune restoration project was observed approximately $\frac{1}{4}$ to $\frac{3}{4}$ miles north of Boynton Inlet.

2.5 SOUTH LAKE WORTH (BOYNTON) INLET

South Lake Worth Inlet, or Boynton Inlet as it is locally known, was constructed in 1957 to improve the water quality of Lake Worth (USACOE, July 1996). The inlet was trained by 2 straight jetties, with a channel width of 130 feet and original depth of -8 feet Mean Low Water (MLW). A sand transfer plant was constructed in 1937 along the north jetty. Bypassing of sand has occurred, more or less, continuously since the plant construction, with no bypassing during 1942-1944, and no bypassing or maintenance dredging records are available from 1953 to 1961 (Olsen Associates, Inc., 1990). Major modifications to the jetty were undertaken in 1967, during which the following were undertaken:

- a 410-foot curved extension was added to the north jetty
- 65 feet was added to the south jetty
- a training wall was constructed on the south side of the inlet interior
- the fixed sand transfer plant was relocated 118 feet seaward of its previous position
- the sand transfer plant capacity was increased

The most recent improvements, undertaken in 1971, include partial sealing of the north jetty and construction of an approximately 50-foot spur segment east of the bypassing plant. Maintenance and operation of the inlet sand transfer plant, formerly the responsibility of the South Lake Worth Inlet District (which was abolished by the Florida Legislature during the 1996 Legislative Session), is now administered by the PBCERM.

Olsen (1990) estimated the average bypassing rate of the fixed plant at approximately 70,000 cubic yards per year, and indicated that maintenance dredging of the interior shoal sand was only undertaken on 2 occasions since 1973, during which a total of between 50,000 and 70,000 cubic yards were placed.

The USACOE (1996) estimates that the net littoral drift of sand to Boynton Inlet from the beaches to the north is 135,000 cubic yards per year to the south. Of this quantity, an estimated 4,000 cubic yards per year accretes along the shoreline between R-146 and the inlet (the shoreline immediately south of Chillingsworth Curve).

An Inlet Management Plan for South Lake Worth Inlet is in preparation by Palm Beach County, with the County, the FDEP, the Town of Manalapan, and the Town of Ocean Ridge providing funding, review, and technical oversight of the Plan development and recommendations. The above parties executed a Settlement Agreement to Case No. 88-0909 on September 5, 1996, which, in part, allows for the construction of an impermeable low profile groin by the Town of Manalapan at a location 600 to 900 feet north of the north jetty. In addition, the parties have agreed that Manalapan may pursue shore protection efforts for the area north of Chillingsworth Curve if such recommendations do not appear in the South Lake Worth Inlet Management Plan.

SECTION 3

3.0 COASTAL STRUCTURES INVENTORY

3.1 SUMMARY AND METHODOLOGY

An inventory and inspection of coastal structures on Palm Beach Island was performed by ATM between May 13 and May 17, 1997. During the inspection, structure type, size, condition, effectiveness, and potential for presenting a safety hazard were noted. Structure locations were surveyed (horizontal and vertical) by a licensed Professional Land Surveyor. The survey extended from Lake Worth Inlet south to the South Lake Worth Inlet.

As part of the inventory, seawalls, groins, discharge/intake pipes, revetments, and other notable erosion control structures were inspected, photographed, and assessed. In general, structure condition ranged from excellent to poor. Many of the groins observed were in poor condition and appeared to be ineffective in impounding sand. They also present a significant safety concern for beach users. Structure location drawings with survey stations (Figures 3-1 through 3-3) are provided. Each structure survey is summarized in Table 3-1. Photographs of selected structures and/or notable features on the Island are provided in Appendix A. Photo locations are referenced to Survey Station Numbers as indicated in Table 3-1.

3.2 GENERAL STRUCTURE DESCRIPTIONS AND CONDITIONS

During the inventory, a wide range of structures was encountered. The purpose of most structures is for erosion control. These include seawalls, groins, revetments, and jetties. Other type structures encountered included dune crossovers, low elevation privacy walls, discharge pipes, remnant pipe supports, and sea water supply systems. A general description of the structures inventoried is provided in the following sections.

Seawalls and Revetments

Much of the survey area contained shore hardening structures which extended to the beach face. With the exception of one small revetment located near R-133 and the FDOT revetment, these hardening structures consist primarily of seawalls. Privacy walls which were located well inland of vegetation lines were not surveyed unless easily accessible.

**Table 3 - 1
Palm Beach Island Coastal Structures Inventory
May 13-19, 1997**

Survey Station Nos.	Structure Description and Construction	Structure Condition and Effectiveness	Potential for Safety Hazard	Remarks and Observations	Photo ID (roll#)
2000	Monument R-76 at centerline of jetty	Good; Effective	Low	Lake Worth Inlet south jetty	
2001	Survey turning point	Good; Effective	N/A		7/13, 14
2002	Jetty, centerline at beginning of rock	Good	Low	Sand Transfer Plant not operating at time of survey	7/16
2003	Top of western dredge pipe outfall, 1-foot diameter	Good	Low	Sand Transfer Plant not operating at time of survey	7/17
2004	Top of eastern dredge pipe outfall, HDPE, 1-foot diameter				
2005-2011	Edge of vegetation			Seawall/privacy wall well west of edge of vegetation; beginning & end points of wall unknown	7/15
2012	Monument R-78A	Good; Effective	N/A	In vegetation	
2013, 2014	Seawall/privacy wall, concrete, approximately less than 1-foot high		Low	Northeast point first measured	
2015	Monument, ACOE LWI-60, 1993		N/A	Monument on seawall - location check only	
2016	Edge of vegetation				7/18
2017	Seawall, concrete	Good; Effective		Seawall buried in some instances	7/19, 20, 21
2018-2019	Edge of vegetation		N/A		
2020	Seawall, concrete	Good; Effective		Intersection of end of vegetation and beginning of continuously exposed wall	
2021	Seawall, concrete	Excellent; Effective	Low	Angle break in seawall	7/22
2022-2023	Groin, steel sheet pile	Very Poor--Derelict Structure; Ineffective	High	2nd groin	7/23
2025-2026	Groin, steel sheet pile	Very Poor--Derelict Structure; Ineffective	High	2nd groin	
2027-2028	Groin, steel sheet pile	Poor to Very Poor; Ineffective	High	Seawall in good condition	
2029-2030	Groin, steel sheet pile	Very Poor; Ineffective	High	4th groin	
2031	Monument R-81 1974		N/A		
2032-2033	Groin, steel sheet pile	Very Poor; Ineffective	High	Seawall in good condition, 5th groin	7/24
2034-2035	Groin, steel sheet pile	Very Poor; Ineffective	High	6th groin	
2036-2037	Groin, steel sheet pile	Very Poor; Ineffective	High	Seawall in good condition; 7th groin	
2038	Pipe in surf zone, 6-inch diameter steel with supports	Unknown	High	1st of 2 pipes	
2039	Pipe in surf zone, 6-inch diameter steel with supports	Unknown	High	2nd of 2 pipes	
2040	Survey turning point				
2041	Groins (2 parallel), steel sheet pile	Very Poor; Ineffective	N/A	On top of seawall	
2042	Seawall, concrete	Excellent; Effective	High	Groins are submerged and begin at northeast base of concrete seawall; seawall in good condition	
2100	Groin, concrete H-piles with panels	Poor--H-piles in place, panels missing or deteriorated	Low	Northwest corner	
2101	Seawall, concrete, stepped-base, then concave arch wall	Excellent; Effective	High	2 feet by 2 feet H-piles, begin at corner of seawall	
			Low	Water at base	8/1

Notes:
 1.) Groins showing 2 station numbers include one station at eastmost accessible point, and on at base of seawall where groin bisects. In most cases, groin extends further into surf zone.
 2.) Due to high number of seawall construction types, not all types documented: seawall type / condition noted at each groin bisect point.
 3.) Seawalls / privacy walls located well behind vegetation lines not surveyed unless accessible without damaging vegetation
 4.) Submerged seawalls not surveyed unless accessible due to wave action.
 5.) Walkovers only surveyed if separate structure and semi-permanent.
 6.) Outfalls in seawall faces only surveyed if flowing, or deemed critical to beach face.

Table - 1
Palm Beach Island Coastal Structures Inventory
May 13-19, 1997

Survey Station Nos.	Structure Description and Construction	Structure Condition and Effectiveness	Potential for Safety Hazard	Remarks and Observations	Photo ID (roll#)
2102-2103	Seawall, concrete	Good; Effective	Low	Sand walkway in gap between consecutive seawalls	8/2
2104	Seawall, timber over concrete	Fair to Good; Effective timber falling away	Moderate	Seawall transition point	8/3
2105	Groin, concrete H-piles with concrete panels	Very Poor; Ineffective	High	Submerged at low tide	
2106	Groin, concrete H-piles with concrete panels	Very Poor; Ineffective	High	Submerged at low tide; intersects with concrete seawall	
2107	Edge of vegetation and seawall, concrete 4-foot high panels	Good to Excellent; Effective	Low		
2108	Steel pipe with well point system, 6-inch diameter	Unknown	High	Purpose of system unknown	8/6
2109	Seawall, concrete	Good to Excellent; Effective	Low	Vegetation between consecutive seawalls	8/4, 8
2110	Groin, steel sheet pile with some timber	Very Poor	High	Submerged	8/7
2111	Groin, steel sheet pile	Very Poor--Derelict Structure; Ineffective broken off at waterline	High	Seawall 20-foot high concrete, excellent condition	
2112	Groin, steel sheet pile	Very Poor; Ineffective	High	Seawall has exposed reinforcement in some locations	
2113	Seawall inflection point, concrete	Good; Effective exposed metal mesh in some locations	Moderate	Submerged seawall in surf zone, unable to survey	8/9, 10
2114	Groin, steel sheet pile	Very Poor; Ineffective	High	Submerged	
2115	Groin, steel sheet pile	Very Poor--Derelict Structure; Ineffective	High	Still submerged seawall	
2116	Groin, steel sheet pile	Very Poor; Ineffective	High		
2117	Groin, steel sheet pile	Very Poor; Ineffective	High		
2118	Steel pipe protruding from sand at seawall	Unknown	Moderate	Only 6 inches exposed above water	
2119	Groin, steel sheet pile	Very Poor; Ineffective	High	Elbow exposed only at seawall	
2120	Groin, steel sheet pile	Very Poor; Ineffective	High	Only 1 foot exposed above water	
2121	Steel pipe, 8-inch diameter	Unknown	High	Still submerged seawall	8/11
2122	Groin, steel sheet pile	Very Poor; Ineffective	High	Some sections broken off and laying on beach; seawall changes construction	
2123-2124	Seawall corner, concrete	Excellent to Good; Effective	Low	2nd pipe appears to be attached to edge of groin	8/12
2125	Pipe, 6-inch diameter PVC with steel supports	Good--some settling at north end	High	Seawall ends, turns to natural ground	8/13, 14, 21
2126-2127	Seawall, concrete, concave face	Good--well worn but structurally intact	High	Pipe exposed at elbow only; pieces broken on beach	8/15, 16, 17, 18, 19, 20
2128	Pipe, 4-inch diameter PVC	Unknown	Moderate	Point 2127 is inflection point	
2129	Seawall, concrete with protruding toe protection at 10-foot intervals	Excellent; Effective	Low	Pipe exposed at elbow only	
2130	Groin, rock	Good--well worn but structurally intact	Moderate	Still possible submerged seawall	
2131	Monument R-87	Excellent to Good; Effective	N/A	Extends to submerged seawall and bisects shoreside seawall	
2132-2134	Seawall, concrete	some divots but structurally intact	Low	Monument on top of seawall - location check only	8/22
2135	Pipe supports, metal (pipe missing)	Unknown	High	Seawall changes dimensions at property lines	
2136, 2139	Seawall, concrete panels with cap	Excellent; Effective	Low	Still possible submerged seawall	

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2137	Groin, steel sheet pile with concrete cap	Fair; Slightly Effective sheet pile rusted away in some sections	High	Begin newer groin field	8/23,24
2138	Monument R-88		N/A	Position check	
2140	Groin, poured concrete between steel sheet pile	Good; Slightly Effective sheet pile rusting away, concrete intact	High		
2141	Steel pipe, 12-inch diameter	Unknown	High	Pipe outfall on beach with timber supports	
2142	Seawall, concrete	Excellent; Effective	Low	Seawall behind vegetation	
2143-2144	Pipe system, steel	Unknown	High	Pipe system in surf zone with well points--unknown function; submerged seawall no longer visible	
2145-2146	Groin, poured concrete between steel sheet pile	Fair; Ineffective concrete intact, sheet pile rusted or missing	High	Privacy wall beyond vegetation	
2147	Groin, poured concrete between steel sheet pile	Poor; Ineffective only 1-inch visible	High		
2148	Pipe, 12-inch diameter PVC with metal bands	Unknown	High		
2149	Pipe supports (different pipe), metal	Unknown	High		
2150	Groin, poured concrete between steel sheet pile	Fair to Poor; Ineffective	High	Pipe not visible	9/3
2151, 2156	Seawall, timber with concrete covered timber piles	Poor; Effective timber falling away--falling	Moderate		9/1,2,4,24
2152	Pipe supports, metal	Unknown	High	Pipe missing	9/23
2153	Groin, steel sheet pile between rock	Very Poor; Ineffective	High	Barely exposed	9/10
2154	Wood piles on beach extend 2-feet above sand	Derelict Piles; Ineffective	High	Unknown purpose	
2155	Groin, steel sheet pile	Very Poor--Derelict Structure	High		9/19
2157	Groin, timber with panels	Very Poor; Ineffective	High	Near south terminus of timber seawall	
2158-2159	Groin, steel sheet pile	Very Poor; Ineffective	High		
2160, 2162	Seawall, steel sheet pile with concrete cap	Good; Effective sheet pile rusting but structurally intact	Low		
2161	Survey monument: DNR 06-78-E-04		N/A	Position check	
2163	Pipe supports, metal	Pipe Not Present	High		
2164	Groin, steel sheet pile with rocks near tip	Poor; Ineffective	High		
2165	Seawall, concrete	Excellent; Effective	Low	Stepped base with concave arched wall	9/22
2166-2167	Groin, rock	Fair; Slightly Effective	Moderate	Groin is approximately 15 feet wide	
2168-2169	Groin, steel sheet pile	Poor; Ineffective	High	Concrete seawall in this area in good condition	
2170, 2172	Groin, steel sheet pile	Poor; Ineffective	High	Vegetation abuts seawall	9/19
2171	End of vegetation		Low		
2173	Monument BM A-10 #103 US Harbor Survey		N/A	Position check	
2174-2180,	Seawall, concrete	Good to Excellent; Effective	Low	Various construction types	9/5, 17, 18, 20, 21
2182			N/A	On concrete seawall - Position check	
2181	Monument R-91		High		
2183	Groin, steel sheet pile	Poor; Ineffective	High		
2184-2185	Seawall, steel sheet pile with concrete cap	Excellent; Effective	Low		
2186	Groin, steel sheet pile	Poor; Ineffective	High		
2187	Seawall, concrete	Excellent	Low	Gap in seawall at 2.5 feet	

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2188	Outfall, 18-inch diameter concrete	Good; Active	Low	Flowing—affects beach	9/16
2189	Groin, concrete	Fair; Slightly Effective	Moderate	Approximately 2 feet wide	
2190-2193	Seawall, steel sheet pile with concrete cap	Excellent; Effective	Low	Point 2193 starts vegetation only; end of seawall	9/13, 14, 15
2194-2195	Seawall, concrete	Excellent; Effective	Low	Northeast and southeast corners	
2196	Edge of vegetation		N/A	In front of each access gap	
2197	Wood pilings	Very Poor—Derelict Structure	High		9/11, 12
2198	Edge of vegetation		N/A		9/8, 9, 10
2199-2200	Groin, concrete with 35-foot wide rock "T", 18-inch wide concrete	Good to Excellent; Effective	Moderate	Only concrete exposed, appears to be effective	
2201-2202	Groin, concrete with edge rocks 35 feet wide, 18-inch wide concrete	Good to Excellent; Effective	Moderate		
2203	Groin, timber	Very Poor—Derelict Structure; Ineffective	High		
2204	Outfall, 18-inch diameter concrete	Good; Active	Low	Flowing—affects beach	
2205-2206	Groin, steel sheet pile with rocks at tip	Good; Slightly Effective	High	Directly in front of Breakers	9/7
2207-2208	Groin, concrete with edge rocks	Good; Slightly Effective	High		
2209	Survey Monument				
2210	Outfall, 36-inch diameter concrete	Good; Active	Low	Flow affects beach	9/6
2211-2212	Groin, concrete with edge rocks	Good; Slightly Effective	High	In front of Breakers	
2213	Outfall, 12-inch diameter concrete	Good; Active	Low	Flow affects beach	
1266	Outfall, 12-inch diameter concrete	Good; Active	Low	Seawall in good condition	
1264-1265	Groin, steel sheet pile	Very Poor; Ineffective	High	Submerged/buried	
1262-1263	Groin, steel sheet pile	Very Poor; Ineffective	High	Concrete seawall in good condition	
1261	Outfall, 12-inch diameter concrete	severely deteriorated with broken off sections	Low	Protrudes through seawall	
1259-1260	Groin, steel sheet pile	Good; Active	High	Pipe protruding from water 40 feet north of groin; unable to survey—safety hazard	
1258	Outfall, 12-inch diameter concrete	structurally intact but buried	Low	Protrudes through seawall	
1256-1257	Groin, steel sheet pile	Good; Active	High	Protrudes through seawall	
1255	Outfall, 12-inch diameter concrete	Poor to Very Poor; Ineffective	Low	Protrudes through seawall	
1253-1254	Groin, steel sheet pile	Good; Active	High	1st groin north of curve in seawall	
1252	Outfall, 12-inch diameter concrete	Poor; Ineffective	Low	Protrudes through seawall	
1251	Outfall, 12-inch diameter concrete	Good; Active	Low	Protrudes through seawall	
1250	Survey turning point		N/A	On timber walkover	
1247-1249	Seawall, concrete	Excellent to Good; Effective	Low	Seawall curves; several drainage holes in seawall	7/9, 10, 11, 12
1245-1246	Groin, steel sheet pile with concrete blocks around shoreside portion	Very Poor; Ineffective seawall in Good Condition except where steel mesh exposed	High		
1243	Survey turning point		N/A	24.5 feet east of seawall	
1241-1242	Groin, steel sheet pile	Fair to Poor; Ineffective	High	Completely submerged; 1244 is PL point in seawall	
1240 1244	Groin, single thickness steel sheet pile	Derelict Structure; Ineffective	High	Completely submerged	
1239	Steel pipe with supports, 6-inch diameter	Unknown	High	Completely submerged	

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1238	Steel pipe with supports, 8-inch diameter	Unknown	High		
1236-1237	Groin, steel sheet pile	Derelict Structure--exposed sheet pile	High	Seawall, good condition in this area	
1235	Survey turning point		N/A	65.5 feet east of monument R-105	7/7, 8
1234	Seawall, inflection point, 6 feet high	Poor--metal mesh exposed through concrete, major cracks and bowing	Moderate	Near monument R-104	7/6
1233	Steel pipe at waterline, 6-inch diameter with supports	Unknown	High	Steel pipe submerged--not exposed	
1231-1232	Groin, pre-fabricated hexagon concrete blocks with concrete panels	Very Poor, Ineffective panels missing and some blocks knocked over	High		
1229-1230	Groin, concrete H-piles with slots for panels	Very Poor; Ineffective all panels missing	High	Seawall height change	7/5
1227-1228	Groin, poured concrete between flat steel sheet pile	Fair, Slightly Effective sheet pile rusting away, concrete stable	High	2-foot sand elevation differential	
1225-1226	Groin, concrete and steel sheet pile	Good to Fair; Ineffective excessive growth on sections	High	Only sheet pile at base of seawall	7/4
1223-1224	Groin, concrete to waterline, then steel sheet pile	Fair to Poor; Ineffective concrete sections intact, sheet pile severely rusted	High		
1221-1222	Groin, pre-fabricated hexagon concrete blocks with concrete panels	Excellent; Ineffective	Moderate		
1219-1220	Groin, pre-fabricated hexagon concrete blocks with concrete panels	Excellent; Ineffective	Moderate	Groin too low to be effective--does not extend to seawall	6/24
1218	Seawall, concrete, 3 feet high	Good; Effective	Low	Southeast corner of continuous seawall	6/23; 7/3
1216-1217	Groin, pre-fabricated concrete block segments; pipe system	Excellent; Ineffective	High	Attached to sides of groin are 2 steel 12-inch diameter pipes, and 2, 6-inch diameter PVC pipes with well points; appears to be pool supply system to adjoining condo/hotel	7/1, 2
1214-1215	Groin, pre-fabricated concrete block segments	Excellent; Slightly Effective	Moderate		
1213	House on steel sheet pile bulkhead foundation	Good; Effective	Low		
1211-1212	Groin, pre-fabricated concrete block segments	Excellent; Ineffective	Moderate		
1209-1210	Groin, concrete to waterline, then steel sheet pile	Fair to Poor; Ineffective concrete sections intact, sheet pile severely rusted	High	Groin intersects with southeast corner of house	6/21, 22
1207-1208	Groin, concrete to waterline, then steel sheet pile	Fair to Poor; Slightly Effective to Ineffective concrete sections intact, sheet pile severely rusted	High	Slight berm present in this area	
1205-1206	Groin, concrete to waterline, then steel sheet pile	Fair to Poor; Slightly Effective concrete sections intact, sheet pile severely rusted	High	2-foot sand elevation differential	
1203	Survey turning point			On groin	6/21
1202, 1204	Groin, concrete to waterline, then steel sheet pile	Fair to Poor; Slightly Effective concrete sections intact, sheet pile severely rusted	High	Slightly more effective than other groins--3-foot sand elevation differential	
1201	Privacy wall, concrete	Good; Effective	Low	Northeast corner	
1199-1200	Groin, concrete to waterline, then steel sheet pile	Fair to Poor; Slightly Effective concrete sections intact, sheet pile severely rusted	High		
1198	Monument R-109		N/A	On privacy wall	

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1197	Steel pipe with supports, 8-inch diameter	Unknown	High		
1195-1196	Groin, concrete to waterline, then steel sheet pile	Fair to Poor; Slightly Effective concrete sections intact; sheet pile severely rusted	High		
1193-1194	Groin, concrete to waterline, then steel sheet pile	Fair to Poor; Slightly Effective concrete sections intact; sheet pile severely rusted	High		
1191-1192	Groin, concrete to waterline, then steel sheet pile	Fair to Poor; Slightly Effective concrete sections intact; sheet pile severely rusted	High	Groins slightly effective in concrete sections only; too low	6/20
1190	Seawall, concrete block, 3 feet high	Fair to Poor; Effective some sections broken off due to shoreside construction operations	Low		
1188-1189	Groin, steel sheet pile and wood at shore, sheet pile only in water	Very Poor to Poor; Slightly Effective	High		6/19
1187	Seawall, concrete, 6 feet high	Excellent; Effective	Low	Extends to water	
1186	Metal pipe on beach, 8-inch diameter	Unknown	High		
1185	Groin, concrete with steel sheet pile; reinforced with rubble on sides to water, then sheet pile only	Concrete section: Excellent; Effective Sheet Pile section: Very Poor; Ineffective	High		
1184	Monument R-110 (21 feet offset west)		N/A		
1182-1183	Groin, combination of steel sheet pile at shore; concrete and steel sheet pile at tip	Very Poor to Remnant sheet pile broken off at waterline	High	Groin located in pocket beach north of DOT project	6/15, 16, 18
1179-1181	Seawall, concrete with cap; stepped toe/base	Excellent; Effective protection for wave action	Low	Seawall angles into shore	6/17
1176-1178	Groin, rock and steel sheet pile	Very Poor; Ineffective	High	Last groin prior to seawall; little or no beach exposed	
1175	Survey turning point		N/A		
1173-1174	Groin, double layer steel sheet pile (18th groin)	Very Poor; Ineffective	High	Last exposed groin before start of DOT project; revetment extends to MHW	
1171-1172	Groin, double layer steel sheet pile (17th groin)	Very Poor; Ineffective	High		6/11, 12, 13
1169-1170	Groin, double layer steel sheet pile (16th groin)	Very Poor; Ineffective	High		6/10
1167-1168	Groin, double layer steel sheet pile (15th groin)	Very Poor; Ineffective	High		6/8, 9
1165-1166	Groin, double layer steel sheet pile (14th groin)	Very Poor; Ineffective	High		
1163-1164	Groin, double layer steel sheet pile (13th groin)	Very Poor; Ineffective	High		
1161-1162	Groin, double layer steel sheet pile (12th groin)	Very Poor; Ineffective	High		
1159-1160	Groin, double layer steel sheet pile (11th groin)	Very Poor; Ineffective	High		
1157-1158	Groin, double layer steel sheet pile (10th groin)	Very Poor; Ineffective	High		
1155-1156	Groin, double layer steel sheet pile (9th groin)	Very Poor; Ineffective	High		
1154	Survey turning point		N/A		
1152-1153	Groin, double layer steel sheet pile (8th groin)	Very Poor; Ineffective	High		6/5, 6, 7
1147-1151	Submerged remnant seawall in surf zone, concrete with some metal tips	Very Poor--Remnant	High		
1145-1146	Groin, double layer steel sheet pile (7th groin)	Poor to Very Poor; Ineffective	High		
1143-1144	Groin, double layer steel sheet pile (6th groin)	Fair to Poor; Ineffective	High		
1141-1142	Groin, double layer steel sheet pile (5th groin)	Fair; Ineffective	High		
1139-1140	Groin, double layer steel sheet pile (4th groin)	Fair; Ineffective	High	Even numbered stations are at base of revetment	6/4

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1137-1138	Groin, double layer steel sheet pile (3rd groin)	Fair; Ineffective	High	Several walkovers in area--good condition, locations not surveyed in	6/3
1135-1136	Groin, double layer steel sheet pile (2nd groin)	Fair; Ineffective	High	Groins through this area have similar construction and effectiveness	6/1
1134	Steel pipe, 8-inch diameter	Unknown	High	Between 1st and 2nd groin	
1132-1133	Groin, steel sheet pile with concrete cap (southernmost groin; 1st groin)	Very Poor; Ineffective	High	Exposed rebar; survey stations are easternmost accessible point and base of revetment	5/21, 22, 23
1131	Survey turning point				5/24
1130	Rock revetment--rubble; DOT project	Good--filter cloth pulling away in some locations	Moderate	Revetment terminal point extends to waterline one hour prior to high tide; South terminus of DOT revetment	5/19, 20; 6/2, 14
1127-1129	Edge of vegetation--south of DOT rock revetment		Moderate to High	Excessive dune erosion with visible slides	5/18
1126	Base of dunes / edge of vegetation				5/11, 12, 13, 14, 15
1125	Survey turning point				
1122-1124	Edge of vegetation and berm at public beach		Rock--High	Natural hardbottom is exposed at bottom of dune; little sand on beach; large rocks	5/7, 8, 9, 10
1120	Monument PB--Hydro 120-1990				
1119; 1121	Seawall, steel sheet pile with concrete cap	Good--some rust; Effective	Low		5/4, 5, 6
1118	Seawall, poured concrete with gunnite at top	Excellent; Effective	Low	Seawall transition	5/3
1117	Survey turning point			At Par 3 Golf Course	4/24
1115-1116	Edge of vegetation; 115 at R-123 and 1116 at R-122			No privacy wall; natural dune in front of golf course	4/20, 21, 22, 23; 5/1, 2
1114	Survey turning point				
1109-1113	Edge of vegetation		N/A	Exposed privacy wall behind vegetation line	
1108	Survey turning point				
1099-1107	Seawall, poured concrete, some sections have slope footer at base	Excellent; Effective	Low	Some stations are edge of vegetation in front of seawall	4/16, 17, 18, 19
1093-1098	Vegetative front and bulkhead line on north side of pier; concrete bulkhead	Bulkhead Excellent; Effective	Low	Station 1097 is lifeguard station	4/13, 14
1090-1092	Survey stations on north side of Lake Worth Pier				4/11, 12, 15; 5/16, 17
1089	Survey turning point		N/A		
1081-1088	Survey stations on south side of Lake Worth Pier	Pier pilings Excellent to Good; Effective	N/A		4/7, 8, 9
1080	Survey turning point		Low	Station 1084 is lifeguard station	
1079	Edge of vegetation		N/A		4/3, 4, 5, 6
1077-1078	Seawall, steel sheet pile with concrete cap, tar covering steel	Excellent to Good; Effective	Low		3/24; 4/1, 2
1075-1076	Edge of vegetation				
1073-1074	Seawall, steel sheet pile with concrete cap	Fair--excessive rust and deterioration of sheet pile knuckles; concrete Good condition; Effective	N/A	2-foot scarp at edge of vegetation	3/23
1066	Railroad rail protruding vertically from sand		High	Exposed at low tide	3/22

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1067-1072	Edge of vegetation		N/A		
1064-1065, 1063	Edge of vegetation Monument R-133		N/A	Station 1069 at T-131	3/20, 21
1062	Survey turning point		N/A		
1058-1061	Seawall, steel sheet pile with cove cap	Poor to Very Poor; Portions Not Effective large holes through steel	Moderate	Various walkovers in area	3/16, 17, 18, 19, 4/10
1050-1057	Exposed concrete pilings on beach (9) extend 1 to 2 feet from sand		High	Seawall gap in front of pilings	3/14, 15
1054	raised squares on face				
1047-1049	Sloped concrete revetment with alternating Seawall, steel sheet pile with concrete cap;	Good; Effective	Low	At DEP monument R-136	3/11, 12, 13
1040-1046	some solid concrete seawall	Poor to Excellent; Effective exposed footer in some locations		Condition varies with property	3/2-10
1039	Survey turning point		N/A		3/1
1036-1038	Seawall, sheet pile with concrete cap	Good to Fair; Effective metal exposed and rusted in places	Low	Pool and storm drains through wall present	2/24
1035	Seawall transition from concrete block to steel sheet pile with concrete cap	Concrete block: Poor; Effective SSP: Fair to Good; Effective	Low	Continuous seawall begins at north end of public beach; each property has variance in seawall type material and condition	2/23
1033-1034	Private Seawall, concrete	Excellent to Fair; Effective	Low	Porch overhang	2/22
1032	Timber walkover	Excellent	None	Public beach	
1031	Timber walkover	Excellent	None	Public beach	
1030	Timber lifeguard station	Excellent	None	Public beach	
1029	Survey turning point				2/21
1028	Timber walkover coating	Excellent	None	Public park walkover into vegetation	2/19, 20
1026	Unknown structure submerged at low tide; possible groin or pipes or cables, 2 parallel segments	Unknown	High	Does not extend above MLW; possibly marked with vertical stake	2/16
1025	Seawall, sheet pile with concrete cap and epoxy paint coating	Excellent; Effective	Low	Southeast corner of Ritz Carlton seawall	2/14, 15
1024	Monument R-139		N/A		
1023	Survey turning point		N/A		
1017	Survey turning point		N/A		
1016,	Seawall, steel sheet pile with concrete cap;	Excellent to Good; Effective	Low	Seawall dimensions vary at each property line	2/5-13
1027	Seawall, sheet pile with concrete cap and epoxy coatings include gunnite, epoxy paint, and none;	Excellent; Effective		Northeast corner of Ritz Carlton seawall; tapers	2/17, 18
1018-1022	rubble toe protection present in small sections Buried pipe in sand, 10 feet south of color change in Sawtooth seawall, 8-inch diameter steel with some concrete attached	Unknown	High	Observed 2 days after area surveyed--exact location not surveyed	2/4
1009-1015	Sawtooth seawall, poured concrete	Excellent; Effective	Low	25 feet between points, 10 foot indent between points, 10 feet wide	1/22, 23, 24, 0, 1, 2, 2/1, 2, 3

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1008	Monument R-143		N/A	Station on monument	1/21
1002-1007	Seawall, sheet pile with concrete cap; coatings include gunnite, epoxy paint, and none	Excellent to Poor; Effective	Low	Each property has variance in seawall coating and condition	1/20
229-230	Seawall, sheet pile with concrete cap, bare and gunnite covering	Good; Effective some rust on steel	Low	Start new number system	1/17, 18, 19
226-228	Edge of vegetation/top of scarp		N/A	Gap in seawall	
223, 224,	Seawall, sheet pile with concrete cap,	Good; Effective	Low	Seawall ends +/- 220 feet north of R-146 (50 feet south of curve in road)	1/13, 14, 15, 16
222, 225	approximately 2 feet high, 15 feet wide	but does not interact with surf zone		Beginning of transition to visible escarpment	1/9, 10, 11, 12
219-221	Edge of vegetation	Excellent	N/A		
218	Timber walkover	Excellent	None		1/7
217	Edge of vegetation	Excellent; Effective	N/A		1/8
216	Timber walkover	Excellent; Effective	None		1/5, 6
213-215	Edge of vegetation restoration project	Excellent; Effective	N/A	Revegetation project in progress (note privacy wall beyond vegetation)	
210-212	Edge of vegetated dune	Excellent; Effective	N/A	Naturally occurring	1/4
202-209	North jetty of South Lake Worth Inlet	Excellent; Effective	Low	(all marks on eastern or seaward edge)	1/3

Notes:

- 1.) Groins showing 2 station numbers include one station at eastmost accessible point, and on at base of seawall where groin bisects. In most cases, groin extends further into surf zone
- 2.) Due to high number of seawall construction types, not all types documented; seawall type / condition noted at each groin bisect point
- 3.) Seawalls / privacy walls located well behind vegetation lines not surveyed unless accessible without damaging vegetation
- 4.) Submerged seawalls not surveyed unless accessible due to wave action.
- 5.) Walkovers only surveyed if separate structure and semi-permanent.
- 6.) Outfalls in seawall faces only surveyed if flowing, or deemed critical to beach face

The majority of the seawalls observed were constructed of steel sheet pile with concrete caps of various dimensions. The seawalls changed in construction type at nearly every property line. Limited areas of steel sheet pile seawall had exposed toe scour protection consisting of rock riprap, and was primarily just south of the Ritz-Carlton Hotel. The condition of seawalls varied from poor to excellent. Generally, steel sheet pile coated with paint, gunite, or other coatings tended to be in much better condition than those where bare metal was exposed. In some instances, the pilings were totally covered with sand, and no assessment of the steel sheets could be made. In a few areas, portions of the sheet piles were completely rusted through, and exposed soil was visible behind the walls.

Concrete was a second type of seawall noted. Construction type consisted of poured in place or pre-cast panels. The condition of these seawalls generally ranged from good to excellent. Several different designs were observed, with arched faces, stepped footers, and the back supports. A few areas were spalled with exposed metal mesh; however, no failed concrete seawalls were noted. Surprisingly, very few of these seawalls were observed to contain drainage or weep holes.

Some small sections of seawall were constructed of timber, either in part or whole. The condition of these seawalls was generally poor with visible evidence of early modes noted in May 1997.

One Shoreline Segment where coastal armoring differed from any other location on Palm Beach Island is the FDOT revetment located between reference monuments R-110 and R-116. The granite armor stone revetment was generally observed to be in good condition. At the terminal (north and south) ends of the structure, the armor stone is beginning to slide down the revetment slope, and the underlying filter fabric is pulling away from the crest of the embankment.

Groins

Groins of various construction material types were surveyed during the inventory, and consisted mostly of steel sheet pile, with and without a concrete cap. Most steel groins showed excessive wear, and the sheet pile frequently had deteriorated to the point of being ineffective. The worn and corroded steel posed a considerable safety hazard. During the inventory, only the exposed portions of the groins were surveyed. A few groins were

constructed of poured concrete between steel sheet pile. These tended to be in better condition with most of the sheet pile rusted away but with the concrete still intact.

Near R-107, several pre-fabricated concrete groins, assembled in place, were surveyed. These groins were in much better condition than the steel sheet pile groins frequently found elsewhere on the Island. They appeared to be slightly effective in impounding sand. They were also less of a safety hazard, as no sharp edges or exposed bolts were present.

Rock groins were only present in the Mid-Town Beach restoration area. However, directly in front of the Breakers Hotel several concrete groins with adjacent rock sections exist. These groins were in fair to good condition, and more effective than other groins observed in that general shoreline area.

In general, the majority of the present groin structures on the island are ineffective in impounding sand, are in poor condition, and present a significant safety hazard. In some instances, the groins appear to be randomly placed, and are not of sufficient length, height, or spacing to adequately contain a beach planform between structures.

Piers

The only pier located in the study area is the Lake Worth Pier. The pier is constructed of reinforced concrete, timber, and steel. During the survey, there was no evidence that the pier significantly affecting the littoral processes in the local area. Structurally, the pier is in excellent condition, and ties directly into the seawall along the roadway.

Miscellaneous Structures

The remainder of the structures surveyed include dune crossovers, outfalls, pipes/supports, and well point systems for sea water supply. Crossovers which were attached to seawalls but not permanent (removable) were not surveyed. The timber walkways encountered appeared to be in good condition, and did not appear to affect shoreline dynamics. Crossovers along the FDOT revetment were independent structures on piles, and were generally in good condition.

There appears to be a dewatering system installation at two locations, some 200 feet south of FDEP Reference Monument R-88 and 600 feet south of R-106 fronting the Palm Beach Bath and Tennis Club, comprised of several pipes crossing the beach face. These exposed pipes

join a second system of pipes paralleling the beach, which are in turn connected to well points and suction lines. The system at the Bath and Tennis Club appeared to be functioning, and a noticeable discharge was observed. The second system appeared to be derelict, and was not operating. Both of these structures present significant safety hazards, as a large portion of the system is below water level.

In addition, several remnant pipes, supports, and miscellaneous unknown structures were surveyed throughout the study area. These also present significant safety hazards.

Several stormwater outfalls are located along the Island shoreline. Only municipal outfalls, or outfalls larger than 8 inches in diameter were surveyed. In some instances, the outfalls were observed to be flowing, and had eroded channels across the beach to the shoreline. Rock scour protection has been placed at the discharge point of several of the larger outfalls to help limit the extent of erosion from flowing water on the beachface.

3.3 DESCRIPTIVE AREAS (NORTH TO SOUTH)

For the purpose of this inventory, the study area was divided into areas which exhibited similar structure characteristics. The separation of these areas is not dependent or related to coastal processes, but is based solely on similarity of the structures and armoring techniques. A brief description of each area reach is given in the following sections, and progress north to south.

Lake Worth Inlet Spoil Area (Range 76 - 78)

Beginning at the Lake Worth Inlet south jetty, the coastal armoring in this area is limited to privacy walls well landward of the shoreline. The accretion of sand from the inlet sand bypassing system is obvious, and the beach is very wide. A wide, dense vegetated dune exists between the beach and privacy walls providing excellent storm protection.

North End of Palm Beach Island (Range 78 - 90+100 feet S.)

This inventory area is the largest covering approximately 2.5 miles. It is characterized by almost continuous seawalls of various construction. In the northern portion of this reach, there are some short sections with a strip of vegetation in front of the privacy walls. Further south, just seawalls predominate. Most of the seawalls, are constructed of steel sheet pile and/or concrete, most are in excellent condition, and are effective in

preventing landward recession of the shoreline. Seawall cap elevations are characteristically high in this area, with the majority of the structures extending 15 feet or more above the beach level providing a high level of storm protection.

Another feature of this reach is the presence of a continuous groin field. The groins, constructed mainly of steel sheet pile, are typically in very poor condition, and are ineffective in impounding longshore-directed sand. The corroded steel is missing in several instances, and often barely exposed above the sand, creating a significant safety hazard for beach users.

North of Mid-Town (Range 90 - 95)

Structural armoring in Reach 3 consists of nearly continuous seawalls, with small gaps containing vegetation only. The seawalls in this area are more randomly constructed than in any other reach shoreline segment. They consist of timber, concrete, and steel sheet pile. The beach width becomes extremely narrow near the southern end of the reach with seawalls subjected to wave action at high tides. Several stormwater outfalls which protrude through seawalls were observed to be flowing at the time of the survey.

In addition to the seawalls, this reach also supports a continuous groin field. The groins in the northern portion of the reach appear significantly older, being constructed of steel sheet pile and concrete. They are similar to those groins found in Reach 2. Further south, near the Breakers Hotel, the groins appear to be of more recent construction, being constructed of steel sheet pile and concrete and include rock armoring, either along the sides, or in a perpendicular fashion near the head. These newer groins are noticeably more effective and are in much better structural condition.

Mid Town (Range 95 - 104)

This reach includes the recently nourished Mid-Town Beach Restoration Project, and extends approximately 4,500 feet further south. Within the Mid-Town project area, eleven modular concrete groins were placed with armor stone at the heads and along the sides of the structures, and extend variable distances offshore. The groins are in good condition, and appear to be effective. As part of the project, several older steel sheet pile groins were removed from the area. South of the nourishment area, the older steel sheet pile groins are still in place, although severely deteriorated and ineffective. They also pose a high safety risk.

A seawall is continuous along this reach, and is constructed of concrete. The seawall is in good condition, and the in the Mid-Town beach fill has covered the toe scour protection which was exposed prior to the project. There are several stormwater outfalls protruding through the seawall which, when flowing, create temporary swales leading to the surf zone. Additionally, there are pedestrian walkthroughs in the seawall which continue beneath the adjacent roadway to the west side of State Road A1A.

South of Mid Town (Range 104 - 110)

Structural armoring of this reach is very similar to the previous reach. The northern portion of the reach contains ineffective steel sheet pile groins in very poor condition. Some newer groins have been installed in the southern portion of the reach, and are constructed of pre-cast concrete. These newer groins appear to have been installed independent of each other, set along property lines. They are in fair to good condition, and slightly effective. They do not appear to be a safety hazard, as there are no sharp edges or exposed metal.

The seawall is mostly continuous along this reach, consisting primarily of poured in place concrete of various dimensions. Directly north of the DOT revetment, the seawall jogs slightly westward, and is directly exposed to the wave action. North of this seawall segment is a small pocket beach, which continues for approximately 800 feet.

FDOT Revetment (Range 110 - 116 plus 500 feet south)

This area of the Island is armored exclusively with a continuous rock revetment constructed by the FDOT in 1987. The revetment is in good condition, with only the terminal ends showing wear. The filter fabric behind the revetment appears to be pulling away in some locations. The revetment appeared to be structurally sound, and should only require minor periodic maintenance.

Also located in this area is a continuous groin field. All of the groins are constructed of steel sheet pile, and were found to be in poor condition and ineffective. A major portion of each groin is submerged, and it appears that the groin crest elevations are too low to be effective in impounding longshore transported sand.

Phipps Ocean Park Area (Range 116 plus 500 feet south - 125)

This small area varies from those previously described for several reasons, one of which is the lack of seawall, with the exception of a small section directly south of the Park. Dune vegetation extends to the sand beach. Also, there are no groins in this area.

The natural dune is very high; however, it is being undermined by wave attack and collapsing in some areas. The timber dune overwalks are in fair condition, although they appear to be undercut by waves on a regular basis.

Lake Worth Pier Area (Range 125 - 131)

Starting approximately 2,000 feet south of the Par 3 Golf Course, this reach continues south to Lantana Park. This section of Beach alternates between seawall and natural vegetation. The seawall sections are in good condition, and in most cases tie to each other. There are no groins or other erosion control structures in this area.

South Palm Beach (Range 131 - 138)

The northern portion of this reach consists of an erosional dune with natural vegetation, and a lack of seawalls. Continuing south, shore armoring intensifies. The seawalls are in good condition, and no failures were observed. No groins or other erosion control structures were located in this area.

Manalapan (Range 138 - 146)

This reach is characterized by a continuous seawall and narrow beach face. The seawall is constructed predominantly of steel sheet pile with a concrete cap, and varies in condition from fair to excellent. The affect of different coatings on the steel is evident with exposed metal sheet pile noticeably more deteriorated than in covered areas. Joints, or knuckles on the sheet pile, show considerably more wear than other portions of the wall.

Some sections of the seawall are constructed of concrete, and one noticeably different style is located near Range 142. This seawall is characterized by a scallop type face, with pointed sections approximately 25 feet apart. This wall is massive in relation to other structures, and appears to be effective. The beach face is very narrow along this reach, and the seawalls are exposed to wave action during higher tides and storm events.

Manalapan and Inlet (Range 146 - 151)

This reach includes the Town of Manalapan shoreline directly north of the South Lake Worth Inlet. It is characterized by a lack of seawalls, and significant expanses of low-elevation vegetated dunes. Accretion of sand in the form of an updrift fillet is evident north of the Inlets north jetty. During the time of the survey, several small scale dune revegetation projects were observed, extending from the secondary dune to the shore face. There are several private dune overwalks which terminate in the vegetation zone, and low privacy walls are likely present behind the vegetation. A steel sheet pile wall with a concrete cap was located beginning approximately 60 feet south of the point of tangency with the Chillingworth Curve. The north return wall, which appears to tie into the edge of pavement was noted to lack a concrete cap. The tops of the steel sheets were noted to be badly corroded (See Appendix A). No other coastal armoring is present in this Reach.

SECTION 4

4.0 ISLAND SEDIMENT BUDGET

4.1 METHODOLOGY

The sediment budget for Palm Beach Island was prepared using profile surveys taken in 1974 at every third reference monument, in 1990 at each monument, and in 1997 at each monument except R-95 through R-99, (the Mid-Town Project area). The locations of each of the FDEP Control Monuments used in the analysis as well as the Beach Profile Comparison plots for 1974 versus 1990 and 1990 versus 1997 are provided in Appendix B. The volume change at Mid-Town was determined using the April, 1997 monitoring profiles surveyed by Sea Systems, Inc. The monument locations for the project monitoring network do not coincide exactly with the FDEP monuments for the Mid-Town shoreline segment. However, the locations surveyed are physically close enough to the FDEP monuments to provide a valid comparison with historic (pre-project) data. Volumetric and shoreline changes by monument for the two periods of record are furnished in Table 4-1.

4.2 RESULTS FOR PALM BEACH ISLAND

Palm Beach Island lost a total of approximately 555,000 cubic yards per year, or 6.7 cubic yards per foot per year, between 1990 and 1997. These losses were partially mitigated by:

- the Mid-Town beach nourishment project;
- operation of the sand transfer plant, which was rehabilitated and resumed operation in May 1996; and,
- Lake Worth Inlet maintenance dredge operations.

The Mid-Town project placed 882,158 cubic yards of sand between R-95 and R-100 in December, 1995, representing an average of 133,156 cubic yards per year over the period of analysis. The transfer plant moved an estimated 261,855 cubic yards, or 39,525 cubic yards per year to the northern 500 feet of the island. Additionally, 810,271 cubic yards (122,305 cubic yards per year) of maintenance spoil was placed in the permitted disposal area along the Island's northern 2,500 feet. The realized (measured) sand loss is 260,011 cubic yards per year, or 3.1 cubic yards per foot per year. By comparison, there was a net gain between 1974 and 1990 of 106,585 cubic yards per year, or +1.3 cubic yards per foot per year. Volumetric and Shoreline change rates by FDEP Range Monument are provided for the 1974 - 1990 and 1990 - 1997 analysis periods. Volume changes by shoreline reach over the entire Island are summarized in Table 4.2. The changes between 1990 and 1997 are shown graphically in

**Table 4-1
Volumetric and Shoreline Changes for Palm Beach Island**

Monument	1974 to 1990		1990 to 1997		Comments
	Volume Change (cy/ft)	Shoreline Change (ft)	Volume Change (cy/ft)	Shoreline Change (ft)	
R-76	--	52.99	152.25	171.93	STP discharge and USACOE dredge spoil area
R-77	--	104.67	159.37	136.52	
R-78	164.57	87.63	-76.41	42.89	1995 borrow area excavation for Mid-Town Beach Restoration Project area
R-79	--	34.24	-16.62	-13.91	
R-80	--	0.46	-52.74	-7.06	1974 profile terminated at -5.28
R-81	24.06	-0.90	-68.24	-34.13	
R-82	--	15.59	-77.91	-30.87	
R-83	--	19.06	-46.16	-23.54	
R-84	70.85	11.52	-47.34	-13.38	
R-85	--	0.55	-7.84	7.90	
R-86	--	43.64	-14.90	-1.64	
R-87	--	23.51	-43.85	23.68	
R-88	--	39.14	-109.16	-28.94	
R-89	--	11.48	5.97	1.12	
R-90	66.27	89.16	-22.37	-36.15	Monument reset in 1977
R-91	--	72.25	-5.93	7.60	
R-92	--	97.69	-10.41	-28.70	The following 1997 profiles were used to calculate shoreline and volumetric changes: 94I for 95, 96A for 96, 97A for 97, 98A for 98, and 98J for 99
R-93	84.70	60.88	-15.75	-8.27	
R-94	--	reset	6.92	-65.79	
R-95	--	8.25	-56.88	-29.11	
R-96	-32.35	20.42	103.33	92.15	
R-97	--	-13.77	110.78	185.53	
R-98	--	-50.00	55.76	110.06	
R-99	-27.26	43.05	86.19	62.22	
R-100	--	41.69	-14.31	-17.66	
R-101	--	46.33	35.17	10.39	
R-102	-21.29	43.09	25.30	-23.16	
R-103	--	48.00	-1.64	4.77	Nearshore profile "depression"
R-104	--	26.33	11.95	-9.23	
R-105	28.13	31.52	-23.82	0.53	
R-106	--	-9.34	-6.78	18.17	
R-107	--	3.41	-23.79	5.36	
R-108	-15.93	-39.31	-70.19	-13.44	
R-109	--	-17.83	-24.35	15.58	
R-110	--	-25.03	-9.74	27.78	
R-111	-22.83	7.97	-71.31	-9.74	
R-112	--	-27.99	-10.12	26.52	
R-113	--	-12.08	-65.32	-10.83	
R-114	-19.85	-25.89	-46.74	-6.68	
R-115	--	-26.69	-29.59	8.51	
R-116	--	-31.94	-66.86	-16.81	
R-117	-11.71	-54.72	-99.54	-61.37	
R-118	--	34.55	-88.38	-62.29	
R-119	--	41.44	-72.86	-31.99	
R-120	22.92	82.91	-86.52	-65.54	
R-121	--	50.84	-82.29	-49.73	

Table 4-1
Volumetric and Shoreline Changes for Palm Beach Island
(continued)

Monument	1974 to 1990		1990 to 1997		Comments
	Volume Change (cy/ft)	Shoreline Change (ft)	Volume Change (cy/ft)	Shoreline Change (ft)	
R-122	--	44.44	-56.81	-10.17	
R-123	10.56	27.33	6.36	52.64	
R-124	--	-13.24	-21.69	42.70	
R-125	--	16.11	-21.35	28.68	
R-126	-3.13	38.22	-3.55	25.98	
R-127	--	41.24	-3.41	-21.01	
R-128	--	95.50	-49.59	-48.73	
R-129	-0.79	61.26	-90.24	-82.85	south of Lake Worth Pier
R-130	--	70.95	-71.51	-50.80	
R-131	--	33.67	-45.20	-24.96	
R-132	-15.75	4.34	-28.76	-3.45	
R-133	--	-4.53	-29.62	4.06	
R-134	--	-33.42	-37.28	16.08	
R-135	-50.02	-23.64	-13.44	21.15	
R-136	--	-30.33	-45.60	5.36	
R-137	--	-38.28	-26.94	-14.34	
R-138	-22.56	-54.97	-16.59	5.22	
R-139	--	-42.83	-30.35	-23.75	
R-140	--	-32.48	-16.43	-15.39	
R-141	25.44	83.98	-41.20	-73.00	
R-142	--	-22.52	-33.14	-13.46	
R-143	--	-44.13	-9.07	16.23	
R-144	2.20	-58.86	-4.59	-2.80	
R-145	--	-21.01	-26.61	-22.03	
R-146	--	23.10	-28.37	-55.98	Shoreline is accretional above Mean High Water
R-147	88.68	63.70	6.58	1.28	" "
R-148	--	80.81	11.64	10.70	" "
R-149	--	76.78	-5.20	0.95	" "
R-150	58.50	37.60	-1.15	21.86	" "
R-151	--	-1.67	-16.81	14.19	" "

NOTES:

Shoreline changes referenced to NGVD

Volume changes computed to -25.0 feet NGVD

Time period for 1974 to 1990 surveys = 15.8 years

Time period for 1990 to 1997 surveys = 6.6 years

-- indicates insufficient data in the 1974 profile data set (long lines were measured only at every third monument)

Shaded values indicate volumetric losses/shoreline recession

Table 4-2
1990 - 1997 Sediment Budget
Annual Volume Change Rates by Reach Designation

Reach No.	Start	End	Length (ft)	Volume Change		Comments
				cy/yr	cy/ft/yr	
1	R-76	R-78	2,410	36,104	15.3	2,400 ft south of Lake Worth South Jetty; sand bypassing
2	R-78	R-90+400	13,660	(90,889)	-6.7	High erosion rates
3	R-90+400	R-95	5,800	(12,157)	-2.1	
4	R-95	R-102+300	8,065	64,566	8.0	Mid-Town Project: Change Without Fill = -8.5 cy/ft/yr
5	R-102+300	R-110+100	9,065	(23,832)	-2.6	
6	R-110+100	R-116+500	6,685	(41,460)	-6.2	High erosion rates
7	R-116+500	R-125	8,725	(74,723)	-8.6	Highest erosion rates on the island
8	R-125	R-134	10,690	(66,054)	-6.2	High erosion rates
9	R-134	R-137+400	3,655	(16,114)	-4.4	La Bonné Vie to Lantana Avenue access
10	R-137+400	R-145+740	8,560	(30,113)	-3.5	
11	R-145+740	Inlet (R-151+300)	5,530	(5,339)	-1.0	Accretional above MHW
Total			82,845	(260,011)	-3.1	
Measured Annual Shoreline Volume Change				(260,011)	-3.1	
Fill Added:						
Bypassing Plant				39,525	0.5	
Channel Maintenance				122,305	1.5	
Mid-Town Project				133,156	1.6	
Actual Annual Shoreline Volume Changes				(554,997)	-6.7	

Figure 4-1. The cumulative volume changes between 1990 and 1997 at 5-foot contour intervals are provided in Appendix B. Reach designations are discussed in detail in Section 6 of this Plan.

Two features are of particular note in Figure 4-1. The substantial accretion in the northernmost 2,000 feet of Palm Beach Island resulting from both the sand transfer plant bypassing and maintenance dredging operations as well as the second highest erosion rates on the Island over the 2.6 miles of shoreline south of this area, strongly suggests that material bypassed to the south side of Lake Worth Inlet is not being rapidly or efficiently dispersed to the downdrift shorelines. Second, the erosion rates in Reaches 6 and 7, the area which includes Sloan's Curve and the FDOT rock revetment, had two of the most extreme erosion rates on the Island between 1990 and 1997, with losses of 15 cubic yards per foot per year at FDEP Monument R-117 at the north end of Reach 7. The erosion is most evident recognizing the development of a substantial offshore trough extending from 200 to 1,000 feet offshore in 5 to 15 feet of water.

4.3 UPDATED LAKE WORTH INLET SEDIMENT BUDGET

Updated sediment budgets for Lake Worth Inlet for the periods 1990-97 and 1974-97 are shown in Figures 4-3 and 4-4, respectively. A definition sketch is provided as Figure 4-2. The sediment budget was updated using the 1997 profile data, sand bypassing records, and inlet maintenance dredging data.

Sand placed by the bypassing plant and maintenance dredging between 1990 and 1997 was confined to the northern 2,500 feet of the island between approximately R-76 and R-78. The southward movement of sand from this region is limited because of the sheltering effects of the south jetty. The reader is referred to the Lake Worth Inlet Management Plan Wave Refraction Analysis for additional details. Under northerly wave conditions, the most significant southward movement of sand occurs within the immediate nodal region at R-78, which is at the extreme southern end of the inlet maintenance spoil placement area. Under southerly wave conditions, however, sand along the entire placement area is readily moved and redeposited in the inlet or moved offshore.

Incremental Volume Changes at Five Foot Elevation Intervals

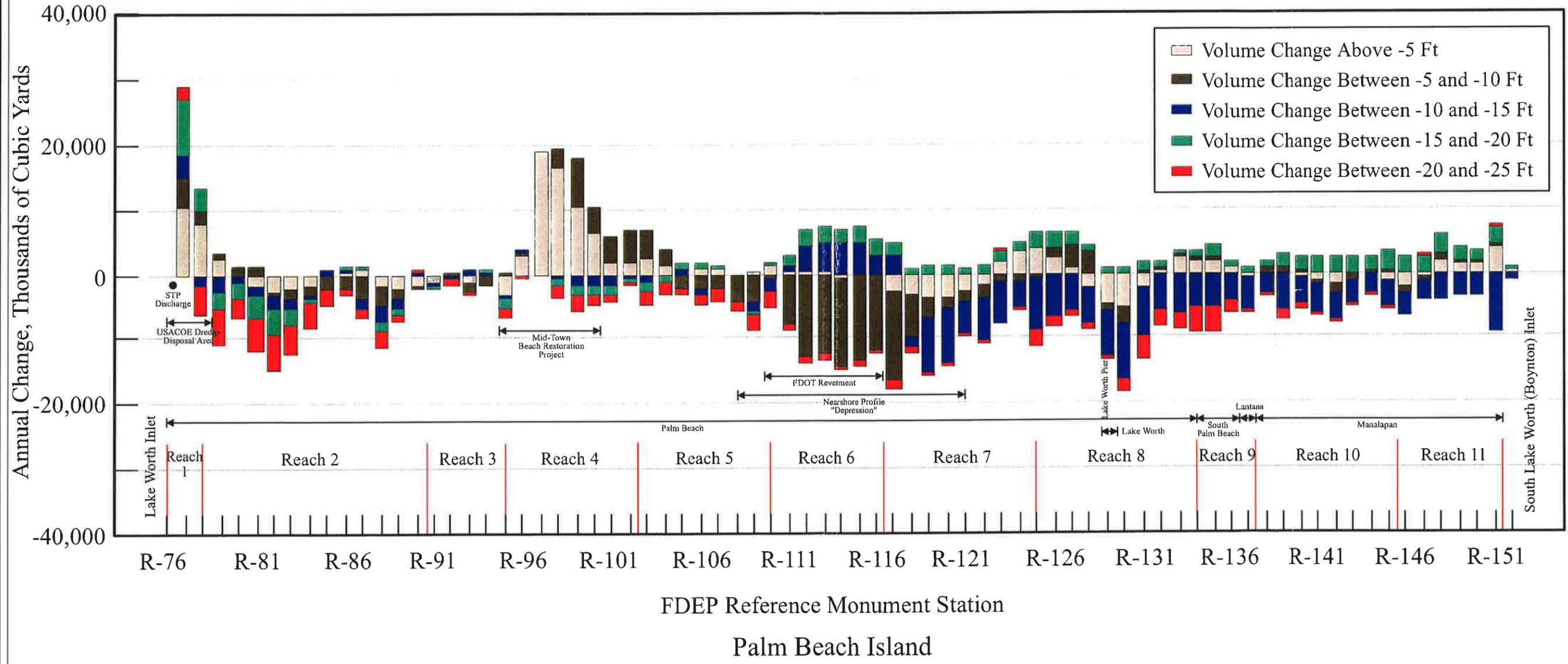
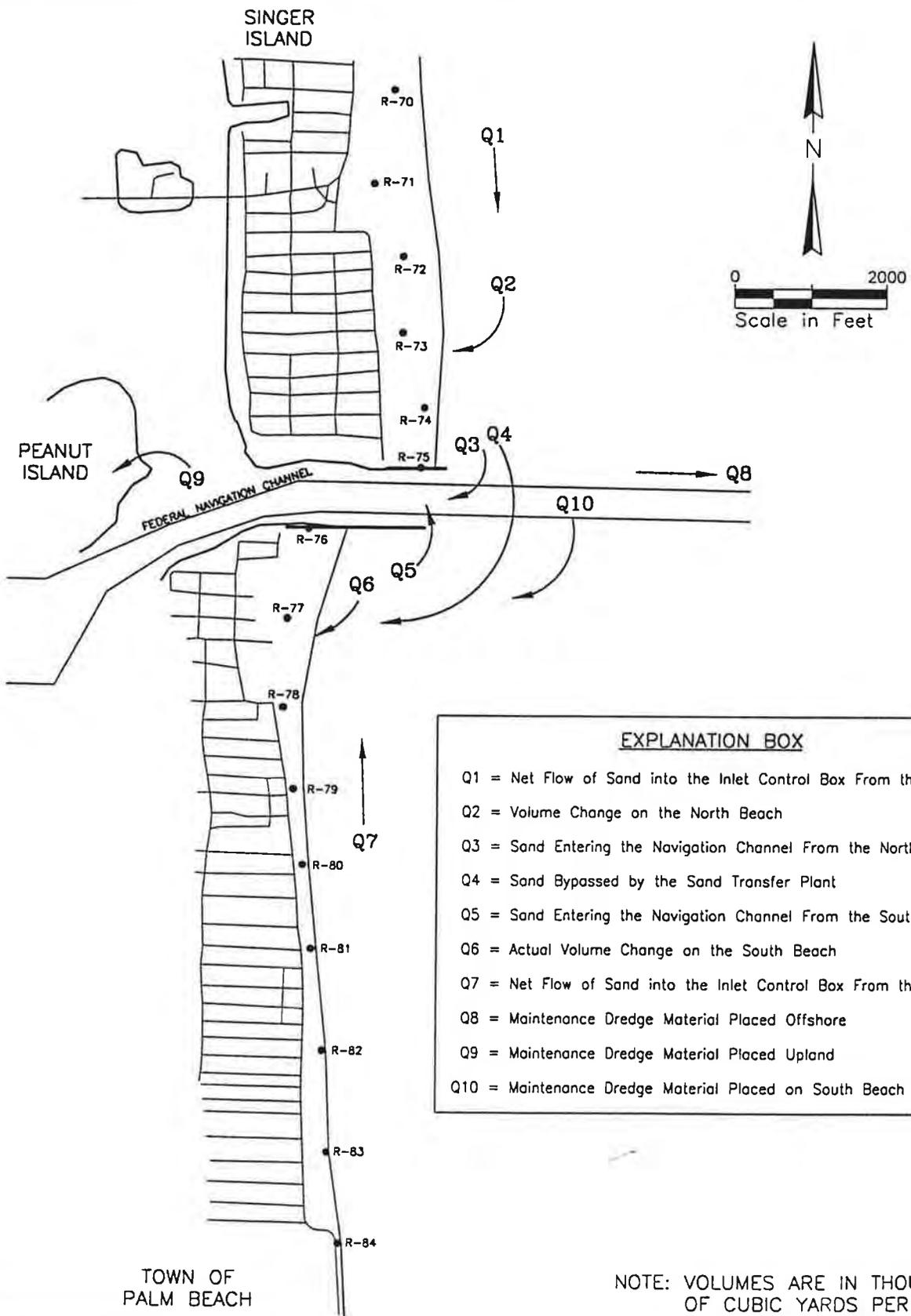


Figure 4-1
Annual Volume Changes on Palm Beach Island, 1990 - 1997



EXPLANATION BOX

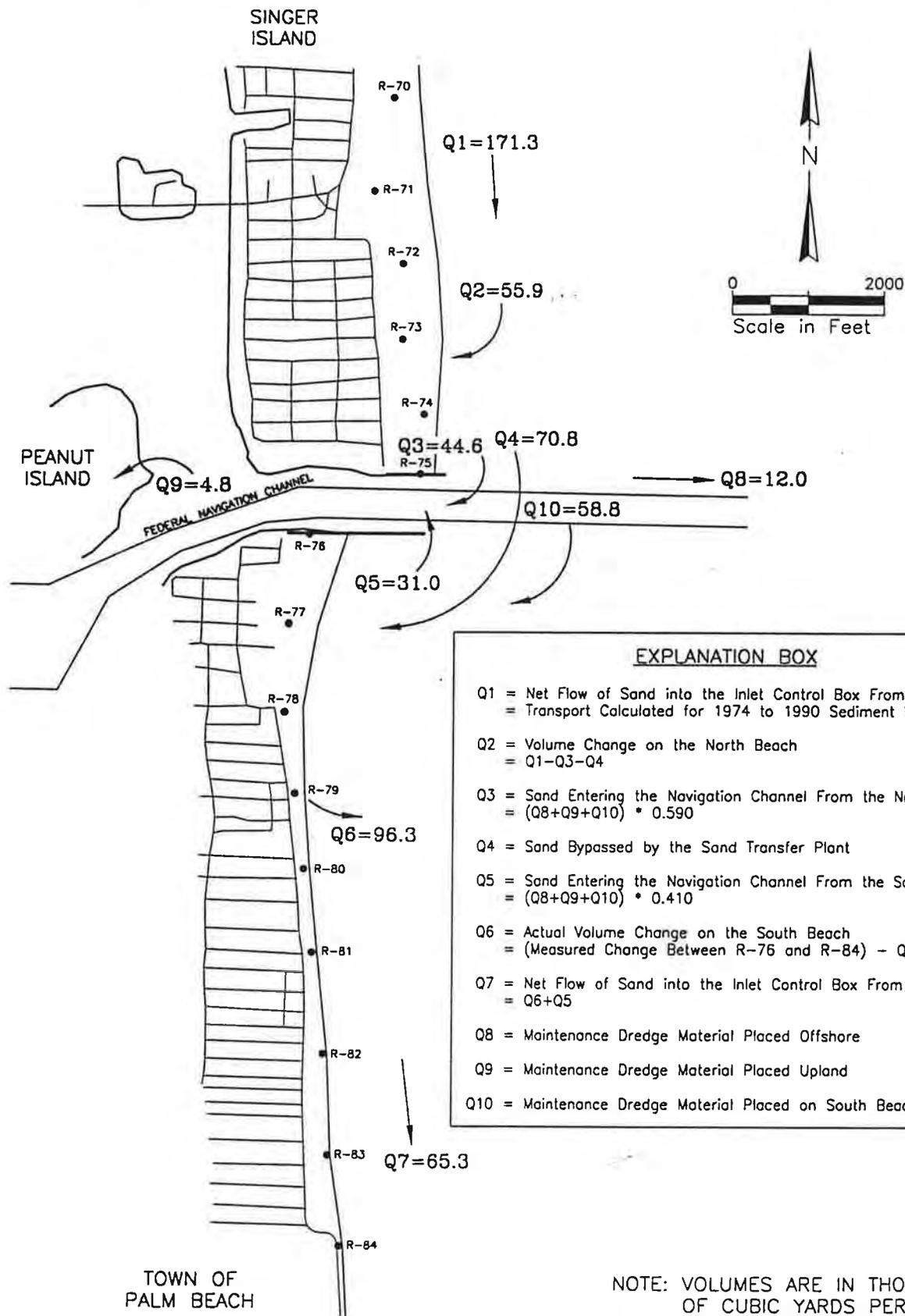
Q1 = Net Flow of Sand into the Inlet Control Box From the North
 Q2 = Volume Change on the North Beach
 Q3 = Sand Entering the Navigation Channel From the North
 Q4 = Sand Bypassed by the Sand Transfer Plant
 Q5 = Sand Entering the Navigation Channel From the South
 Q6 = Actual Volume Change on the South Beach
 Q7 = Net Flow of Sand into the Inlet Control Box From the South
 Q8 = Maintenance Dredge Material Placed Offshore
 Q9 = Maintenance Dredge Material Placed Upland
 Q10 = Maintenance Dredge Material Placed on South Beach

NOTE: VOLUMES ARE IN THOUSANDS OF CUBIC YARDS PER YEAR.

96-01.DWG 08/28/97

Figure 4-2
 Definition Sketch for Lake Worth Inlet Sediment Budget
 (Direction of Arrows Taken as Positive)





EXPLANATION BOX

$Q1$ = Net Flow of Sand into the Inlet Control Box From the North
= Transport Calculated for 1974 to 1990 Sediment Budget

$Q2$ = Volume Change on the North Beach
= $Q1 - Q3 - Q4$

$Q3$ = Sand Entering the Navigation Channel From the North
= $(Q8 + Q9 + Q10) \cdot 0.590$

$Q4$ = Sand Bypassed by the Sand Transfer Plant

$Q5$ = Sand Entering the Navigation Channel From the South
= $(Q8 + Q9 + Q10) \cdot 0.410$

$Q6$ = Actual Volume Change on the South Beach
= (Measured Change Between R-76 and R-84) - $Q4$ - $Q10$

$Q7$ = Net Flow of Sand into the Inlet Control Box From the South
= $Q6 + Q5$

$Q8$ = Maintenance Dredge Material Placed Offshore

$Q9$ = Maintenance Dredge Material Placed Upland

$Q10$ = Maintenance Dredge Material Placed on South Beach

NOTE: VOLUMES ARE IN THOUSANDS OF CUBIC YARDS PER YEAR.

Figure 4-3
Updated Conceptual Sediment Budget,
Lake Worth Inlet
1974 to 1997



08/28/97 96-03.DWG

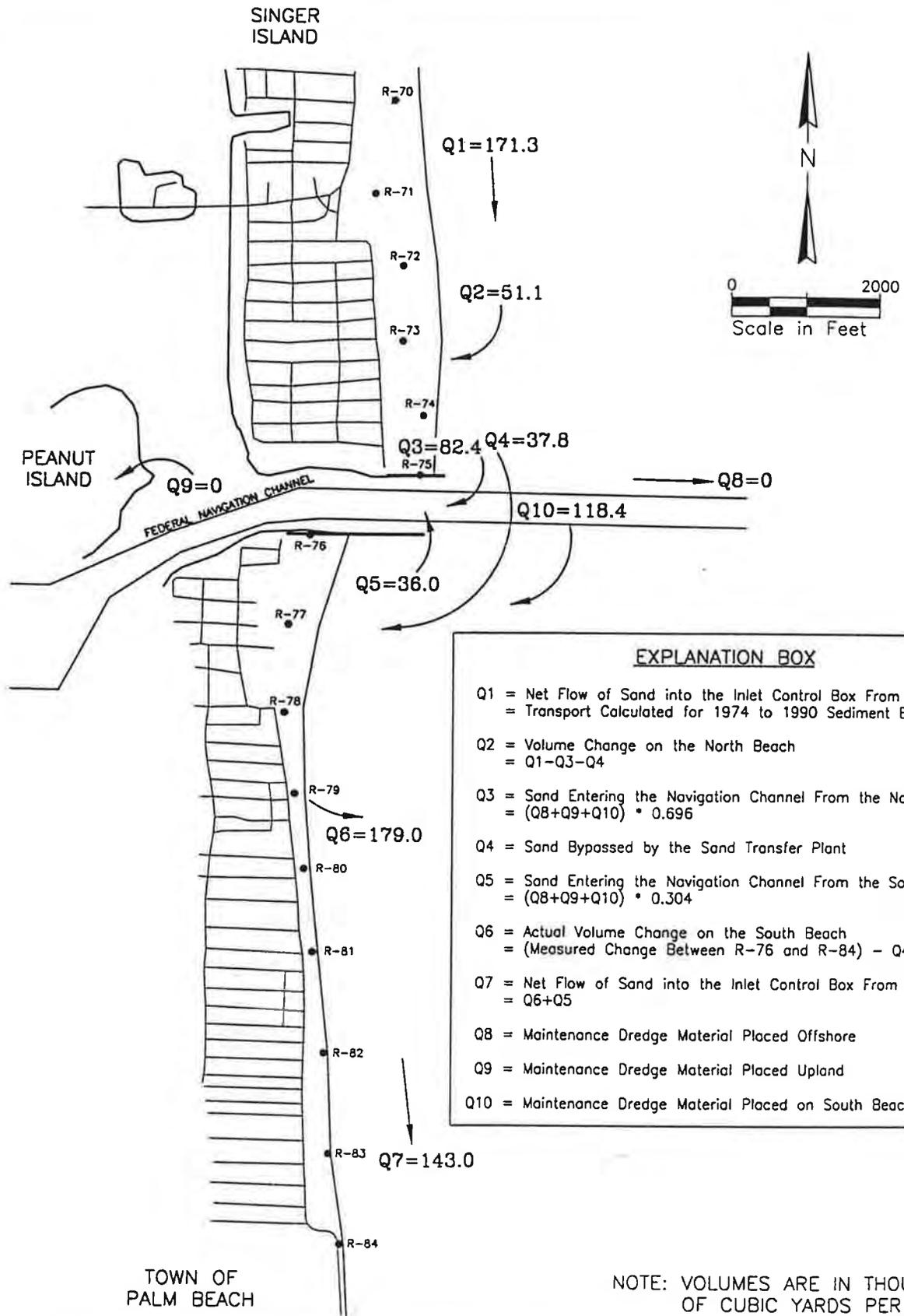


Figure 4-4
Updated Conceptual Sediment Budget,
Lake Worth Inlet
1990 to 1997



Sand moves into Lake Worth Inlet from both the north and the south. With the sand transfer plant in operation, the volume of sand entering from the south was estimated to be 50 percent of the total channel sedimentation. During the period 1990 to 1994, when the plant was not operational, the relative volume of sand entering from the south was reduced to 25 percent of the total. These numbers are based, in part, upon an assessment of the pre- and post-dredge maintenance surveys for the inlet and in part on the relative percent of time that sand transport is from the north versus the south. A similar analysis between 1994 and 1997 was not completed because pre- and post-dredge maintenance dredge surveys could not be obtained from the USACOE.

Evaluation of the 1997 beach profile data suggest that the relative channel shoaling volume from the south is closer to 55 percent than 25 percent. The placement of maintenance dredge spoil and bypassed sand on the extreme north end of Palm Beach Island has so overfilled the area that the sand much more easily migrates around the end of the south jetty and back into Lake Worth Inlet rather than being south transported to the remainder of the Island. The profile at R-76 shows a large volume of sand that has accreted immediately south of the jetty. Additionally a deeper area parallel to and south of the south jetty has formed. Currents generated in this channel tend to carry sand that has accreted adjacent to the south jetty back into Lake Worth Inlet.

For purposes of the updated sediment budget, it was assumed that sand found below the -10-foot contour moves around the end of the south jetty while sand above the -10-foot contour stays in place and/or eventually moves to the south.

Fifty-five percent of the sand accretion between R-76 and R-78 is below the 10 foot contour. This number is extrapolated to assume that 55 percent of all material placed in this region (all of it above the 10 foot contour) eventually ends up below the 10 foot contour and migrates back into the inlet or offshore.

The total volume of sand placed between R-76 and R-78 between 1990 and 1997 is 1,072,126 cubic yards, which includes 810,271 cubic yards of maintenance spoil and an estimated 261,855 cubic yards from the bypassing plant. Estimates for the bypassing plant are based upon pump tests conducted by Palm Beach County, which showed a pump rate of 230 cubic

yards per hour. (Clinton W. Thomas, personal communication). A tabulation of sand transfer plant hours of operation and by passed volumes (based on pre- and post-rehabilitation hourly pump rates) since plant operation commenced in November 1958 are provided in Appendix B.

SECTION 5

5.0 SAND SOURCES FOR BEACH RESTORATION AND RENOURISHMENT

5.1 METHODOLOGY

An assessment of previously identified and potential deposit areas was undertaken to determine the location, quality, and relative quantities of beach-quality sand resources located offshore or in the vicinity of Palm Beach Island. Approximately 85 vibracores have been obtained offshore of the south end of Singer Island and directly offshore of Palm Beach Island since the mid-1960's. The locations of the general bounded borrow areas are shown on Figure 5-1. For the exact location of each individual vibracore obtained offshore of Palm Beach Island, the reader is referred to Figures 6-1 through 6-13 in the following section of this report.

5.2 PREVIOUS SAND SOURCE STUDIES AND INVESTIGATIONS PERFORMED OFFSHORE OF PALM BEACH ISLAND

Nearshore Continental Shelf Investigation - USACOE Coastal Engineering Research Center

The USACOE Jacksonville District contracted for geophysical exploration (field work) off of Florida's east coast in 1965, with seismic profiling and vibracoring operations supervised under contract with the Coastal Engineering Research Center (CERC). CERC provided funding support for the project, which is detailed in Technical Memorandum Number 29 (USACOE, 1969). The purpose of the study was part of a Sand Inventory Program and was to locate and evaluate potential sand deposits suitable for use in shore protection and restoration projects.

Three vibracores (Core Number Designations C-29, C-30 and C-31) were recovered offshore of Palm Beach Island as part of this Program. The location of each of the vibracores are displayed in Figures 6-4, 6-8 and 6-13 and are labeled with a 'C' prefix. The core analyses conducted revealed relatively fine-grained samples, with mean grain size varying between 0.165 and 0.265 mm. The study concluded that, in a general sense, the "...sand size sediment from the shelf bordering southeastern Florida is of marginal quality" (USACOE, 1969).

Town of Palm Beach Borrow Area Investigations

Discrete offshore areas were targeted and investigated by the Town of Palm Beach in 1987 in support of the proposed (at that time) Mid-Town Beach Nourishment Project. Two areas were identified approximately one-half mile offshore of the project shoreline (see Figure 5-1 for the bounded borrow areas determined by detailed vibracoring, the locations of which are provided on Sheets 6-4 through 6-6). However, the material located within the potential borrow areas contained relatively fine-grained sand, with a composite mean grain size of 0.19 mm (Coastal Planning & Engineering, Inc. 1988). The characteristics of the borrow source sand would have required a high overfill ratio to account for the relative incompatibility of the borrow material with the native beach sand (which was determined to display a native mean grain size of 0.31 mm).

A subsequent sand source investigation was undertaken by the Town which targeted the Lake Worth Inlet shoal complex in an attempt to locate coarser sand (Coastal Planning & Engineering, Inc., 1989) which more closely matched the native beach sand. Two borrow areas were identified in this Phase II investigation, which revealed composite mean grain size of 0.25 mm and 0.30 mm in the north and south borrow areas, respectively. Estimated quantities of available sand were 4.7 million cubic yards in the north borrow area and 7.37 million cubic yards in the south shoal. Due to cemented sand layers present, particularly in the south borrow area, dredge limitations to a 10 foot average depth of cut yielded an estimated dredge quantity of 1.95 million cubic yards and 2.63 million cubic yards in the north and south borrow areas, respectively (USACOE, 1992). Based on the higher quality and quantity of sand in the south borrow area, the Town elected to pursue this area for the proposed Mid-Town Beach Nourishment Project.

Coast of Florida Erosion and Storm Effects Study - USACOE

The USACOE, Jacksonville District, and the (former) Florida Department of Natural Resources conducted a cooperative feasibility study of beach erosion and storm damage problems associated with the lower southeast Florida coast (Palm Beach, Broward and Dade Counties), referred to as study Region III. The Coast of Florida Erosion and Storm Effects Study for Region III (COFS Feasibility Study) was initiated in August 1988, with study costs shared between the two agencies on an equal basis. The Study includes an appendix pertaining to geotechnical investigations.

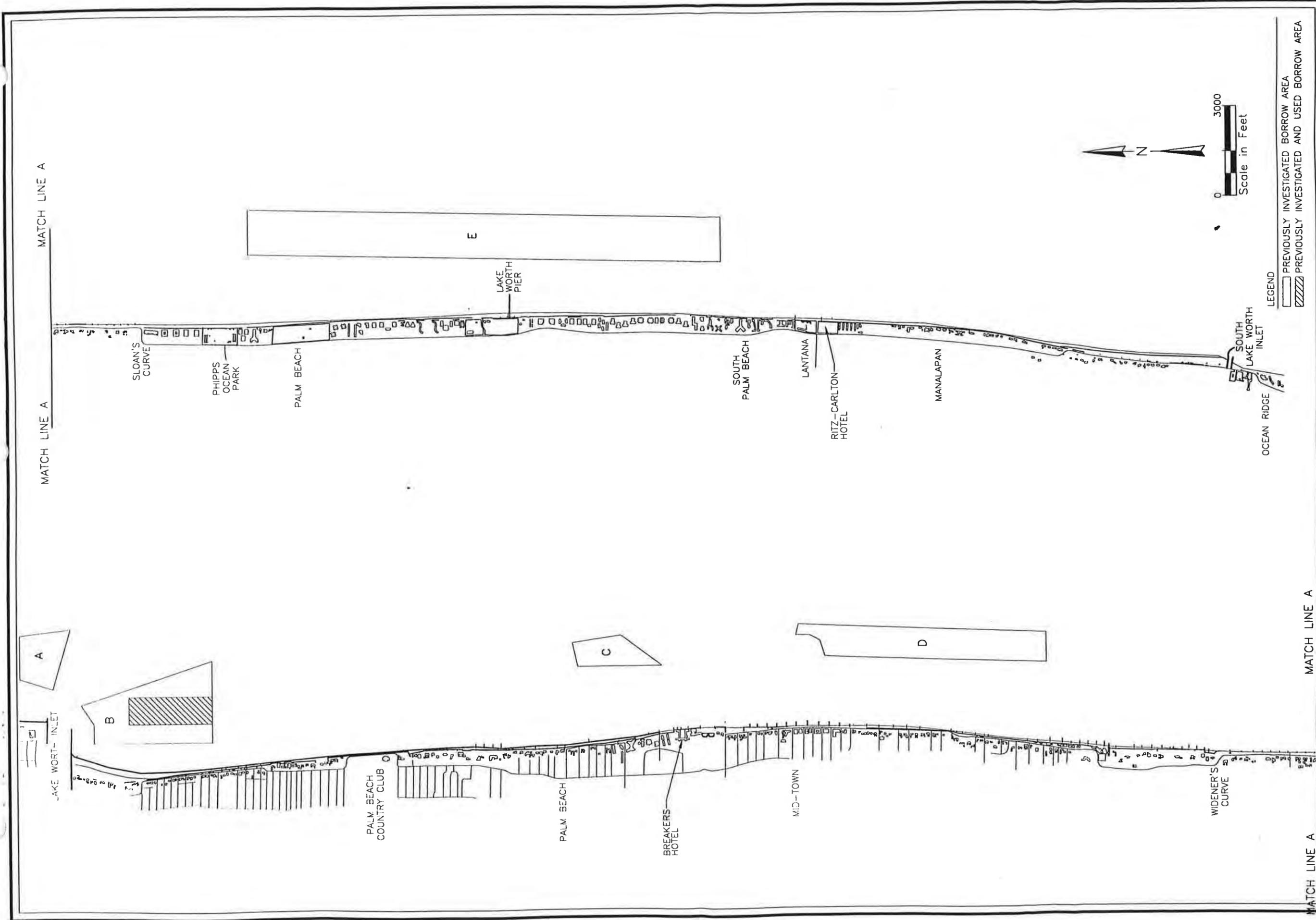


FIGURE 5-1
EXISTING SAND SOURCES OFFSHORE OF PALM BEACH ISLAND

A total of seven vibracores were obtained offshore of Palm Beach Island (PBCERM, 1993) in conjunction with the COFS. As with previous study findings summarized above, the physical location of the COFS vibracores are provided in Figures 6-7 through 6-12. A straight compositing of the samples analyzed within the vibracores indicates a mean grain size of 0.2 mm and a silt/clay content of 0.41 percent. Because the cores were taken some distance apart and due to relatively consistent sampling depths within each extracted core, a weighted composite does not appear to lend benefit to determining such values. Clearly, the sand samples extracted at these discrete locations indicates that relatively fine-grained sand deposits reside offshore of Palm Beach Island.

Palm Beach County Department of Environmental Resource Management

In June 1993, Palm Beach County obtained twenty vibracores offshore of Palm Beach/South Palm Beach in support of beach restoration of the shoreline in this area (PBCERM, 1993). The vibracores are designated in Figures 6-7 through 6-11 as LW-1 through LW-20, respectively and were taken from 2,300 feet to approximately 3,600 feet offshore of the area between the Reef and La Bonne' Vie Condominiums. Water depths in the area of investigation ranged from 29 to 38 feet. Composite samples were taken in each of the cores with the composite mean grain size of all twenty cores determined to be 0.18 mm. In comparison the 'native' beach yielded a composite mean grain size of 0.38 mm. This grain size discrepancy and the sorting characteristics of the native versus "borrow" area indicate that the sand deposit will probably require a more significant overfill volume for the beach located west of the area studied.

Mid-Town Beach Restoration Project Borrow Area Investigation

In July 1995, the Town of Palm Beach authorized ATM to obtain vibracore samples of the previously-permitted EBB shoal borrow area located immediately south of Lake Worth Inlet. A total of seventeen (17) cores were acquired to define the optimal quality sand located within the much larger bounded area. The cross-hatched sub-area depicted in Figure 5-1 indicates the optimal area of cut specified. The beachfill contractor utilized sand from this restricted area to construct the Mid-Town project in late fall 1995. A total of approximately 880,000 cubic yards of sand were removed from the borrow area.

5.3 POTENTIAL SOURCES OF SAND FOR BEACH RESTORATION AND RENOURISHMENT ON PALM BEACH ISLAND

Offshore Sand Deposits

In addition to the several large deposits investigated over the past approximately 30 years, there may be additional sand resources of suitable quality and quantity for beach restoration and renourishment offshore of Palm Beach Island. The USACOE estimated that there are 187 million cubic yards of sand offshore of the Island, with average sand deposits estimated to be 30 feet thick (USACOE, July 1996). It was additionally stated that the largest sand deposits are noted to occur offshore of Mid-Town and Manalapan.

Although the Coast of Florida Erosion and Storm Effects Study provided for a 400 foot radius buffer from known hardbottom resources, it should be noted that the sand volumes cited above do not account for such setbacks or the current practical limitations of conventional dredging equipment. Sand isopach maps produced for the Region III Study were derived by utilizing existing seismic profiling information. The USACOE states that the Geographic Information System (GIS) geotechnical coverages provided in the COFS are "...intended to give an overview of the information available. They are not the end product working plates for all scopes of investigations..." (USACOE, July 1996).

Use of any sand resources offshore of Palm Beach Island (and hence the cost of transferring such resources to the shoreline segments in need of restoration/renourishment will be principally restricted by the following:

- existing water depths to the sand interface;
- distance from the borrow area to the project shoreline(s);
- maintaining an adequate buffer from adjacent hardbottom resources; and,
- compatibility of sand deposits with the project beach.

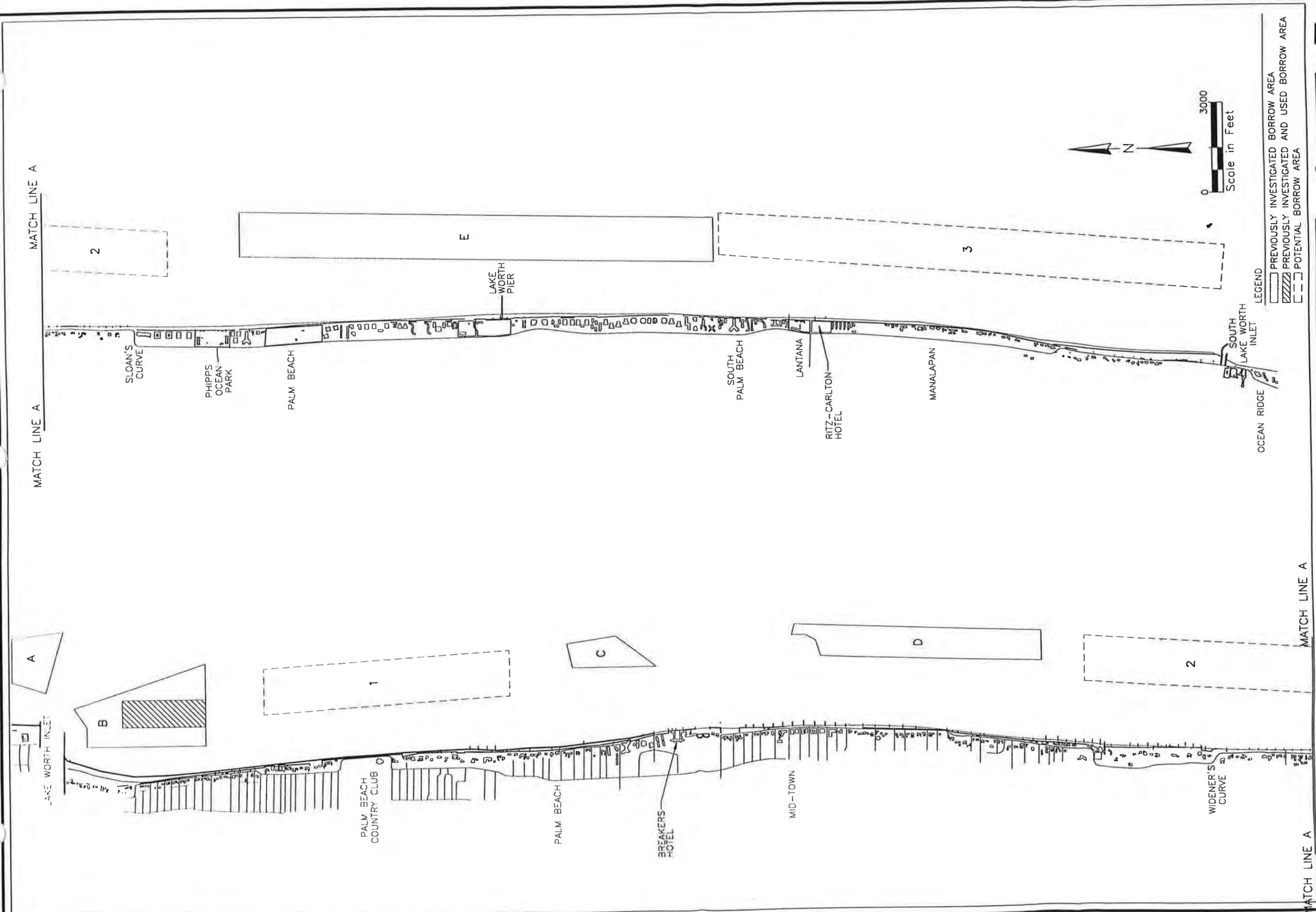
Given the above constraints, it is therefore not likely that 187 million cubic yards of beach-compatible sand could be practically or economically recovered for use. Only through detailed investigation of potential target resource areas will sand source quantity and quality be accurately assessed.

A schematic of areas offshore of Palm Beach Island which may contain beach-quality sand is furnished in Figure 5-2. These areas are depicted as target areas only. Detailed review of side-scan sonar, subbottom and bathymetric data will further refine actual site boundaries and identify the extent of the best sand.

The offshore area located between the Lake Worth Inlet borrow area and the northern Mid-Town area contains a potentially large volume of sand to support shoreline restoration efforts. The COFS indicates sand thicknesses of greater than 15 feet (see Appendix D). Similarly, the area between South Palm Beach and Boynton Inlet may contain suitable quantities of sand for shoreline restoration. For example, a uniform cut of 10 feet in the Area offshore of DEP Monuments R-136 to R-150 designated by the USACOE on Plate E-3 of the COFS Geotechnical Appendix as a "New Borrow Area" would yield a sand volume of approximately 7.5 million cubic yards. The only existing sediment quality information available in this offshore zone is from a single vibracore. Core Number C-31, acquired by the USACOE Coastal Engineering Research Center in 1965, yielded a (non-weighted) average mean grain size of 0.25 mm from three samples taken at 2 ft, 7 feet and 10 feet from the top of the recovered core (USACOE, 1969).

Based on the existing grain size characterizations performed to date on the previously investigated borrow areas and the net erosive characteristics of the Island, Table 5-1 provides a preliminary ranking of the borrow areas depicted in Figure 5-2. Volumes are estimated based on a uniform depth of cut arbitrarily set at 10 feet over the *entire* bounded areas to provide an indication of relative sand quantity and quality characteristics (where available).

Prior to selecting one or more area for sand sourcing on beach restoration or renourishment projects, particularly the previously investigated sites, a limited number of additional vibracores should be acquired. Subsequent laboratory analyses should then be conducted to confirm the relative quality of the sand characteristics previously reported prior to designating such areas for use.



LEGEND

- ▭ PREVIOUSLY INVESTIGATED BORROW AREA
- ▨ PREVIOUSLY INVESTIGATED AND USED BORROW AREA
- - - POTENTIAL BORROW AREA



FIGURE 5--2
EXISTING AND POTENTIAL SAND SOURCES OFFSHORE OF PALM BEACH ISLAND

Table 5-1

Preliminary Ranking by Category of Previously Identified and
Potential Offshore Borrow Areas
Palm Beach Island

Borrow Area Ranking	Borrow Area Designation (From Figure 5-2)	Approximate North-South Extent Relative to Shoreline	Mean Grain Size mm ¹	Volume of Sand Utilizing Uniform 10 ft. Cut Depth ² (Cubic Yards)
1	B	Lake Worth Inlet South Jetty to Kenlyn Road	N/A (Optimal area of cut utilized for Mid-Town Beach Restoration Project)	N/A
2	A	South end of Singer Island to Lake Worth Inlet	0.25	1.95 X 10 ⁶
3	D	Royal Palm Way to Via Palma	0.19	2.99 X 10 ⁶
4	E	Phipps Ocean Park to La Bonne' Vie	0.18	5.15 X 10 ⁶
5	C	Wells Road to Breakers Row	0.19	1.48 X 10 ⁶
1	3	The Barclay to South Lake Worth Inlet	0.21 (Based on COFS-37, COFS-38, and C-31)	9.61 X 10 ⁶
2	1	Colonial Lane to Casa Benita	To be determined	4.61 X 10 ⁶
3	2	Woodbridge Road to 2000 Sloan's Curve	0.15 (Based on C-32, C-33, and C-34)	6.61 X 10 ⁶

Notes:

1. Composite mean grain size as reported by others (see report text for references).
2. Assumes 100% of material in borrow area is accessible and beach-compatible.

Spoil Disposal Site on Peanut Island

Discussion with Mr. David Roach, Assistant Executive Director of the Florida Inland Navigation District, revealed that approximately one million cubic yards of potentially beach-quality sand resides within the spoil disposal site on Peanut Island. Mr. Roach indicated that the sand spoil contains some rock and rock fragments, likely requiring some type of screening operation to separate the rock from the sand. The District and Palm Beach County are anticipating improvements to the Peanut Island parcel and expects that the sand may be available for transport off the Island on or before the year 2002. Further quality tests (core borings and grain size analyses), and cost estimates for rock removal and transport to Palm Beach Island shoreline segment(s) should be conducted prior to considering this potential sand source as economically viable for beach restoration and/or renourishment.

Upland Sources

Should more detailed offshore sand source investigations conclude that sand from such sources would require high overfill ratios for shoreline restoration, sand could be obtained from quarry sources proximate to Palm Beach County. Quarried sand in the Lake Wales/Ortona area is typically processed for concrete and masonry use and may display grain size characteristics which may be suitable for use in beach restoration. The unit costs and impact to infrastructure (roads) associated with truck hauling to the project area(s) make this alternative not viable during the planning horizon considered in this report.

SECTION 6

6.0 SHORELINE REACH IDENTIFICATION AND CHARACTERIZATION

6.1 METHODOLOGY

The 15.7 mile-long Palm Beach Island displays an irregular shoreline, with much of the oceanfront backed by seawalls and revetments. Groin fields are also prevalent along the northernmost 8.4 miles of the shoreline, with the highest concentration of such structures present between Wells Road and Sloan's Curve. Vegetated dune features are present from the Lake Worth Inlet south jetty to Onondaga Avenue, at Clarke Avenue Beach, Phipps Ocean Park to R.G. Kreusler Memorial Park, Lantana Municipal Beach and south of Chillingsworth Curve to South Lake Worth Inlet. Dune vegetation is present along individual parcels throughout the Island where shore protection structures (seawalls) are located further landward when compared to adjacent properties or where seawalls were absent altogether. Land uses vary but are fairly uniformly characterized. Single and multifamily residential designations are predominant. The remainder of the shoreline is in public ownership, either by the local municipalities or by Palm Beach County.

A determination of distinct "zones" along the Island was conducted whereby segments of the shoreline were reviewed in a step-wise approach, then merged to designate the reach areas.

1. shore protection/shoreline stabilization structures;
2. coastal processes and current shoreline condition;
3. land use designation; and,
4. mitigation requirements/ability to construct a viable project.

A brief description of each shoreline delineation scheme is provided below. Zone prefix designations are shown in Figures 6-1 through 6-13 and were established as follows:

- Shore Protection/shoreline stabilization structures (SP);
- Coastal Processes and current shoreline condition (CP);
- Land Use designation (LU); and,
- Mitigation Requirements/viability of expediting permitting to allow construction of shore protection/stabilization project(s) (MR).

Shore Protection/Shoreline Stabilization Structures

With the assistance of Morgan & Eklund, Inc., ATM conducted an inventory of coastal and shore protection structures on Palm Beach Island. The survey was conducted from May 13 through May 19, 1997. A complete description of the Coastal Structures Inventory is provided in Section 3 of this Plan.

A shoreline characterization by structural type and consistency was performed to determine distinct changes along the Atlantic Ocean. The characterization utilized the findings of the structures survey, the Florida Department of Natural Resources' (FDNR) Coastal Construction Control Line aerial photographs and the FDEP video assessments of the County conducted in July 1995 and June 1996. The Island was divided into 8 zones after referring to the above information. Zone references are provided with physical features, street names, or upland development features identified. In Table 6 - 1, the FDNR Range Monument designations are furnished to more precisely delineate the zones.*

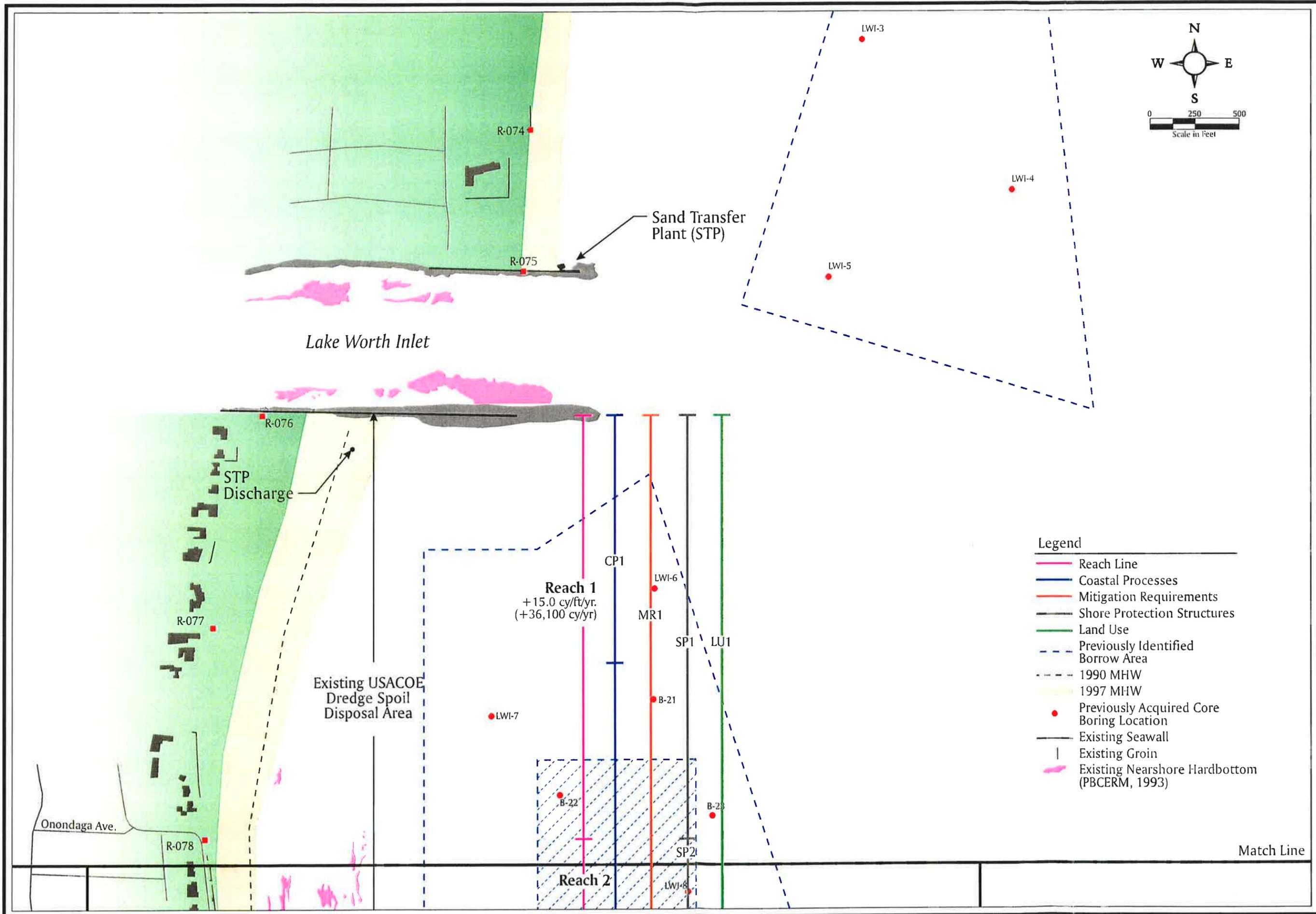


Figure 6-1
 Town of Palm Beach, Florida
 Comprehensive Coastal Management Plan
 Designation of Shoreline Zone and Reach Boundaries



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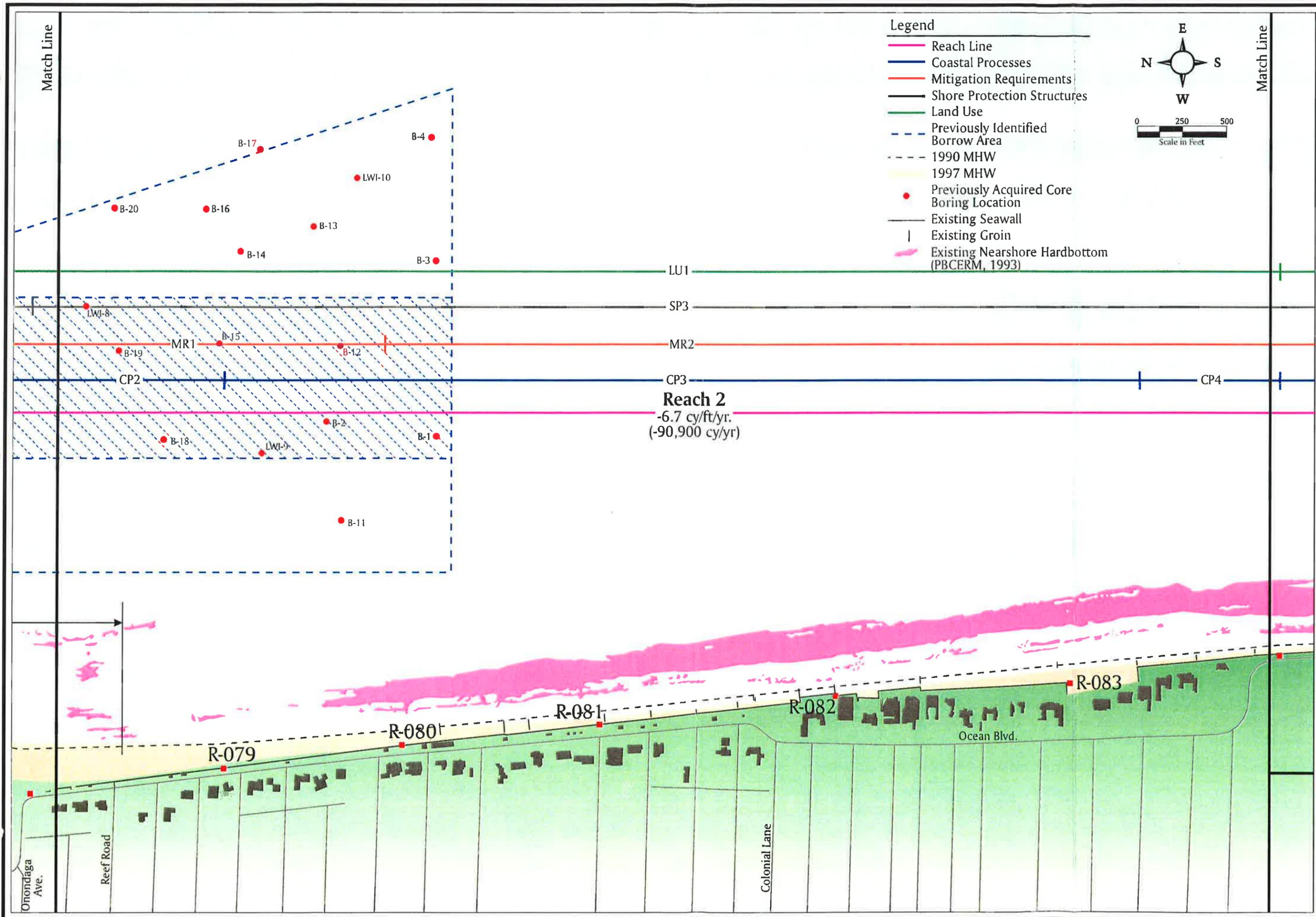


Figure 6-2
Town of Palm Beach, Florida
Comprehensive Coastal Management Plan
Designation of Shoreline Zone and Reach Boundaries

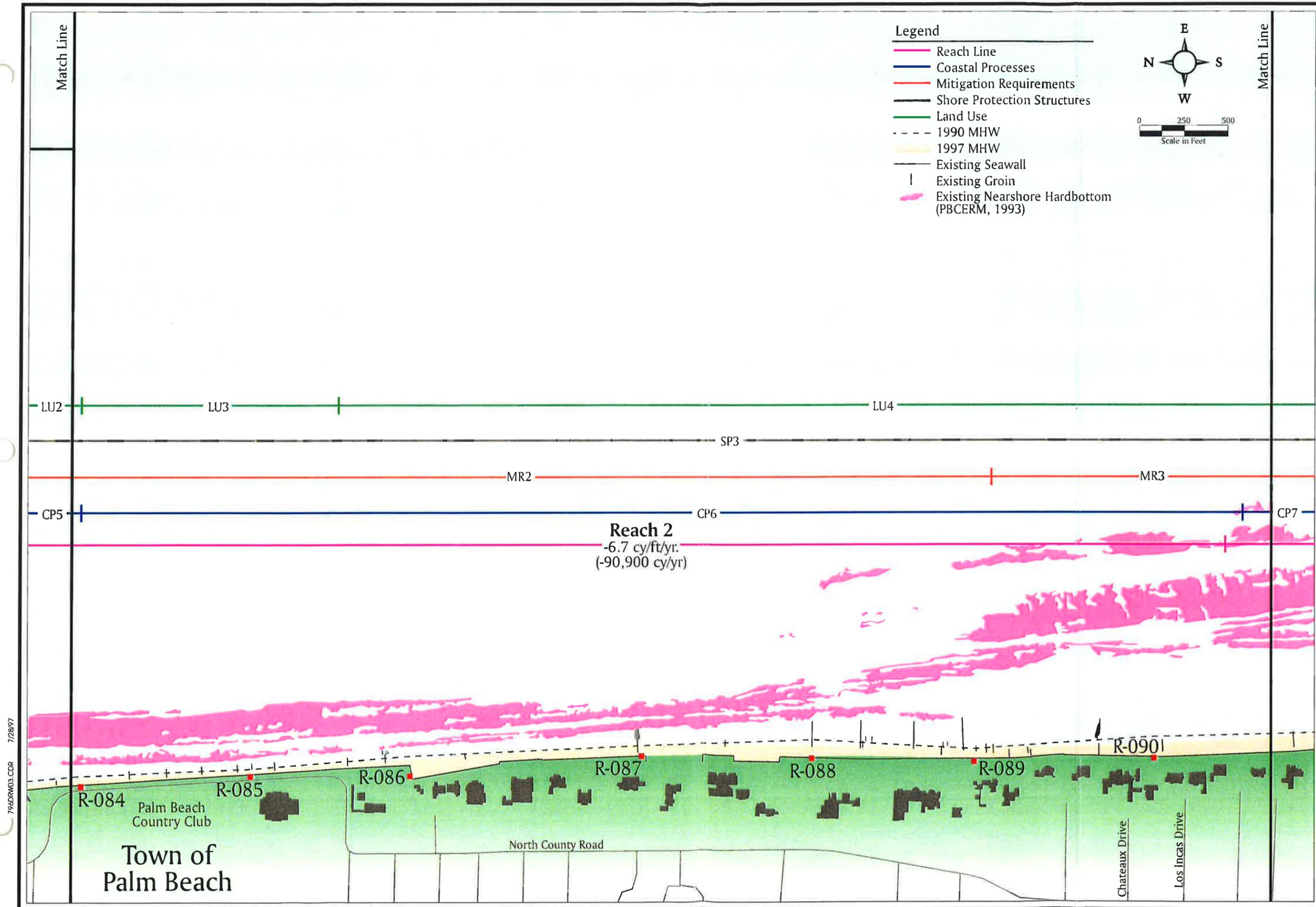


Figure 6-3
Town of Palm Beach, Florida
Comprehensive Coastal Management Plan
Designation of Shoreline Zone and Reach Boundaries

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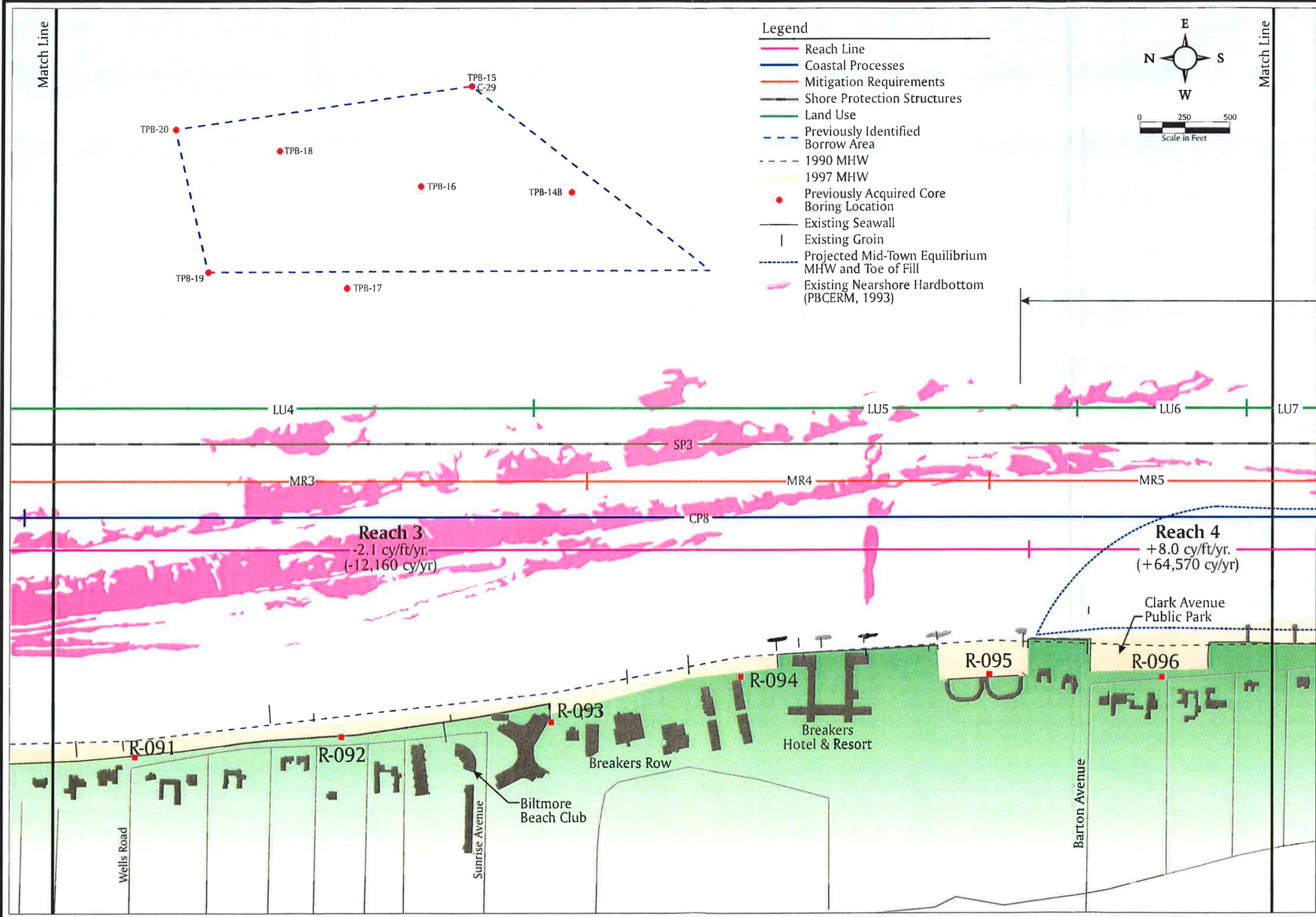


Figure 6-4
Town of Palm Beach, Florida
Comprehensive Coastal Management Plan
Designation of Shoreline Zone and Reach Boundaries



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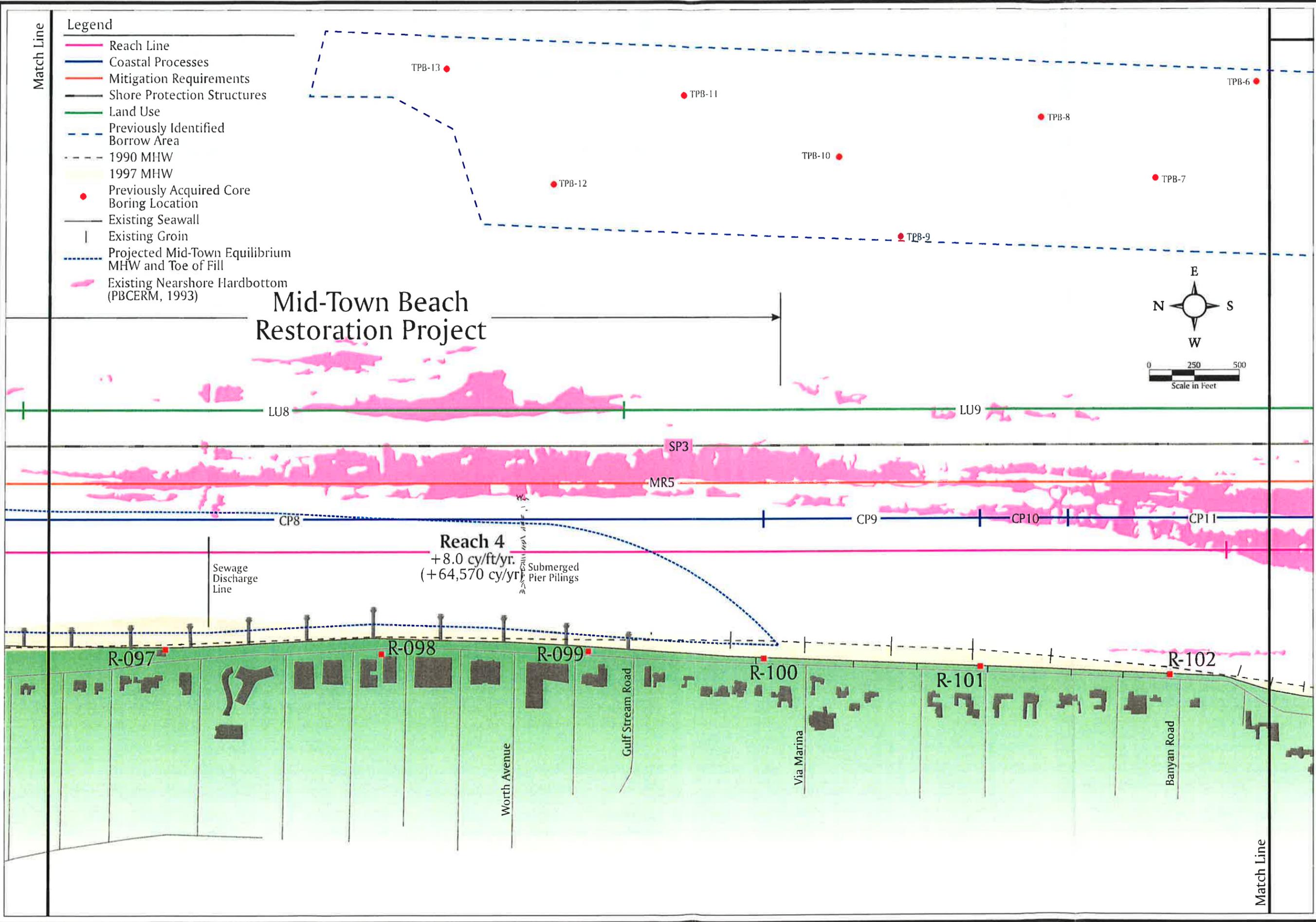


Figure 6-5
Town of Palm Beach, Florida
Comprehensive Coastal Management Plan
Designation of Shoreline Zone and Reach Boundaries

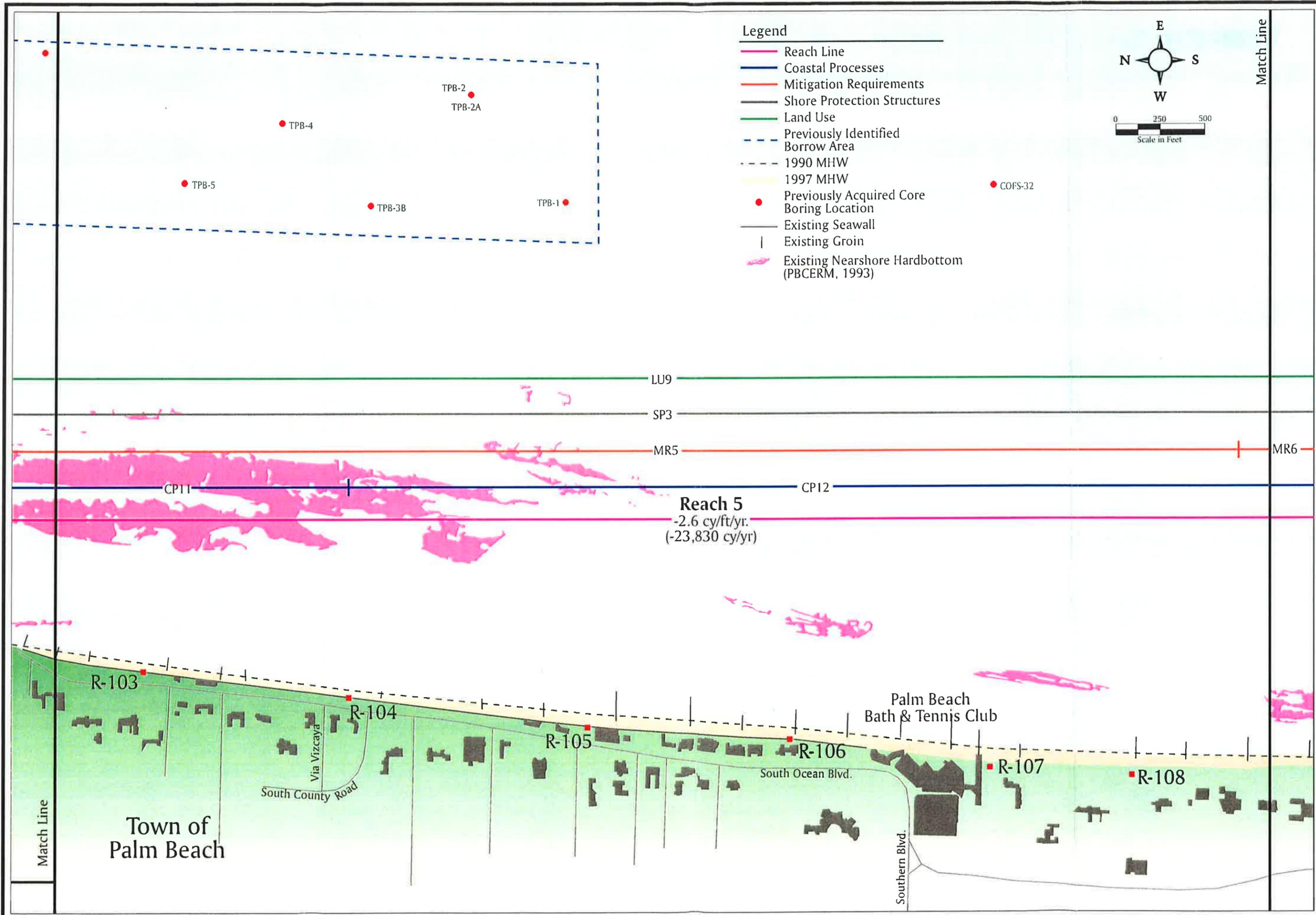


Figure 6-6
 Town of Palm Beach, Florida
 Comprehensive Coastal Management Plan
 Designation of Shoreline Zone and Reach Boundaries



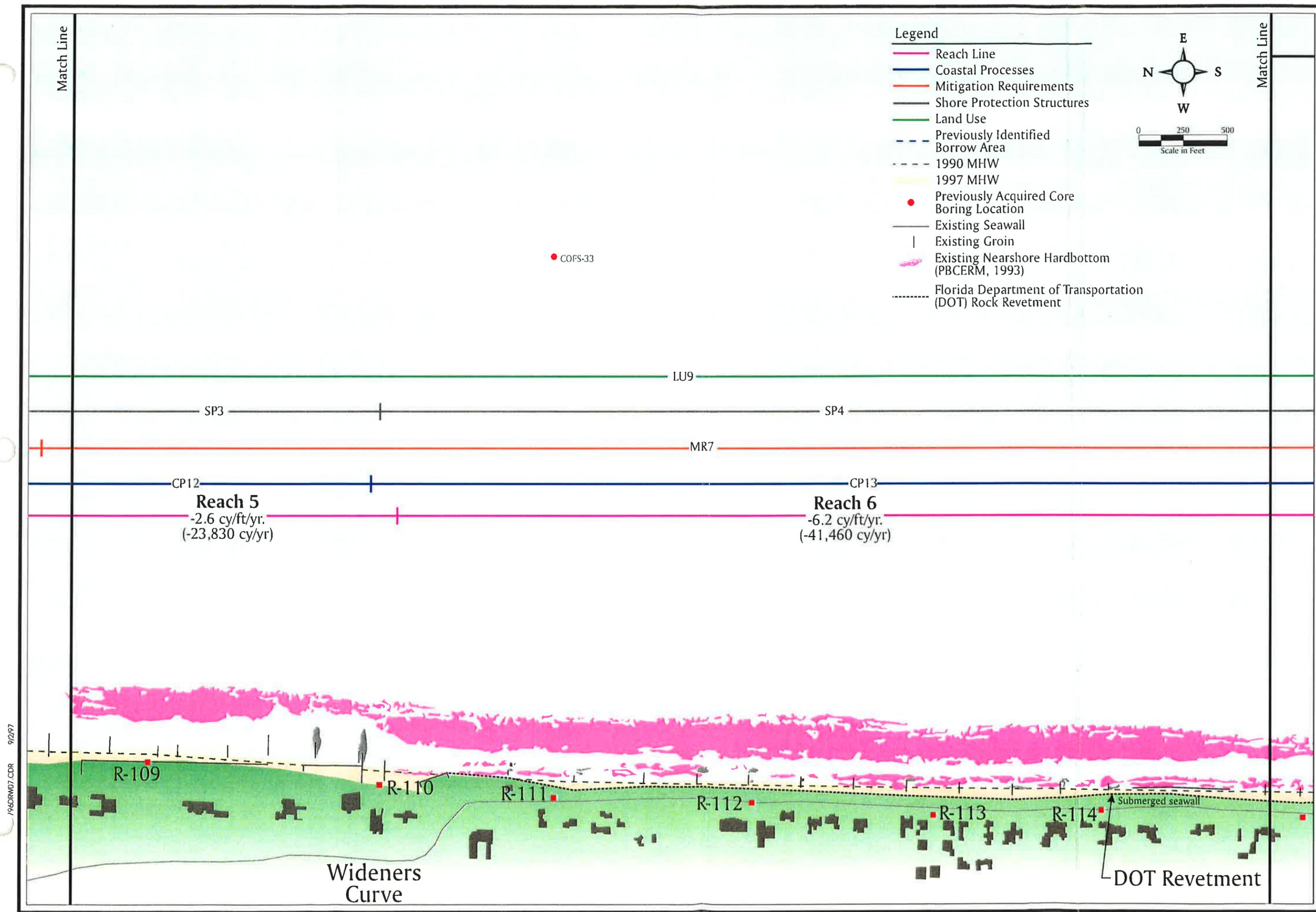


Figure 6-7
Town of Palm Beach, Florida
Comprehensive Coastal Management Plan
Designation of Shoreline Zone and Reach Boundaries

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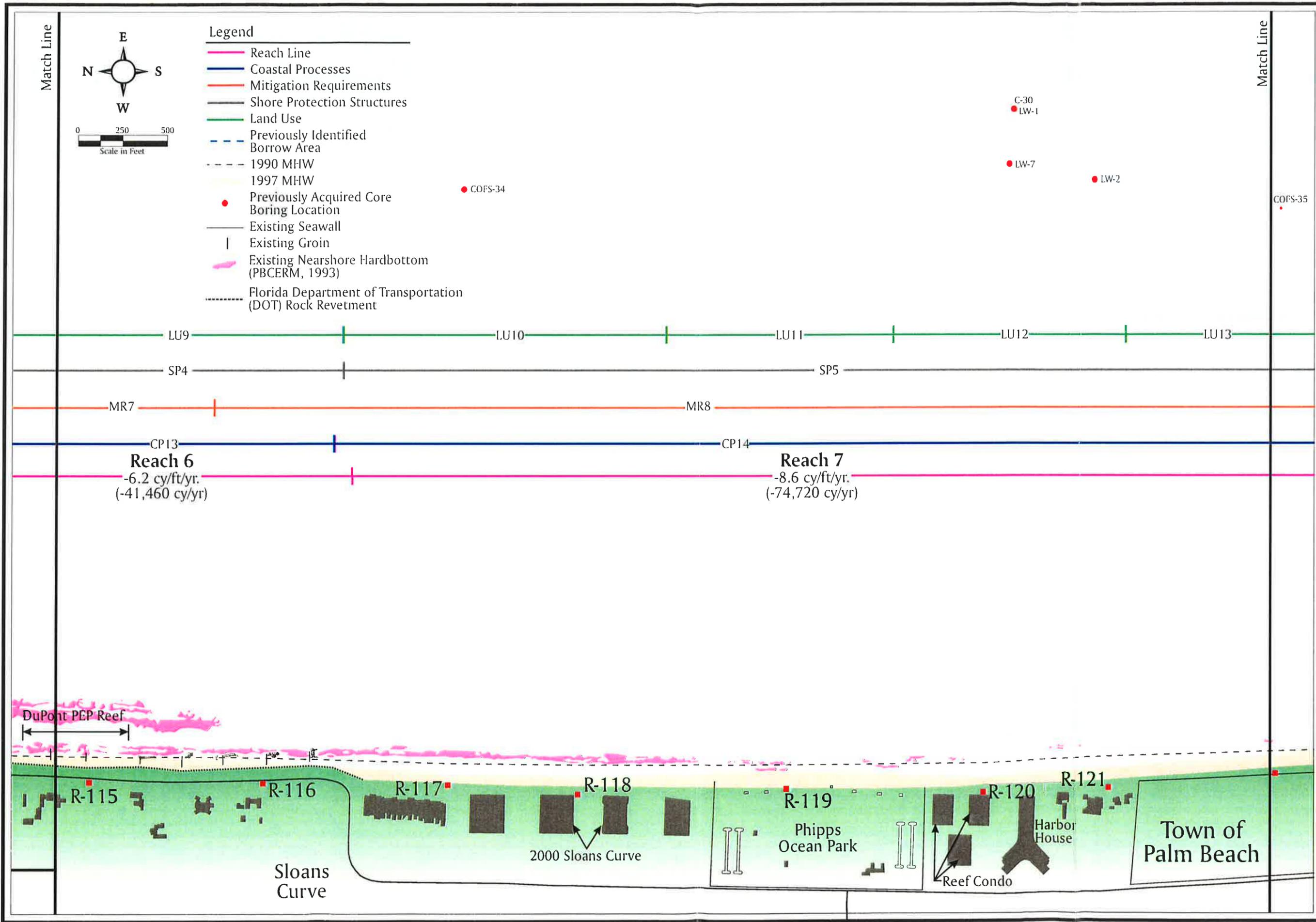
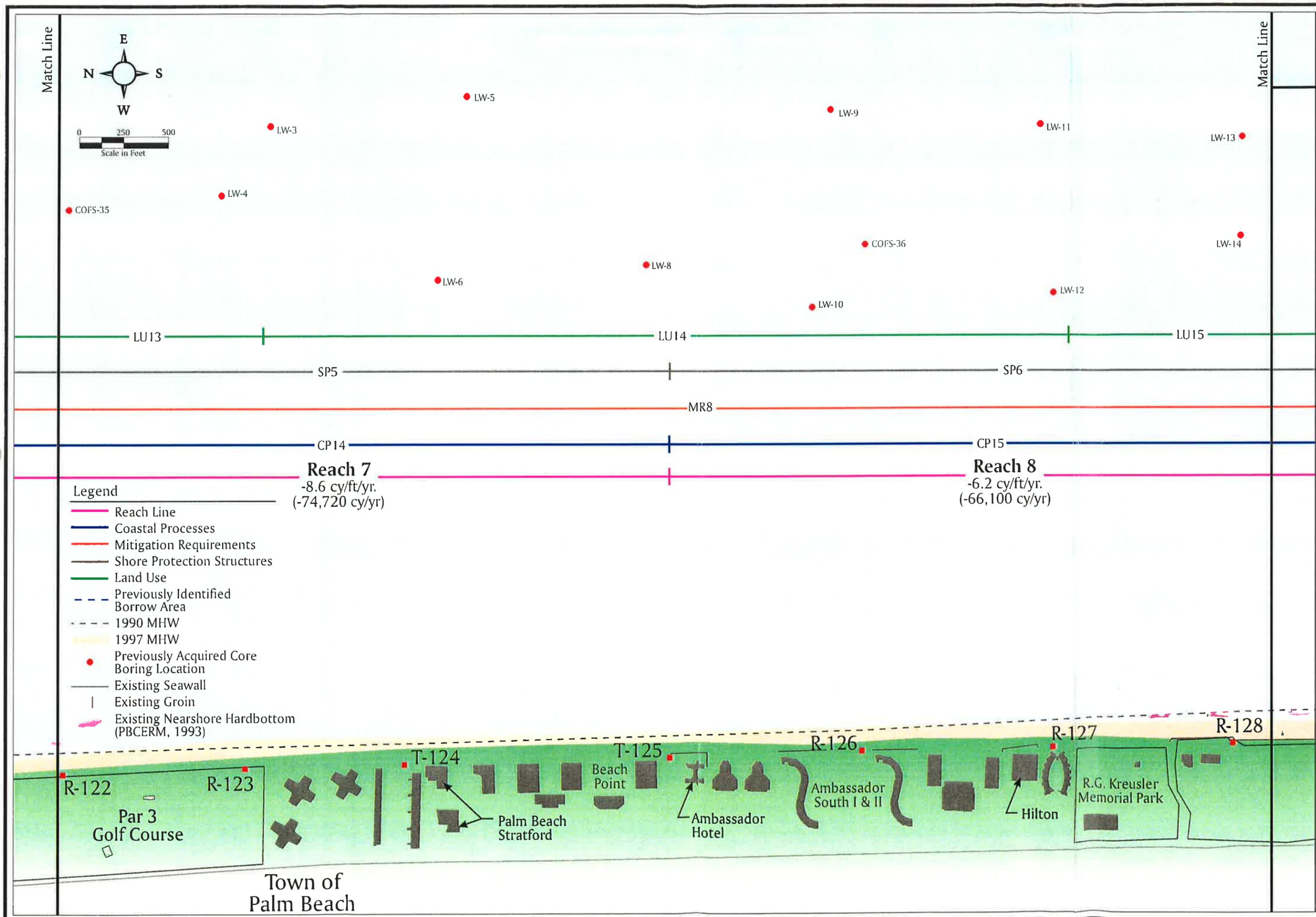


Figure 6-8
Town of Palm Beach, Florida
Comprehensive Coastal Management Plan
Designation of Shoreline Zone and Reach Boundaries

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- Legend**
- Reach Line
 - Coastal Processes
 - Mitigation Requirements
 - Shore Protection Structures
 - Land Use
 - Previously Identified Borrow Area
 - 1990 MHW
 - 1997 MHW
 - Previously Acquired Core Boring Location
 - Existing Seawall
 - Existing Groin
 - Existing Nearshore Hardbottom (PBCERM, 1993)

Reach 7
 -8.6 cy/ft/yr.
 (-74,720 cy/yr)

Reach 8
 -6.2 cy/ft/yr.
 (-66,100 cy/yr)

Town of Palm Beach

Figure 6-9
 Town of Palm Beach, Florida
 Comprehensive Coastal Management Plan
 Designation of Shoreline Zone and Reach Boundaries

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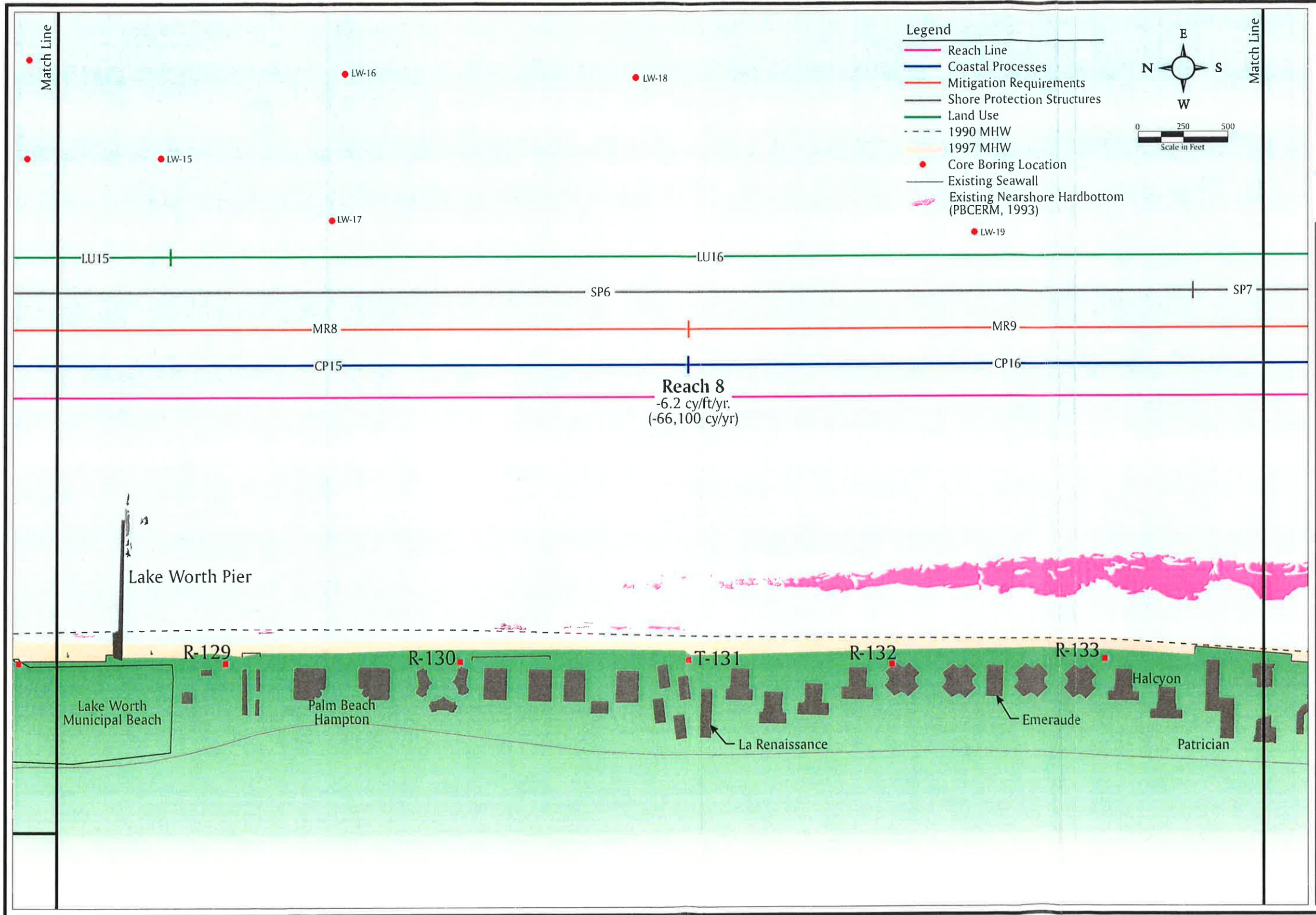


Figure 6-10
 Town of Palm Beach, Florida
 Comprehensive Coastal Management Plan
 Designation of Shoreline Zone and Reach Boundaries

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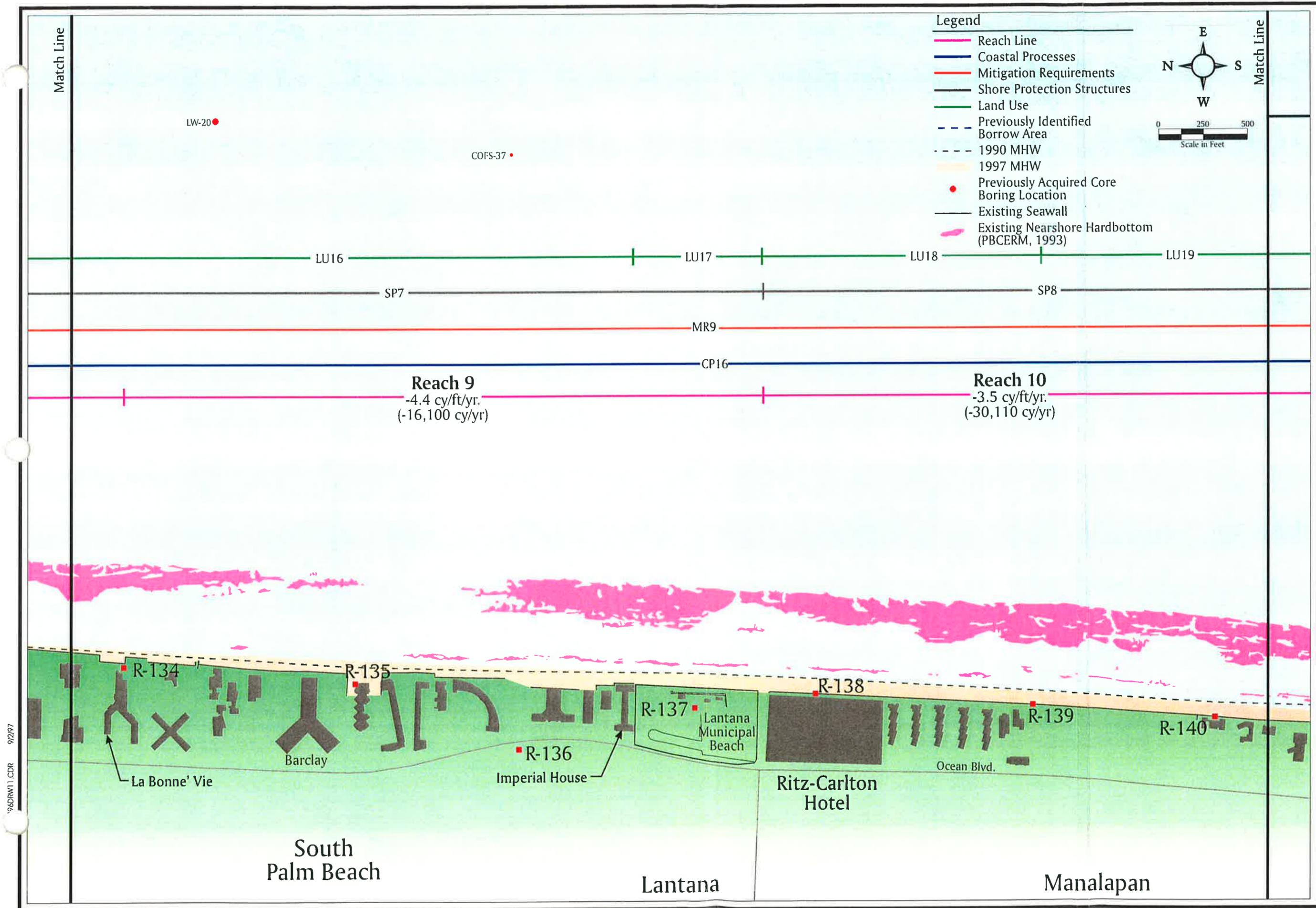
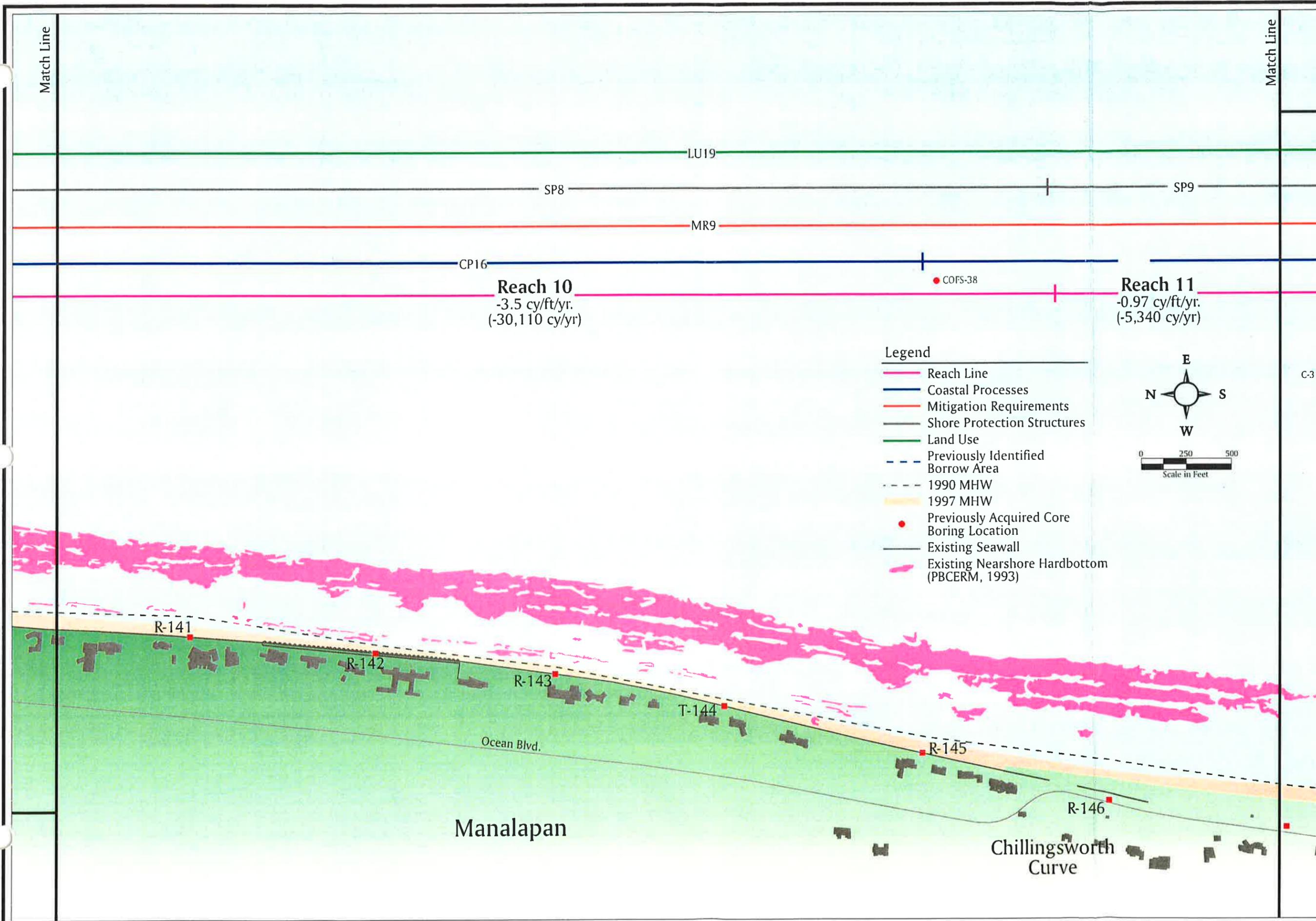


Figure 6-11
 Town of Palm Beach, Florida
 Comprehensive Coastal Management Plan
 Designation of Shoreline Zone and Reach Boundaries

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- Legend**
- Reach Line
 - Coastal Processes
 - Mitigation Requirements
 - Shore Protection Structures
 - Land Use
 - - - Previously Identified Borrow Area
 - - - 1990 MHW
 - 1997 MHW
 - Previously Acquired Core Boring Location
 - Existing Seawall
 - Existing Nearshore Hardbottom (PBCERM, 1993)

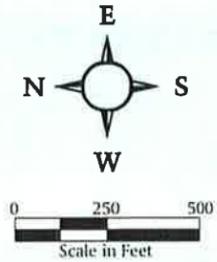
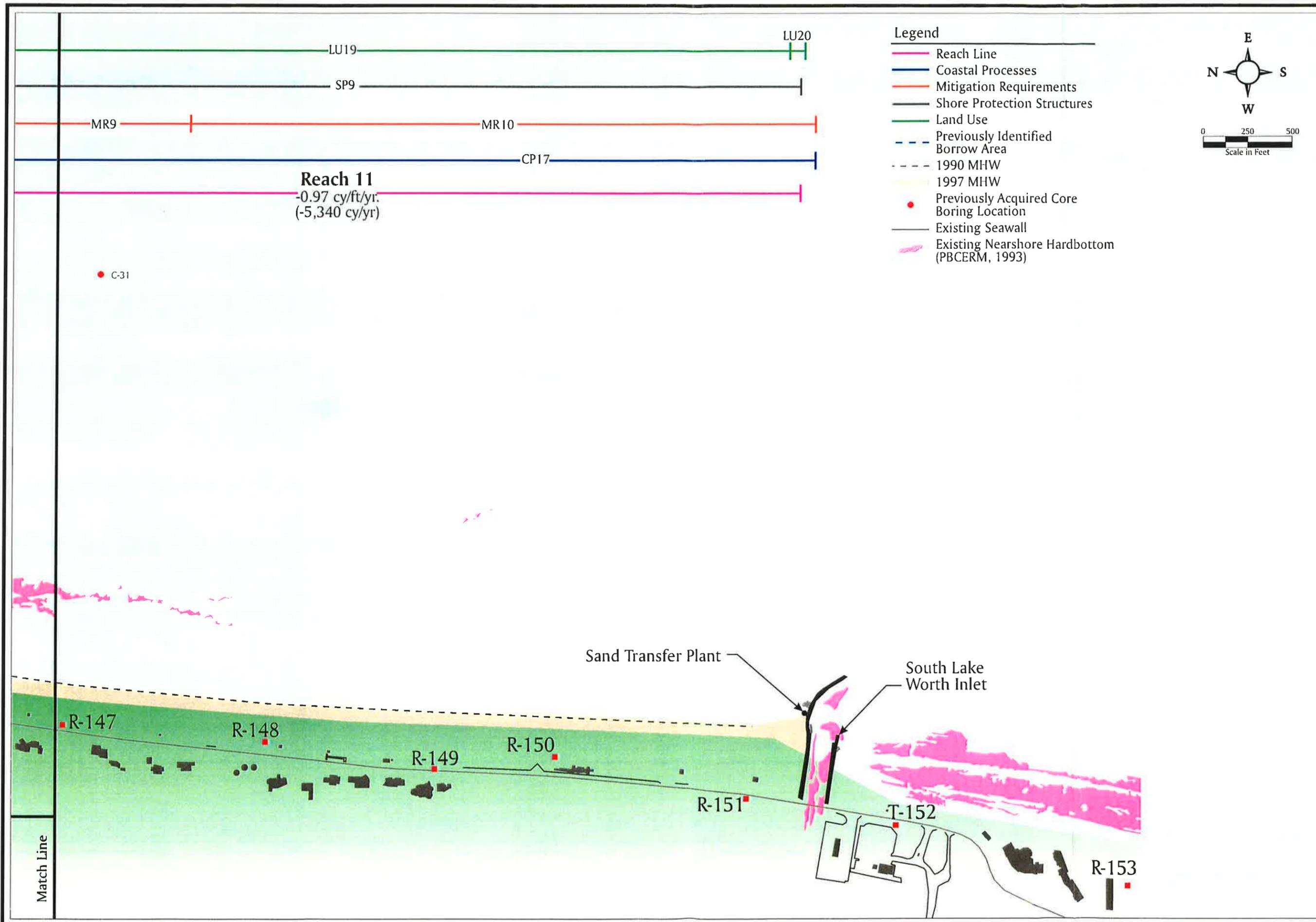


Figure 6-12
 Town of Palm Beach, Florida
 Comprehensive Coastal Management Plan
 Designation of Shoreline Zone and Reach Boundaries

796DRW13.CDR 9/2/97



- Legend**
- Reach Line
 - Coastal Processes
 - Mitigation Requirements
 - Shore Protection Structures
 - Land Use
 - - - Previously Identified Borrow Area
 - - - 1990 MHW
 - 1997 MHW
 - Previously Acquired Core Boring Location
 - Existing Seawall
 - Existing Nearshore Hardbottom (PBCERM, 1993)

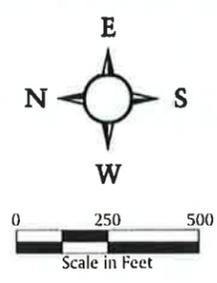


Figure 6-13
 Town of Palm Beach, Florida
 Comprehensive Coastal Management Plan
 Designation of Shoreline Zone and Reach Boundaries



Table 6-1
Established Shoreline Reach Boundaries on Palm Beach Island

Reach	Upland Parcel/Street/Feature Reference	DNR Monument Reference
1	Lake Worth Inlet south jetty to Onondaga Avenue (500 feet north of Reef Road)	R-76 to R-78
2	Onondaga Avenue to 1,080 feet north of Wells Road	R-78 to R-90 + 400 feet south
3	1,080 feet north of Wells Road to Via Bethesda	R-90 + 400 feet south to R-95
4	Via Bethesda to 270 feet south of Banyan Road	R-95 to R-102 + 300 feet south
5	300 feet south of Banyan Road to 170 feet north of Widener's Curve	R-102 + 300 feet south to R-110 + 100 feet south
6	170 feet north of Widener's Curve to Sloan's Curve	R-110 + 100 feet south to R-116 + 500 feet south
7	Sloan's Curve to the Ambassador Hotel	R-116 + 500 feet south to T-125
8	Ambassador Hotel to La Bonné Vie	T-125 to T-134
9	La Bonné Vie to Lantana Avenue access	T-134 to R-137 + 400 feet south
10	Lantana Avenue access to Chillingsworth Curve	R-137 + 400 feet south to R-145 + 740 feet south
11	Chillingsworth Curve to South Lake Worth Inlet	R-145 + 740 feet south to R-151 + 300 feet south

Description of Shore Protection Structure Type By Zone

Zone SP1

(Lake Worth Inlet to Onondaga Avenue)

The northernmost segment of shoreline of Palm Beach Island from the Lake Worth Inlet south jetty to a point approximately 2,400 ft to the south is characterized by a wide, flat, low elevation beach berm with vegetated dunes landward of the seasonal high water line. Individual properties may be protected by seawalls, but such structures are located well landward of the vegetation line and are hence not interacting with the beach/dune system at this time.

Zone SP2

(Onondaga Avenue to Widener's Curve)

The approximate seven miles of shoreline occupying this zone is generally characterized by seawall-backed beaches and either individual groin structures or groin fields. Several parcels in this zone do not have shore protection structures fronting the shoreline, but the groin fields and seawalls have essentially established and fixed the shoreline position. The Mid-Town Beach Restoration Project, constructed by the Town in 1996, is the only shoreline segment in this zone that has been restored in the last twenty years. As indicated in Chapter 2, the beach in the vicinity of Chilean Avenue was nourished in 1977 by the placement of approximately 86,000 cubic yards of sand (Olsen Associates, 1987).

Zone SP3

(Widener's Curve to Sloan's Curve)

This 6,800 ft shoreline segment is predominately backed by a sloping rock revetment constructed by the FDOT. The revetment was constructed in 1987 following long-term erosional stress and storm damage impacts to State Route A1A, the Island's hurricane evacuation route. A cursory visual inspection of the revetment on June 5, 1997 revealed that the crest of the revetment appears to have been recently subjected to the placement of small gravel to fill in soil wash-out areas. In addition, many of the revetment armor stone, particularly near the toe of the structure, did not exhibit good interlock. It is possible the structure has rotated or settled.

Zone SP4

(Sloan's Curve to the Ambassador Hotel)

South of the FDOT revetment, the shoreline transitions to a seawall-backed and vegetated dune dominated shoreline. Phipps Ocean Park, owned and maintained by the Town of Palm Beach, occupies 1,200 ft of shoreline frontage and is characterized by a narrow beach perched over exposed hardbottom

Zone SP5

(Ambassador Hotel to Halcyon/Patrician of Palm Beach)

The approximately 9,850 ft of shoreline in this zone includes R.G. Kreuzler Memorial Park and Lake Worth Municipal Beach, comprising 19% of the total zone frontage. Those parcels not fronted by vertical seawalls display a vegetated dune feature backed by multifamily developments. The parcels with seawalls are more or less contiguous with the edge of the vegetated dunes.

Zone SP6

(Halcyon/Patrician of Palm Beach to Ocean Avenue/Lantana Avenue access)

With the exception of the approximately 700 ft of ocean frontage occupied by Lantana Municipal Beach and a 200 ft pocket beach at Concordia East, the remainder of the shoreline is fixed by vertical seawalls and rock armoring.

Zone SP7

(Ocean Avenue to Chillingsworth Curve)

This entire shoreline zone is backed by vertical seawalls. A portion of the seawall, particularly the \pm 925 ft. structure fronting the vacant parcel immediately east-southeast of the Manalapan Town Hall, is protected by toe scour rock. The beach throughout this zone is narrow and typically is awash during a spring tide event.

Zone SP8

(Chillingsworth Curve to South Lake Worth Inlet):

The shoreline between the Chillingworth Curve and the Boynton Inlet is dominated by a wide, flat, well-vegetated berm and upland. A steel sheet pile seawall approximately 560 ft long was located beginning about 50 ft south of the point of tangency

at the south end of Chillingsworth Curve. This structure is located beneath a moderate to dense vegetative canopy and is between 50 and 110 ft landward of the observed edge of vegetation when measured in May 1997.

6.2 COASTAL PROCESSES AND CURRENT SHORELINE CONDITION

A review of the Palm Beach Island shoreline was conducted to determine current as well as historic beach profile changes. The FDEP Bureau of Beaches and Coastal Systems shoreline change database was accessed and comparative profile plots were produced. The profile plots appear in Appendix B of the Plan.

In addition to the beach profile data, ATM assessed the recent condition of the Island shoreline with the assistance of FDEP videotape overflights of Palm Beach County conducted on July 20, 1995 and June 13, 1996. An ATM coastal engineer directed the May 1997 coastal structures inventory and also noted general shoreline conditions at that time. Finally, a team of ATM coastal engineers performed a field reconnaissance of much of the Island's shoreline on June 5, 1997.

Utilizing the above information and a plan of the Island shoreline with the coastal structures and the nearshore hardbottom, Coastal Processes Zones were identified as follows:

Description of Coastal Processes and Current Shoreline Condition by Zone

Zone CP1

(Lake Worth Inlet to midway between Mediterranean and Caribbean Roads)

The shoreline immediately south of the south jetty at Lake Worth Inlet was identified in the Lake Worth Inlet Management Plan (ATM, 1995) as being north of a suspected nodal area. In addition, the shoreline in this zone has benefited from inlet maintenance dredge spoil disposal placement and also receives the discharge of the Lake Worth Inlet Sand Transfer Plant. The beach planform at the time of this Plan preparation was noted to be highly irregular due to the discharged (bypass) sand. The area displayed an approximate 350 ft wide, low elevation (less than +5 ft. NGVD) berm backed by a dense dune vegetation zone of 150 to more than 300 ft wide.

Zone CP2

(Mediterranean/Caribbean midpoint to 100' north of Angler Way)

Maintenance dredge spoil placement practices and existing permit authorizations dictate termination of periodic fill placement at the approximate mid-point of this zone. Vertical seawalls are in evidence near the south zone boundary. The dune vegetative band width steadily diminishes as one moves south, with the edge of vegetation located approximately 25 ft seaward of the vertical seawall face at Angler Way.

Zone CP3

(100' North of Angler Way to Tradewind Drive easterly "projection")

The shoreline in this zone displays the emergence of groins and the general absence of a dune vegetation along a fairly continuous alignment of vertical seawalls. The beach is narrow and relatively steep in this zone. An 1,100 ft segment between Laurian Lane and 200 ft south of Sandpiper Drive displays a somewhat narrow band of vegetated dune backed by discontinuous seawalls with cap elevations at or near existing grade.

Zone CP4

(Tradewind Drive to Palm Beach Country Club)

A very narrow beach fronts this approximate 750 ft-long zone, with continuous seawall crest elevations exceeding +20 ft NGVD.

Zone CP5

(Palm Beach Country Club/Ocean Boulevard Roadway Protective Seawall to 580 ft north of Wells Road)

Steel sheet pile and concrete groins are prevalent throughout the 6,670 ft segment. With the exception of two "gaps," the entire shoreline is backed by vertical seawalls.

Zone CP6

(580 ft north of Wells Road to 740' south of Gulfstream Road [includes Mid-Town Beach Restoration Project area])

Groin fields and vertical seawalls dominate this shoreline zone. The Mid-Town Beach Restoration Project, completed in March 1996, introduced approximately 880,000 cubic yards of sand into the system fronting the (formerly) highly eroded Mid-Town shoreline.

Zone CP7

(740' south of Gulfstream Road to El Brillo Way)

The 1,195 ft of shoreline segment immediately south of the Mid-Town project beachfill may be characterized as having a relatively wide berm backed by a vertical seawall, which protects Ocean Boulevard. Beachfill from the Mid-Town project has migrated to this shoreline segment.

Zone CP8

(El Brillo Way to 130' south of El Vedado Way)

Although only 480 ft long, the character of the shoreline displays a rapid change at the zone south boundary, where a nearshore hardbottom feature is present approximately 100 ft east of the seawall.

Zone CP9

(130' south of El Vedado Way to 150' south of Via Vizcaya)

The shoreline orientation changes to a more north-northeasterly heading when compared to Zone CP8. The nearshore hardbottom feature (as mapped by PBCERM) as well as the roadway protective seawalls, may have a controlling influence on the shoreline orientation shift noted herein. As with Zone CP8, all of Zone CP9 is backed by seawalls.

Zone CP10

(150' south of Via Vizcaya to 300' north of Widener's Curve)

Steel sheet pile and concrete groins with varying degrees of effectiveness in sand retention are found in this zone. South of the Palm Beach Bath and Tennis Club, a 1,700 ft shoreline segment displays dense to fringe dune vegetation as viewed from north to south. A 350-ft pocket beach is present north of a seawall oriented at

approximately 27° NNW; the subject seawall is located east of the point of reverse curvature at Widener's Curve.

Zone CP11

(300' north of Widener's Curve to Sloan's Curve)

As previously discussed, the shoreline in this zone is characterized by a low elevation, narrow to non-existent beach berm continuously armored by a rock revetment constructed by the FDOT in 1987. Seawalls are present at the north and south ends of the zone, further delineating (and fixing) the shoreline position. Hardbottom is visible from the shoreline and is emergent (above the water surface) in several locations.

Zone CP12

(Sloan's Curve to the Ambassador Hotel)

The nearshore hardbottom feature noted along the FDOT revetment is most notably emergent at Phipps Ocean Park, where the crest is at elevation + 2.5 NGVD (as measured at Monument R-119). The majority of this shoreline is fronted by vegetated dune features with various crest elevations. The Reef, Harbour House, Sea Lord and the Ambassador Hotel were the only upland developments in this zone observed in May and June 1997 where seawalls dictated the visible delineation between the beach and upland infrastructure. The remainder of the shoreline revealed a vegetative buffer between the edge of berm and upland property.

Zone CP13

(Ambassador Hotel to Renaissance)

Seawall-backed properties become more evident in this zone. A narrow vegetative band fronts the seawall-protected properties north of R.G. Kreuzler Memorial Park, with the seawall fronting the Lake Worth Municipal Beach (north of the Municipal Pier) displaying no vegetative buffer zone. South of Lake Worth Municipal Beach, the only property without a distinct dune vegetative fringe or dune feature is the 100 ft of shoreline at the Palm Beacher. Carlton Place, with approximately 440 ft of shoreline frontage, displayed a May 1997 vegetated zone 30-40 ft seaward of the seawall.

Zone CP14

(Renaissance to 375' north of Chillingsworth Curve)

A 2,800 ft segment of shoreline between the Patrician and the Imperial House (the southernmost 830 ft of the Town of Palm Beach and the entire Town of South Palm Beach) is fronted by seawalls with a relatively discontinuous alignment. For example, Concordia East, with approximately 200 ft of frontage, displays a shorefront offset to the west due to continuous seawalls to its north and south (at the Barclay and Tuscany, respectively). Lantana Municipal Beach displays a well-vegetated dune, with an absence of vegetation fronting the Lantana Avenue access and finally transitioning into a seawalled shoreline from the Ritz Carlton Hotel to the south zone boundary. Toe scour rock protection was observed fronting portions of the seawall from the Ritz-Carlton to the south boundary of the vacant upland parcel approximately 3,000 ft to the south of the Hotel.

Zone CP15

(375' north of Chillingsworth Curve to South Lake Worth Inlet north jetty)

At the time of this Plan preparation, the emergent shoreline south of Chillingsworth Curve appeared to be in very good condition. Broad expanses of dune vegetation were noted, with several restoration plots in evidence fronting the private upland parcels north of the South Lake Worth Inlet. Recreational beaches seaward of the restored dune vegetation were noted to be rather narrow (approximately 40 ft wide) when compared to adjacent dry beach zones (60 ft+ wide berm).

The Coastal Processes Shoreline Zones are summarized in Table 6-2.

6.3 LAND USE DESIGNATION

Shoreline segment boundaries were next established according to changes in Land Use. To assist with this effort, the FDEP Coastal Construction Control Line aeriels, Palm Beach County Property Appraiser and Town of Palm Beach property database, and the "Palm Beach County Atlas: Shoreline Management Plan" (Olsen Associates, Inc., 1987) were referred to. The dominant Land Use zones are designated as 'LU##' and are as Summarized in Table 6-3.

Table 6-2

Coastal Processes Zones on Palm Beach Island

Zone	Zone Location	DNR Monument Ranges
CP1	Lake Worth Inlet to midway between Mediterranean and Caribbean Roads	R-76 to R-77 + 200 feet south
CP2	Mediterranean/Caribbean midpoint to 100 feet north of Angler Way	R-77 + 200 feet south to R-79
CP3	100 feet North of Angler Way to Tradewind Drive easterly "projection"	R-79 to R-83 + 400 feet south
CP4	Tradewind Drive to Palm Beach Country Club	R-83 + 400 feet south to R-84
CP5	Palm Beach Country Club/Ocean Boulevard Roadway Protective Seawall to 580 feet north of Wells Road	R-84 to R-90 + ~500 feet south
CP6	580 feet north of Wells Road to 740 feet south of Gulfstream Road (includes Mid-Town Beach Restoration Project area)	R-90 + 500 feet south to R-100
CP7	740 feet south of Gulfstream Road to El Brillo Way	R-100 to R-101
CP8	El Brillo Way to 130 feet south El Vedado Way	R-101 to R-101 + 500 feet south
CP9	130 feet south of El Vedado Way to 150 feet south of Via Vizcaya	R-101 + 500 feet south to R-104
CP10	150 feet south of Via Vizcaya to 300 feet north of Widener's Curve	R-104 to R-110 + 50 feet north
CP11	300 feet north of Widener's Curve to Sloan's Curve	R-110 + 50 feet north to R-116 + 450 feet south
CP12	Sloan's Curve to the Ambassador Hotel	R-116 + 400 feet south to T-125
CP13	Ambassador Hotel to Renaissance	T-125 to T-131
CP14	Renaissance to 375 feet north of Chillingsworth Curve	T-131 to R-145
CP15	375 feet north of Chillingsworth Curve to South Lake Worth Inlet north jetty	R-145 to T-151 + ~300 feet south

Table 6-3

Land Use Zones on Palm Beach Island

Zone	Zone Designation (Dominant Land Use)	Approximate DNR Monument Ranges
LU1	Residential Medium Density	Lake Worth Inlet (R-76) to R-84
LU2	Private (Palm Beach Country Club)	R-84 to R-85+ 500 feet south (roadway curve to curve)
LU3	Residential Low to Medium Density	R-85 + 500 feet south to R-93 + 100 feet north
LU4	High Rise Multifamily Residential/ Public Park (Clarke Avenue Beach)	R-93 + 100 feet north to R-95 + 500 feet south
LU5	Public Park/Undeveloped Parcels	R-95 + 500 feet south to R-96 + 470 feet south
LU6	Low Rise Multifamily Residential/ Mid-Town Municipal Beach	R-96 + 470 feet south to R-99 + 200 feet south
LU7	Single-family Residential - Medium and Low Density	R-99 + 200 feet south to Sloan's Curve (R-116 + 450 feet south)
LU8	Multi-family Residential Low and High Rise	R-116 + 450 feet south (Sloan's Curve) to R-118 + 500 feet
LU9	Public Park (Phipps Ocean Park)	R-118 + 500 feet to R-119 + 600 feet
LU10	Mixed Use Upland Development	R-119 + 600 feet south to R-121 + 100 feet south
LU11	Town of Palm Beach Par 3 Golf Course (Public)	R-121+ 100 feet south to R-123 + 100 feet south
LU12	High Rise Multi-family Residential	R-123 to R-127 + 90 feet south
LU13	Public Park (R.G. Kreusler Memorial Park and Lake Worth Municipal Beach)	R-127 + 90 feet south to R-128 + 860 feet south
LU14	High Rise Multi-family Residential	R-128 + 860 feet to R-136 + 660 feet south
LU15	Public (Lantana Municipal Beach)	R-136 + 660 feet south to R-138 + 305 feet north
LU16	Residential Medium Density	Ritz-Carlton to R-139 + ~50 feet south
LU17	Residential Low to Medium Density	R-139 + ~50 feet south to T-151 + ~240 feet south
LU18	Public (South Lake Worth Inlet District Park)	T-151 + ~240 feet south to north jetty of South Lake Worth (Boynton) Inlet

6.4 CONSTRUCTABILITY/MITIGATION REQUIRED

The predominate feature that will likely affect the approval of beachfill restoration and renourishment efforts is the nearshore hardbottom resources off Palm Beach Island. Based on the Palm Beach County ERM 1993 mapping of the hardbottom features, field observation by ATM coastal engineers, and the "Palm Beach County Atlas: Shoreline Management Plan" (Olsen Associates, Inc., 1987), the shoreline was again divided into distinct zones.

Zone boundaries were selected based primarily on the proximity of the nearshore features to the present-day shoreline and on a preliminary assessment of the likely beachfill quantities and/or structural improvements (i.e., groin fields) that would be necessary to restore the shoreline segment.

The presence of dense, established stands of dune vegetation which may reside at an elevation below an optimal fill template berm elevation may also warrant consideration by the regulatory agencies. However, the hardbottom issue was deemed potentially more impactful to expedient authorization and total project costs. The regulatory agencies will undoubtedly require mitigation of viable hardbottom communities directly impacted by beachfill, and may require mitigative action for secondary impacts associated with shoreline restoration.

Consistent with the previous zone designations, the "constructability"/mitigation required zones are designated as 'MR#' in Table 6-4. The zone designations are approximate and based on representation of the nearshore hardbottom resources visible in 1993. Erosional stress to the Island's beaches has likely changed the extent of the exposed nearshore features. Although the nearshore hardbottom areas offshore of the Breakers Hotel and Mid-Town beach have been subjected to detailed verification (USACOE, January, 1992), a comprehensive mapping and characterization of such resources will determine the extent of mitigation required in conjunction with shoreline restoration activities on the Island.

6.5 SHORELINE REACH DESIGNATION

Based on the above boundary designations and conditions noted within each respective Zone, shoreline reach designations (reaches) were established as presented in Table 6-5. As indicated previously, the Shoreline Reaches are depicted graphically in Figures 6-1 through 6-11.

Table 6-4

Constructability/Mitigation Required Zones on Palm Beach Island

Zone	Zone Location/Identifiable Upland Reference	DNR Monument Ranges
MR1	Lake Worth Inlet south jetty to 130 feet north of Kenlyn Road	R-76 to R-80 + 100 feet north
MR2	130 feet north of Kenlyn Road to 2,500 feet north of Wells Road	R-80 + 100 feet north to R-89 + 100 feet south
MR3	2,500 feet north of Wells Road to the Biltmore Beach Club	R-89 + 100 feet south to R-93 + 200 feet south
MR4	Blitmore Beach Club to Breakers Beach Club	R-93 + 200 feet south to R-95
MR5	Breakers Beach Club to 1,500 feet south of the Palm Beach Bath and Tennis Club	R-95 to R-108 + 600 feet south
MR6	1,500 feet south of Palm Beach Bath and Tennis Club to 750 feet north of Sloan's Curve	R-108 + 600 feet south to R-115 + 700 feet south
MR7	750 feet north of Sloan's Curve to La Renaissance	R-115 + 700 feet south to T-131
MR8	La Renaissance to 2,000 feet south of Chillingsworth Curve	T-131 to R-147 + 700 feet south
MR9	2,000 feet south of Chillingsworth Curve to South Lake Worth Inlet north jetty	R-147 + 700 feet south to T-151 + 300 feet south

Table 6-5

Established Shoreline Reach Boundaries on Palm Beach Island

Reach	Upland Parcel/Street/Feature Reference	DNR Monument Reference
1	Lake Worth Inlet south jetty to Onondaga Avenue (500 feet north of Reef Road)	R-76 to R-78
2	Onondaga Avenue to 1,080 feet north of Wells Road	R-78 to R-90 + 400 feet south
3	1,080 feet north of Wells Road to Via Bethesda	R-90 + 400 feet south to R-95
4	Via Bethesda to 270 feet south of Banyan Road	R-95 to R-102 + 300 feet south
5	270 feet south of Banyan Road to 170 feet north of Widener's Curve	R-102 + 300 feet south to R-110 + 100 feet south
6	170 feet north of Widener's Curve to Sloan's Curve	R-110 + 100 feet south to R-116 + 500 feet south
7	Sloan's Curve to the Ambassador Hotel	R-116 + 500 feet south to T-125
8	Ambassador Hotel to La Bonne' Vie	T-125 to T-134
9	La Bonne' Vie to Lantana Avenue access	T-134 to R-137 + 400 feet south
10	Lantana Avenue access to Chillingsworth Curve	R-137 + 400 feet south to R-145 + 740 feet south
11	Chillingsworth Curve to South Lake Worth Inlet	R-145 + 740 feet south to R-151 + 300 feet south

The various Zones and Shoreline Reaches are graphically depicted in Figures 6-1 through 6-13, inclusive. Specific project requirements and proposed corrective action(s) within each Reach are provided in Section 7 of this Plan.

SECTION 7

7.0 PROPOSED SHORELINE IMPROVEMENT AND PROTECTION PLAN

7.1 METHODOLOGY

Subsequent to the reach designation, consideration of the Island's shoreline condition and regulatory permitting constraints, it has been concluded that the Town of Palm Beach, the City of Lake Worth, the Town of South Palm Beach, the Town of Lantana and the Town of Manalapan should initiate a series of actions to ensure that the Palm Beach Island shoreline is properly restored and maintained.

The principal objectives of the plan are to provide a level of storm protection to the entire Island shoreline and to reestablish sand transport denied the Island by the Lake Worth Inlet. A secondary goal is to provide a high quality beach. Beach restoration and renourishment are the principal methods which are economically and environmentally feasible. Beach restoration involves identifying a suitable source of borrow sand (typically found offshore of the project shoreline) and transferring that sand to the shoreline to create an additional beach width and height. The sand is placed at an elevation suitable to protect the upland property and infrastructure from a moderate to severe storm event. Material pumped to shore from conventional dredging equipment is placed and graded above the waterline at construction, with a seaward slope of the fill established by earthmoving equipment to tie into, or 'toe' in to the pre-construction beach at some elevation below the practical limits of equipment movement. Those segments of the artificially created beach above the slope break, or berm, are graded to a final elevation and occasionally planted with dune vegetation at the landward limits of the new berm.

Upon completion of the fill project, the shoreline is then subjected to a period of adjustment as waves and currents shape the created shoreline into a quasi-stable, or "equilibrium" configuration. Given that the shoreline restoration alone does not eliminate the erosion problem which predicated the activity, the beach will continue to erode until a maintenance event, or "renourishment" of the shoreline is necessary.

The State of Florida has recently approved applications for permits to restore eroding shorelines with the placement of beachfill in conjunction with the placement of hardened structures placed roughly perpendicular to the shoreline. These structures, typically referred to as groins, help stabilize the placed sand and minimize sand losses from the restored shoreline to the adjacent beaches. For example, the Florida Department of Environmental Protection, Bureau of Beaches and Coastal Systems issued permits for the Mid-Town Beach Restoration

Project, the Marco Island T-Groin Project at Hideaway Beach in Collier County, and the Ocean Ridge Shore Protection Project. Construction of the Mid-Town project was completed by the Town of Palm Beach in February 1996, the Marco Island project (T-head structures are geotextile sand-filled bags and are considered temporary) was completed in September 1997, and the Ocean Ridge shore protection project is scheduled to be completed in early 1998.

It is noted that the Mid-Town project is the only one of the three with a groin field on the open coast, as the other two projects are immediately adjacent to a littoral cell boundary at a tidal inlet. This issue *may* become significant in attempting to gain permit authorization for groin fields proposed to be constructed away from such a boundary (i.e., another project similar to Mid-Town).

Given the condition of the Island shoreline in designated Reaches 2 through 10, inclusive, the principal recommendation is to restore the shoreline by placing sand (beach restoration). Each discrete shoreline Reach is treated individually given that there may be funding, political, environmental and/or legislative issues which would render a project-by-project treatment appropriate. Priority order of Plan implementation is given at the end of this section and provided in schedule form. For consistency in presentation, however, recommended actions are furnished in order according to ascending Reach number, or a north to south progression of the proposed improvements.

7.2 SHORELINE MANAGEMENT OF REACH 1

Lake Worth Inlet South Jetty to Onondaga Avenue (500' north of Reef Road)

The first segment of shoreline south of the Lake Worth Inlet south jetty, from FDEP reference monuments R-76 to R-78, occupies approximately 2,400 feet of Atlantic Ocean frontage. This area has been subjected to direct sand placement in recent years as a result of dredged sand disposal from the maintenance of Lake Worth Inlet. In May 1996, Palm Beach County and the Town of Palm Beach completed repairs to the Sand Transfer Plant (STP), and sand pumping operations have been ongoing since that time. The STP discharge location is shown in Figure 7-1, where approximately 261,855 cubic yards of sand have been transferred from May 1996 through April 1997 (Clinton W. Thomas, personal communication and via records furnished by Mr. Thomas). As indicated in Figure 4-1, the sand quantity placed on this shoreline, even when annualized from 1990 to 1997, is substantial. Coupled with approximately annual

placement of dredge disposal sand by the USACOE since 1990, the shoreline in Reach 1 is net accretional over the period of analysis utilized in developing the revised sediment budget (September/October 1990 to April/May 1997).

The FDEP has modified the USACOE's permit authorization to increase the template area within which sand can be placed, in Reach 1 and the northernmost approximately 500 feet of Reach 2. The modification principally seeks to increase the berm elevation to allow sand placement to an elevation of +7 ft NGVD in lieu of the current authorization, which only permits placement to an elevation equivalent to the Mean High Water (MHW) line, or elevation +1.90 NGVD.

With the continued STP discharge of sand onto the north end of Palm Beach Island and placement of beach-quality maintenance dredge sand in the disposal area by the USACOE, two principal Lake Worth Inlet Management Plan objectives of sand bypassing across the Inlet and maintenance of the navigation channel are at least partially satisfied. However, additional actions are necessary to appropriately manage Lake Worth Inlet and its adverse impacts to the Palm Beach Island shoreline. Figure 7-1 provides the objectives and rationale behind a comprehensive treatment of the Reach 1 shoreline. The Executive Summary of the Lake Worth Inlet Management Plan is included in this section of the Comprehensive Plan for reference and to reiterate the Plan recommendations.

**LAKE WORTH INLET MANAGEMENT PLAN
EXECUTIVE SUMMARY**

In October 1993, the Town of Palm Beach agreed to undertake preparation of the Lake Worth Inlet Management Plan in cooperation with the State of Florida. The purposes of the Inlet Management Plan are to:

- Quantitatively evaluate the impact of Lake Worth on adjacent beaches;
- Evaluate and recommend corrective measures to mitigate for the erosive impact of the Inlet; and
- Furnish an implementation plan to the State of Florida for adoption in accordance with Florida Statute 161.161.

A sediment budget was computed for the Lake Worth Inlet to assist with evaluation of alternative actions necessary to correct for deficiencies in sand bypassing at the inlet. Based on a period of record from 1974 to 1994, the net annual littoral drift rate was determined to be approximately 170,000 cubic yards per year. A sand bypassing deficit was determined based on the net southerly longshore transport rate of 170,000 cubic yards per year, less 63,000 cubic yards per year, which was transported by the sand transfer plant, and approximately 43,000 cubic yards per year by disposal of navigation channel maintenance dredging. The resulting average annual deficit for that 20 year period of record is 64,000 cubic yards per year.

Environmental resources in the vicinity of Lake Worth Inlet were evaluated (primarily upland communities and nearshore hardbottom habitats) to determine their relative extent and aid in assessing the potential for impacts associated with inlet system modifications.

Thirteen engineering alternatives to the inlet system were identified; several of these alternatives which were considered viable were subjected to additional analysis.

EXCERPT FROM THE LAKE WORTH INLET MANAGEMENT PLAN

Lake Worth Inlet Management Plan recommendations include: reactivation and improvement of the existing sand transfer facility; improvements to the maintenance dredging aspect of the navigation channel; and proposed modifications to spoil placement on the shoreline south of the Inlet.

Principal elements of the Inlet Management Plan were described to accomplish the three primary objectives of bypassing sand across the inlet, navigation channel maintenance, and supplemental nourishment.

Plan Recommendations:

1. Reactivating the fixed sand transfer plant.
2. Increasing the performance of the sand transfer plant by accomplishing upgrades to the plant machinery removing the "L" groin and allowing for multiple discharge points south of the jetty.
3. Expanding the existing settling basin with a 500 foot by 200 foot extension.
4. Extending the southern limits of the USCOE disposal area.
5. Offset any bypassing shortfalls by dredging the expanded sand trap.
6. Pursue a beach restoration project along Palm Beach Island to partially offset the historic sand losses resulting from the Inlet.

The Town has received approval from the FDEP to place maintenance dredged sand within the Mid-Town Beach Restoration Project template via an authorized pipeline access corridor directly offshore of Sea Spray Avenue. Improvements to the STP and extension of the pipeline discharge at the north end of the Island are currently estimated at \$1.3 million, and will be dependent on the actual materials of construction used, the relative placement of the pipeline to the shoreline, the number of discharge ports, and the extent of desired and agreed upon improvements to the presently reactivated STP.

The FDEP has required monitoring of the inlet and adjacent barrier island shorelines to validate the Lake Worth Inlet Management Plan sediment budget. Monitoring and subsequent reporting costs are estimated at \$38,000 per year for a minimum 3-year period. Estimated costs to expand the settling basin sand trap north of the Inlet as recommended in the Lake Worth Inlet Management Plan (ATM, April 1995) are \$1.19 million. This initiative would provide an additional 70,000 to 100,000 cubic yards of expanded basin capacity. The cost to maintain the larger basin will be dependent upon the amount of sand available for dredging.

7.3 ESTABLISHMENT OF SHORELINE MANAGEMENT "BASELINE" DESIGN CRITERIA FOR BEACHFILL PROJECTS AND GROIN FIELDS

The targeted level of storm protection for all beach restoration projects on the Island should enable any individually considered shoreline restoration segment to avoid significant damage from a 15 year return interval storm at any time between the initial restoration (first time sand is placed on the shoreline) and subsequent renourishments (regular maintenance interval of sand placement to restore the shoreline to its initial restoration position). The dune erosion model EDUNE was evaluated at two non-seawall backed beach profile locations on the Island, at FDEP monuments R-119 and R-137. Fifteen and twenty-five year return interval storm events were simulated. The fifteen year storm eroded approximately 17 cubic yards per front foot of the lower beach, berm and dune segments of the beach, while the twenty-five year event caused a unit loss of approximately 24 cubic yards per foot.

An eight year renourishment interval is sought for project cost effectiveness, maximum funding participation by the DEP (for those projects which are eligible for state cost sharing support), and realistic sand placement volumes as advance nourishment.

It is assumed that sand requirements for each identified shoreline Reach are available and of suitable quality to minimize the overfill requirements. That is, the sand must be compatible, or

nearly so, with the existing or 'native' sand on the pre-Project shoreline. For consistency, an overfill factor of 1.0 to 1.20 has been assumed for the purposes of development of shoreline solutions detailed in this Plan. Final sand volume requirements for each shoreline designated for restoration will be determined by many design factors, among which the sand compatibility will be key. Berm elevations are established at elevation +9 feet above the National Geodetic Vertical Datum of 1929, or NGVD. It is noted that both the Mid-Town Beach Restoration Project (constructed in 1995/96) and the Ocean Ridge Shore Protection Project (construction underway at the time of Plan preparation) specified this berm elevation.

Beachfill construction slopes of 1 vertical to 10 horizontal are recommended from the edge of berm to the approximate Mean Low Water shoreline (-1.1 NGVD), where the fill should transition into the existing bottom at a slope of 1 vertical to 20 horizontal. As evidenced by the cross-section plots provided in Appendix E, the use of this dual-slope configuration results in a constructed profile which closely mimics the existing shoreline and nearshore slopes.

Assumed sand unit prices are established for Plan development and costing purposes as uniform over the entire Island at \$6.50 per cubic yard in place. Mobilization of dredging equipment and work crews will be entirely dependent upon sand source proximity to the fill site, the specified or optimal dredge plant type necessary to properly access and excavate sand from the borrow area(s) and transport it to shore, the proximity of such equipment and crews to the project site at the time of project bidding, and whether one or more projects are anticipated to be bid sequentially.

The construction of groin fields, or adjustable nourished headland structures, as reported by the Palm Beach Shore Protection Board (1996) are assumed to be configured as T-head structures in a more or less continuous field to assist with sand retention characteristics of placed sand (beachfill) and reduction in longshore sand transport differentials between adjacent shoreline segments. To a lesser degree, the structure head orientation will assist with wave energy transformation and help to limit cross-shore movement of sand to deeper water. It is further assumed that all such groins will be constructed of armor stone placed on a geotextile mattress or fabric to limit differential settlement of the armor units following construction.

As with the beachfill component described previously, granite armor stone costs are consistently assumed at \$100 per ton furnished and installed. Granite is selected for its high

density, hardness, durability and hence, reduced maintenance requirements following construction. Stone used to fill void spaces created by the armor stone, or 'chinking' stone, is assumed to be \$70 per ton installed. Obviously, actual costs will vary depending on the quantity of rock specified at construction, rock availability from quarry sources in the southeastern United States, rail transportation fees, competitive bids from experienced marine contractors, etc.

All groin fields depicted in this Plan are assumed to be spaced at a ratio of three times the structure length as measured from the landward terminus of the groin to the centerline of the "T" head of the groin. Groins are assumed to be configured with a stem or trunk elevation of +6 NGVD, with a 20 foot transition section sloped at 10:1 and carrying the +4 NGVD crest elevation to the head (waterward terminus) of the structure.

The orientation, length, individual weight specification (range of acceptable weights) of armor stone and the on-center spacing of the individual groins, as well as the total number of groins required to comprise a discrete groin field can only be adequately determined in detailed design, with wave refraction/diffraction and shoreline evolution modeling conducted to establish such parameters and to additionally satisfy regulatory agency evaluation of the structures' function and benefits to the project(s). Therefore, all groin fields represented in this plan are shown in concept only and are not deemed to be the definitive length, width, spacing or orientation.

7.4 SHORELINE MANAGEMENT OF REACH 2

Onondaga Avenue to 1,080' north of Wells Road

Because of relatively high erosion rates averaging 6.7 cubic yards per foot per year over this 13,600 ft shoreline segment, which extends from DEP Reference Monuments R-78 to R-90 + 400' south, supplemental sand placement must occur. The presence of extensive nearshore hardbottom resources is prevalent over the entire Reach boundary, although only limited characterization of the resource has been conducted (ATM, April 1995). Until the hardbottom feature is adequately mapped and characterized, the extent of an actual beachfill impact is largely unknown.

Assuming the reef feature is all quality structure and thereby requiring mitigation for impacts related to direct burial by beachfill construction (primary impacts) or subsequent migration of

sand from project post-construction equilibration (secondary impacts), the beachfill volume is reduced from an optimal solution to a more modest quantity of sand to restore this shoreline. Two discrete sections of shoreline are recommended to be anchored by construction of groin fields with a total of approximately 22 groins required. To minimize nearshore hardbottom impacts, an average beachfill (sand nourishment) volume of approximately 45 cubic yards per front foot is projected to withstand a 15-year storm event.

Due to the extensive nature and proximity of hardbottom resources to shore, as well as relatively high erosion rates in this segment of the Island, the anticipated three year renourishment interval is much higher than the targeted eight year interval specified above. It is possible that higher unit fill placement quantities could be realized (thrus providing a greater renourishment interval) if the extent of exposed nearshore hardbottom is determined to be less than that shown in Figures 7-2 and 7-3.

Typical groin plan and section views are provided in Figure 7-2(a) and are provided as typical for such structures recommended in adjacent shoreline Reaches. A tabulation of the beachfill template volumes shown in plan view in Figures 7-2 and 7-3 is provided in Table 7-1. Cross-sectional views at each DEP Reference Monument depicting the existing (May 1997) beach with the proposed beachfill template overlay within Shoreline Reach 2 are provided in Appendix E. Even with a modest (45 cubic yards per front foot), the construction toe-of-fill covers approximately 17.6 acres of nearshore hardbottom as represented by the PBCERM in 1993. As before, a detailed characterization and mapping of this resource will be necessary prior to establishing mitigation requirements.

7.5 SHORELINE MANAGEMENT OF REACHES 3 AND 4

1,080' north of Wells Road to Via Bethesda and from Via Bethesda to 300' south of Banyan Road

The approximately 5,800 foot shoreline Reach 3 segment, which extends from DEP Reference Monuments R-90 + 400' south to R-95, has one of the lowest average annual volumetric loss rates on the Island when evaluated over the 1990 to 1997 time period. However, the existing shoreline is extensively and almost continuously armored by seawalls. In addition, several derelict to functional groins were noted in the surf zone during the May 1997 structures inventory.

The south Reach boundary is coincident with the north limit of the Mid-Town Beach Restoration Project, and beachfill spreading from this project onto the Breakers Beach Club shoreline appears to be somewhat moderating what could be a much higher background erosion rate on this 1.1 mile shoreline. For cost-effectiveness and due to the high development density of multifamily residences and the presence of the Breakers Hotel in close proximity to Mid-Town, the management solution for Reach 3 is beach restoration to occur simultaneously with the renourishment of the Mid-Town Project. The condition of the groins in the vicinity of the Breakers Hotel and Beach Club should be carefully evaluated, as these structures may warrant rehabilitation to increase their effectiveness in sand retention. The Mid-Town groin field should be inspected and maintained to support the beachfill project depicted in Figures 7-3 and 7-4 (with individual cross-sections supplied in Appendix E).

An assumed beachfill template volume averaging 78 cubic yards per foot should restore the Mid-Town Project at its first anticipated renourishment interval in about the year 2000, and will advance the shoreline in Reach 3 suitable for protection from a 15-year storm and able to support an eight-year renourishment interval. Table 7-2 provides a detailed accounting of the fill quantities by reference monument as well as physical descriptions of the planform depicted in Figures 7-3 and 7-4. Detailed Reach objectives and 'design' rationale behind the proposed Reach improvements are also provided in the Figures.

The Mid-Town south project limit should be expanded to coincide with the Reach 4 south boundary at approximately 350 feet south of R-102. Less than 0.4 acres of mapped nearshore hardbottom are expected to be impacted by the constructed beachfill. Adjustments to the beachfill may result in higher impacts depending on post-construction performance of the fill and the quality of the placed sand.

7.6 SHORELINE MANAGEMENT OF REACH 5

300' south of Banyan Road to 170' north of Widener's Curve

Moderate erosion rates from 1990 to 1997 of approximately 2.5 cubic yards per foot per years were calculated for the 9,065 foot Reach 5, which terminates immediately north of Widener's Curve and the north terminus of the Florida Department of Transportation rock revetment which fronts Route A1A. A plan view of the proposed improvements for this Reach - approximately 620,000 cubic yards of beachfill 'anchored' at the south terminus by an 1,850 ft groin field comprised of 4-5 rubble-mound, T-head groins - is provided in Figure 7-5, with the beachfill template quantities given in Table 7-3.

The groin field is necessary to moderate the end losses of fill spreading into the highly erosional Reach 6 shoreline, and, to a lesser extent, to allow a modest fill template volume reduction in an attempt to minimize nearshore hardbottom impacts between R-108.5 and R-110. Approximately 3.7 acres of nearshore hardbottom are located within the construction toe of fill limits for the beachfill project shown in Figure 7-5.

7.7 SHORELINE MANAGEMENT OF REACH 6

170' north of Widener's Curve to Sloan's Curve

The FDOT rock revetment, constructed in 1987, is currently (1990-1997) experiencing the second-highest unit erosion rates on Palm Beach Island. The shoreline over this time period has lost 6.2 cubic yards per foot per year on average over the 6,685 foot shoreline between DEP Reference Monuments R-110 + 100' south to R-116 + 500' south.

While beachfill would seem to be a logical solution to offset the erosion problem, a large nearshore profile "depression" has increased in extent over this time. The approximate extent of this feature is plotted in Figure 7-6 and is also evident in contour plots generated by SURFER software and provided in Appendix C. Extensive hardbottom resources are present within 200 feet of the 1997 Mean High Water shoreline.

Due to the high longshore transport energies evident in this Reach, coupled with the large trough located between 70 and 350 feet from shore and the extensive hardbottom resources, direct placement of sand in this shoreline segment is not recommended. Rather, the condition of the FDOT revetment should be carefully assessed and the structure maintained to protect the only means of hurricane evacuation for this segment of the Island (Highway A1A). Should a characterization of the hardbottom reveal low quality structure with little biodiversity, a limited quantity beachfill and groinfield solution may be warranted.

Sand spreading effects from Reach 5 and Reach 7 (to be discussed in the following paragraph) shoreline restorations, if both constructed, should be monitored to determine fill longevity in this shoreline Reach and its attendant impacts to the nearshore hardbottom. It is anticipated, however, that the longshore current velocities in this Reach are extremely high, rendering the residence time of any sand entering the surf zone between the west edge of the nearshore hardbottom and the revetment toe very brief.

7.8 SHORELINE MANAGEMENT OF REACH 7

Sloan's Curve to the Ambassador Hotel

The proposed management of the shoreline segment with the highest erosion rates on Palm Beach Island (8.6 cubic yards per foot per year) over the last 6.6 years is a beachfill project with an average of 140 cubic yards per front foot of sand placement and the construction of an approximately 1,900 ft groin field comprised of eight T-head rubble-mound structures, as shown in Figures 7-6 and 7-7. Beachfill template volumes are provided in Table 7-4. The high unit fill quantities are necessary to mitigate for the extremely pronounced beach profile lowering evident in the nearshore zone. This is depicted in plan view in Figures 7-6 and 7-7 as a "nearshore profile depression." Beach profile comparisons for the shoreline so affected by this feature are provided in Appendix B.

The extent of the proposed Reach 7 restoration represents a slight modification from the proposed federal shore protection project as depicted in the Coast of Florida Erosion and Storm Effects Study for Region III (USACOE, July 1996) in that the south Reach boundary represents a toe of fill template reduction to zero in the event that Reach 8 is not restored at the same time as Reach 7. The proposed use of T-head groins represents a deviation from the presently proposed federal project, which represents a 1.1 million cubic yard beachfill only. The proposed addition of structures to assist with retaining sand along the Phipps Ocean Park, Harbor House and terminating immediately north of the Par 3 Golf Course will require review and approval by both the state and the federal governments, particularly with regard to potential federal participation in the cost of construction of the groin field.

Fill quantities in the proposed Reach 7 restoration (1.16 million cubic yards over a 1.95 mile long shoreline segment extending from R-116 to R-126) are substantially higher than the proposed federal project, in large part due to the additional sand volume necessary to stabilize the shoreline given the presence of the nearshore profile depression. A total of 1.5 acres of nearshore hardbottom are located within the plan view limits of the proposed construction toe of fill; this impact would be the highest total expected regardless of the fill project equilibration due to the lack of other hardbottom resources in the area. It is noted that the hardbottom in the vicinity of Phipps Ocean Park is exposed intertidally, and much of the beach is rendered difficult to traverse by foot without encountering these rock outcroppings.

7.9 SHORELINE MANAGEMENT OF REACH 8

Ambassador Hotel to La Bonne' Vie

The remainder of the proposed federal project shoreline proposed for restoration as outlined in USACOE, July 1996 is treated in the proposed management solution for Reach 8 and the northern 2,240 ft of Reach 9. Reach 8, which extends from FDEP Reference Monument T-125 to R-134, terminates at the La Bonne' Vie, which is also at the approximate south municipal boundary of the Town of Palm Beach.

A proposed 965,000 cubic yard beachfill template, which includes the construction of a 2,000 ft groin field comprised of six T-head structures, is represented in plan view in Figure 7-8 and is tabulated in Table 7-5, represents an average beachfill volume at construction of approximately 90 cubic yards per front foot of shoreline, and 123 cubic yards per foot over the full template section of the beachfill. The north and particularly south tapers to tie the ends of the Reach into the existing shoreline represent the 33 cubic yard per foot differential. The south taper should initiate at monument T-131 and be anchored with T-head groins at the approximate spacing and alignments shown due to the reemergence of nearshore hardbottom resources approximately 300 feet east of the 1997 Mean High Water shoreline. Approximately 0.7 acres of nearshore hardbottom are located within the construction toe of fill. Depending on the character and relief of the hardbottom, as well as the quality of the borrow sand utilized to restore the shoreline, greater secondary impacts (in total acreage) may result. Due to the similarities in the fill volumes and high erosion rates, it may be cost-effective to combine the Reach 8 and Reach 7 restorations into a single event to reduce mobilization costs.

7.10 SHORELINE MANAGEMENT OF REACHES 9 AND 10

La Bonne' Vie to Lantana Avenue Access (Reach 9) and Lantana Avenue Access to Chillingsworth Curve

The communities of South Palm Beach and Lantana comprise the approximate physical boundaries of this proposed 3,550 ft shoreline Reach, which is bounded by FDEP monuments R-134 and R-137 + 400' south. Because the length of shoreline may not result in a very cost-effective treatment of beachfill restoration as a separate and distinct project, it is recommended that the restoration of Shoreline Reach 10 be constructed concurrently. The 8,300 feet of shoreline in Reach 10, with similar shoreline erosion rates as Reach 9, would provide a more cost-effective and continuous beachfill project to provide storm protection and recreational beach. A total of approximately 718,000 cubic yards of beachfill will provide

approximately 50 cubic yards of sand per front foot of shoreline, with a construction template as shown in Figures 7-9 and 7-10 and compiled in Table 7-6. Depending upon the quality of the nearshore hardbottom resources located east of the shoreline, a limited groin field comprised of six to seven T-head groins may reduce project end losses (spreading) and cross-shore toe of fill equilibration to the hardbottom from FDEP Monuments T-141 to T-144.

A summary of the probable T-head groin field construction costs island-wide is provided in Table 7-7. As previously stated, the stone quantities and costs are conceptual only and will require detailed design to refine all aspects of the groin field(s) shown herein.

7.11 SHORELINE MANAGEMENT OF REACH 11

Chillingsworth Curve to South Lake Worth Inlet

The southernmost segment of shoreline on Palm Beach Island, while indicating a minor erosive trend over the entire Reach on average, is actually accretional above the Mean High Water line. Given the presence of dune vegetation and absence of shoreline-fronting seawalls in this Reach, as well as its proximity to the Inlet, the shoreline would appear to be best managed by maintaining present practices until such time as the South Lake Worth Inlet Management Plan is adopted by the Florida DEP and implemented by the Town of Manalapan, Palm Beach County, the Town of Ocean Ridge, the FDEP and the USACOE as appropriate. The shoreline will additionally benefit from end losses following restoration of Reach 10.

7.12 PROJECTION OF BEACHFILL AND GROIN FIELD CONSTRUCTION COSTS OVER A 30 YEAR PLANNING HORIZON

At the request of the Palm Beach Shore Protection Board at their regular meeting of July 29, 1997, an analysis of present worth and annualized costs of the plan recommended construction (restoration) and maintenance (renourishment) was conducted to provide an indication of budgeting requirements necessary to implement Plan recommendations. The year of construction and maintenance events is assumed to assist with this computation. A five percent discount rate (eight percent interest and a three percent inflation factor) was further assumed and applied uniformly throughout the analysis. The results of the computation, by Reach, are provided in Table 7-8. The assumed renourishment interval, with the exception of Reach 2 (estimated at three years), is eight years. The quality of the sand source(s) utilized for construction, the extent of storm activity following construction, construction sequencing of

adjacent Reach restoration and renourishments, and the maintenance or remedial adjustment to constructed groin fields will all influence the required renourishment interval.

The present value of all initial Reach restoration projects (beachfill or beachfill and structures) is approximately \$37,227,000. Actual costs of the improvements stated above in 1997 dollars is \$45,045,000.

When projected over a 30 year horizon, the present value of all restoration and renourishment costs for improvements to Reaches 2 through 5, inclusive, and Reaches 7 through 10, inclusive is approximately \$63,981,000. Total annual costs of the initial project construction and subsequent maintenance (renourishment) at the intervals stated are approximately \$4,162,000. It must be noted that these figures presented in Table 7-8 and above are **exclusive** of contractor mobilization and demobilization costs, sand source investigation, hardbottom mapping and characterization, project performance monitoring and mitigation costs.

7.13 RECOMMENDATIONS

The Palm Beach Island shoreline is currently displaying a net erosional trend. The entire Island shoreline, with the exception of Reaches 1 and 4, and to a limited extent in Reach 11, displays modest to severe erosion rates when considered over the 1990 to 1997 timeframe. As discussed in Section 5 of this document, several existing and potential sand sources exist offshore. The total sand volume required to initially restore the shoreline as represented above is approximately 5 million cubic yards. The borrow area identified by Palm Beach County DERM in 1993 would appear to satisfy this requirement, although sand quality will require further analysis with respect to anticipated project performance.

Should the target areas identified in Figure 5-2 be investigated and all deemed to be viable sources, total sand search costs to adequately probe, conduct detailed bathymetric, sidescan, subbottom and magnetometer surveys of the area, obtain vibracores, and conduct detailed vibracore sand sample analysis and compositing sufficient for plans and specifications level designation of the borrow area(s) are expected to be approximately \$700,000. Refinement of this cost will be dependent on the actual areas surveyed and subsequently refined as viable candidate borrow areas.

Of similar importance and extent is the mapping and characterization of nearshore hardbottom resources located within the construction and projected (following borrow area sand characteristic determination) equilibrium toe of fill to determine the required mitigation of these resources due to both primary and secondary construction impacts. Costs to survey and characterize all the areas recommended are expected to range between \$250,000 and \$350,000. Priority for characterization should follow the proposed shoreline restoration schedule by Reach as presented in Figure 7-12.

Mitigation and monitoring costs will be dictated by project impacts and approved solutions to restoration of the shoreline on a Reach basis. Assuming hardbottom mitigation is required at a ratio of one acre of new hardgrounds to be created for every one acre of existing feature impacted, mitigation construction costs of \$50,000/acre, and required mitigation for only those hardbottom areas depicted in Figures 7-2 through 7-11, inclusive which are directly impacted by the *construction* projects recommended, an expenditure of approximately \$1,500,000 would be expected to provide such 1:1 mitigation ratios. Mobilization and demobilization costs are assumed at \$750,000 per shoreline reach/combined reaches targeted for a singular restoration or renourishment event. Therefore, the six restoration project priorities requires total mobilization/demobilization fees of \$4,500,000.

The above indicates cumulative totals of an actual 1997 cost of initial beachfill/groin field plan improvements recommended herein (less monitoring) of approximately \$52,045,000. With the addition of recommended initial implementation elements associated with Lake Worth Inlet (as cited in Section 7.2 of this Plan), total 1997 costs are approximately \$55,871,000.

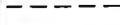
Singer Island

R-074

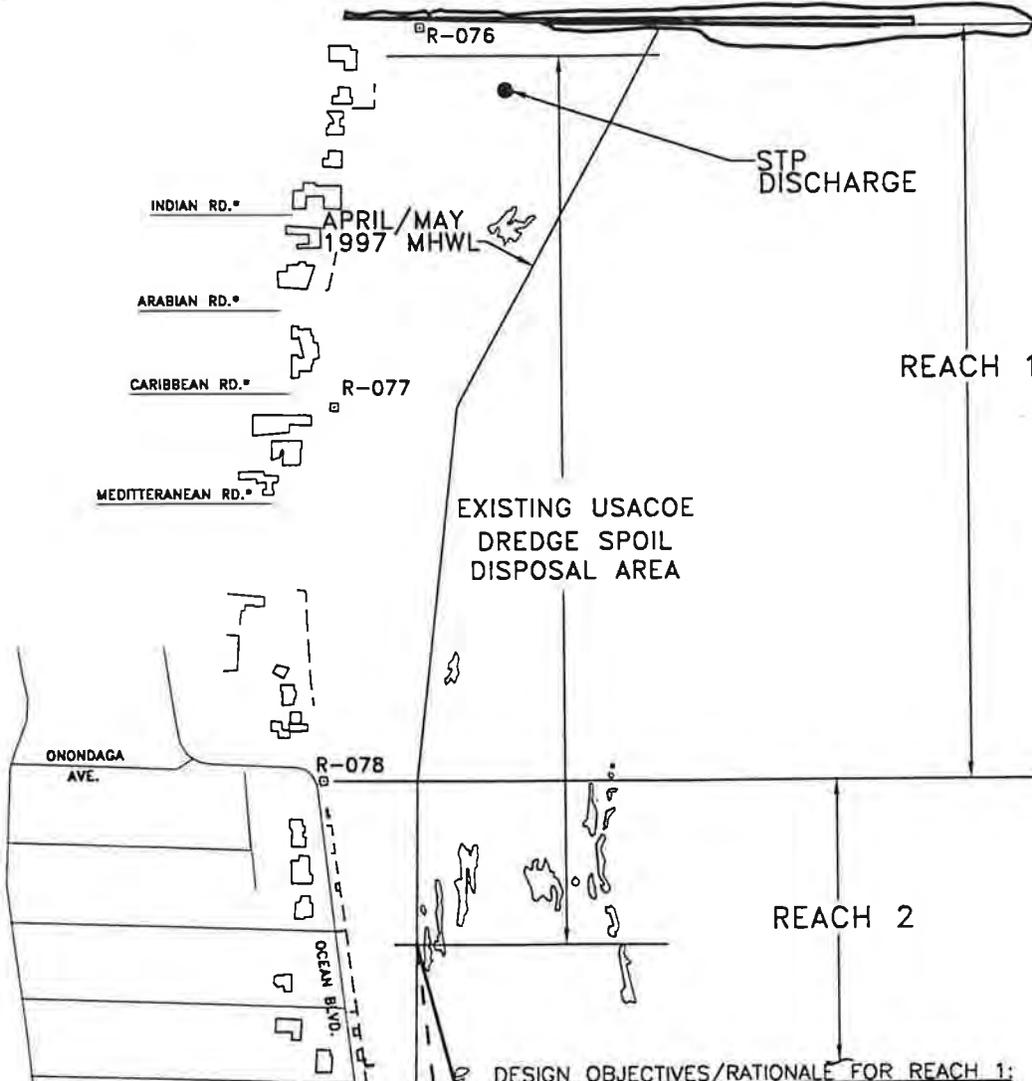
SAND TRANSFER PLANT (STP)

R-075

LEGEND

-  EXISTING NEARSHORE HARDBOTTOM (PBCERM 1992)
-  EXISTING MHWL
-  EXISTING SEAWALL
-  PROPOSED EDGE OF CONSTRUCTION BERM (ELEV. +9 NGVD)
-  PROPOSED CONSTRUCTION MHWL
-  PROPOSED CONSTRUCTION TOE OF FILL
-  PUBLIC BEACH ACCESS

Lake Worth Inlet



DESIGN OBJECTIVES/RATIONALE FOR REACH 1:

- REINSTATE INLET SAND TRANSFER TO PALM BEACH ISLAND
- EXTEND LOCATION OF STP DISCHARGE FURTHER SOUTH
- MODIFY CURRENT USACOE DREDGE SPOIL DISPOSAL PRACTICES
- IMPLEMENT THE LAKE WORTH INLET MANAGEMENT PLAN
- REPAIR AND MAINTAIN ROADWAY AND PROPERTY PROTECTIVE SEAWALLS AS REQUIRED

8/28/97

FIGURE 7-1
RECOMMENDED ACTIONS FOR
SHORELINE REACH 1

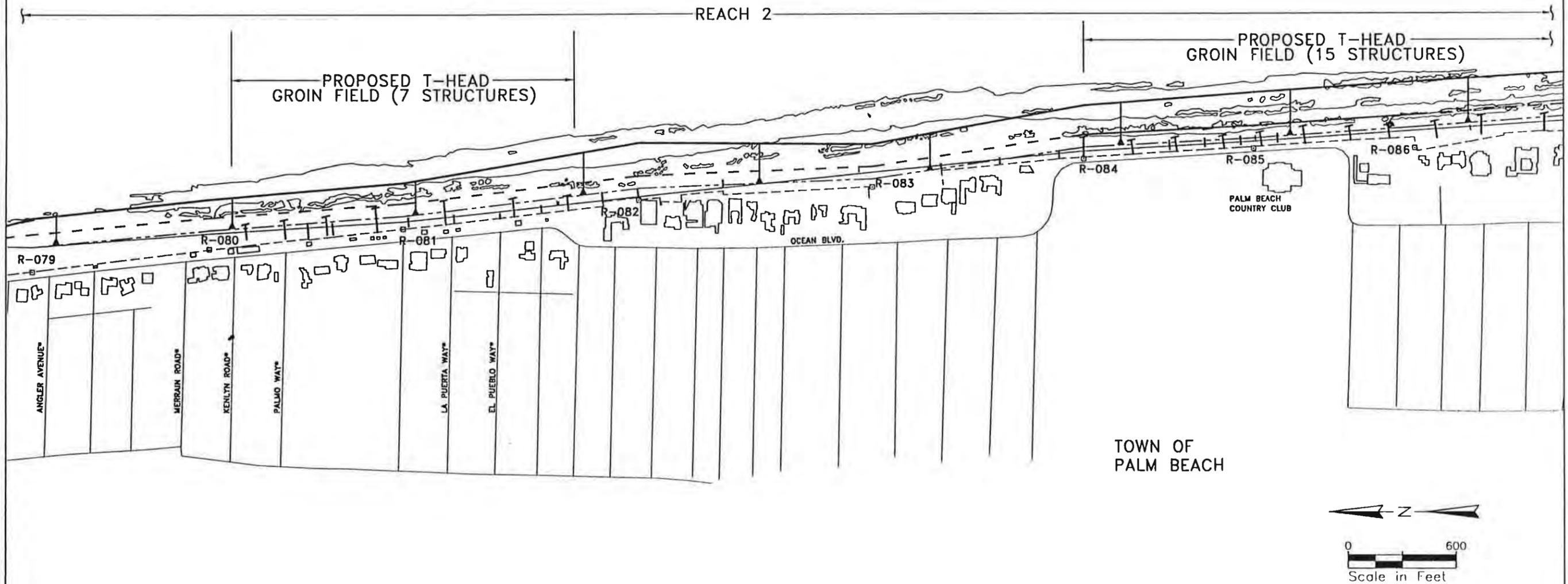


LEGEND

-  EXISTING NEARSHORE HARDBOTTOM (PBCERM 1992)
-  EXISTING MHWL
-  EXISTING SEAWALL
-  PROPOSED EDGE OF CONSTRUCTION BERM (ELEV. +9 NGVD)
-  PROPOSED CONSTRUCTION MHWL
-  PROPOSED CONSTRUCTION TOE OF FILL
-  PROPOSED RUBBLE MOUND GROIN
-  EXISTING GROIN (TO BE ASSESSED FOR REMOVAL OR REHABILITATION)
-  PUBLIC BEACH ACCESS

DESIGN OBJECTIVES/RATIONALE FOR REACH 2 SHORELINE RESTORATION:

- CHARACTERIZE AND MAP NEARSHORE HARDBOTTOM RESOURCES
- EVALUATE CONDITION OF AND REMOVE/REHABILITATE EXISTING GROINS AS APPROPRIATE
- PLACE APPROXIMATELY 610,000 CUBIC YARDS OF BEACHFILL TO PARTIALLY MITIGATE INLET IMPACTS AND RESTORE SAND DEFICIT TO HIGHLY EROSIONAL 13,660 FT. SHORELINE SEGMENT
- CONSTRUCT TWO T-HEAD GROIN FIELDS TO MINIMIZE BEACHFILL END LOSSES (BOTH LONGSHORE AND CROSSHORE)
- TERMINAL STRUCTURE (GROIN) TO BE SITED IN THE VICINITY OF R-80 TO DISSIPATE NORTHEAST INCIDENT WAVE ENERGY AND TO ALLOW FOR BETTER FILL "TOE-IN" TO MINIMIZE IMPACTS TO NEARSHORE HARDBOTTOM
- NORTH TERMINAL GROIN TO TIE INTO SEAWALL @ R-80 + 220'S AND EXTEND 70' WATERWARD AT STEM
- GROIN STEMS (TRUNK) @ +6' NGVD WITH 1V:2H TRANSITION SECTION TO HEAD +6'-- +4' NGVD
- STEM 5' WIDE @ CREST WITH 1V:2H SIDE SLOPES
- STRUCTURE HEADS ALL ASSUMED TO BE 50' LONG IN REACH 2
- HEAD FROM +4' TOE IN @ 1V:2H
- FINAL GROIN FIELD SPACING, ALIGNMENT AND ELEVATION, AS WELL AS BEACHFILL RESTORATION AND RENOURISHMENT VOLUMES DEPENDENT UPON BEACHFILL GRAIN SIZE
- REPAIR AND MAINTAIN ROADWAY AND PROPERTY PROTECTIVE SEAWALLS AS REQUIRED



PBCH2E/76RECO1 9/2/97

FIGURE 7-2
RECOMMENDED ACTIONS FOR SHORELINE REACH 2

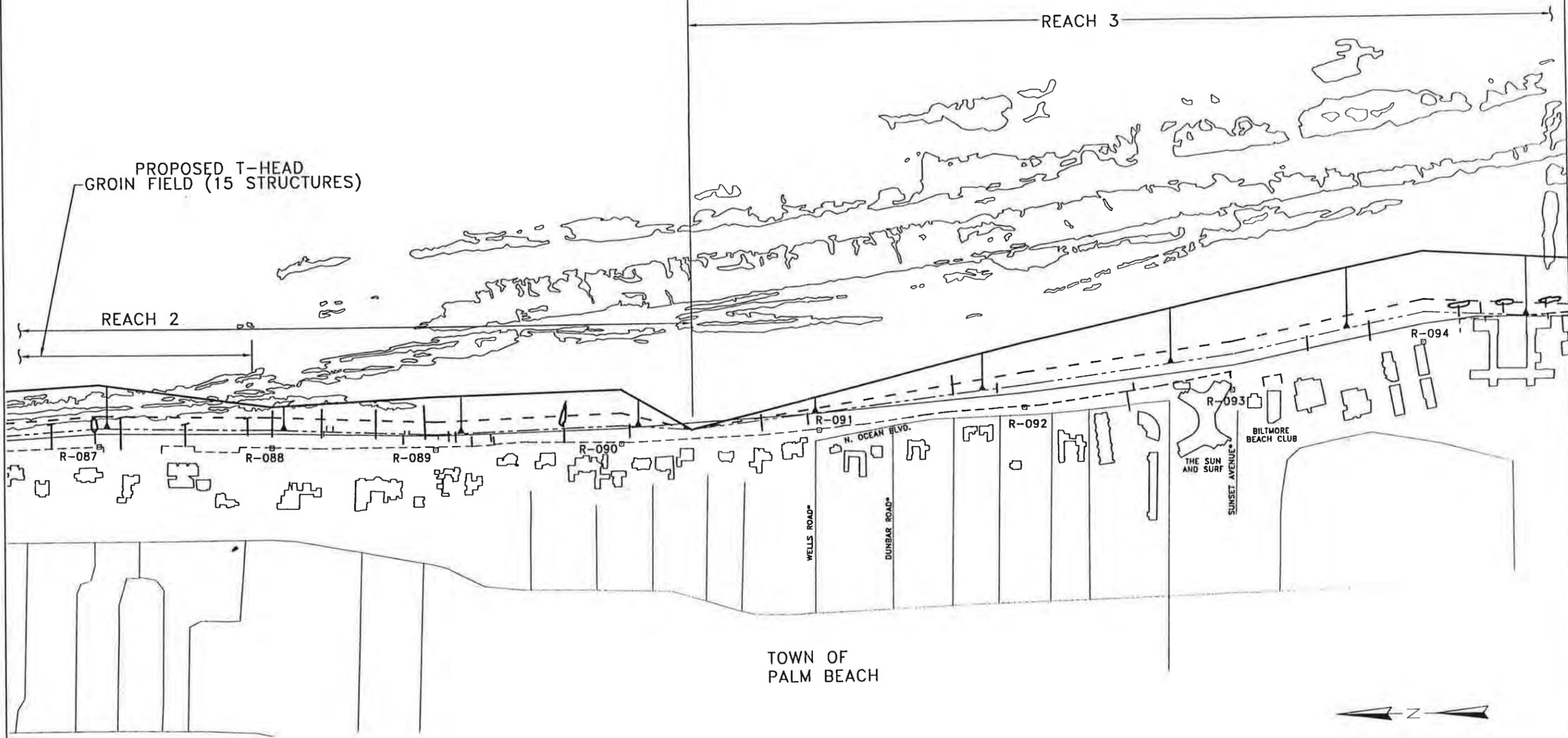
TOWN OF
PALM BEACH

LEGEND

-  EXISTING NEARSHORE HARDBOTTOM (PBCERM 1992)
-  EXISTING MHWL
-  EXISTING SEAWALL
-  PROPOSED EDGE OF CONSTRUCTION BERM (ELEV. +9 NGVD)
-  PROPOSED CONSTRUCTION MHWL
-  PROPOSED CONSTRUCTION TOE OF FILL
-  PROPOSED RUBBLE MOUND GROIN
-  EXISTING GROIN (TO BE ASSESSED FOR REMOVAL OR REHABILITATION)
-  PUBLIC BEACH ACCESS

DESIGN OBJECTIVES/RATIONALE FOR REACH 3/4 SHORELINE RESTORATION:

- RESTORE SHORELINE POSITION WITH BEACHFILL TO MODERATE WEAK EROSIONAL TREND IN REACH 3
- REHABILITATE AND MAINTAIN BREAKERS HOTEL AND MID-TOWN GROINS AS REQUIRED
- RENOURISH MID-TOWN TO COMPLY WITH 40% VOLUMETRIC LOSS PROVISION (FROM PROJECT AREA EXTEND MID-TOWN BEACHFILL SOUTH LIMIT 2,800 FT TO REACH BOUNDARY)
- EVALUATE CONDITION OF EXISTING GROINS AND REMOVE DERELICT STRUCTURES/RESTORE FUNCTIONAL GROINS
- MONITOR FILL SPREADING INTO REACHES 2 AND 5
- STRUCTURES (GROINS) NOT NEEDED IN REACH 3 DUE TO HARDBOTTOM 500+ FT FROM 1997 MHWL
- REPAIR AND MAINTAIN ROADWAY AND PROPERTY PROTECTIVE SEAWALLS AS REQUIRED



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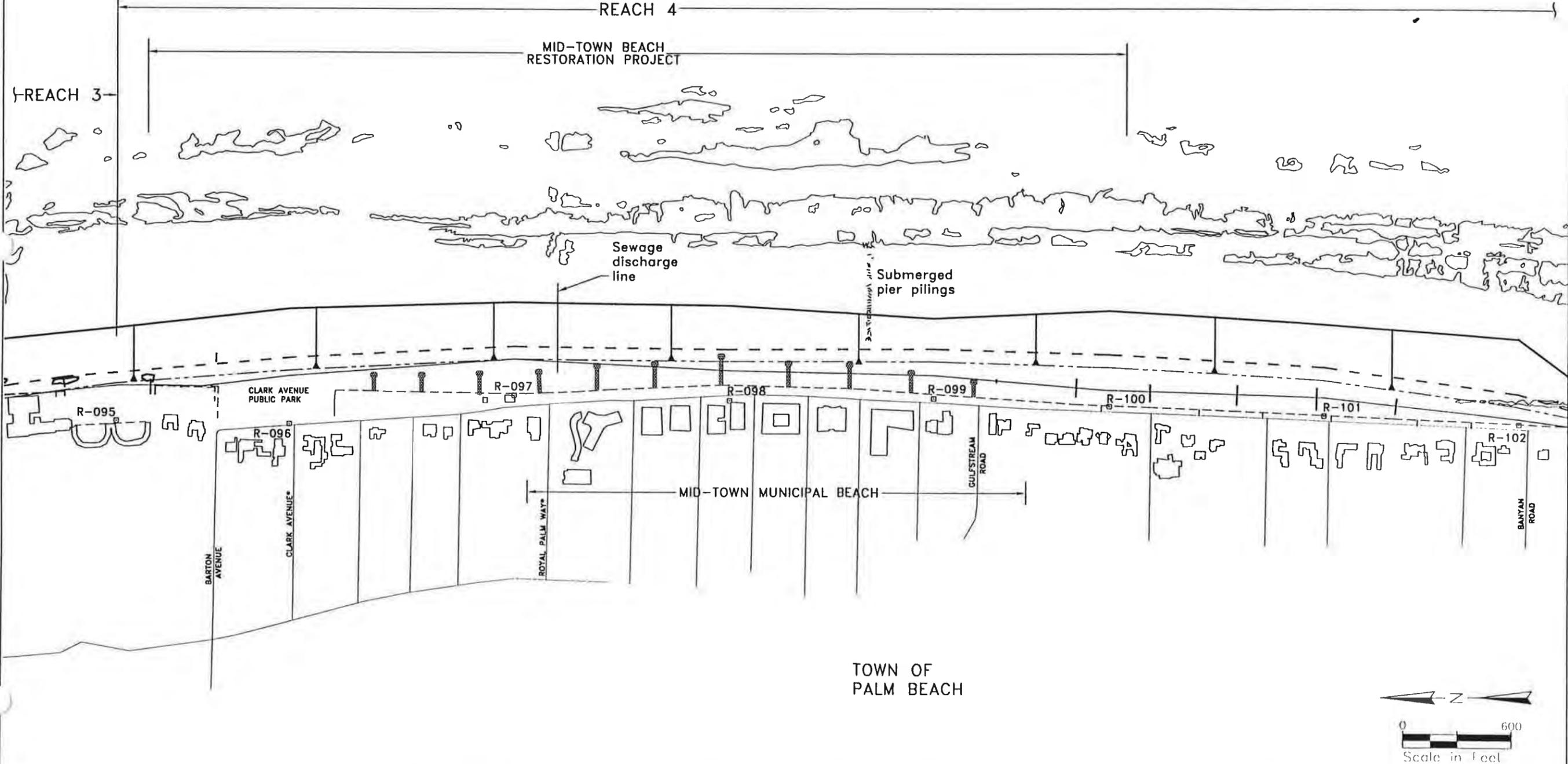
FIGURE 7-3
 RECOMMENDED ACTIONS FOR SHORELINE REACH 2 (CONTINUED)
 AND REACH 3

LEGEND

-  EXISTING NEARSHORE HARDBOTTOM (PBCERM 1992)
-  EXISTING MHWL
-  EXISTING SEAWALL
-  PROPOSED EDGE OF CONSTRUCTION BERM (ELEV. +9 NGVD)
-  PROPOSED CONSTRUCTION MHWL
-  PROPOSED CONSTRUCTION TOE OF FILL
-  PROPOSED RUBBLE MOUND GROIN
-  EXISTING GROIN (TO BE ASSESSED FOR REMOVAL OR REHABILITATION)
-  PUBLIC BEACH ACCESS

DESIGN OBJECTIVES/RATIONALE FOR REACH 3/4 SHORELINE RESTORATION:

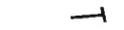
- REHABILITATE AND MAINTAIN BREAKERS HOTEL AND MID-TOWN GROINS AS REQUIRED
- RENOURISH MID-TOWN TO COMPLY WITH 40% VOLUMETRIC LOSS PROVISION (FROM PROJECT AREA EXTEND MID-TOWN BEACHFILL SOUTH LIMIT 2,800 FT TO REACH BOUNDARY)
- EVALUATE CONDITION OF EXISTING GROINS AND REMOVE DERELICT STRUCTURES/RESTORE FUNCTIONAL GROINS
- MONITOR FILL SPREADING INTO REACHES 2 AND 5
- STRUCTURES (GROINS) NOT NEEDED IN REACH 3 DUE TO HARDBOTTOM 500+ FT FROM 1997 MHWL
- REPAIR AND MAINTAIN ROADWAY AND PROPERTY PROTECTIVE SEAWALLS AS REQUIRED

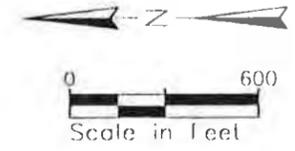


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FIGURE 7-4
 RECOMMENDED ACTIONS FOR SHORELINE REACH 4

LEGEND

-  EXISTING NEARSHORE HARDBOTTOM (PBCERM 1992)
-  EXISTING MHWL
-  EXISTING SEAWALL
-  PROPOSED EDGE OF CONSTRUCTION BERM (ELEV. +9 NGVD)
-  PROPOSED CONSTRUCTION MHWL
-  PROPOSED CONSTRUCTION TOE OF FILL
-  PROPOSED RUBBLE MOUND GROIN
-  EXISTING GROIN (TO BE ASSESSED FOR REMOVAL OR REHABILITATION)



REACH 5

DESIGN OBJECTIVES/RATIONALE FOR REACH 5:

- CHARACTERIZE AND MAP NEARSHORE HARDBOTTOM RESOURCES FROM R-107 TO R-110 + 700'S
- CONSTRUCT 620,000 CUBIC YARD BEACHFILL TO RESTORE MODERATELY EROSIONAL SHORELINE
- CONSTRUCT 1850 FT. ± GROIN FIELD WITH 4-5 RUBBLE-MOUND T-HEAD GROINS @ 450' O.C. (GROINS TYPICALLY 100-150 FT. LONG WITH 70-90' HEADS) TO REDUCE FILL REQUIREMENTS/HARDBOTTOM IMPACTS SOUTH OF R-108 TO NOURISHMENT TOE-IN @ R-110 + 700'S
- REPAIR AND MAINTAIN ROADWAY AND PROPERTY PROTECTIVE SEAWALLS AS REQUIRED

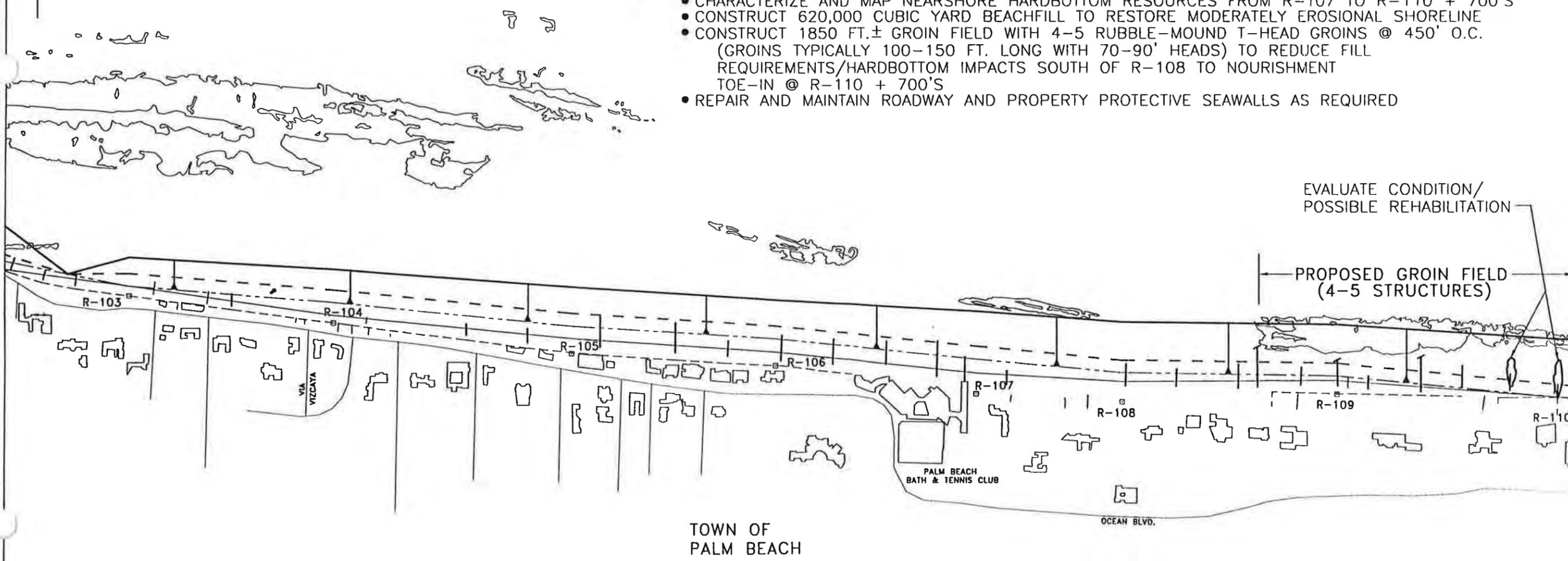
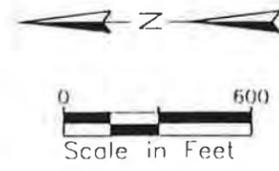


FIGURE 7-5
 RECOMMENDED ACTIONS FOR SHORELINE REACH 5

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LEGEND

-  EXISTING NEARSHORE HARDBOTTOM (PBCERM 1992)
-  EXISTING MHWL
-  EXISTING SEAWALL
-  PROPOSED EDGE OF CONSTRUCTION BERM (ELEV. +9 NGVD)
-  PROPOSED CONSTRUCTION MHWL
-  PROPOSED CONSTRUCTION TOE OF FILL
-  PROPOSED RUBBLE MOUND GROIN
-  EXISTING GROIN (TO BE ASSESSED FOR REMOVAL OR REHABILITATION)



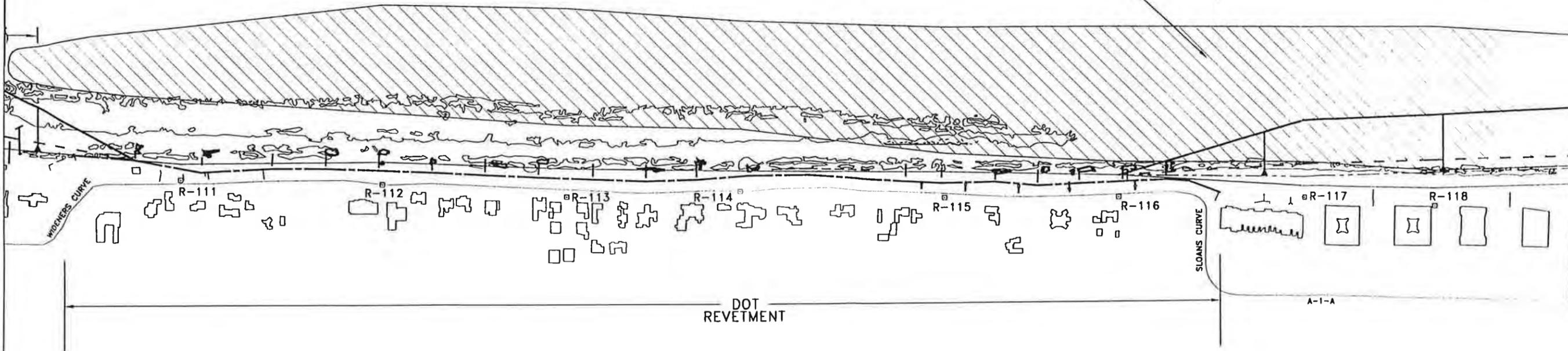
REACH 6

REACH 7

DESIGN OBJECTIVES/RATIONALE FOR REACH 6:

- MAINTAIN FDOT REVETMENT FORM AND FUNCTION/STABILITY OF STRUCTURE CROSS-SECTION
- EVALUATE CONDITION OF EXISTING GROINS AND REHABILITATE/REMOVE AS REQUIRED
- CHARACTERIZE AND MAP NEARSHORE HARDBOTTOM RESOURCES
- MONITOR SAND "BLEEDING" FROM REACH 5 AND REACH 7 RESTORATION AND SUBSEQUENT RENOURISHMENTS
- MONITOR SAND MIGRATION IMPACTS TO NEARSHORE HARDBOTTOM
- REPAIR AND MAINTAIN ROADWAY AND PROPERTY PROTECTIVE SEAWALLS AS REQUIRED

APPROXIMATE LOCATION OF NEARSHORE PROFILE "DEPRESSION"



DOT REVETMENT

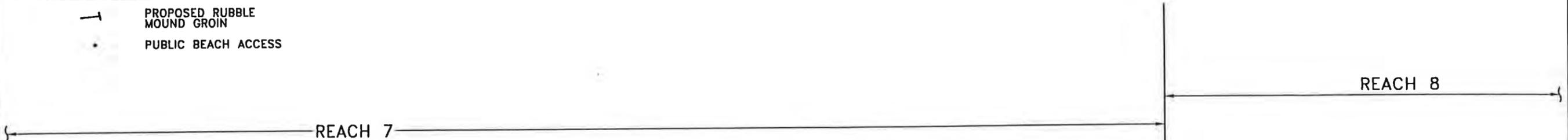
A-1-A

TOWN OF PALM BEACH

FIGURE 7-6
RECOMMENDED ACTIONS FOR SHORELINE REACH 6

LEGEND

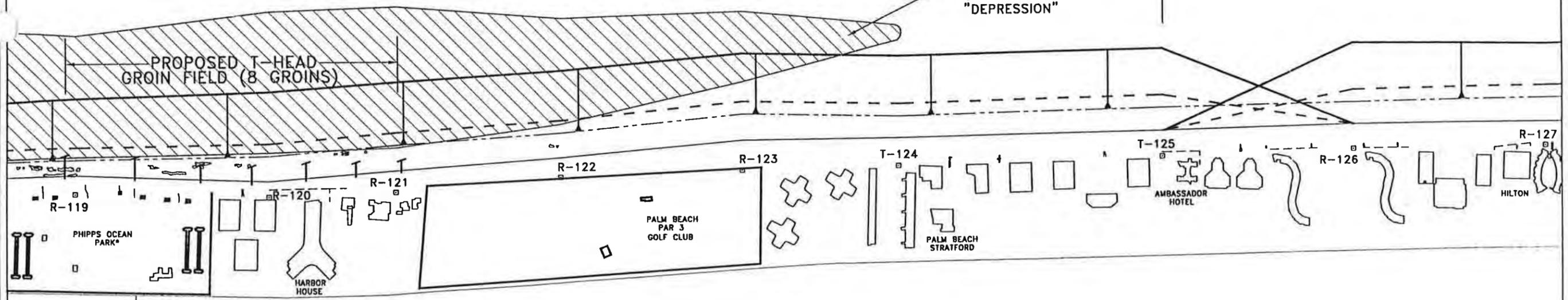
-  EXISTING NEARSHORE HARDBOTTOM (PBCERM 1992)
-  EXISTING MHWL
-  EXISTING SEAWALL
-  PROPOSED EDGE OF CONSTRUCTION BERM (ELEV. +9 NGVD)
-  PROPOSED CONSTRUCTION MHWL
-  PROPOSED CONSTRUCTION TOE OF FILL
-  PROPOSED RUBBLE MOUND GROIN
-  PUBLIC BEACH ACCESS



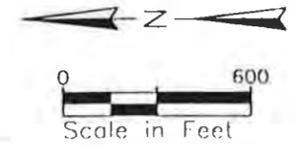
DESIGN OBJECTIVES/RATIONALE FOR REACH 7:

- CHARACTERIZE AND MAP NEARSHORE HARDBOTTOM
- CONSTRUCT APPROXIMATELY 1.16 MILLION CUBIC YARD BEACHFILL TO MITIGATE FOR THE HIGHEST EROSION LOSSES ON PALM BEACH ISLAND 1990-1997
- NEARSHORE PROFILE "DEPRESSION" LOCATED OFFSHORE OF NORTH HALF OF REACH
- MITIGATE LOSS OF RECREATIONAL BEACH AT PHIPPS OCEAN PARK
- PROTECTION OF OCEAN FRONT PROPERTIES FROM STORM DAMAGE (HIGH STORM DAMAGE BENEFIT)
- MINIMAL HARDBOTTOM RESOURCE IMPACTS AT SOUTHERN 2/3 OF PROJECT
- CONSTRUCT 1900 FT ± GROIN FIELD WITH 8 RUBBLE-MOUND T-HEAD GROINS @ 250-400 FT SPACING TO MINIMIZE BOTH LONGSHORE AND CROSS SHORE LOSSES
- REPAIR AND MAINTAIN ROADWAY AND PROPERTY PROTECTIVE SEAWALLS AS REQUIRED

APPROXIMATE LOCATION OF NEARSHORE PROFILE "DEPRESSION"



TOWN OF PALM BEACH



9BCH2J/796RECO1 9/2/97

FIGURE 7-7
 RECOMMENDED ACTIONS FOR SHORELINE REACH 7

LEGEND

-  EXISTING NEARSHORE HARDBOTTOM (PBCERM 1992)
-  EXISTING MHWL
-  EXISTING SEAWALL
-  PROPOSED EDGE OF CONSTRUCTION BERM (ELEV. +9 NGVD)
-  PROPOSED CONSTRUCTION MHWL
-  PROPOSED CONSTRUCTION TOE OF FILL
-  PROPOSED RUBBLE MOUND GROIN
-  PUBLIC BEACH ACCESS

REACH 8

DESIGN OBJECTIVES/RATIONALE FOR REACH 8:

- CHARACTERIZE AND MAP EXTENT OF NEARSHORE HARDBOTTOM FROM LAKE WORTH MUNICIPAL PARK TO PALM BEACH/SOUTH PALM BEACH MUNICIPAL BOUNDARY TO UPDATE PBCERM 1993 EFFORTS
- CONSTRUCT 965,000 CUBIC YARD BEACHFILL TO RESTORE HIGHLY ERODING SHORELINE
- LIMIT HARDBOTTOM IMPACTS BY BEACHFILL
- CONSTRUCT 2,000 FT+ GROIN FIELD WITH 6 RUBBLE-MOUND T-HEAD STRUCTURES AT 300-400 FT SPACING
- GROINS ENABLE TOE OF FILL TEMPLATE AT SOUTHERN 3500 FT OF REACH TO TAPER AND REDUCE FILL LOSSES TO SOUTH
- REPAIR AND MAINTAIN ROADWAY AND PROPERTY PROTECTIVE SEAWALLS AS REQUIRED

REACH 9

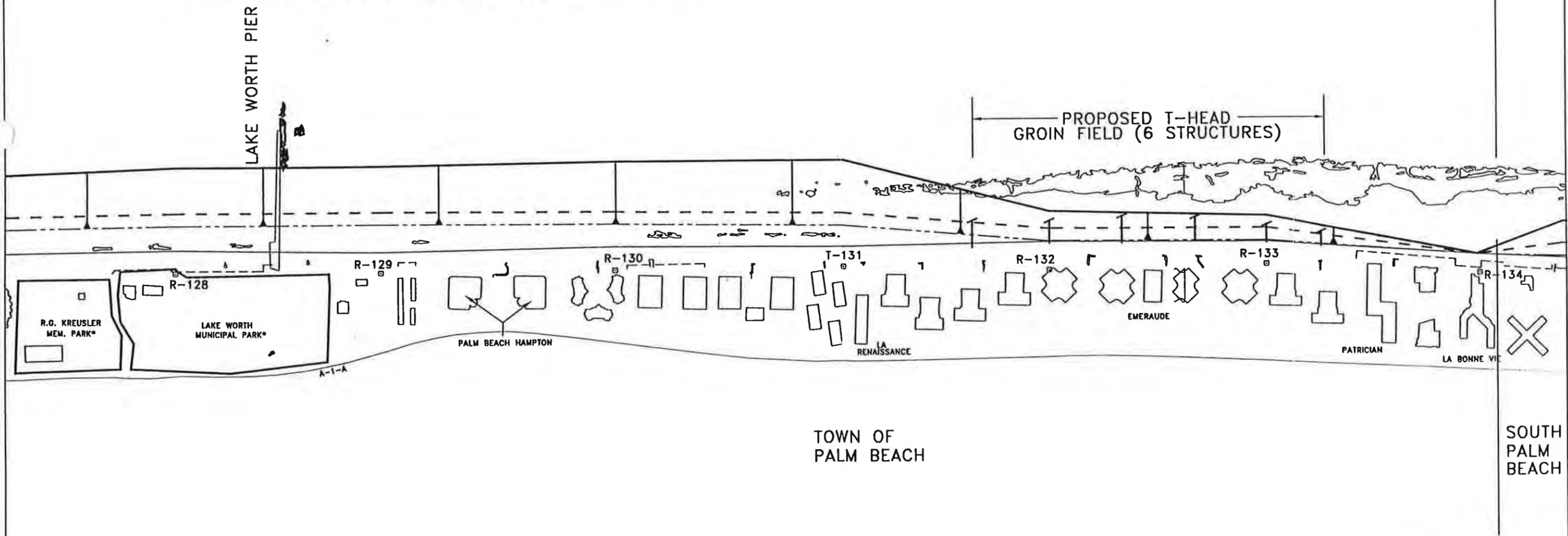


FIGURE 7-8
RECOMMENDED ACTIONS FOR SHORELINE REACH 8

LEGEND

-  EXISTING NEARSHORE HARDBOTTOM (PBCERM 1992)
-  EXISTING MHWL
-  EXISTING SEAWALL
-  PROPOSED EDGE OF CONSTRUCTION BERM (ELEV. +9 NGVD)
-  PROPOSED CONSTRUCTION MHWL
-  PROPOSED CONSTRUCTION TOE OF FILL
-  PUBLIC BEACH ACCESS

REACH 9

REACH 10

DESIGN OBJECTIVES/RATIONALE FOR REACH 9

- CHARACTERIZE AND MAP NEARSHORE HARDBOTTOM TO UPDATE PBCERM 1993 EFFORTS
- RESTORE SAND DEFICIT TO MODERATELY EROSIONAL SHORELINE
- MODIFY TEMPLATE VOLUMES AS NECESSARY TO MINIMIZE TOE OF FILL IMPACTS TO HARDBOTTOM
- REPAIR AND MAINTAIN ROADWAY AND PROPERTY PROTECTIVE SEAWALLS AS REQUIRED

DESIGN OBJECTIVES/RATIONALE FOR REACH 10 SHORELINE RESTORATION:

- CHARACTERIZE AND MAP NEARSHORE HARDBOTTOM OVER ENTIRE REACH BOUNDARY TO SUPPLEMENT PBCERM 1993 STUDY
- CONSTRUCT BEACHFILL TO RESTORE MODERATE SHORELINE EROSION LOSSES
- EVALUATE POSSIBLE 6-7 STRUCTURE T-HEAD GROIN FIELD BETWEEN R-141 AND R-142 TO MINIMIZE CROSS-SHORE LOSSES/SECONDARY IMPACTS TO EXISTING NEARSHORE HARDBOTTOM

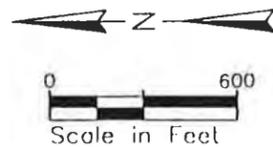
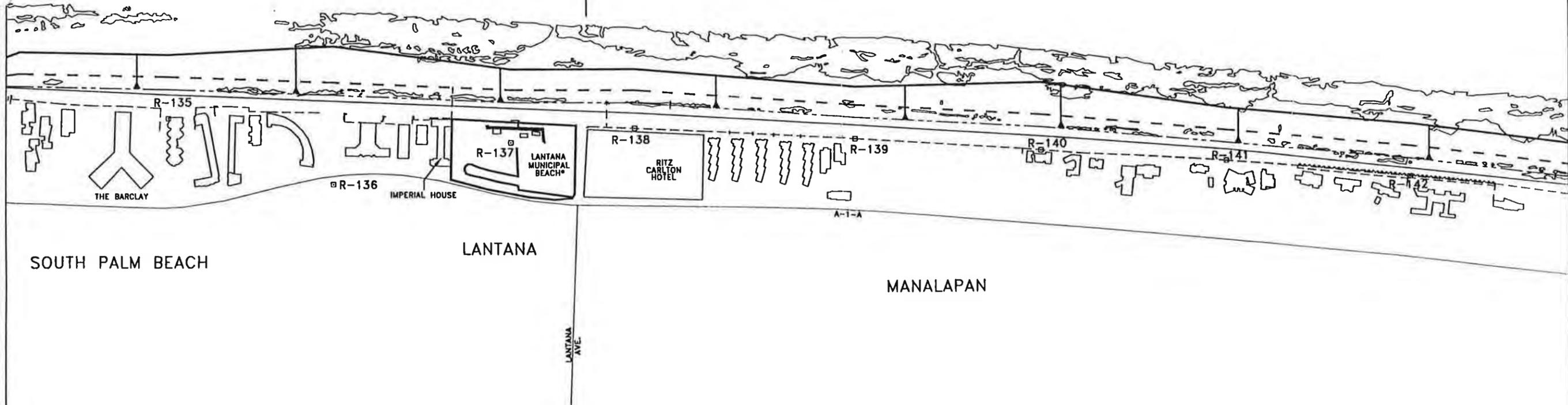


FIGURE 7-9
 RECOMMENDED ACTIONS FOR SHORELINE REACHES 9 AND 10

LEGEND

-  EXISTING NEARSHORE HARDBOTTOM (PBCERM 1992)
-  EXISTING MHWL
-  EXISTING SEAWALL
-  PROPOSED EDGE OF CONSTRUCTION BERM (ELEV. +9 NGVD)
-  PROPOSED CONSTRUCTION MHWL
-  PROPOSED CONSTRUCTION TOE OF FILL

REACH 10

DESIGN OBJECTIVES/RATIONALE FOR REACH 10 SHORELINE RESTORATION:

- CHARACTERIZE AND MAP NEARSHORE HARDBOTTOM OVER ENTIRE REACH BOUNDARY TO SUPPLEMENT PBCERM 1993 STUDY
- CONSTRUCT BEACHFILL TO RESTORE MODERATE SHORELINE EROSION LOSSES
- EVALUATE POSSIBLE 6-7 STRUCTURE T-HEAD GROIN FIELD BETWEEN R-141 AND T-144 TO MINIMIZE CROSS-SHORE LOSSES/SECONDARY IMPACTS TO EXISTING NEARSHORE HARDBOTTOM
- REPAIR AND MAINTAIN ROADWAY AND PROPERTY PROTECTIVE SEAWALLS AS REQUIRED

REACH 11

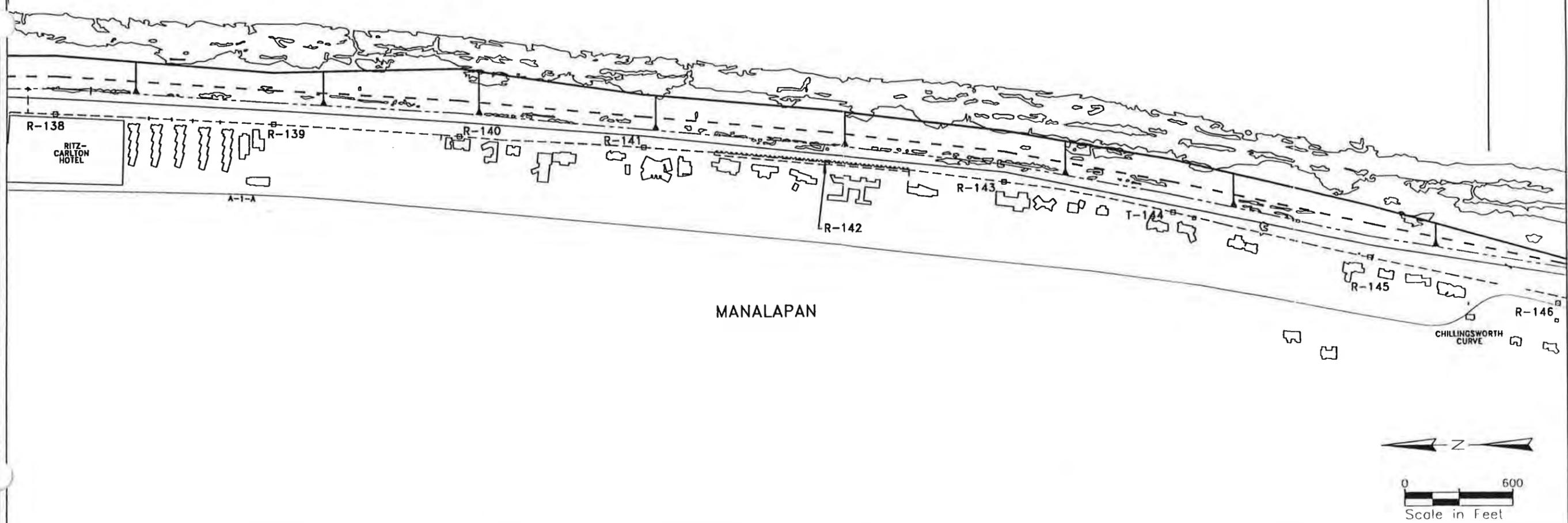
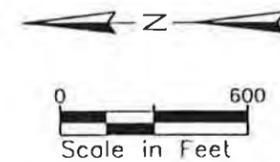


FIGURE 7-10
 RECOMMENDED ACTIONS FOR SHORELINE REACH 10

LEGEND

-  EXISTING NEARSHORE HARDBOTTOM (PBCERM 1992)
-  EXISTING MHWL
-  EXISTING SEAWALL
-  PROPOSED EDGE OF CONSTRUCTION BERM (ELEV. +9 NGVD)
-  PROPOSED CONSTRUCTION MHWL
-  PROPOSED CONSTRUCTION TOE OF FILL
-  PUBLIC BEACH ACCESS



REACH 11

DESIGN OBJECTIVES/RATIONALE FOR REACH 11 SHORELINE RESTORATION:

- MONITOR SAND "BLEEDING" FROM REACH 9/10 RESTORATION
- MAINTAIN VEGETATIVE DUNES
- IMPLEMENT SOUTH LAKE WORTH INLET MANAGEMENT PLAN OBJECTIVES AS REQUIRED TO AVOID ADVERSE IMPACTS TO SHORELINE
- REPAIR AND MAINTAIN ROADWAY AND PROPERTY PROTECTIVE SEAWALLS AS REQUIRED

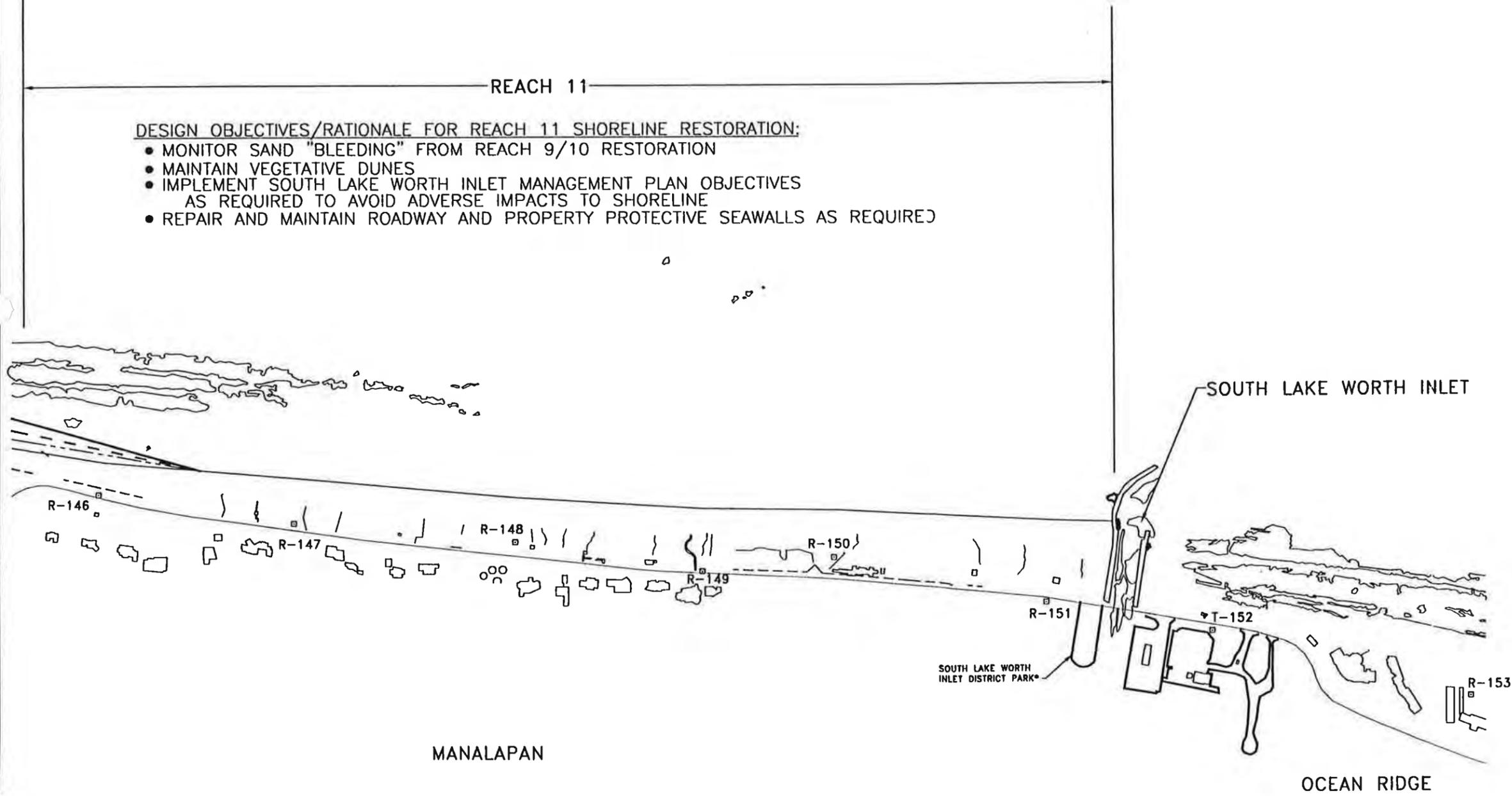


FIGURE 7-11
RECOMMENDED ACTIONS FOR SHORELINE REACH 11

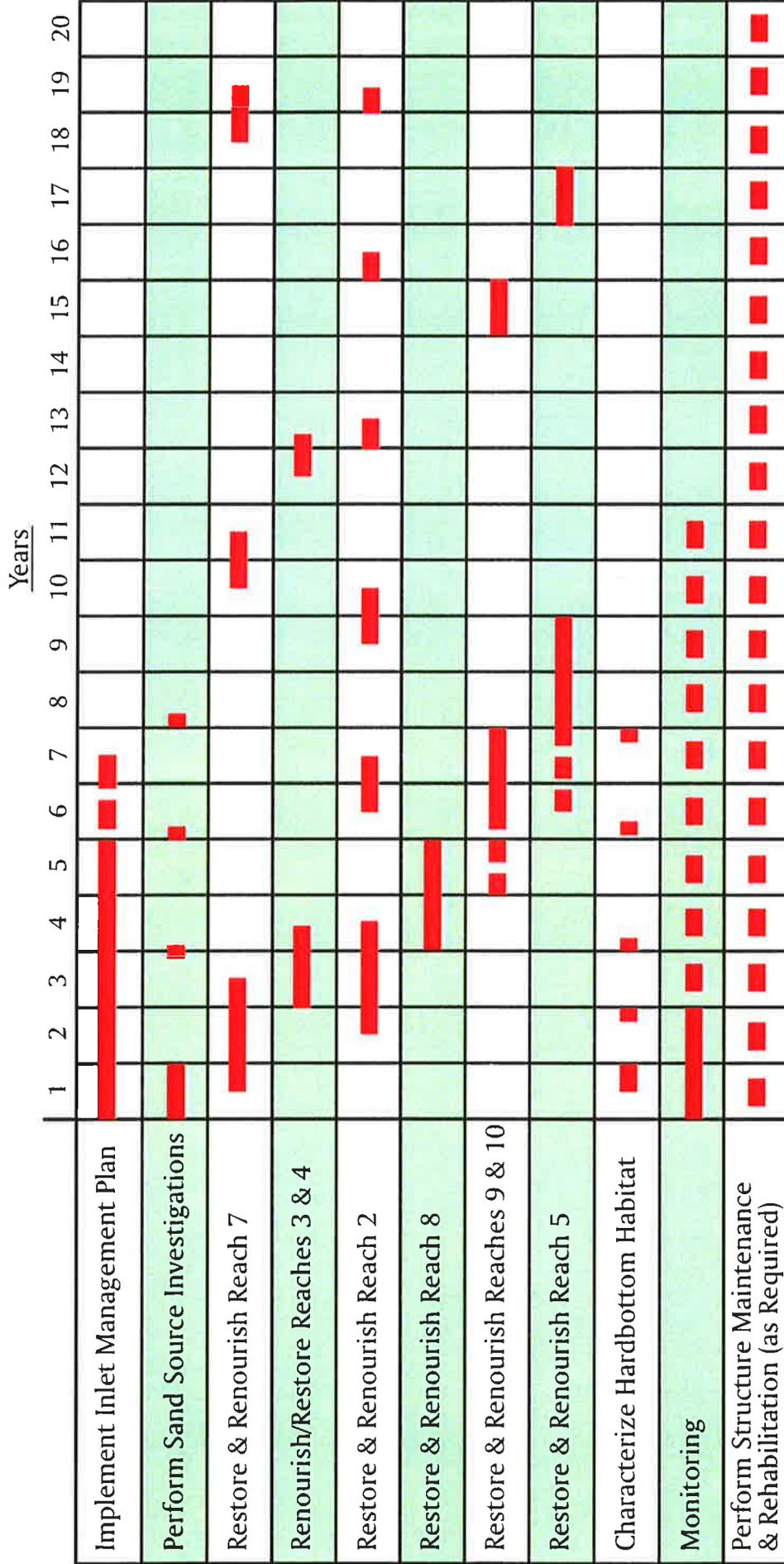


Figure 7-12
 Proposed Implementation Schedule
 Town of Palm Beach, Florida
 Comprehensive Coastal Management Plan



**TABLE 7-1
PROPOSED PALM BEACH ISLAND BEACH RESTORATION PROJECT TEMPLATE VOLUMES
SHORELINE REACH 2**

Project Reach	FDEP Monument Reference	Station	Intervening Distance (ft)	Beachfill Template (cy/ft)	Average (cy/ft)	Beachfill Volume (cy)	Construction Berm Width (ft)	Construction Berm from Mon., ft.	Monument to Constr. MHWL (ft)	Monument to Construction Toe (ft)
	R-78	0	1085	0	19.5	21158	0		N/A	N/A
	R-79	1085	1005	39	42.0	42210	95	141	211	300
	R-80	2090	1135	45	47.5	53913	90	106	176	280
	R-81	3225	1340	50	52.0	69680	73	73	143	260
	R-82	4565	1330	54	47.5	63175	56	67	137	323
	R-83	5895	1195	41	44.0	52580	35	47	117	243
2	R-84	7090	965	47	49.5	47768	56	66	136	301
	R-85	8055	910	52	50.0	45500	45	59	129	318
	R-86	8965	1330	48	48.5	64505	60	120	190	379
	R-87	10295	980	49	47.5	46550	97	101	171	346
	R-88	11275	925	46	48.5	44863	95	101	171	230
	R-89	12200	1060	51	46.0	48760	65	85	155	297
	R-90	13260	400	41	20.5	8200	65	101	171	303
	R-90+400	13660		0			0		N/A	N/A
Averages - Full Template				40	43		59		136	256
TOTAL				48	48		67		153	298
Estimated TOTAL BEACHFILL COST				13,660		608,860				
						\$3,957,590				

NOTES:

- Volumes were computed by the average-end area method and template overlays performed on the April/May 1997 beach profiles.
- Volumes are based on the construction template required to place a minimum of 40 cy/ft within the full template segment of the Reach.
- The assumed spacing between groins is approximately 250 ft, with groin lengths variable between 50 and 125 ft.
- The project assumes the beachfill will taper to the existing (1997) profile grade at the Reach north and south boundaries, in the event that Reach 3 restoration does not occur concurrently.
- Volumes assume a suitable sand source with an overfill factor of unity to 1.20, a dual-sloped construction template, and a unit cost of sand (in-place) of \$6.50/cy.

**TABLE 7-2
PROPOSED PALM BEACH ISLAND BEACH RESTORATION PROJECT FILL TEMPLATE VOLUMES
SHORELINE REACHES 3 AND 4**

Project Reach	FDEP Monument Reference	Station	Intervening Distance (ft)	Beachfill Template (cy/ft)	Average (cy/ft)	Beachfill Volume (cy)	Construction Berm Width (ft)	Construction Berm from Mon. (ft)	Monument to Constr. MHWL (ft)	Monument to Construction Toe (ft)	
3	R-91+750	0		0			0	N/A	N/A	N/A	
	R-92	400	400	50	25	10000	115	126	196	362	
	R-93	1580	1180	101	76	89090	140	201	271	542	
	R-94	2680	1100	91	96	105600	120	172	242	514	
	R-95C	4520	1840	100	95	175324	90	91	161	416	
4	R-96A	5095	575	88	94	53811	105	301	371	646	
	R-97A+91	6611	1516	41	64	97267	95	201	271	519	
	R-98A+38	7620	1009	61	51	51444	120	181	251	531	
	R-99D	9170	1550	85	73	113344	160	206	276	447	
	R-100	9674	504	99	92	46272	200	218	288	533	
	R-101	10869	1195	100	100	118926	170	200	270	509	
	R-102	11954	1085	81	91	98529	95	101	171	476	
	R-102+750	12704	750	0	41	30450	N/A	N/A	N/A	N/A	
	Averages				69	75		108		231	423
	Averages - Full Template				85	84		120		267	466
TOTAL			12,704			990,057					
Estimated TOTAL BEACHFILL COST						\$6,435,373					

NOTES:

- Volumes were computed by the average-end area method and template overlays performed on the April/May 1997 beach profiles.
- Volumes are based on the construction template required to place an average of 85 cy/ft (full template section) within the Reach limits.
- Existing groin spacing is variable but typically 300 - 400 ft. on center. Orientation, condition and spacing to be evaluated to determine extent of repairs/rehabilitation necessary to increase fill project performance and minimize hardbottom impacts to Reach 3.
- The project assumes the beachfill will taper to the existing (1997) profile grade at the Reach north and south boundaries in the event that Reach 2 and Reach 5 restoration projects do not occur concurrently.
- Volumes assume a suitable sand source with an overfill factor of unity to 1.20, a dual-sloped construction template, and a unit cost of sand (in-place) of \$6.50/cy.

**TABLE 7-3
PROPOSED PALM BEACH ISLAND RESTORATION PROJECT - SHORELINE REACH 5**

Project Reach	FDEP Monument Reference	Station	Intervening Distance (ft)	Beachfill Template (cy/ft)	Average (cy/ft)	Beachfill Volume (cy)	Construction Berm Width (ft)	Construction Berm from Mon., (ft)	Monument to Constr. MHWL (ft)	Monument to Construction Toe (ft)
5	R-102.5	0	500	0	15	7393	0	N/A	N/A	N/A
	R-103	500	1160	30	53	61028	90	56	126	217
	R-104	1660	1355	76	79	106754	110	116	186	301
	R-105	3015	1170	82	81	94624	110	153	223	370
	R-106	4185	1135	80	82	93161	125	150	220	364
	R-107	5320	820	84	82	66916	150	194	264	458
	R-108	6140	1230	79	78	95639	100	162	232	442
	R-109	7370	1325	77	58	77506	80	101	171	386
	R-110	8695	720	40	20	14530	80	101	171	427
	R-110.7	9415		0			0	N/A	N/A	N/A
	Averages - Full Template				55 80	61 80		85 113		159 216
TOTALS			9,415			617,549				
Estimated	TOTAL BEACH FILL COST					\$4,014,066				

NOTES:

- Volumes were computed by the average-end area method and template overlays performed on the April/May 1997 beach profiles.
- Volumes are based on the construction template required to place an average of 80 cy/ft (full template section) within the Reach limits.
- Existing groin spacing is variable but typically 300 - 400 ft. on center. Orientation, condition and spacing to be evaluated to determine extent of groin repairs/rehabilitation necessary to increase fill project performance and minimize hardbottom impacts to Reach 6.
- The project assumes the beachfill will taper to the existing (1997) profile grade at the Reach north and south boundaries in the event that Reach 4 restoration does not occur concurrently.
- Volumes assume a suitable sand source with an overfill factor of unity to 1.20, a dual-sloped construction template, and a unit cost of sand (in-place) of \$6.50/cy. Dredge mobilization costs not included.
- If hardbottom habitat at R-108 + 700' S to R-110 + 700'S (Reach 5 south taper limit) is deemed viable, template volumes should be reduced by 30-50% and a short (1,900 ft) groin filled comprised of five rubble-mound T-head structures should be constructed.

TABLE 7-4
PROPOSED PALM BEACH ISLAND BEACH RESTORATION PROJECT FILL TEMPLATE VOLUMES
SHORELINE REACH 7

Project Reach	FDEP Monument Reference	Station	Intervening Distance (ft)	Beachfill Template (cy/ft)	Average (cy/ft)	Beachfill Volume (cy)	Construction Berm Width (ft)	Monument to Constr. MHWL (ft)	Monument to Construction Toe (ft)
	R-116	0		0			0	N/A	N/A
	R-117	1040	1040	81	40.3	41959	115	186	430
	R-118	1835	795	101	90.6	72063	130	259	510
	R-119	3020	1185	120	110.3	130741	150	264	541
	R-120	4125	1105	149	134.3	148402	187	300	593
	R-121	4855	730	152	150.3	109693	210	336	621
	R-122	5805	950	150	150.9	143379	210	321	602
	R-123	6830	1025	152	151.0	154775	230	388	660
	T-124	7730	900	122	136.9	123174	175	351	621
	T-125	9225	1495	114	118.0	176365	170	346	609
	R-126	10315	1090	0	57.2	62326	0	N/A	N/A
Averages - Full Template				104	114		143	250	472
				141	145		194	327	606
Totals			10,315			1,162,877			
Estimated TOTAL BEACHFILL COST						\$7,558,698			

NOTES:

- Volumes were computed by the average-end area method, with beachfill template overlays performed on May 1997 profiles at each DEP Monument.
- Volumes are based on the construction template required to place an average of 140 cy/ft (Reach 7) and 120 cy/ft (Reach 8) in the full template segment within the Reach boundaries.
- The assumed spacing between the eight groins proposed for Reach 7 varies between 240 - 375 ft., with groin lengths variable between 80 and 125ft.
- The Reach 7 project assumes the beachfill will taper to the existing (1997) profile grade at the Reach south boundary, in the event that Reach 7 restoration does not occur concurrently with the Reach 8 restoration project.
- Volumes assume a suitable sand source with an overfill factor of unity to 1.20, a dual-sloped construction template, and a unit cost of sand (in-place) of \$6.50/cy. Mobilization costs are considered additional to the unit costs.

TABLE 7-5
PROPOSED PALM BEACH ISLAND BEACH RESTORATION PROJECT FILL TEMPLATE VOLUMES
SHORELINE REACH 8

Project Reach	FDEP Monument Reference	Station	Intervening Distance (ft)	Beachfill Template (cy/ft)	Average (cy/ft)	Beachfill Volume (cy)	Construction Berm Width (ft)	Monument to Constr. MHWL (ft)	Monument to Construction Toe (ft)
	T-125	0		0					
	R-126	1090	1090	114	57.0	62130	0	N/A	N/A
	R-127	2185	1095	109	111.5	122120	180	333	598
	R-128	3220	1035	127	117.8	121923	180	340	575
	R-129	4395	1175	141	133.7	157051	185	337	596
	R-130	5805	1410	126	133.6	188418	200	342	601
	R-131	7100	1295	121	123.6	160075	190	329	611
	R-132	8265	1165	36	78.2	91062	170	302	600
	R-133	9490	1225	33	34.4	42134	78	232	329
	R-134	10690	1200	0	16.6	19914	75	203	272
Averages - Full Template				90	90		140	269	465
TOTALS			10,650	123	124	964,827	184	331	597
Estimated	TOTAL BEACHFILL COST					\$6,271,374			

NOTES:

- Volumes were computed by the average-end area method, with beachfill template overlays performed on May 1997 profiles at each DEP Monument.
- Volumes are based on the construction template required to place an average of 120 cy/ft in the full template.
- The assumed spacing between the six groins proposed for Reach 8 varies between 300-400 ft. and groin lengths variable between 80 and 150 ft.
- The Reach 8 project assumes the beachfill will taper to the existing (1997) profile grade at the Reach north and south boundaries in the event that Reach 8 restoration does not occur concurrently with either the Reach 7 or Reach 9 restoration projects.
- Volumes assume a suitable sand source with an overfill factor of unity to 1.20, a dual-sloped construction template, and a unit cost of sand (in-place) of \$6.50/cy. Mobilization costs are considered additional to the unit costs.

**TABLE 7-7
ESTIMATED QUANTITIES AND CONSTRUCTION COSTS FOR PROPOSED GROIN FIELDS**

REACH	Groin Number	Armor Stone, Tons (Trunk)	Armor Stone, Tons (Transition)	Armor Stone, Tons (Head)	Total Armor Stone, Tons	Chinking Stone, Tons	Estimated Total Rock Costs (\$)	Foundation Mattress, SF	Mattress Costs, In Place (\$)	TOTAL GROIN COSTS (In Place) (\$)
2	G2N-1	665	150	270	1085	120	\$116,900	4400	\$66,000	\$182,900
	G2N-2	870	150	250	1270	130	\$136,100	4400	\$66,000	\$202,100
	G2N-3	870	150	250	1270	130	\$136,100	4750	\$71,250	\$207,350
	G2N-4	950	150	250	1350	135	\$144,450	5800	\$87,000	\$231,450
	G2N-5	950	150	250	1350	135	\$144,450	5625	\$84,375	\$228,825
	G2N-6	870	150	250	1270	130	\$136,100	4575	\$68,625	\$204,725
	G2N-7	665	150	250	1065	120	\$114,900	4050	\$60,750	\$175,650
(@R-84)	G2S-1	710	150	250	1110	120	\$119,393	4575	\$68,625	\$188,018
	G2S-2	568	150	250	968	100	\$103,794	4050	\$60,750	\$164,544
	G2S-3	568	150	250	968	100	\$103,794	4050	\$60,750	\$164,544
	G2S-4	568	150	250	968	100	\$103,794	4050	\$60,750	\$164,544
	G2S-5	606	150	250	1006	105	\$107,931	4190	\$62,850	\$170,781
	G2S-6	666	150	250	1066	105	\$113,989	4609	\$69,135	\$183,124
	G2S-7	606	150	250	1006	105	\$107,931	4190	\$62,850	\$170,781
	G2S-8	606	150	250	1006	105	\$107,931	4190	\$62,850	\$170,781
	G2S-9	710	150	250	1110	120	\$119,393	4575	\$68,625	\$188,018
	G2S-10	710	150	250	1110	120	\$119,393	4575	\$68,625	\$188,018
	G2S-11	710	150	250	1110	120	\$119,393	4575	\$68,625	\$188,018
	G2S-12	776	150	250	1176	125	\$126,369	4820	\$72,300	\$203,489
	G2S-13	947	150	250	1347	140	\$144,457	5450	\$81,750	\$226,207
	G2S-14	710	150	250	1110	120	\$119,393	4575	\$68,625	\$188,018
	G2S-15	568	150	250	968	100	\$103,794	4050	\$60,750	\$164,544
REACH 2 TOTALS		15,868	3,300	5,520	24,688	2,585	\$2,649,748	100,124	\$1,501,860	\$4,151,608
5	G5-1	1415	150	270	1835	165	\$195,063	7475	\$112,125	\$307,188
	G5-2	1136	150	250	1536	155	\$164,439	6900	\$103,500	\$267,939
	G5-3	950	150	250	1350	135	\$144,450	5800	\$87,000	\$231,450
	G5-4	950	150	250	1350	135	\$144,450	5625	84375	\$228,825
REACH 5 TOTALS		4,451	600	1,020	6,071	590	\$648,401	25,800	\$387,000	\$1,035,401

TABLE 7-7 (continued)
ESTIMATED QUANTITIES AND CONSTRUCTION COSTS FOR PROPOSED GROIN FIELDS

REACH	Groin Number	Armor Stone, Tons (Trunk)	Armor Stone, Tons (Transition)	Armor Stone, Tons (Head)	Total Armor Stone, Tons	Chinking Stone, Tons	Estimated Total Rock Costs (\$)	Foundation Mattress, SF	Mattress Costs, In Place (\$)	TOTAL GROIN COSTS (In Place) (\$)
7	G7-1	994	150	422	1566	160	\$167,830	6375	\$95,625	\$263,455
	G7-2	994	150	250	1394	140	\$149,190	5625	\$84,375	\$233,565
	G7-3	994	150	250	1394	140	\$149,190	5625	\$84,375	\$233,565
	G7-4	776	150	250	1176	120	\$126,019	4820	\$72,300	\$198,319
	G7-5	776	150	250	1176	120	\$126,019	4820	\$72,300	\$198,319
	G7-6	710	150	250	1110	110	\$118,693	4575	\$68,625	\$187,318
	G7-7	666	150	250	1066	110	\$114,339	4190	\$62,850	\$177,189
REACH 7 TOTALS		5,910	1,050	1,922	8,883	900	\$951,280	36,030	\$540,450	\$1,491,730
8	G8-1	1136	150	250	1536	155	\$164,439	6900	\$103,500	\$267,939
	G8-2	947	150	250	1347	135	\$144,107	5450	\$81,750	\$225,857
	G8-3	1231	150	250	1631	165	\$174,604	6500	\$97,500	\$278,604
	G8-4	994	150	250	1394	140	\$149,190	5625	\$84,375	\$233,565
	G8-5	757	150	250	1157	120	\$124,126	4750	\$71,250	\$195,376
	G8-6	615	150	250	1015	105	\$108,877	4225	\$63,375	\$172,252
REACH 8 TOTALS		5,679	900	1,500	8,079	820	\$865,343	33,450	\$501,750	\$1,367,093
TOTAL GROIN CONSTRUCTION COSTS - REACHES 2, 5, 7 AND 8										\$8,045,832

NOTE: All quantities and costs shown are estimates only and subject to refinement pending final design and permitting.

**TABLE 7-8
30-YEAR COST PROJECTIONS FOR RECOMMENDED SHORELINE
MANAGEMENT SOLUTIONS BY REACH**

Reach 2					
Nourishment Volume =	44.6	cy/ft			
15-Year Storm Loss =	17	cy/ft			
Annual Erosion =	6.7	cy/ft			
Total Loss =	37.1	cy/ft			
Unit Cost =	\$6.50	per cy			
Renourishment Interval =	3	years			
Reach Length =	13,660	feet			
	Cost	Year (n)	Rate (i)	Present Value	Annual Cost Over 30 Years
BEACHFILL					
Initial Beachfill					
Construction	\$3,957,590	3	5%	\$3,418,715	\$222,392
Design and Permitting	\$395,759	2	5%	\$358,965	\$23,351
First Renourishment					
Construction	\$1,784,679	6	5%	\$1,331,755	\$86,633
Design and Permitting	\$178,468	5	5%	\$139,834	\$9,096
Second Renourishment					
Construction	\$1,784,679	9	5%	\$1,150,420	\$74,836
Design and Permitting	\$178,468	8	5%	\$120,794	\$7,858
Third Renourishment					
Construction	\$1,784,679	12	5%	\$993,776	\$64,647
Design and Permitting	\$178,468	11	5%	\$104,346	\$6,788
Fourth Renourishment					
Construction	\$1,784,679	15	5%	\$858,461	\$55,844
Design and Permitting	\$178,468	14	5%	\$90,138	\$5,864
Fifth Renourishment					
Construction	\$1,784,679	18	5%	\$741,571	\$48,240
Design and Permitting	\$178,468	17	5%	\$77,865	\$5,065
Sixth Renourishment					
Construction	\$1,784,679	21	5%	\$640,597	\$41,672
Design and Permitting	\$178,468	20	5%	\$67,263	\$4,376
Seventh Renourishment					
Construction	\$1,784,679	24	5%	\$553,372	\$35,998
Design and Permitting	\$178,468	23	5%	\$58,104	\$3,780
Eighth Renourishment					
Construction	\$1,784,679	27	5%	\$478,023	\$31,096
Design and Permitting	\$178,468	26	5%	\$50,192	\$3,265
Ninth Renourishment					
Construction	\$1,784,679	30	5%	\$412,934	\$26,862
Design and Permitting	\$178,468	29	5%	\$43,358	\$2,821
Subtotal Sand Cost	\$22,021,671			\$11,690,485	\$760,483
GROINS					
Construction	\$4,151,608	3	5%	\$3,586,315	\$233,295
Design and Permitting	\$415,161	2	5%	\$376,563	\$24,496
Subtotal Groin Cost	\$4,566,769			\$3,962,878	\$257,791
Total Reach Cost	\$26,588,440			\$15,653,363	\$1,018,274
Initial Reach Cost	\$8,920,118				
Initial Reach Cost (Present)				\$7,740,558	

TABLE 7-8 (continued)
30-YEAR COST PROJECTIONS FOR RECOMMENDED SHORELINE
MANAGEMENT SOLUTIONS BY REACH

Reach 3 and 4

Nourishment Volume =	78.1	cy/ft
Storm Loss =	17	cy/ft
Annual Erosion =	4.6	cy/ft
Total Loss =	53.6	cy/ft
Unit Cost =	\$6.50	per cy
Renourishment Interval =	8	years
Reach Length =	12,704	feet

	Cost	Year (n)	Rate (i)	Present Value	Annual Cost Over 30 Years
BEACHFILL					
Initial Beachfill					
Construction	\$6,435,373	3	5%	\$5,559,117	\$361,629
Design and Permitting	\$643,537	2	5%	\$583,707	\$37,971
First Renourishment					
Construction	\$3,020,077	11	5%	\$1,765,776	\$114,866
Design and Permitting	\$302,008	10	5%	\$185,407	\$12,061
Second Renourishment					
Construction	\$3,020,077	19	5%	\$1,195,147	\$77,746
Design and Permitting	\$302,008	18	5%	\$125,490	\$8,163
Third Renourishment					
Construction	\$3,020,077	27	5%	\$808,923	\$52,622
Design and Permitting	\$302,008	26	5%	\$84,937	\$5,525
Subtotal Sand Cost	\$17,045,164			\$10,308,504	\$670,583
Total Reach Cost	\$17,045,164			\$10,308,504	\$670,583
Initial Reach Cost	\$7,078,910				
Initial Reach Cost (Present)				\$6,142,824	

**TABLE 7-8 (continued)
30-YEAR COST PROJECTIONS FOR RECOMMENDED SHORELINE
MANAGEMENT SOLUTIONS BY REACH**

Reach 5

Nourishment Volume =	65.6	cy/ft
Storm Loss =	17	cy/ft
Annual Erosion =	2.5	cy/ft
Total Loss =	37.0	cy/ft
Unit Cost =	\$6.50	per cy
Renourishment Interval =	8	years
Reach Length =	9,415	feet

	Cost	Year (n)	Rate (i)	Present Value	Annual Cost Over 30 Years
BEACHFILL					
Initial Beachfill					
Construction	\$4,014,066	8.5	5%	\$2,651,401	\$172,477
Design and Permitting	\$401,407	7	5%	\$285,272	\$18,557
First Renourishment					
Construction	\$1,223,950	16.5	5%	\$547,193	\$35,596
Design and Permitting	\$122,395	15	5%	\$58,874	\$3,830
Second Renourishment					
Construction	\$1,223,950	24.5	5%	\$370,362	\$24,093
Design and Permitting	\$122,395	23	5%	\$39,848	\$2,592
Third Renourishment					
Construction	\$0	32.5	5%	\$0	\$0
Design and Permitting	\$0	31	5%	\$0	\$0
Subtotal Sand Cost	\$7,108,163			\$3,952,950	\$257,145
GROINS					
Construction	\$1,035,401	8.5	5%	\$683,911	\$44,489
Design and Permitting	\$103,540	7	5%	\$73,584	\$4,787
Subtotal Groin Cost	\$1,138,941			\$757,495	\$49,276
Total Reach Cost	\$8,247,104			\$4,710,445	\$306,421
Initial Reach Cost	\$5,554,414				
Initial Reach Cost (Present)				\$3,694,168	

**TABLE 7-8 (continued)
30-YEAR COST PROJECTIONS FOR RECOMMENDED SHORELINE
MANAGEMENT SOLUTIONS BY REACH**

Reach 7					
Nourishment Volume =	112.8	cy/ft			
Storm Loss =	17	cy/ft			
Annual Erosion =	8.6	cy/ft			
Total Loss =	85.8	cy/ft			
Unit Cost =	\$6.50	per cy			
Renourishment Interval =	8	years			
Reach Length =	10,315	feet			
	Cost	Year (n)	Rate (i)	Present Value	Annual Cost Over 30 Years
BEACHFILL					
Initial Beachfill					
Construction	\$7,558,698	2	5%	\$6,855,962	\$445,990
Design and Permitting	\$755,870	0.5	5%	\$737,653	\$47,985
First Renourishment					
Construction	\$4,612,868	10	5%	\$2,831,901	\$184,219
Design and Permitting	\$461,287	9.5	5%	\$290,183	\$18,877
Second Renourishment					
Construction	\$4,612,868	18	5%	\$1,916,742	\$124,687
Design and Permitting	\$461,287	17.5	5%	\$196,408	\$12,777
Third Renourishment					
Construction	\$4,612,868	26	5%	\$1,297,326	\$84,393
Design and Permitting	\$461,287	25.5	5%	\$132,936	\$8,648
Subtotal Sand Cost	\$23,537,032			\$14,259,112	\$927,576
GROINS					
Construction	\$1,491,730	2	5%	\$1,353,043	\$88,017
Design and Permitting	\$149,173	0.5	5%	\$145,578	\$9,470
Subtotal Groin Cost	\$1,640,903			\$1,498,621	\$97,487
Total Reach Cost	\$25,177,935			\$15,757,733	\$1,025,063
Initial Reach Cost	\$9,955,471				
Initial Reach Cost (Present)				\$9,092,236	

TABLE 7-8 (continued)
30-YEAR COST PROJECTIONS FOR RECOMMENDED SHORELINE
MANAGEMENT SOLUTIONS BY REACH

Reach 8					
Nourishment Volume =	90.0	cy/ft			
Storm Loss =	17	cy/ft			
Annual Erosion =	6.2	cy/ft			
Total Loss =	66.6	cy/ft			
Unit Cost =	\$6.50	per cy			
Renourishment Interval =	8	years			
Reach Length =	10,690	feet			
	Cost	Year (n)	Rate (i)	Present Value	Annual Cost Over 30 Years
BEACHFILL					
Initial Beachfill Construction	\$6,271,374	4.5	5%	\$5,035,132	\$327,543
Design and Permitting	\$627,137	3	5%	\$541,745	\$35,241
First Renourishment Construction	\$3,446,456	12.5	5%	\$1,872,865	\$121,833
Design and Permitting	\$344,646	11	5%	\$201,507	\$13,108
Second Renourishment Construction	\$3,446,456	20.5	5%	\$1,267,629	\$82,461
Design and Permitting	\$344,646	19	5%	\$136,388	\$8,872
Third Renourishment Construction	\$3,446,456	28.5	5%	\$857,981	\$55,813
Design and Permitting	\$344,646	27	5%	\$92,313	\$6,005
Subtotal Sand Cost	\$18,271,816			\$10,005,560	\$650,876
GROINS					
Construction	\$1,367,093	4.5	5%	\$1,097,605	\$71,401
Design and Permitting	\$136,709	3	5%	\$118,095	\$7,682
Subtotal Groin Cost	\$1,503,802			\$1,215,700	\$79,083
Total Reach Cost	\$19,775,619			\$11,221,260	\$729,959
Initial Reach Cost	\$8,402,314				
Initial Reach Cost (Present)				\$6,792,577	

TABLE 7-8 (continued)
30-YEAR COST PROJECTIONS FOR RECOMMENDED SHORELINE
MANAGEMENT SOLUTIONS BY REACH

Reach 9 and 10

Nourishment Volume =	50.4	cy/ft
Storm Loss =	17	cy/ft
Annual Erosion =	3.8	cy/ft
Total Loss =	47.3	cy/ft
Unit Cost =	\$6.50	per cy
Renourishment Interval =	8	years
Reach Length =	14,250	feet

	Cost	Year (n)	Rate (i)	Present Value	Annual Cost Over 30 Years
BEACHFILL					
Initial Beachfill					
Construction	\$4,667,065	6.5	5%	\$3,398,704	\$221,091
Design and Permitting	\$466,707	5	5%	\$365,677	\$23,788
First Renourishment					
Construction	\$2,801,994	14.5	5%	\$1,381,091	\$89,842
Design and Permitting	\$280,199	13	5%	\$148,596	\$9,666
Second Renourishment					
Construction	\$2,801,994	22.5	5%	\$934,777	\$60,809
Design and Permitting	\$280,199	21	5%	\$100,575	\$6,543
Third Renourishment					
Construction	\$0	30.5	5%	\$0	\$0
Design and Permitting	\$0	29	5%	\$0	\$0
Subtotal Sand Cost	\$11,298,158			\$6,329,421	\$411,738
Total Reach Cost	\$11,298,158			\$6,329,421	\$411,738
Initial Reach Cost	\$5,133,772				
Initial Reach Cost (Present)				\$3,764,381	
Total Project Cost	\$108,132,420			\$63,980,726	\$4,162,038
Initial Project Cost	\$45,044,998				
Initial Project Cost (Present)				\$37,226,746	

SECTION 8

8.0 REGULATORY REQUIREMENTS AND CONSTRAINTS

Prior to restoring the shoreline segments (reaches) of Palm Beach Island as indicated in Section 7, each segment must be properly designed and submitted for regulatory agency approval by the USACOE, Jacksonville District and the Florida Department of Environmental Protection. Of primary concern to the agencies are the primary (as a direct result of the physical construction of the project) and secondary (e.g., as a result of post-construction adjustment of a beachfill project) impacts of a proposed project to the adjacent shorelines and to the surrounding environmental resources.

8.1 FEDERAL AGENCY PERMIT AUTHORIZATIONS

The South Permits Branch of the Regulatory Division, USACOE, Jacksonville District regulates all activities in navigable waters of the United States and has authority to review applications pursuant to Section 10 of the Rivers and Harbors Act of 1899 (33 United States Code, Section 403) and Section 404 of the Clean Water Act (33 United States Code Section 1344). Of primary concern to the Corps are discharges of dredged material into navigable waters and the assurance that waterway navigability and water quality are not violated. They also evaluate environmental resource impacts, historic resources, and the proposed project benefits to public health, safety and welfare.

An additional concern to Federal agencies are the effects of shoreline restoration and preservation of sea turtle nesting. The following species of sea turtles are protected by the government and have been documented to nest on Palm Beach Island:

- loggerhead sea turtle (*Caretta caretta*);
- green sea turtle (*Chelonia mydas*);
- leatherback sea turtle (*Dermochelys coriacea*); and,
- hawksbill sea turtle (*Eretmochelys imbricata*).

If the USACOE makes a determination that the above listed species may be affected by the proposed activities associated with shoreline restoration, the agency must request formal consultation with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service as defined under Section 7 of the Endangered Species Act. For dredging projects in the vicinity of the Lake Worth and South Lake Worth Inlets, the West Indian Manatee (*Trichechus manatus latirostris*) may also require protection through the implementation of an approved

Manatee Awareness/Protection Plan. In addition to direct dredge-related impacts to these species, sand compatibility with sea turtle nesting beaches, and sediment as it pertains to maintenance of water quality and sand placement, all require attention during construction as well as subsequent monitoring. Such specific provisions are typically established on a project-by-project basis.

Evaluation of project impacts to the public interest are reviewed under the authority of Section 404(b) of the Clean Water Act or by the criteria established under authority of Section 102(a) of the Marine Protection, Research and Sanctuaries Act of 1972. With regard to all of the above, the USACOE issues a Public Notice describing the proposed activities and solicits written comments typically within a 30 day timeframe.

8.2 STATE OF FLORIDA PERMIT AUTHORIZATIONS

The Florida Department of Environmental Protection Department regulates activities below the Mean High Water shoreline as waters of the state and additionally restricts all activities proposed to be conducted seaward of the Coastal Construction Control Line (CCCL). Construction in the nearshore areas can be regulated pursuant to Section 161.041 of the Florida Statutes and Rules 62B-33 and 62B-41, Florida Administrative Code. Public noticing of proposed Departmental action on a project must be conducted pursuant to Chapter 120, Florida Statutes. A water quality certification must be obtained from the Department ensuring that state water quality standards are not violated during dredge and fill activities in, on or over waters of the state. The Department's jurisdictional authority over proposed projects is provided under Chapters 373 and 403, Florida Statutes, Title 62, Florida Administrative Code, and Public Law 92-500.

The Department focuses attention on assurances from applicants that the proper protection is afforded to nesting sea turtles, preservation of water quality, avoidance, minimization or mitigation to anticipated impacts to hardbottom communities in the nearshore zone of the Atlantic Ocean shoreline, and establishment and maintenance of the integrity of the beach/dune system for all proposed shoreline improvements.

A meeting was conducted with representatives of the Florida Department of Environmental Protection on 20 August, 1997, during which the preliminary Plan recommendations and concepts were presented to prompt Department comments and suggestions on the proposed

Plan. Meeting attendees were furnished a draft copy of the Summary Report and provided editorial corrections to ATM. The attached pages represent the results of the meeting.

MEETING SUMMARY REPORT
FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF BEACHES AND COASTAL SYSTEMS

August 20, 1997

Meeting Attendees:

FDEP Bureau of Beaches and Coastal Systems

Robert M. Brantly, Jr., P.E./Professional Engineer

Philip G. Flood, Jr./Environmental Specialist III

Robert Lutz/Environmental Specialist II

Applied Technology and Management, Inc.

Michael R. Barnett, P.E./Senior Coastal Engineer

Purpose of Meeting:

To review significant findings regarding shoreline change trends on Palm Beach Island, identification of distinct shoreline reaches, and review of agency submittal and regulatory review requirements for permitting of solutions to shoreline erosion problem areas on the Island.

Meeting Summary:

Mike Barnett presented Messrs. Brantly, Flood and Lutz with a summary graphic representing the volumetric changes, which were computed on Palm Beach Island from 1990 to 1997. The FDEP 1990 beach profile database was utilized and compared to beach profiles obtained by the Town of Palm Beach in April and May, 1997. As evidenced by the 1990 to 1997 volume changes, the Island was noted to be net erosional in all except Reach 4 (the Mid-Town Beach Restoration Project area, by virtue of the placement of 880,000 cubic yards of beachfill and the construction of 11 variable-length modular groins in late 1995/early 1996) and immediately adjacent to Lake Worth and South Lake Worth (Boynton) Inlets.

Erosional stress was further reviewed to demonstrate the relative magnitude of the problem in the vicinity of Reaches 6 and 7 (FDOT revetment to Monument T-125) and to discuss the established priority for shoreline restoration. A review of a plan showing the extent of

nearshore hardbottom resources was conducted to discuss for 'permissibility' of using beachfill alone and beachfill in conjunction with stabilizing structures (groins).

Shoreline restoration permitting discussion centered primarily on construction impacts associated with sand placement in the vicinity of existing nearshore hardbottom resources. The Department reviews hardbottom resource condition, extent and anticipated project impact on a case-by-case basis. Mr. Brantly indicated the Department is hoping to develop a Policy Memorandum regarding such review and impact evaluation in the future, but such a guidance document does not presently exist.

Project shoreline restoration was discussed according to Reach designations and progressed from north to south. Reach 1 (Lake Worth Inlet south jetty to R-78) was identified as needing the STP discharge extended south of an area of wave focusing. This focus point is located approximately 2,000 feet south of the inlet. There is also a need to place Palm Beach Harbor/Lake Worth Inlet maintenance dredge spoil south of Reach 1 to help restore sand movement along the Island. Mr. Flood concurred that these objectives were largely consistent with the Lake Worth Inlet Management Plan and that the Department was currently finalizing a contract with the Town of Palm Beach to validate the sediment budget at the Lake Worth Inlet and to determine the extent of the inlet's impacts to the Palm Beach Island shoreline.

Reach 2, which extends 13,660 feet south of Onondaga Avenue, was investigated by completing shore-normal diver transects from Lake Worth Inlet south to R-83 as a component of the Lake Worth Inlet Management Plan (ATM, April 1995). (Note: Although not specifically discussed at the meeting, the hardbottom assessment was conducted in July 1994, in which longitudinal transects were conducted in the intertidal zone, at the -5 to -9 ft NGVD contour, and at the seaward edge of the reef feature [between -10 and -15 ft NGVD]. Hardbottom relief and biodiversity were highly variable, with vertical relief of the rock substrate generally between 0 inches [flush with the sand bottom] and 18 inches).

Computations performed by ATM indicate a construction toe of fill planform "impact" of 17.6 acres, the proposed beachfill template averages approximately 48 cubic yards per foot and two distinct groin fields are proposed to reduce the cross-shore movement of the beachfill. Mr. Brantly and Mr. Lutz responded that while the quality of the hardbottom resources in the nearshore of this shoreline reach may not be as 'high' as those found further south (i.e., in the vicinity of the Breakers and offshore of Mid-Town), the extent of the impact -- approximately 10

acres/mile of restored shoreline -- is considered to be extreme. Even bare rock with 6 to 12 inches of vertical relief is considered by the Department to constitute "structural habitat" and carries an associated value used to determine mitigation ratios. For example, in the Department's review of the Ocean Ridge Shore Protection Project, a 0.5:1 mitigation ratio was established for such nearshore structure.

Mr. Brantly indicated that the Department would likely have concerns over the use of structures proposed for Reach 2 (approximately 22 groins in two distinct 'fields' between R-80 to R-82 and R-84 to R-88), and would likely resist approving such proposed measures. In the past, the Department has approved the construction of groins at the boundaries of littoral cells. As this shoreline Reach was not deemed by Mr. Brantly to constitute such a boundary, the Department would require the applicant to demonstrate that the structures are needed to moderate an extremely high longshore transport potential when compared to the adjacent shorelines. The use of modeling techniques, such as GENESIS (Generalized Model for Simulating Shoreline Change) would be required to provide the Department with such assurances (USACOE, December 1989).

Mr. Brantly further stated that Departmental reviews of all applications the reconstruction of any existing groins would require proof that the structure is partially functional and that the proposed reconstruction would not necessarily stabilize a shoreline with a high differential transport potential, but would more uniformly distribute the transport to the downdrift (adjacent) shoreline. For the proposed beach restoration projects, existing groins will be assessed, reviewing their current condition and ability to function as a groin. All groins deemed by the Department to be derelict must be targeted for removal as a condition of the project area restoration. Structures demonstrated to be non-derelict may remain in place, but additional justification will be required to repair or reconstruct them.

Mr. Brantly suggested that the plan for Reach 2 restoration should seek only to maintain a minimal shoreline, and instead serve as a potential maintenance dredge spoil placement area for the USACOE as the "advance maintenance" component of the beachfill. The proximity of Reach 2 to the inlet would appear to make maintenance dredge sand placement viable from the USACOE "least cost to the federal government" perspective. Since the quality of the sand taken from the last several Harbor/Inlet maintenance events has been high, placement along this shore segment would appear to be logical and serve to feed the downdrift shoreline.

The Department voiced no objection over sand placement only in Reaches 3, 4 and 5 (with the exception of maintaining or modifying the Mid-Town groin field, subject to further environmental assessment). Reach 6 recommendations indicated by Mr. Barnett are principally to maintain the stability and function of the existing FDOT rock revetment and to allow Reach 5 sand spreading to "feed" the Reach 6 shoreline. The Reach 6 has considerable hardbottom resources. The presence of a noticeable nearshore profile "depression" between the -5 ft and -15 ft NGVD contour will require high initial beachfill quantities to restore the shoreline position. This potentially will result in potential nearshore hardbottom impacts. Mr. Brantly responded that the Department would require that the applicant conduct a beachfill spreading analysis into Reach 6 resulting from sand placement in both Reaches 5 and 7 (immediately north and south of the FDOT revetment).

Mr. Brantly indicated that minimizing hardbottom impacts along the open coast shoreline with the combined beachfill/groin field solution for Reach 7 and 8 did not appear to be the proper use of such structures, since this shoreline segment does not appear to be at a littoral cell boundary. The Department's approach to hardbottom resources in the nearshore area for any project is to first avoid, then minimize impacts to, and finally mitigate for any unavoidable and justified impacts.

Sand sources were the next topic of discussion. The primary concerns of the Department are:

- the distance of the borrow area(s) from the shoreline;
- the presence of any transverse (cross-shore) hardbottom between the borrow and fill areas;
- the relative quality of the sediment.

The borrow areas previously investigated offshore of Palm Beach Island were briefly reviewed. Mr. Brantly indicated that the landward edge of a borrow area should be beyond the depth of closure. Turbidity impacts have been demonstrated to be more adverse when considering hardbottom resources, which have a distinct transverse alignment relative to the shoreline. Buffer setbacks between the borrow area boundary and such resources must be provided.

Performance characteristics (sand quality) of the beachfill are typically the responsibility of the applicant. The U.S. Fish and Wildlife Service will typically limit the quality of the borrow material by stipulating that it contain not more than 10% fine-grained sediment (i.e., that which

will pass a #200 sieve). The Bureau of Beaches and Coastal Systems will similarly restrict the use of material, which exceeds such a percentage of fine-grained material to avoid water quality degradation during dredging, transportation, and placement of the sediment to the project shoreline.

SECTION 9

9.0 ESTIMATED BENEFITS FOR RECOMMENDED BEACH RESTORATION PROJECTS

The rapid growth in the residential population of Florida over the last two decades along with the continued long-term growth and urbanization of the coastal zone in the State has greatly increased the demand for Florida's sandy beaches. This increased demand for homes on these barrier islands and beach related activities places continuous pressures on Palm Beach Island.

Although Florida has a shoreline of approximately 1,350 miles, only 275 miles are salt-water beaches. Palm Beach Island, located within Palm Beach County, is a barrier island approximately fifteen miles long and one mile wide at its widest part. The northern twelve miles of Palm Beach Island are located in the Town of Palm Beach while the southern three miles are located in Lantana, South Palm Beach and Manalapan. Palm Beach Island is divided by the north/south road, Ocean Boulevard which is also State Road A1A. In general, land east of Ocean Boulevard faces the Atlantic Ocean and is typically referred to as the "Oceanfront" side of the island. Land west of Ocean Boulevard faces Lake Worth and is typically referred to as the "Lake" side of the island.

It is obvious from its geographical location that the Town of Palm Beach is located adjacent to a rapidly growing large urban population. Because of this, the fixed supply of beachfront available for public use is becoming increasingly taxed. As is the case with most growth situations, the residents of Palm Beach Island have both gained and lost from the decrease in beaches. The most obvious loss suffered by the residents and tourists alike is the limited availability of quality beaches, traffic congestion, and rising shore protection costs. On the other hand, residents have experienced a very positive effect in that the value of their properties have increased at a rate much greater than the overall change in prices as measured by the Consumer Price Index. Palm Beach Island's major economic asset is the miles of Atlantic Oceanfront sand beaches. As long as these sandy beaches exist, property values are likely to continue to rise.

Therefore, it is in the interest of all residents of the Town of Palm Beach, South Palm Beach, and Manalapan to see that these sand beaches are preserved.

Florida's beaches are subject to chronic, long-term erosion from the forces of wind and water. Erosion destroys the quality of beachfront and reduces its carrying capacity. Prudent development decisions along remaining undeveloped beachfront can help in beach preservation, however, nearly all available property has been developed and valuable structures cannot realistically be moved landward to provide for new beachfront. As a result, over the past 30 years it has been necessary to artificially protect valuable structures by the construction of seawalls and sloped rock revetments. Given the extensive frontage of hardened structures and the high costs to oceanfront homeowners for maintaining these structures, it is usually economically preferable to restore the beaches using a beach management plan approach. Beach restoration has been employed in Florida and elsewhere for many years and the techniques used are now familiar. Beach restoration is the terminology used to describe large scale beach reconstruction projects by placing sand fill often in conjunction with sand retaining structures such as groins and breakwaters.

Beach Restoration raises two principal questions:

1. Are the benefits which include storm protection and enhanced recreational use of the newly created beaches worth the cost of nourishing the beach?
2. Who should pay for the beach nourishment project?

Resolution of these questions is difficult because both costs and benefits to some degree are unknown. The costs of a project over time cannot be predicted with 100 percent certainty since the erosion loss may be greater than or less than expected. But computerized models have enabled researchers to develop a high degree of sophistication and confidence in their erosion predictions. Another problem in estimating benefit/cost ratios is that recreational benefits, (as opposed to storm and erosion protection benefits), are difficult to calculate. A public beachfront is usually provided to users free of charge; thus, there is no direct market test or valuation of recreational benefits derived. Estimates of recreation benefits are sensitive to the number of resident users, and tourists, and the imputed value they place upon a day of beach usage.

The purpose of this analysis is to examine the overall economic viability of a beach nourishment project for Palm Beach Island and to determine the benefits attributed to those individual beneficiary groups who are expected to realize them over the design life of the 6

identified Projects. The first question dealing with the overall economic viability of the beach nourishment project is relatively easy to answer. The benefit/cost ratio calculated is 2.04 to 1. What this means is over the lifetime of the project, the community will derive \$2.04 of benefits for each dollar of costs. The computation of storm protection and land loss prevention benefits, recreational benefits and the question of who gains these benefits comprises the major portion of this section of the report.

9.1 BENEFIT CATEGORIES

As previously discussed, a beach nourishment project provides storm and erosion protection and recreational benefits. For the purpose of estimating project benefits, oceanfront properties were grouped into shoreline reaches. "Reaches" are characterized by similar erosion rates, recreational beach areas and types of upland development. These factors were used to divide the Island into eleven beach reaches (refer to Section 6, Table 6-5).

When looked at from an economic point of view, a nourishment project, over its lifetime, will generate a stream of benefits to the property owners. These benefits include property value increases which are greater than what they would have been if a beach restoration project had not been completed. Even properties not directly on the beach can benefit from the nourishment program because these properties will also become more valuable.

A benefit analysis of this type allows the allocation of benefits to the different groups of properties on Palm Beach Island. The following major benefit categories were used in this analysis:

1. A land use category of residential property as opposed to commercial property.
2. A location category. Oceanfront properties east of Ocean Boulevard and properties extending west of Ocean Boulevard.
3. A second location category which is concerned with the reach in which a property is located.
4. A distinction between private and public property (roads, water and sewage systems, and public buildings).

5. Consideration to whether or not a property is protected by an erosion control structure.
6. Consideration of the relative location of major habitable structures to the mean high water line.

Categories 1 through 6 are used in allocating storm protection benefits and are exclusively storm protection and erosion benefit allocators.

9.2 DATA COMPILATION AND BENEFITS METHODOLOGY

Project benefits associated with storm protection and erosion losses were generated for properties that front on the ocean. Benefits were calculated for properties within the immediate project area that will benefit from the placed sand and sand retaining structures (i.e., groins). To reduce the annual recreational value to net present value, a "corrected" interest rate was used. At the present time, the typical interest is 8 percent. If this 8 percent rate is used as the discount factor, it would leave out the impact of future inflation. Therefore, the inflation rate must be subtracted from the bonds interest rate. Though the inflation rate has fluctuated over time, the average rate of inflation for the past 10 years has been 3 percent.

The storm protection benefits derived from a beach nourishment project reflect the engineering design features of the projects. The initial beach restoration project was based on a one in 15-year storm return interval project horizon. Storm protection benefits to upland properties are based on the prevention of land loss; the prevention of damage to major habitable structures; and, the anticipated cost savings realized by not having to maintain or repair the existing seawalls fronting individual properties (both private and public). Benefits are a direct result of the presence of a wide, sand beach that acts as a buffer against both normal annual erosion and destructive storm waves resulting from hurricanes and nor'easters.

One can assume that oceanfront property owners will take whatever actions are in their own economic interest to protect their properties from landward erosion. These actions by the oceanfront property owners will also provide protection to the more landward property owners in the absence of a beach restoration project. Therefore, no direct storm protection benefits are ascribed to non-oceanfront properties. If a portion of a property is located on the ocean, then a storm protection benefit is ascribed.

Historic erosion and beach profile survey data were used to evaluate erosion rates and present structure vulnerability within the project area (refer to Sections 3 and 4). Structure vulnerability of oceanfront "developed" parcels is considered a function of length of the seawall or revetment, mean high water line, mean annual erosion rates, and anticipated shoreline recession for a particular design storm. The average annual erosion rates over the past 7 years were computed along the project reaches. Erosion rates have been estimated based on the period of 1990 to 1997, at approximately 1000 foot intervals and are shown in Table 9-1.

9.3 STORM PROTECTION BENEFITS

The storm protection benefit received by an individual property include the expected reduction in land loss due to erosion, the cost of the land protected and the cost to build an erosion control structure for storm protection or the costs of maintaining or repairing an existing erosion control structure in the absence of the Project. In the case of oceanfront homes, and properties with upland improvements such as pools and cabanas, not presently protected by a hardened structure (such as a seawall or revetment), the distance from the mean high water line to the most seaward structure was compared with the projected erosion rates over 15 and 30 years and the storm recession distance for 15 and 30 year return period storm events.

The expected loss consists of the discounted stream of future losses over a 15-year period (or, alternatively, a 30-year period). The extent of loss varies by reach of shoreline according to the erosion rates. Losses also consider land values, beach widths and distances between buildings and the mean high water line location. As stated previously, in order to account for the future cost of storm protection, a 3 percent inflation factor is used and an 8 percent interest rate is used as the discount factor to reduce costs back to net present worth. In effect, the real discount rate is, therefore, 5 percent. For armored properties the costs for annual maintenance and repair of structural damage to the seawall during a 15-year and 30-year return period storm event is included in the computation of project benefits.

TABLE 9-1: SUMMARY OF STORM PROTECTION BENEFITS TO OCEANFRONT PROPERTIES BY REACH DESIGNATION ALONG PALM BEACH ISLAND

Reach	15 year Project Design Life										30 year Project Design Life			
	Reach Length (ft)	Beachfill Project Length (ft)	Total Oceanfront Property Value (1996 value)	Land Loss Benefit (Present \$)	Seawall Repair Maintenance/ New/Benefits ECS (Present \$)	Total Storm Protection Benefit (Present \$)	Total Storm Protection Benefit (Annual \$)	Land Loss Benefit (Present \$)	Seawall Repair Maintenance/ New/Benefits ECS (Present \$)	Total Storm Protection Benefit (Present \$)	Total Storm Protection Benefit (Annual \$)			
1	2,290	N/A	\$44,914,743	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0			
2	13,544	13,544	\$268,854,443	\$703,503	\$3,569,426	\$4,272,929	\$411,483	\$963,938	\$8,990,851	\$9,954,789	\$648,057			
3	6,008	4,200	\$399,533,146	\$5,136,423	\$2,870,936	\$8,007,359	\$771,109	\$2,457,539	\$4,631,517	\$7,089,056	\$461,498			
4	9,750	9,750	\$113,210,266 *	\$0	\$2,688,382	\$2,688,382	\$258,891	\$0	\$6,696,316	\$6,696,316	\$435,930			
5	7,180	7,180	\$181,032,349	\$711,639	\$1,308,701	\$2,020,340	\$194,559	\$1,053,949	\$3,259,758	\$4,313,707	\$280,822			
6	5,785	N/A	\$125,290,876	\$0	\$1,653,251	\$1,653,251	\$159,208	\$0	\$4,117,976	\$4,117,976	\$268,080			
7	9,100	9,100	\$322,594,527	\$17,586,547	\$2,382,868	\$19,969,415	\$1,923,055	\$17,268,479	\$4,684,851	\$21,953,330	\$1,429,162			
8	10,715	10,715	\$427,294,601	\$9,080,895	\$2,730,988	\$11,811,883	\$1,137,484	\$8,672,204	\$5,689,488	\$14,361,692	\$934,946			
9	3,324	3,324	\$132,045,841	\$750,452	\$579,673	\$1,330,125	\$128,091	\$884,784	\$2,123,870	\$3,008,654	\$195,863			
10	8,661	8,661	\$182,960,966	\$109,610	\$2,517,112	\$2,626,722	\$252,953	\$145,713	\$6,419,711	\$6,565,424	\$427,409			
11	5,645	N/A	\$65,025,669	\$874,588	\$115,343	\$989,931	\$95,330	\$1,096,817	\$737,301	\$1,834,118	\$119,401			
TOTALS	82,002	66,474	\$2,262,757,427	\$34,953,657	\$20,416,680	\$55,370,337	\$5,332,163	\$32,543,423	\$47,351,639	\$79,895,062	\$5,201,169			

Note: (*) Value of roadway and utilities not included

An estimate of land values for the purpose of calculating dollar value of land lost to erosion was based on front foot and square footage land values obtained from the Palm Beach County Property Assessor's office. The total appraised value of properties on Palm Beach Island (1996 values) is \$6.06 billion of which \$2.26 billion represents oceanfront property. The average value of one square foot of land varied between \$34 and \$87 along oceanfront properties on Palm Beach Island (refer to Appendix F, Table F-1). Construction costs for new seawalls or revetments were assumed to be \$1,000 per linear front foot. Maintenance costs for seawalls and revetments were estimated at \$17.70 per front foot per year.

The "without project" storm protection alternatives are whatever actions are in the oceanfront property owners economic interest to protect themselves from yearly landward erosion as allowed by existing local and state policies and regulations. Oceanfront properties fall into three categories including: residential, recreational / commercial and vacant. In addition, oceanfront properties are comprised of two subcategories: properties with an erosion control structure and properties without an erosion control structure.

It is assumed that the seawalled oceanfront properties will maintain or repair their existing erosion control structures in the absence of a project and sets their benefits equal to the maintenance cost savings over a projected 15-year and 30-year benefit period.

The "without project" benefit to unarmored (i.e., non-hardened) oceanfront properties is whatever actions are in the oceanfront property owners economic interest to protect themselves from yearly landward erosion and the occurrence of a 15-year and a 30-year storm event. If the major habitable structures on the property are in jeopardy of significant structural damage from yearly landward erosion or a 15-year storm event, it is assumed that the property owner will armor the shoreline (i.e., construct an erosion control structure) to prevent the loss of major upland structures. Given the policy of the State of Florida regarding the construction of seawalls and revetments, and the extensive shoreline armoring along the Island, it is assumed that permission for construction of an erosion control structure will be given in the case of properties in jeopardy of loss to a 15 year return period storm event. Thus, the dollar amount of an anticipated erosion control structure is included in the total dollar benefit to the property. Since it is assumed that the owner will be allowed to construct a seawall or revetment, the cost for construction and maintenance of this erosion control structure is added to the total benefit.

It was assumed that oceanfront property owners with vacant land will "do nothing" in the absence of a project and the benefits to these properties are set equal to the dollar savings in land loss prevention. Given the state policies on shoreline armoring, it is extremely doubtful that a Coastal Construction Control Line permit for shoreline armoring of vacant properties would be procured. In cases where the project benefits received by vacant properties without an erosion control structure exceeds the total land value, the benefits are set equal to the total property value. In effect this limits the expected erosion and storm losses if nothing is done and accounts for oceanfront properties that are characterized by high erosion rates and locations where future land development is not probable.

Properties that would not install an erosion control structure in the absence of the project include: vacant properties, where no building loss could be experienced, and the properties that are located sufficiently landward from the mean high water line.

9.4 TOTAL STORM PROTECTION BENEFITS

The storm protection benefits of the proposed beach restoration projects were calculated and reduced to net present value. Tables F-2 and F-3 present a summary of the storm protection benefits for beach restoration improvement projects along Palm Beach Island. On the basis of these calculations, the net present value of the storm protection benefit over a 15- and 30-year project horizon calculated for the proposed beach restoration projects along Palm Beach Island are estimated at \$55,370,340 and \$79,895,060 attributed solely to land loss prevention, new seawall construction, and cost savings for seawall maintenance. The annual storm protection value projected over 15 and 30 years is \$5,332,160 and \$5,201,169, respectively. Allocation of these project benefits by Reach for the proposed Beach Restoration Projects is summarized in Table 9-1.

9.5 RECREATIONAL BENEFITS

An improved beach is semi-public, with good access and recreational benefits distributed to all users at a zero or near zero price. Since no one pays, there is no measure test of the value users place on a visit to the beach and no direct means of deriving a demand curve. Means are available for estimating willingness to pay, via interviews of beach users, however this was beyond the scope of this study. However, many such beach valuation and user studies have been performed for the purpose of estimating recreational benefits of beach nourishment projects in recent years. Several of these surveys were performed by ATM and user willingness to pay was estimate relying upon previous findings.

Determination of Recreational Benefits

Unlike storm protection benefits, the recreational benefits flow to all properties within the community regardless of whether the properties are oceanfront or non-oceanfront. Recreation benefits can also be sub-divided between residents and guests, i.e. those persons who typically stay on-island 30 days or less on an annual basis.

Recreation benefits are comprised of the recreational value of the beach that is created by a specific beach restoration project. For planning purposes an estimate of the recreational value of the beach, using a willingness to pay value of \$12.00 per day, was applied to the Town of Palm Beach beach areas, including Reaches 1 through 8. An estimate of beach users' average valuation of a day at the beach was based on findings of recreational user surveys at Longboat Key, Captiva Island and Hutchinson Island, Florida. For this preliminary analysis, it is recommended that a value of \$12.00 per day be applied to Palm Beach Island.

To estimate the recreational value of the Town of Palm Beach properties, extending along Reaches 1 through 8, it is assumed that 5 percent of the Town's residents will use the beaches for recreational purposes. Utilizing 1997 census data provided by the Town it was assumed that 1,195 residents (5 percent of peak and average residents within The Town of Palm Beach on the Island) will use the beaches and that each resident will visit the beach two times each month (for a total of 24 visits annually), additionally it was assumed that off island (Palm Beach County) beach goes out number Island residents users by a 4 to 1 ratio. Therefore, the present value of recreational benefits attributed to beach goes over 15 years is estimated at \$21, 652,620. The present value of these recreational benefits over a period of 30 years is estimated at \$33,120,086.

The total tourist related recreational benefit associated with the public beach access areas, summarized in Table 9-2 in the following section, was estimated based on the total available parking spaces in Reaches 4 through 9. On an average annual basis, it was assumed that 10 percent of the total available parking spaces (1,374 spaces), are occupied by one car (with 2 occupants) for purposes of estimating beach usage. Again assuming a daily "willingness to pay" value of \$12.00 per beach user per day, the net present value, of these future flows of income over a project horizon of 15 years and 30 years, is \$11,339,920 and \$17,345,660. The net present value of recreation benefits of 30 years, including projected resident and tourist use, is thereby estimated at \$50,465,750 along reaches 1 through 8. The beach

restoration projects have a design life of 30 years. Therefore, over a 30-year period, the beach is expected to generate \$3,285,320 of recreational value each year.

9.6 PUBLIC BEACH ACCESS ON PALM BEACH ISLAND

The location, approximate shoreline frontage, and number of car parking spaces dedicated to each of the twenty public beach access sites on the Island is furnished in Table 9-2. As indicated, there is a total of 7,379 linear feet of shoreline on Palm Beach Island designated as public access, with a total of 1, 879 parking spaces currently available. The Florida Department of Environmental Protection determines project cost-sharing in part based on formula values of beach frontage which is deemed "publicly accessible." For example, a "Primary Beach Access Site" is defined by the state as having a minimum of 100 public parking spaces and restroom facilities on-site. Such a facility is assigned the actual frontage occupied by the parcel plus 2,640 feet of additional shoreline in each shore parallel direction. For example, Phipps Ocean Park would be deemed eligible for 6,480 feet of shoreline (1,200 feet of Park property + 2,640 feet north + 2,640 feet south). Parcels with less than 100 parking spaces per mile are determined on a prorated basis according to the mileage equivalent of the parcel being considered.

**TABLE 9-2:
PUBLIC BEACH ACCESSES ON
PALM BEACH ISLAND**

Access Name	Nearest DEP Monument	Shoreline Frontage, ft.	Number of Car Parking Spaces
Indian Road	R-76	15	0
Arabian Avenue	R-77	15	0
Caribbean Avenue	R-77	15	0
Mediterranean Avenue	R-77	15	0
Angler Avenue	R-79	25	0
Merrain Road	R-80	25	0
Kenlyn Road	R-80	25	0
Palmo Way	R-80	25	0
La Puerta Way	R-81	25	0
El Pueblo Way	R-81	25	0
Wells Road	R-91	40	0
Dunbar Road	R-91	25	0
Sunset Avenue	R-93	25	0
Clarke Avenue	R-96	664	0
Mid-Town Municipal Beach	R-97 to R-99	2435	161
Phipps Ocean Park	R-119	1200	288
R. G. Kreuzler Memorial Park	R-127	500	175
Lake Worth Municipal Beach	R-128 to R-129	1200	750
Lantana Municipal Beach	R-137	680	247
South Lake Worth Inlet Dist. Park	R-151	400	258
TOTALS		7,379	1,879

SECTION 10

10.0 COMPREHENSIVE MONITORING PROGRAM

Physical features and environmental resources along Palm Beach Island can be separated into the areas above and below MHW. In general, there has been some investigation of these resources; however, detailed data are not available for the entire Island length. The physical feature and environmental resource monitoring program described herein involves a two-tiered approach as follows:

1. Routine and periodic data collection to form the basis for future decision making and long range planning; and
2. Specific project monitoring criteria for evaluation of performance and adjacent reach effect.

Tier one monitoring efforts are general in nature and establish a regular interval program for island-wide data collection. This effort will provide a solid basis to evaluate short- and long-term shoreline and volumetric changes. Tier two work is tailored to particular projects and should be utilized for monitoring the proposed projects detailed elsewhere in this document.

10.1 PURPOSE AND OVERVIEW

The purpose of a comprehensive coastal monitoring plan is to guide data gathering intended to help develop an understanding of the coastal processes affecting a shoreline. An overall "picture" of the physical processes and conditions on Palm Beach Island is necessary. Obtaining this perspective is accomplished by implementing an island-wide monitoring program to establish a base condition and by measuring changes over time using a standardized approach. Collection efforts should include the following:

- Beach Profiles and Hydrographic Surveys
- Sand Sampling and Analysis
- Aerial Photography
- Coastal Structures and Dune Assessments
- Hardbottom Characterization and Monitoring
- Protected Species Monitoring

The first (and primary) tier of the monitoring plan is to document existing coastal conditions. Much of the data collected to-date has been sporadic, covering only portions of the shoreline directly related to specific projects. This historic data is a valuable resource and provides important information for discreet shoreline segments. To provide for comprehensive shorefront management, it is advisable to conduct monitoring on an island-wide basis. The collection and interpretation of such data guides decisions related to a project's effects and impacts on physical and biological resources. Implementation of this monitoring plan will provide an annually updated overall assessment of the condition of the island beaches and environmental resources (i.e., a "state of the beaches").

The second tier of the monitoring plan is to collect data specific to future projects, measuring the performance of beach nourishment and other coastal protection/preservation efforts. An example of tier two monitoring work is to verify the projected sediment budget for Lake Worth Inlet as proposed in the *Lake Worth Inlet Management Plan* (ATM, 1995). This verification was required by the FDEP as a condition of formal adoption of the Lake Worth Inlet Management Plan (LWIMP). Typically, tier two monitoring requirements are conditions of environmental resource permits.

10.2 TIER ONE: ISLAND WIDE BASELINE MONITORING

This portion of the monitoring program is intended to (1) provide a baseline assessment of the coastal physical features and environmental resources along Palm Beach Island, and (2) establish cyclical and standardized methods of analysis. This data collection and analysis benefit advanced preparation for future project planning and reduce data collection requirements to support project design endeavors (i.e., having quality baseline data in hand). Each element of the recommended program is addressed individually below.

Long-Term General Beach Profiles and Hydrographic Surveys

Beach profiles and hydrographic (offshore) surveys are the most important feature of the comprehensive monitoring plan because they (1) provide input data for long- and short-term volumetric and shoreline change analyses, and (2) assist in guidance and planning for future shoreline protection projects. They will also support the verification of the LWIMP Sediment Budget. The only available comprehensive profile data sets are FDEP data from 1990 and survey information collected for this study in 1997. A 1974 FDEP data set includes only long lines at every third DNR reference monument.

Beach and offshore profiles should be measured at all DNR reference monuments along Palm Beach Island's shoreline (R-76 to T-151). This profile spacing (typically, 1,000 feet) should provide adequate information for planning and preliminary engineering analysis. Profiles should extend along the specified FDEP azimuths, from the backbeach (west of the primary dune or to the seaward edge of a building or roadway) to the -30 feet NGVD contour. The surveys should extend over the active beach and nearshore area, beyond the nearshore reef feature. All surveys should use differential GPS or more accurate positioning and shall be consistent with FDEP and USACOE standards for hydrographic surveys. Vertical and horizontal control should be referenced to NGVD 1929 and the Florida State Plane Coordinate System (NAD 1927 or 1983), respectively, and survey line azimuths identified by magnetic bearing.

All survey data should be stored in digital format for future use. Additionally, all control information and field party notes should be archived for future reference. Survey data should also be made available to the FDEP Bureau of Beaches and Coastal Systems and the USACOE.

Beach and offshore profiles should be performed at 6-month intervals for the first and second years of the program to document seasonal changes to the shoreline. Annual surveys should be performed for subsequent years if the results of the initial monitoring prove this interval reduction to be viable. All surveys should be performed within the same time frame each year, with April and October being the target survey months to capture conditions following the winter and summer seasons. The Town should consider additional wading profiles following significant storm events to document storm-induced beach erosion/accretion. Profile dates and locations can be selected as required by Town Staff.

All survey events should be followed with a summary report, describing the volumetric and shoreline changes from the previous survey, and identifies any erosion "hot spots" requiring attention.

LWIMP Sediment Budget Profiles

Additional profile survey requirements are necessary for the verification of the LWIMP sediment budget. These surveys should comply with the requirements of Section 10.2.1, and shall be surveyed annually for the first 3 years with the following specifications:

- R-67 to R-75 shall be surveyed to 3,500 feet offshore (9 total profiles)
- R-76 to R-94 shall be surveyed to 5,000 feet offshore or to -30 feet NGVD whichever is greater (19 total profiles)
- Offshore surveys shall be conducted at 200 foot intervals from R-71 to R-80 inclusive, to document the extent of the inlet ebb tidal shoal
- Wading profiles shall be measured at the intermediate stations between R-76 and R-80 (approximately 200 foot spacing), established by FDEP in 1993
- Offshore profiles shall be conducted at intermediate stations R-80.5 and R-81.5

In addition to the field surveys, the Town should obtain all future USACOE maintenance dredging and disposal records for the Lake Worth Inlet navigation channel. Analysis of these records will provide estimates of the maintenance dredge quantities to help verify the sediment budget.

To assess sand transfer plant pumping quantities, an agreement with Palm Beach County should be proposed to monitor the production rate of the plant. This would ideally involve the installation and calibration of continuous monitoring equipment on the plant to record period of operation, flow rate, and percent solids content of the discharge slurry. As an alternative, reliance upon frequent wading depth surveys at the suction pit and discharge area(s) (over a predetermined interval) would have to be performed in addition to compiling the detailed operational logs completed by the bypassing plant operator. Although this field survey method could be devised, it would be difficult to obtain the desired accuracy of bypassing quantities. The STP operators are urged to pursue the direct measurement of discharge as the primary method of verifying bypassing plant production. Accurate representation of discharge quantities will directly affect the shoreline management initiatives for the Island's northern reaches.

Surficial Sand Samples

Surficial sand samples shall be collected and analyzed annually to document the native beach characteristics of the shoreline reaches of Palm Beach Island. Surface sand samples shall be collected concurrently with the beach profile surveys, along 22 profile transects for the baseline effort (including the Mid-Town sampling stations) at the following FDEP monuments:

Table 10-1 Proposed Surficial Sand Sampling Transects for Palm Beach Island	
Shoreline Reach	Sand Sample Transect Location(s)
1	R-77
2	R-81, R-85, R-89
3	R-92
4	R-96 through R-99, R-102
5	R-107
6	R-112, R-115
7	R-119, R-123
8	R-127, R-130
9	R-132, R-135
10	R-140, R-143
11	R-148

Sand samples obtained for the baseline event should be collected at elevations +6, +3, 0, -3, and -6 feet NGVD as a minimum. Additional samples can be collected at the -9, -12, -15 and -18 foot contours, particularly following a beach restoration/renourishment project. Samples to wading depth should be collected with a hand-held coring device, while a petite ponar sampler can be deployed from a boat for the offshore samples. A tide staff and survey

equipment are recommended to determine the actual depths (relative to NGVD) at which offshore samples are obtained. ASTM and USACOE procedures should be used to determine grain size distribution and estimate the percent shell and fines. Sieve analysis should employ the use of U. S. Standard sieve sizes 10, 20, 40, 60, 100, 140, 160, 200, and 230 (at a minimum), and be consistent for all samples and sampling events.

Following all data collection and analysis, a summary document containing the sample locations, grain size distributions, and sediment sample statistics (mean, standard deviation, percent shell, and percent fines) should be prepared.

After the third annual monitoring event, the Tier One sand-sampling program should be reevaluated. The acquired data will be available for planning future projects, and new projects will likely include detailed Tier Two monitoring. This may allow the Tier One sediment-sampling program to be modified or discontinued.

Aerial Photography

Vertical aerial photographs should be flown along the Island's shoreline at the time of each annual monitoring survey. The scale of the photographs shall be 1 inch equals 300 feet (or more detailed) and consistent between flights. The flight line shall begin 2,000 feet north of Lake Worth Inlet and proceed southward along Palm Beach Island, terminating approximately 1,000 feet south of Boynton Inlet.

Each photograph shall include the entire beach, nearshore environment (to identify nearshore outcrops/hardbottom), and sufficient upland features (i.e., beach-fronting buildings, roads, etc.) to determine the location of any photograph. The shoreline location in any image should be centered. Consecutive photographs shall have sufficient overlap (approximately 60 percent) to identify common points of interest and allow for digitization/mapping. Photographs shall be taken prior to 2:00 PM to avoid building shadows cast towards the beach.

Local predicted tides should be used to determine flight times so subsequent photography events would occur during similar times in the tidal cycle (preferably low tides). It is preferable that the photographs are rectified; however, at a minimum, horizontal ground control should be established by setting sufficiently sized aerial targets (4 feet by 4 feet minimum) on FDNR reference monuments prior to the flight. In the event that a monument is either not visible due to vegetation or located in an area of heavy traffic, the aerial target should be offset from the

FDNR monument along the profile azimuth. This offset distance and azimuth shall be kept in the target-setting party's field notes for use during subsequent photographic analysis.

Coastal Structures and Dune Vegetation Assessments

Assessments of the extent and condition of dune vegetation and coastal protection structures along Palm Beach Island shall be performed every 3 years, in conjunction with the annual surveys. The aerial photography described above shall be utilized to help determine the extent and general condition of the vegetative communities and degree of exposure of groins, revetments, and seawalls/bulkheads. Each assessment can include digitization of the features into a Town Database assembled as part of the comprehensive program.

A ground truthing survey to verify the dune vegetation and structure conditions should be performed following review of the photography. Following the base mapping effort detailed in Sections 3 and 6 of this report, the field efforts required to verify the vegetation and structures conditions should be minimal. The results of the surveys should be summarized in a written report by shoreline reach. Dune areas should be classified as non-vegetated, sparsely vegetated (< 30 percent cover), and well established (> 30 percent cover). Structures should be characterized by their apparent effectiveness, functionality and state of repair. Any changes since the previous survey should be identified.

Hardbottom Characterization and Monitoring

As it will be costly to perform island-wide hardbottom characterization at one time, priorities for the hardbottom characterization are shown in the following table. The priorities are in accordance with the recommendations of this report. Some existing areas (for example, offshore of the Mid-Town project) have been mapped and characterized sufficiently and do not require baseline mapping.

Hardbottom Characterization Priority

<i>Priority</i>	<i>Reach Area</i>
1	2, 7, and 8
2	3 and 6
3	9.5 through 10

The nearshore hardbottom areas located in reaches that may be impacted by future projects should be accurately mapped. The extent of the hardbottom areas should be identified by any reliable means, including any combination of side-scan sonar, precision echosounder,

ROXANN, and diver techniques. Each area should then be preliminarily characterized as described below.

For the preliminary analyses, a series of transects should be established at locations that are representative of the previously identified reaches of the beach. To the extent possible, hardbottom mapping which has previously been completed should be used to select transect locations. If feasible, the transects which were established by PBCERM (Environmental Assessment of Coastal Resources in Palm Beach, Lake Worth, South Palm Beach, Lantana and Manalapan, Palm Beach County, Florida, May 1993) should be re-surveyed as applicable. Narrative and photographic characterizations should be made part of a cursory qualitative analysis along each transect.

Upon completion of the preliminary identification, more focused and detailed monitoring can be planned. The methodology for detailed hardbottom monitoring should be described in the following two sections.

Video Transects and Quadrat Surveys

Quadrat locations shall be established and monitored at representative locations in the shoreline reaches indicated in Table 10-1. Final quadrat locations shall be established in the field as necessary to ensure coverage of a sufficiently large area such that approximately 10 or more stony coral colonies are found per sample. Differential GPS or an equivalent system shall be used in positioning and relocating the quadrats. Quadrat locations should be established and finalized in the field and a location map created after the initial survey. Survey techniques utilized in the initial survey shall be replicated at each survey interval.

Analysis of 1m² quadrats will consist of determining the number of stony corals (Order *Scleractinia*), soft corals (Order *Gorgonacea*), and sponges (Phylum *Porifera*). Numbers shall be reported as individuals or colonies.

Video Transects

Permanent transects shall be established at representative locations along the reaches indicated in Table 10-1. Locations of the transects shall, to the maximum extent possible, coincide with transects established by Palm Beach County (as described previously).

A controlled video recording along each transect shall be made of the following:

- organisms present
- macrophytic algal communities
- fishes
- Benthic organisms.

All significant organisms observed in the video shall be identified and listed to the lowest taxon practicable. Procedures used to determine quantitative estimates of the above shall be replicated at each sampling interval utilizing a scientifically viable procedure.

Schedule

Following the initial event, subsequent detailed events should be conducted biannually at representative transects in each Reach (to be established during the initial survey).

Protected Species Monitoring

Monitoring for protected species shall be implemented for the entire shoreline of Palm Beach Island. The following shall be implemented for the baseline monitoring:

Sea Turtles

It is recommended that a systematic monitoring program is developed and implemented for the entire length of Palm Beach Island to document the nesting of protected sea turtles. Monitoring shall be conducted from March 1 through October 1 of every year. The monitoring program shall be consistent with FDEP protocols established by the Bureau of Protected Species Management, including:

- Daily surveys during the nesting season to document nesting frequency and density, and
- Surveys of the island beaches for sand compaction and significant scarps shall be performed prior to March 15 and in early October. Sand compaction shall be measured each mile, with a minimum of 1 transect within each of the 11 shoreline reaches. Transects shall be referenced to the FDEP survey monuments. Compaction shall be measured at 3 stations on each profile, between the mean high water line and the dune feature (the typical sea turtle nesting area). At each of the 3 stations, compaction shall be measured in a vertical series at 3 depths: 0 to 6 inches, 12 to 18 inches, and 18 to 24 inches. The island beaches shall also be surveyed locating any escarpments that exceed 18 inches in height over a longshore distance of 100 feet or more.

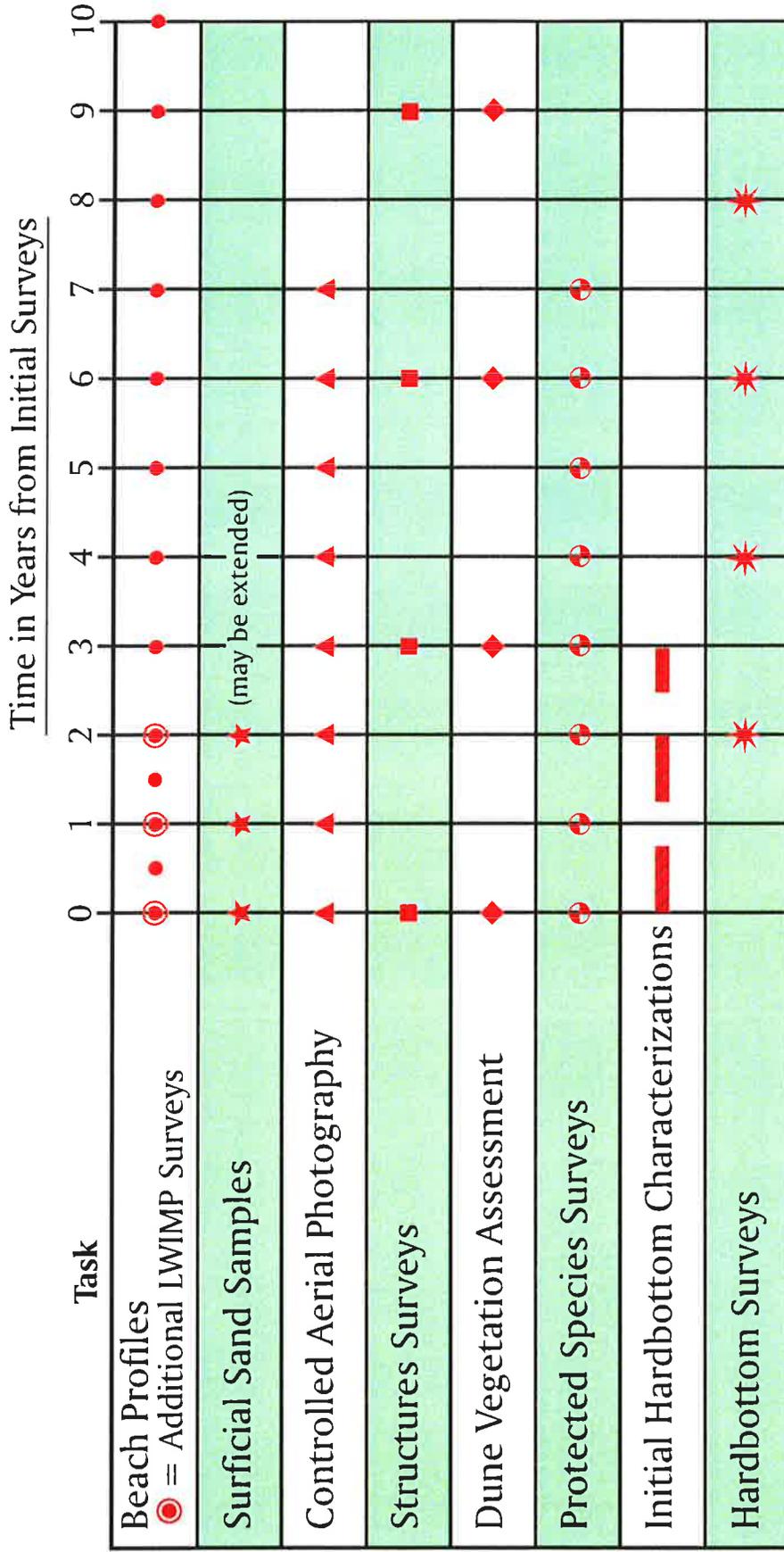
The nesting survey results shall be referenced to the FDEP survey monuments and grouped by shoreline reach. All hatchling disorientation reports shall be filed with the FDEP. Additionally, monthly nighttime surveys are recommended between March 1 and October 1 to determine the extent to which lights on the beach have the potential to present difficulties to hatchling sea turtles. All problem areas discovered during the surveys shall be referred to PBCDERM and FDEP for resolution. The compaction and scarp surveys described above may be refined to be more detailed in the areas of greatest turtle nesting (excluding new projects) after 2 years of monitoring.

Protected Plants

Annually, during July, an inventory should be made of the location of protected plants (endangered/threatened plants). The locations of these plants and the species present should be mapped in a systematic, reproducible manner. This information will be useful for planning shorefront protection works.

Other Protected Species

Surveys for other protected species should be conducted after consultation with the U.S. Fish and Wildlife Service (USFWS) and/or the Florida Game and Freshwater Fish Commission (FGFWFC). Species who may be present include nesting birds such as the Least Tern.



Note: Severe storm events may require additional wading surveys. This chart depicts Tier 1 Monitoring for a 10-year program.

Figure 10-1
Proposed Tier 1 Comprehensive Monitoring Plan for Palm Beach Island



10.3 TIER TWO: PERFORMANCE ASSESSMENT OF SPECIFIC PROJECTS

Additional monitoring activities should be implemented for specific projects, to document impacts to the coastal environment following construction. For example, the Mid-Town Beach Restoration Project has a set of monitoring requirements established to evaluate the project's performance and potential impacts on the adjacent environment (Applied Technology and Management, Inc., July 1995). Requirements for the project specific monitoring should follow the guidelines presented herein and in Section 10.2, at a minimum. Details will be determined at the time of the specific project, and will be subject to state and/or federal permit conditions.

Hydrographic Surveys and Sediment Samples

Additional monitoring requirements may be implemented as necessary to accurately evaluate the performance of the specific projects. Some examples include, but are not limited to, the following:

- Hydrographic surveys of offshore borrow areas to assess recovery rates (surveys at 200 foot intervals immediately following construction and at 6, 12, and 24 months post-construction);
- Higher resolution beach profiles in the immediate vicinity of any groins, seawalls/bulkheads, revetments, or breakwater structures to assess sediment transport and structural effectiveness. These surveys would be typically be within 50 ft of a groin centerline or at 200 ft (maximum) increments in the lee of a breakwater. These surveys would be wading profiles, performed at 6-month intervals for 2 years following construction, then annually thereafter for the design life of the project;
- Surveys of structures to assess condition and performance (annual assessments during post-project surveys); and
- Additional sand samples to verify cross-shore fill adjustment and/or longshore sediment transport (concurrent with all post-construction surveys and at locations specified in the construction permit or minimum cross-shore locations per Section 10).

Beach/Dune Vegetation

A detailed dune restoration plan should be developed and implemented as part of most beach nourishment projects. The success of the dune plantings should be monitored annually for a 3-year period after installation of the plants and should include adjacent areas in addition to planted areas. Best Management Practices (BMPs) should be established for maintenance activities in the vicinity of any nourishment project.

Hardbottom

Detailed qualitative and quantitative assessments should be conducted prior to and after any beach nourishment project. A narrative description of flora and fauna along each transect and photographs representative of the transect(s) should be periodically documented.

Protected Species

- Sea Turtles

Detailed monitoring for nesting sea turtles will be required in the vicinity of any beach nourishment project. The extent of the monitoring should be negotiated with the FDEP.

- Protected Plants

In the vicinity of any beach nourishment project, a detailed survey should be conducted for protected plants immediately prior to nourishment activities. Specific plants that could be affected by the nourishment project should be flagged, staked, and avoided. A survey after completion of the nourishment project should be conducted to verify that protected plants have not been negatively affected by the project.

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REFERENCES

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APPENDIX A



Survey Station Number 2002



Survey Station Number 1247

PH101.CDR 9/2/97

Coastal Structures Inventory-
May 1997

ATM
APPLIED TECHNOLOGY & MANAGEMENT, INC.
ATM



Survey Station Number 2005

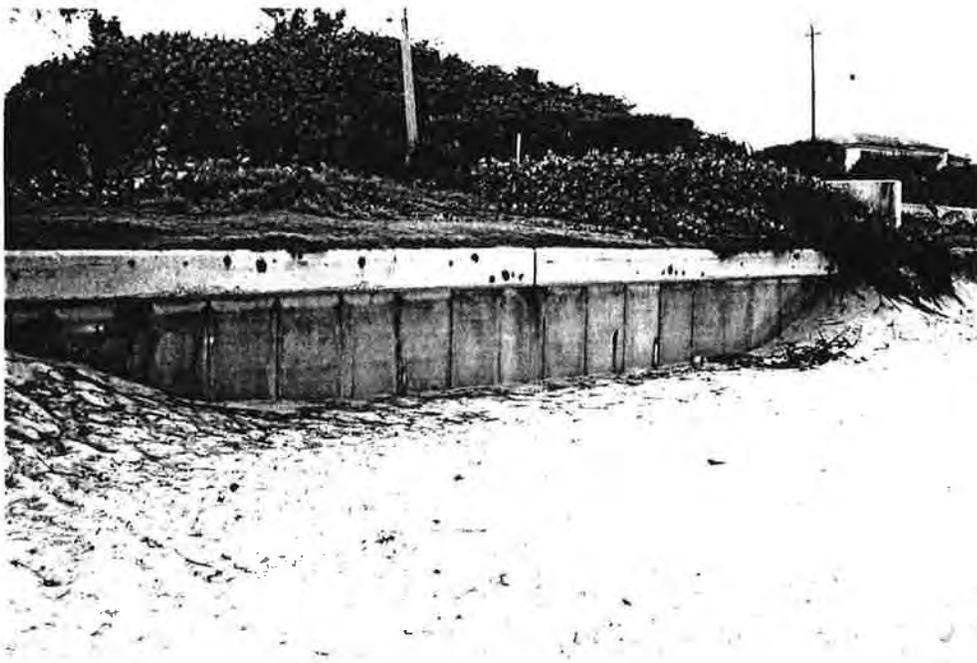


Survey Station Number 2006

PHOTO2 CDR 9/2/97

Coastal Structures Inventory-
May 1997

ATM
APPLIED TECHNOLOGY & MANAGEMENT, INC.



Survey Station Number 2009



Survey Station Number 2010

PH103 CDR 9/2/97

Coastal Structures Inventory-
May 1997





Survey Station Number 2012



Survey Station Number 2032

PHT04 CDR 9/2/97

Coastal Structures Inventory-
May 1997





Survey Station Number 2101



Survey Station Number 2104

PHOTOS.CDR 9/2/97

Coastal Structures Inventory-
May 1997

ATM
APPLIED TECHNOLOGY & MANAGEMENT, INC.
ATM



Survey Station Number 2109



Survey Station Number 2108

PHOTO CDR 9/2/97

Coastal Structures Inventory-
May 1997

ATM
APPLIED TECHNOLOGY & MANAGEMENT, INC.



Survey Station Number 2110



Survey Station Number 2121

PH107 CDR 9/2/97

Coastal Structures Inventory-
May 1997

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APPLIED TECHNOLOGY & MANAGEMENT, INC.
ATM



Survey Station Number 2122



Survey Station Number 2123

PHOTO8.CDR 9/2/97

Coastal Structures Inventory-
May 1997





Survey Station Number 2127



Survey Station Number 2127

PHT09.CDR 9/2/97

Coastal Structures Inventory-
May 1997

ATM
APPLIED TECHNOLOGY & MANAGEMENT, INC.
ATM



Survey Station Number 2137

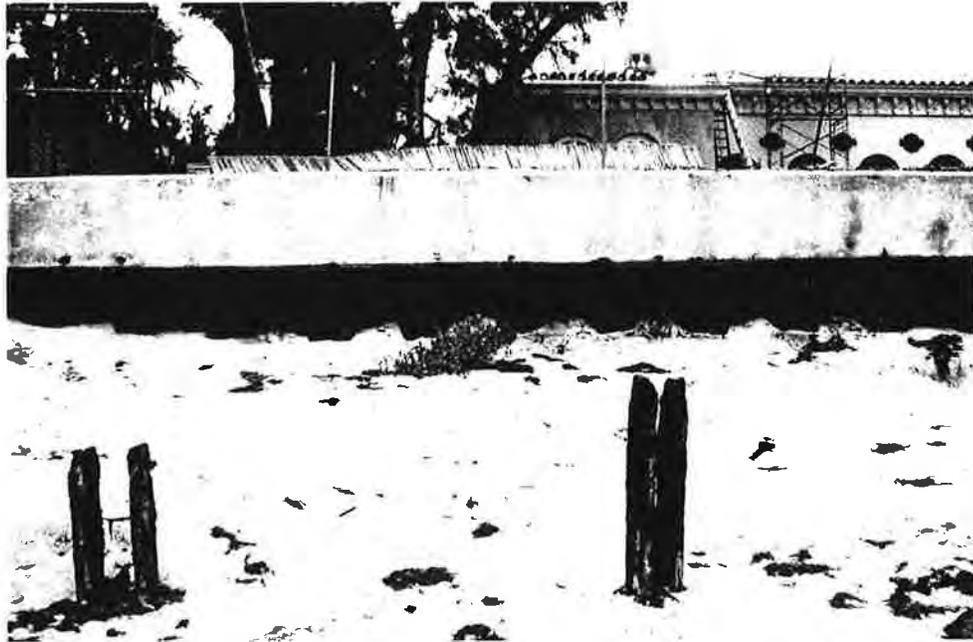


Survey Station Number 2137

PHOTO.CDR 9/2/97

Coastal Structures Inventory-
May 1997





Survey Station Number 2152



Survey Station Number 2156

PHT11 CDR 9/2/97

Coastal Structures Inventory-
May 1997

ATM
APPLIED TECHNOLOGY & MANAGEMENT, INC.



Survey Station Number 2150



Survey Station Number 2156

PH112 CDR 9/2/97

Coastal Structures Inventory-
May 1997

ATM
APPLIED TECHNOLOGY & MANAGEMENT, INC.



Survey Station Number 2174



Survey Station Number 2205

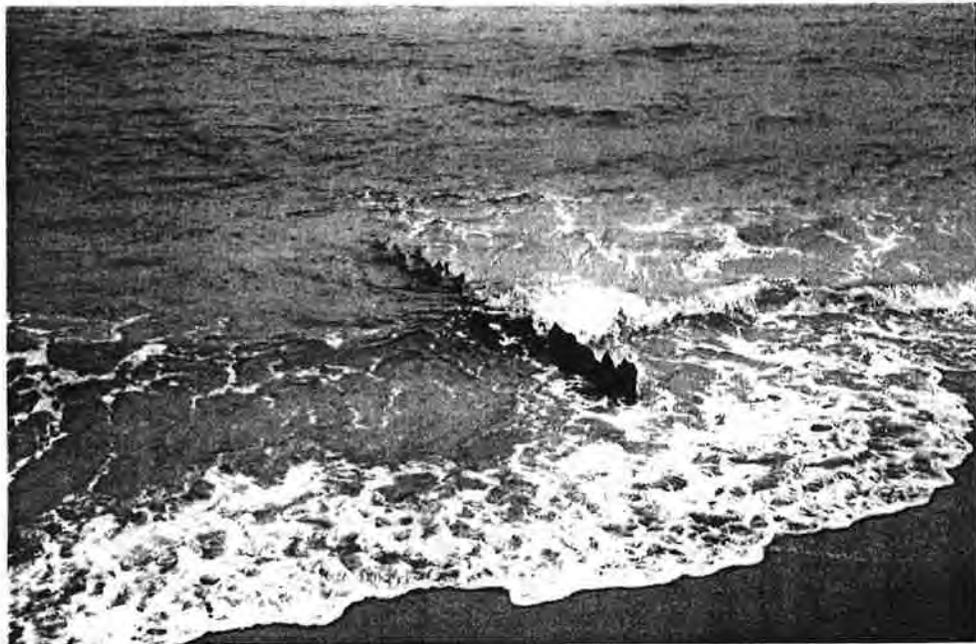
PH113.CDR 9/2/97

Coastal Structures Inventory-
May 1997

ATM
APPLIED TECHNOLOGY & MANAGEMENT, INC.



Survey Station Number 2178



Survey Station Number 2170

PHT14.CDR 9/2/97

Coastal Structures Inventory-
May 1997

ATM
APPLIED TECHNOLOGY & MANAGEMENT, INC.



Survey Station Number 2188



Survey Station Number 2199

PHT15.CDR 9/2/97

Coastal Structures Inventory-
May 1997





Survey Station Number 1219



Survey Station Number 1202

PHT16.CDR 9/2/97

Coastal Structures Inventory-
May 1997

ATM
APPLIED TECHNOLOGY & MANAGEMENT, INC.



Survey Station Number 1216

PHT40 CDR 9/2/97

Coastal Structures Inventory-
May 1997

ATM
APPLIED TECHNOLOGY & MANAGEMENT, INC.



Survey Station Number 1225



Survey Station Number 1218

PHT17 CDR 9/2/97

Coastal Structures Inventory-
May 1997





Survey Station Number 1234



Survey Station Number 1229

PHT18 CDR 9/2/97

Coastal Structures Inventory-
May 1997

ATM
APPLIED TECHNOLOGY & MANAGEMENT, INC.



Survey Station Number 1191



Survey Station Number 1180

PHT19.CDR 9/2/97

Coastal Structures Inventory-
May 1997

ATM
APPLIED TECHNOLOGY & MANAGEMENT, INC.



Survey Station Number 1171



Survey Station Number 1151

PH121.CDR 9/2/97

Coastal Structures Inventory-
May 1997

ATM
APPLIED TECHNOLOGY & MANAGEMENT, INC.



Survey Station Number 1149



Survey Station Number 1146

PHT22 CDR 9/2/97

Coastal Structures Inventory-
May 1997

ATM
APPLIED TECHNOLOGY & MANAGEMENT, INC.



Survey Station Number 1133

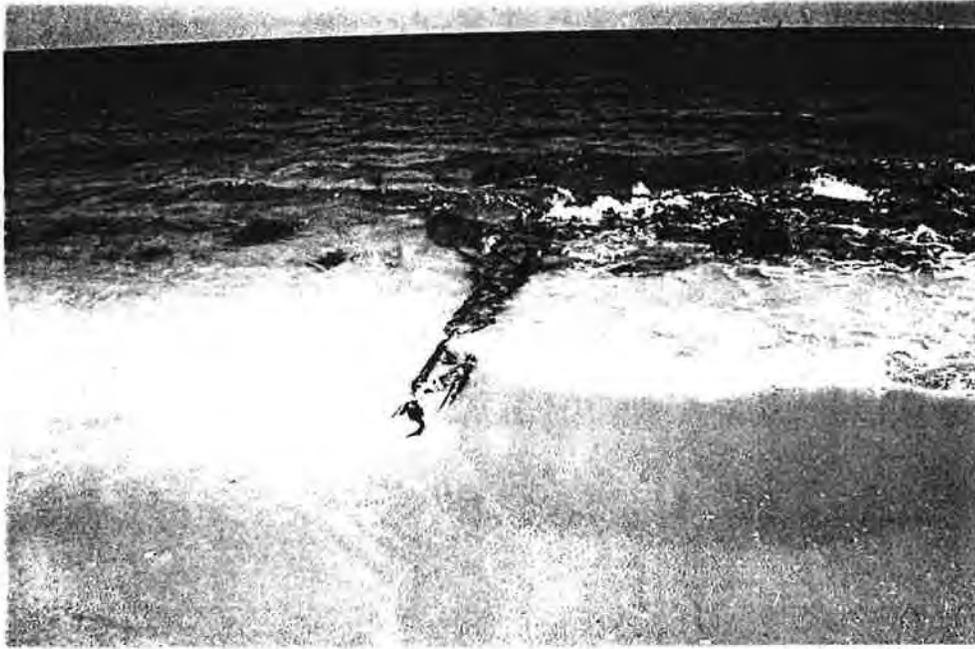


Survey Station Number 1129

PHT23 CDR 9/2/97

Coastal Structures Inventory-
May 1997





Survey Station Number 1135



Survey Station Number 1132

PHT24 CDR 9/2/97

Coastal Structures Inventory-
May 1997

ATM
APPLIED TECHNOLOGY & MANAGEMENT, INC.



Survey Station Number 1126



Survey Station Number 1126

PHT25 CDR 9/2/97

Coastal Structures Inventory-
May 1997





Survey Station Number 1124



Survey Station Number 1117

PHT26 CDR 9/2/97

Coastal Structures Inventory-
May 1997

ATM
APPLIED TECHNOLOGY & MANAGEMENT, INC.
ATM



Survey Station Number 1121



Survey Station Number 1114

PH127.CDR 9/2/97

Coastal Structures Inventory-
May 1997

ATM
APPLIED TECHNOLOGY & MANAGEMENT, INC.



Survey Station Number 1113



Survey Station Number 1113

PHT28 CDR 9/2/97

Coastal Structures Inventory-
May 1997

ATM
APPLIED TECHNOLOGY & MANAGEMENT, INC.



Survey Station Number 1083



Survey Station Number 1060

PHT29 CDR 9/2/97

Coastal Structures Inventory-
May 1997

ATM
APPLIED TECHNOLOGY & MANAGEMENT, INC.



Survey Station Number 1045



Survey Station Number 1040

PHT30.CDR 9/2/97

Coastal Structures Inventory-
May 1997

ATM
APPLIED TECHNOLOGY & MANAGEMENT, INC.



Survey Station Number 1057



Survey Station Number 1046

PHT31 CDR 9/2/97

Coastal Structures Inventory-
May 1997

ATM
APPLIED TECHNOLOGY & MANAGEMENT, INC.



Survey Station Number 1060



Survey Station Number 1055

PHT32.CDR 9/2/97

Coastal Structures Inventory-
May 1997





Survey Station Number 1078



Survey Station Number 1061

PHT33.CDR 9/2/97

Coastal Structures Inventory-
May 1997

ATM
APPLIED TECHNOLOGY & MANAGEMENT, INC.
ATM



Survey Station Number 1036



Survey Station Number 1029

PHT34 CDR 9/2/97

Coastal Structures Inventory-
May 1997

ATM
APPLIED TECHNOLOGY & MANAGEMENT, INC.
ATM



Survey Station Number 1028



Survey Station Number 1025

PHT35 CDR 9/2/97

Coastal Structures Inventory-
May 1997

ATM
APPLIED TECHNOLOGY & MANAGEMENT, INC.
ATM



Survey Station Number 1022



Survey Station Number 1019

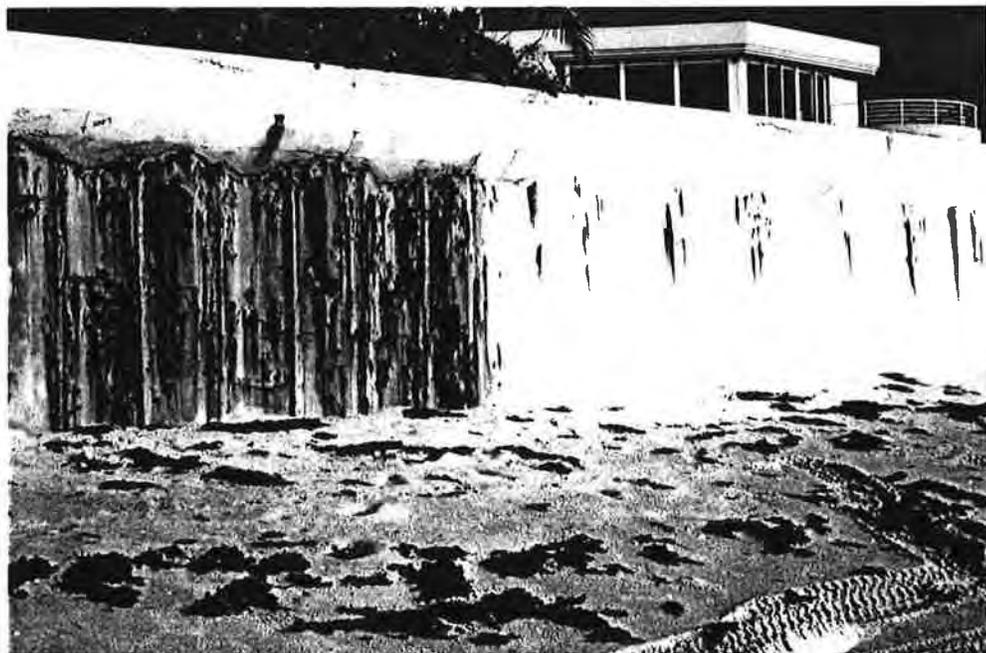
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Coastal Structures Inventory-
May 1997

ATM
APPLIED TECHNOLOGY & MANAGEMENT, INC.



Survey Station Number 1013



Survey Station Number 1007

PHT37.CDR 9/2/97

Coastal Structures Inventory-
May 1997

ATM
APPLIED TECHNOLOGY & MANAGEMENT, INC.
ATM



Survey Station Number 225



Survey Station Number 214

PH138.CDR 9/2/97

Coastal Structures Inventory-
May 1997

ATM
APPLIED TECHNOLOGY & MANAGEMENT, INC.



Survey Station Number 219



Survey Station Number 213

PHT39 CDR 9/2/97

Coastal Structures Inventory-
May 1997



APPENDIX B

Table 1

Survey Control Monument Coordinates and Elevations* for
1997 Beach Profile Surveys - Town of Palm Beach

Monument	Date Established	Northing (NAD 1927)	Easting	Profile Azimuth	Monument Elevation
Palm Beach Island					
R-76	Mar 1974	887080.30	814287.94	100°	8.34
R-77	Mar 1974	885887.720	814012.270	95°	10.82
R-78	Mar 1974	884705.657	813966.552	75°	15.14
R-79	Mar 1974	883622.480	814106.630	80°	14.03
R-80	Mar 1974	882619.640	814234.340	85°	13.54
R-81	Mar 1974	881511.578	814350.164	80°	14.86
R-82	Mar 1974	880174.60	814508.83	75°	14.57
R-83	Mar 1974	878846.62	814578.13	80°	11.98
R-84	Mar 1974	877657.66	814735.65	75°	15.76
R-85	Oct 1990	876697.70	814792.75	70°	15.50
R-86	Mar 1974	875788.72	814793.29	90°	13.41
R-87	Mar 1974	874474.07	814905.66	90°	18.84
R-88	Mar 1974	873498.02	814891.36	95°	15.31
R-89	Mar 1974	872573.11	814871.66	90°	15.25
R-90	Mar 1974	871526.09	814890.83	80°	16.28
R-91	CPE 1989	870408.54	814948.64	80°	16.13
R-92	CPE 1989	869253.26	815059.54	80°	11.70
R-93	Mar 1974	868081.07	815139.41	95°	14.63
R-94	CPE 1989	867009.70	815391.74	90°	14.21
R-94E- R104	Mid-Town Beach	Restoration Project	Monitoring Area	(by Sea Systems Int'l/Univ of FL)	
R-105	Mar 1974	854176.38	814935.72	110°	13.39
R-106	Mar 1974	853031.91	814866.05	90°	13.18
R-107	Mar 1974	851907.30	814709.47	95°	16.33
R-108	Mar 1974	851091.29	814665.15	90°	16.45
R-109	Mar 1974	849878.86	814707.23	90°	12.31
R-110	Mar 1974	848560.25	814579.72	90°	17.38
R-111	Aug 1989	847574.81	814506.57	90°	22.71
T-112	Oct 1977	846435.88	814478.40	95°	18.85
R-113	Jan 1975	845400.14	814406.52	95°	19.23
R-114	Aug 1989	844427.83	814432.76	90°	16.47
R-115	Mar 1974	843277.11	814391.08	90°	18.74
R-116	Aug 1989	842301.66	814385.96	90°	18.93
R-117	Aug 1989	841262.25	814374.52	95°	9.65
R-118	Mar 1974	840533.60	814321.78	95°	25.55

*all information contained in this table to be verified prior to conducting field work

Continued.....

Table 1 (continued)

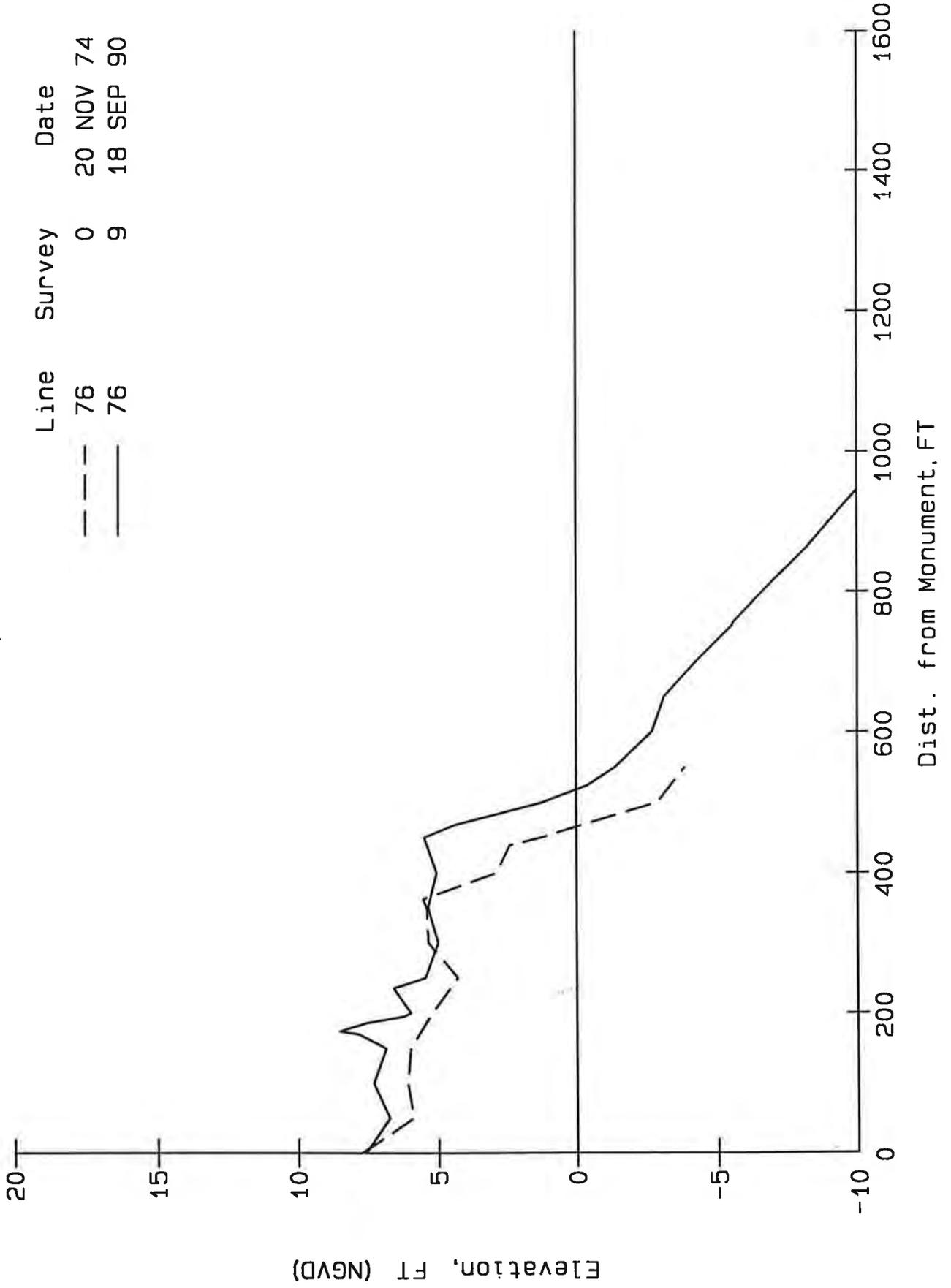
Survey Control Monument Coordinates and Elevations for
1997 Beach Profile Surveys - Town of Palm Beach

Monument	Date Established	Northing (NAD 1927)	Easting	Profile Azimuth	Monument Elevation
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R-120	Mar 1974	838249.37	814330.91	90°	16.66
R-121	Mar 1974	837527.20	814355.91	90°	20.59
R-122	Mar 1974	836585.71	814434.70	90°	16.28
R-123	Mar 1974	835563.39	814468.27	90°	15.56
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T-125	Oct 1977	833178.79	814524.61	90°	16.90
R-126	Mar 1974	832091.55	814562.93	100°	15.14
R-127	Mar 1974	831014.56	814579.51	105°	16.02
R-128	Feb 1975	829984.18	814602.17	105°	18.47
R-129	Mar 1974	828816.80	814601.22	90°	18.32
R-130	Mar 1974	827490.66	814607.63	90°	19.14
T-131	Oct 1977	826195.92	814615.65	90°	20.92
R-132	Sep 1989	825038.01	814588.61	95°	18.84
R-133	Sep 1989	823814.20	814615.08	95°	18.36
R-134	Sep 1989	822617.56	814560.39	95°	20.19
R-135	1989	821302.72	814466.09	95°	21.42
R-136	1989	820368.19	814093.85	95°	4.81
R-137	1989	819361.44	814324.31	95°	10.58
R-138	1989	818663.10	814401.37	95°	14.06
R-139	1989	817420.27	814338.20	95°	13.97
R-140	1974	816369.79	814265.65	95°	16.35
R-141	1974	815325.82	814199.80	95°	14.00
R-142	1974	814292.05	814107.75	95°	14.91
R-143	1974	813288.44	813989.90	95°	14.12
T-144	1977	812337.61	813808.66	100°	14.10
R-145	1974	811223.44	813548.23	105°	14.14
R-146	1974	810175.33	813282.09	100°	21.56
R-147	1974	809174.61	813138.52	100°	19.19
R-148	1974	808047.58	813044.80	95°	14.33
R-149	1974	807097.45	812894.03	90°	24.93
R-150	1989	806426.46	812962.35	95°	13.10
R-151	1975	805350.139	812729.44	95°	21.28

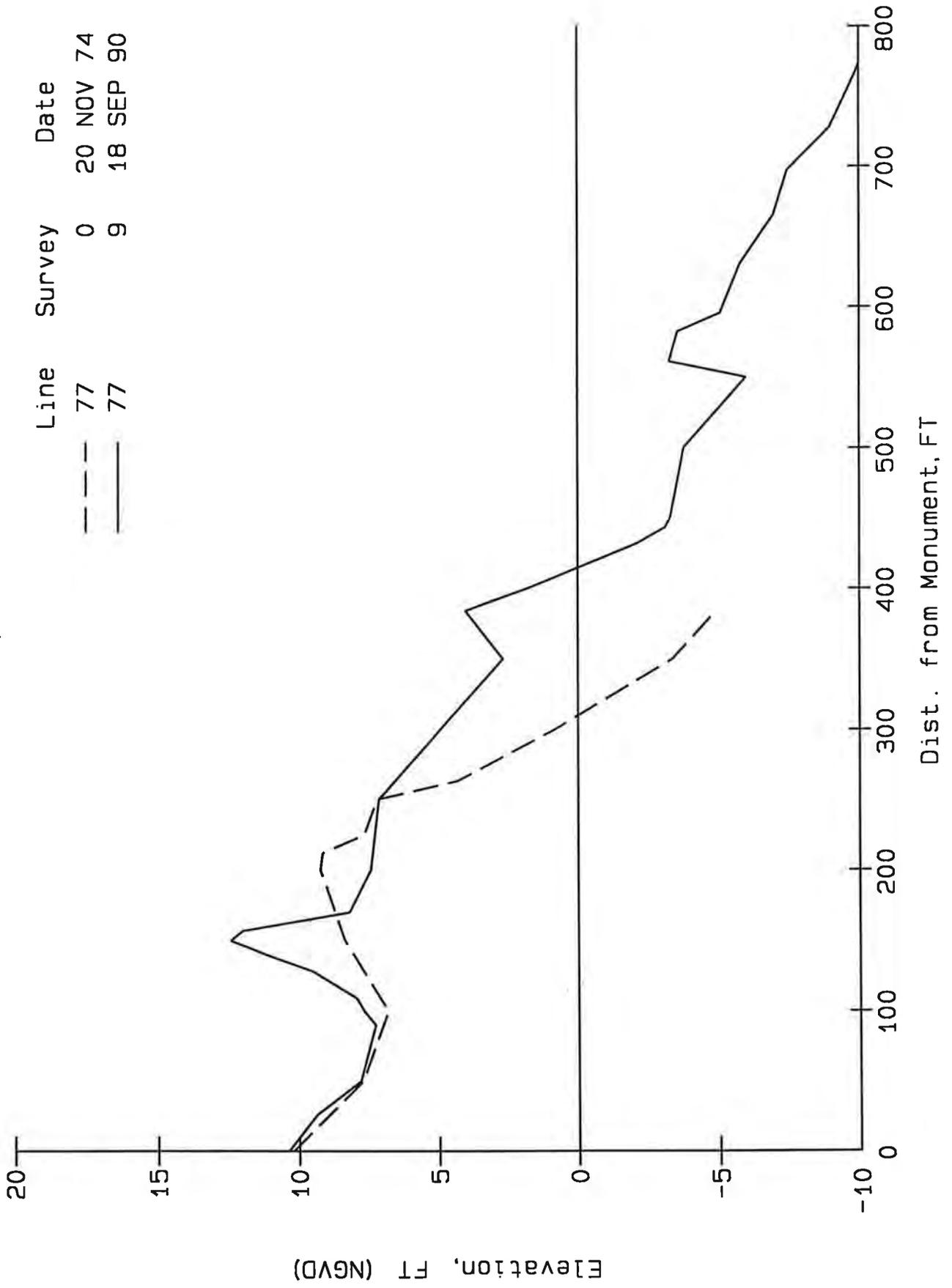
**PALM BEACH ISLAND
BEACH PROFILE COMPARISONS**

1974 - 1990

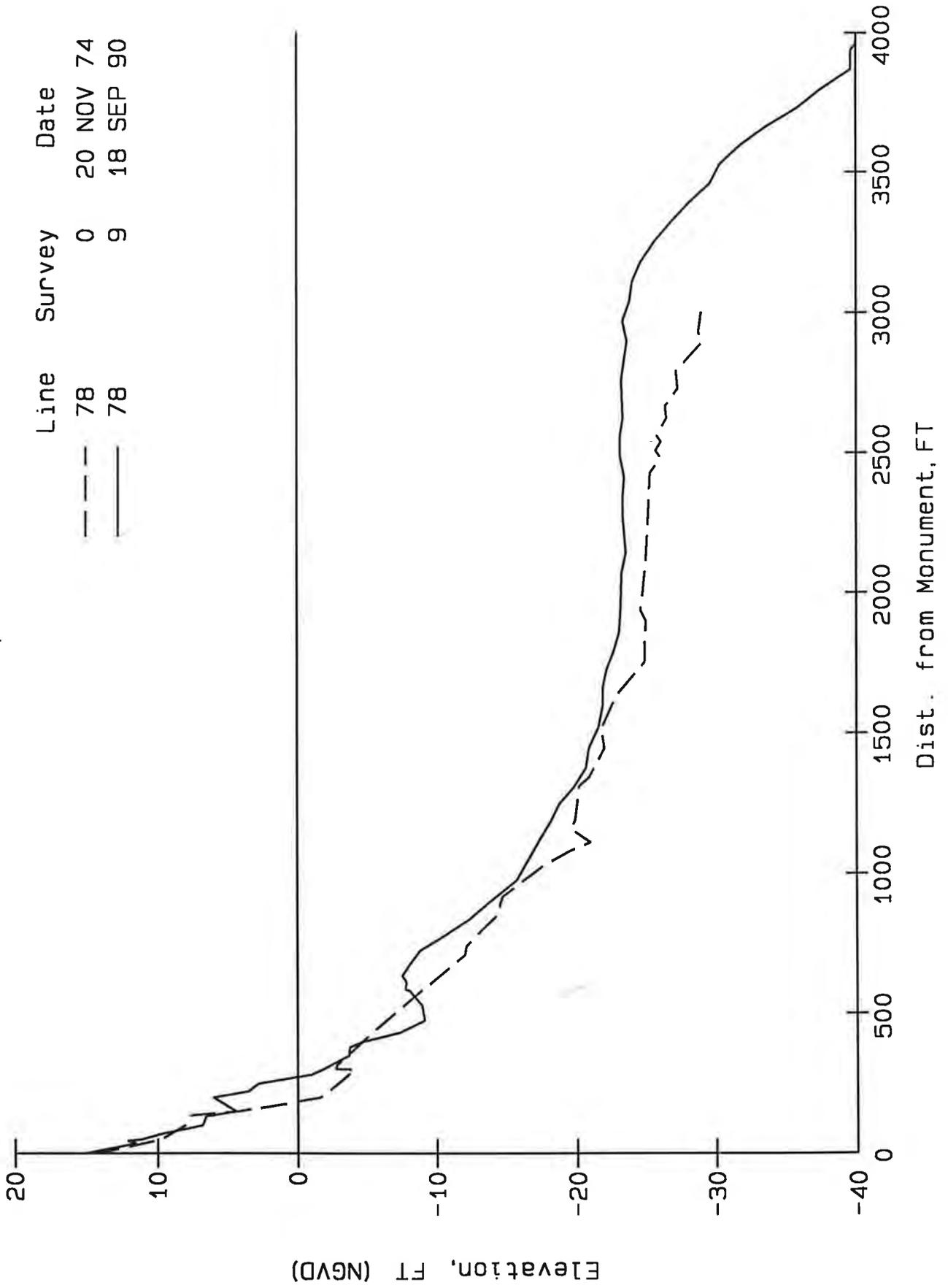
Palm Beach Island
 Beach Profile Comparisons (1974 to 1990)



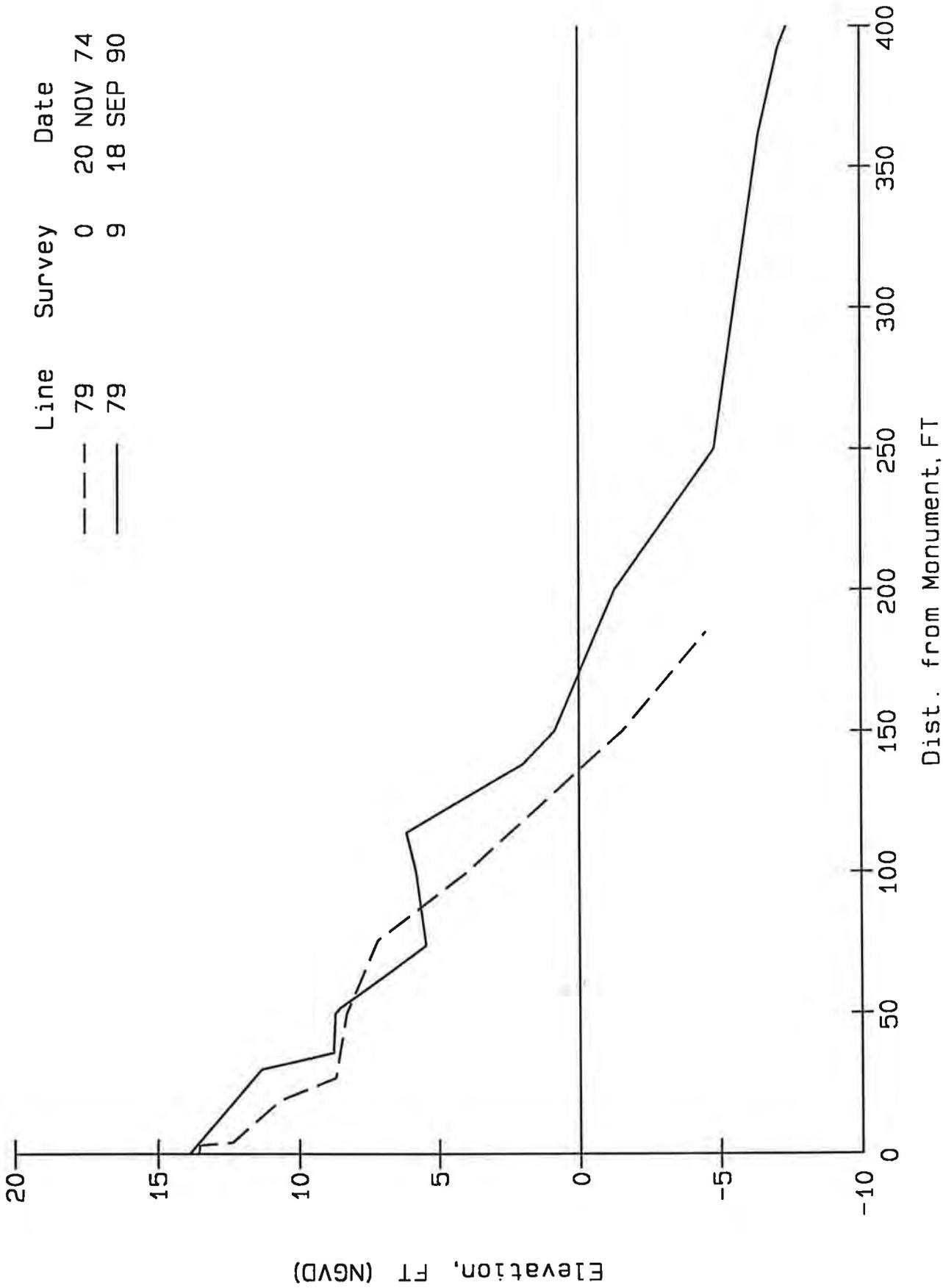
Palm Beach Island
 Beach Profile Comparisons (1974 to 1990)



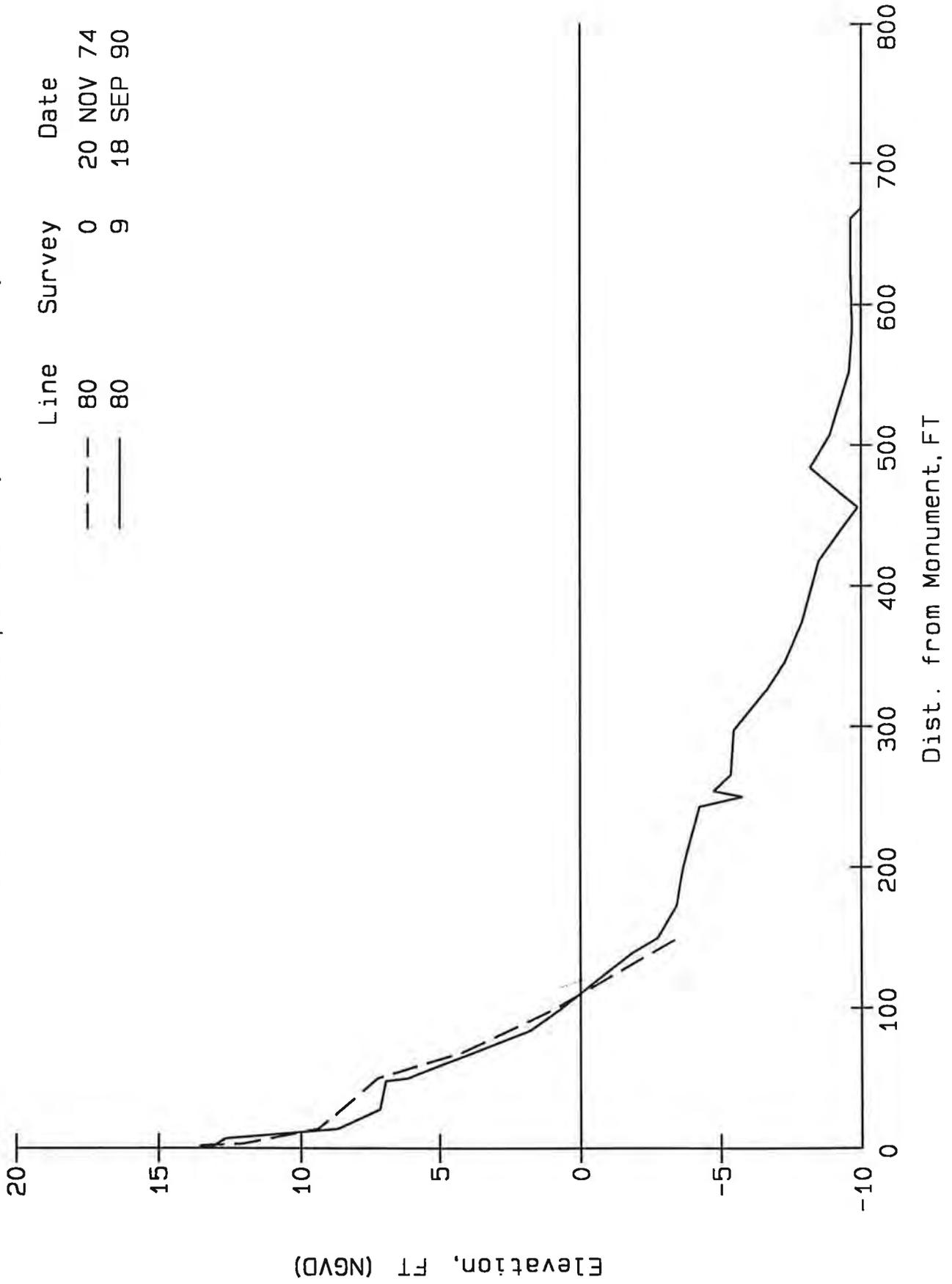
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Beach Profile Comparisons (1974 to 1990)



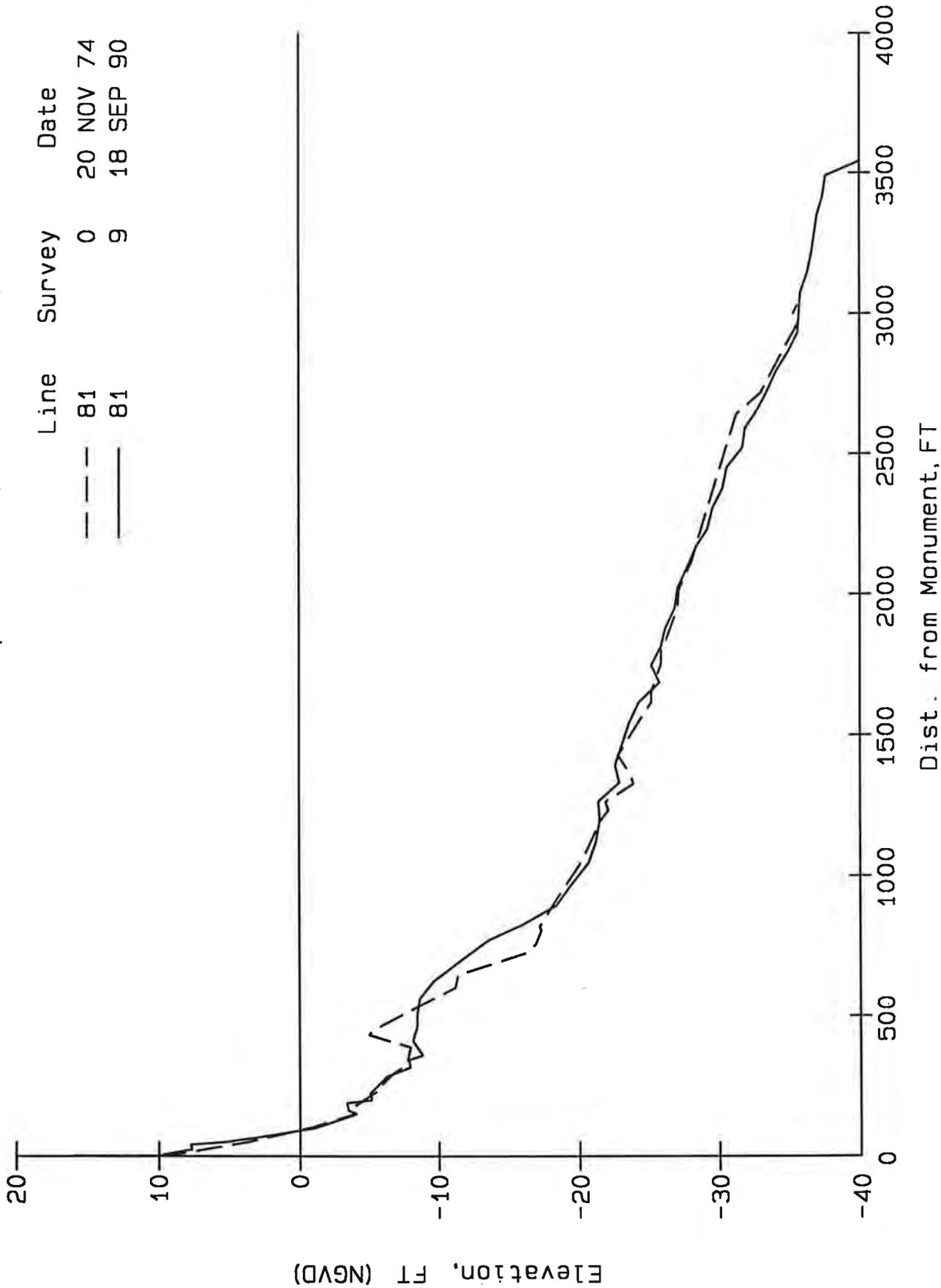
Palm Beach Island
Beach Profile Comparisons (1974 to 1990)



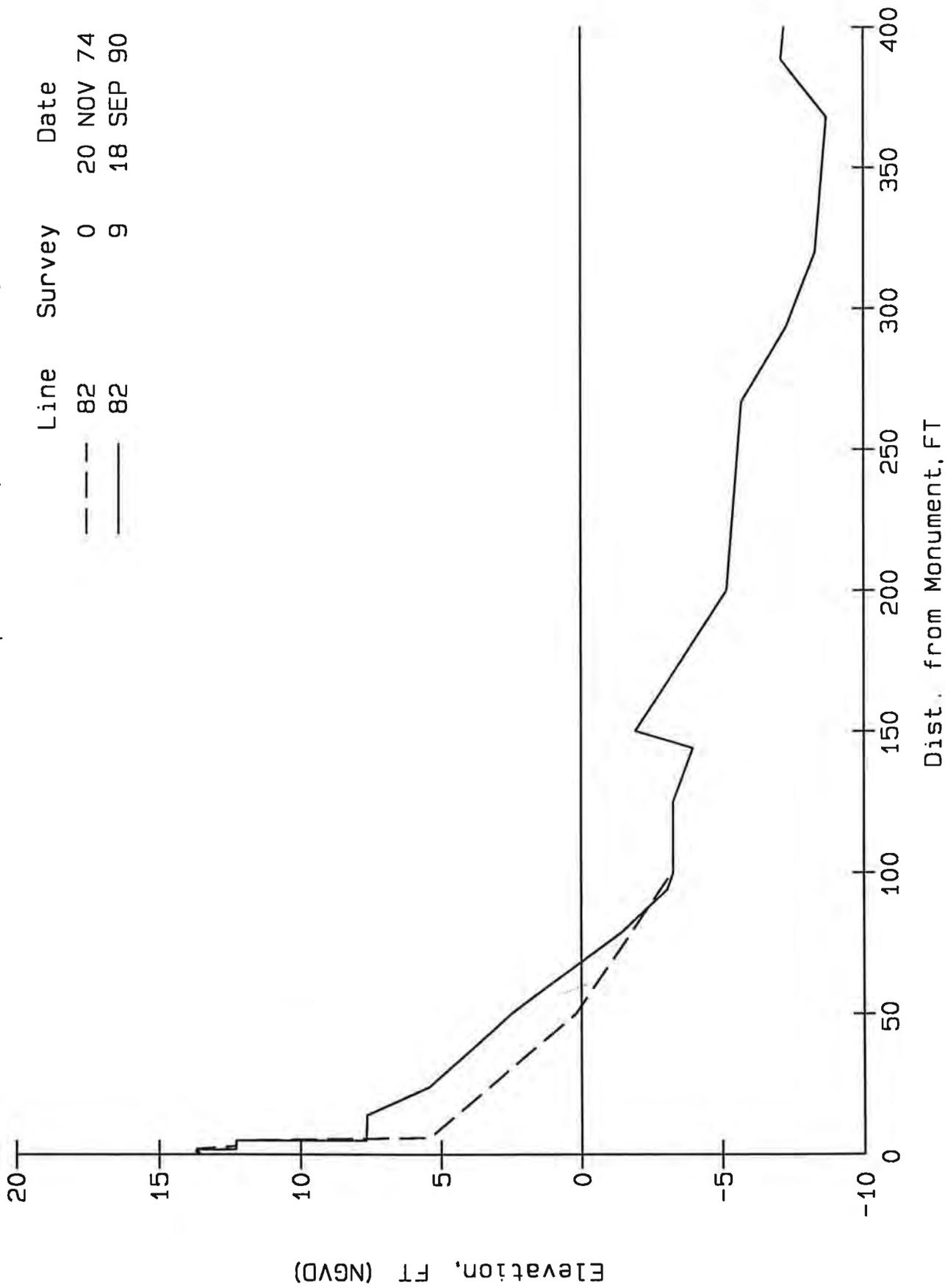
Palm Beach Island
Beach Profile Comparisons (1974 to 1990)



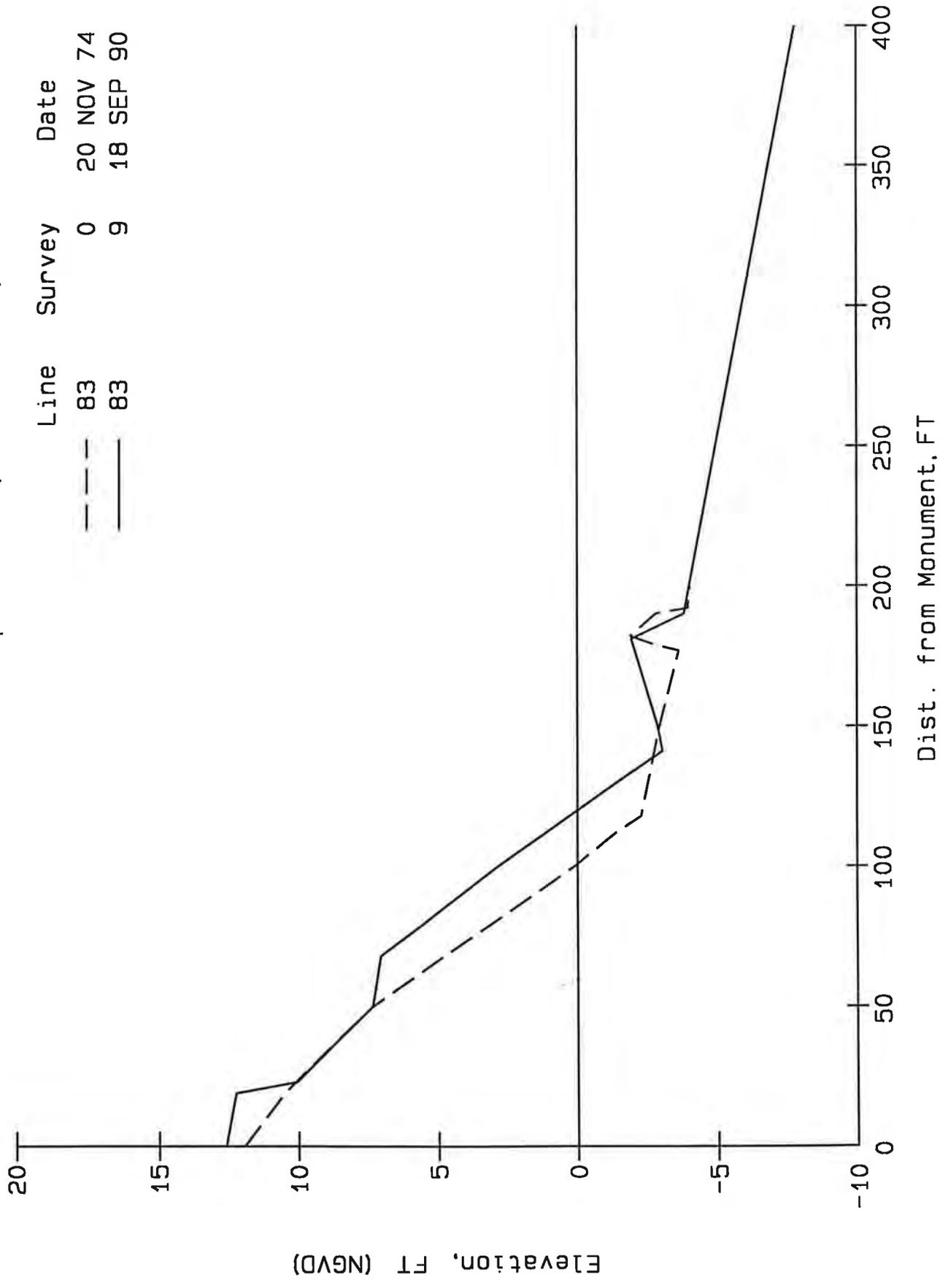
Palm Beach Island
 Beach Profile Comparisons (1974 to 1990)



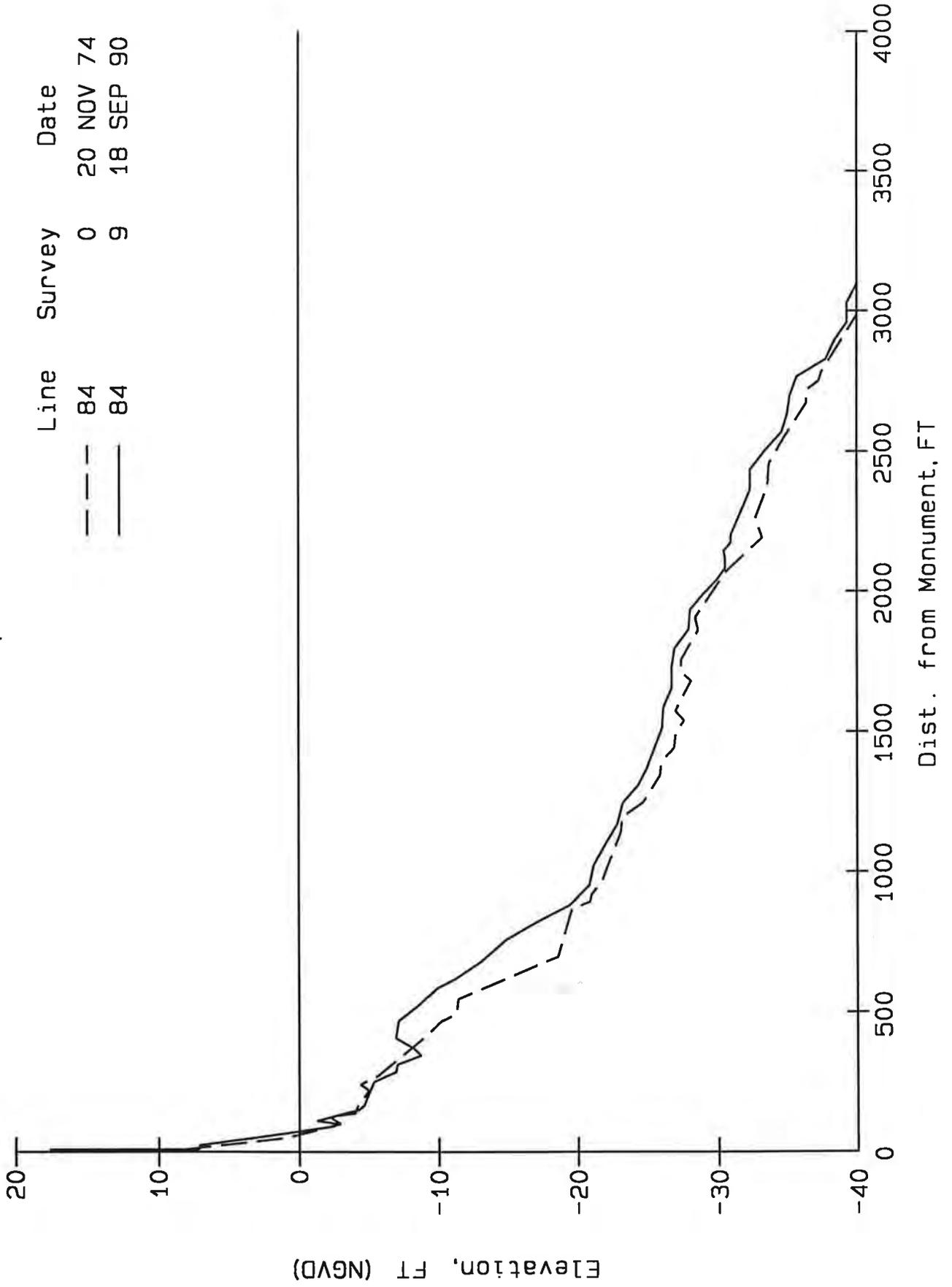
Palm Beach Island
 Beach Profile Comparisons (1974 to 1990)



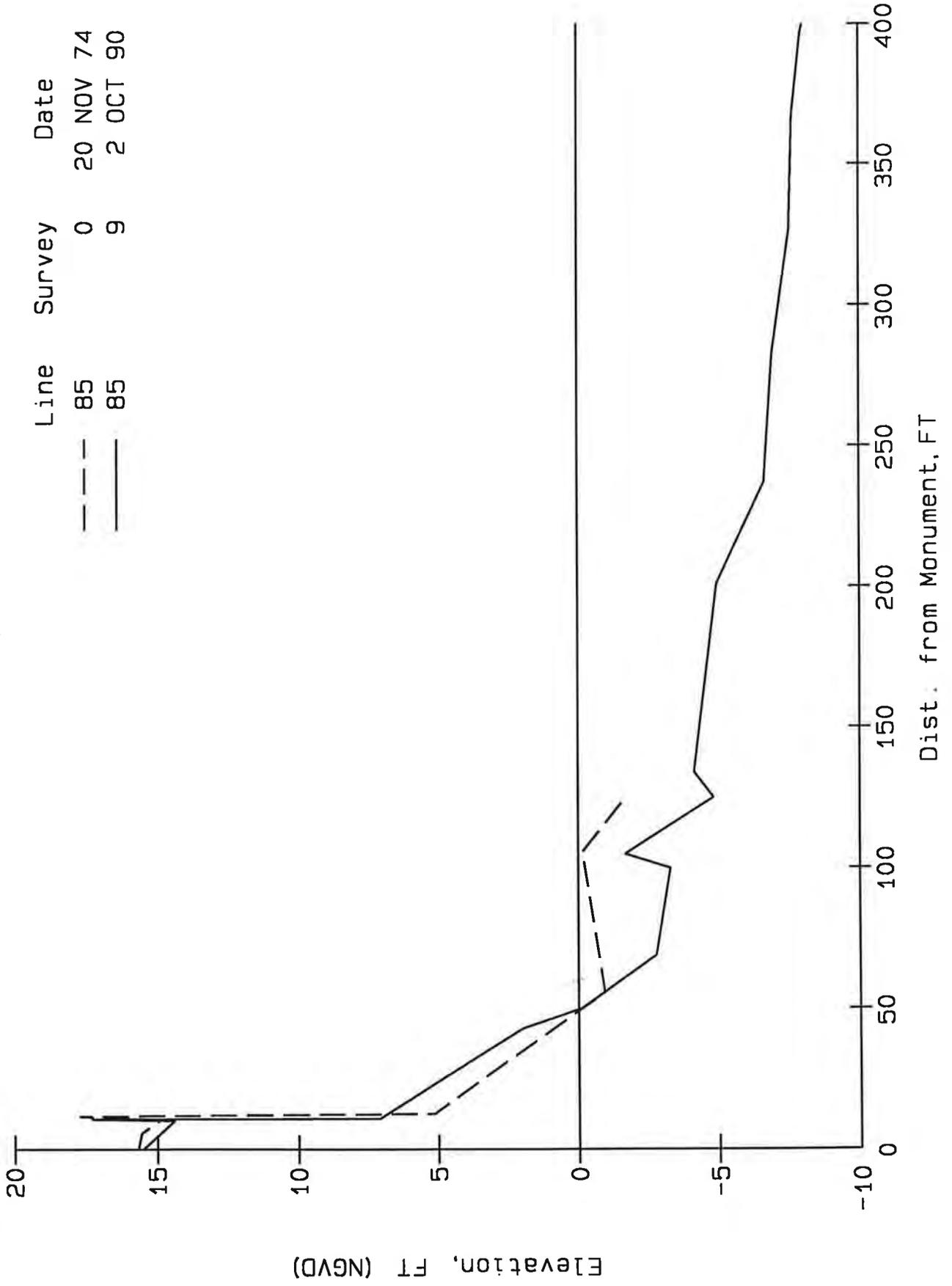
Palm Beach Island
 Beach Profile Comparisons (1974 to 1990)



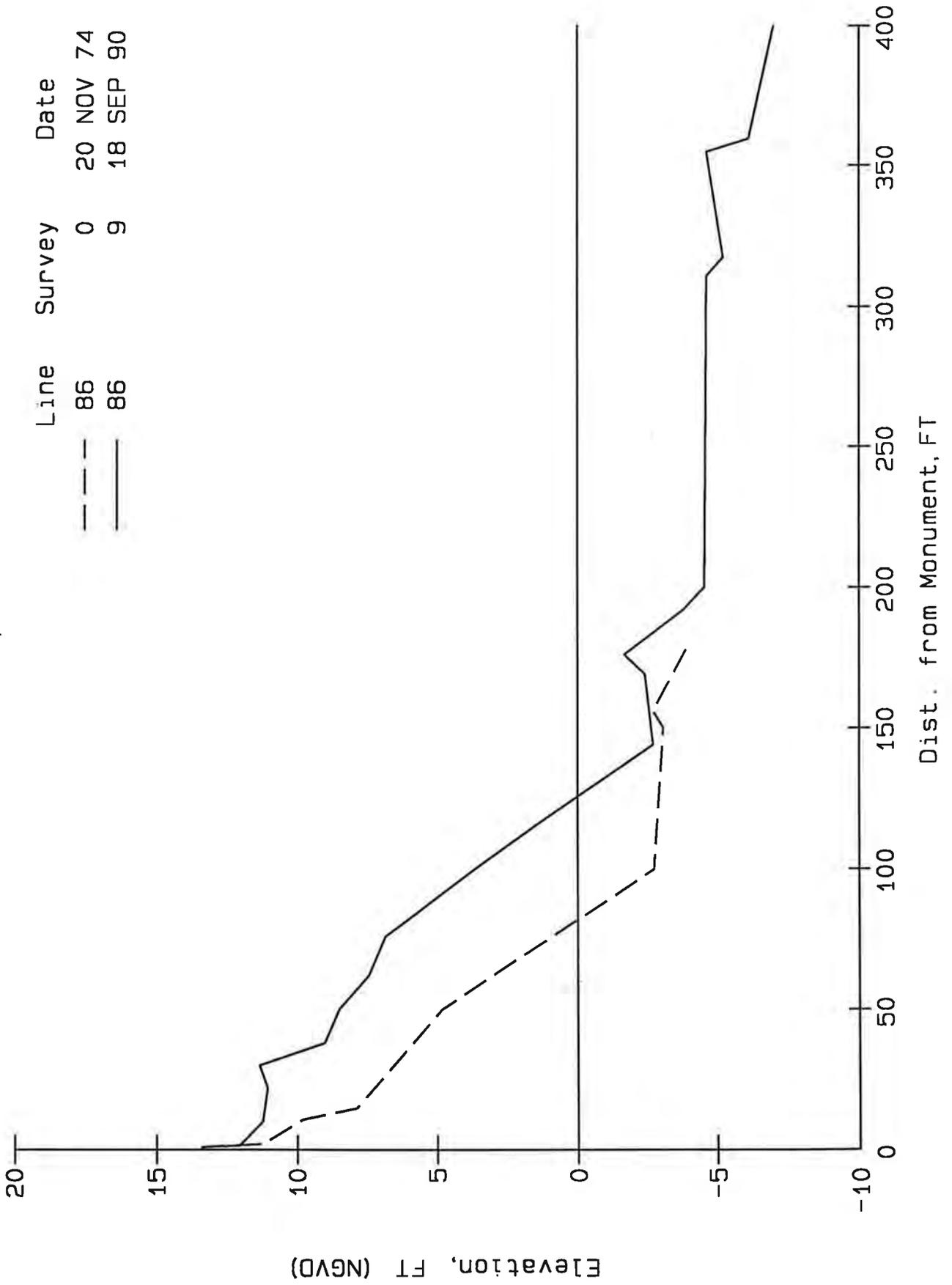
Palm Beach Island
Beach Profile Comparisons (1974 to 1990)



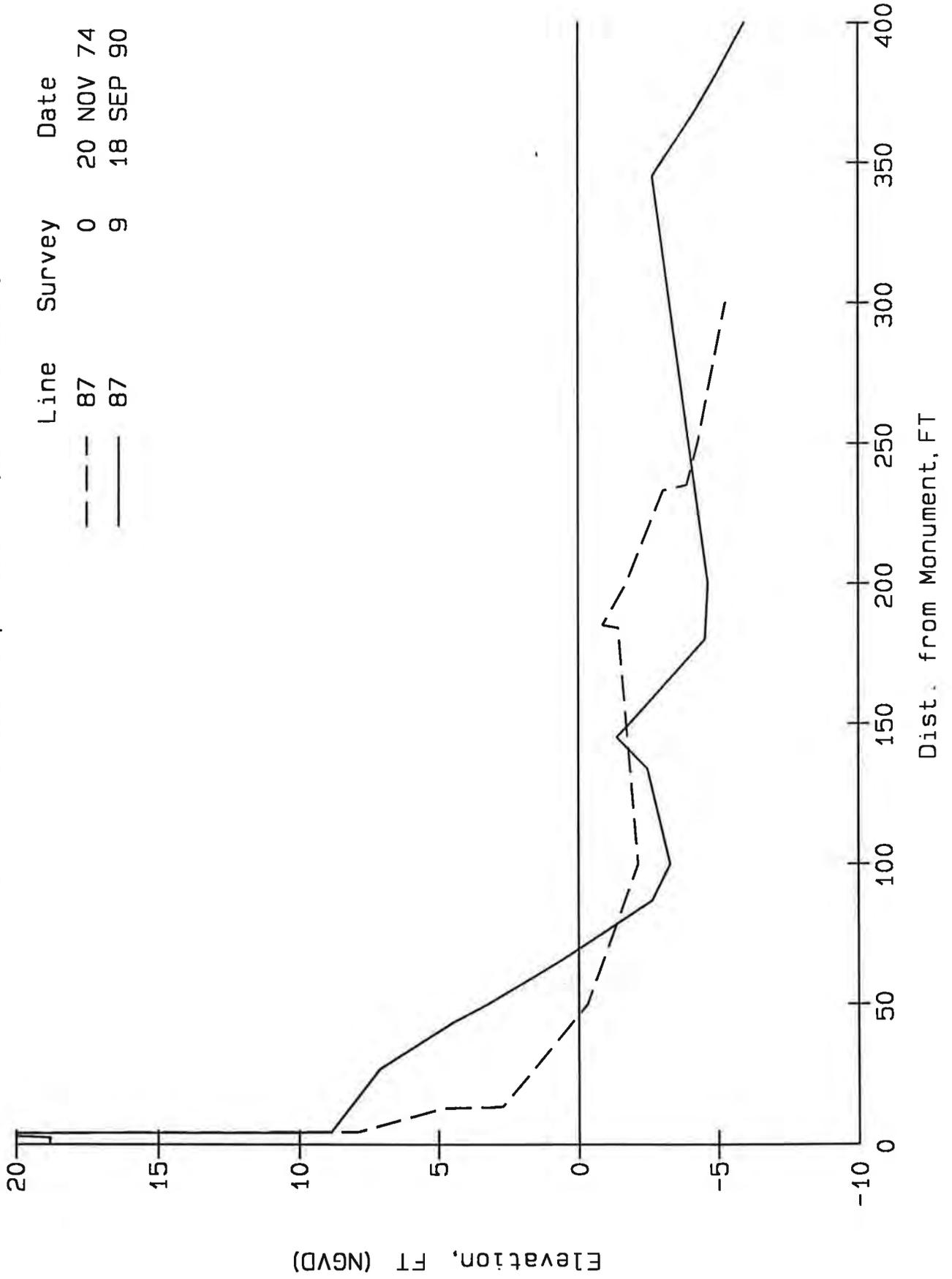
Palm Beach Island
Beach Profile Comparisons (1974 to 1990)



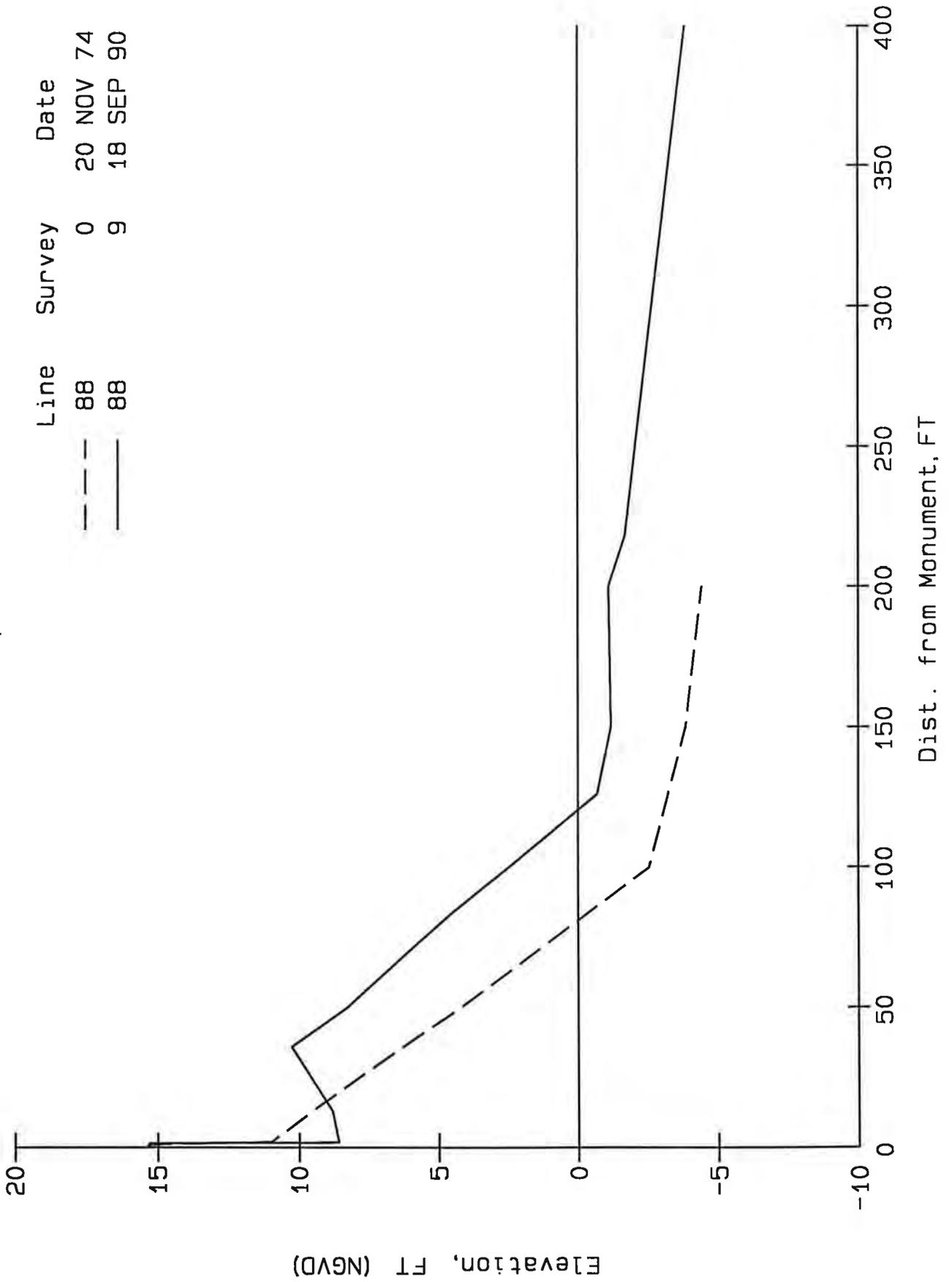
Palm Beach Island
 Beach Profile Comparisons (1974 to 1990)



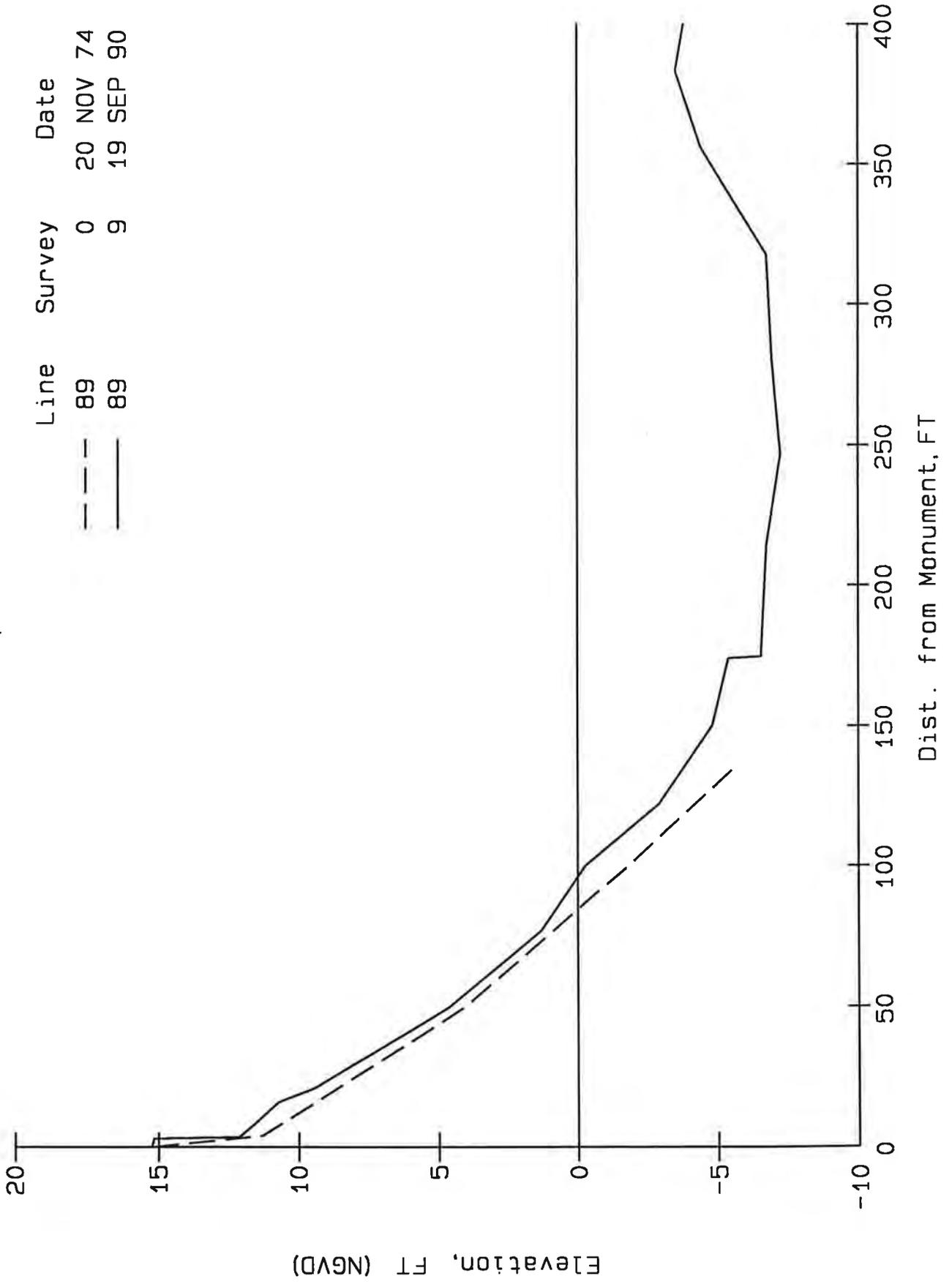
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 Beach Profile Comparisons (1974 to 1990)



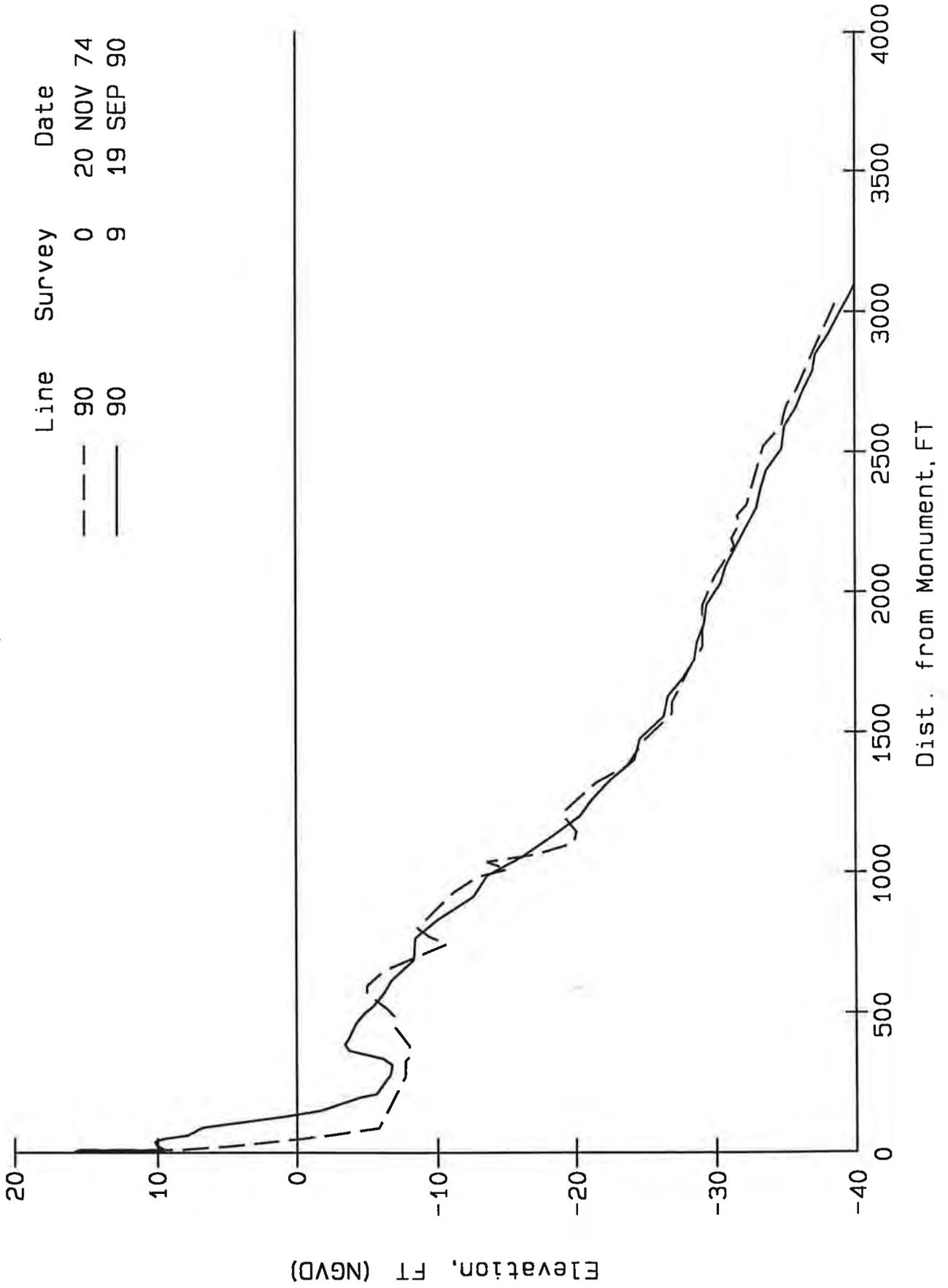
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Palm Beach Island
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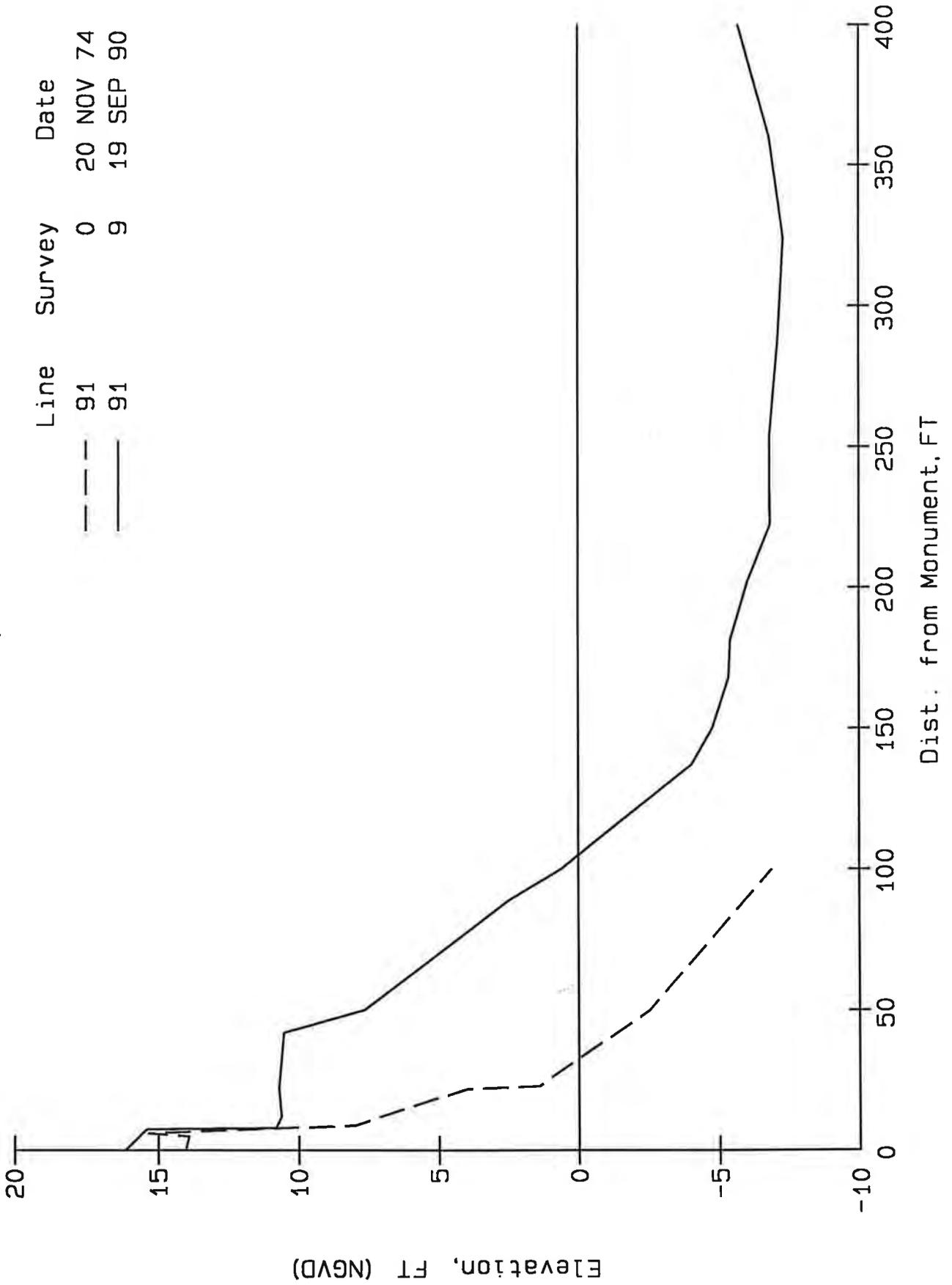
Palm Beach Island
 Beach Profile Comparisons (1974 to 1990)



Elevation, FT (NGVD)

Dist. from Monument, FT

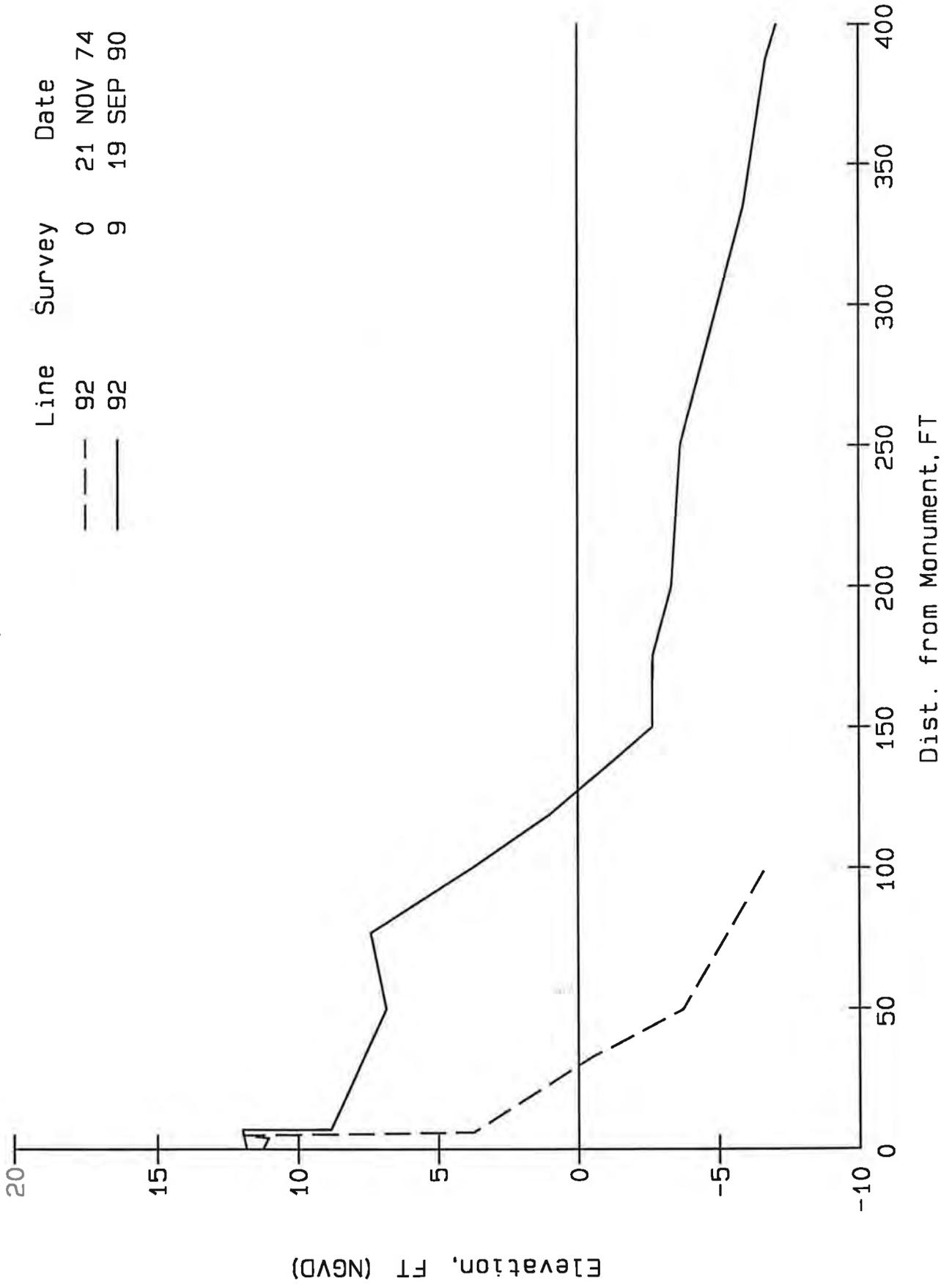
Palm Beach Island
 Beach Profile Comparisons (1974 to 1990)



Elevation, FT (NGVD)

Dist. from Monument, FT

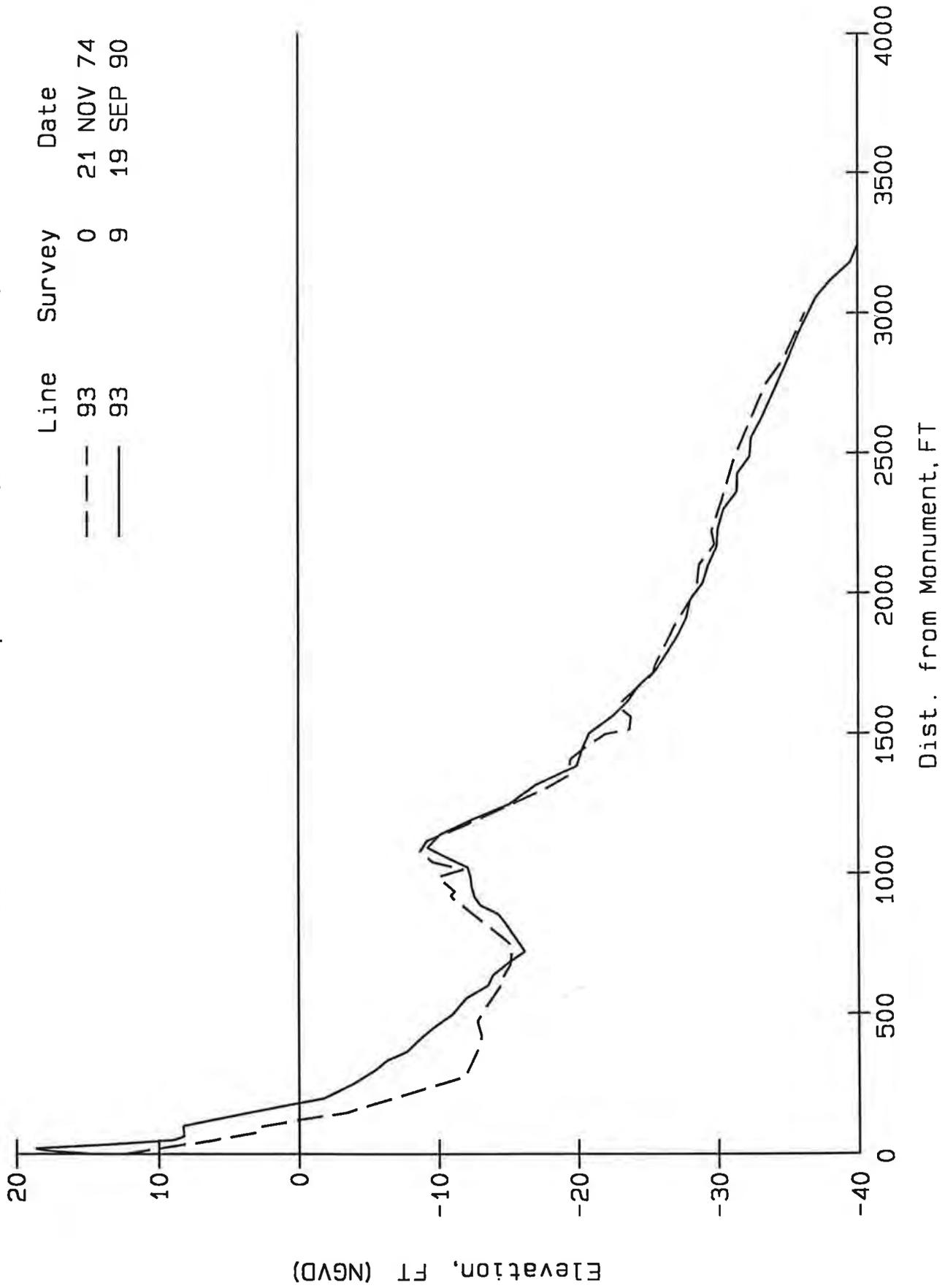
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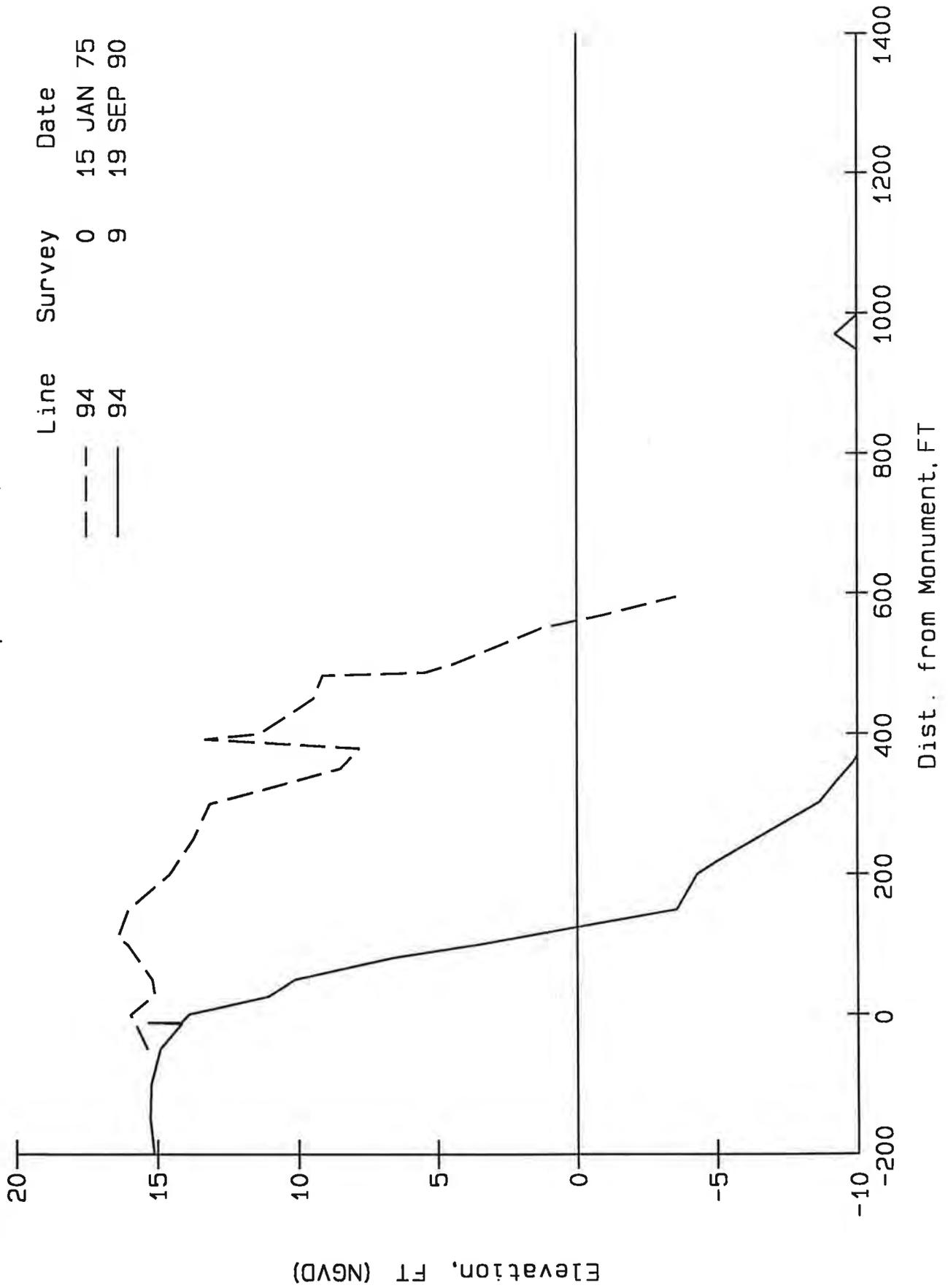
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Dist. from Monument, FT

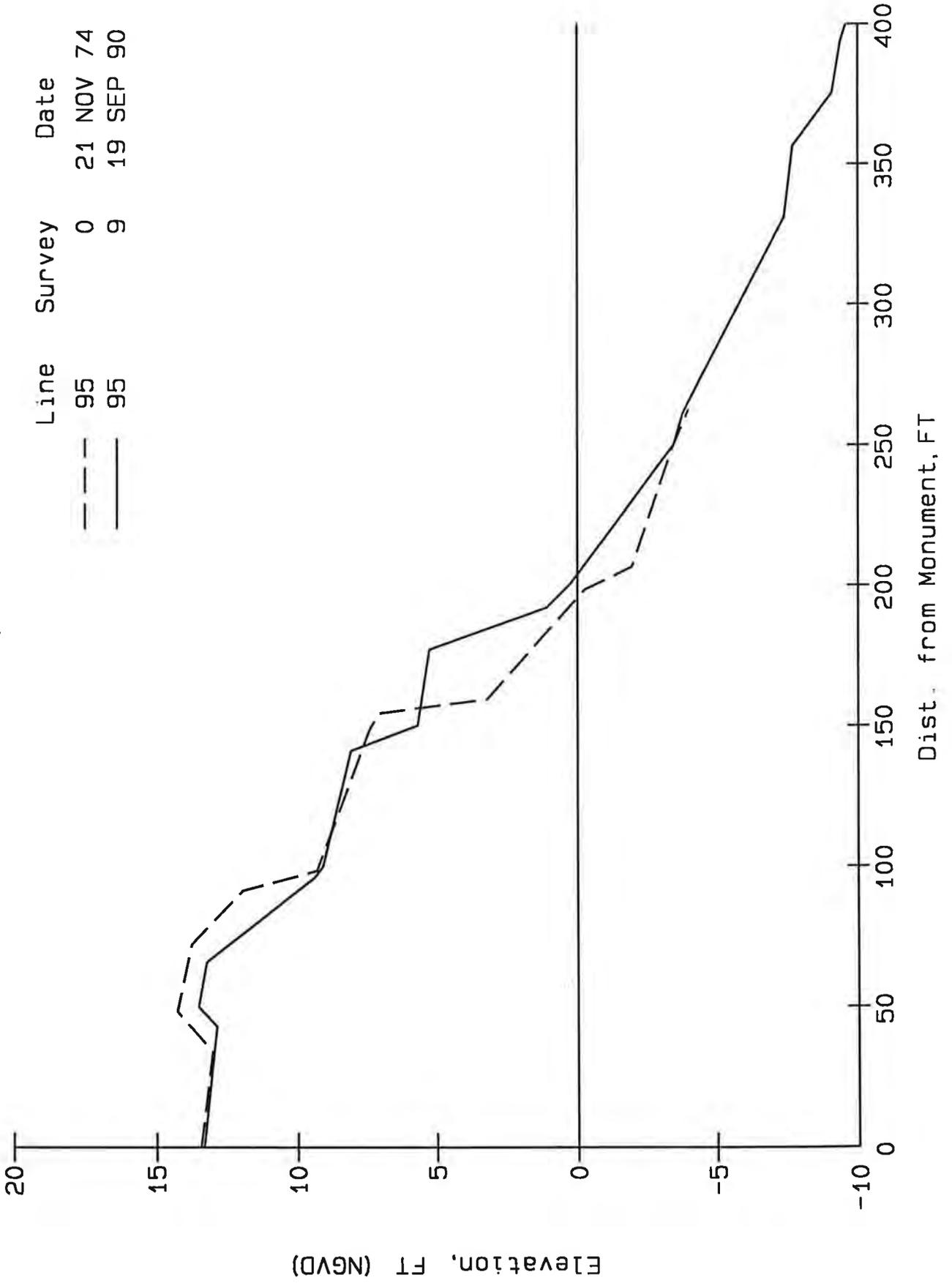
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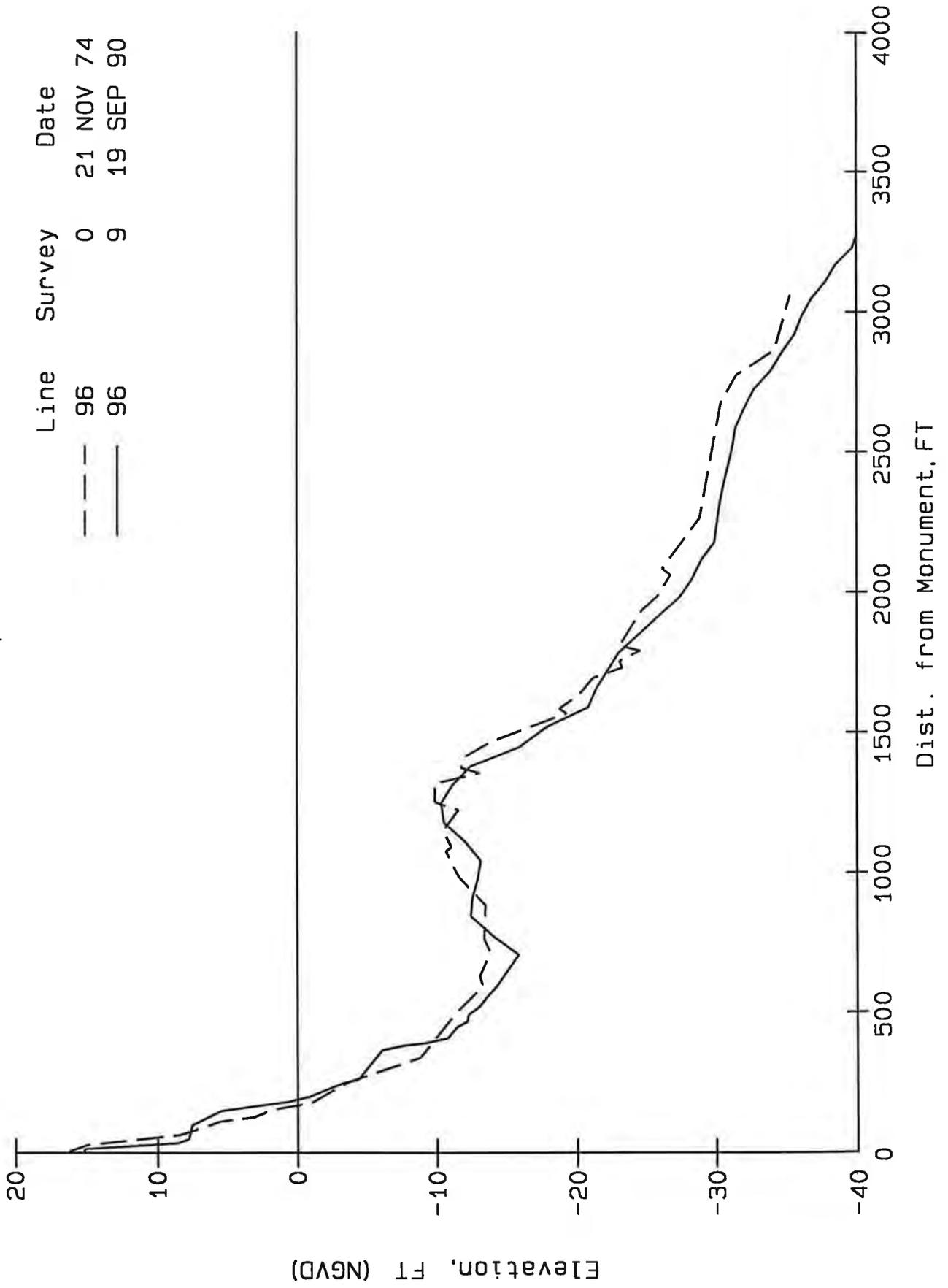
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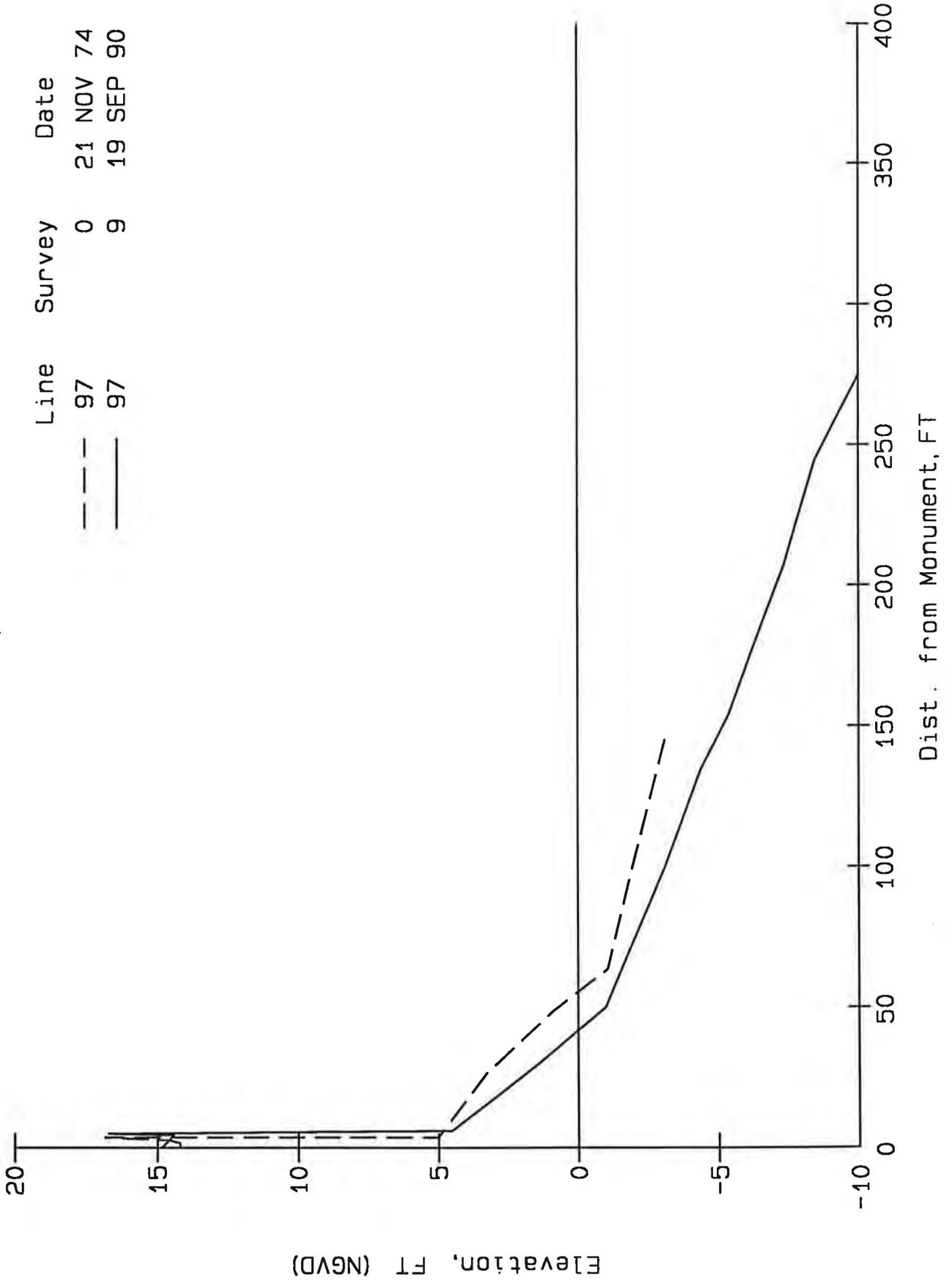
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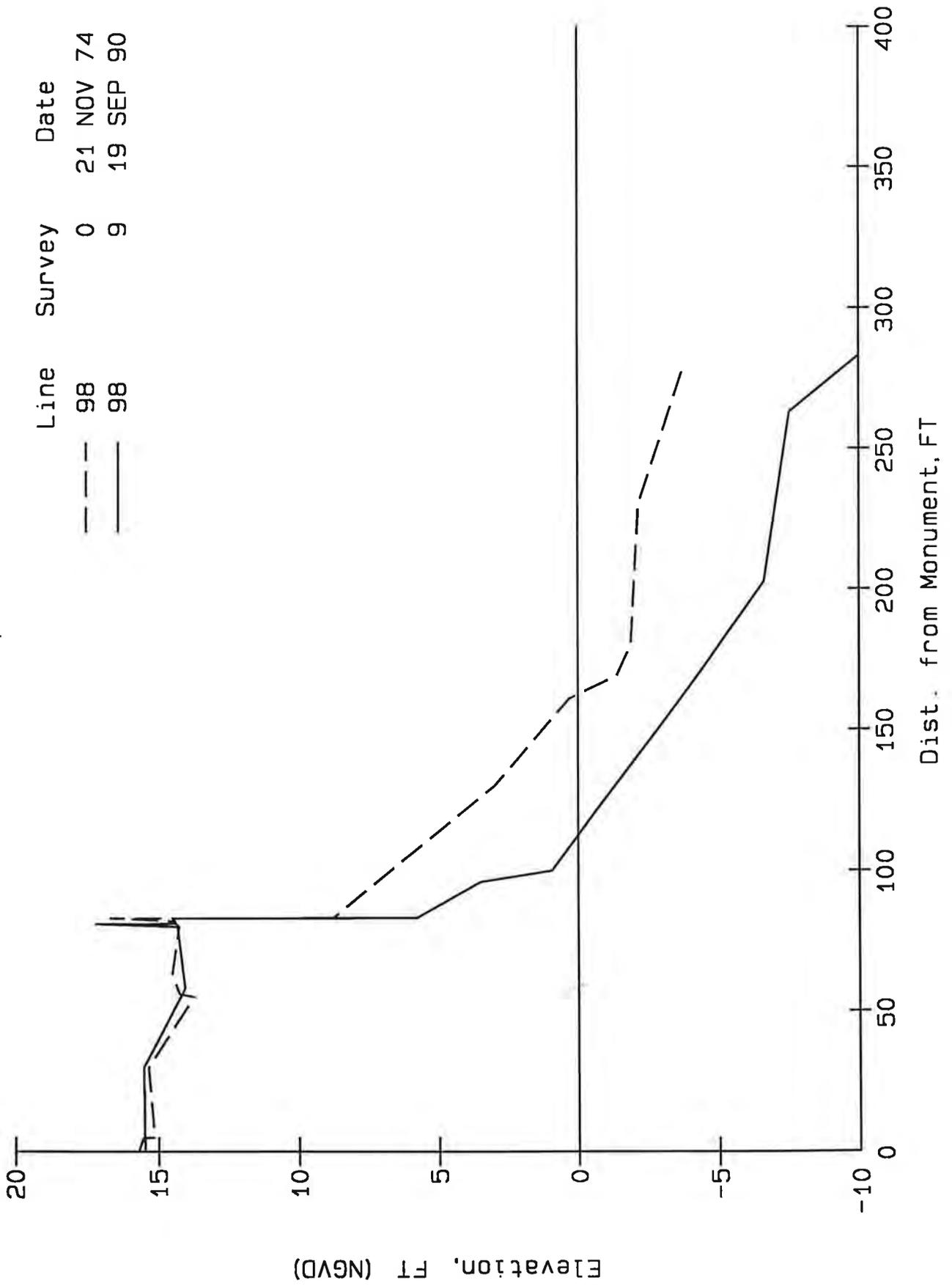
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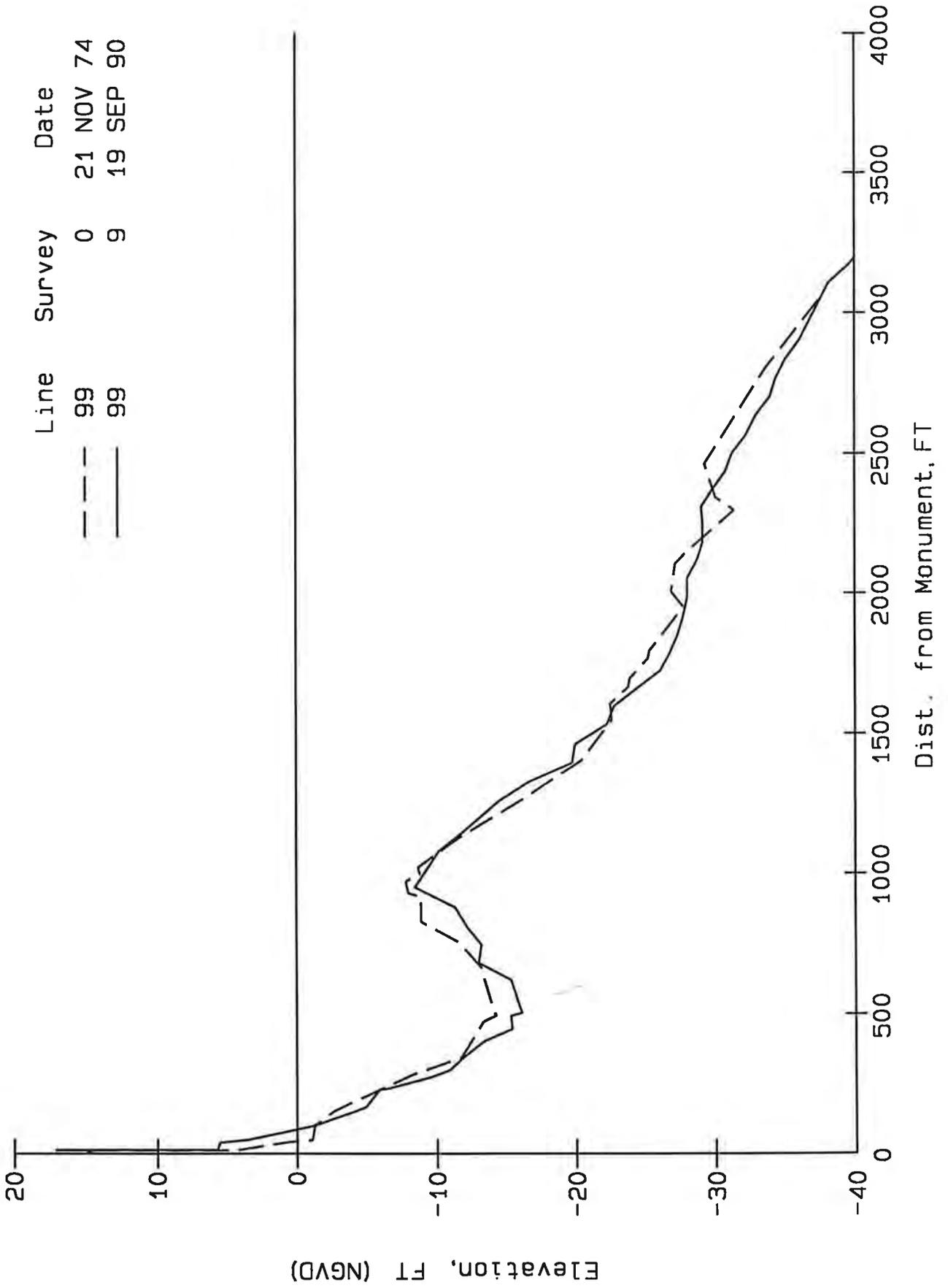
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Beach Profile Comparisons (1974 to 1990)



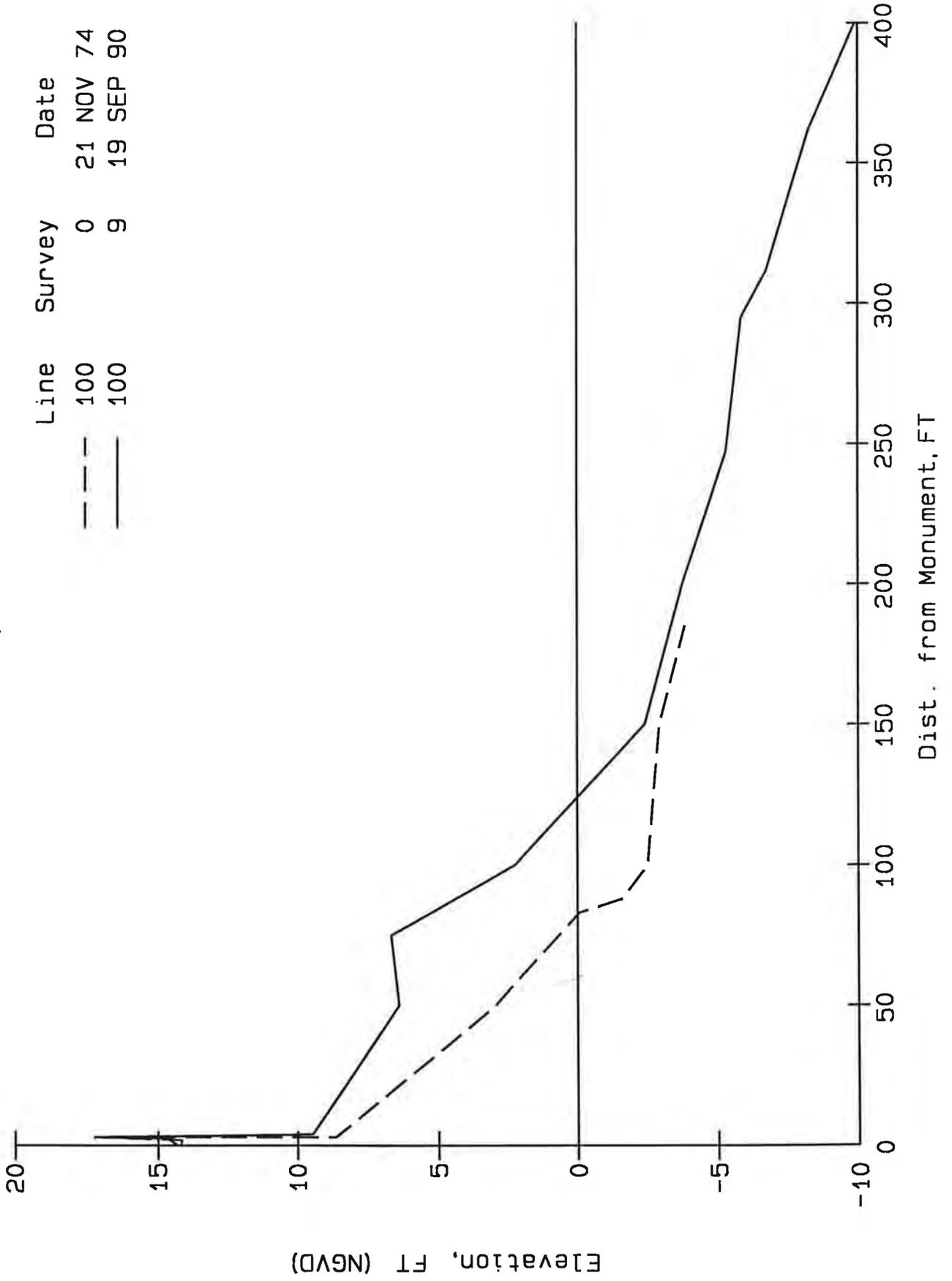
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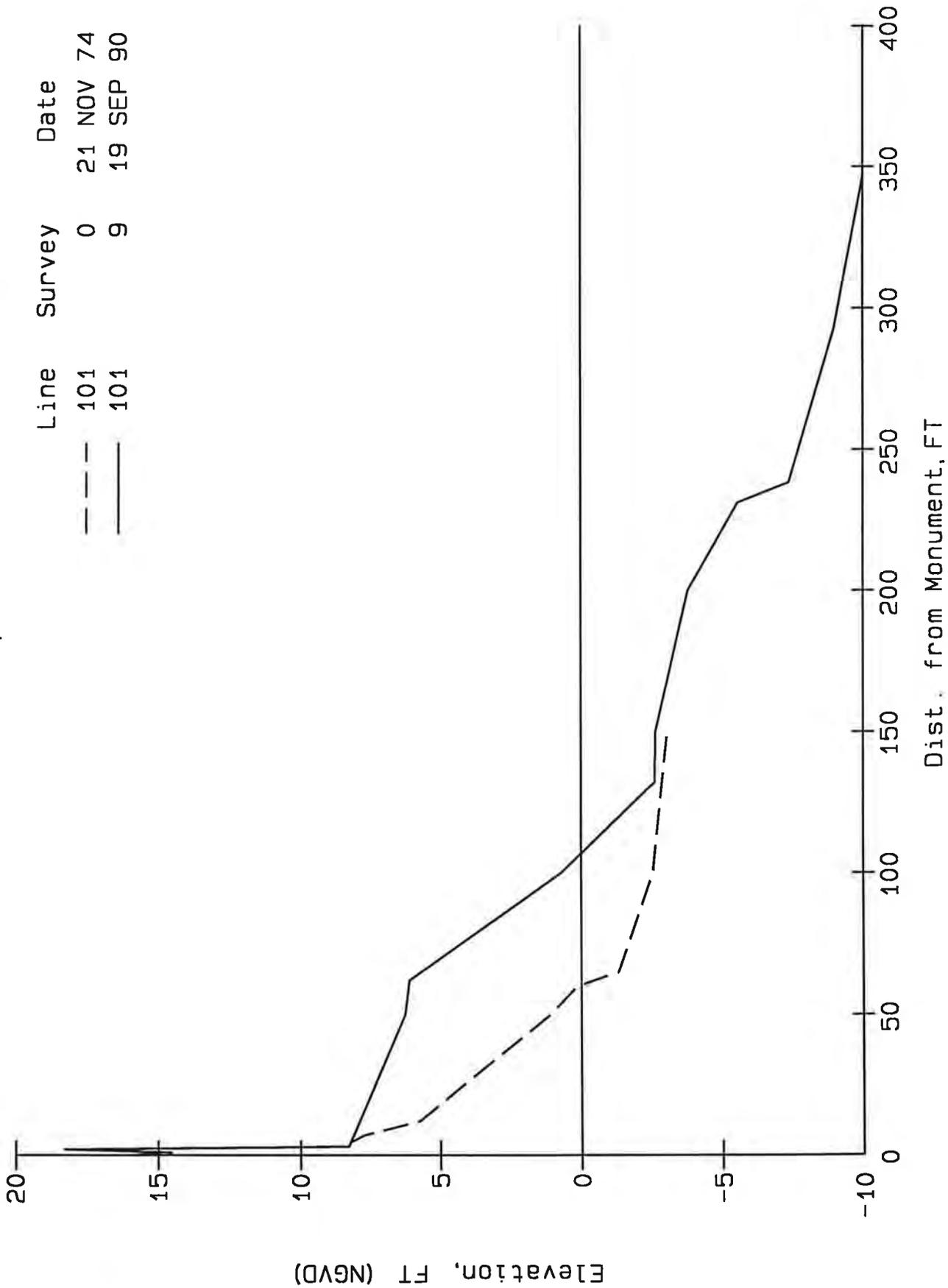
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Beach Profile Comparisons (1974 to 1990)



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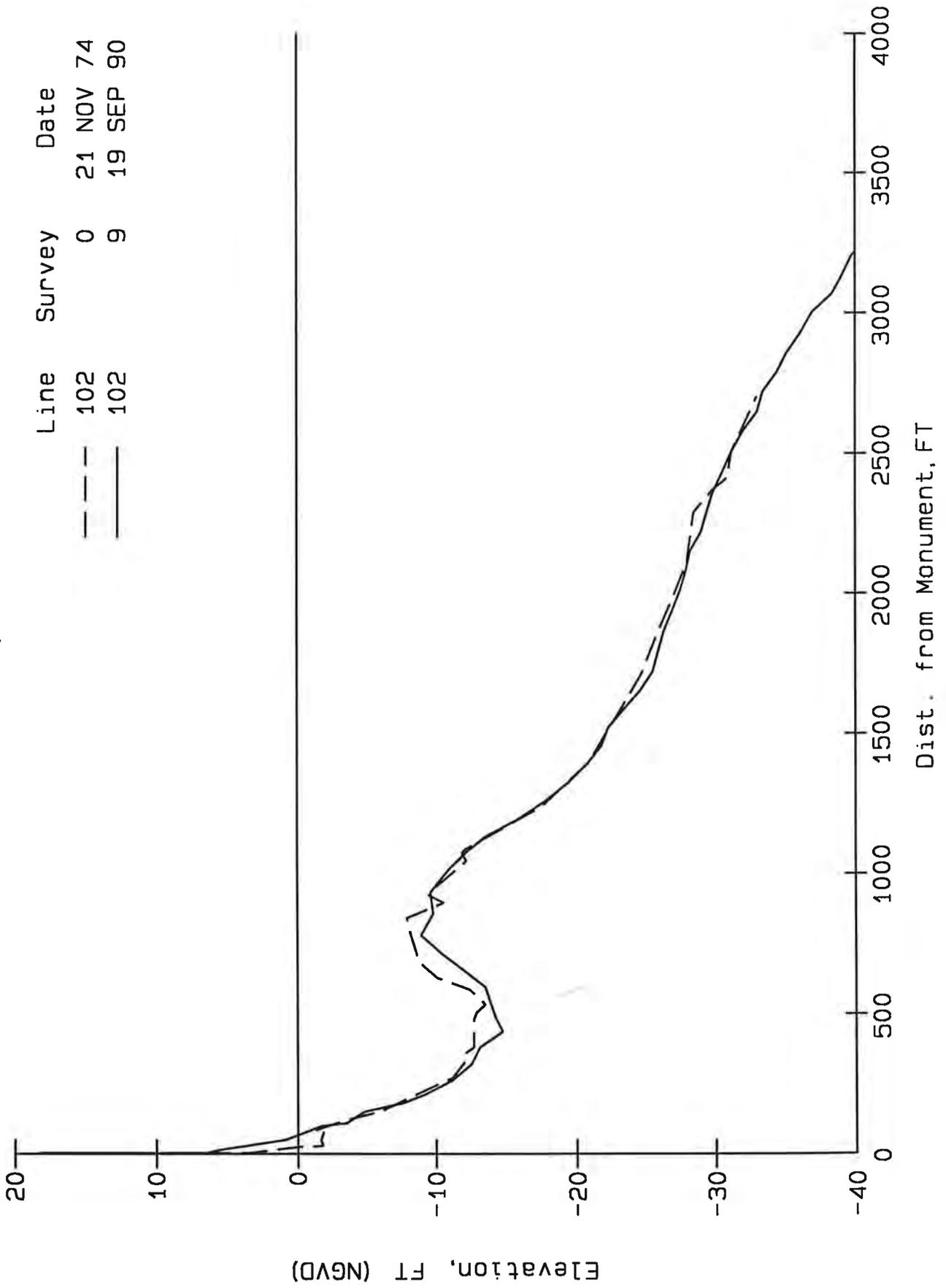


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 Beach Profile Comparisons (1974 to 1990)

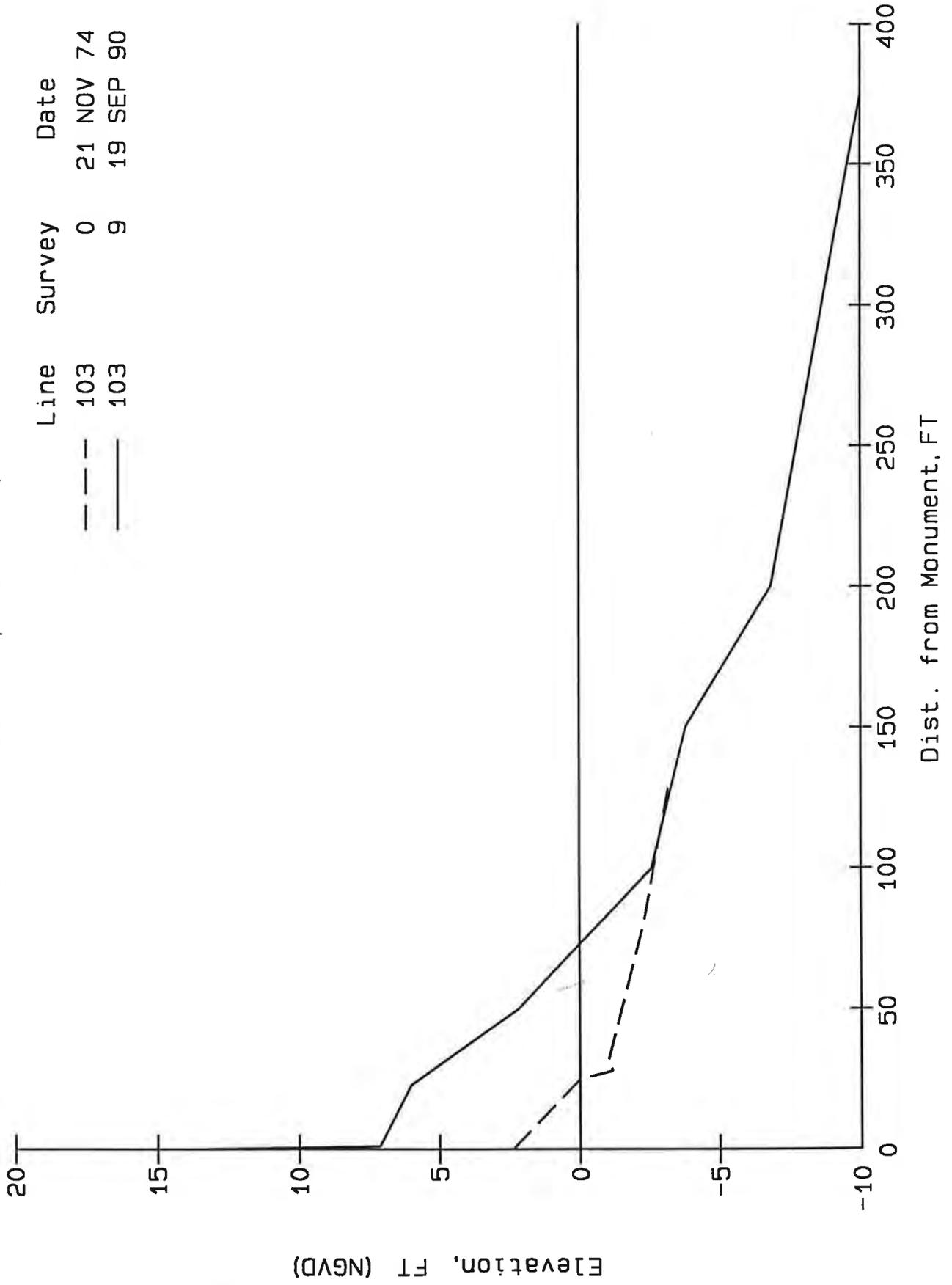


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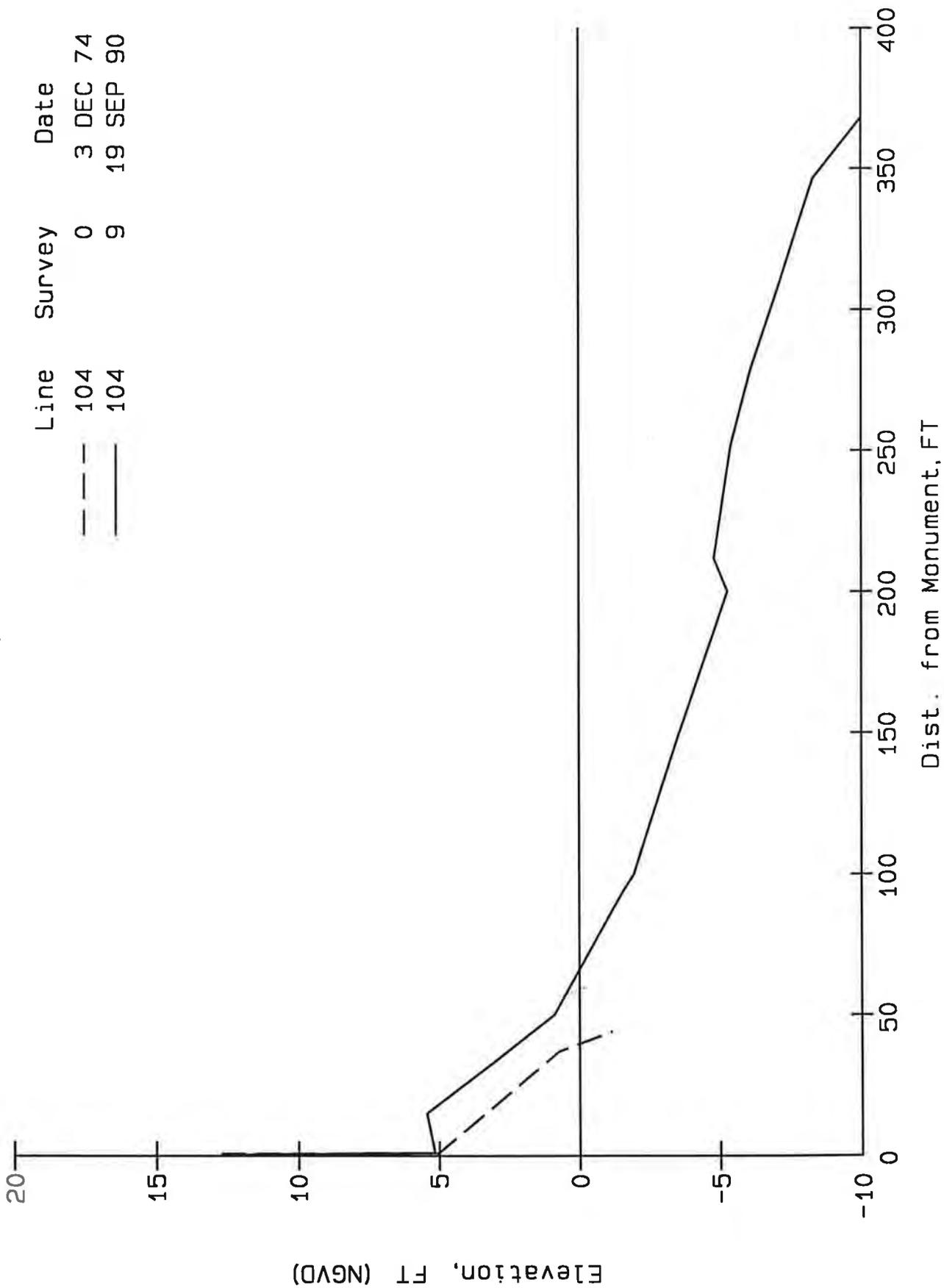
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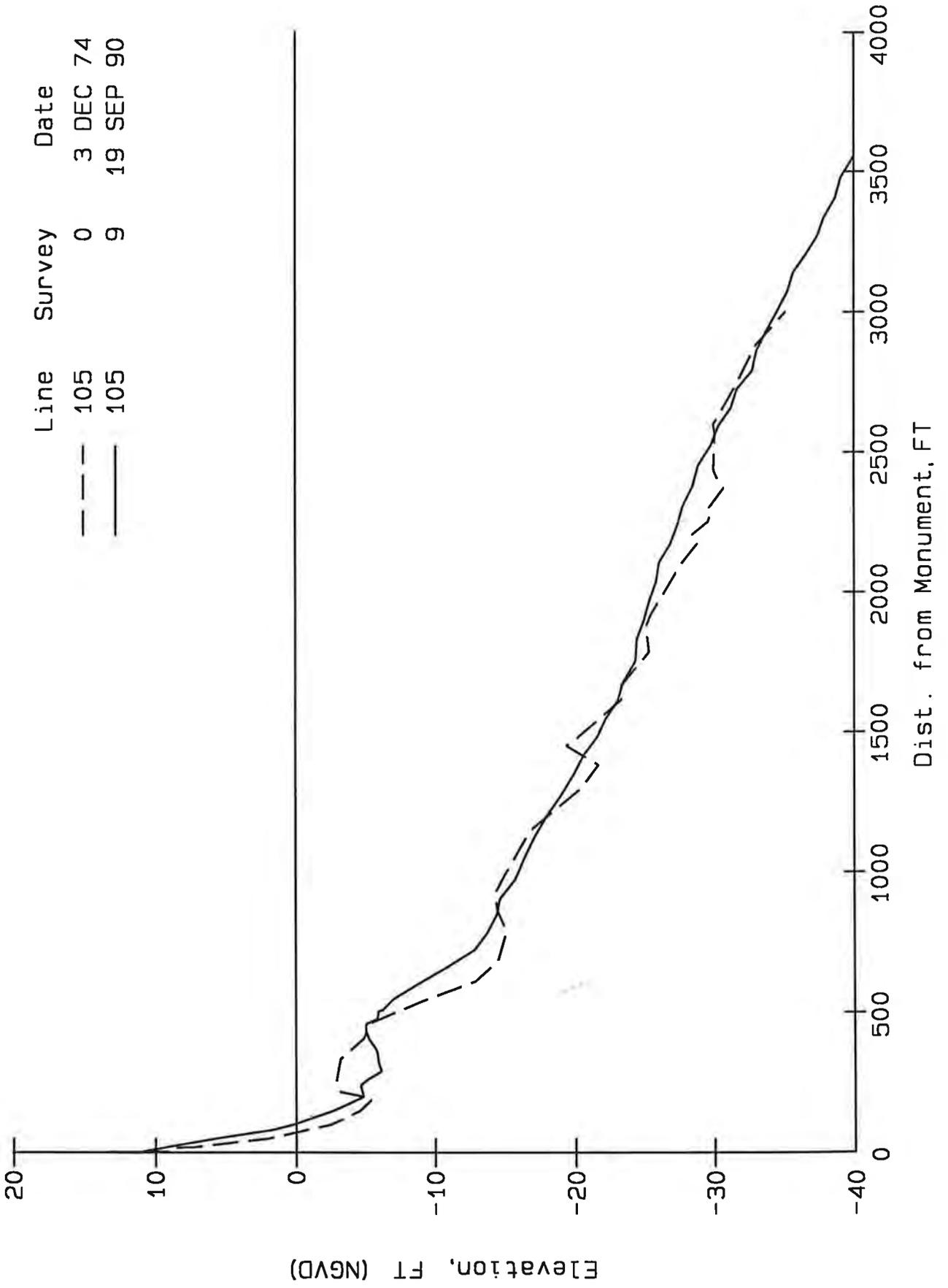
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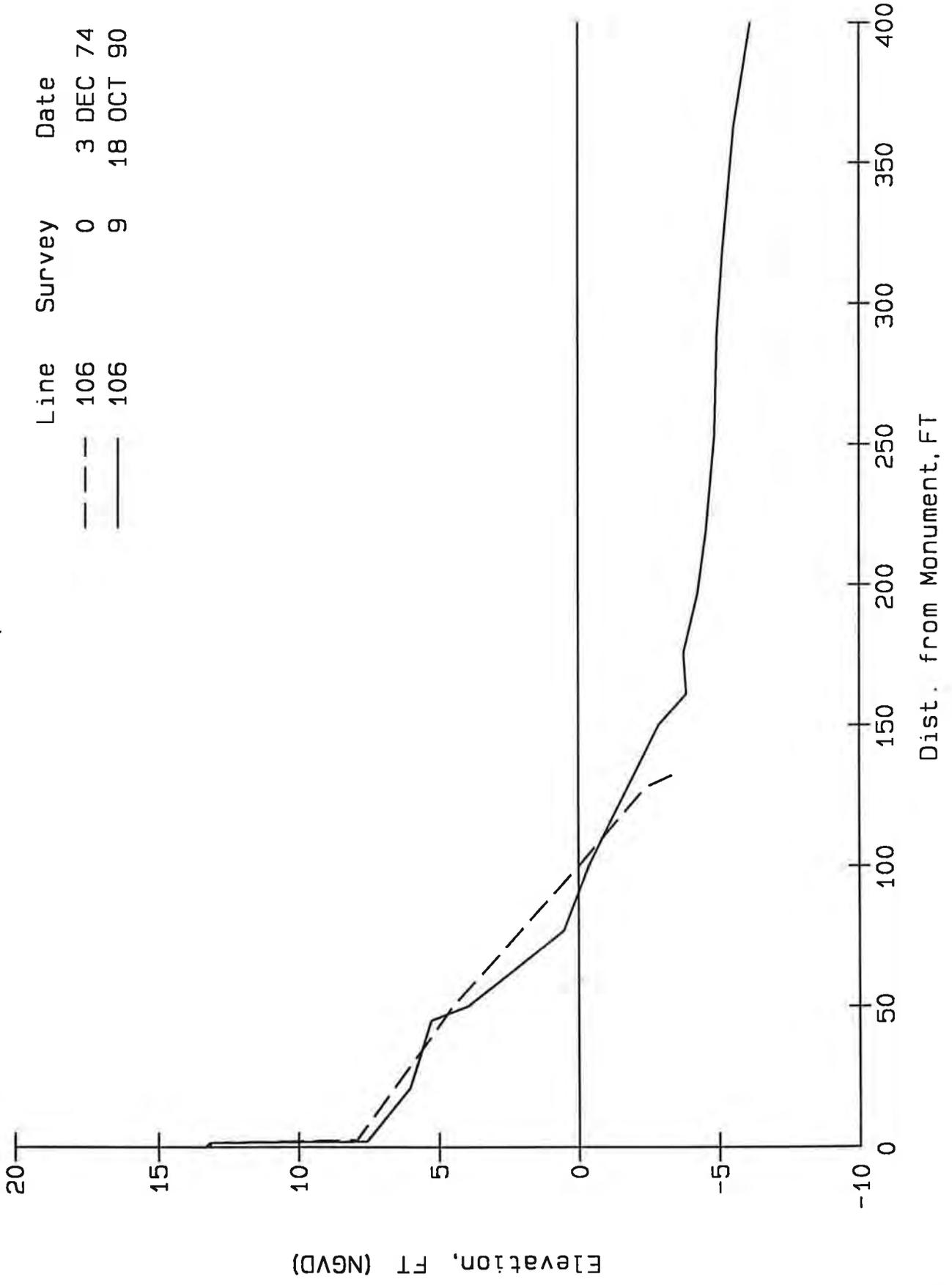
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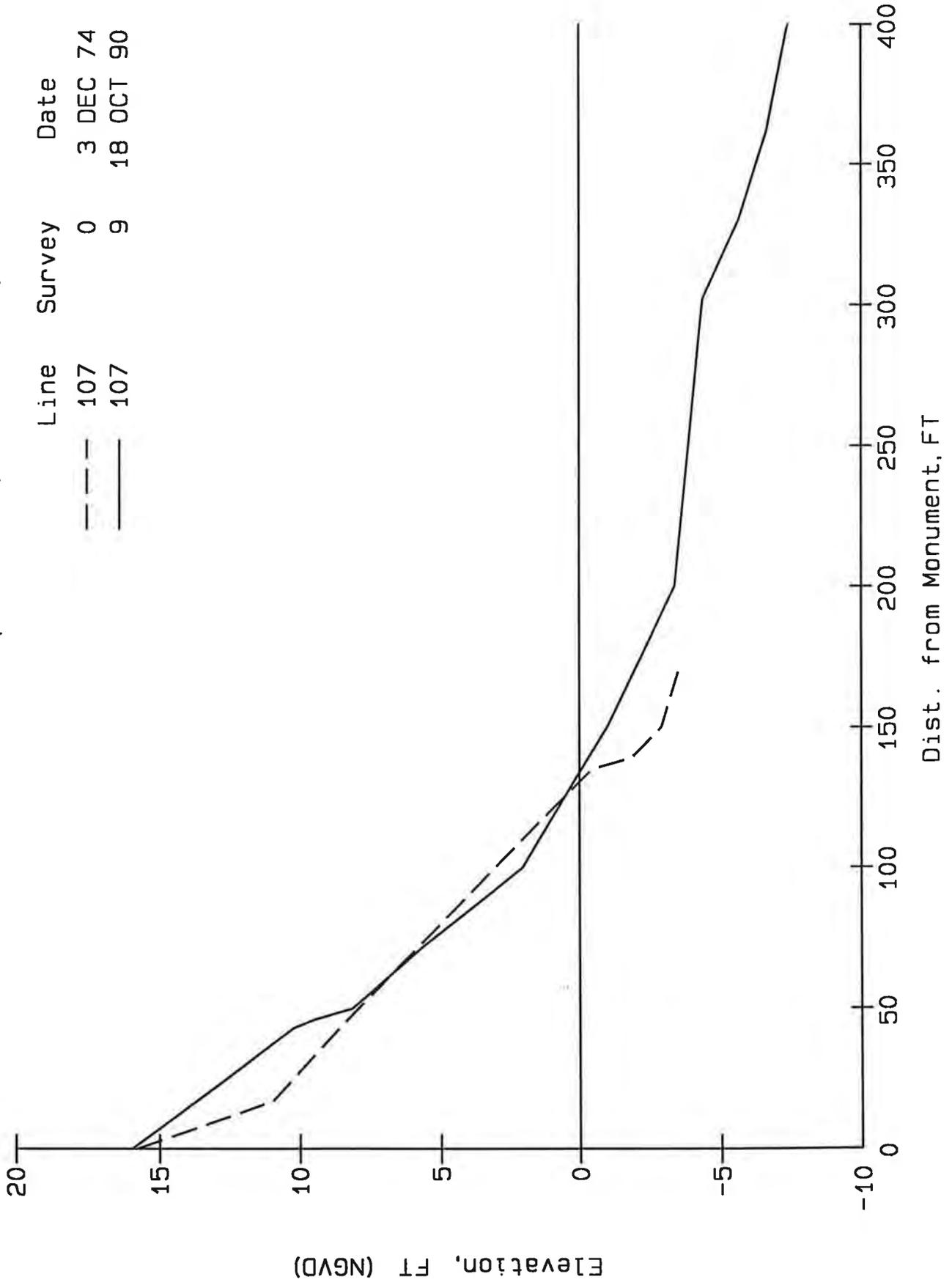
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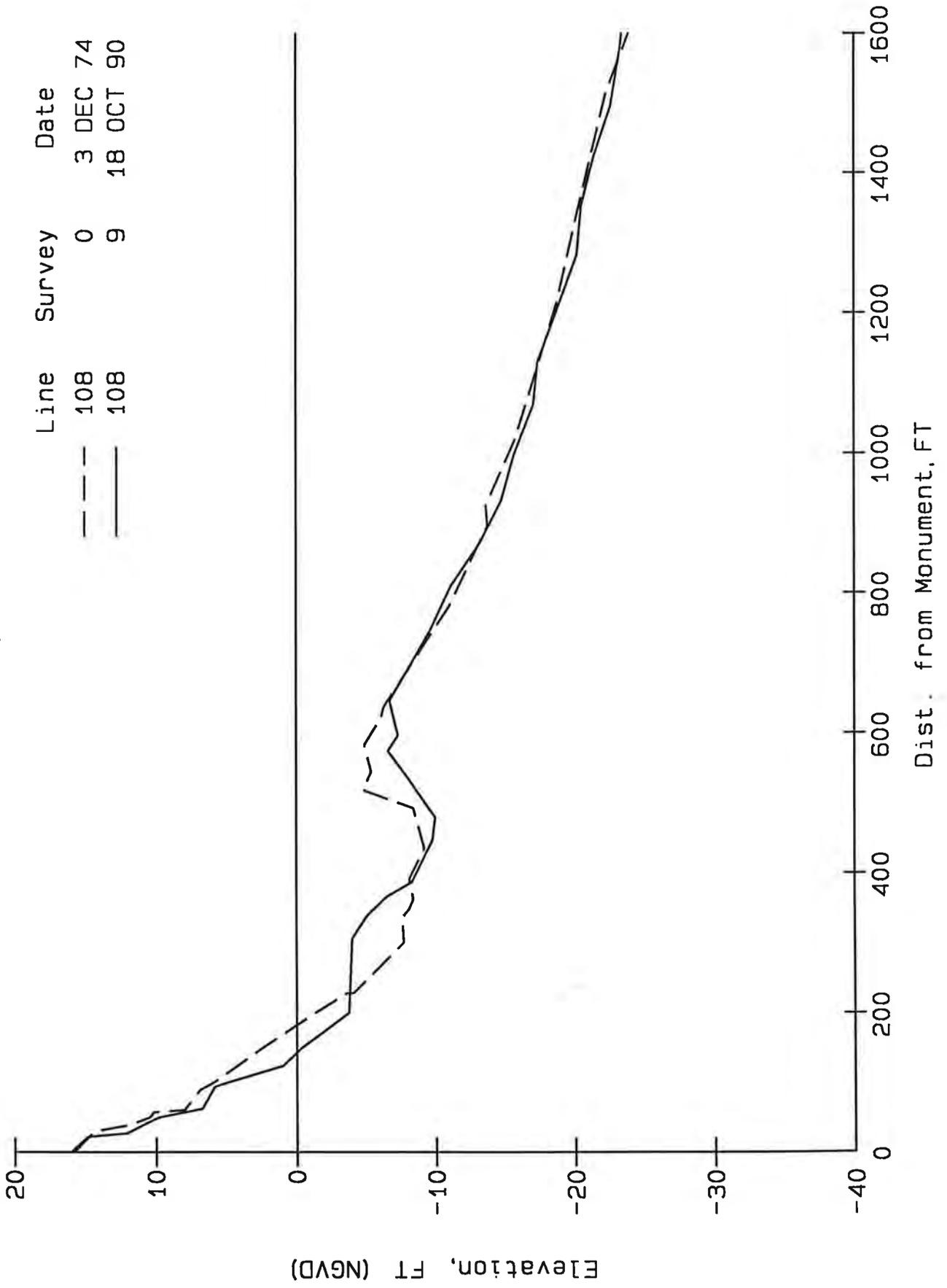
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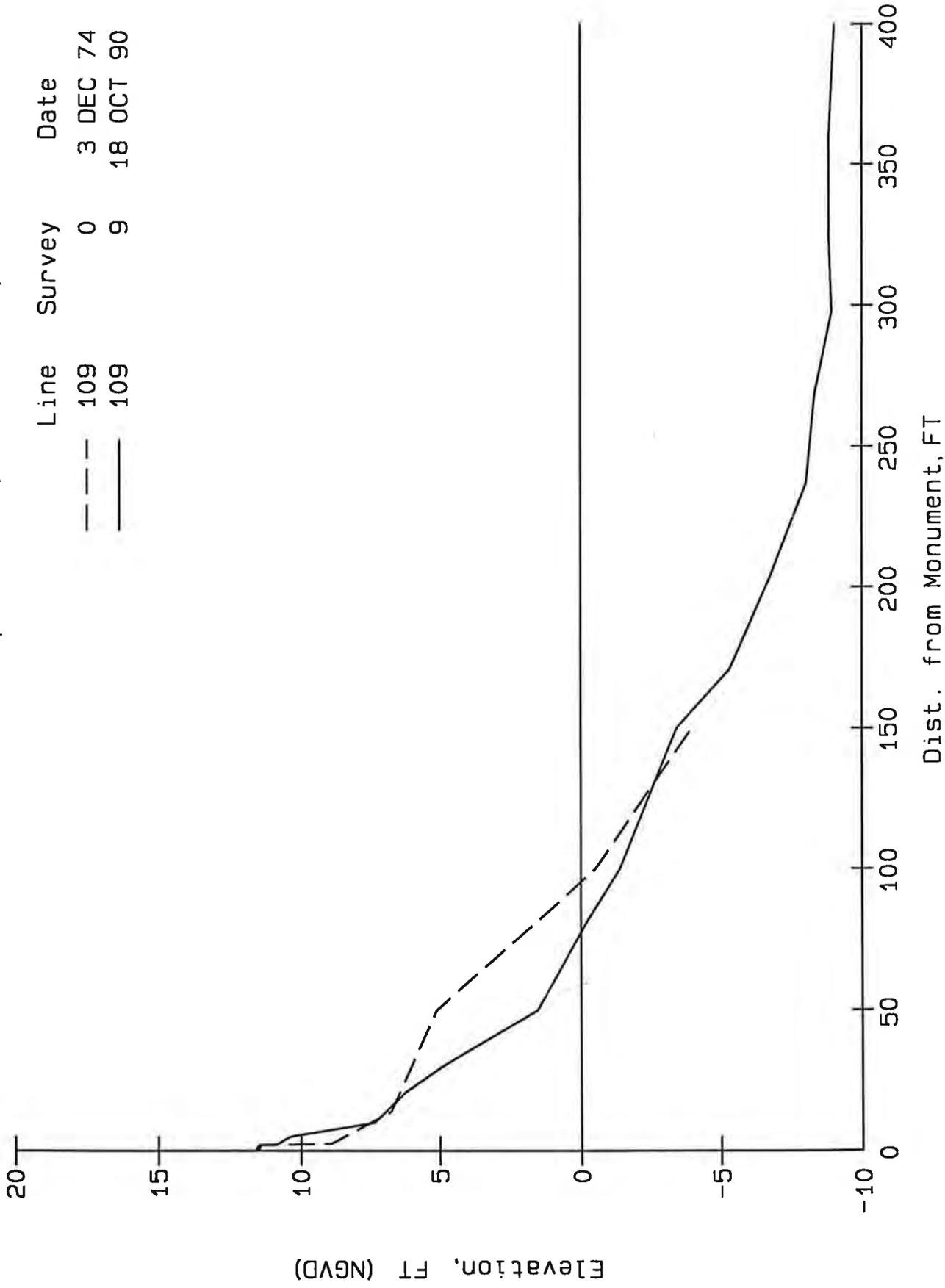
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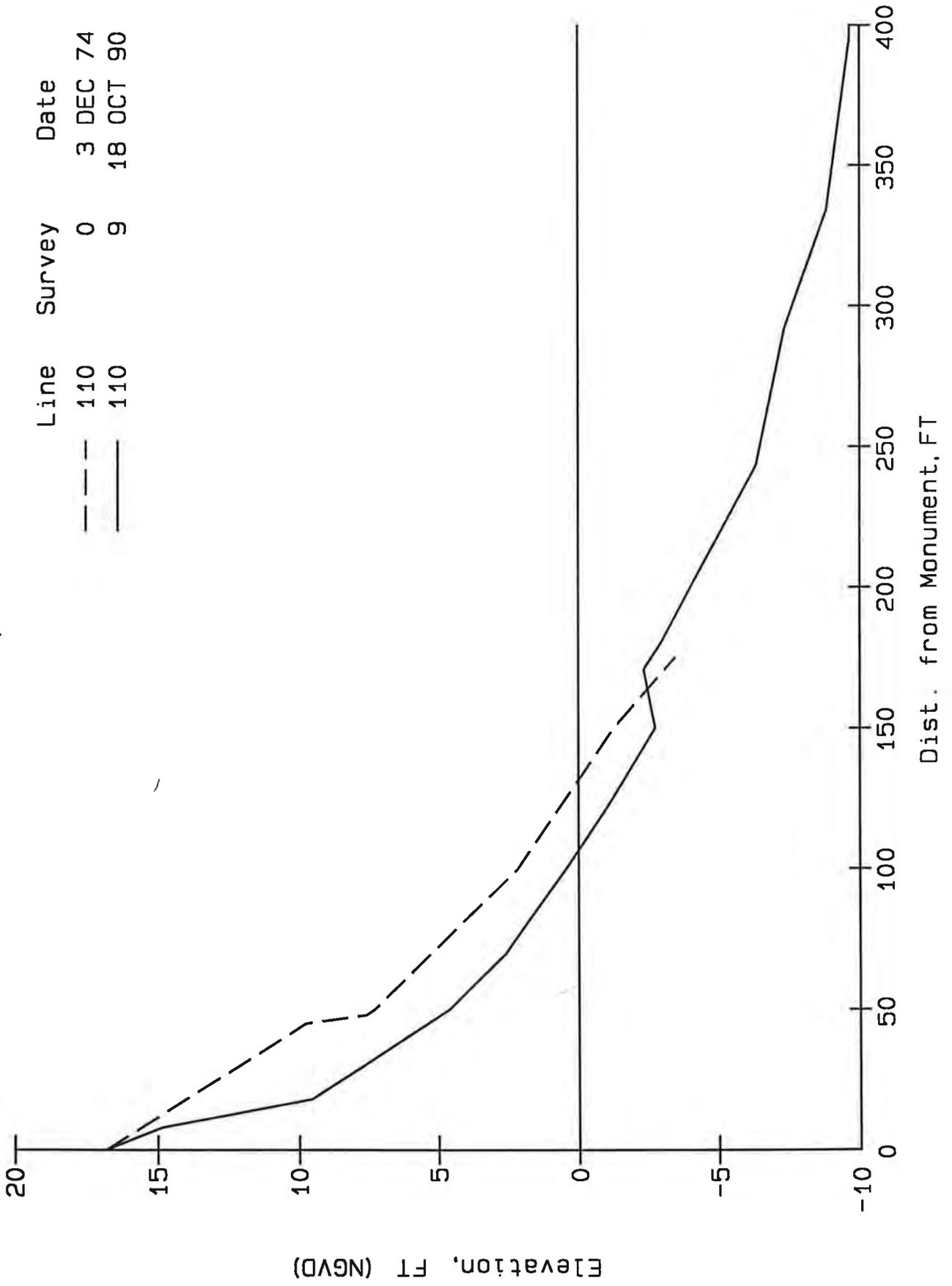
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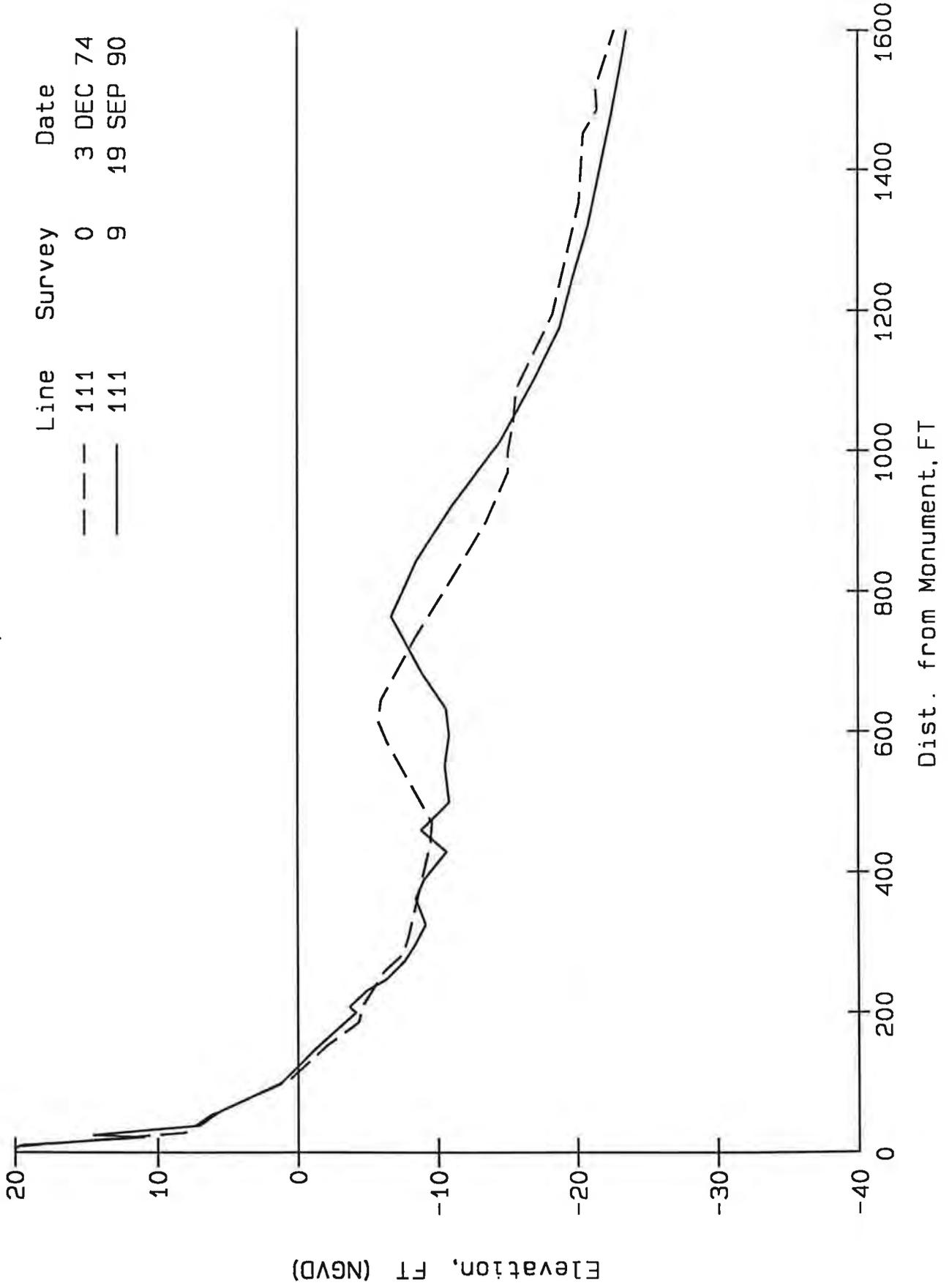
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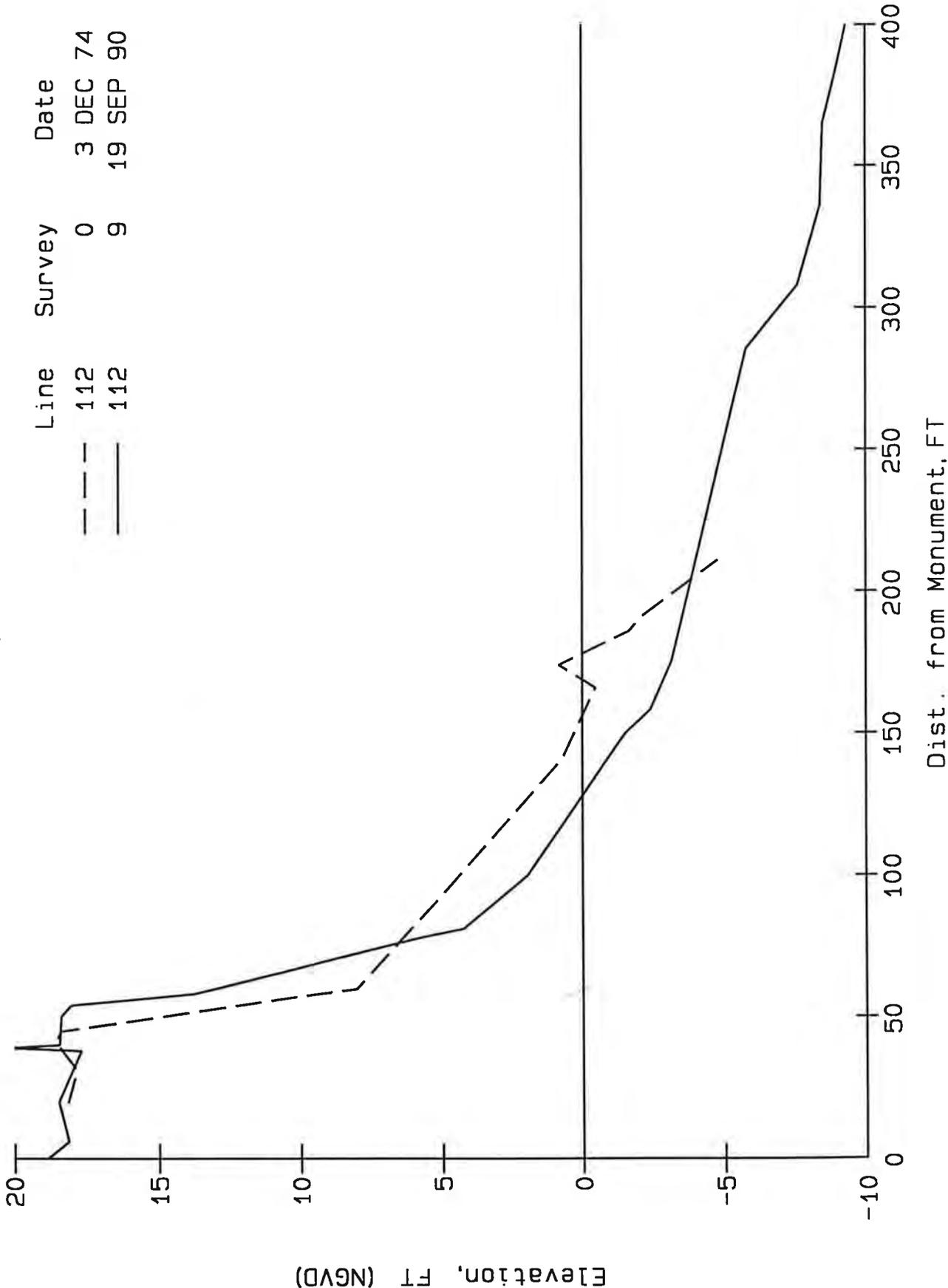
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Palm Beach Island
Beach Profile Comparisons (1974 to 1990)



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 Beach Profile Comparisons (1974 to 1990)

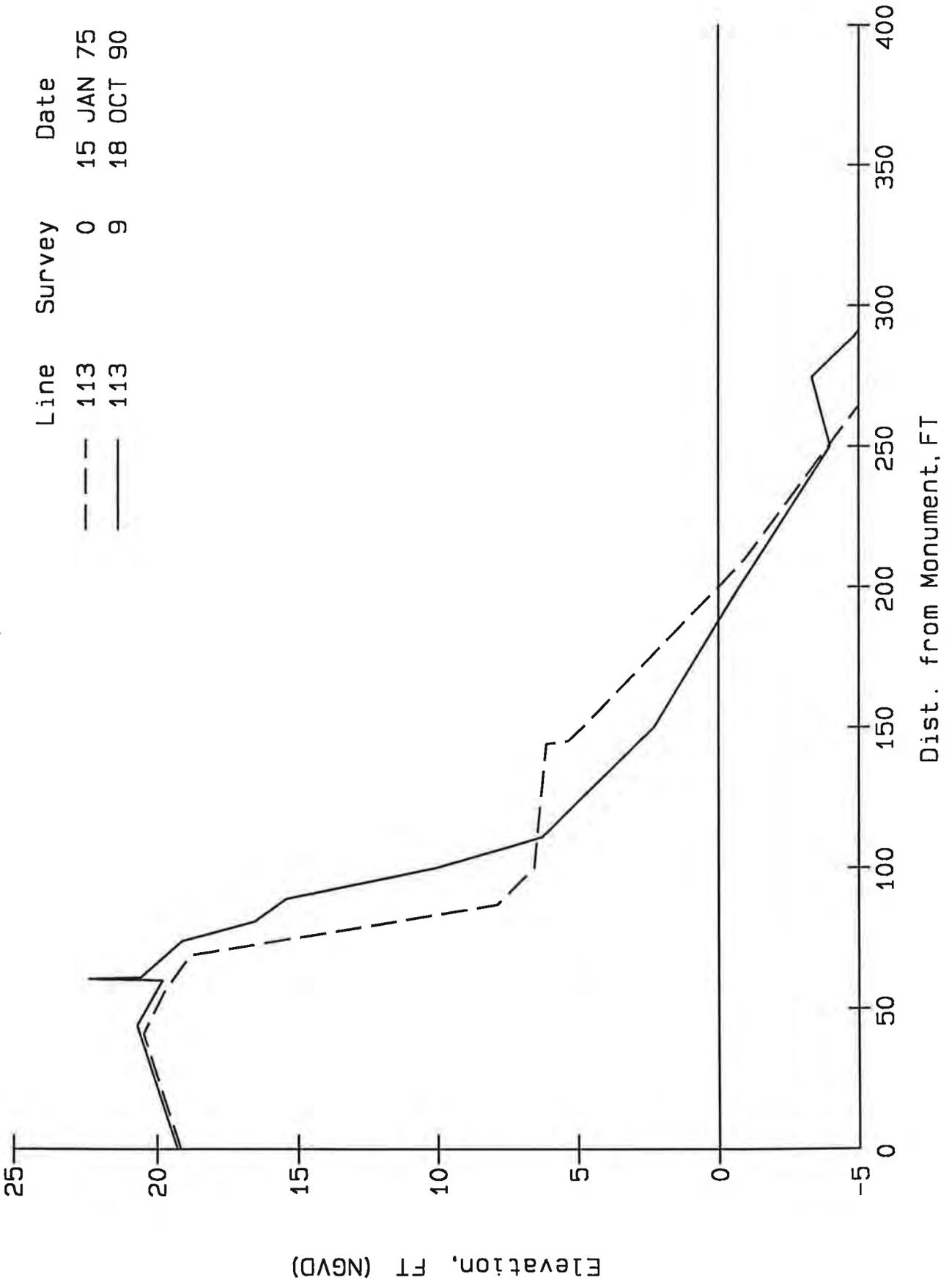


Line	Survey	Date
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—	9	19 SEP 90

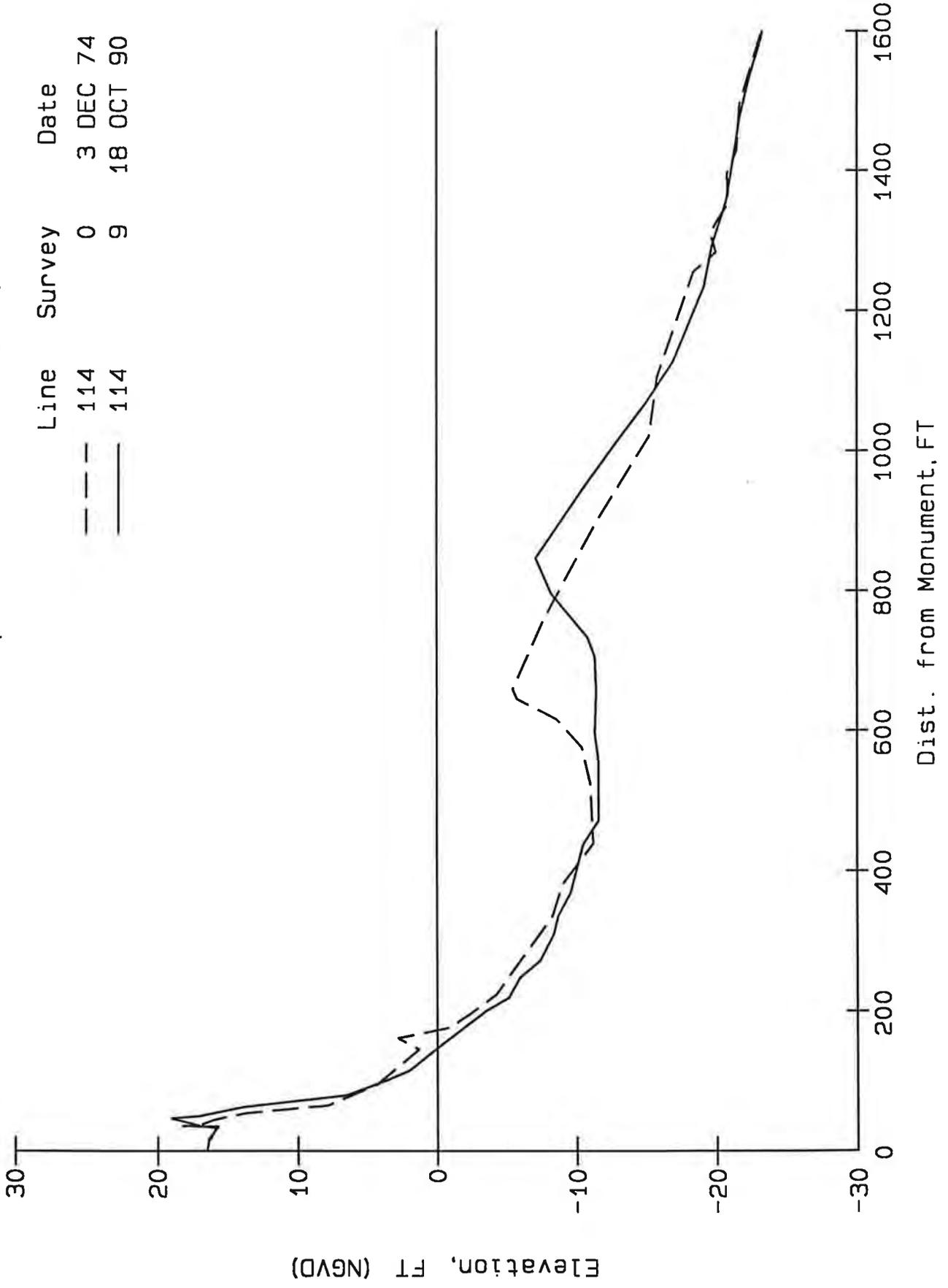
Elevation, FT (NGVD)

Dist. from Monument, FT

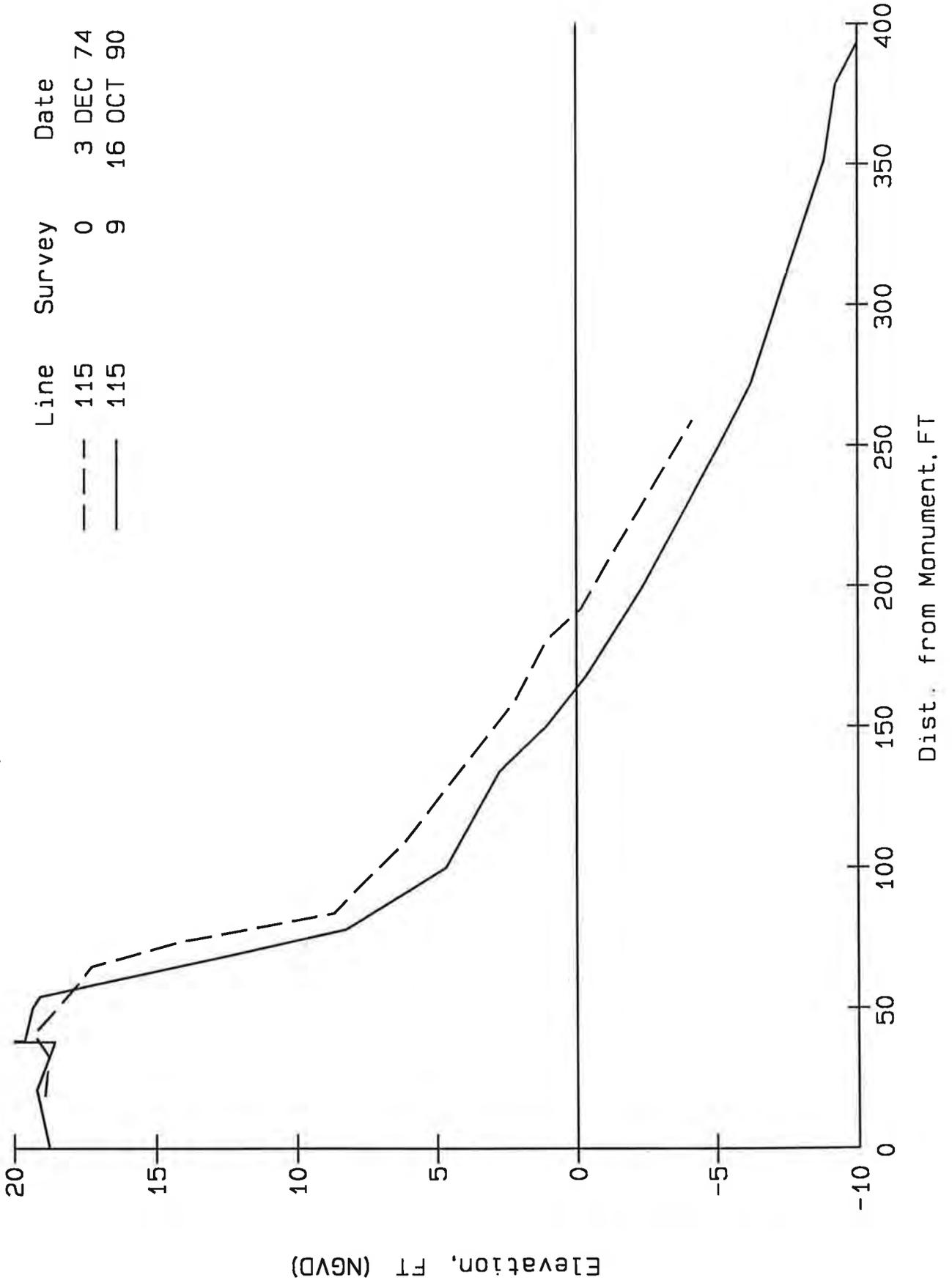
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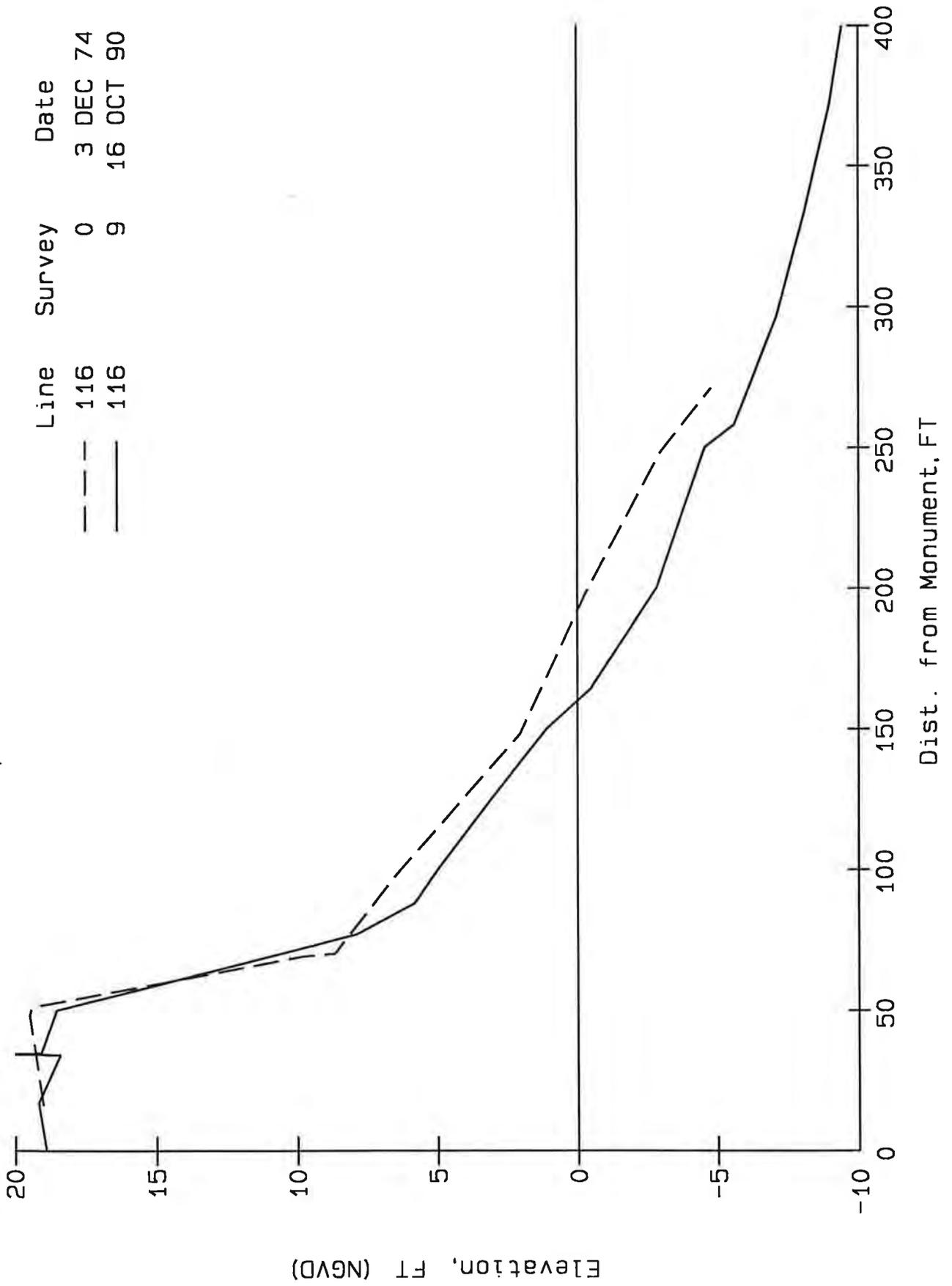
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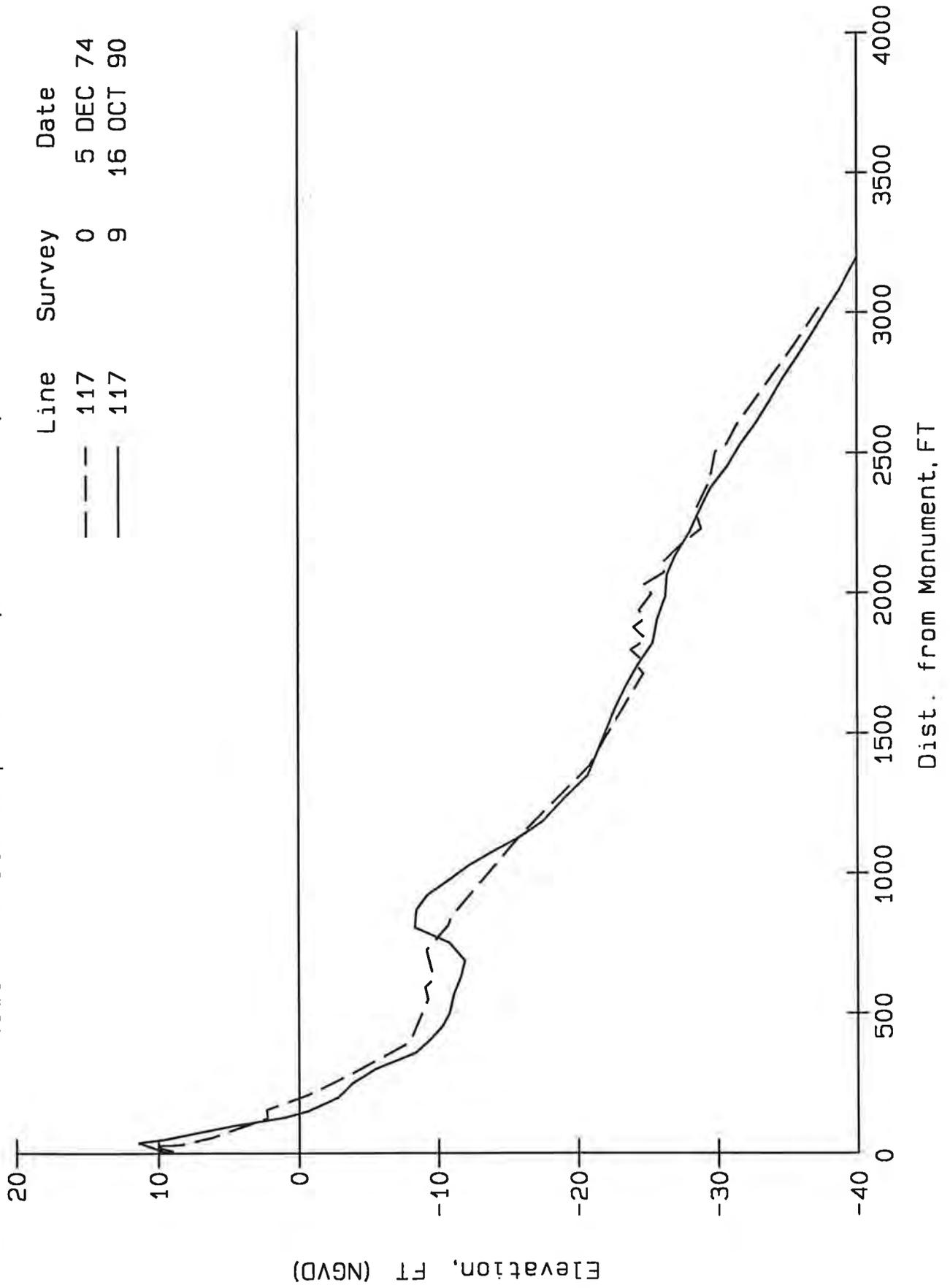
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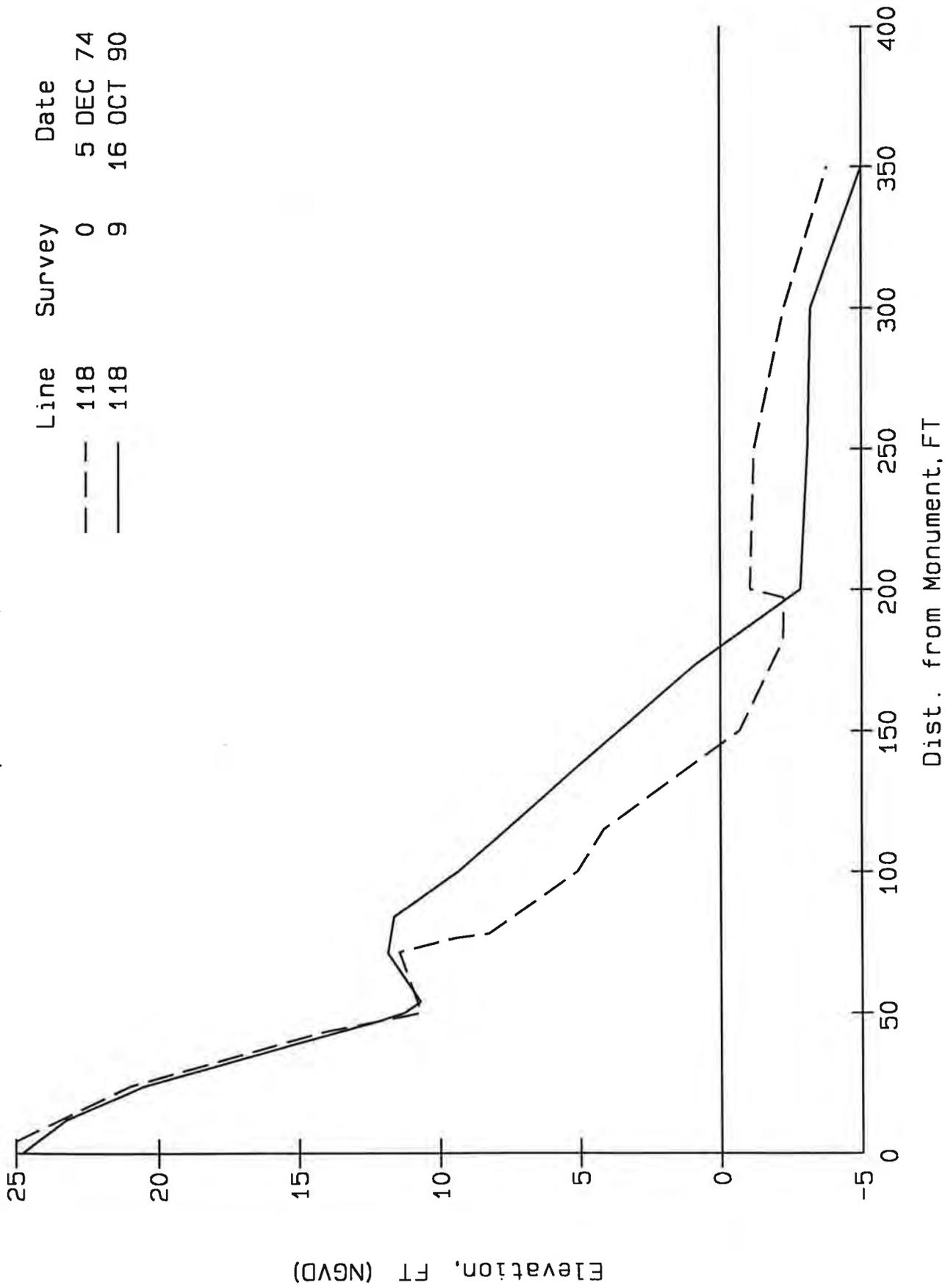
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Beach Profile Comparisons (1974 to 1990)

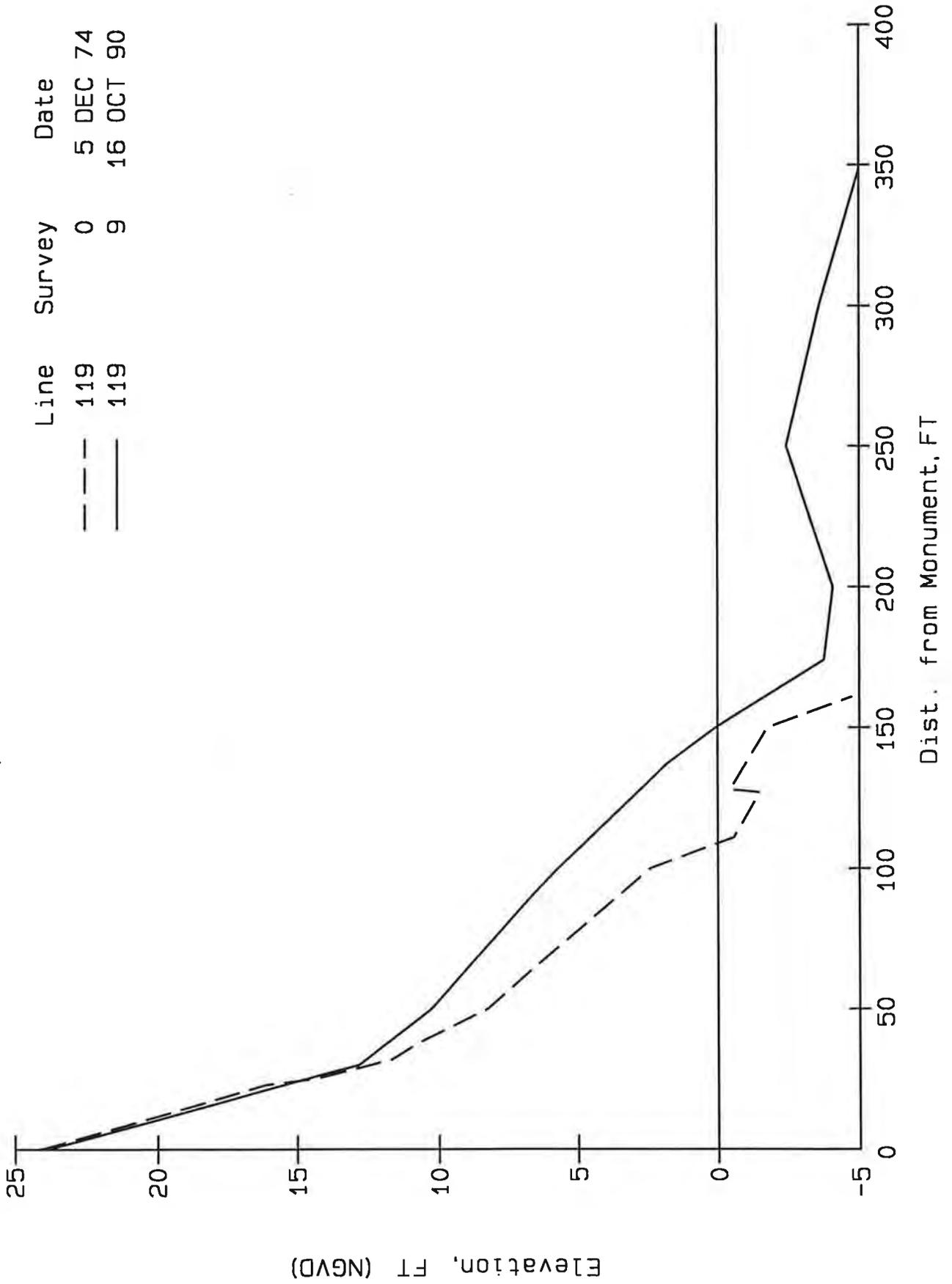


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Beach Profile Comparisons (1974 to 1990)

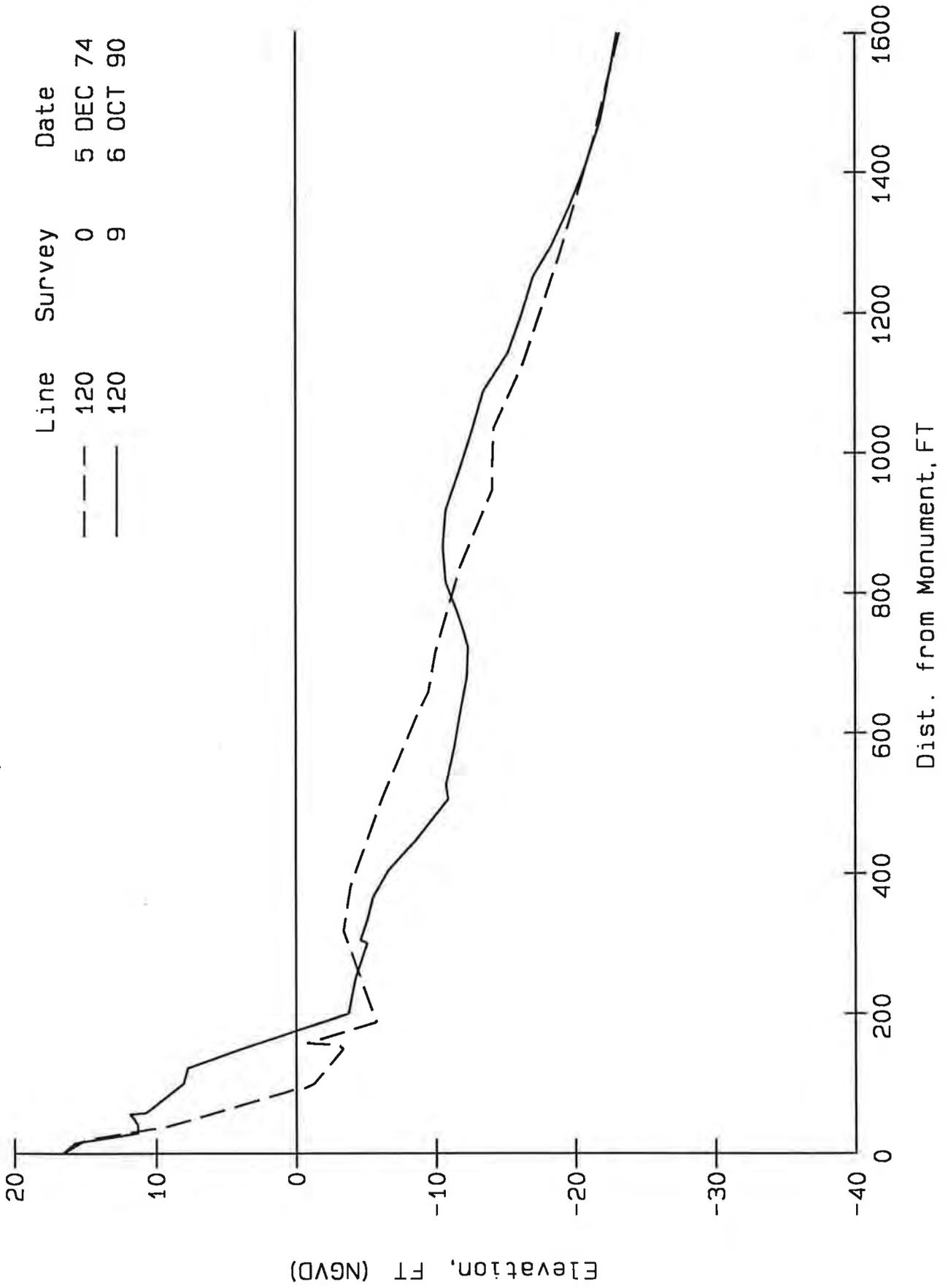


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Beach Profile Comparisons (1974 to 1990)

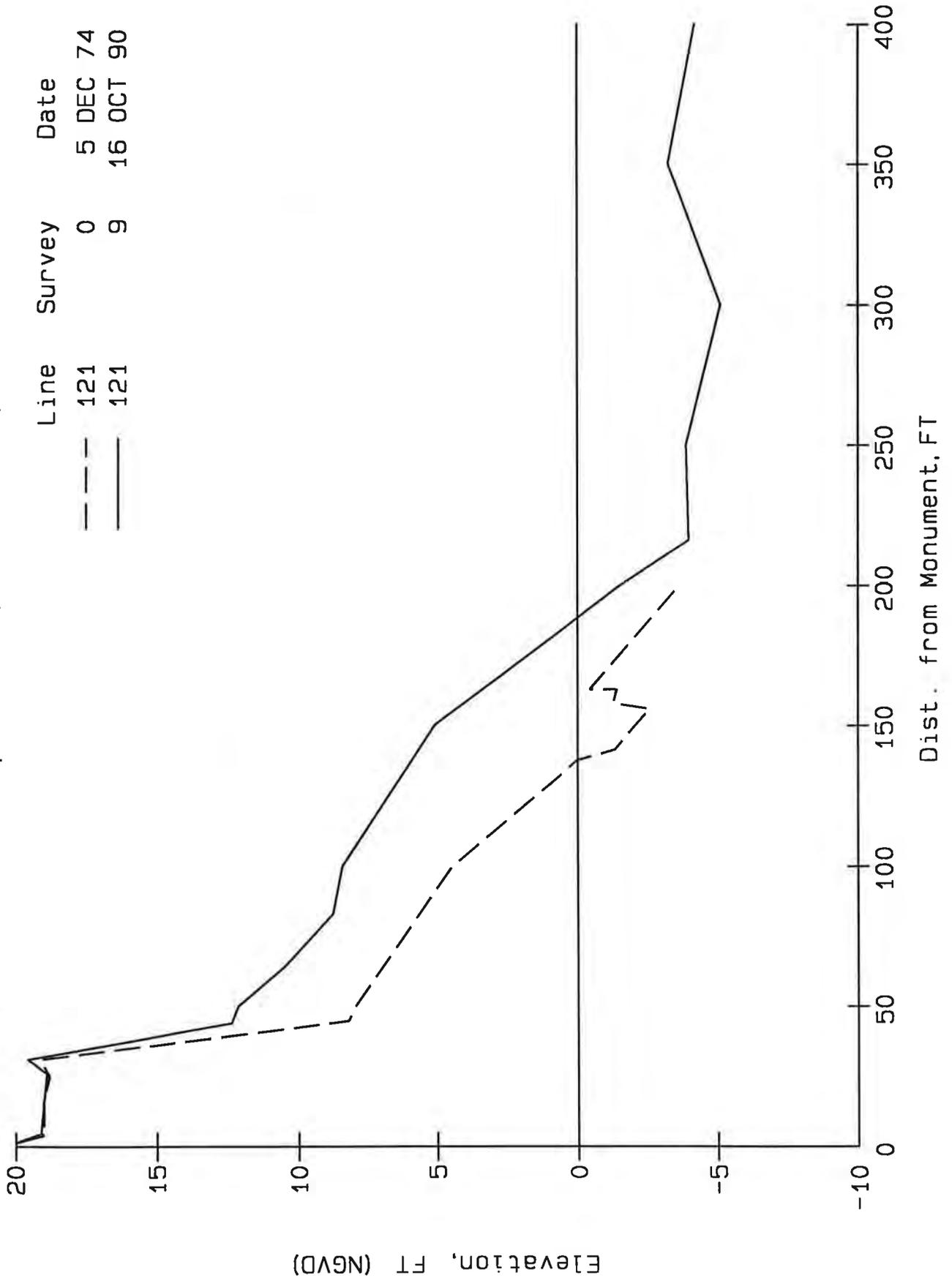
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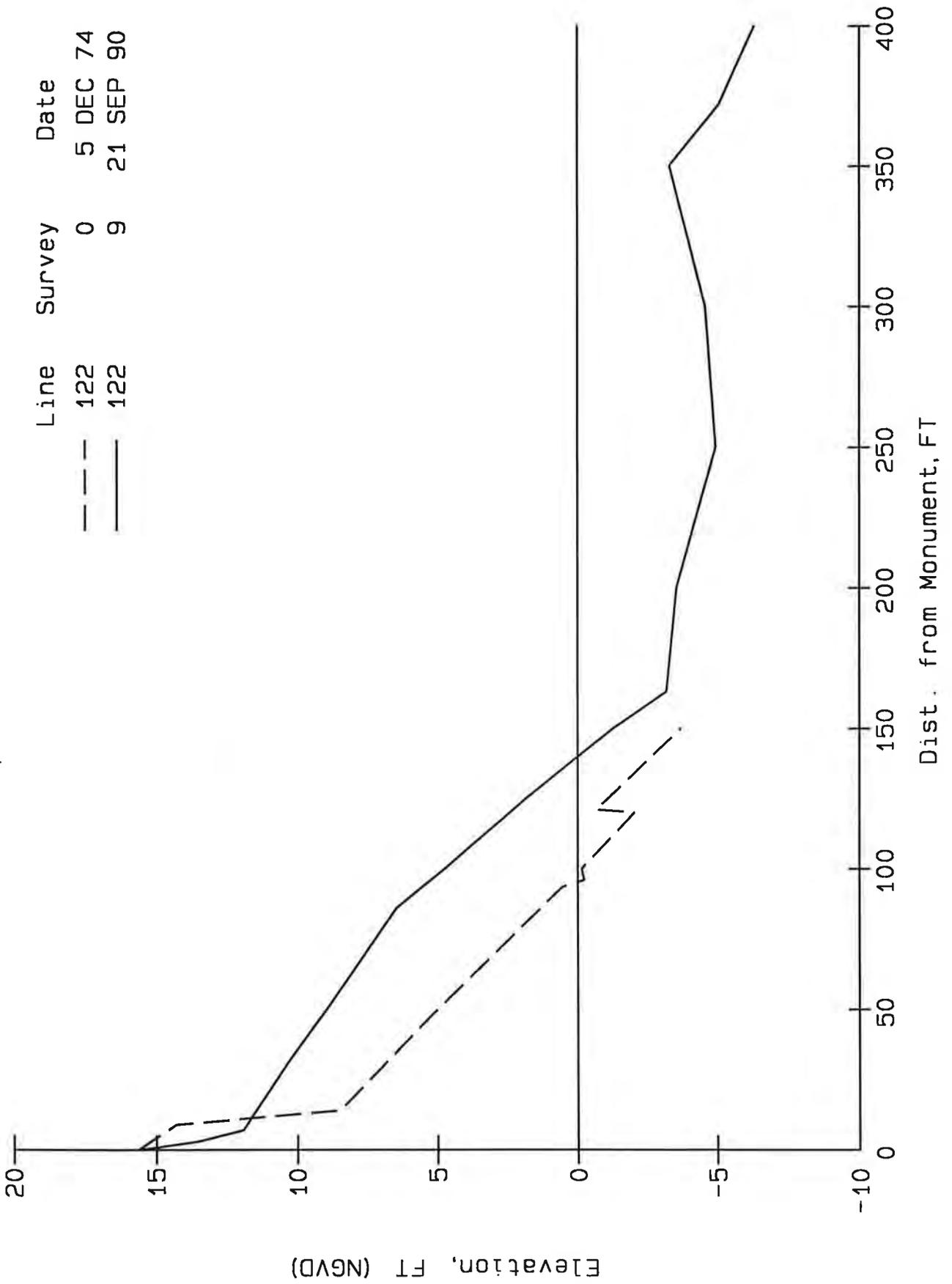
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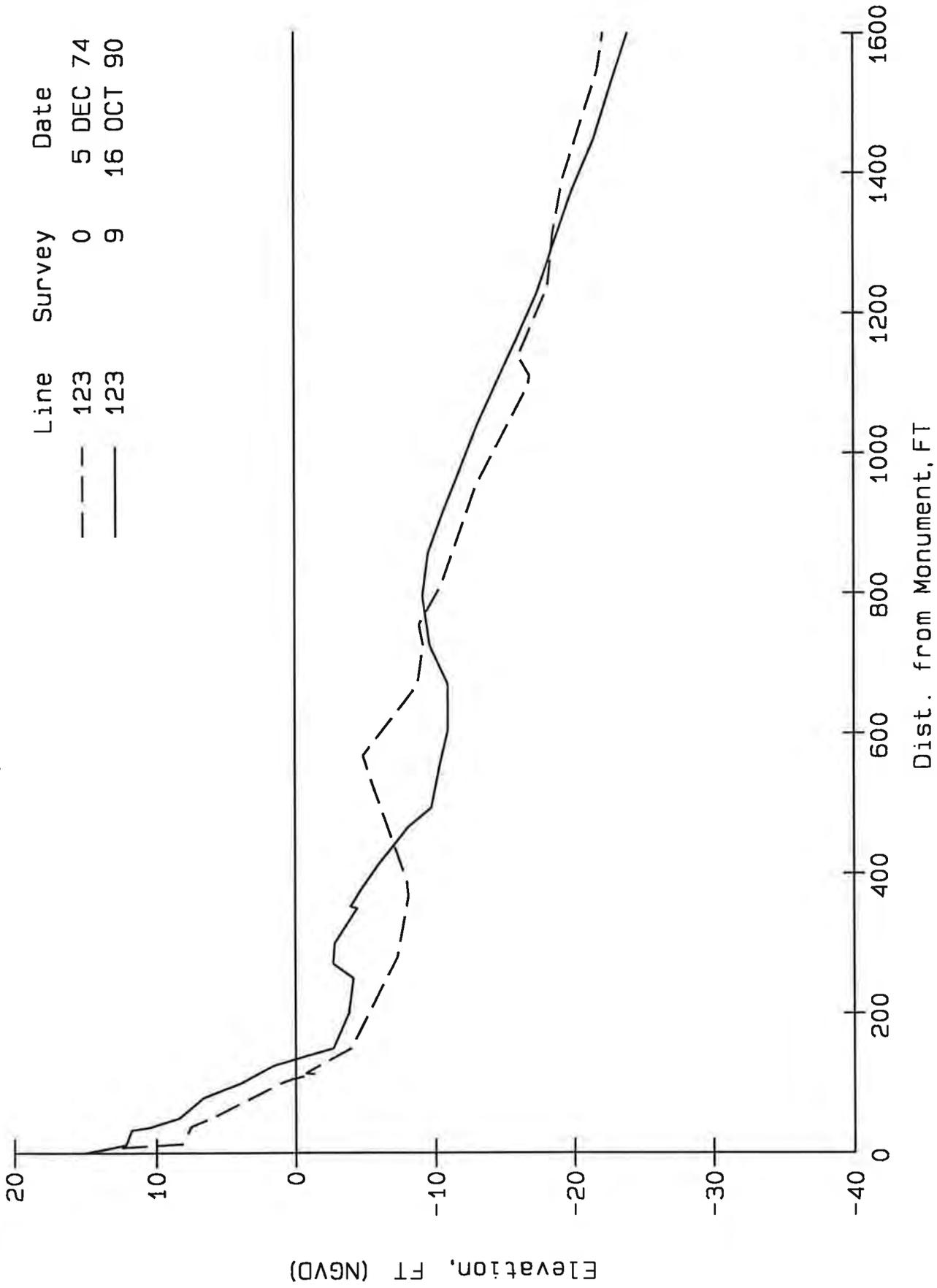
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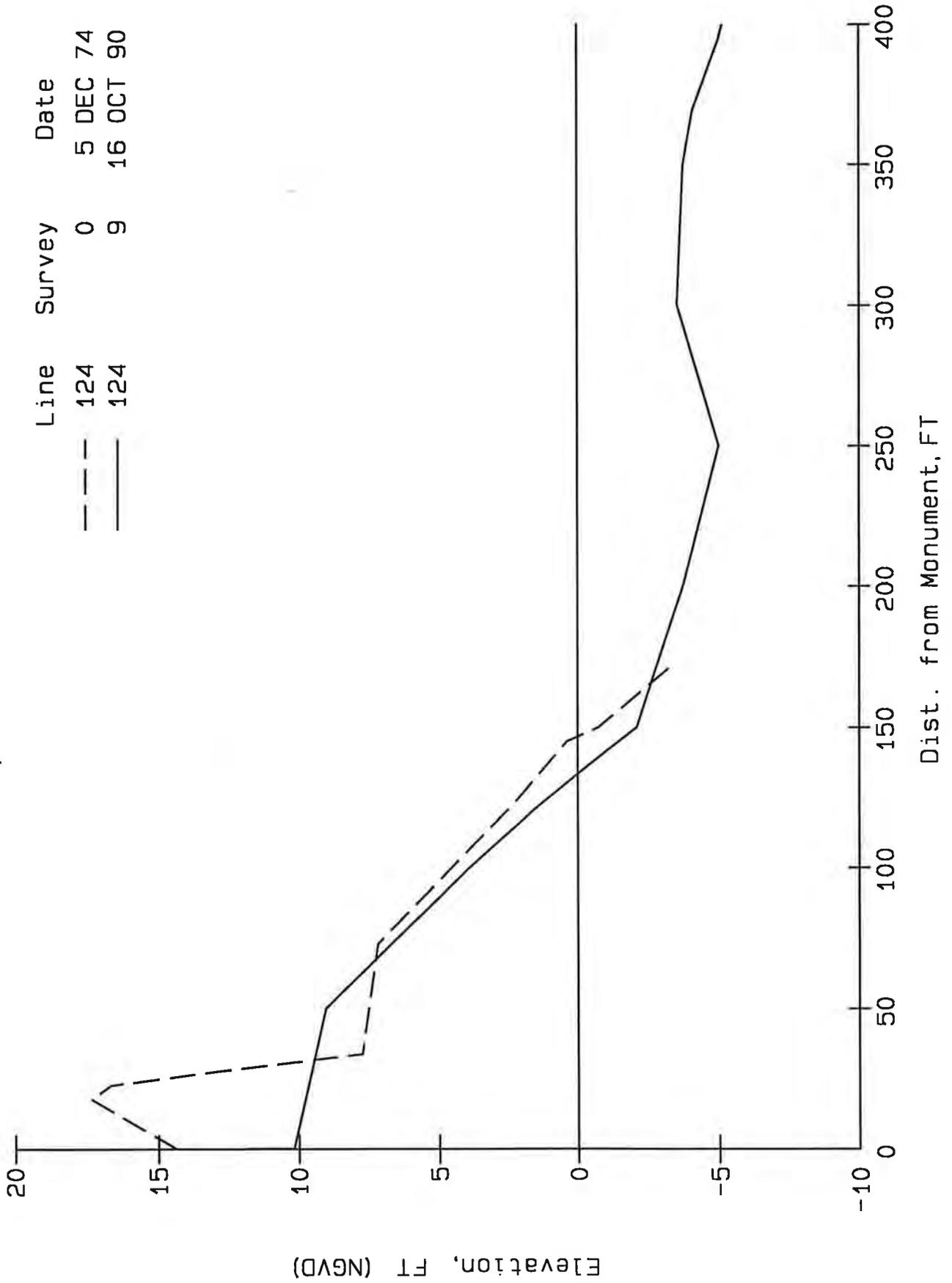
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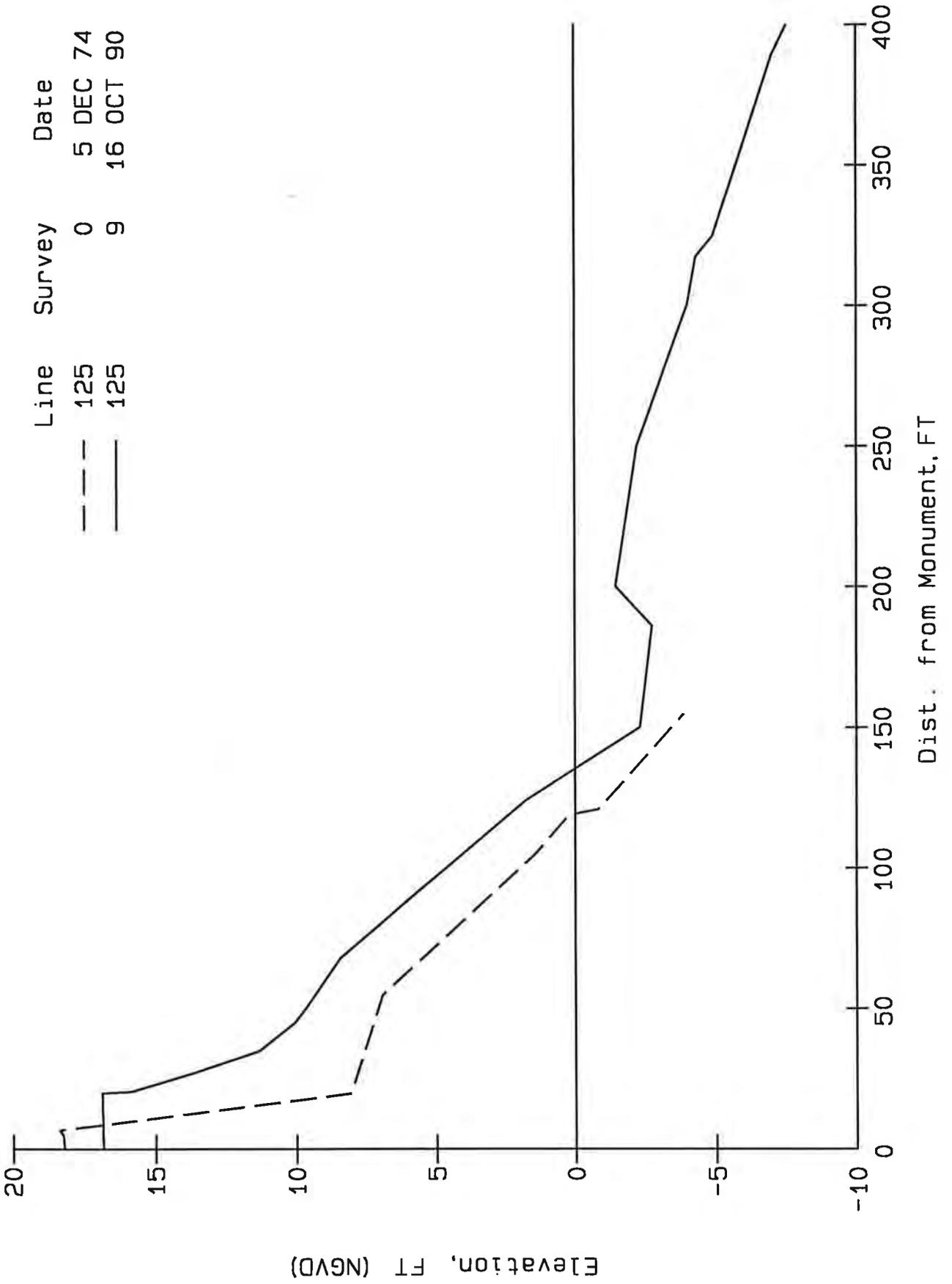
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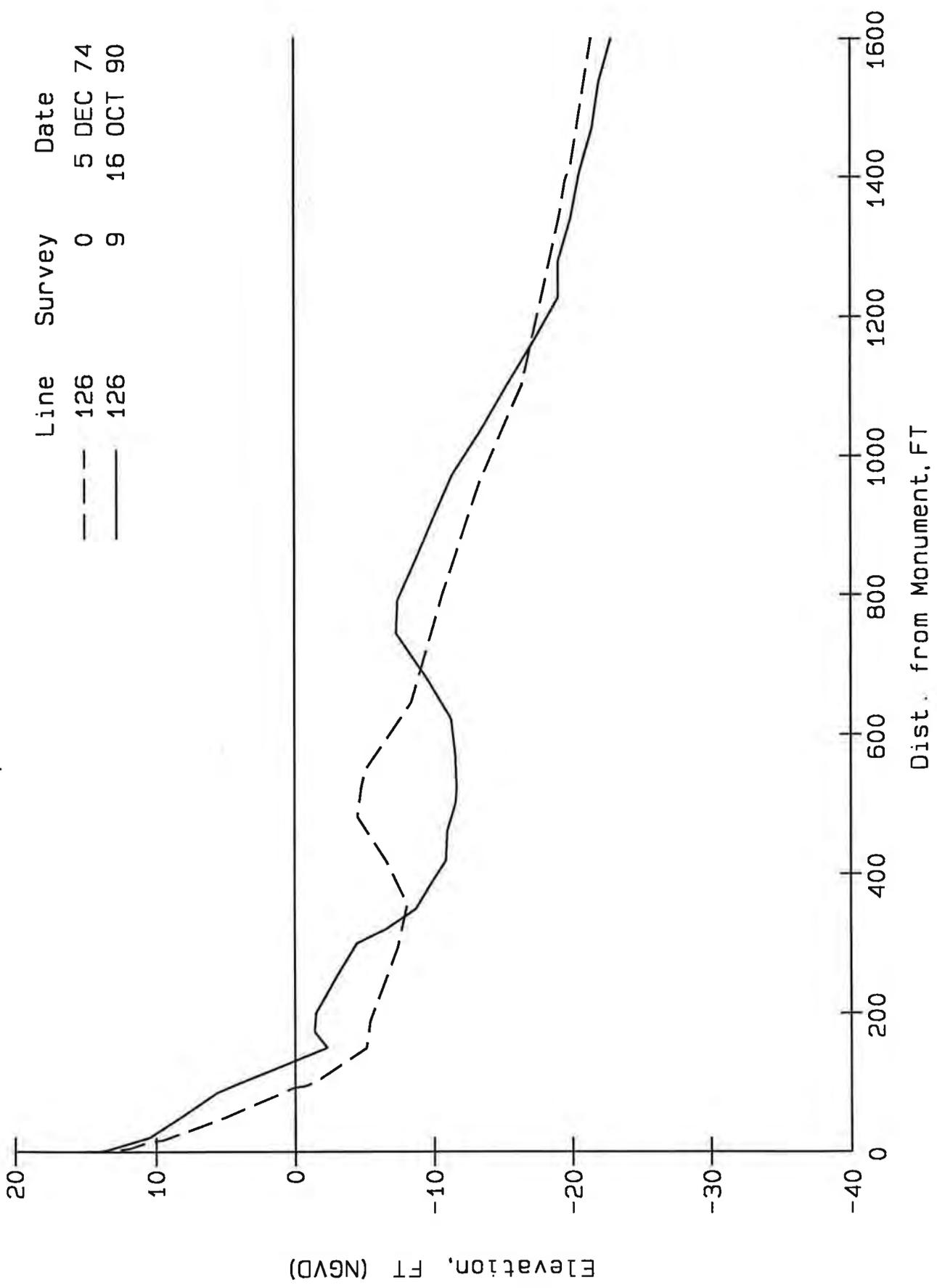
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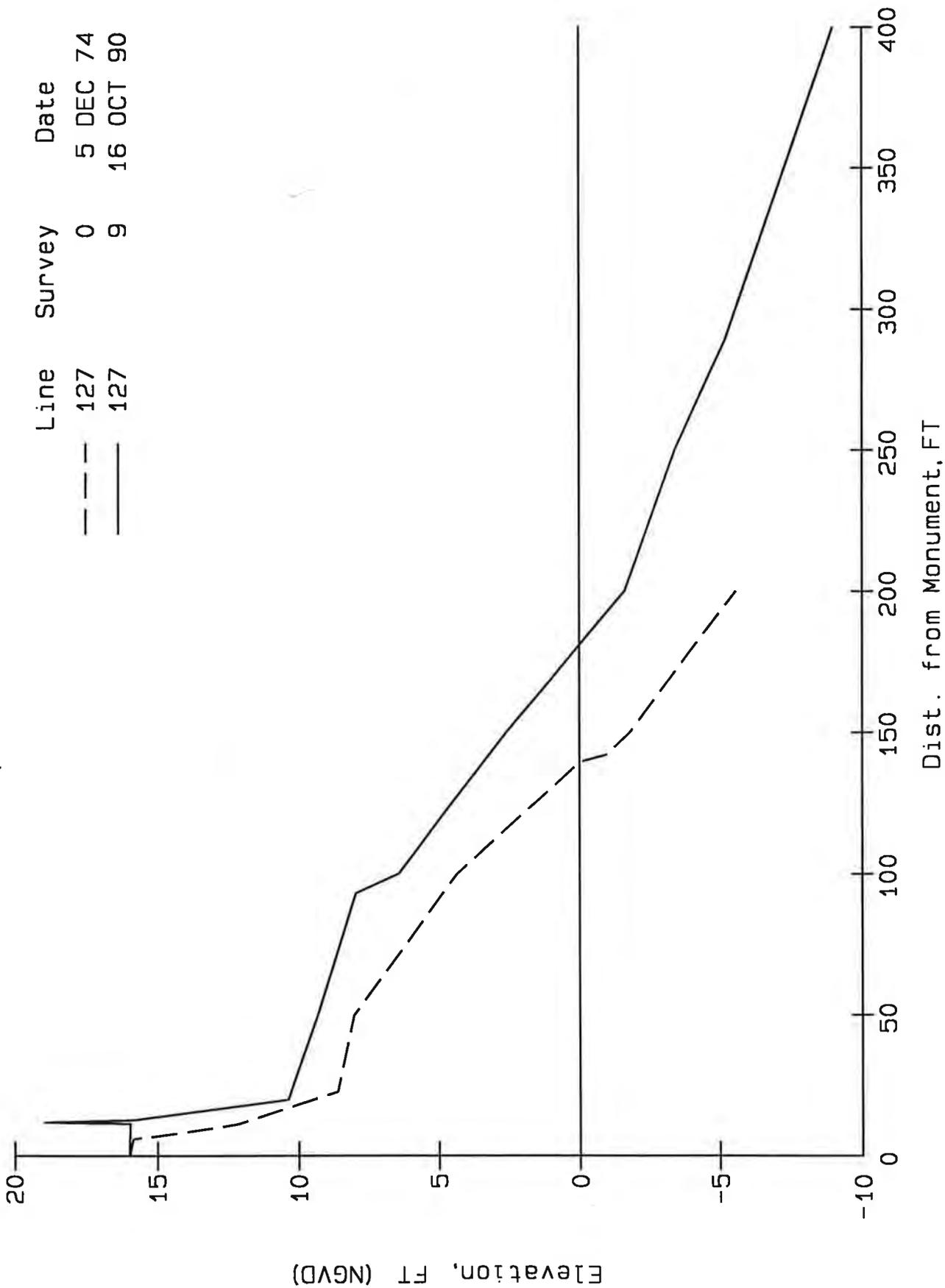
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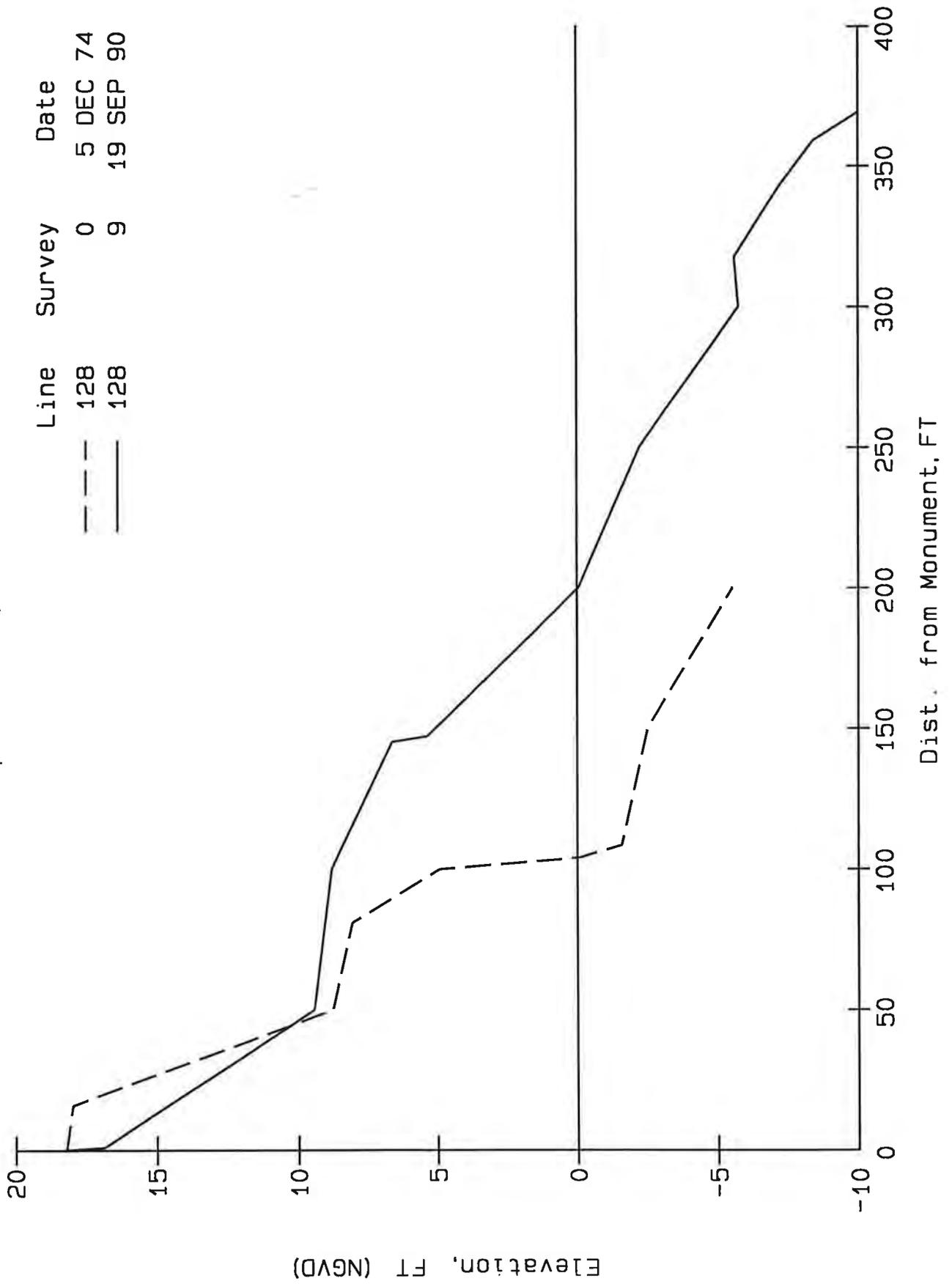
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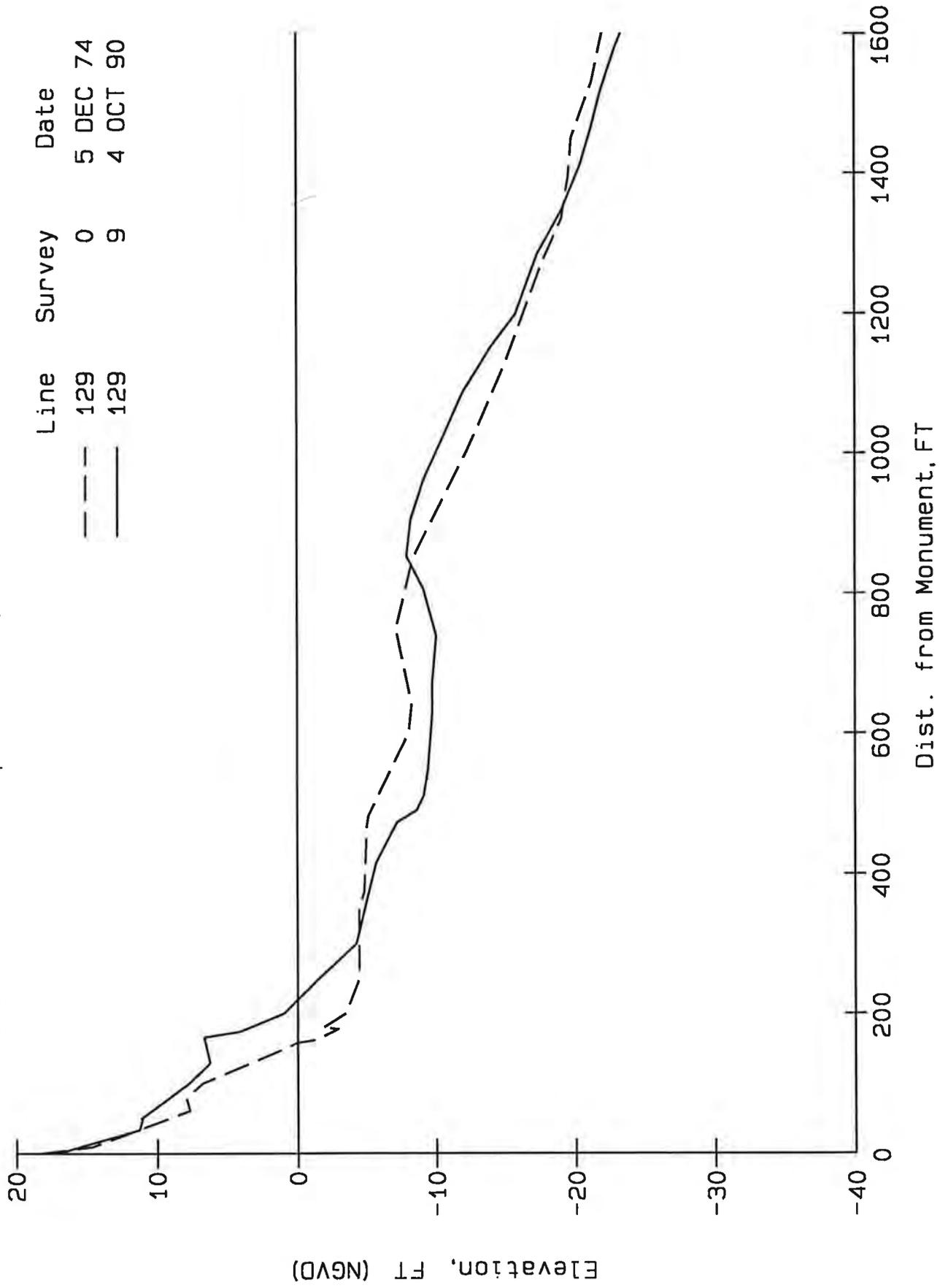
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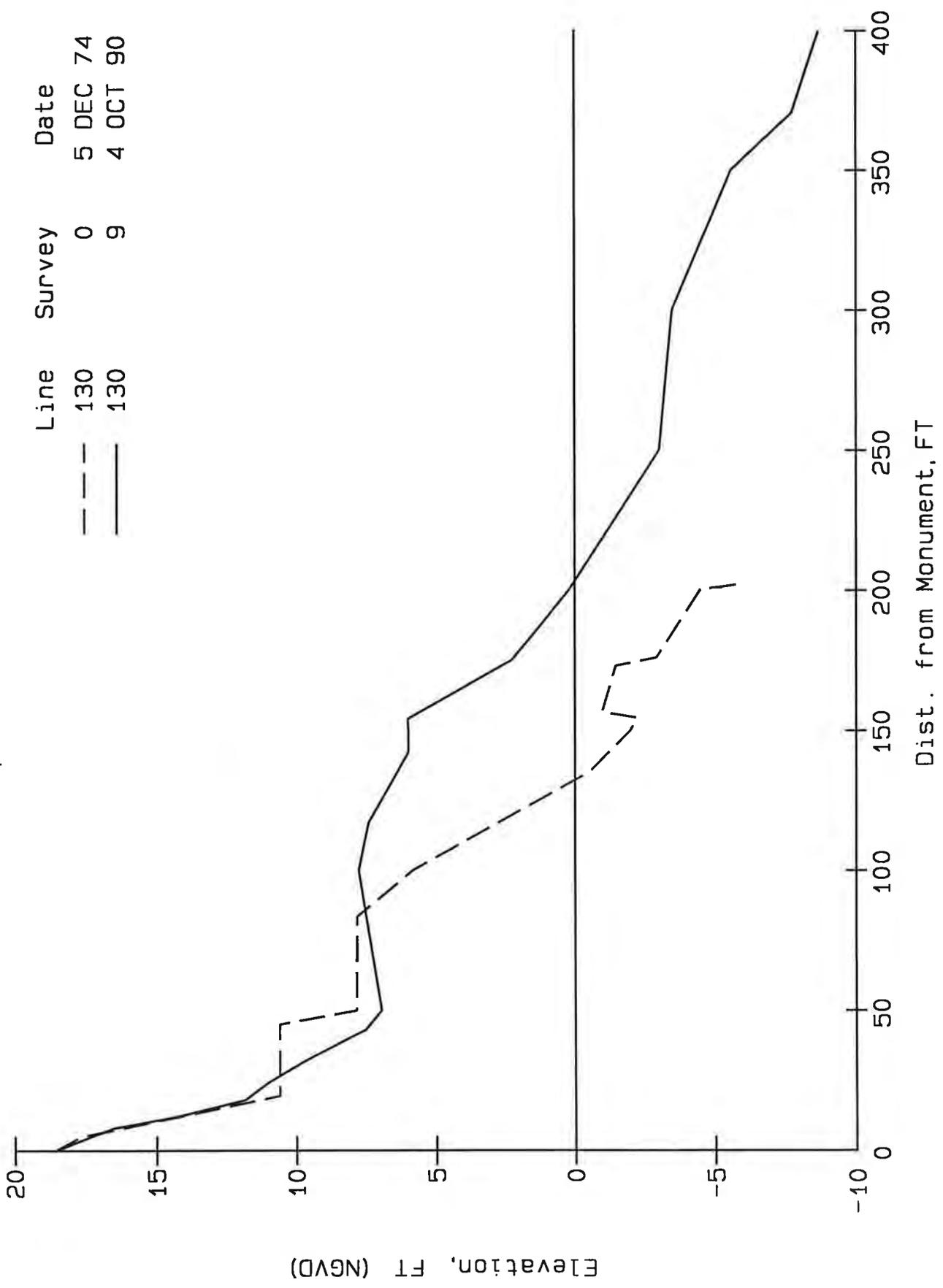
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Palm Beach Island
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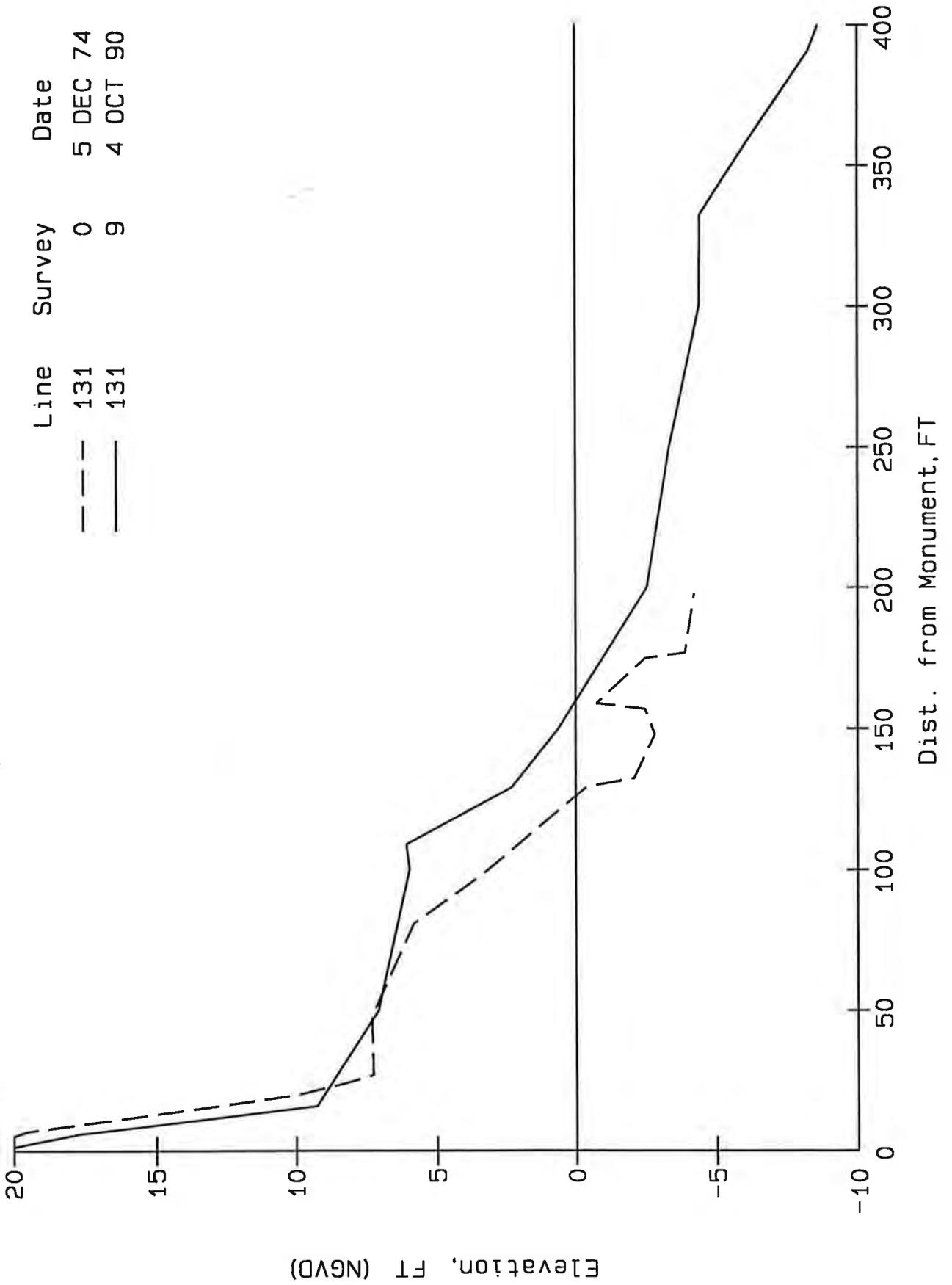


Line	Survey	Date
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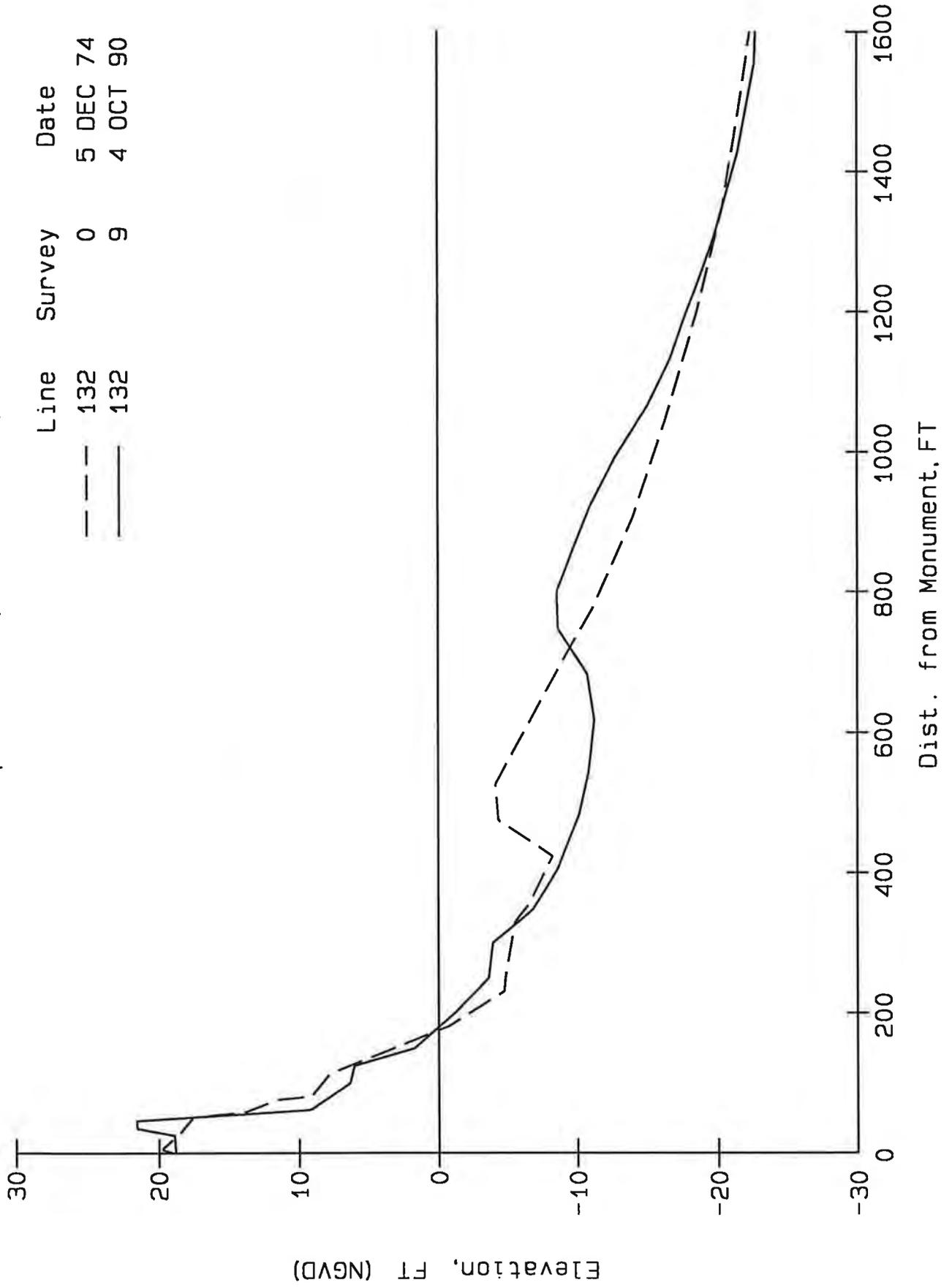
Elevation, FT (NGVD)

Dist. from Monument, FT

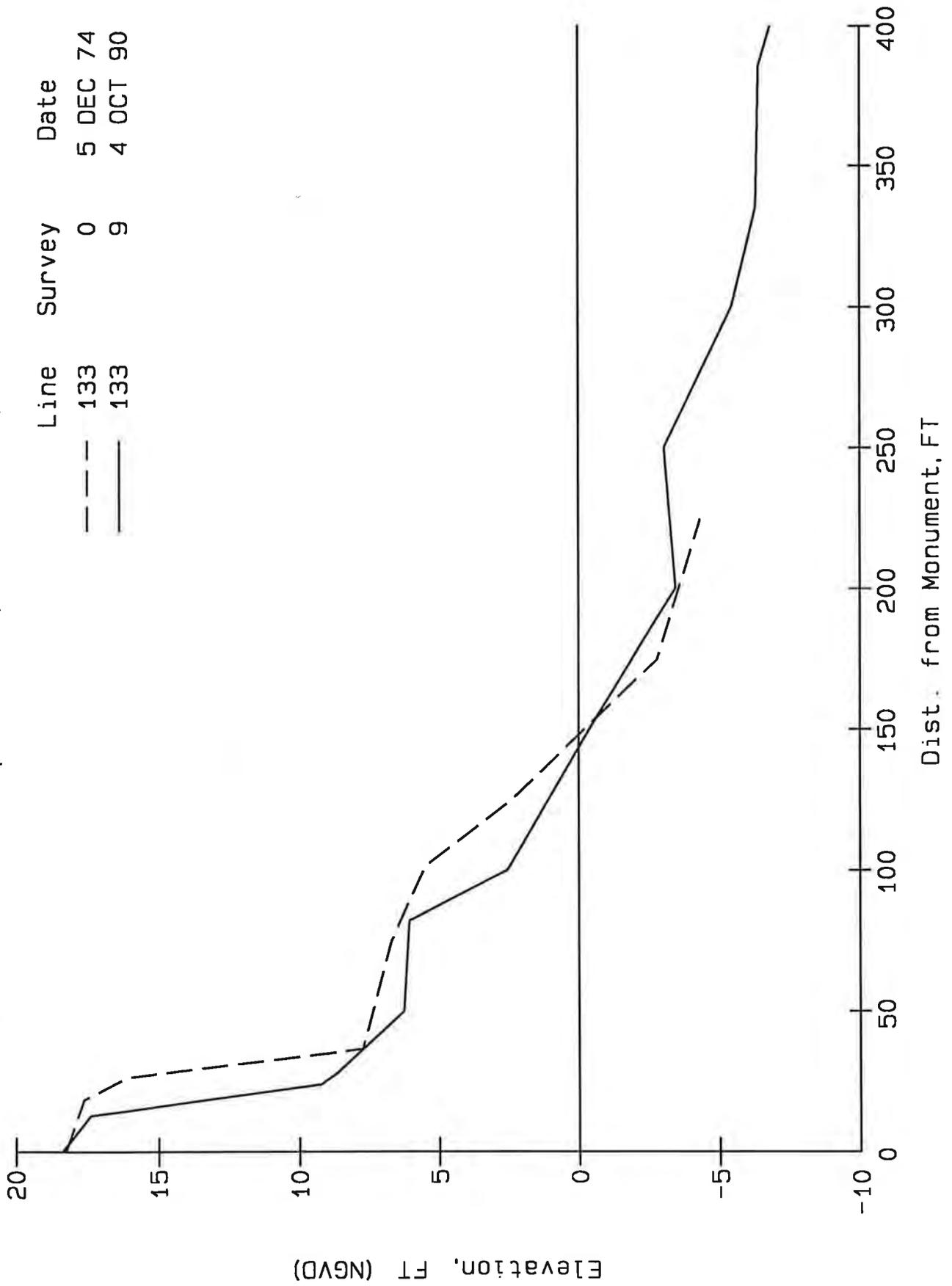
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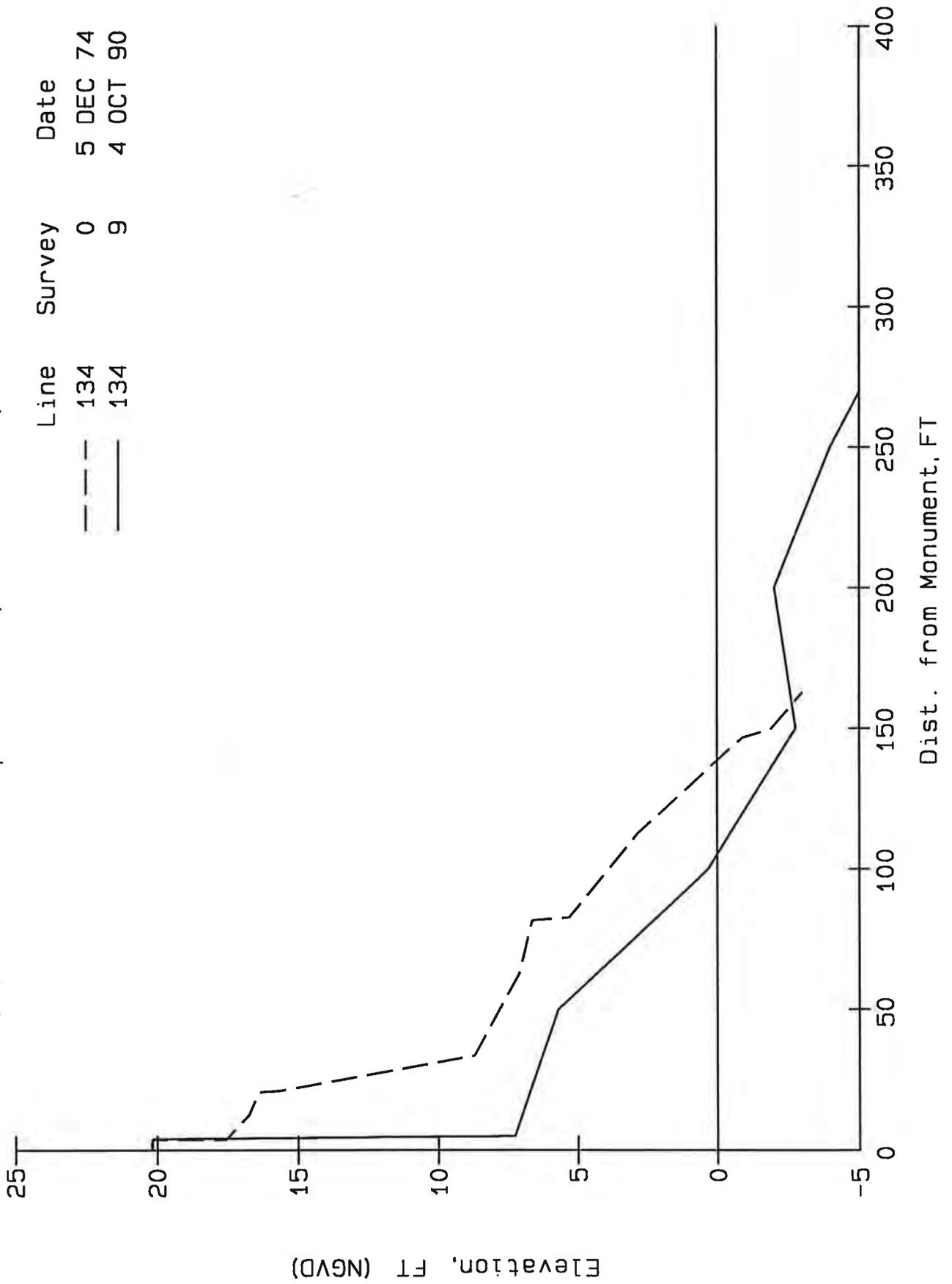
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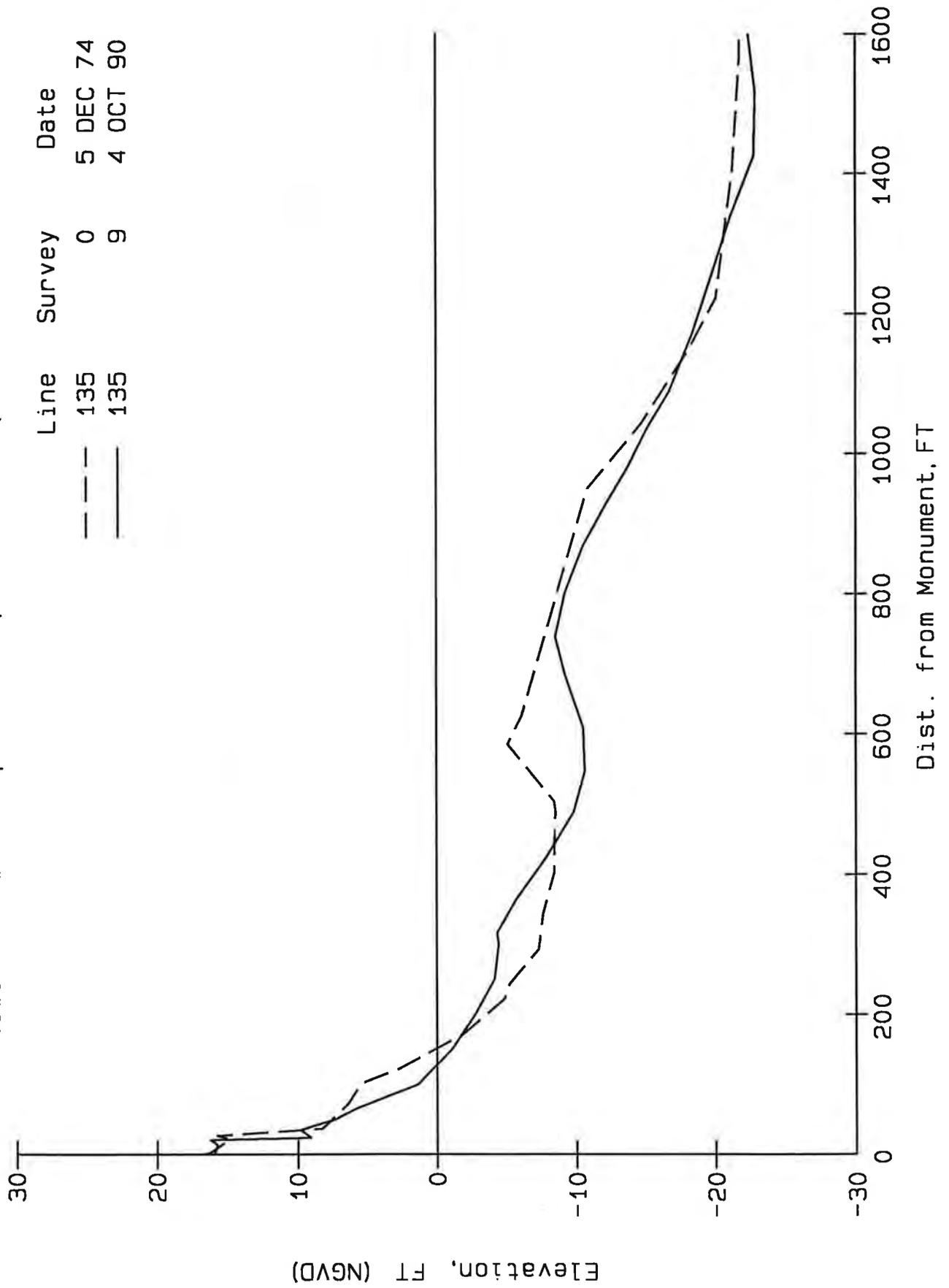
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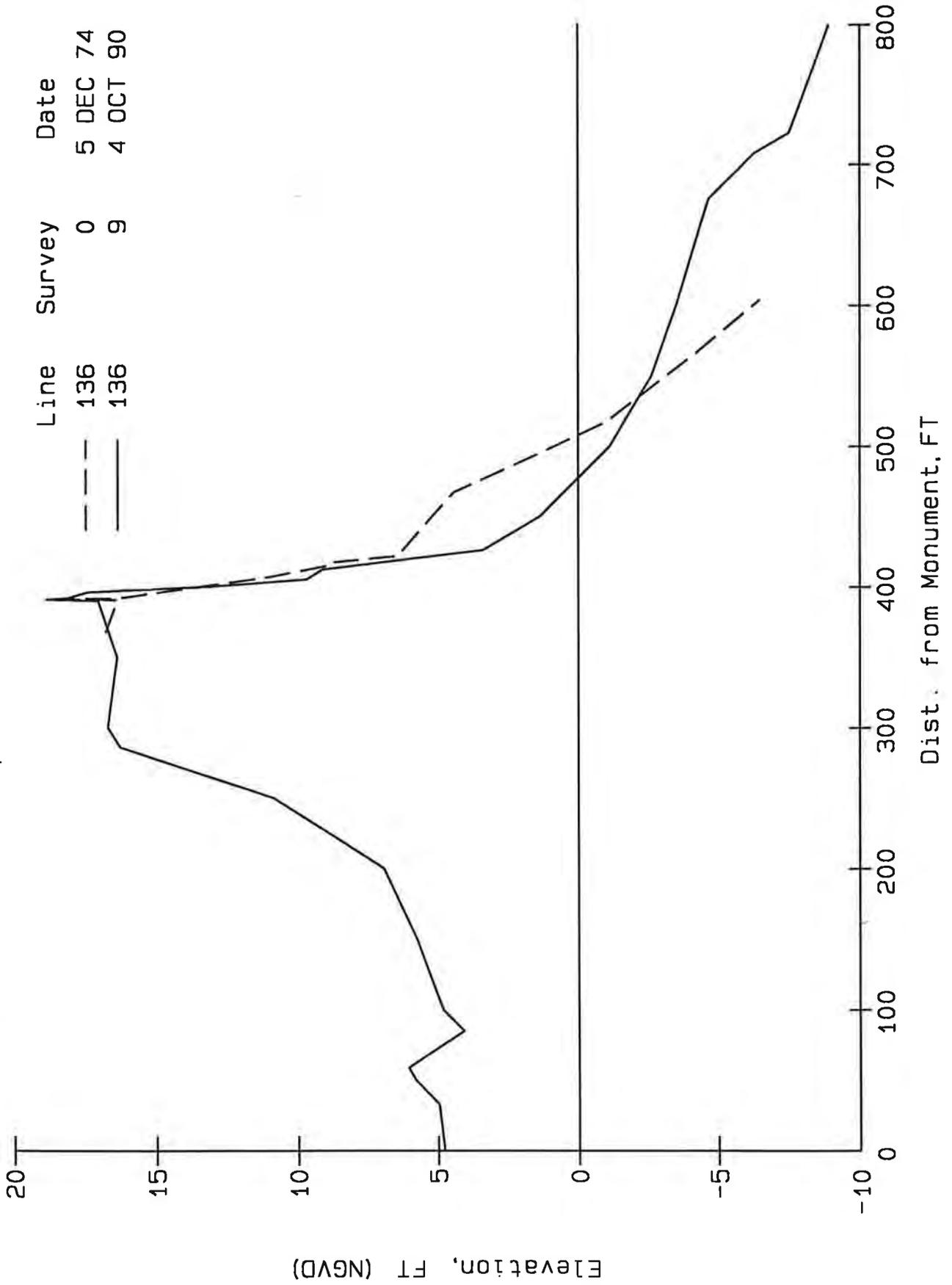
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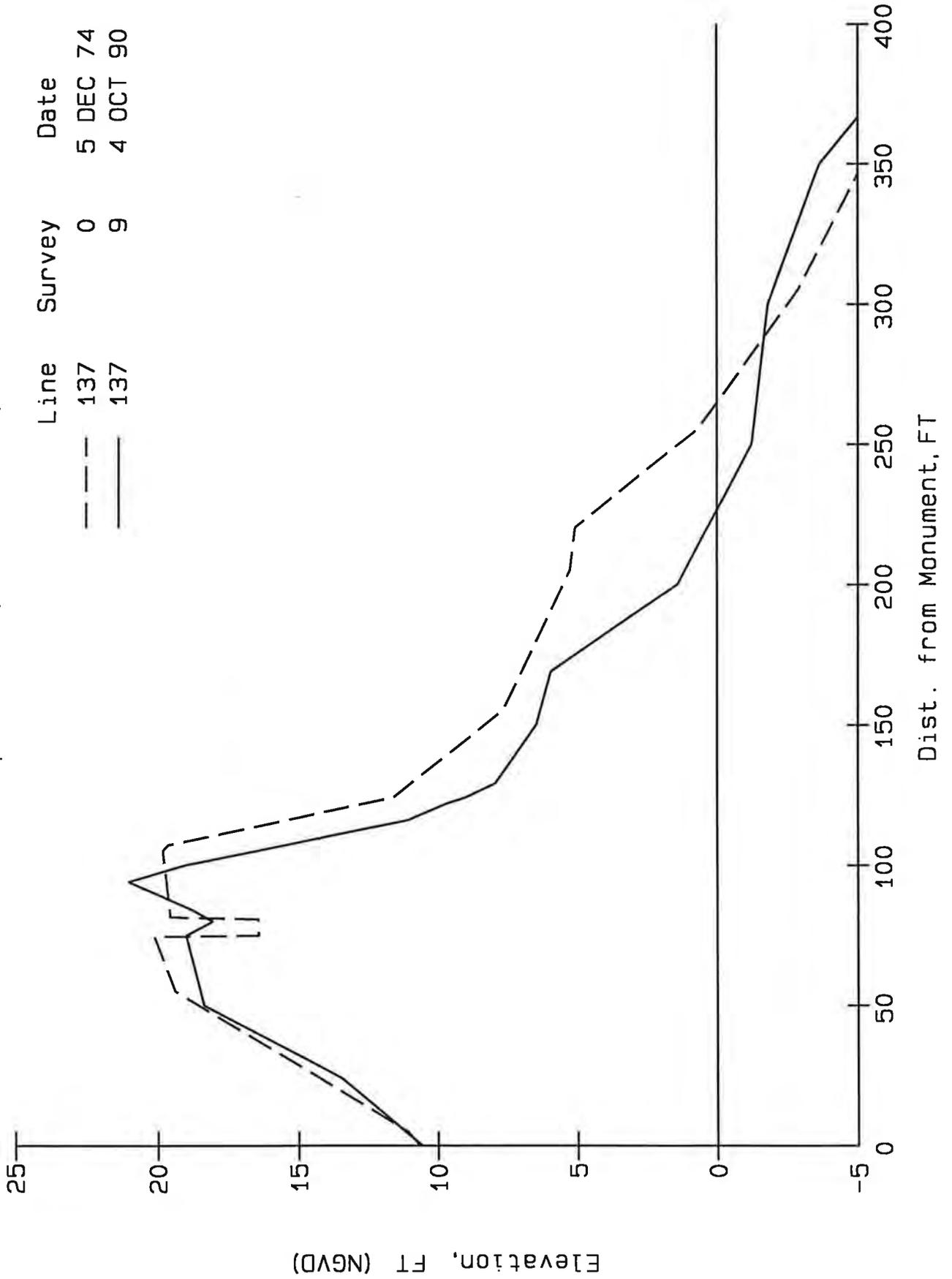
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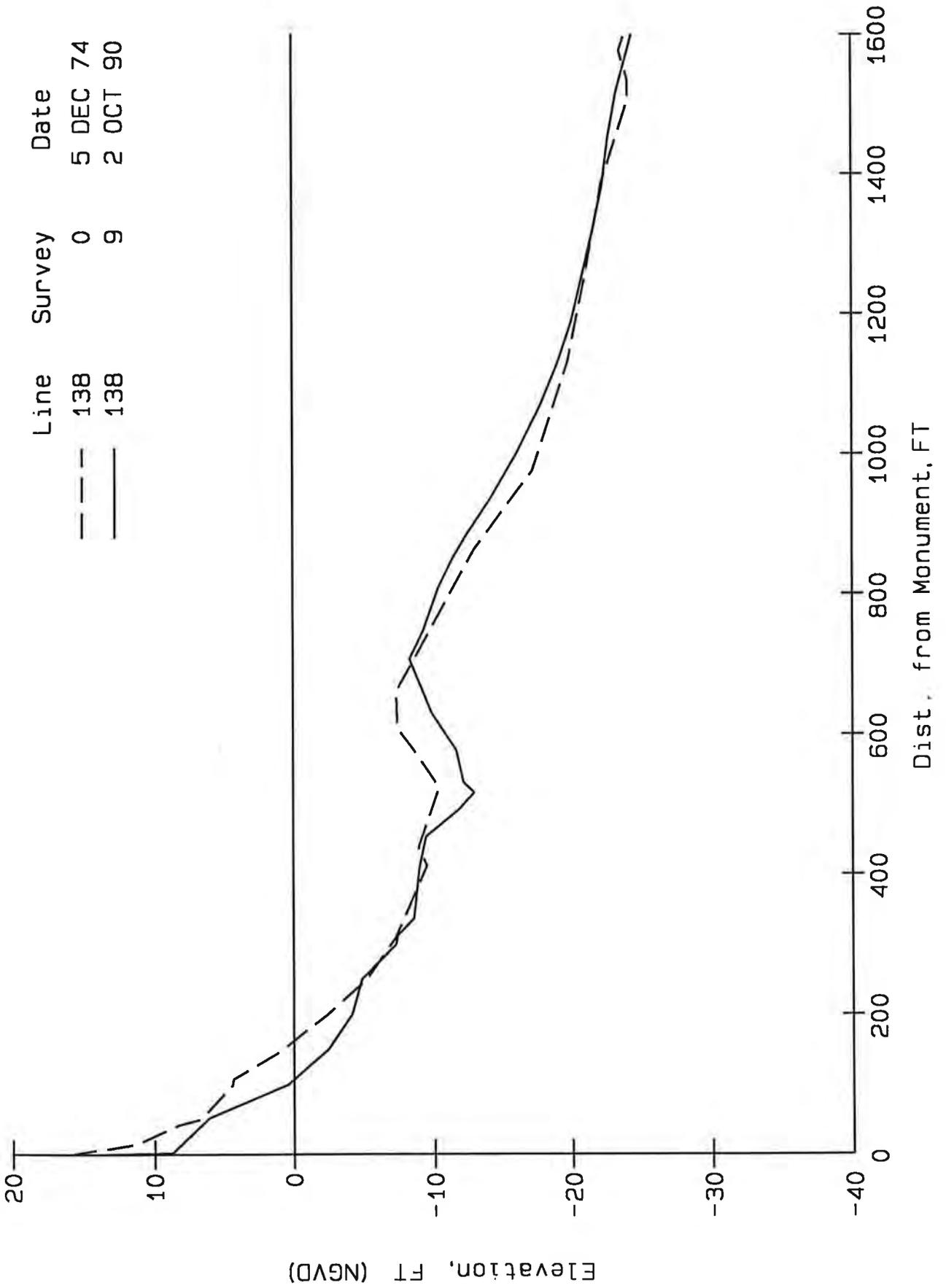
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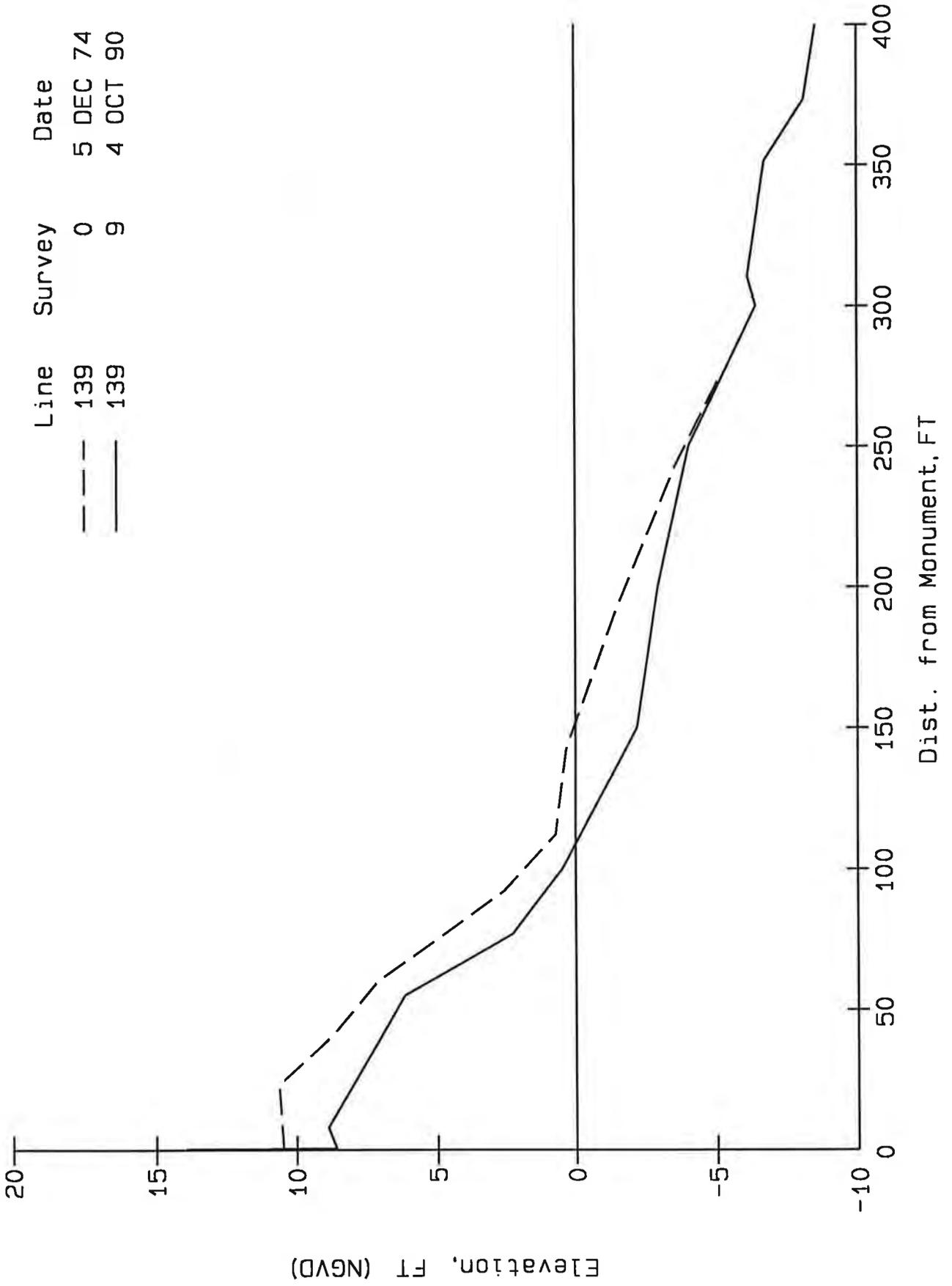
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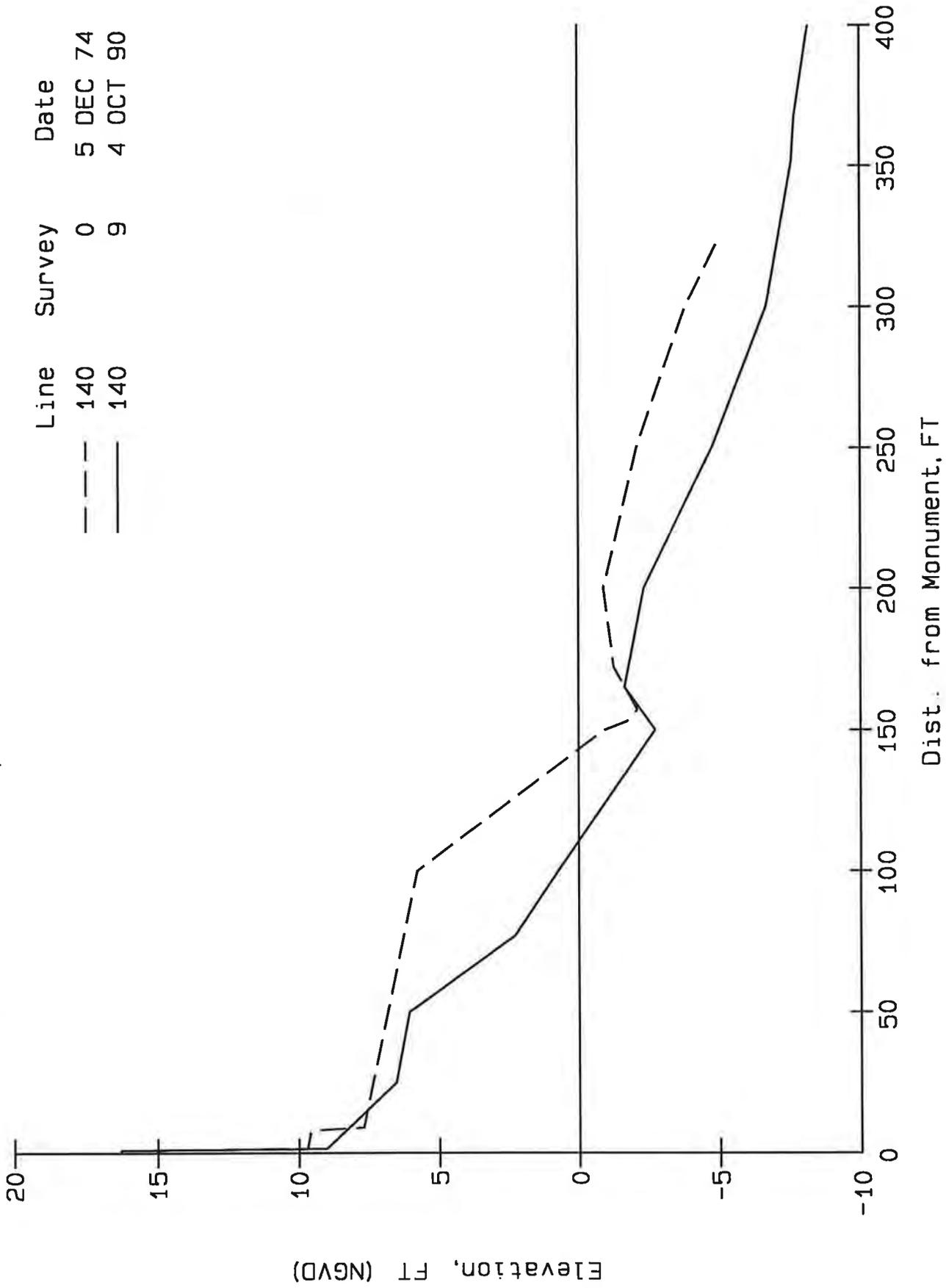
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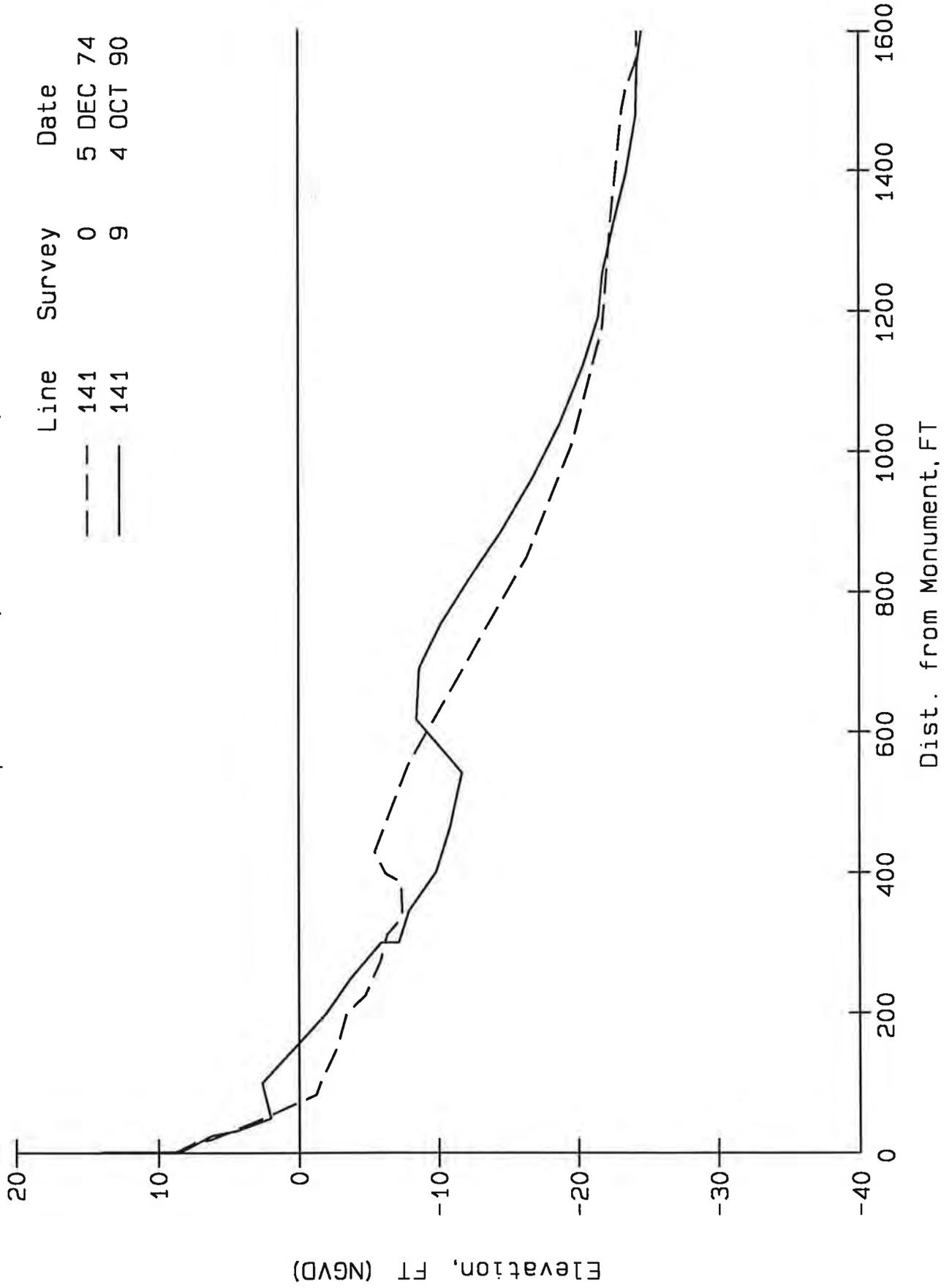
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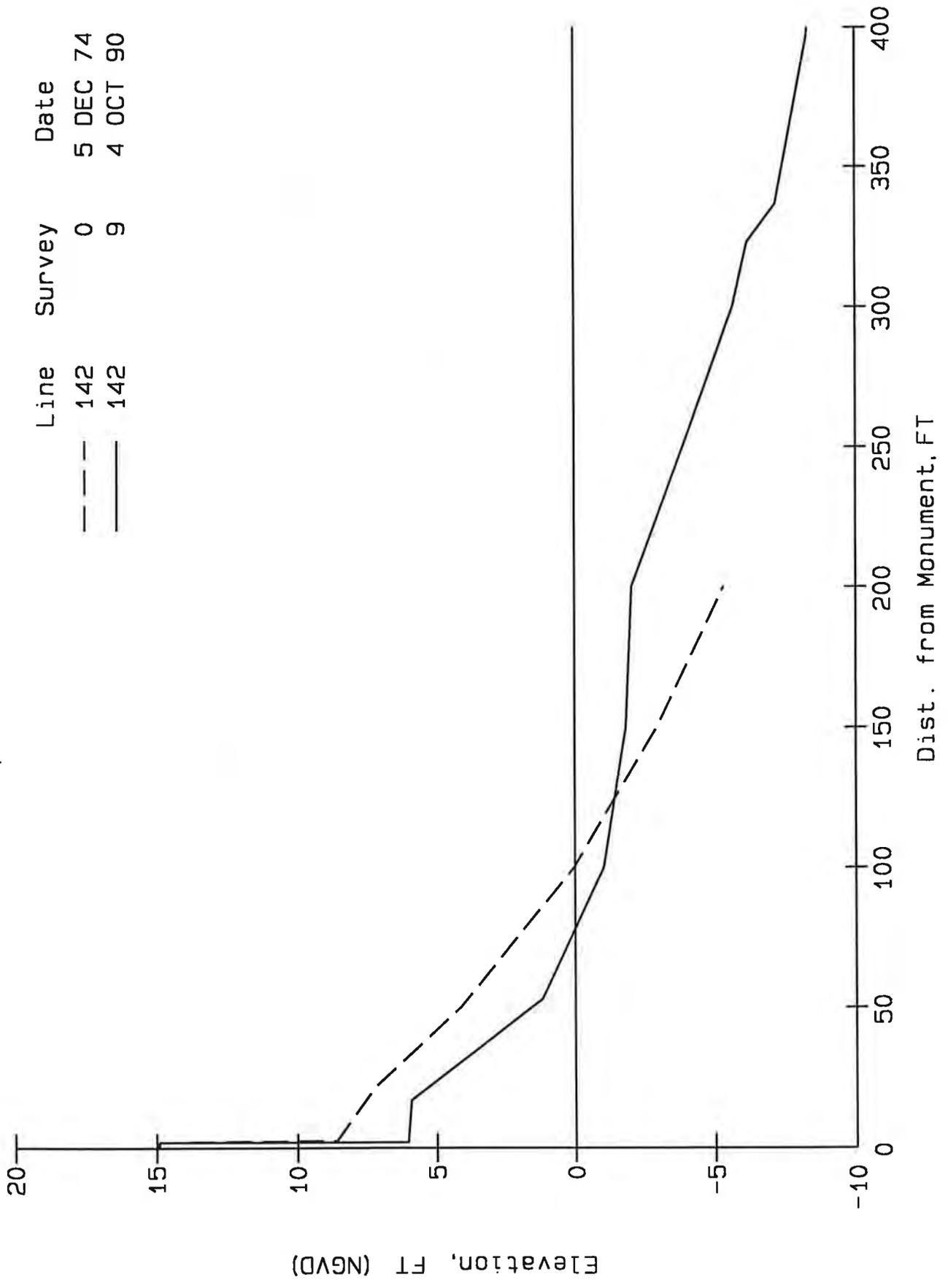
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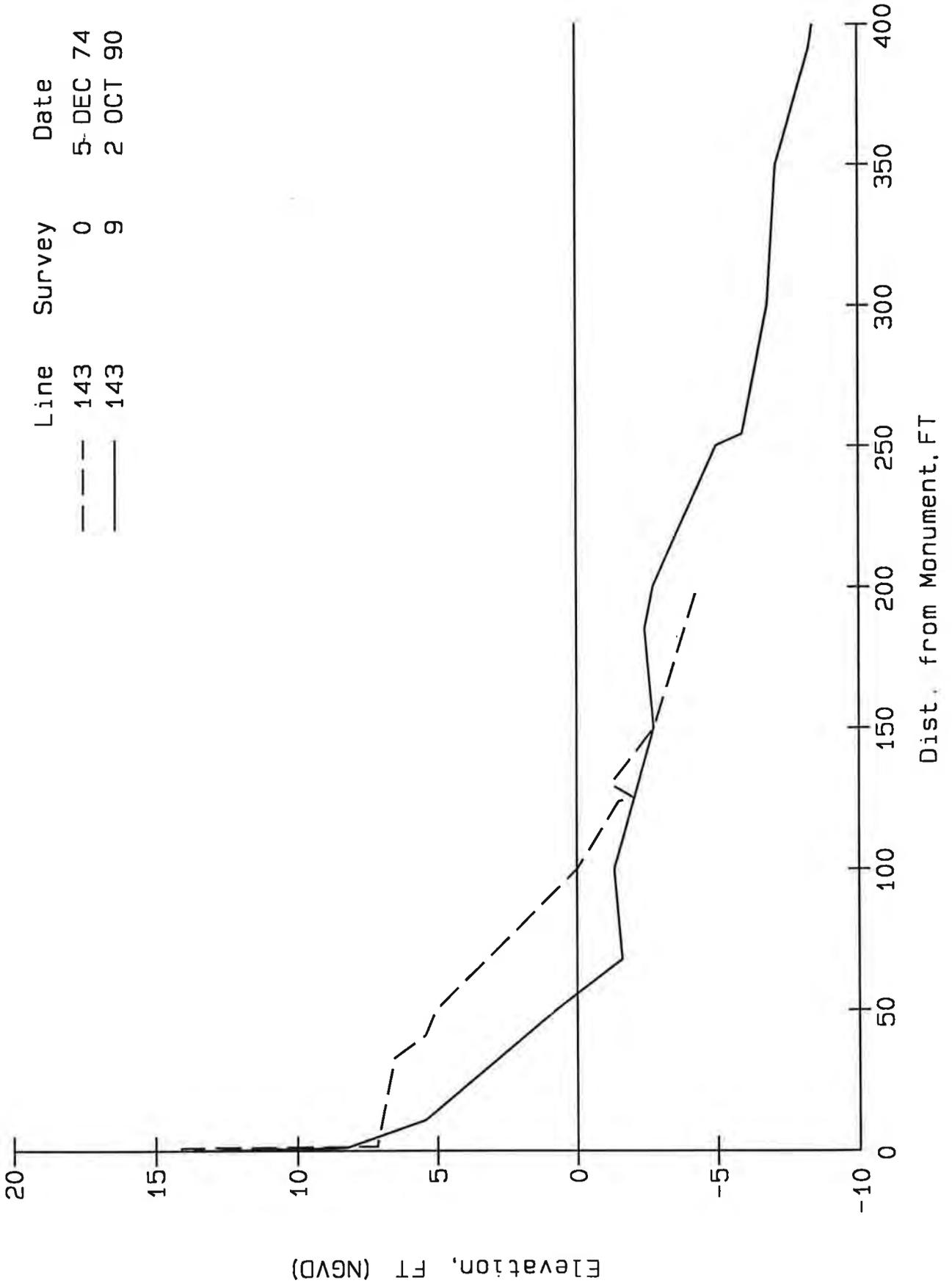
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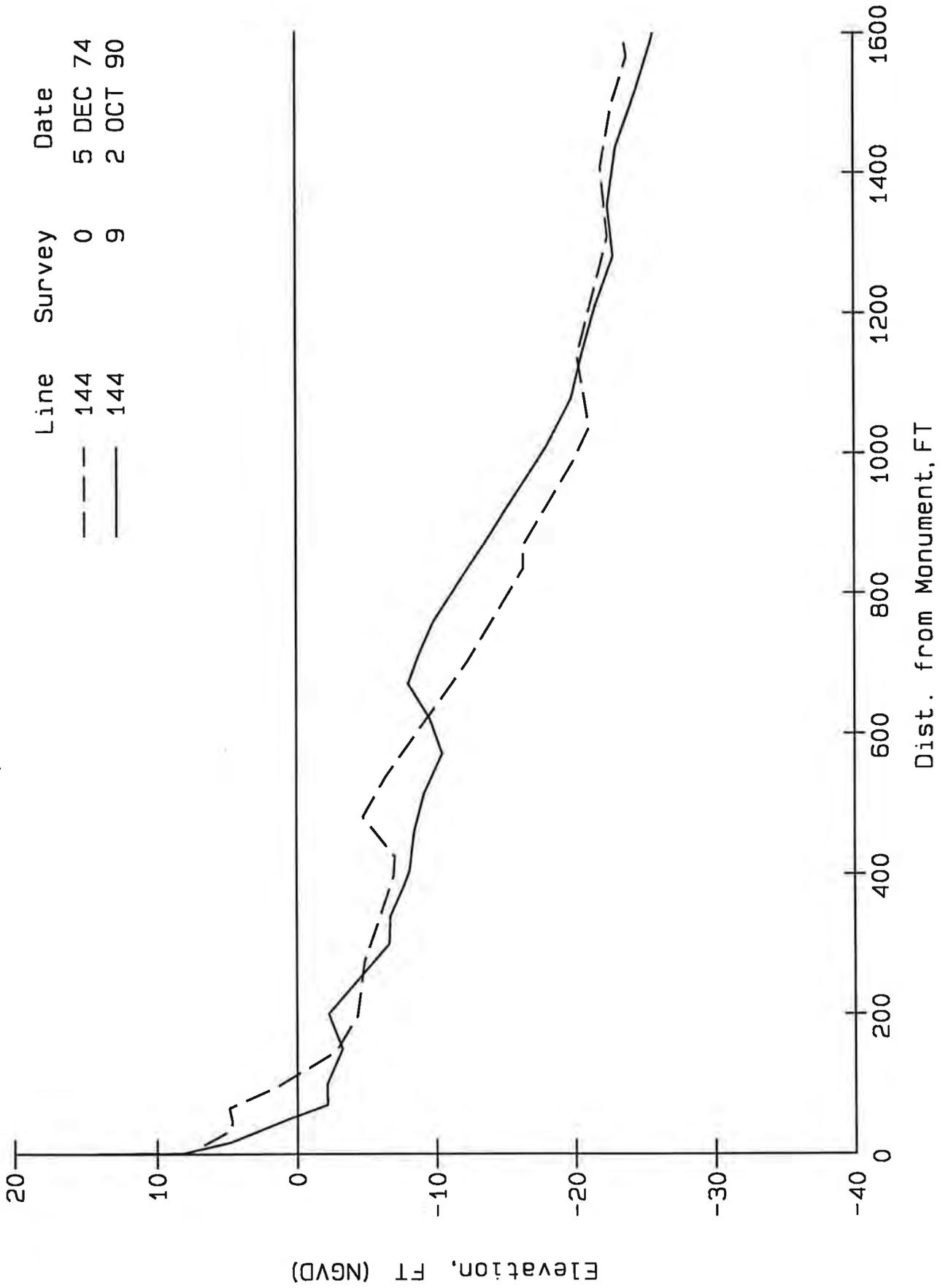
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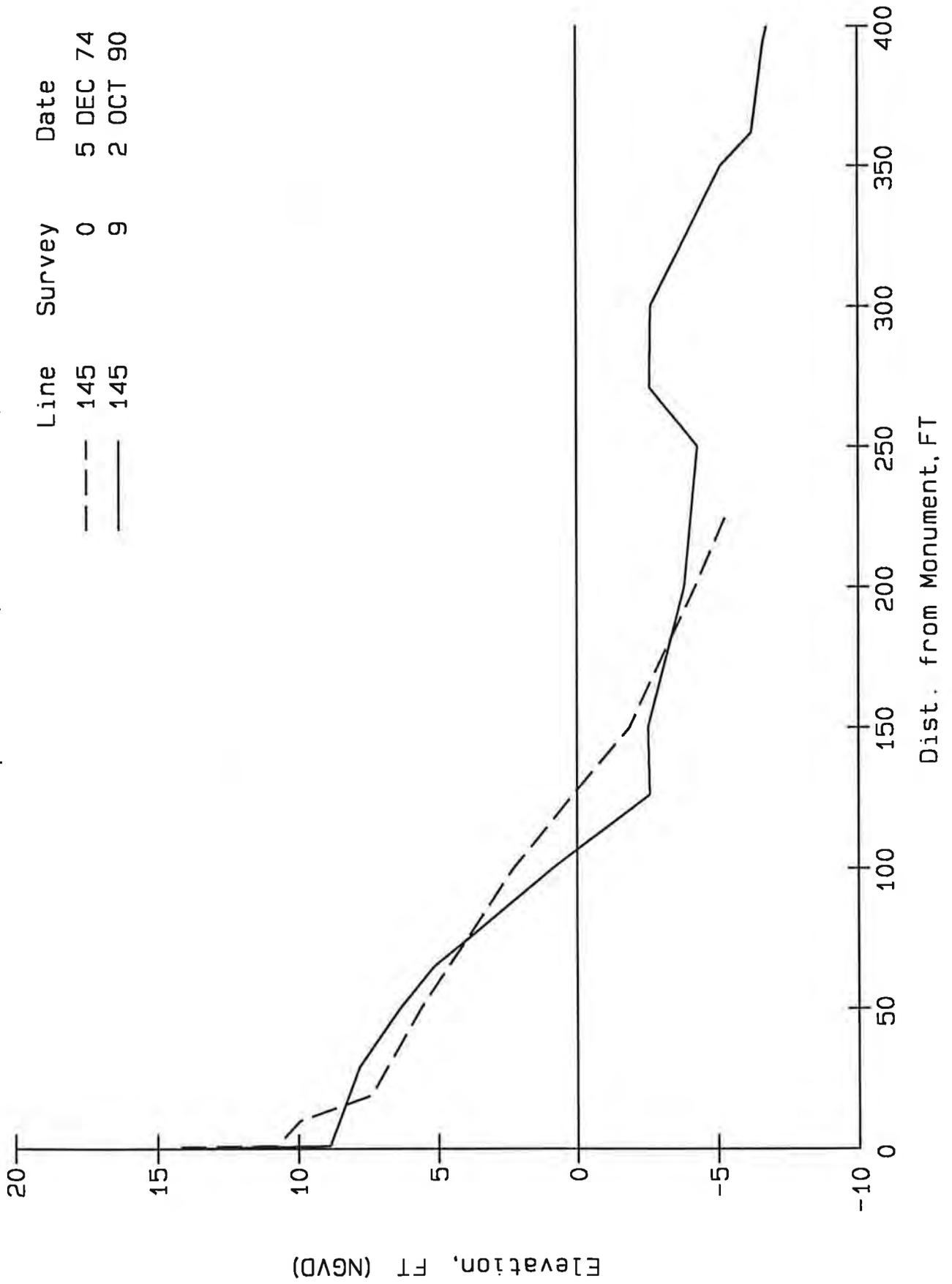
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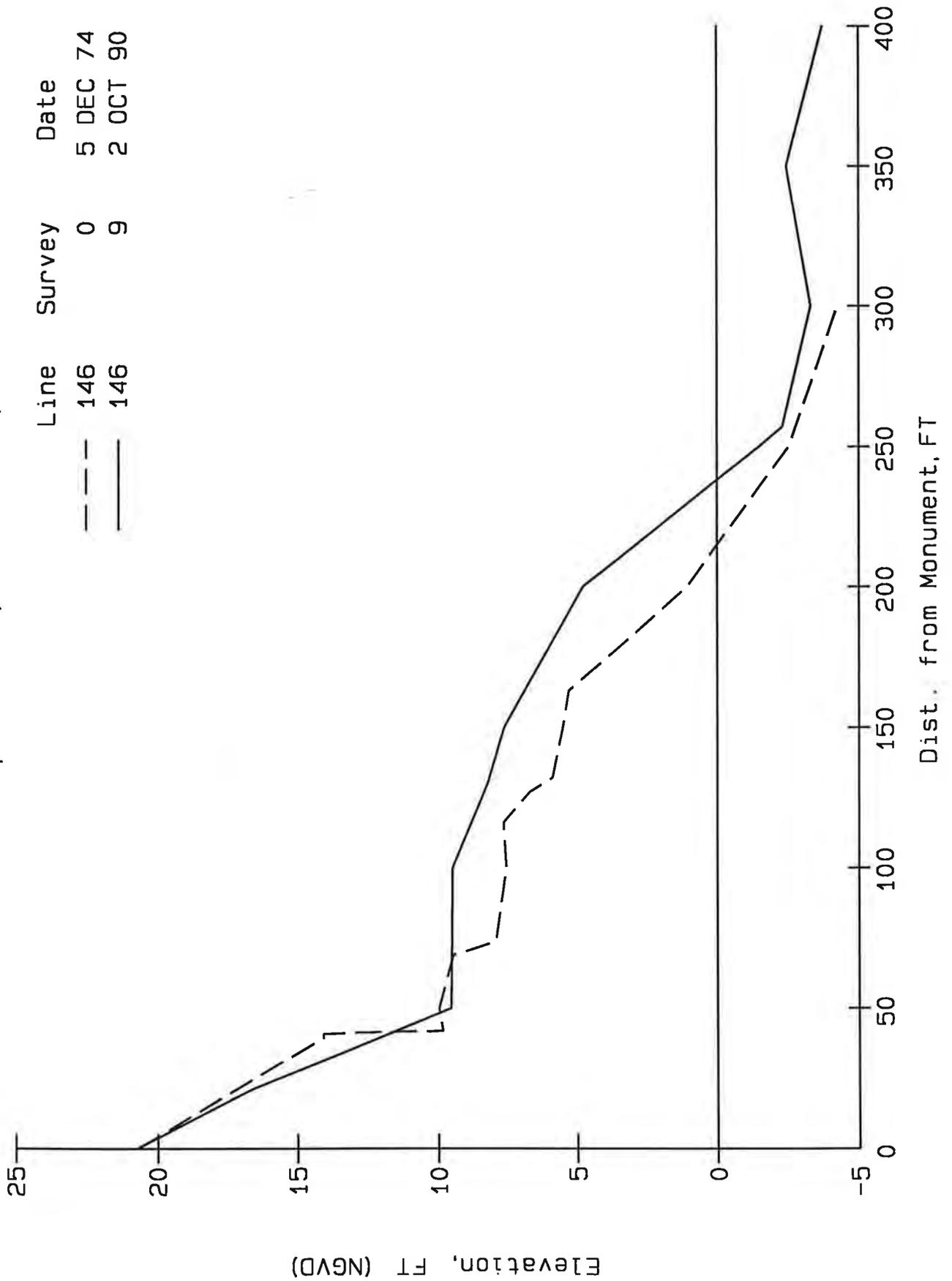
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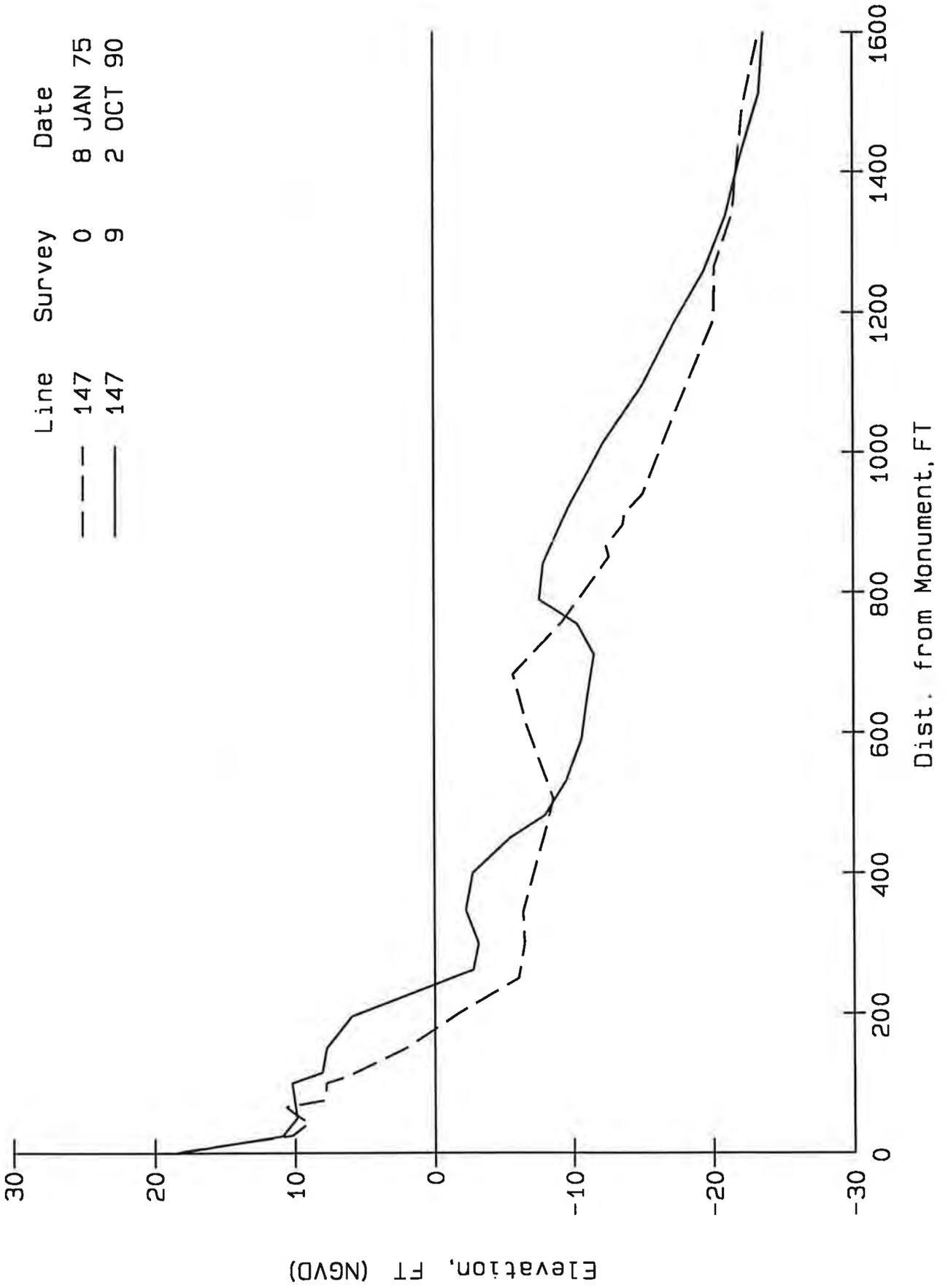
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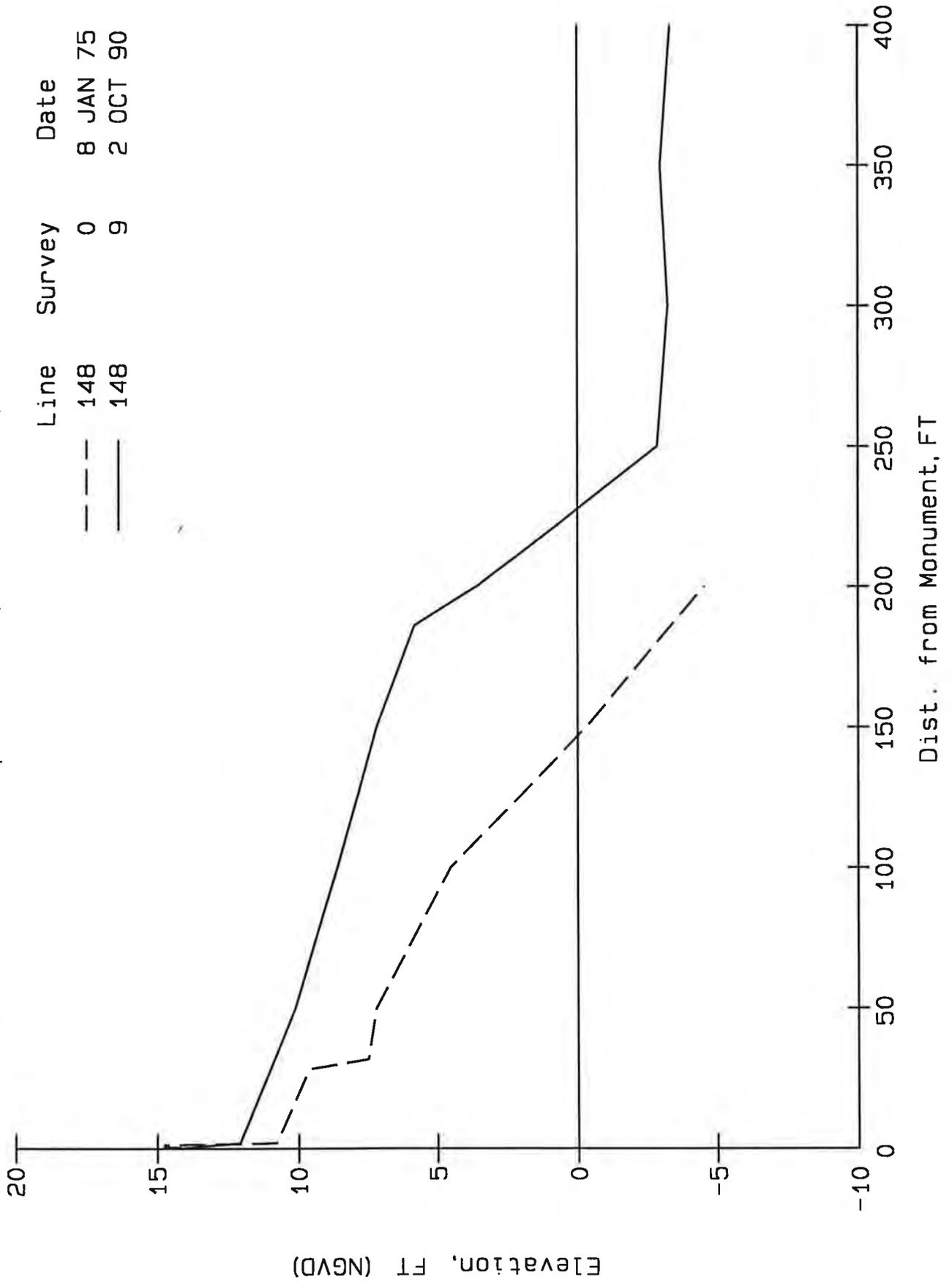
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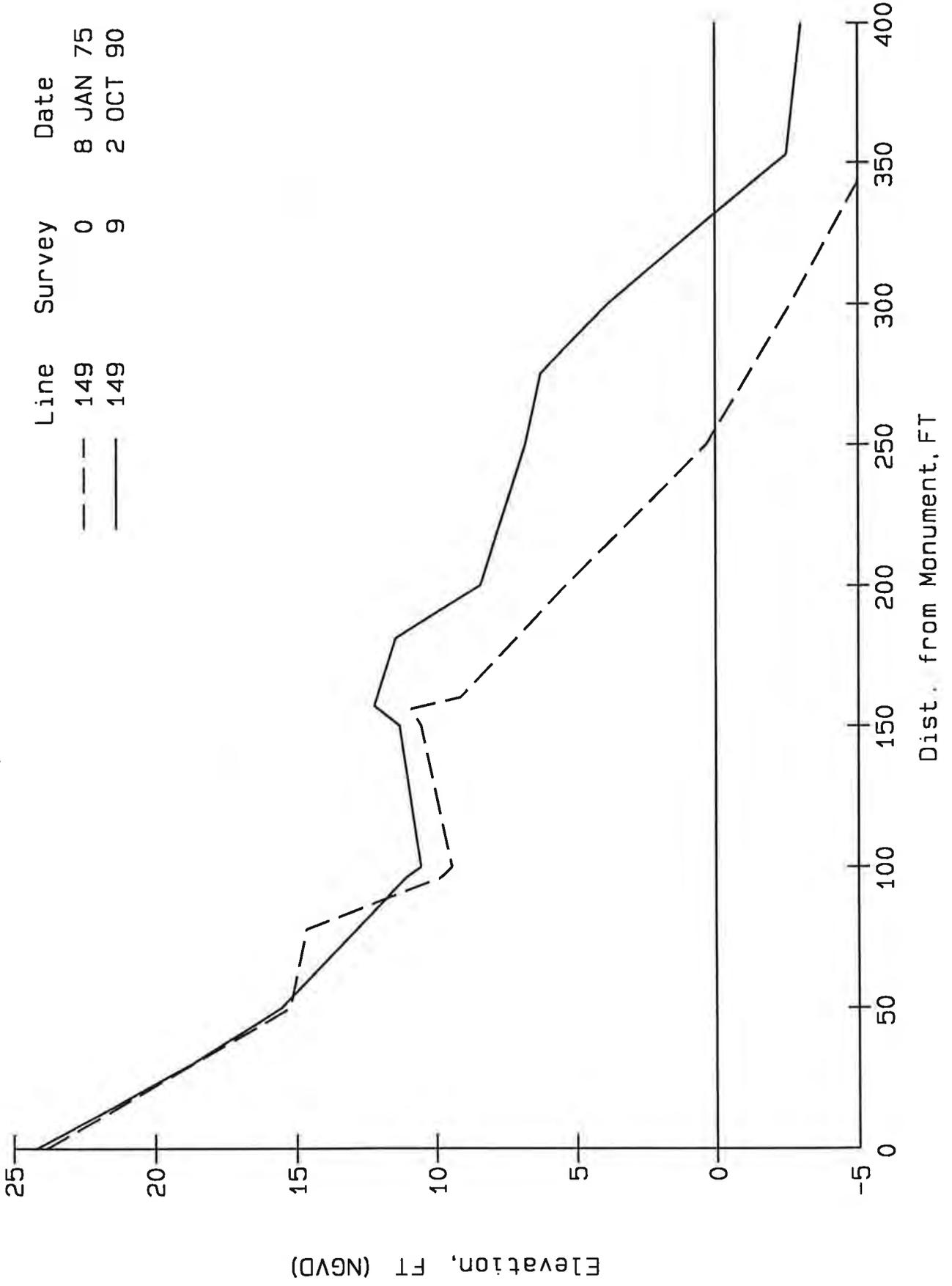
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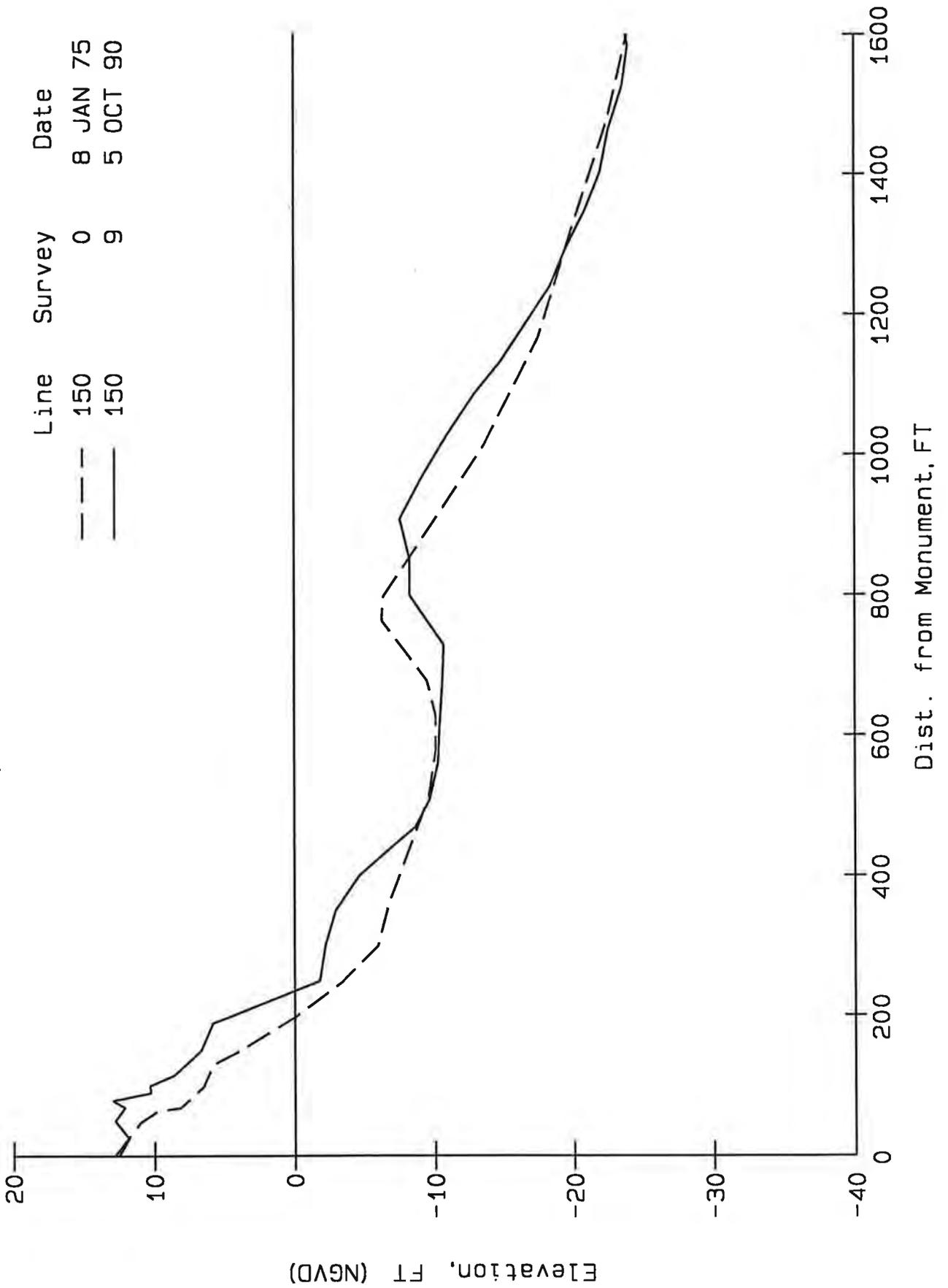
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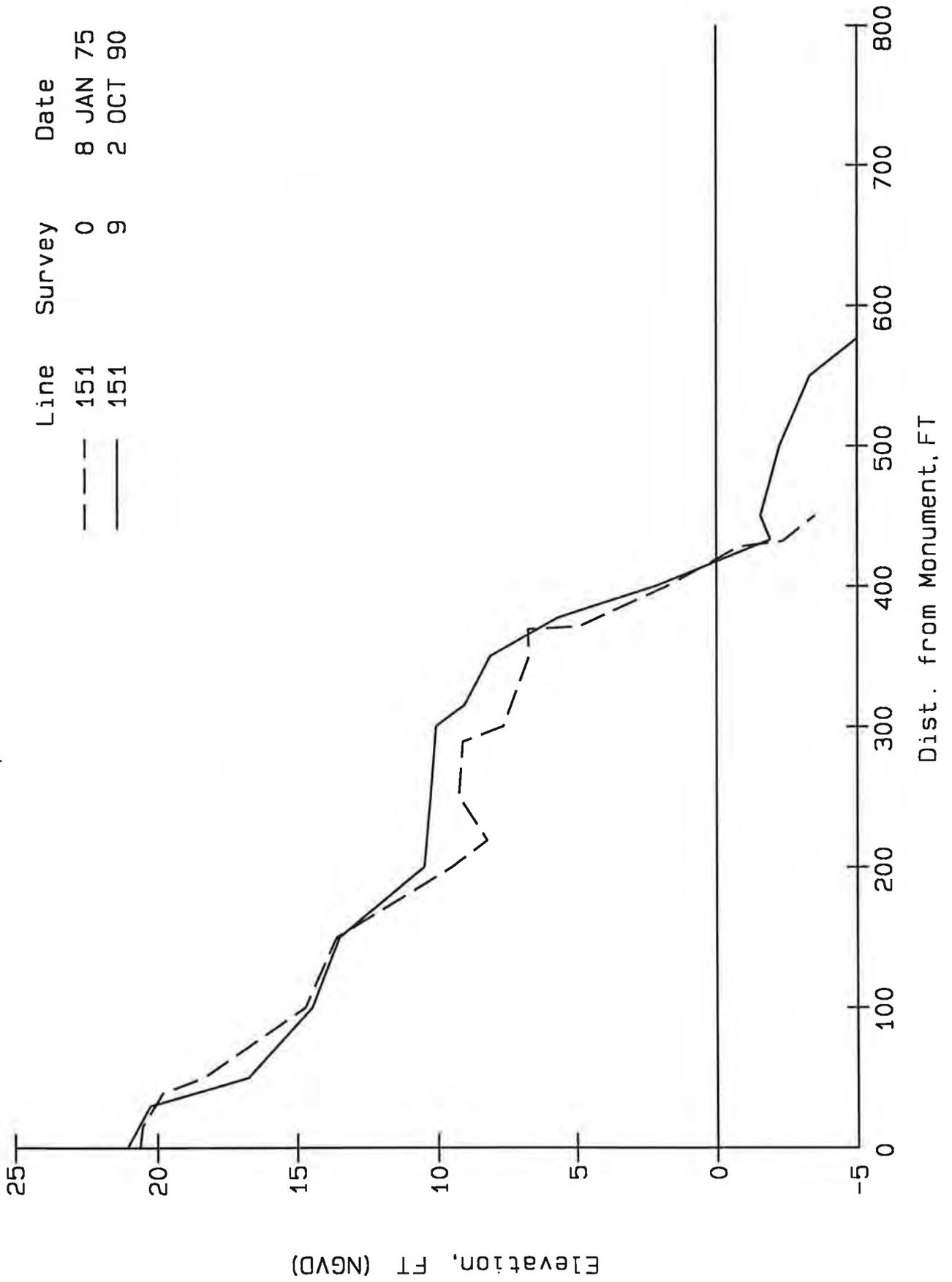
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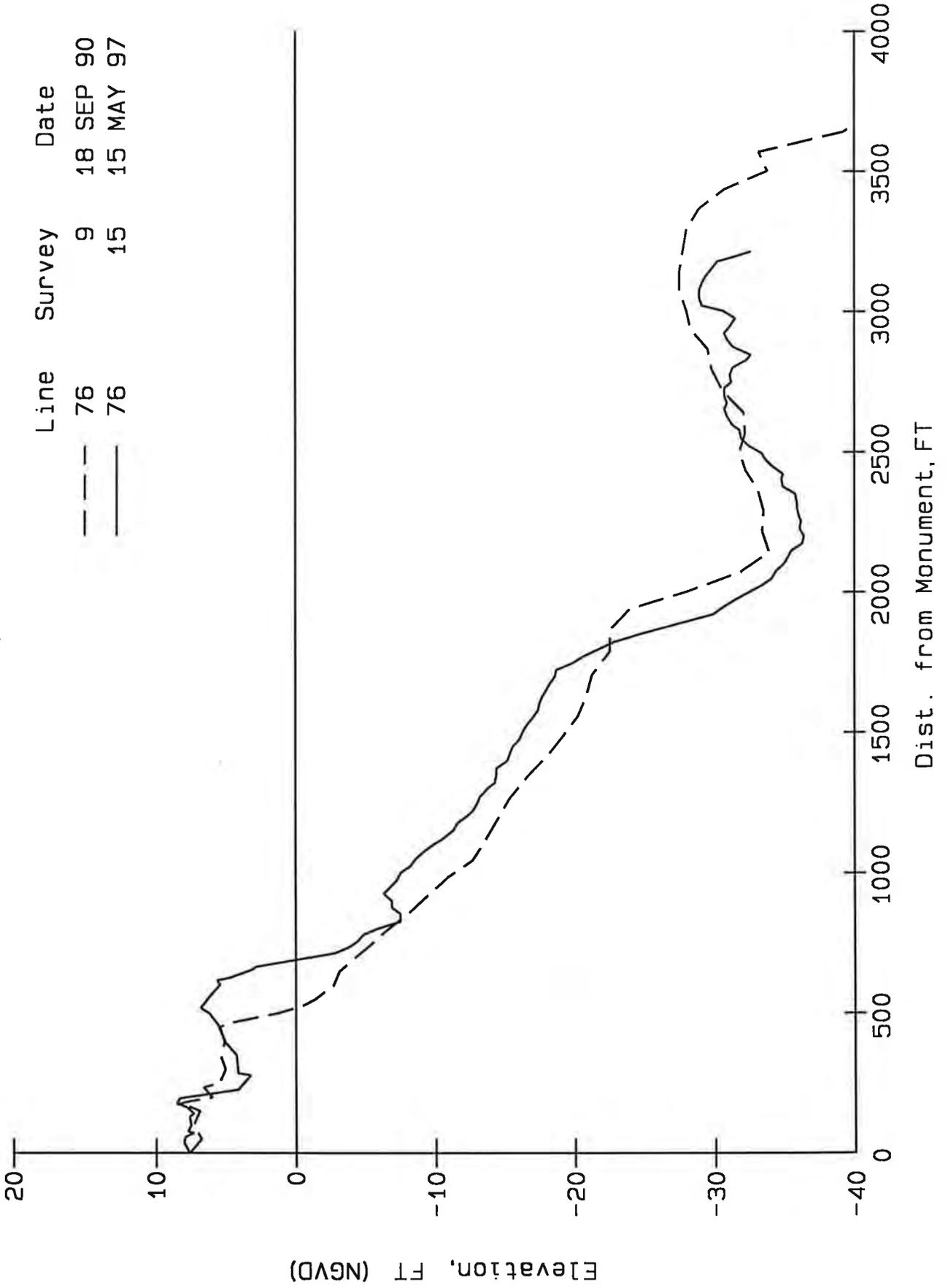
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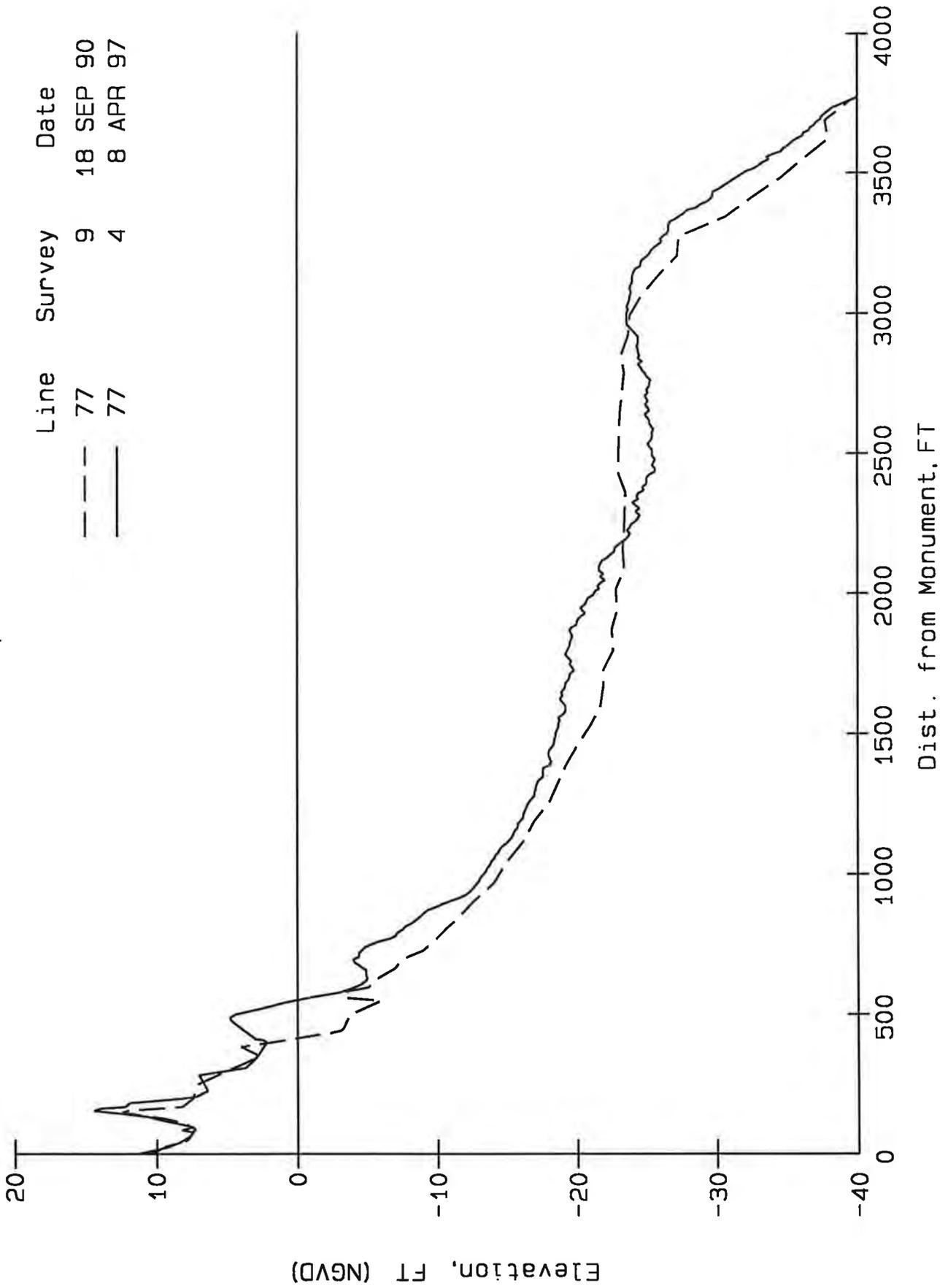
**PALM BEACH ISLAND
BEACH PROFILE COMPARISONS**

1990 - 1997

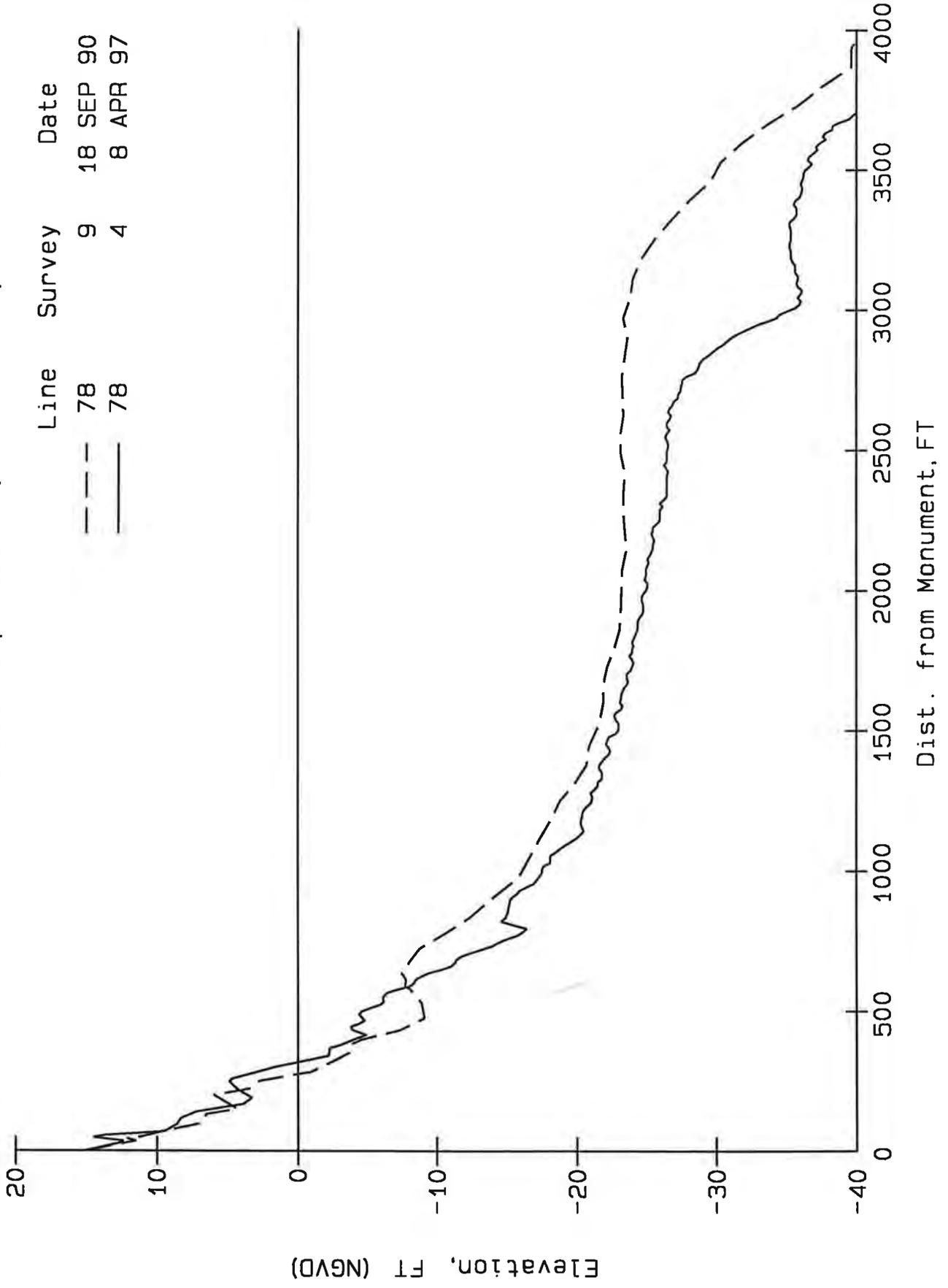
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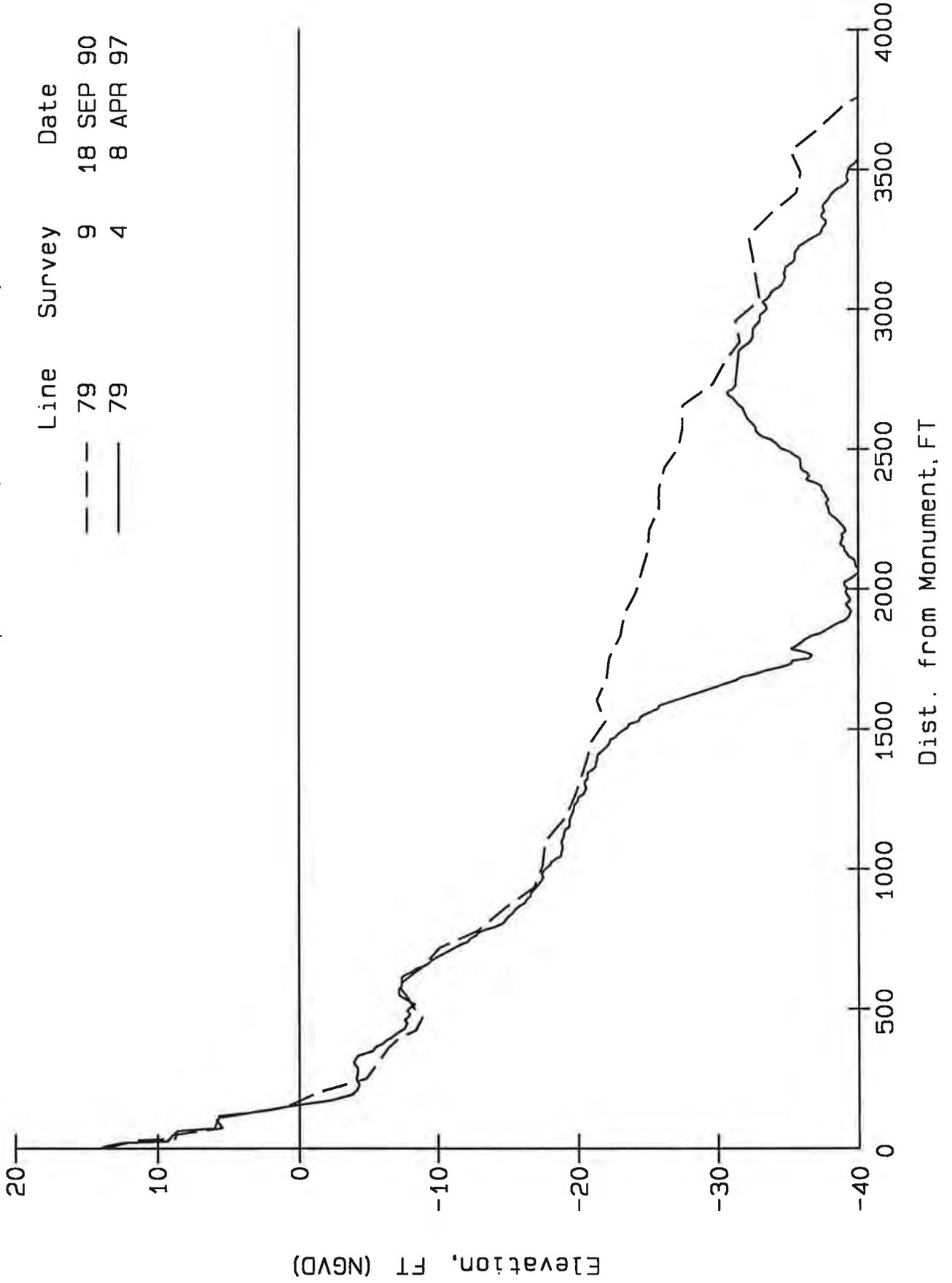
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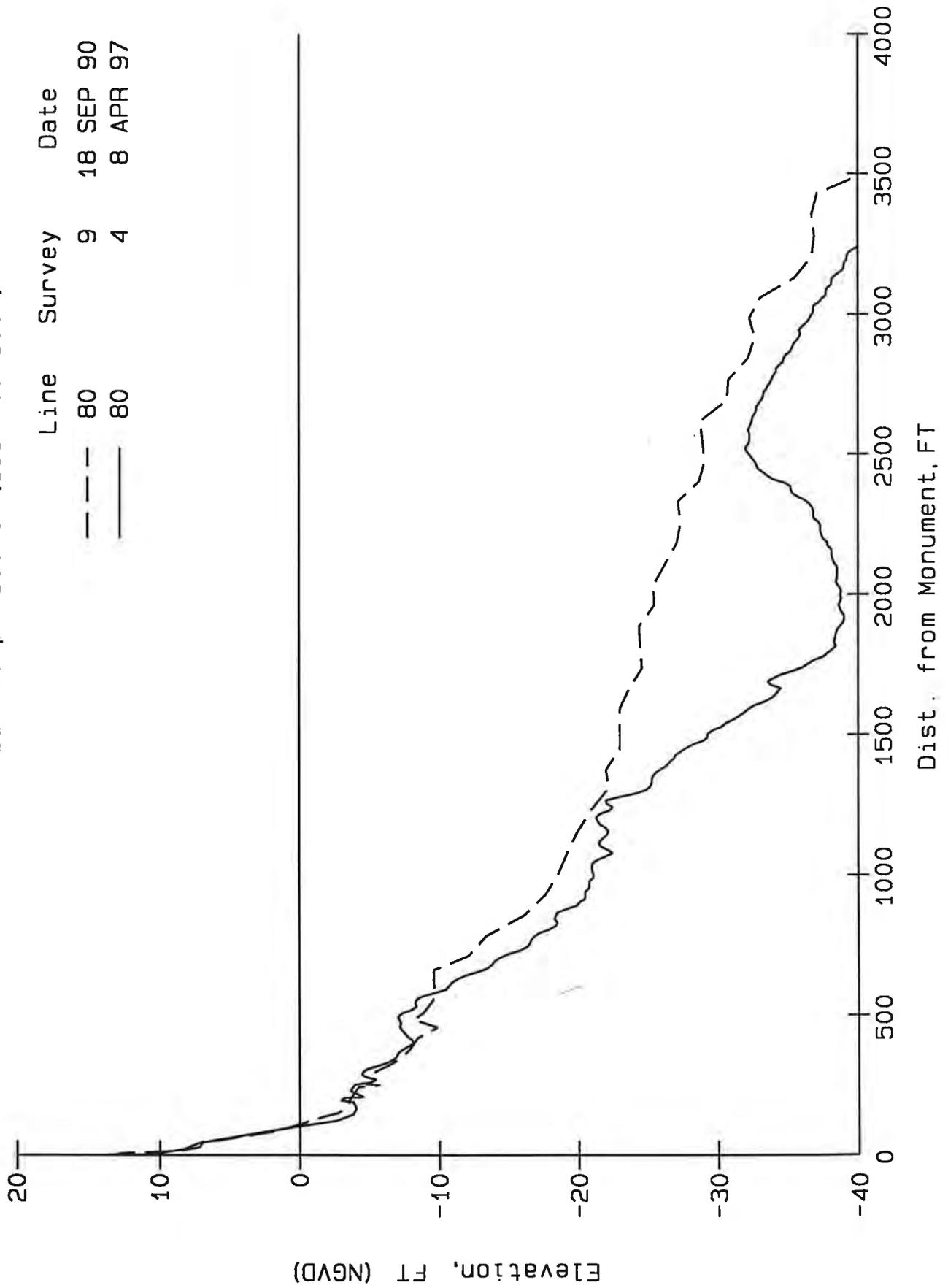
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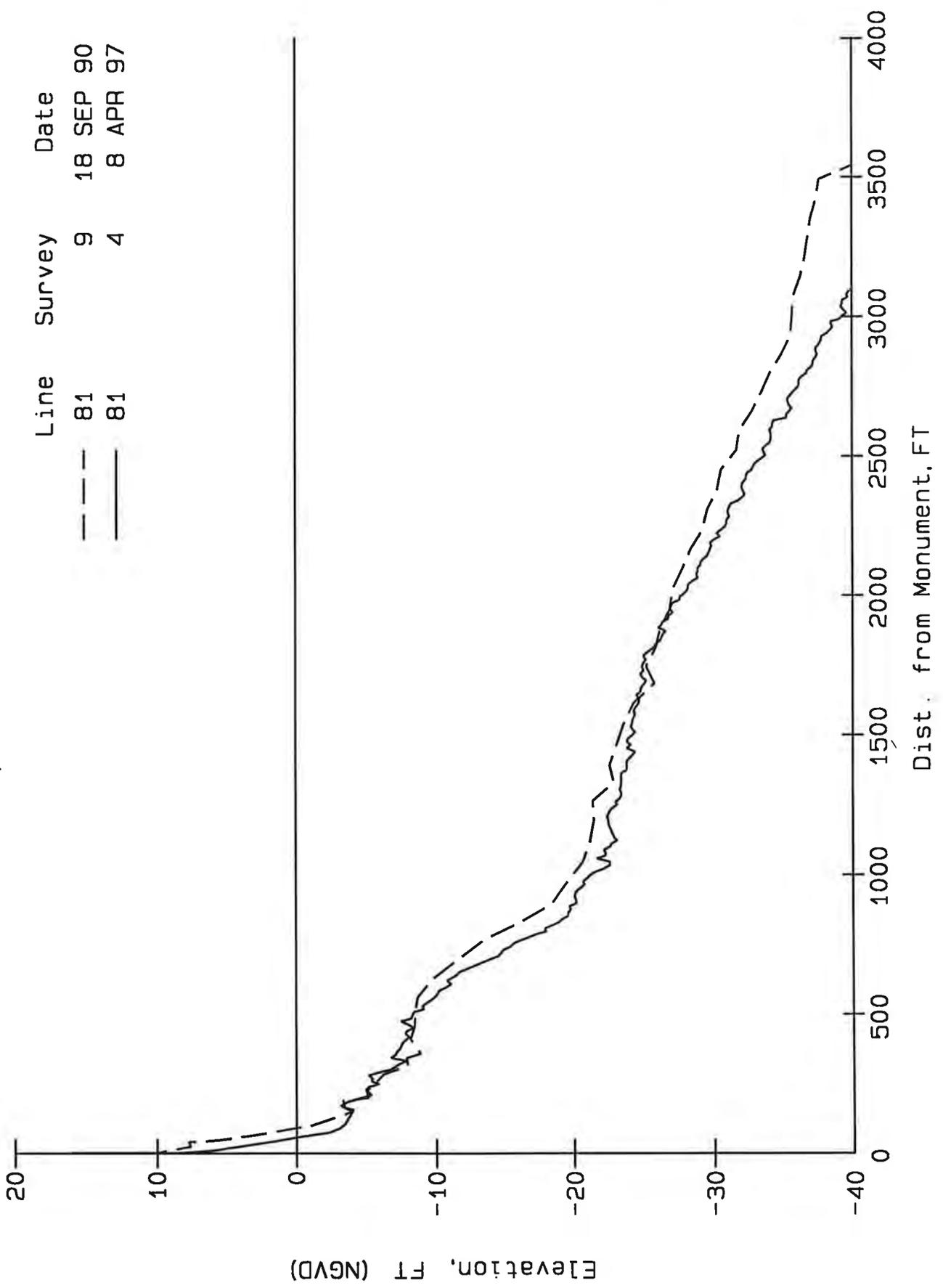
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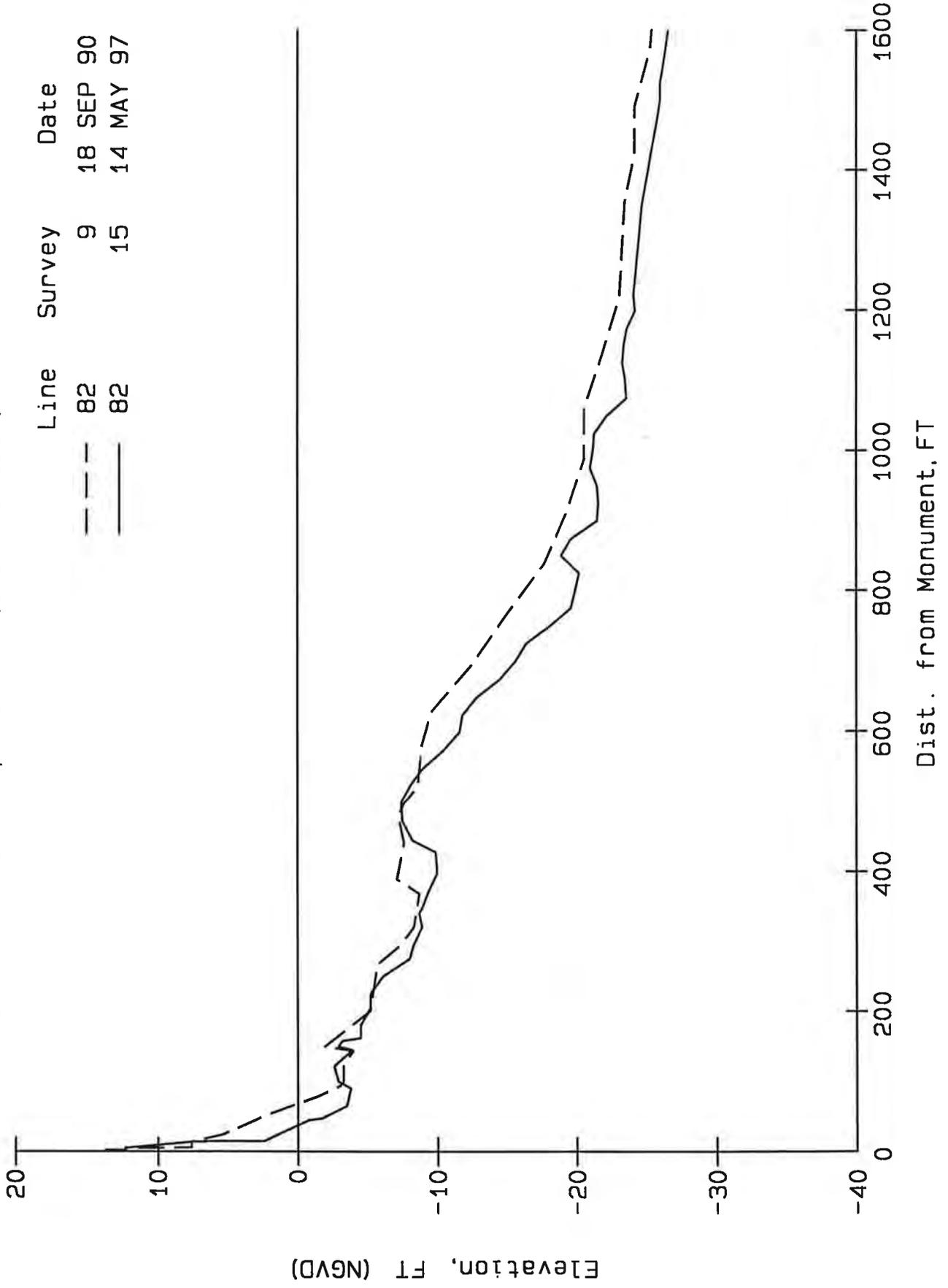
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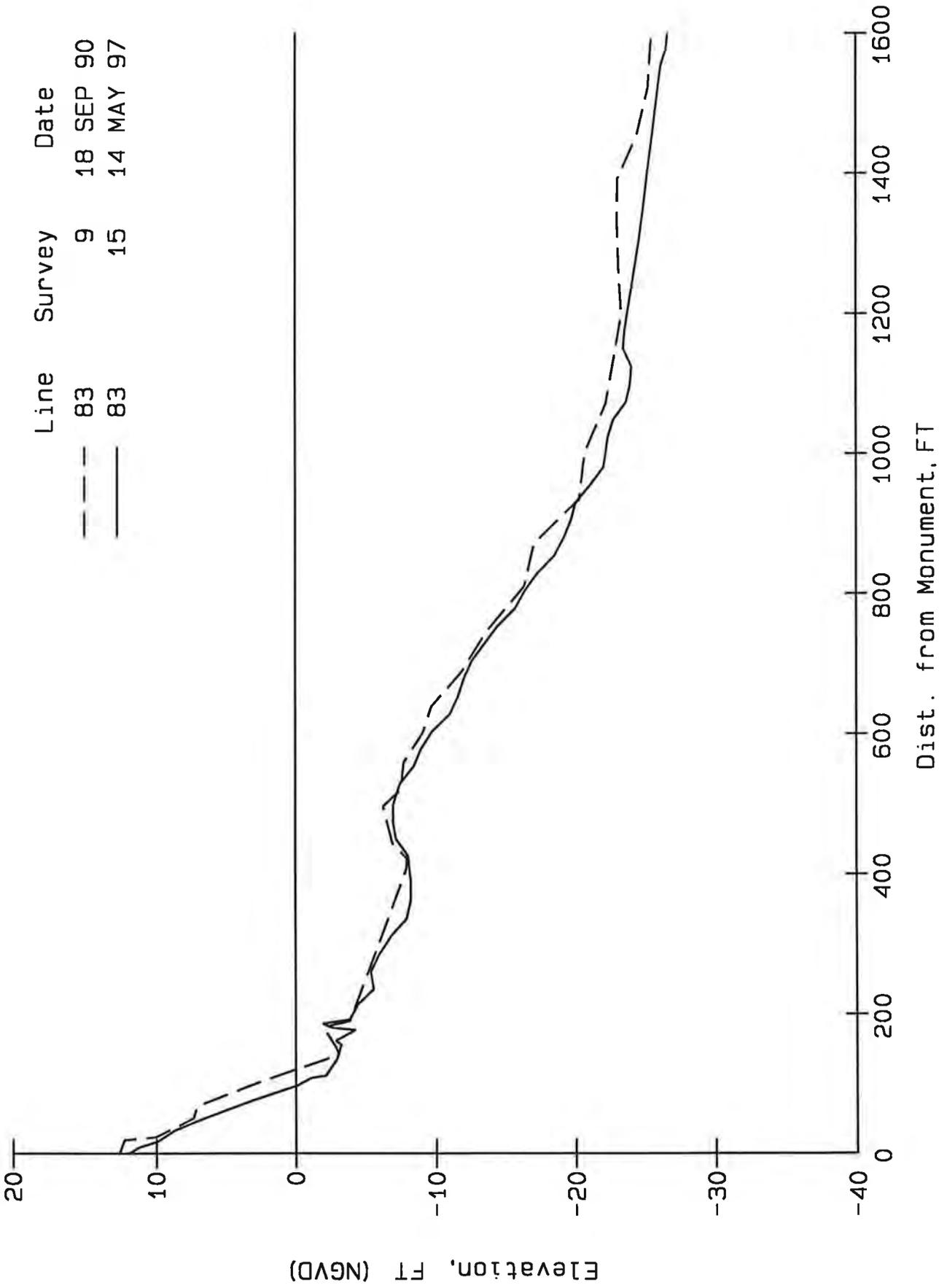
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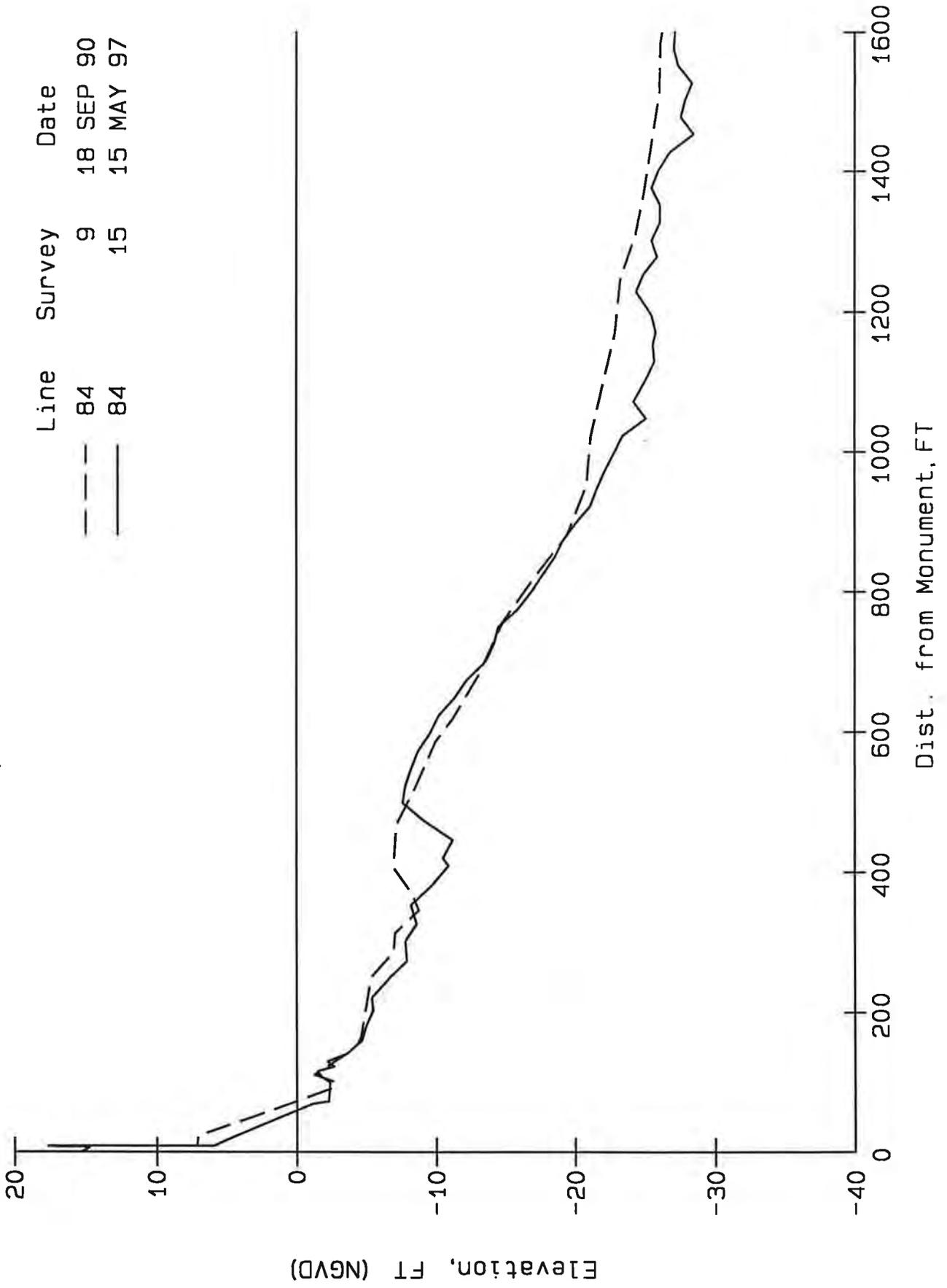
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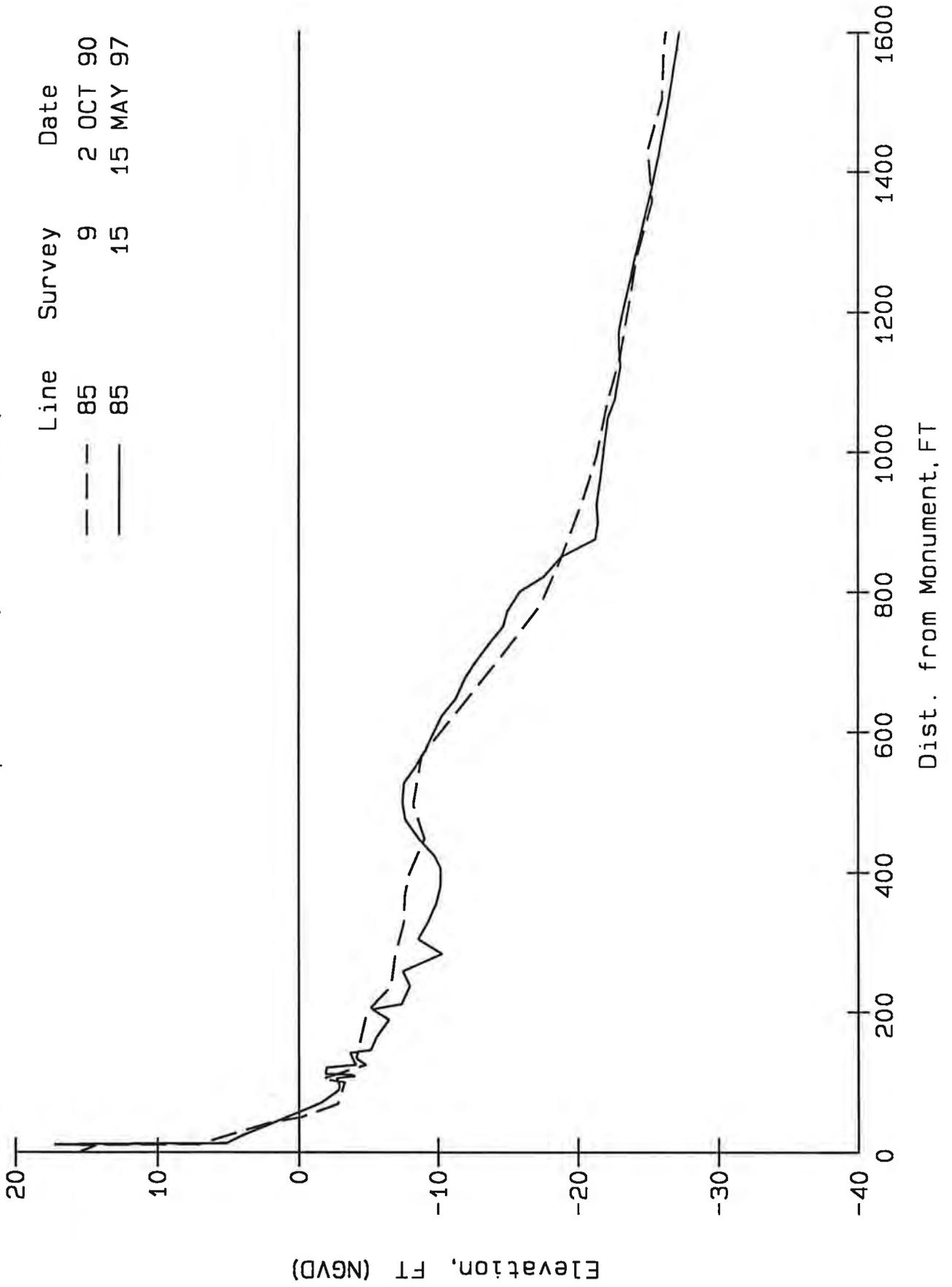
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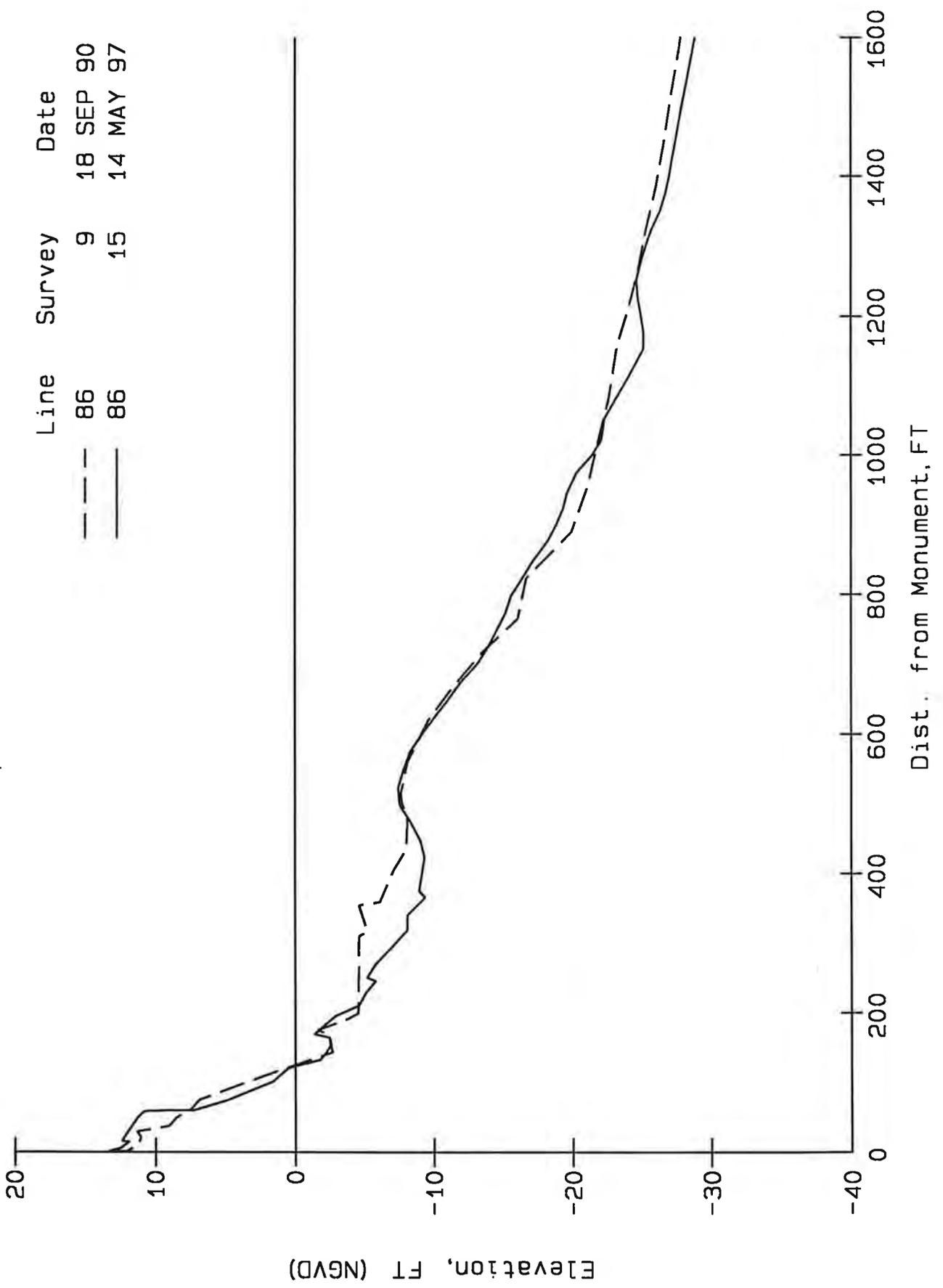
Palm Beach Island
Beach Profile Comparisons (1990 to 1997)



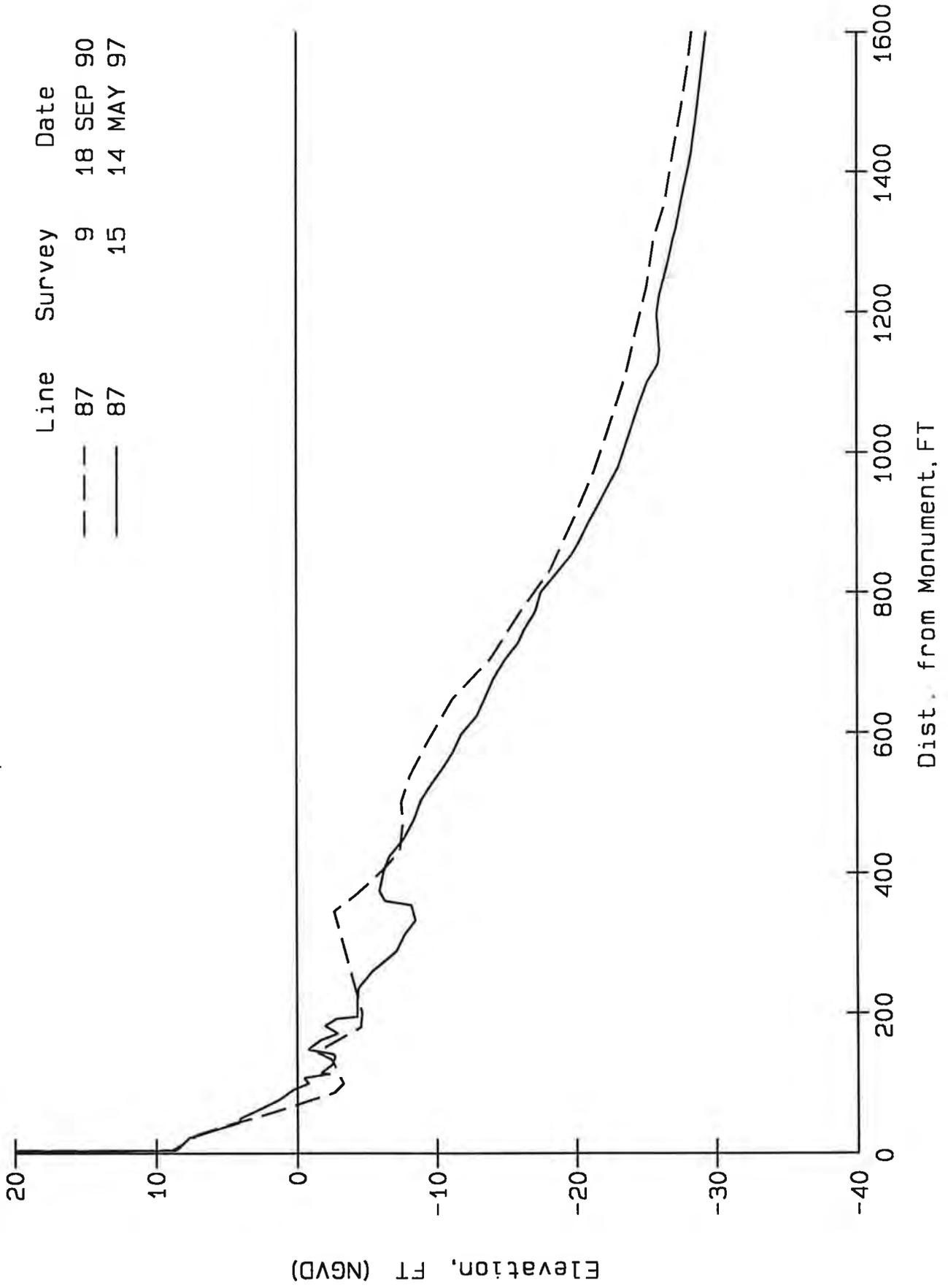
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Beach Profile Comparisons (1990 to 1997)



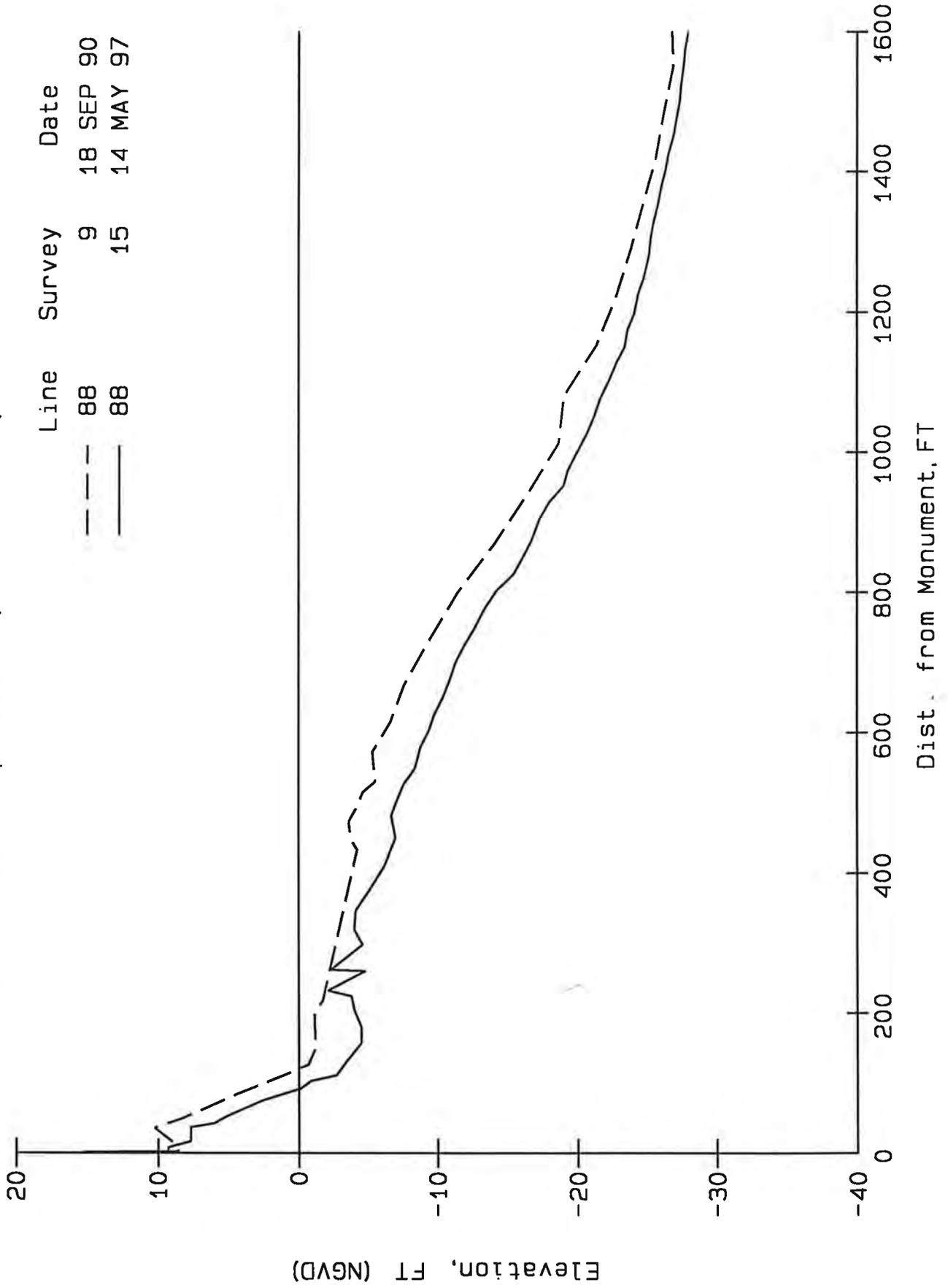
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Beach Profile Comparisons (1990 to 1997)



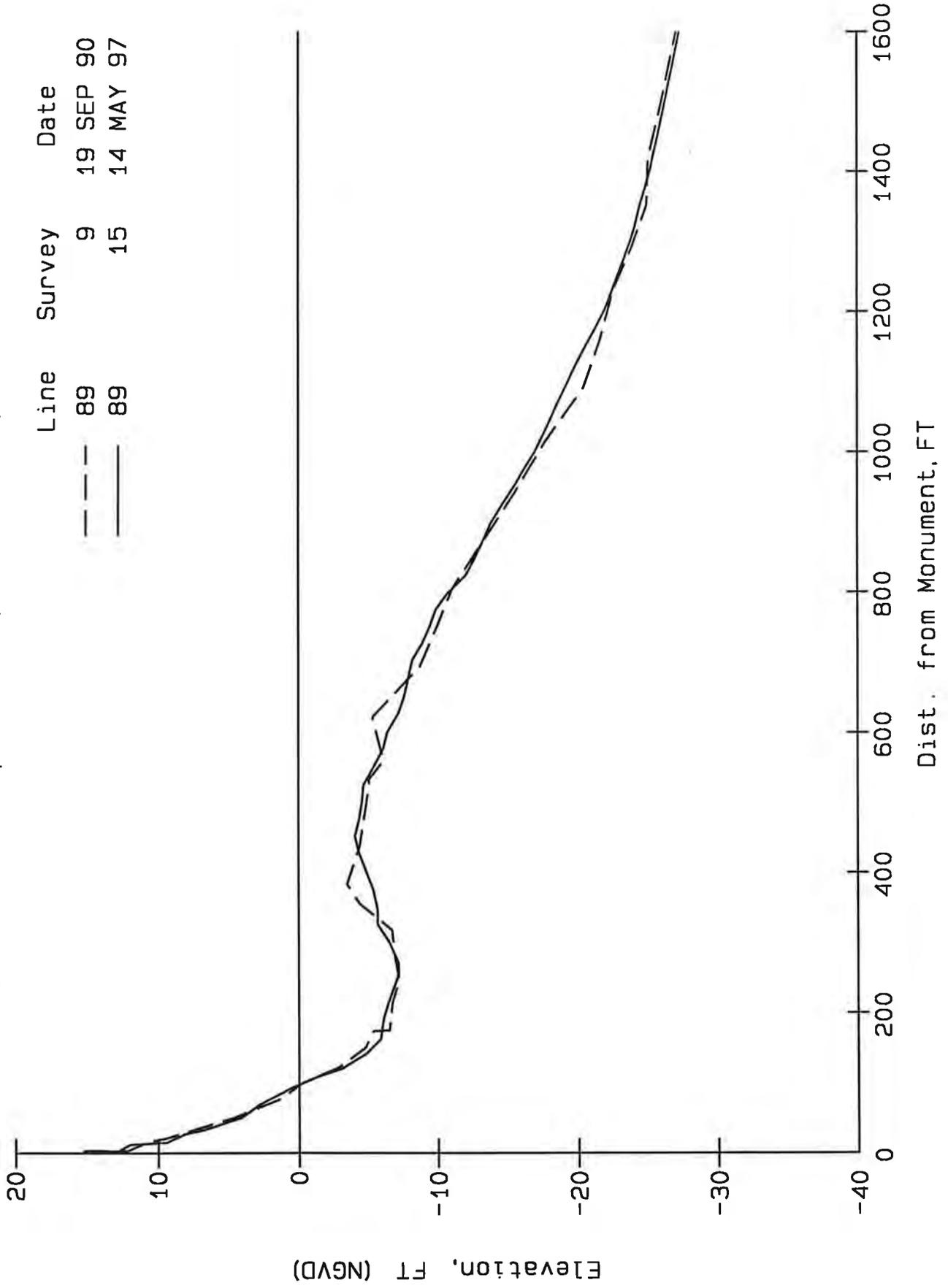
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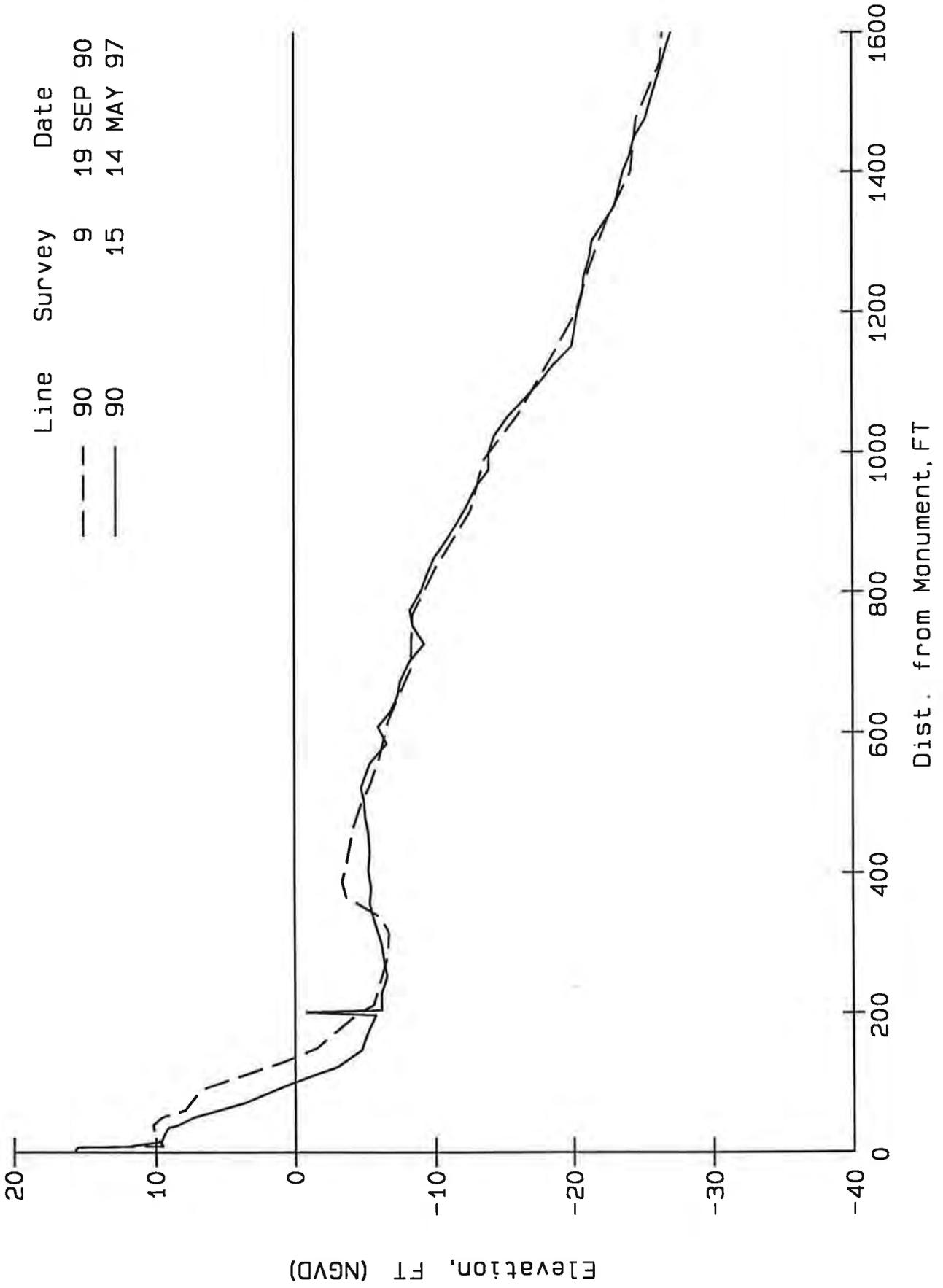
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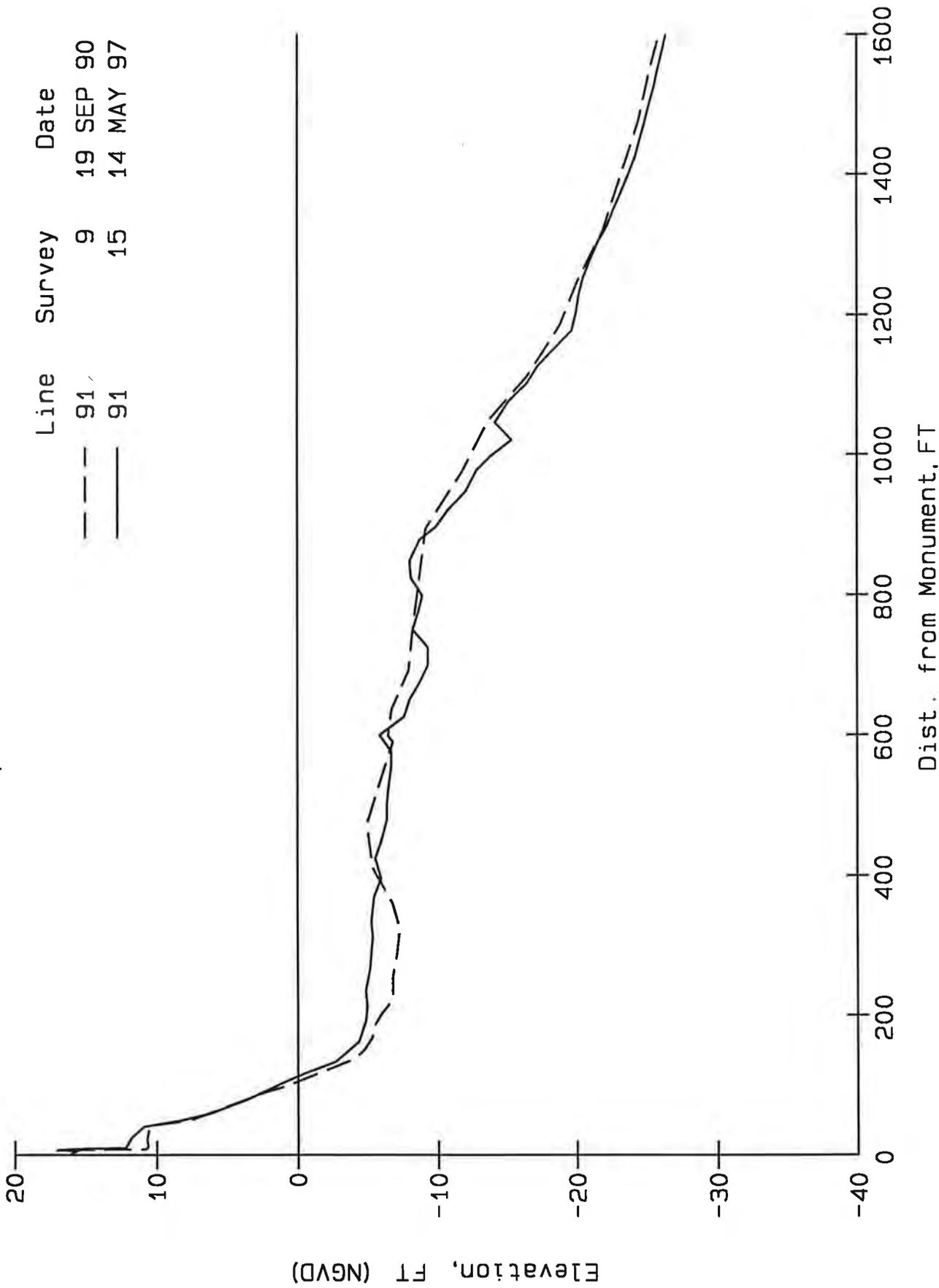
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Beach Profile Comparisons (1990 to 1997)



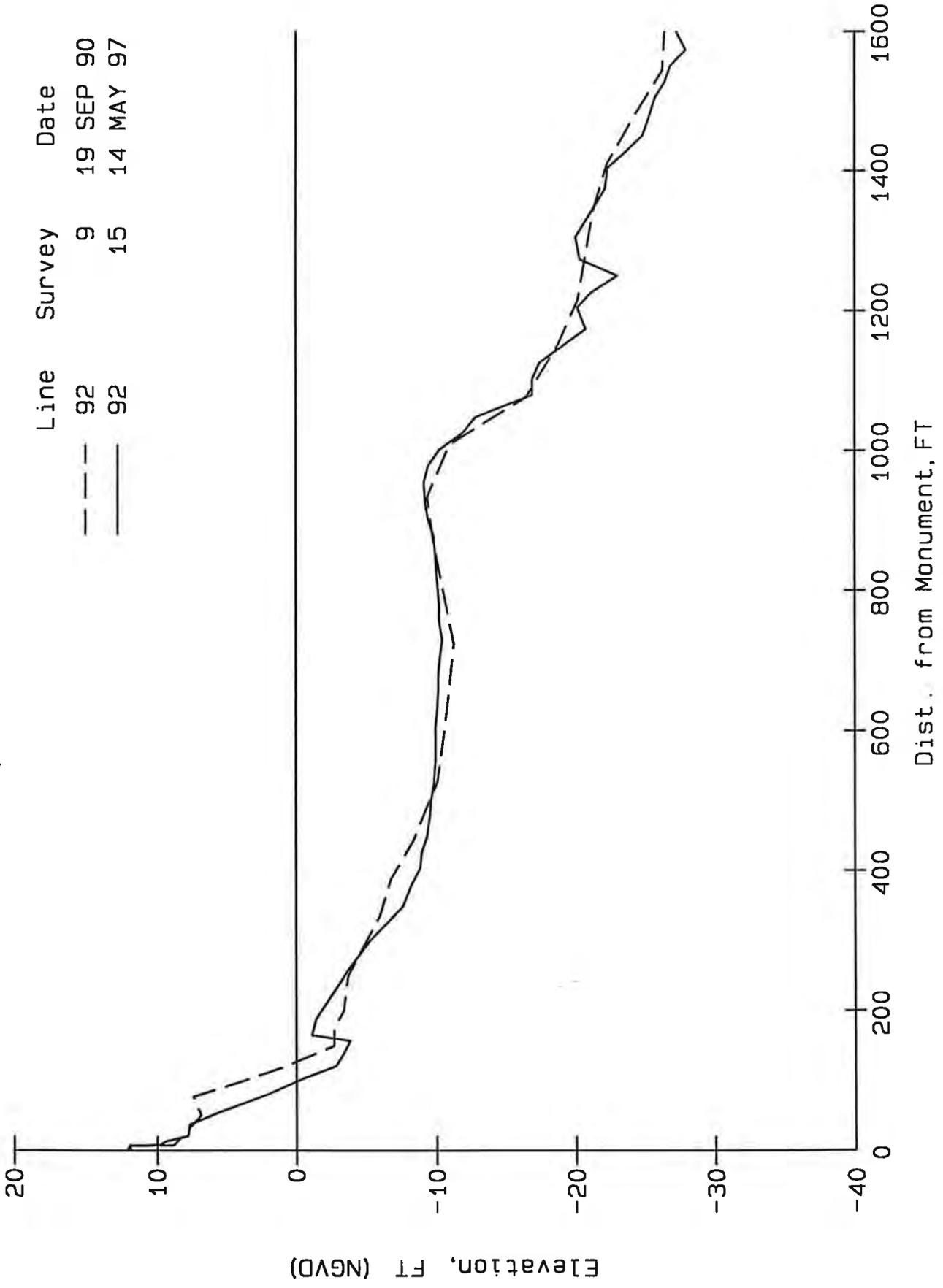
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Beach Profile Comparisons (1990 to 1997)



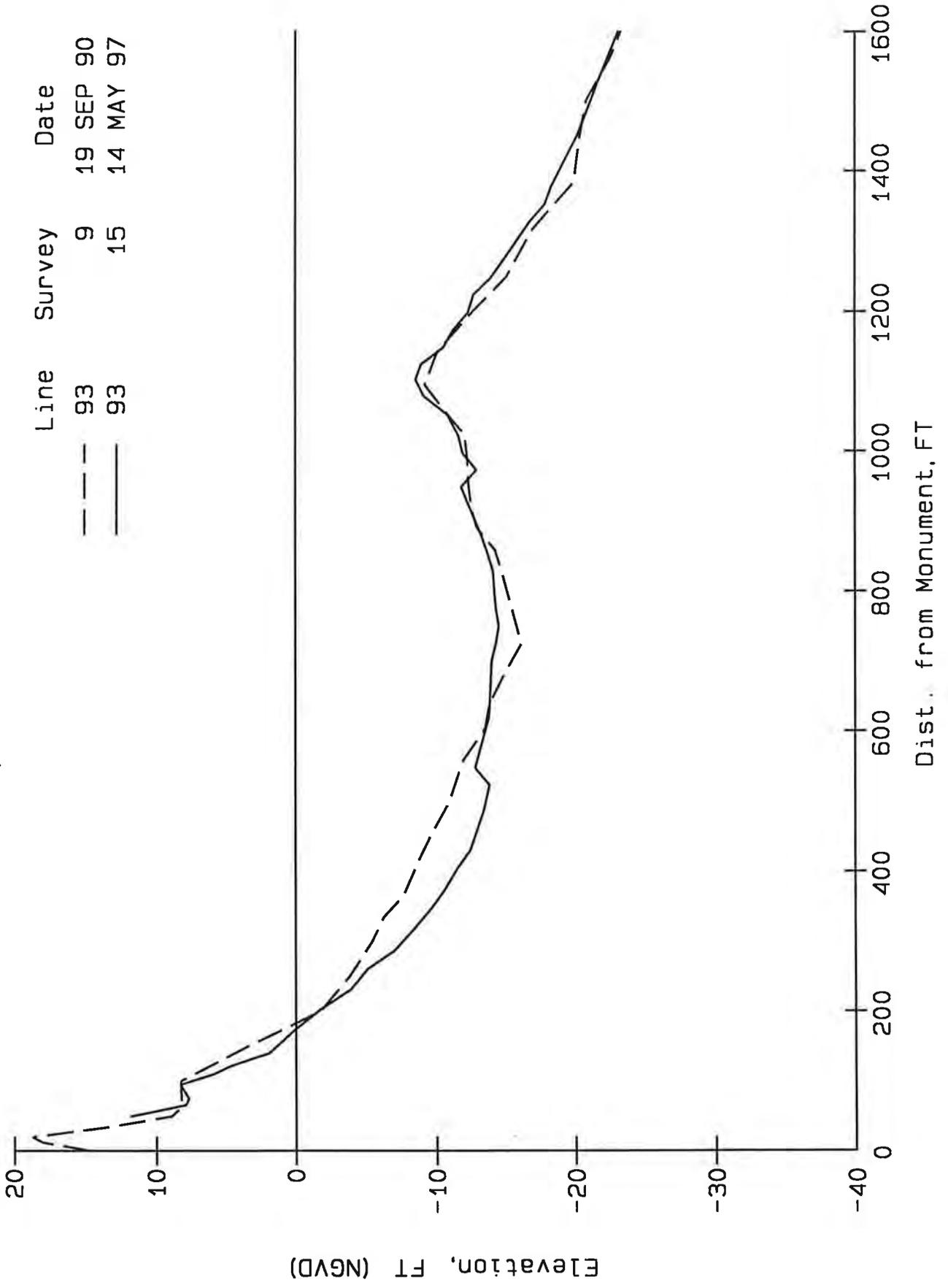
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 Beach Profile Comparisons (1990 to 1997)



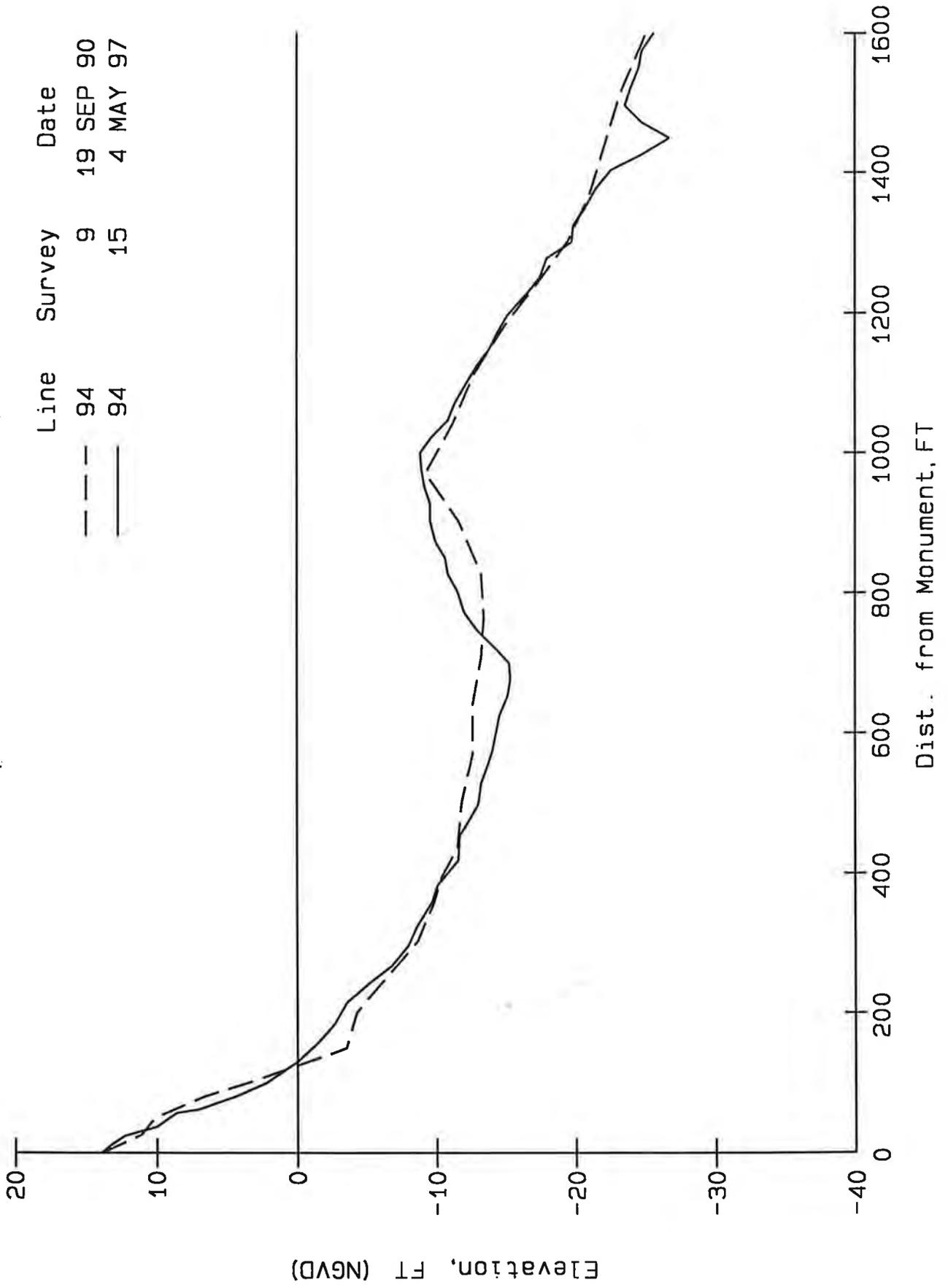
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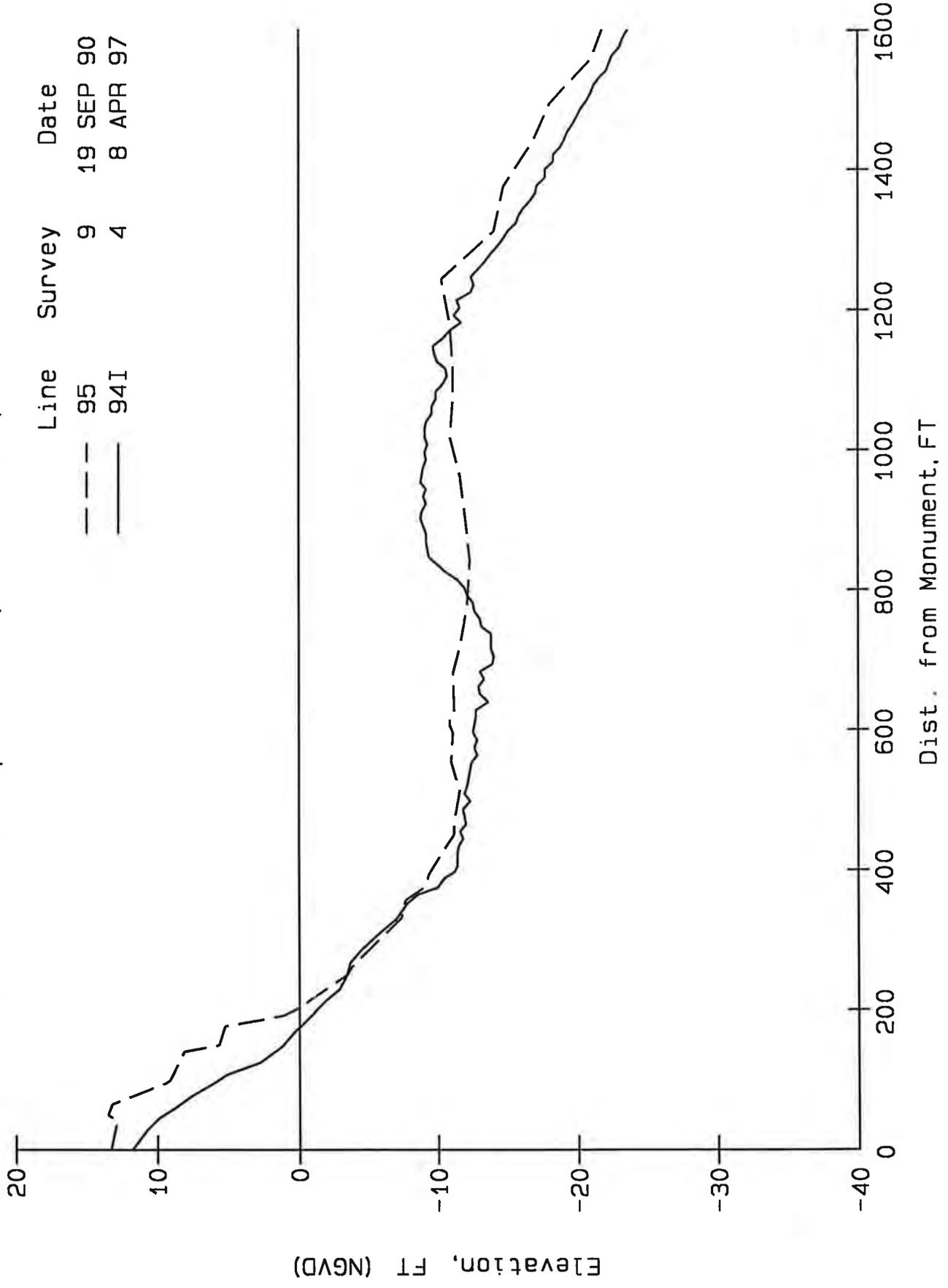
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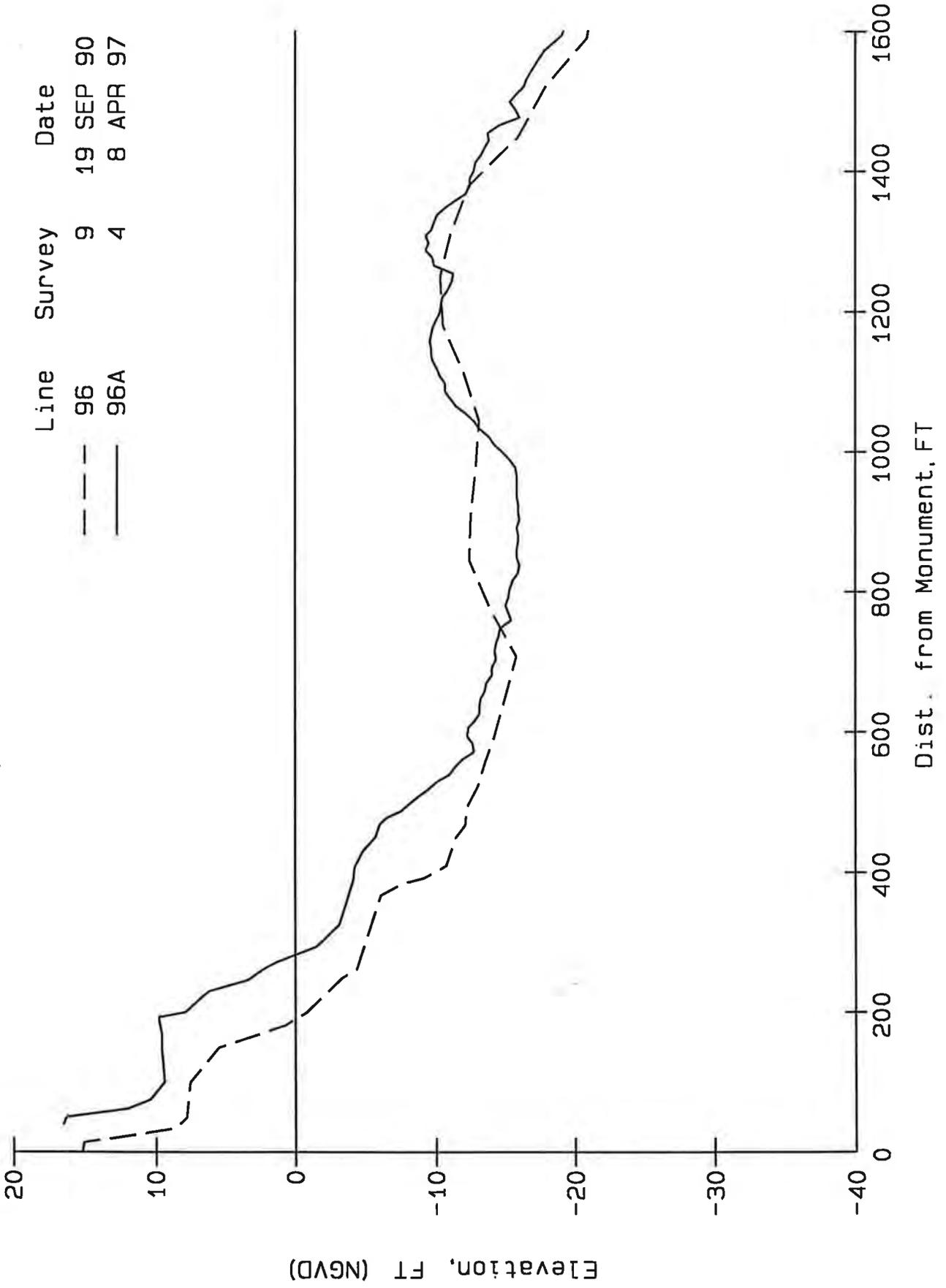
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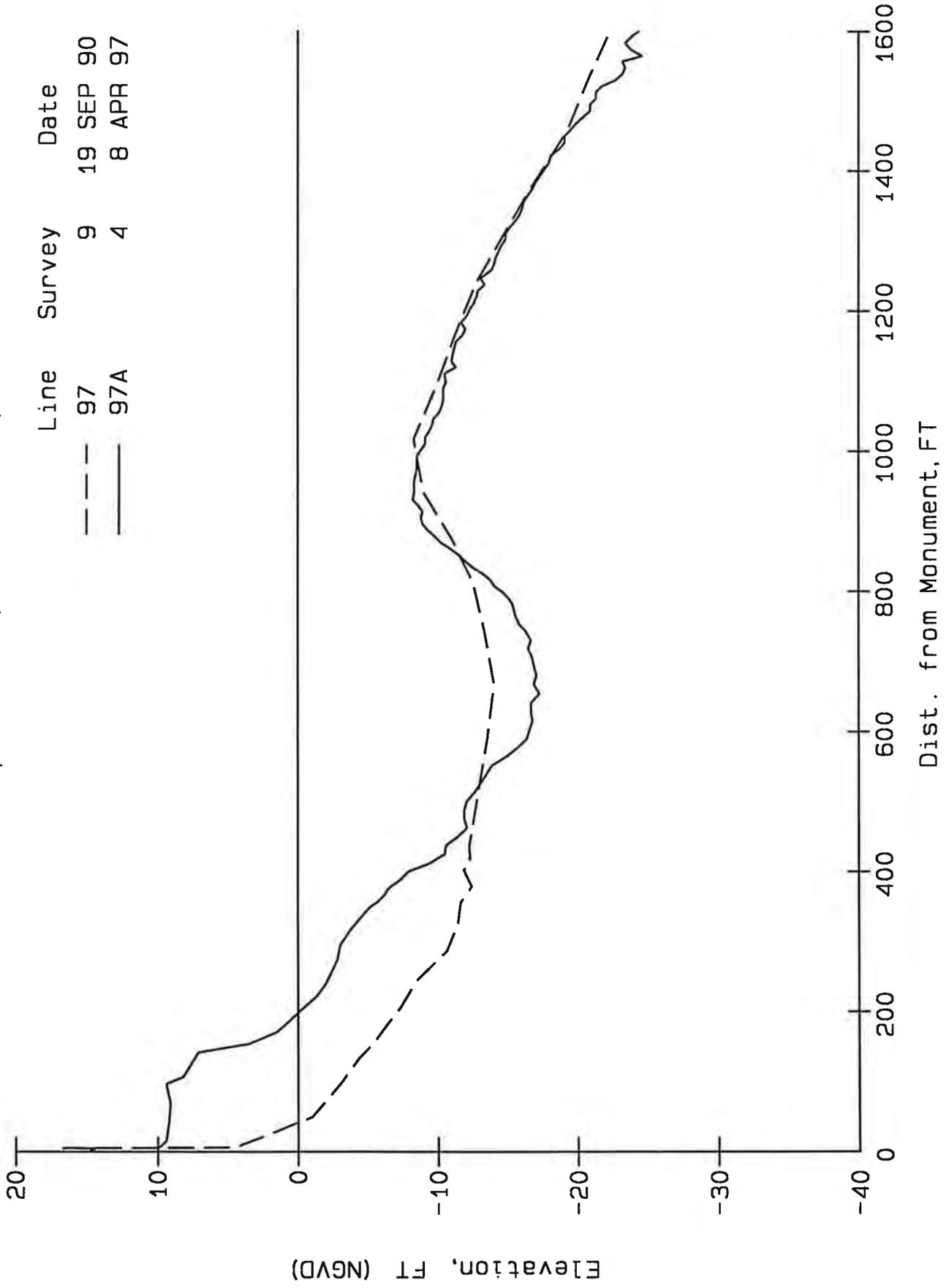
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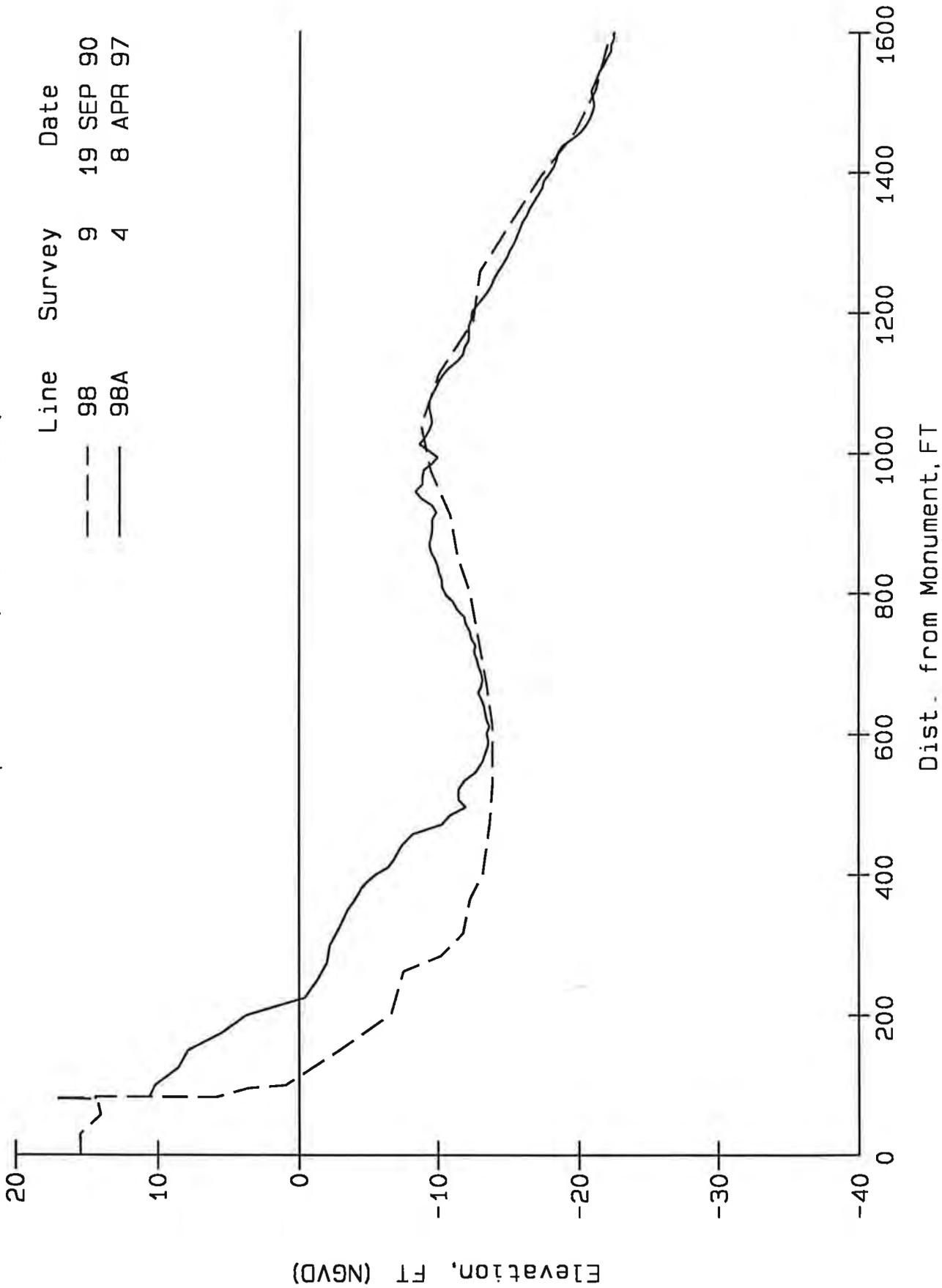
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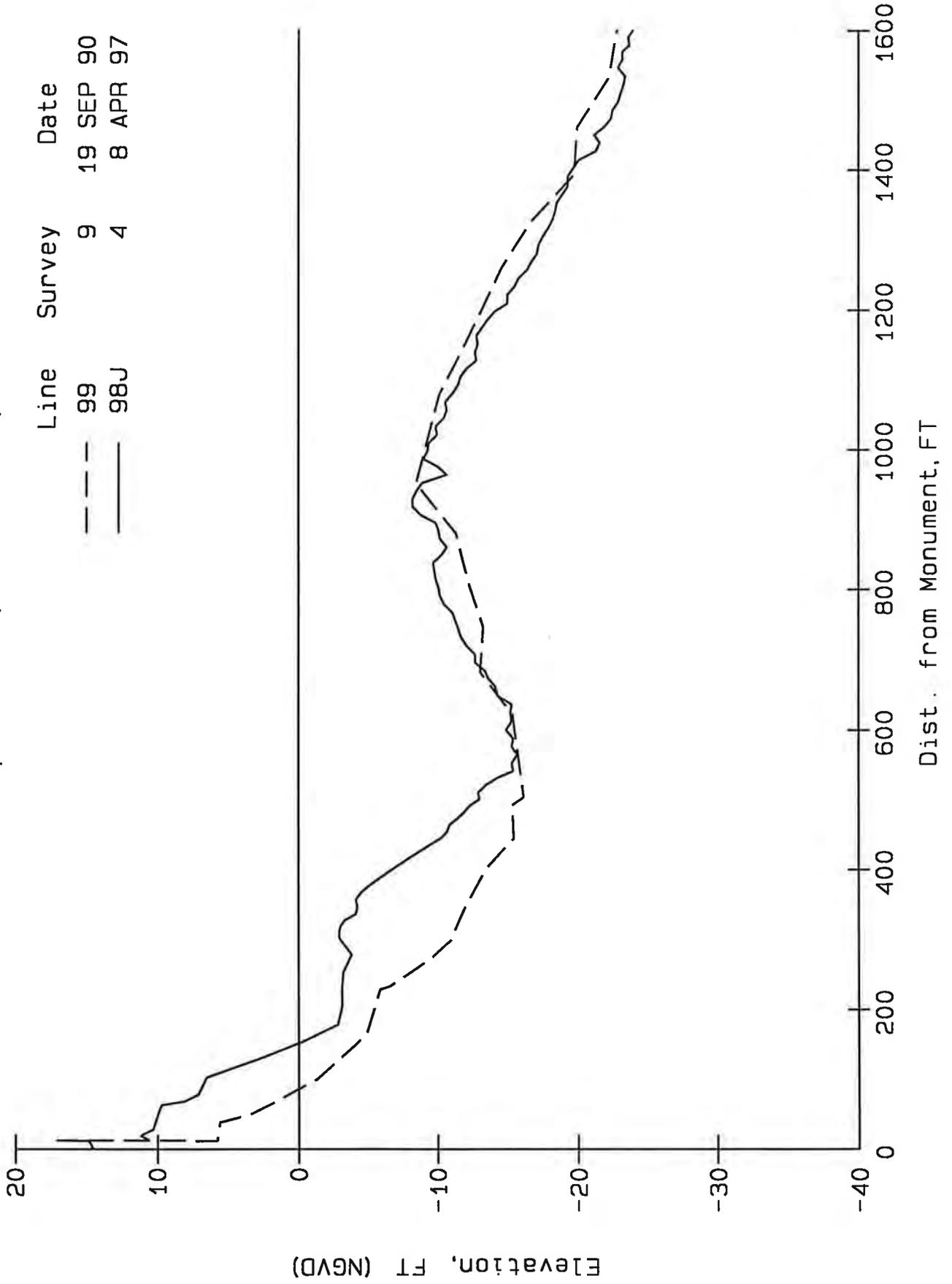
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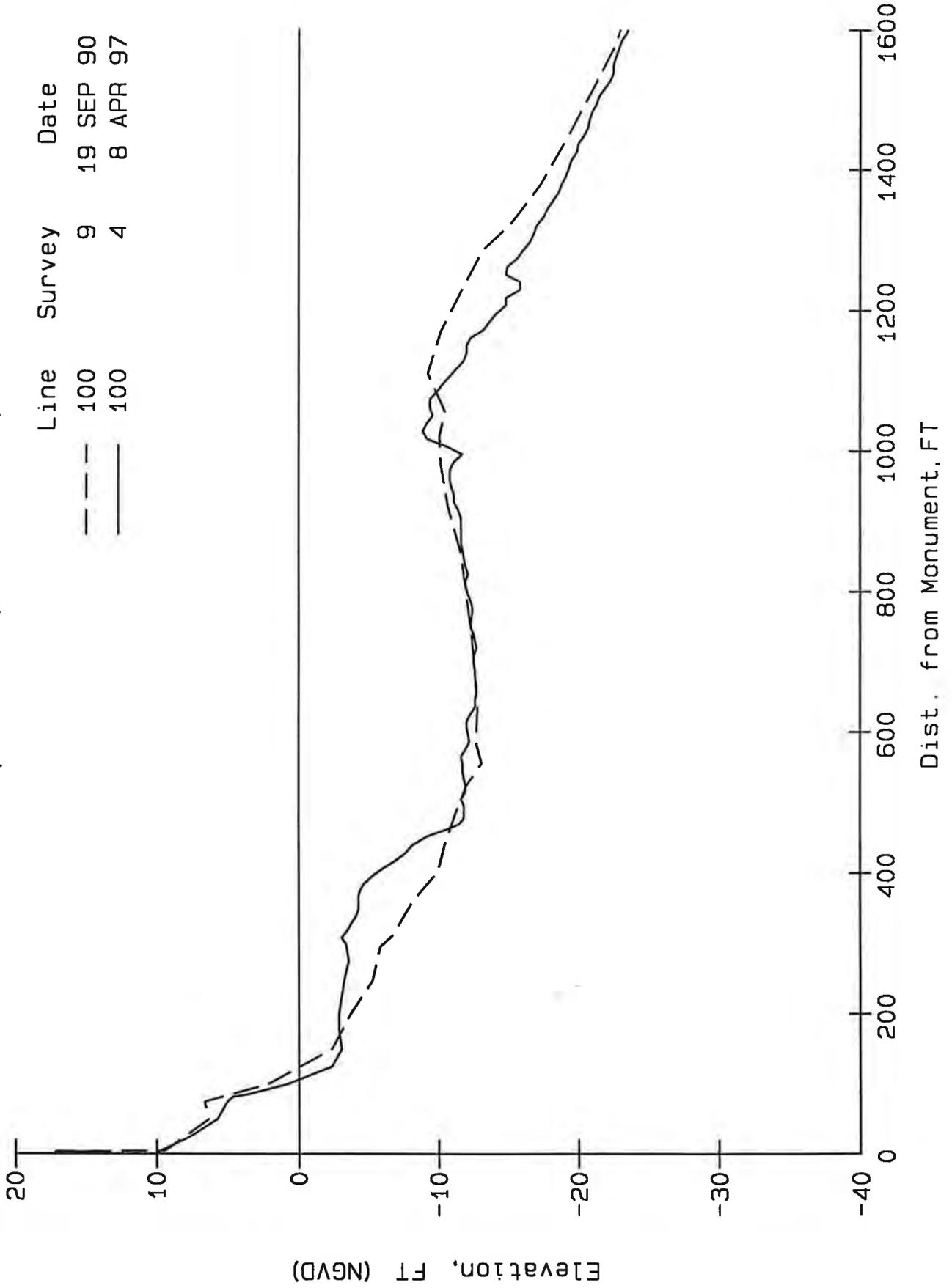
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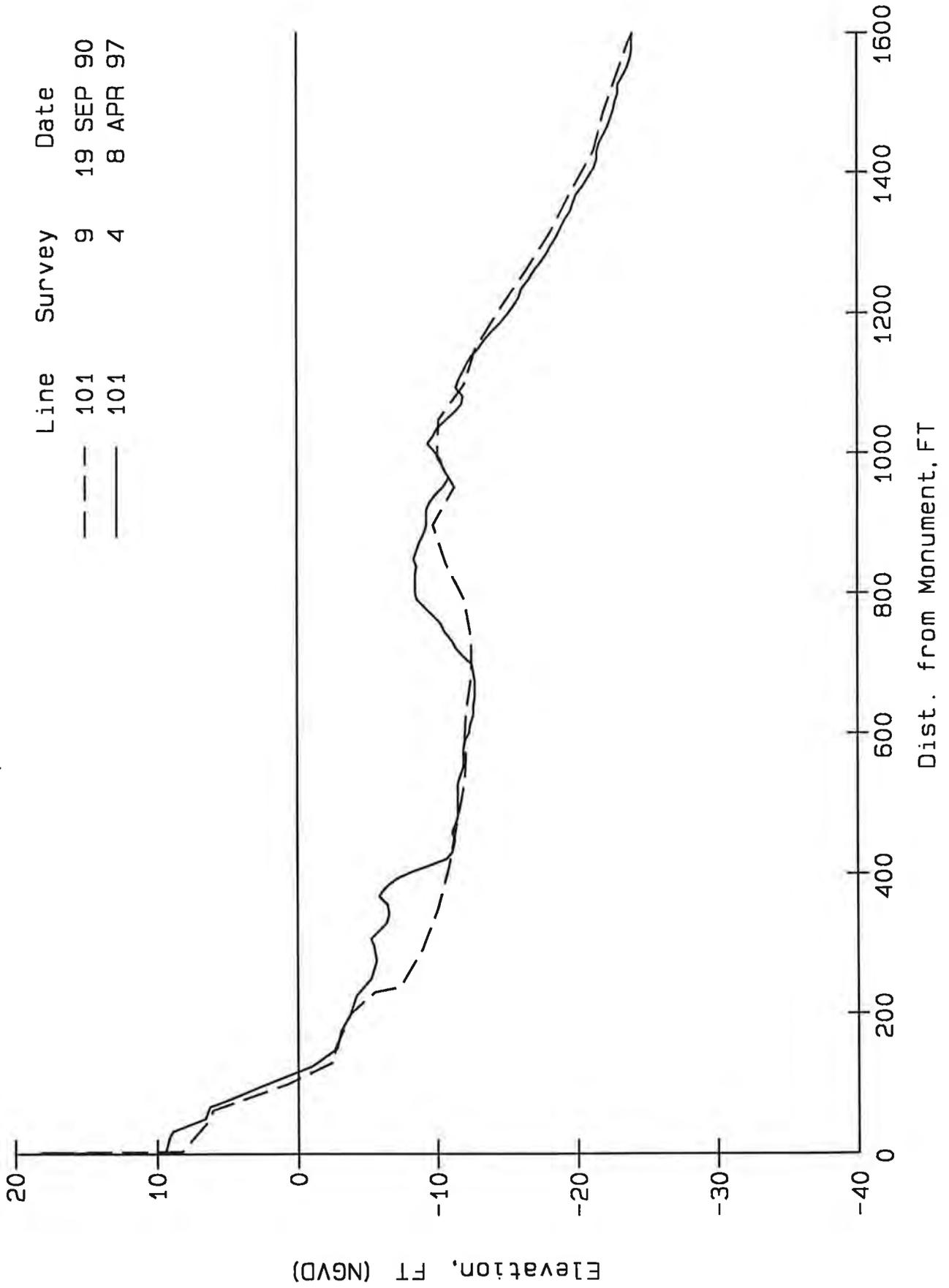
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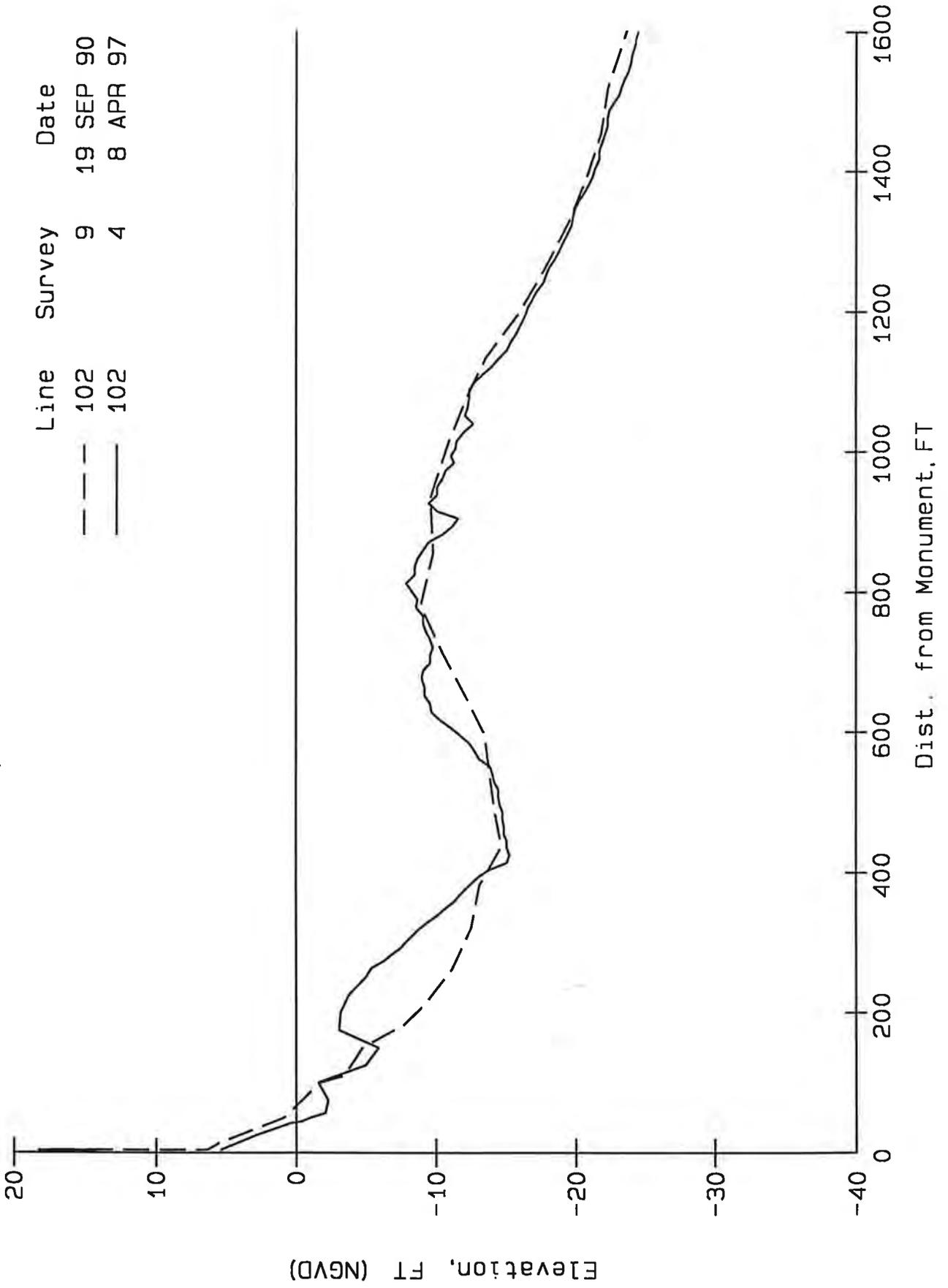
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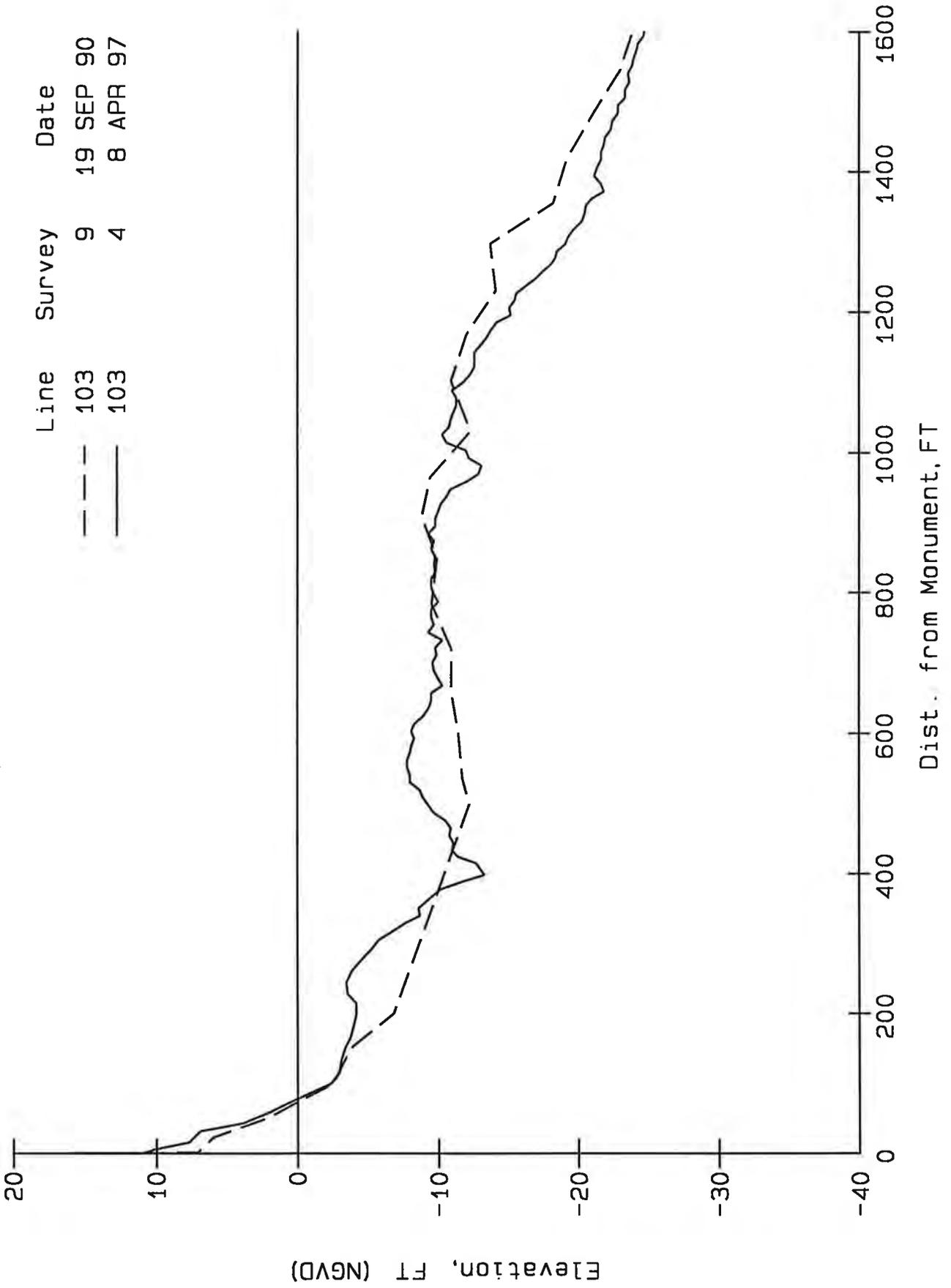
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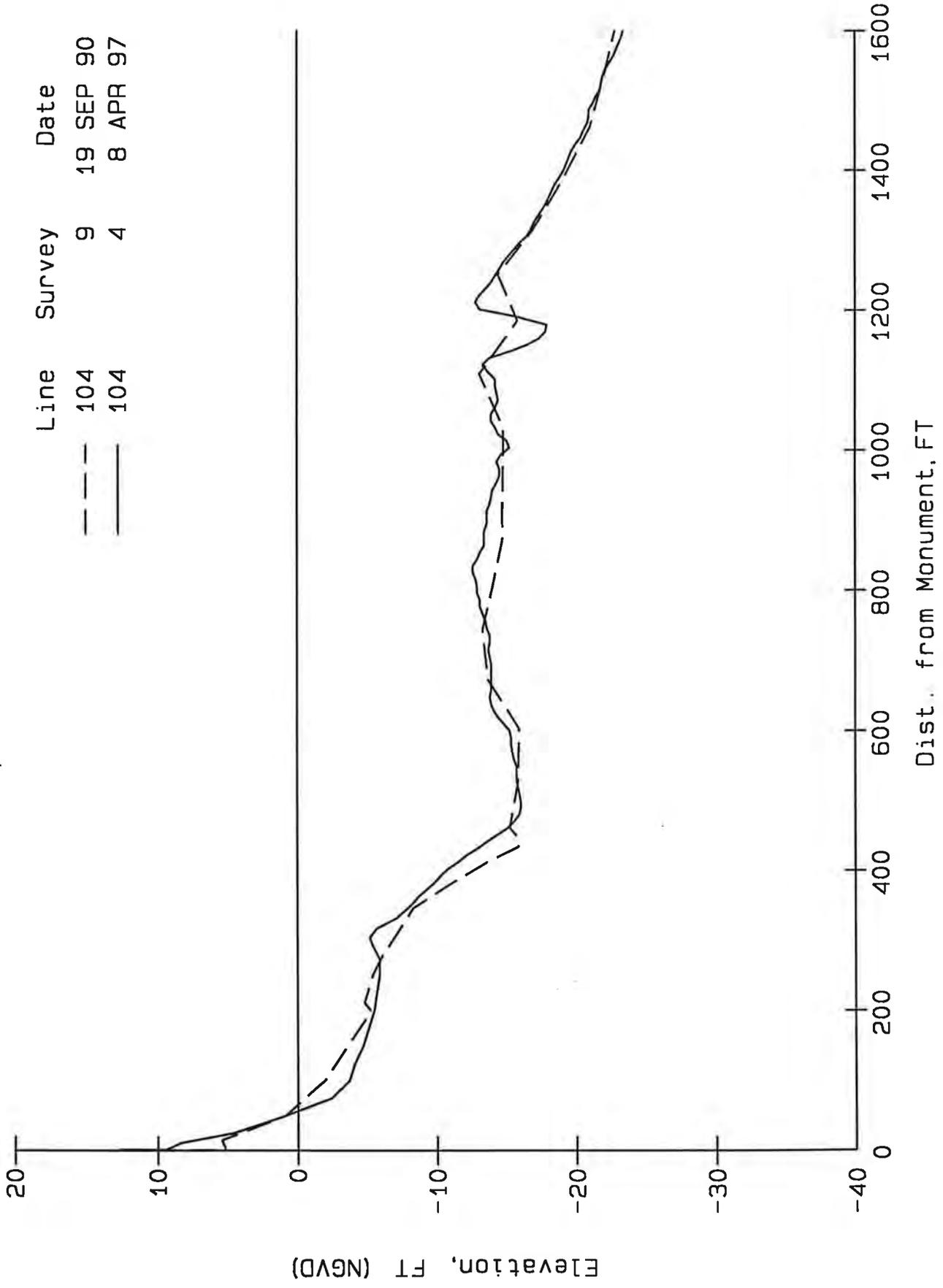
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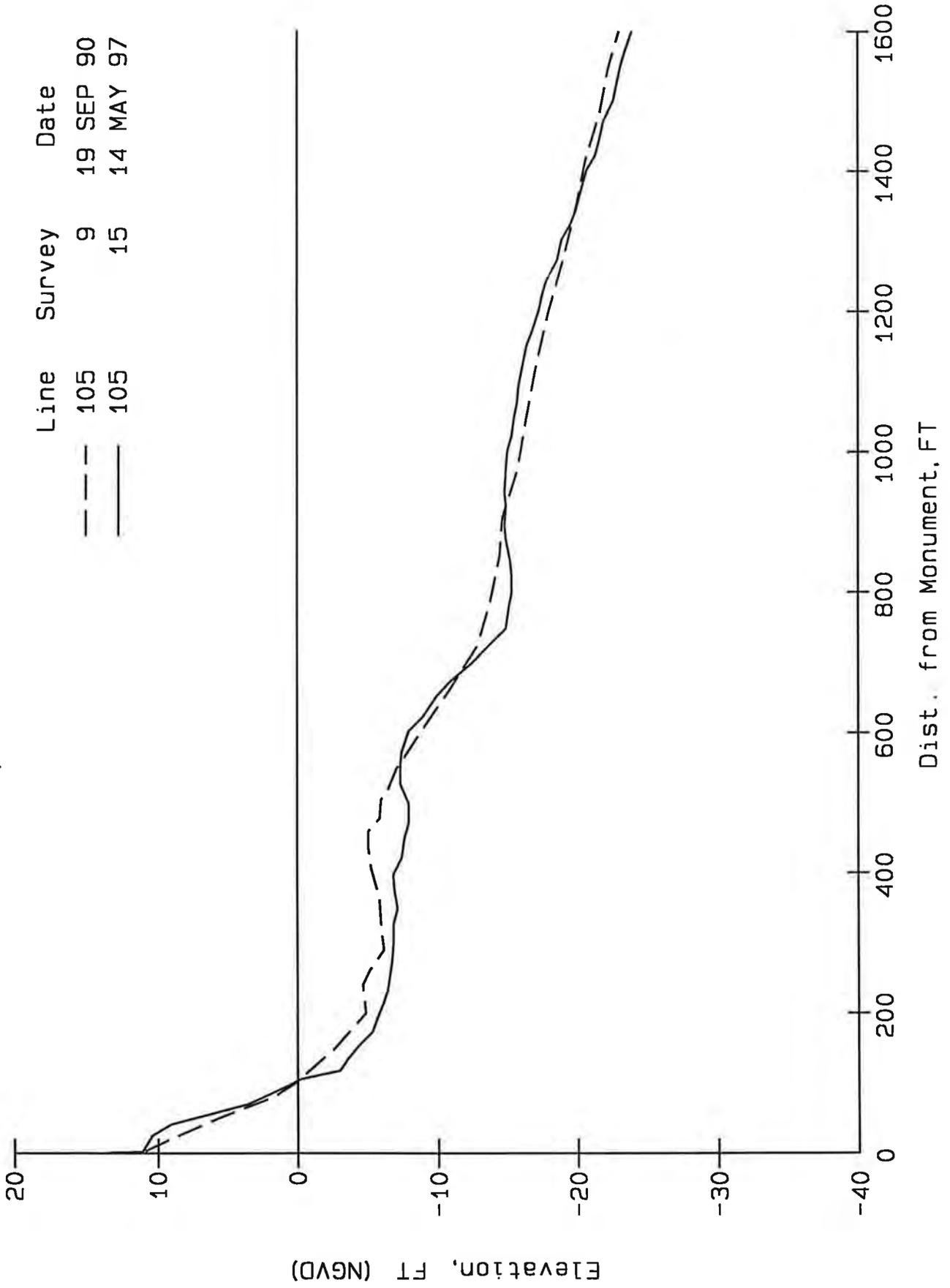
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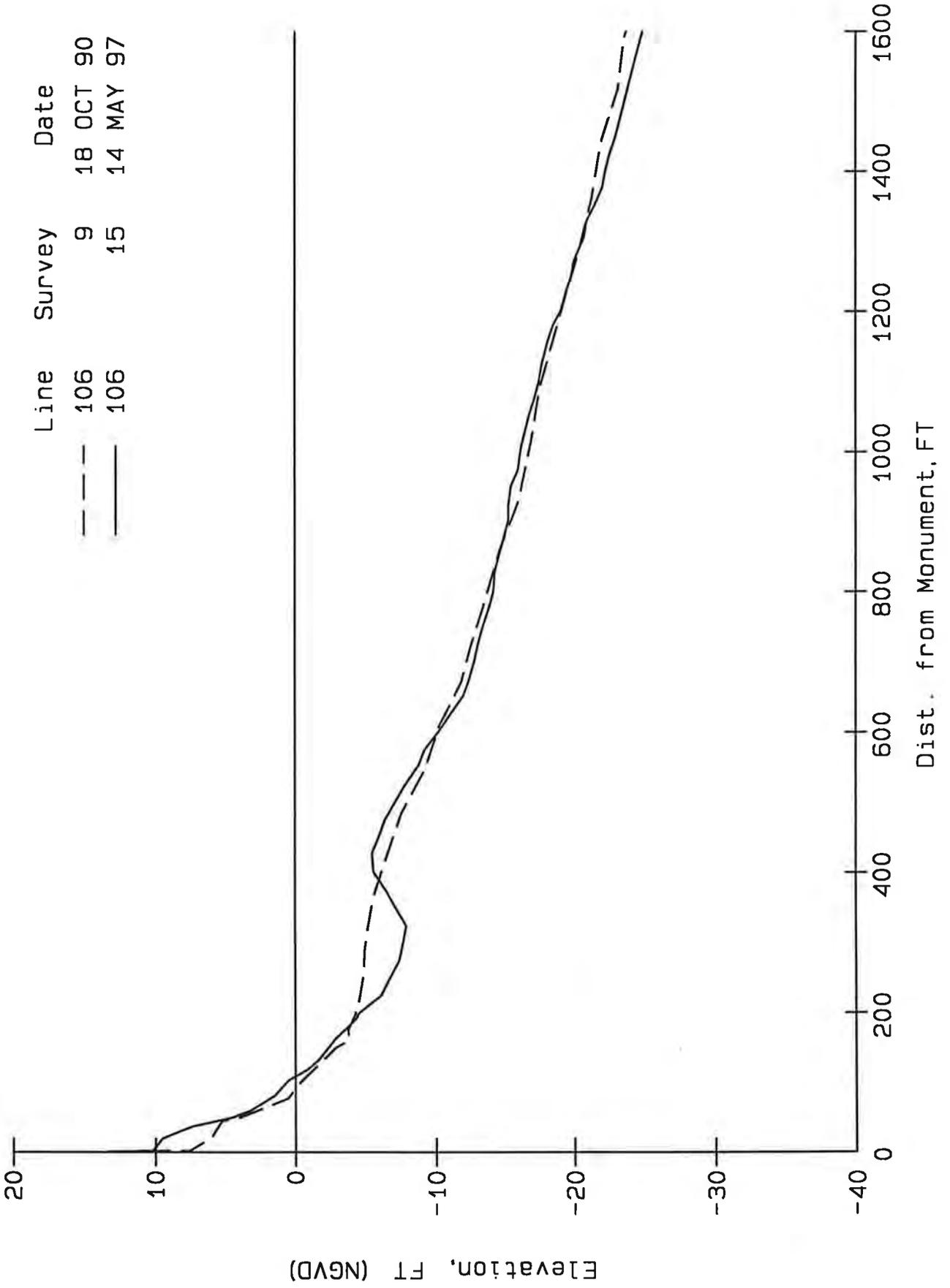
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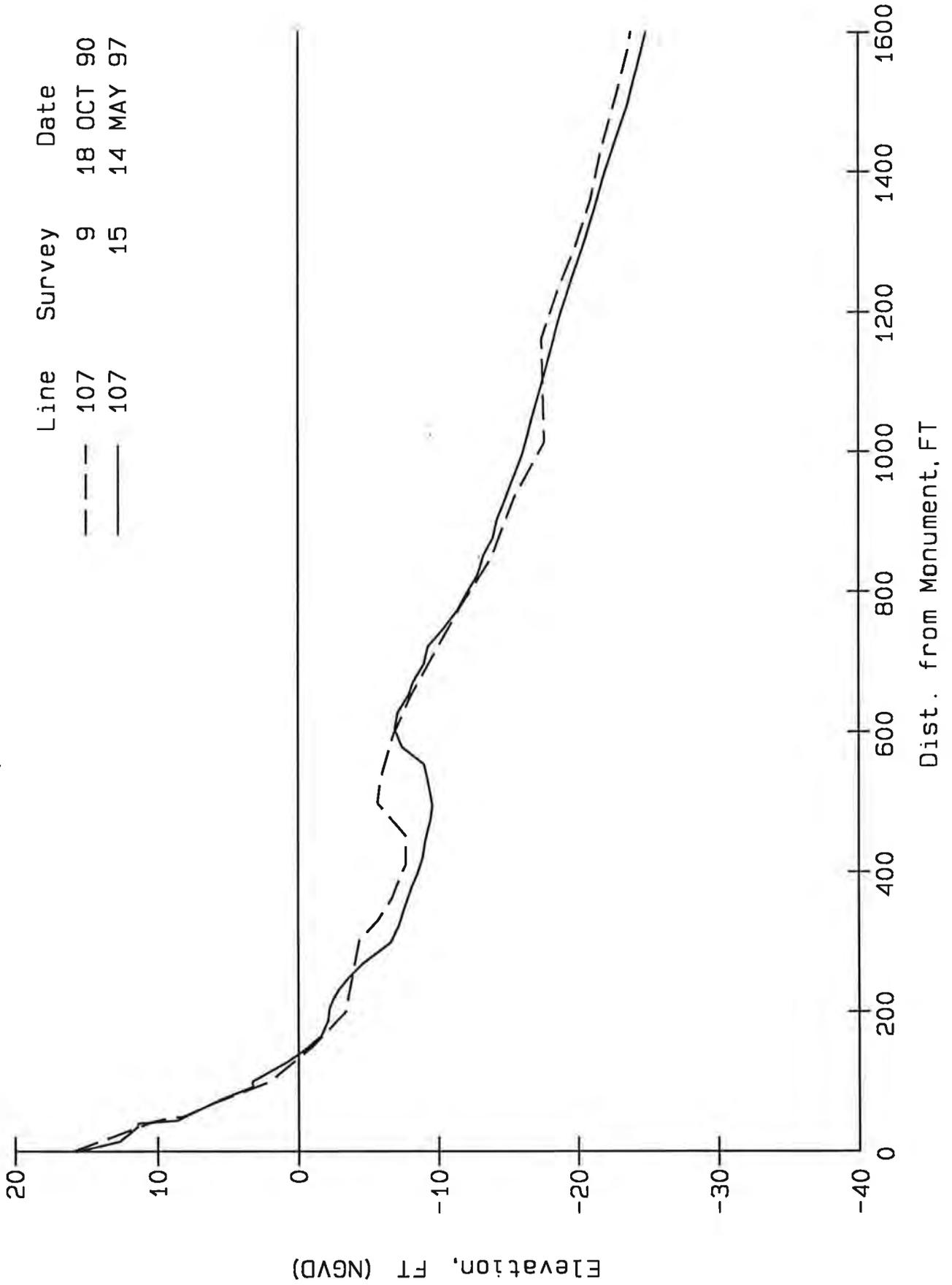
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Beach Profile Comparisons (1990 to 1997)



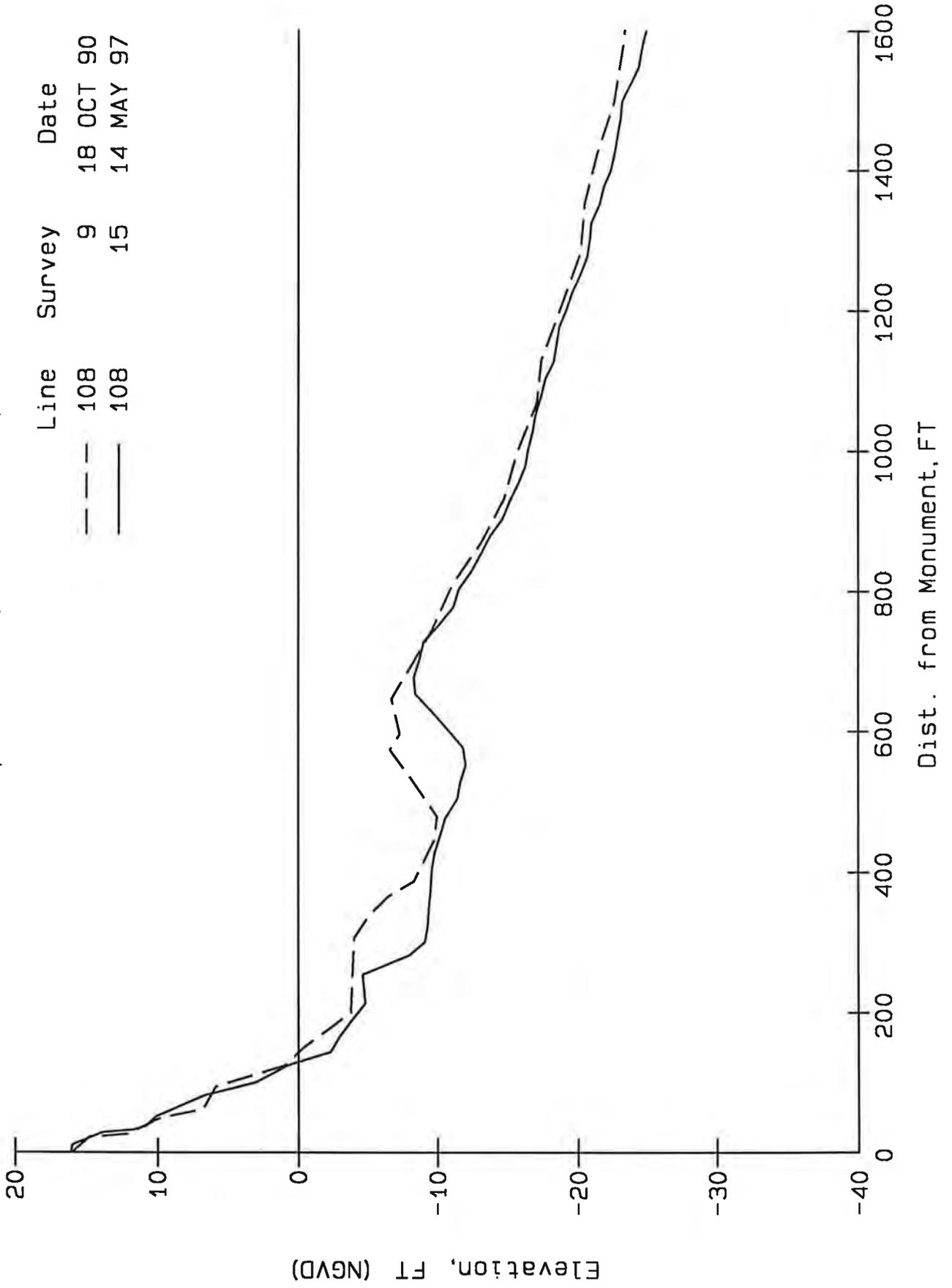
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Beach Profile Comparisons (1990 to 1997)



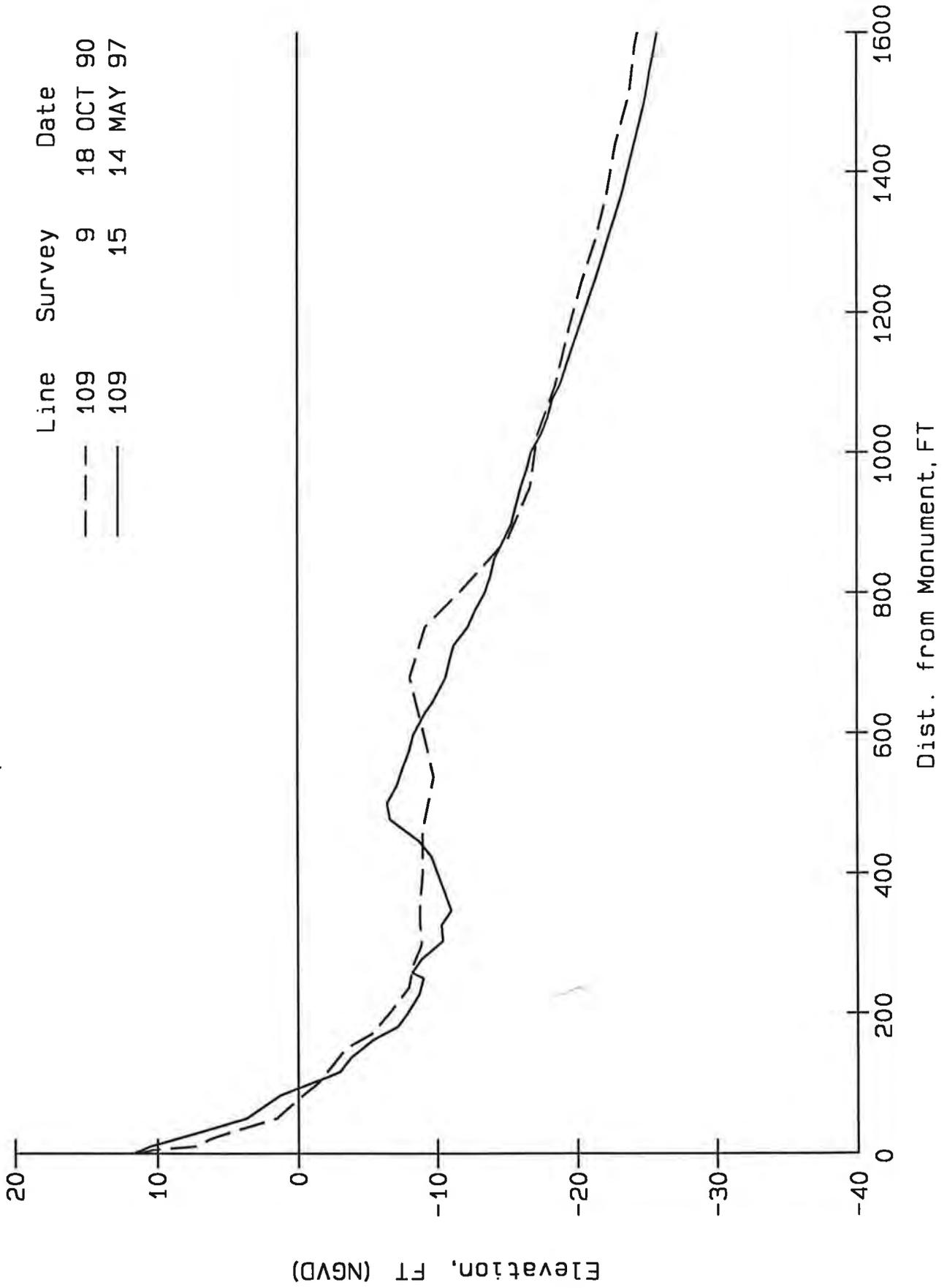
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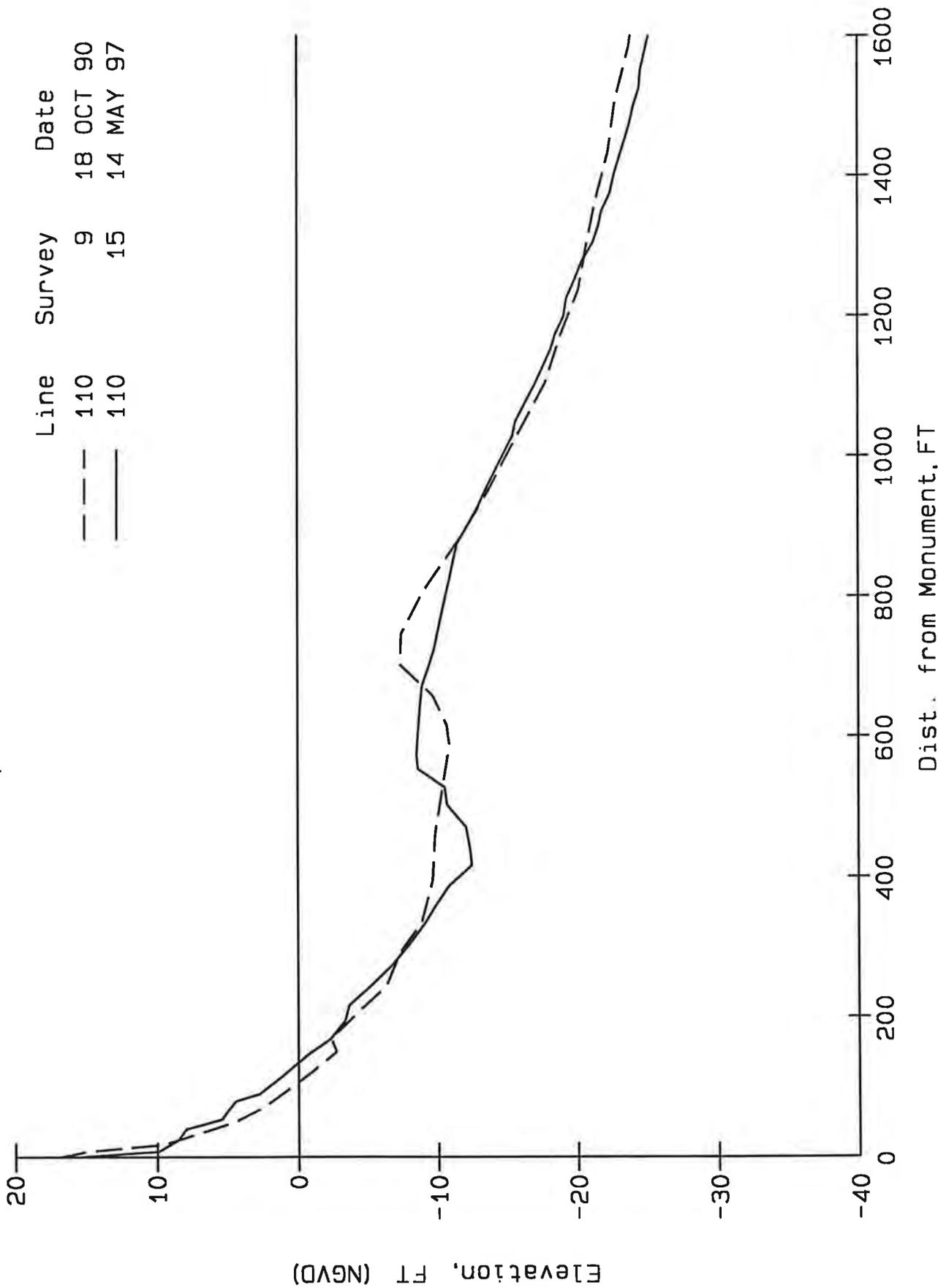
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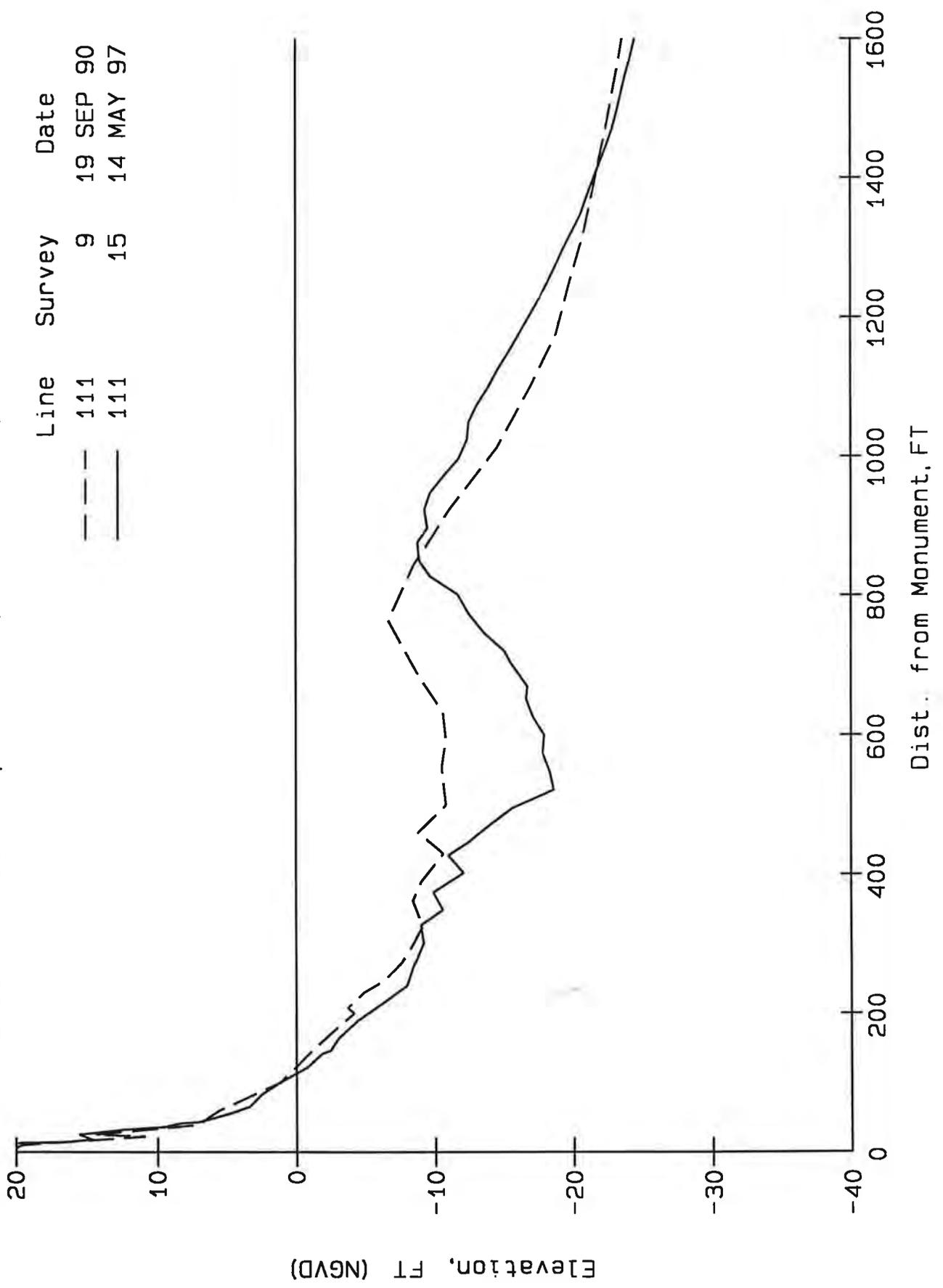
Palm Beach Island
Beach Profile Comparisons (1990 to 1997)



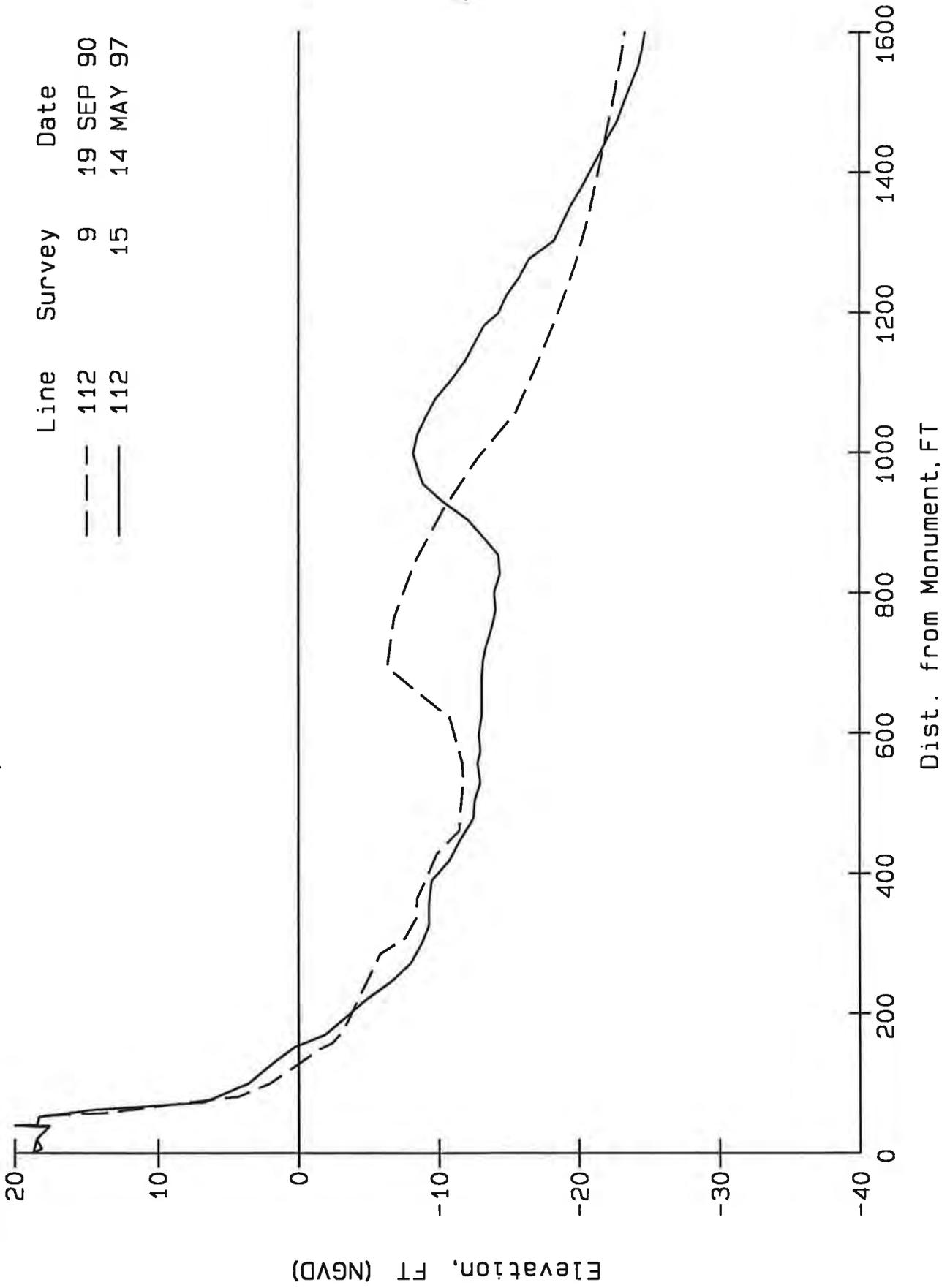
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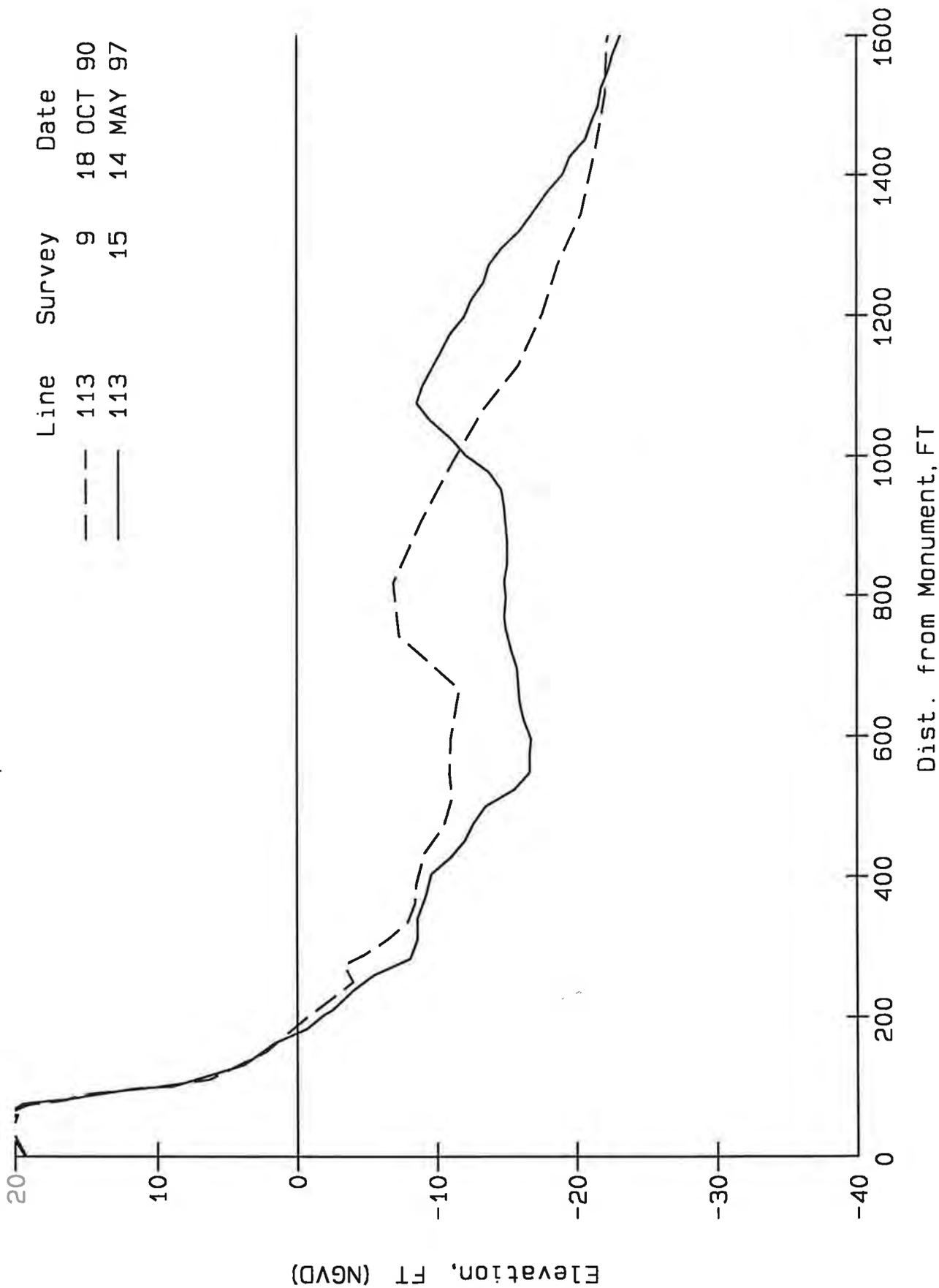
Palm Beach Island
 Beach Profile Comparisons (1990 to 1997)



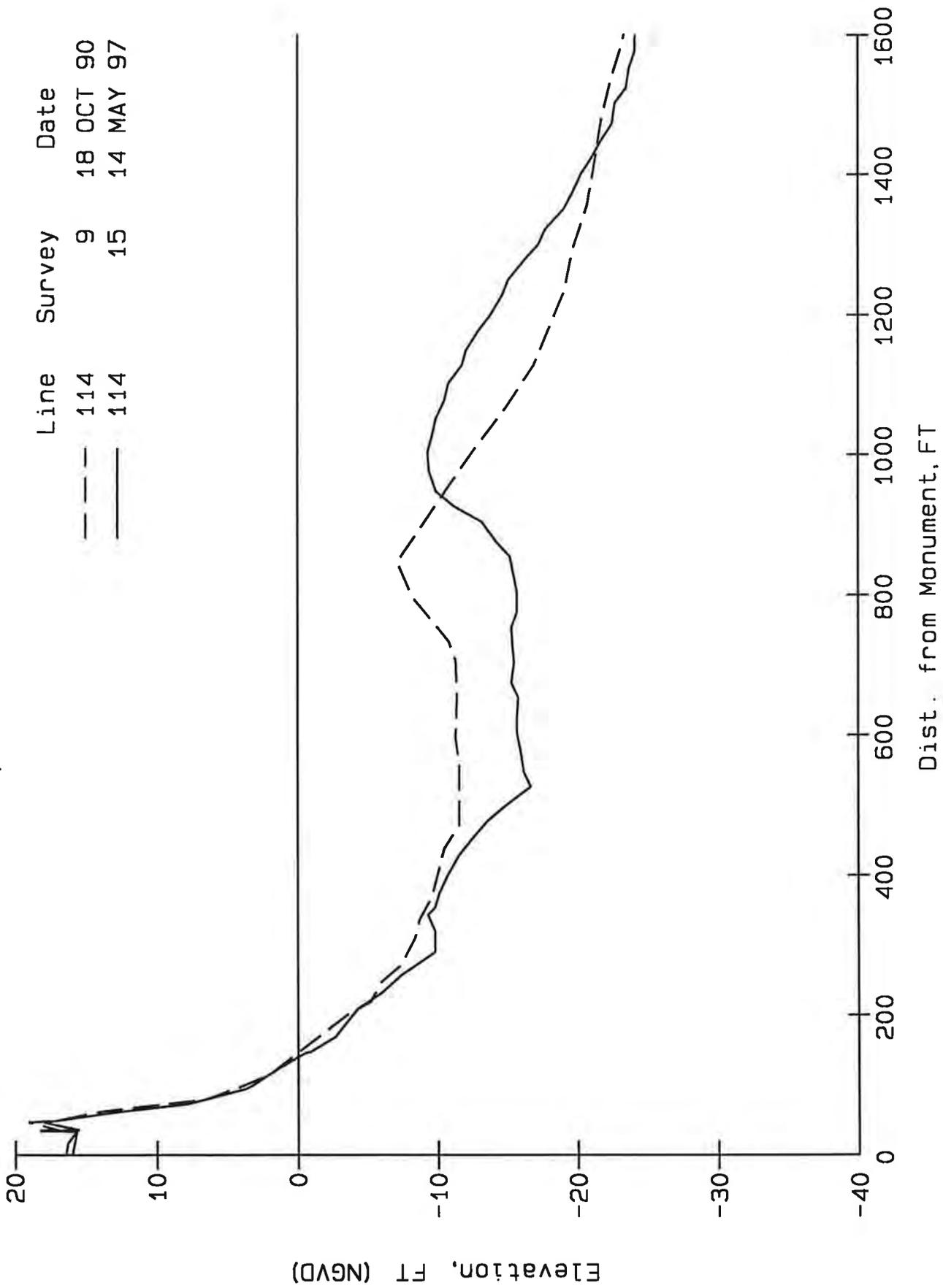
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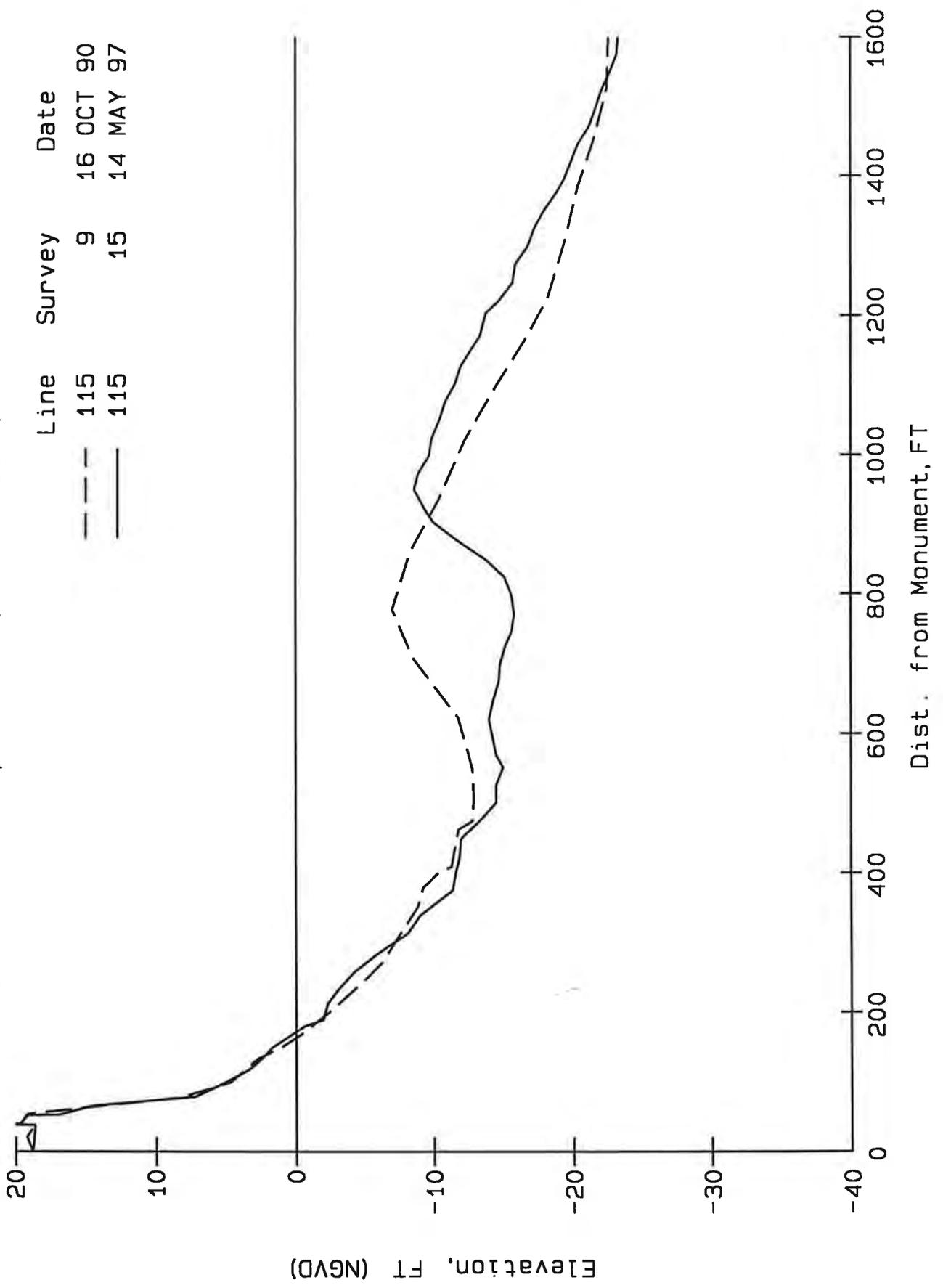
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 Beach Profile Comparisons (1990 to 1997)



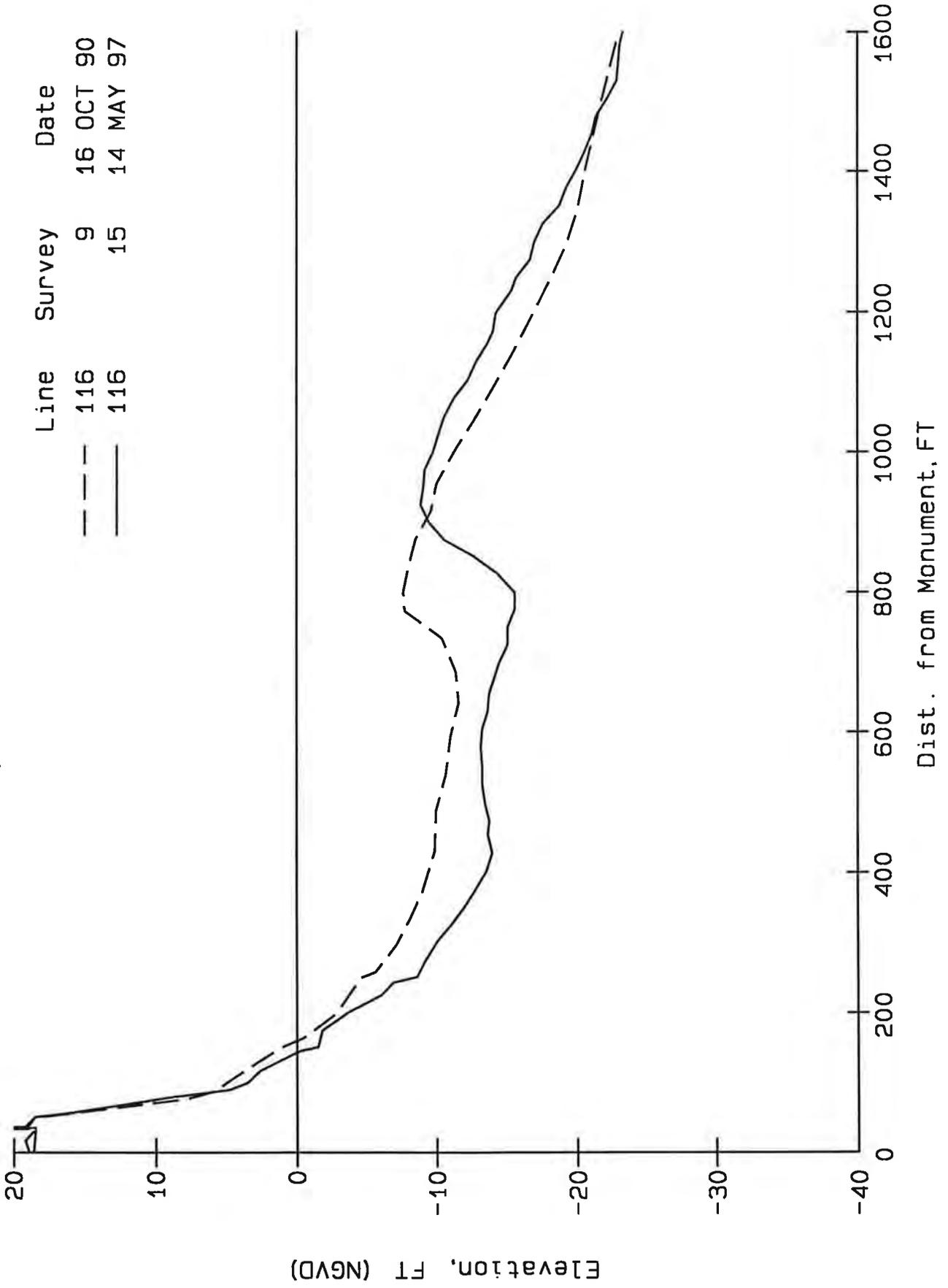
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 Beach Profile Comparisons (1990 to 1997)



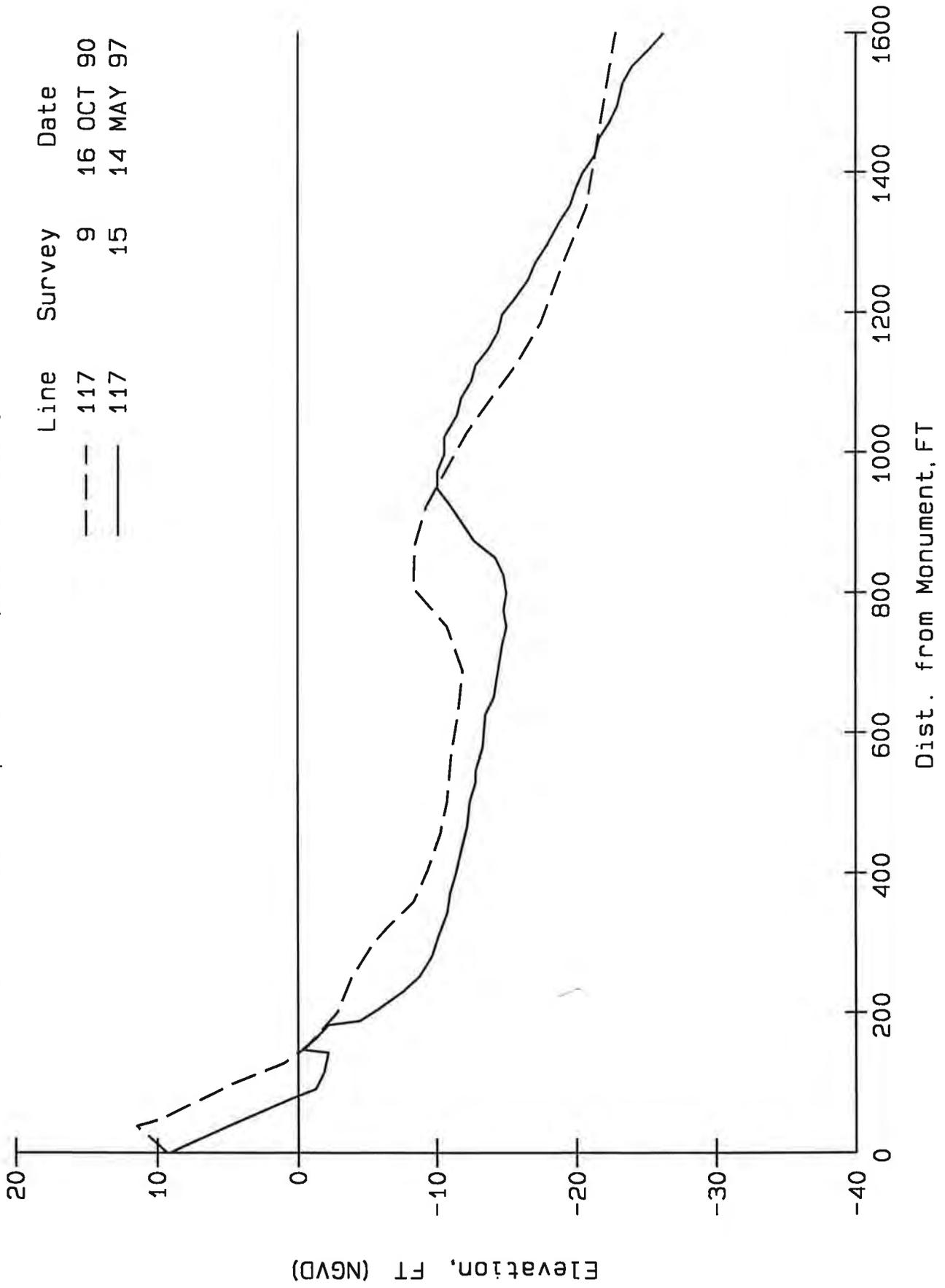
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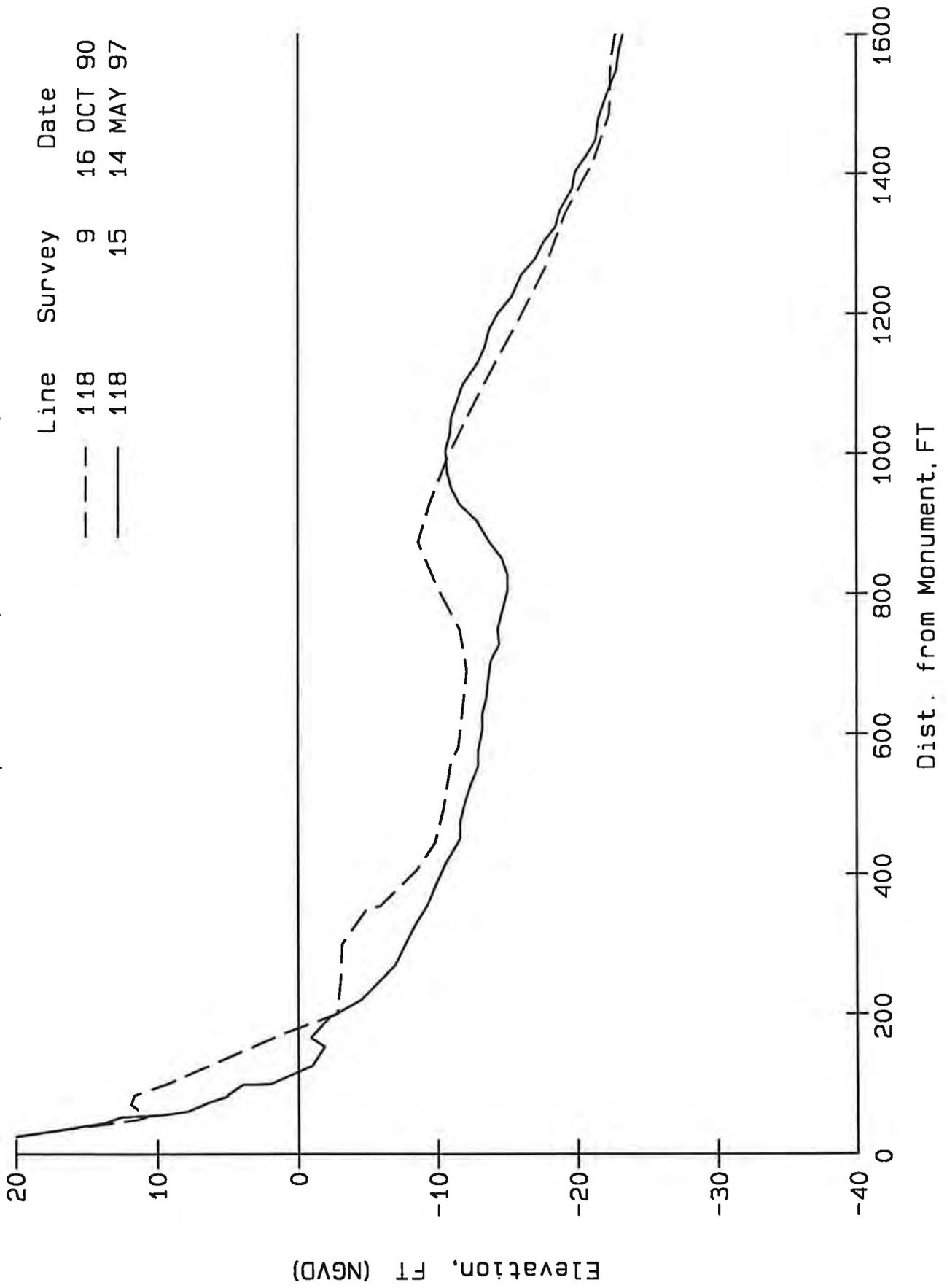
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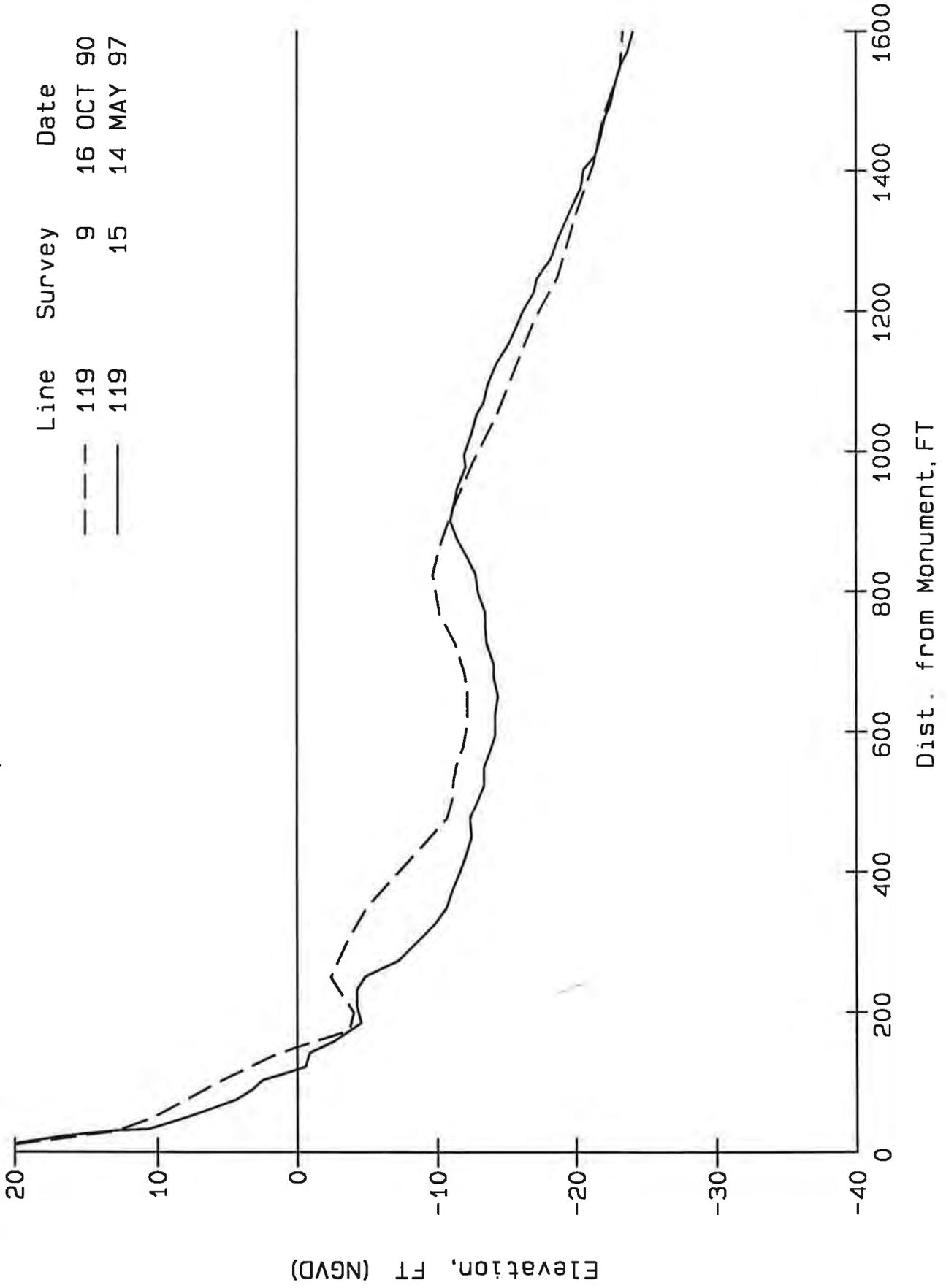
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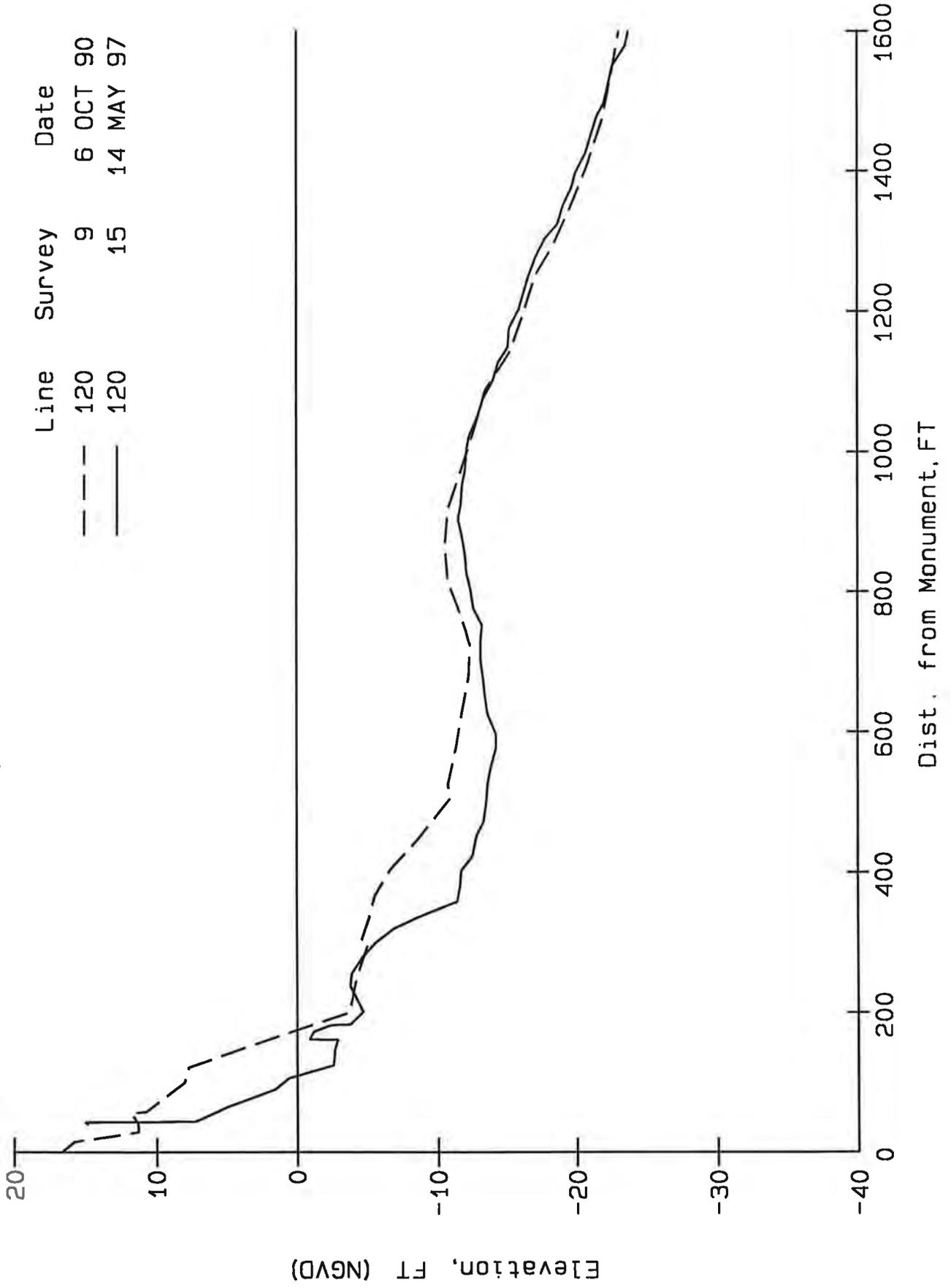
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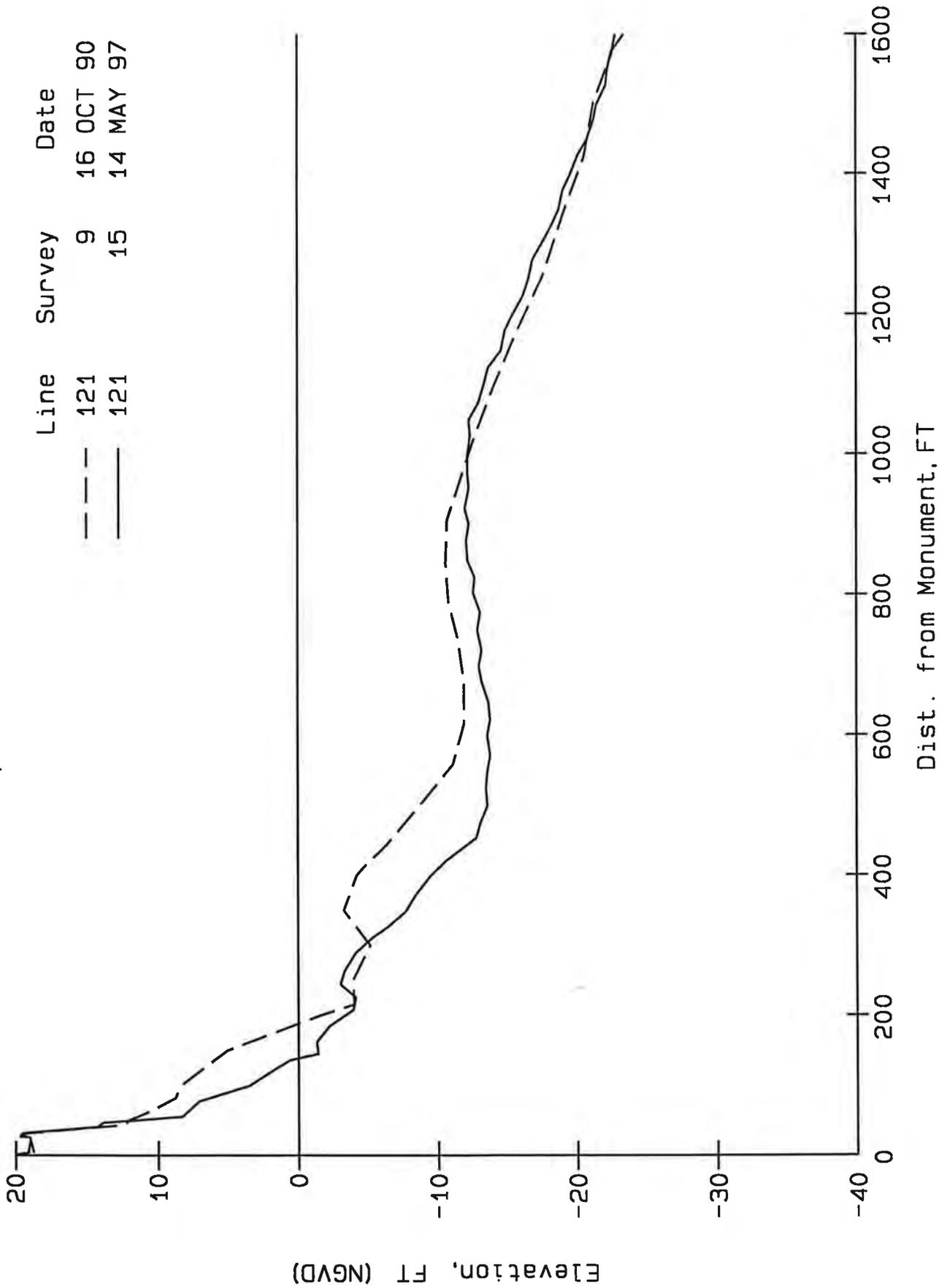
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Beach Profile Comparisons (1990 to 1997)



Palm Beach Island
Beach Profile Comparisons (1990 to 1997)

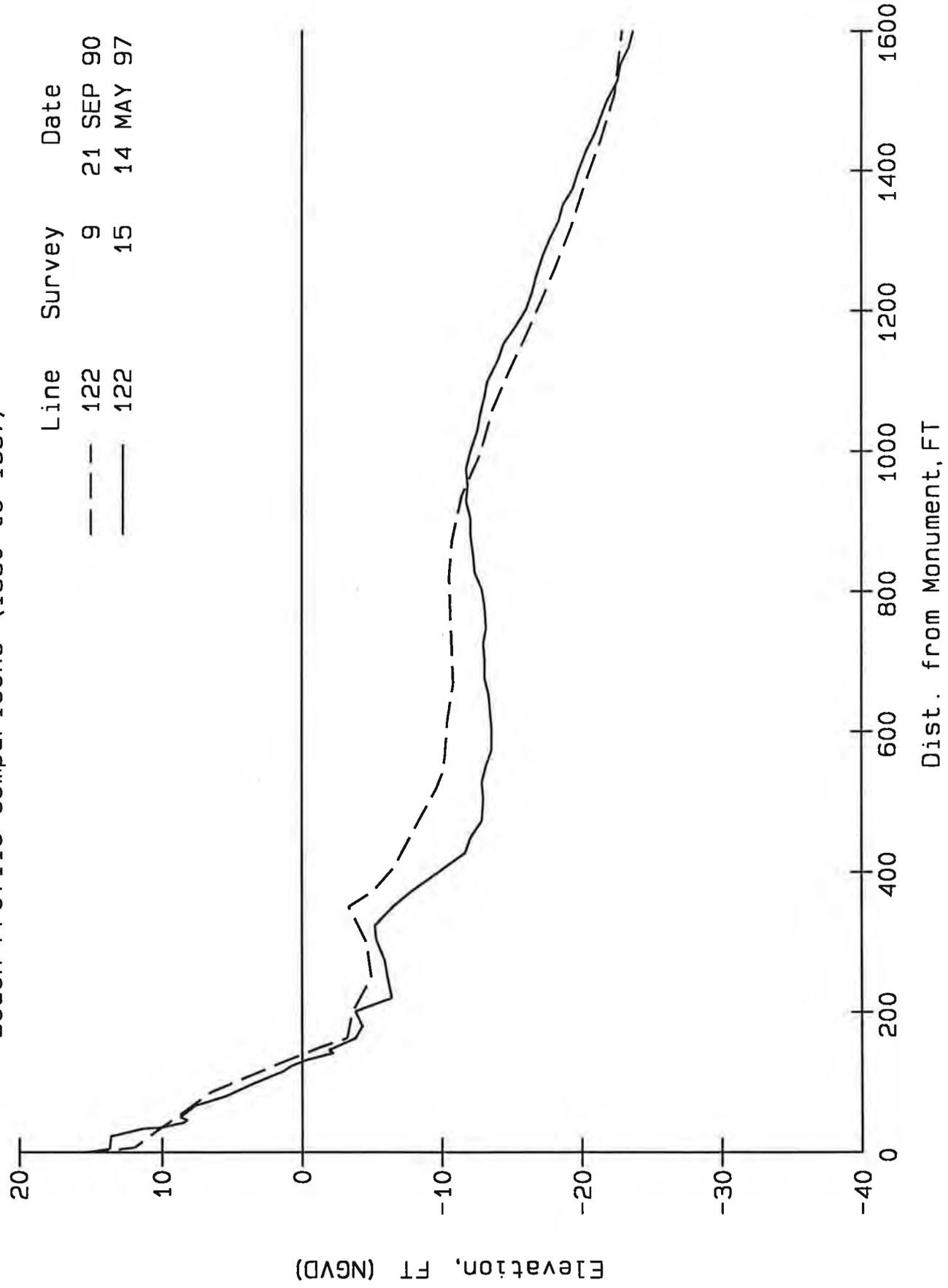


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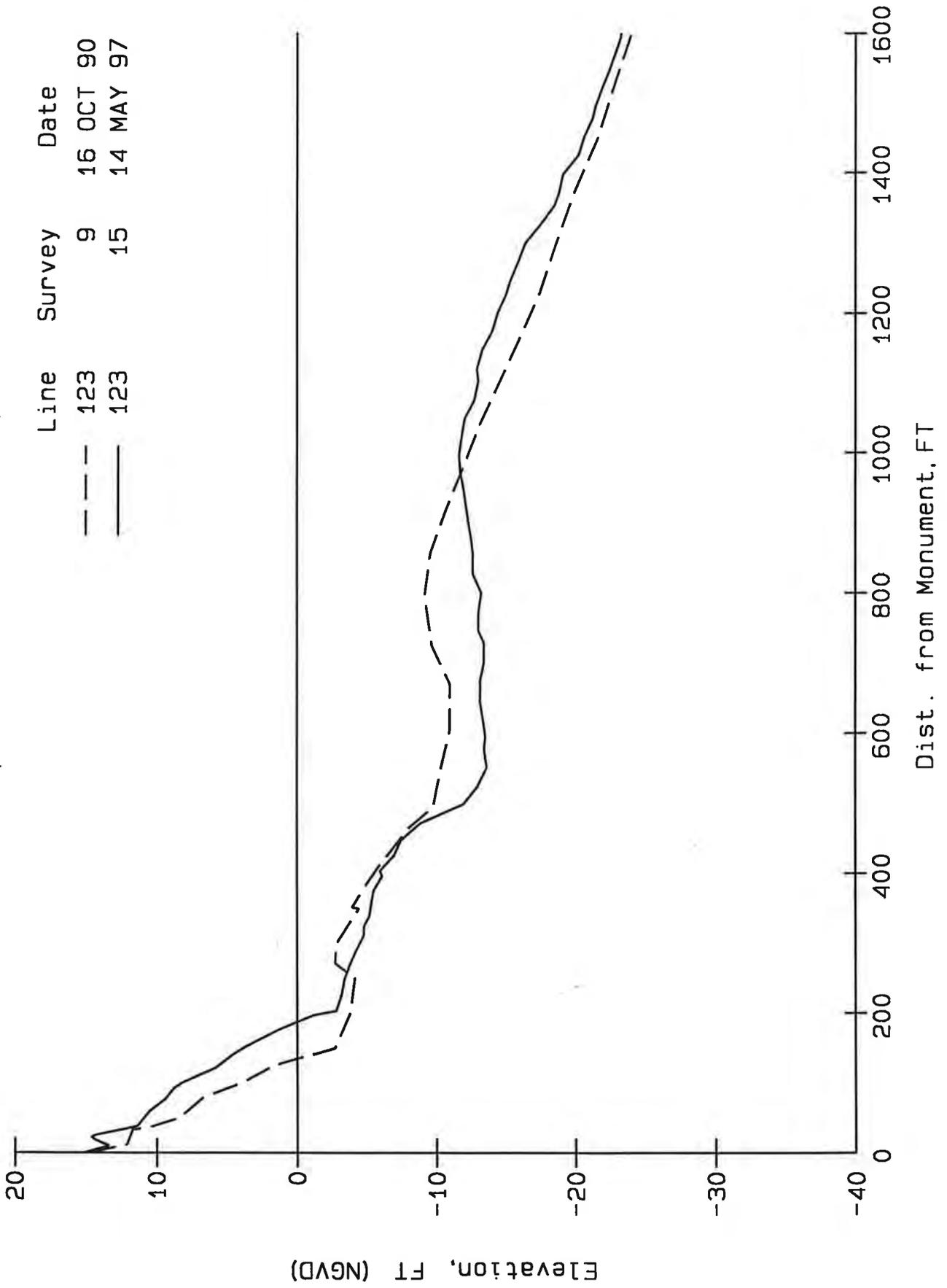


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 Beach Profile Comparisons (1990 to 1997)

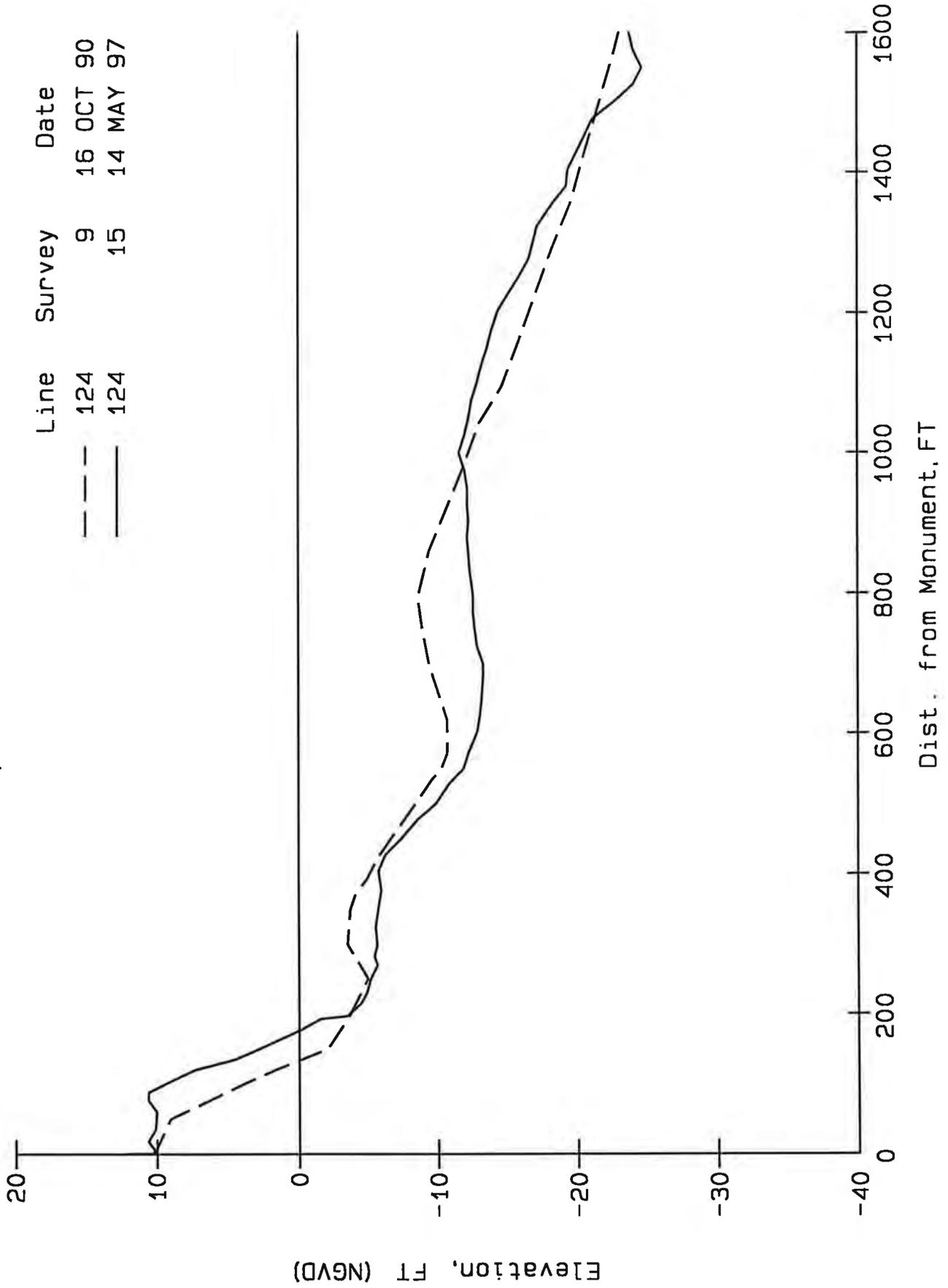
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---	9	21 SEP 90
—	15	14 MAY 97



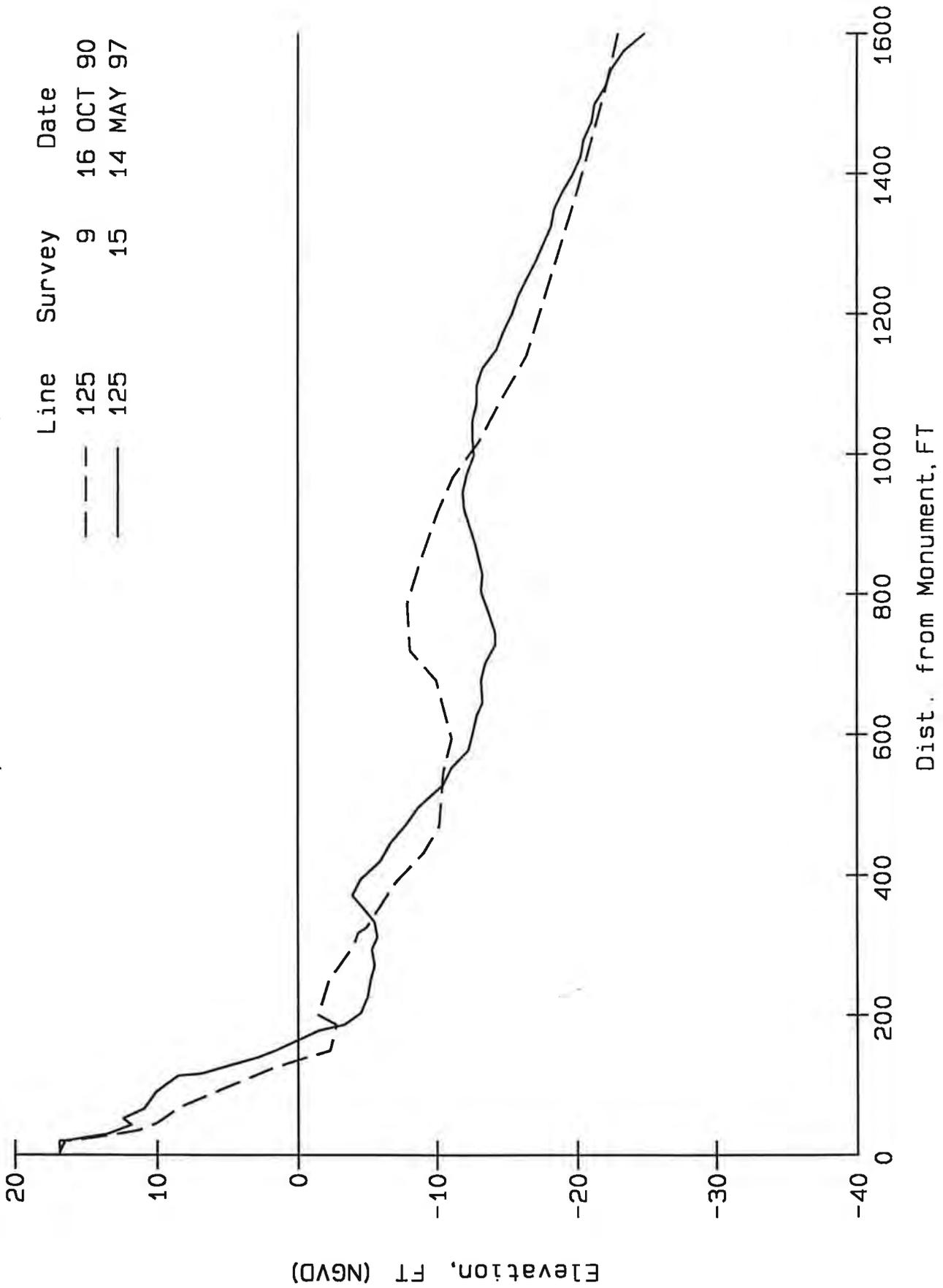
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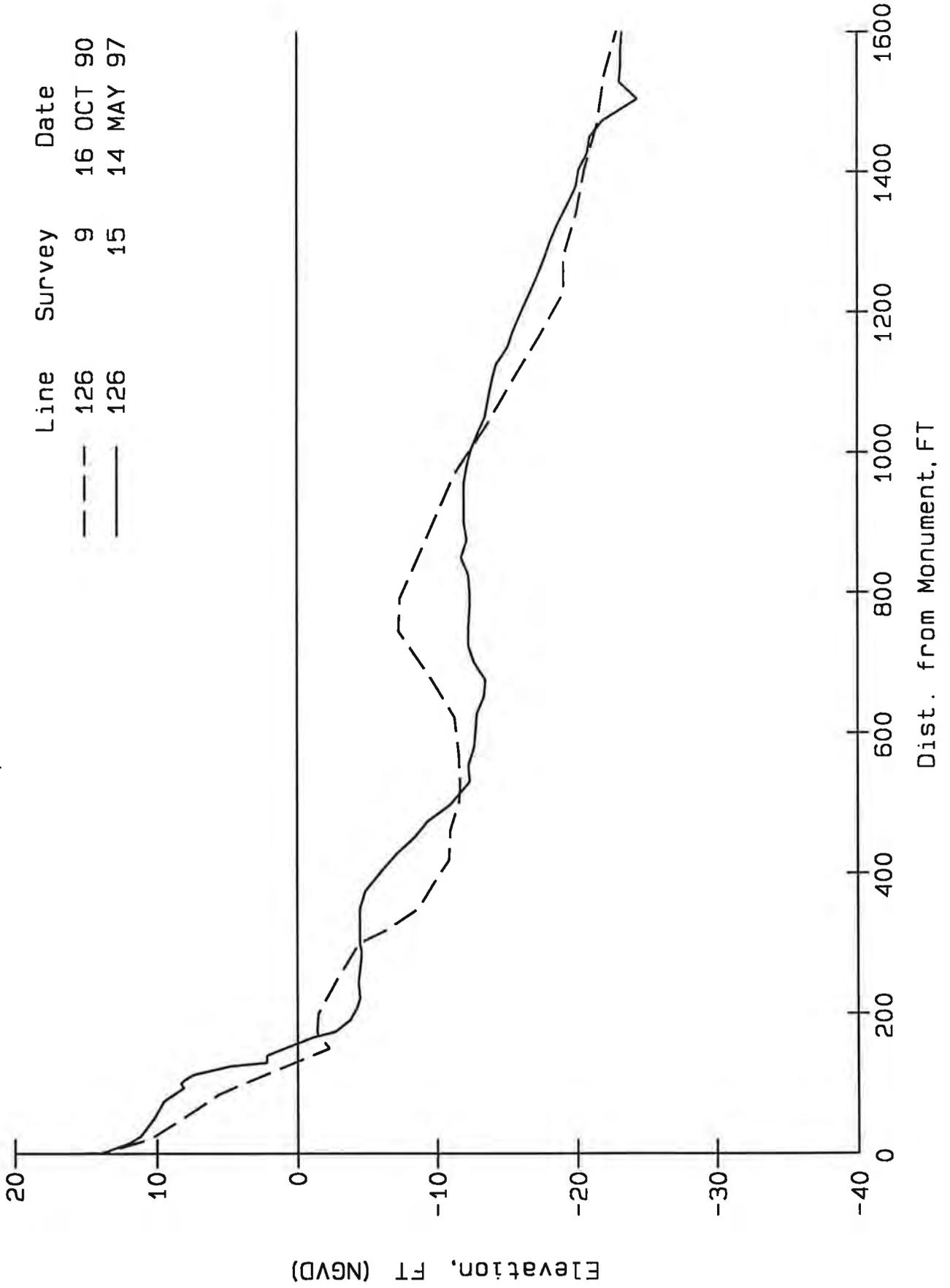
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Beach Profile Comparisons (1990 to 1997)



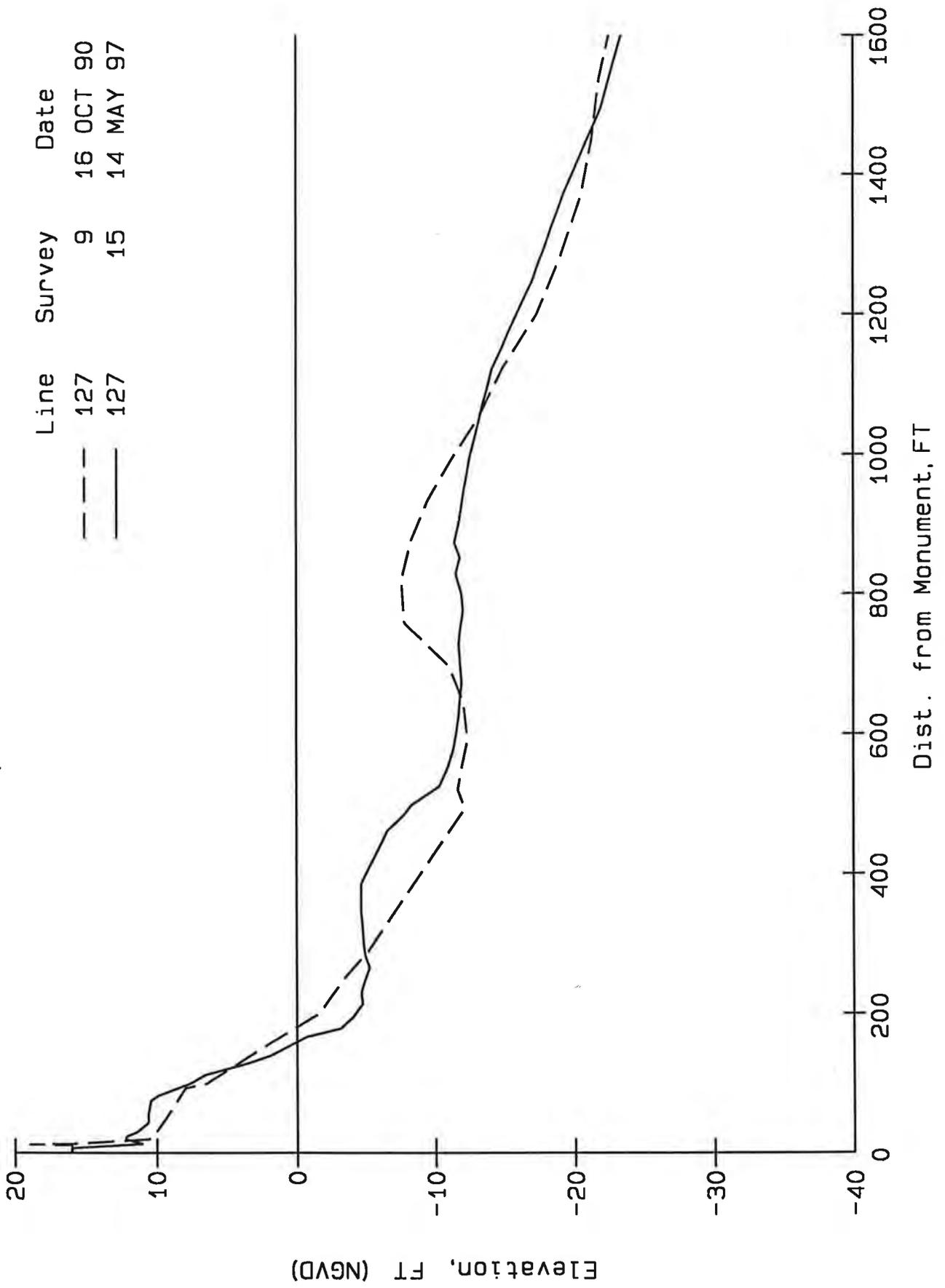
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Beach Profile Comparisons (1990 to 1997)



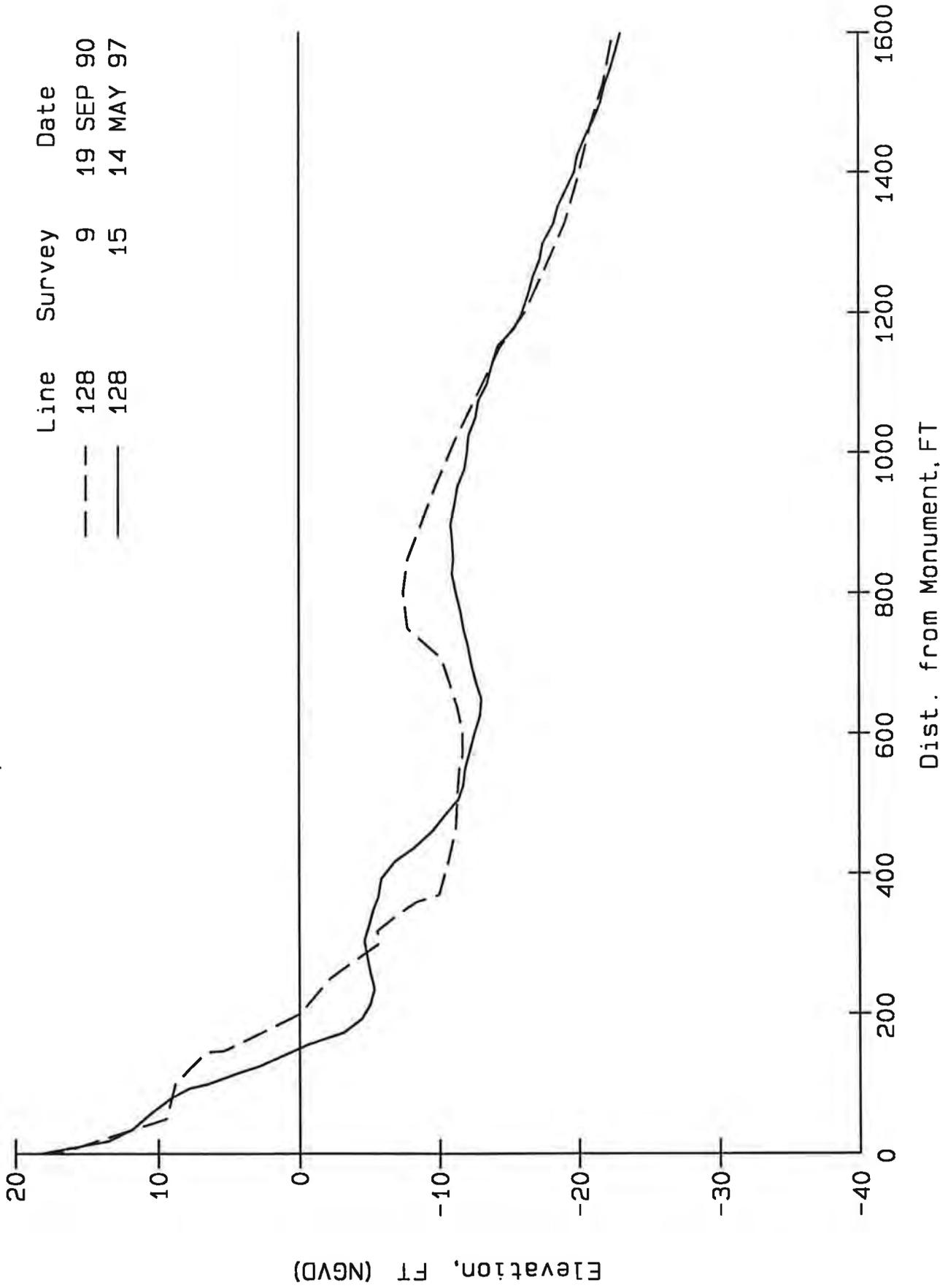
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Beach Profile Comparisons (1990 to 1997)



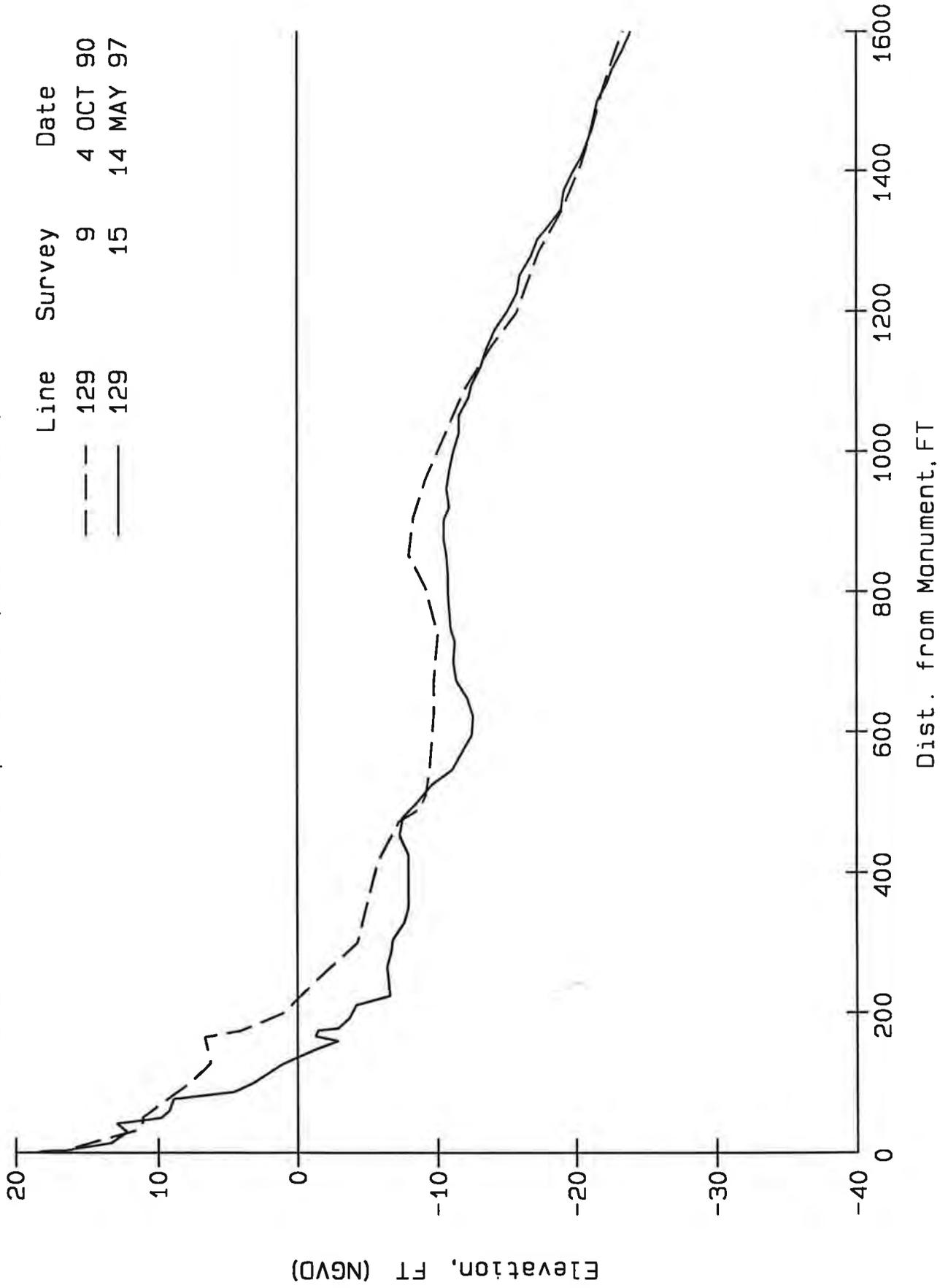
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Beach Profile Comparisons (1990 to 1997)



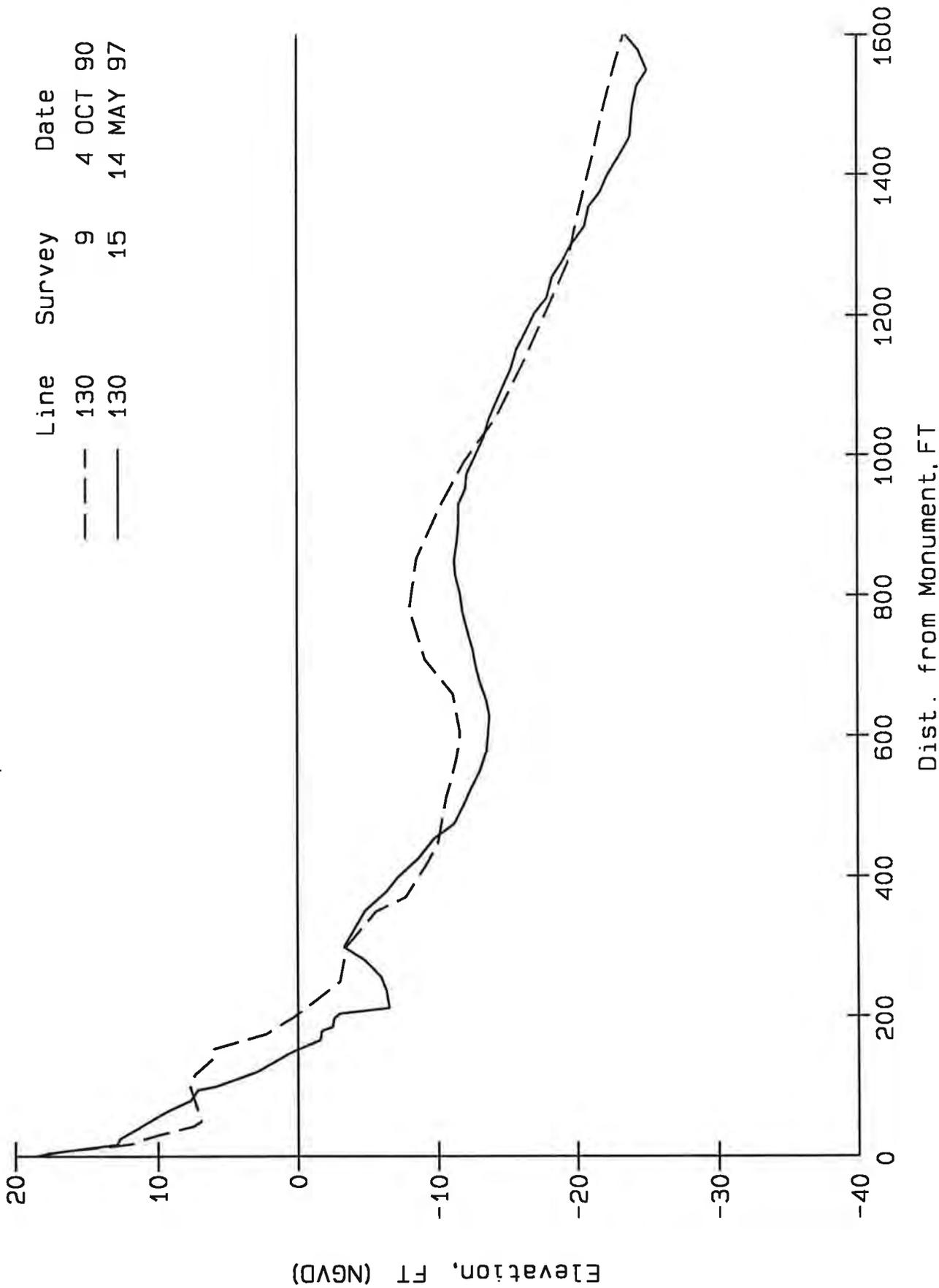
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 Beach Profile Comparisons (1990 to 1997)



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Beach Profile Comparisons (1990 to 1997)

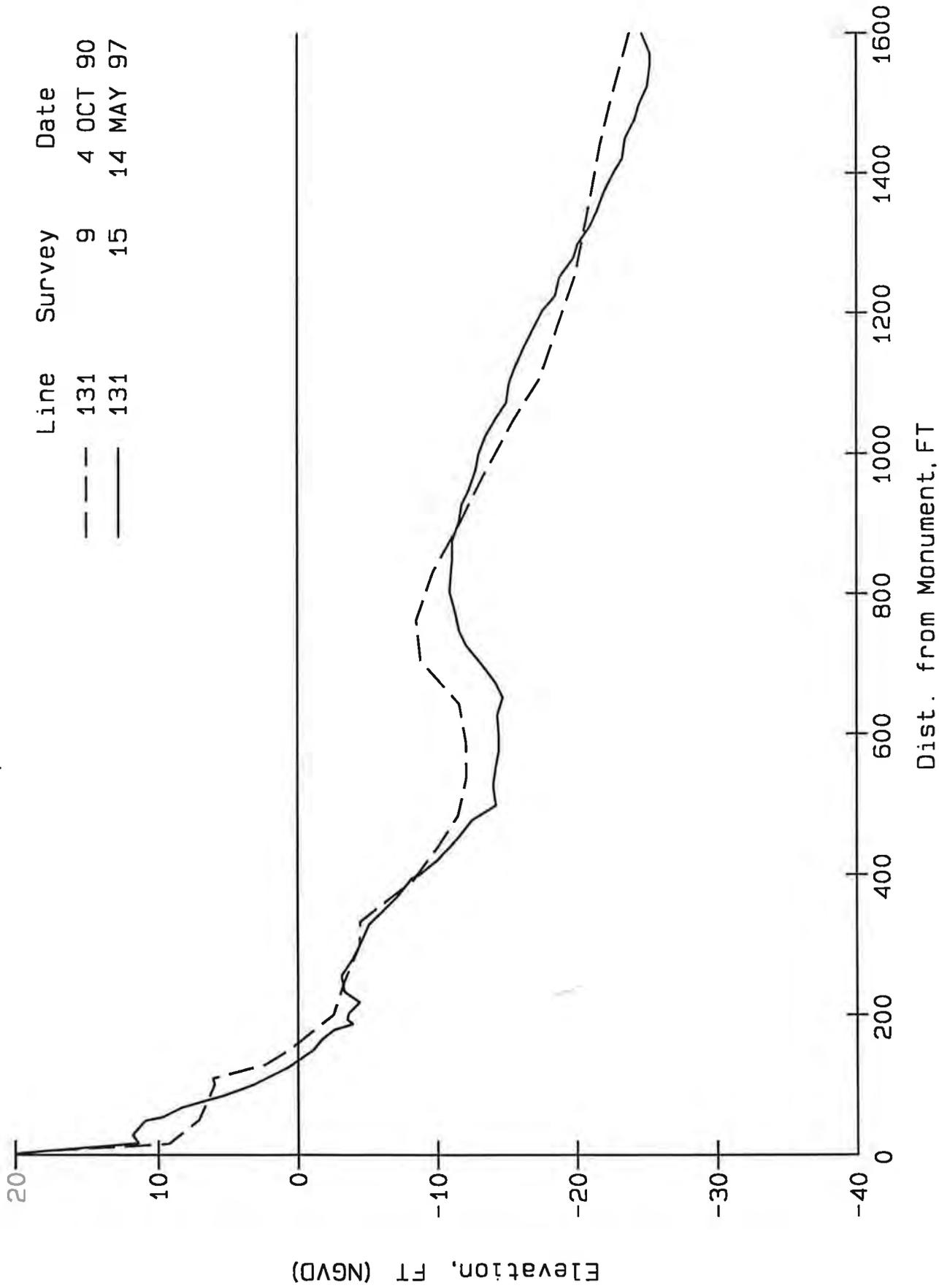


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Beach Profile Comparisons (1990 to 1997)

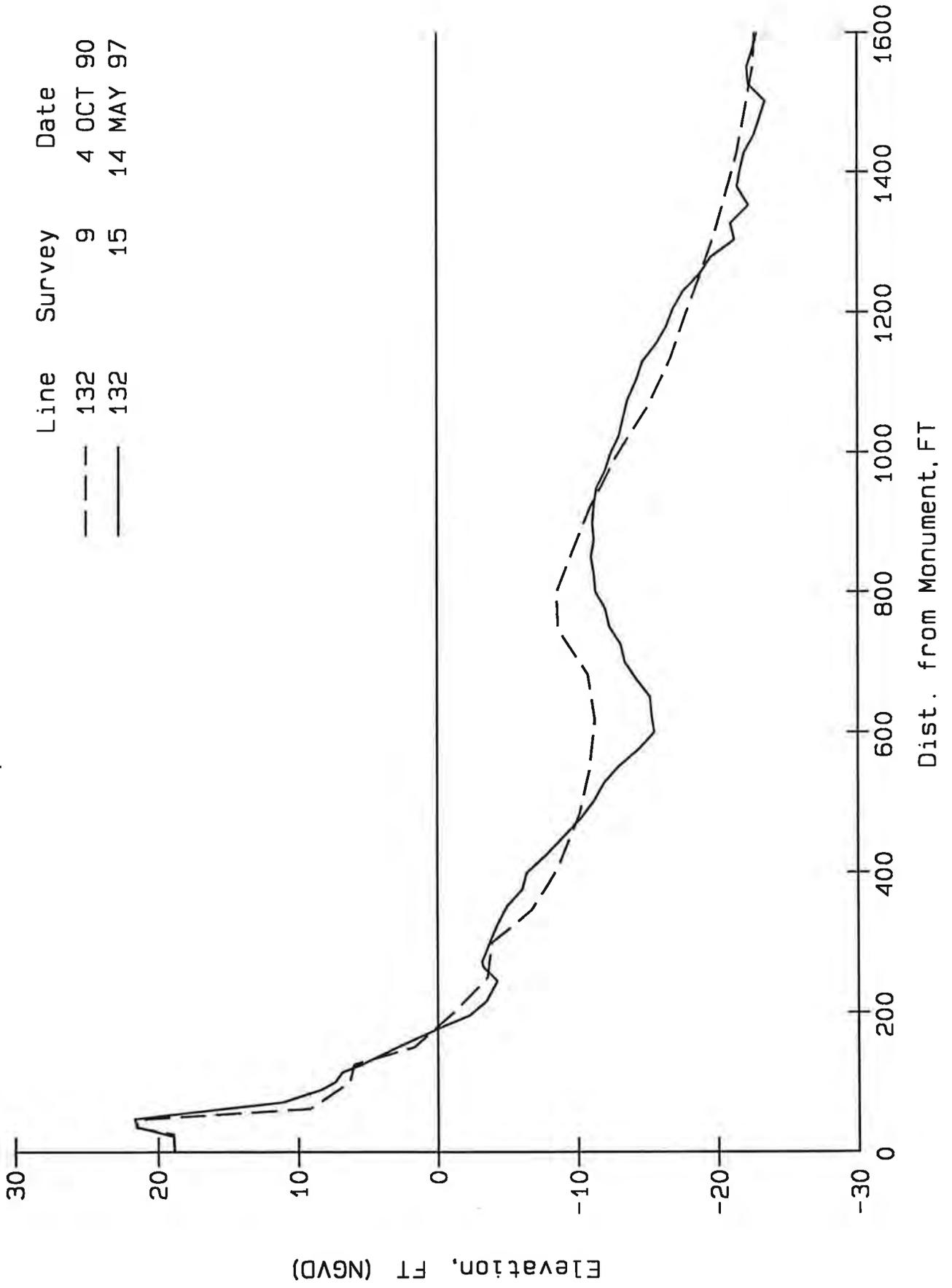


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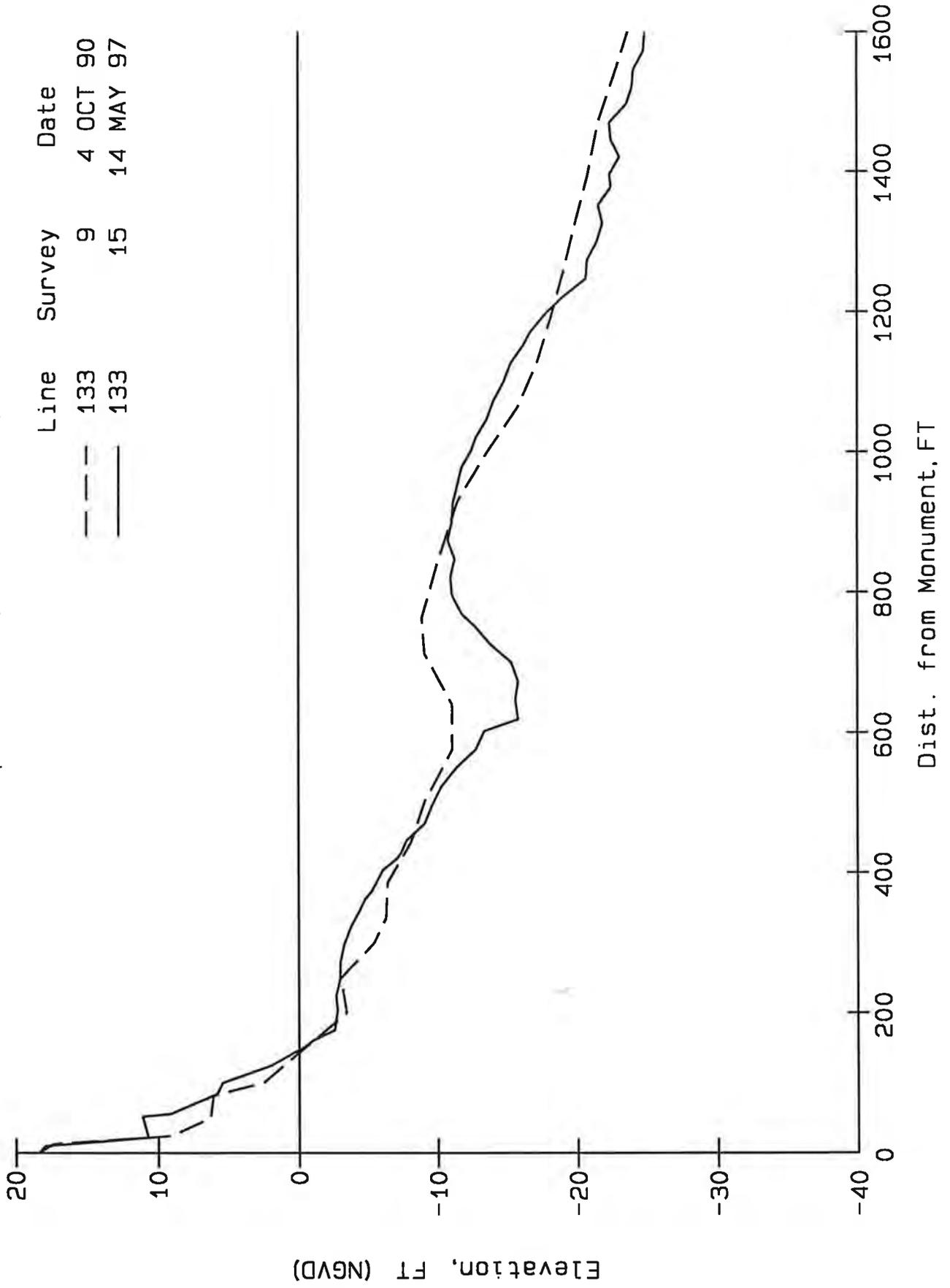
Line	Survey	Date
---	9	4 OCT 90
—	15	14 MAY 97



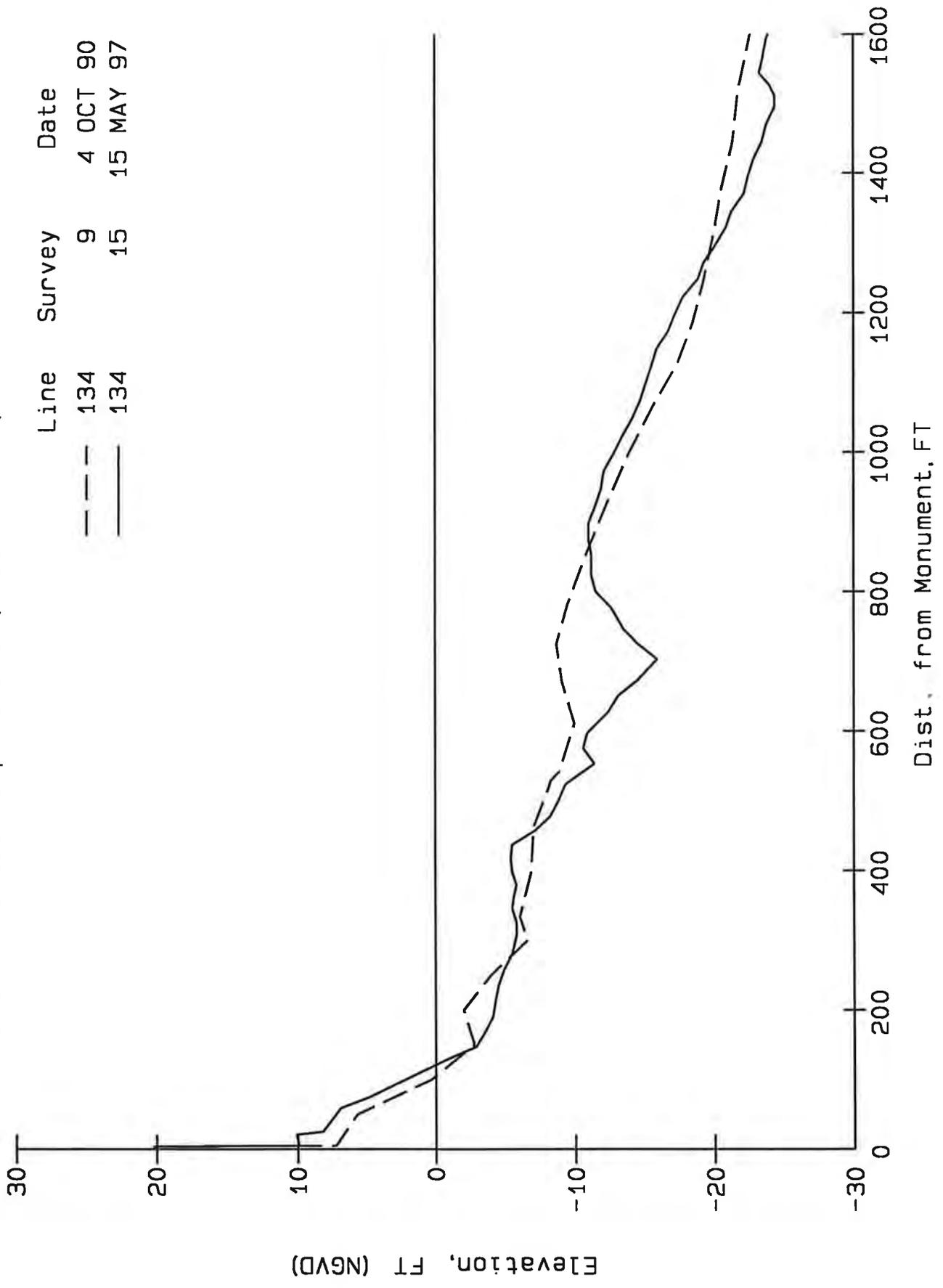
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Beach Profile Comparisons (1990 to 1997)



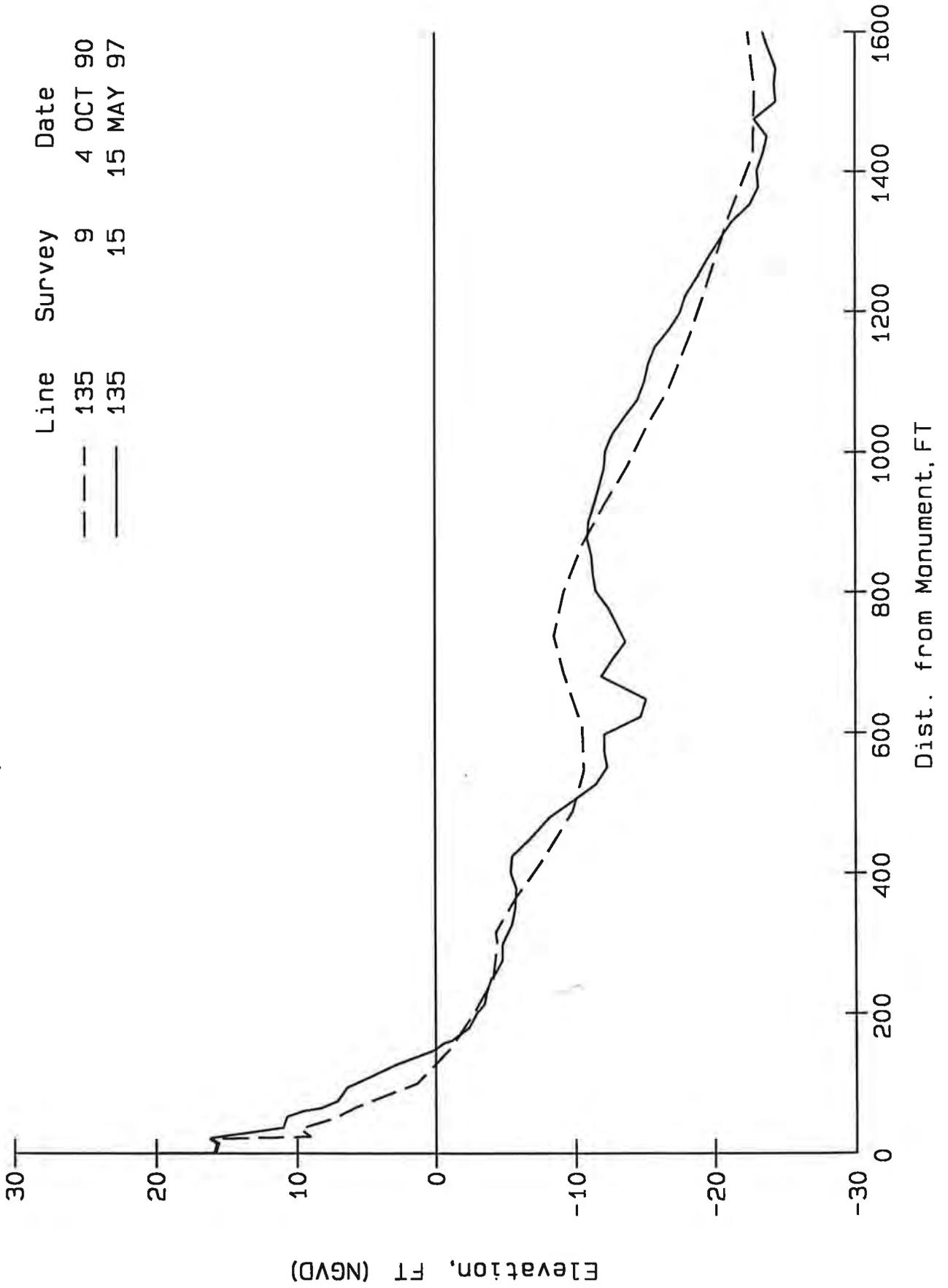
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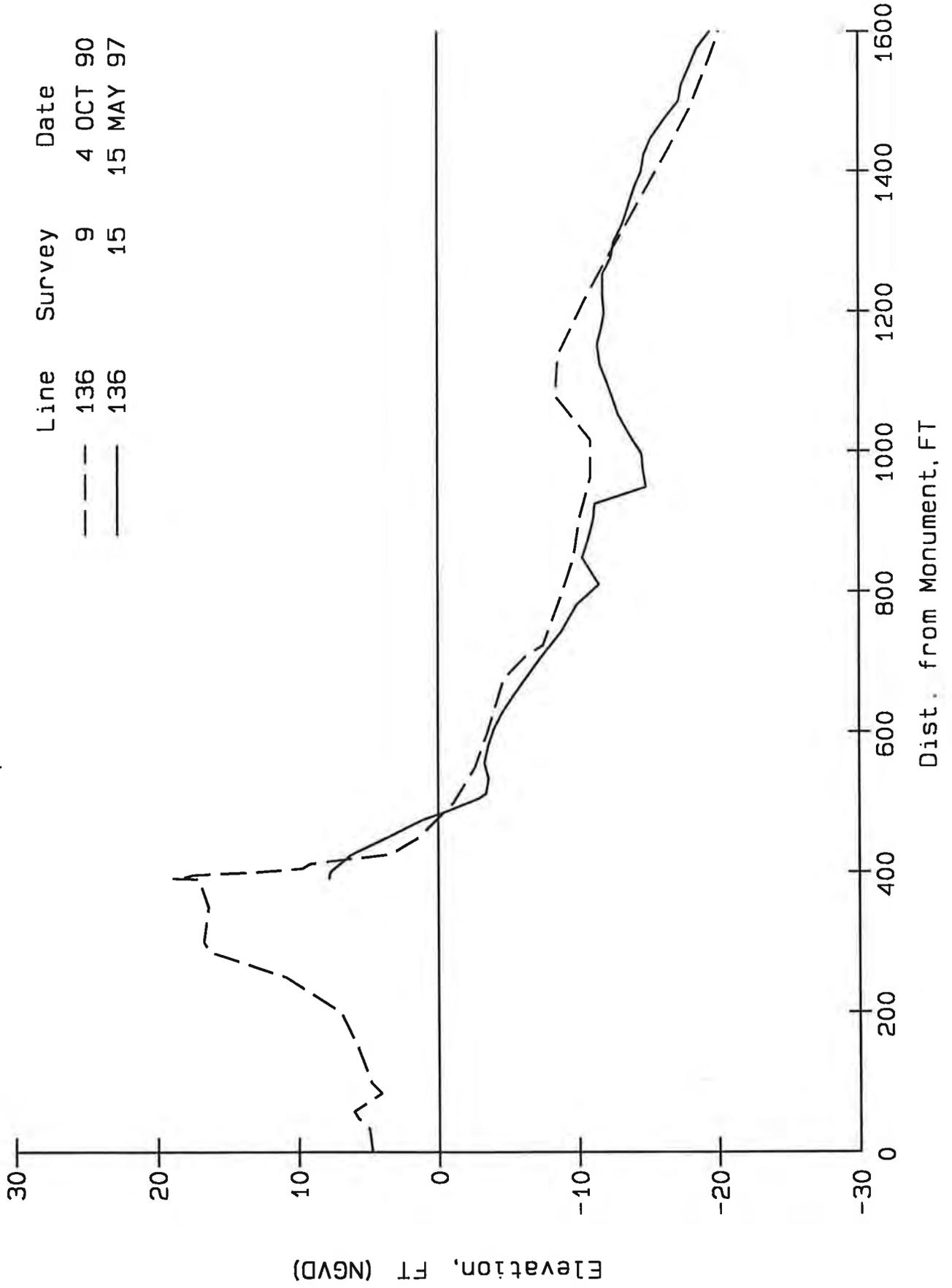
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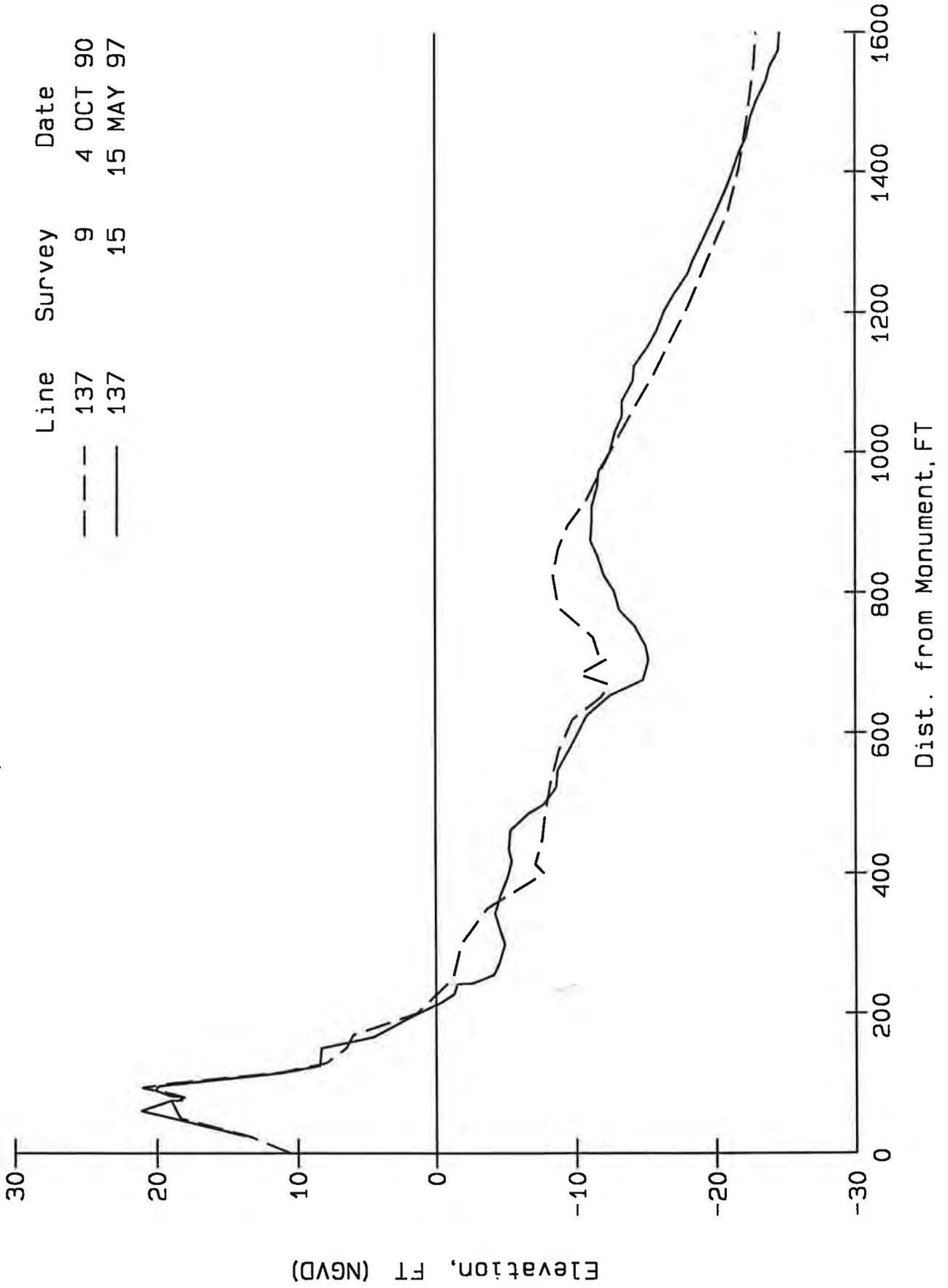
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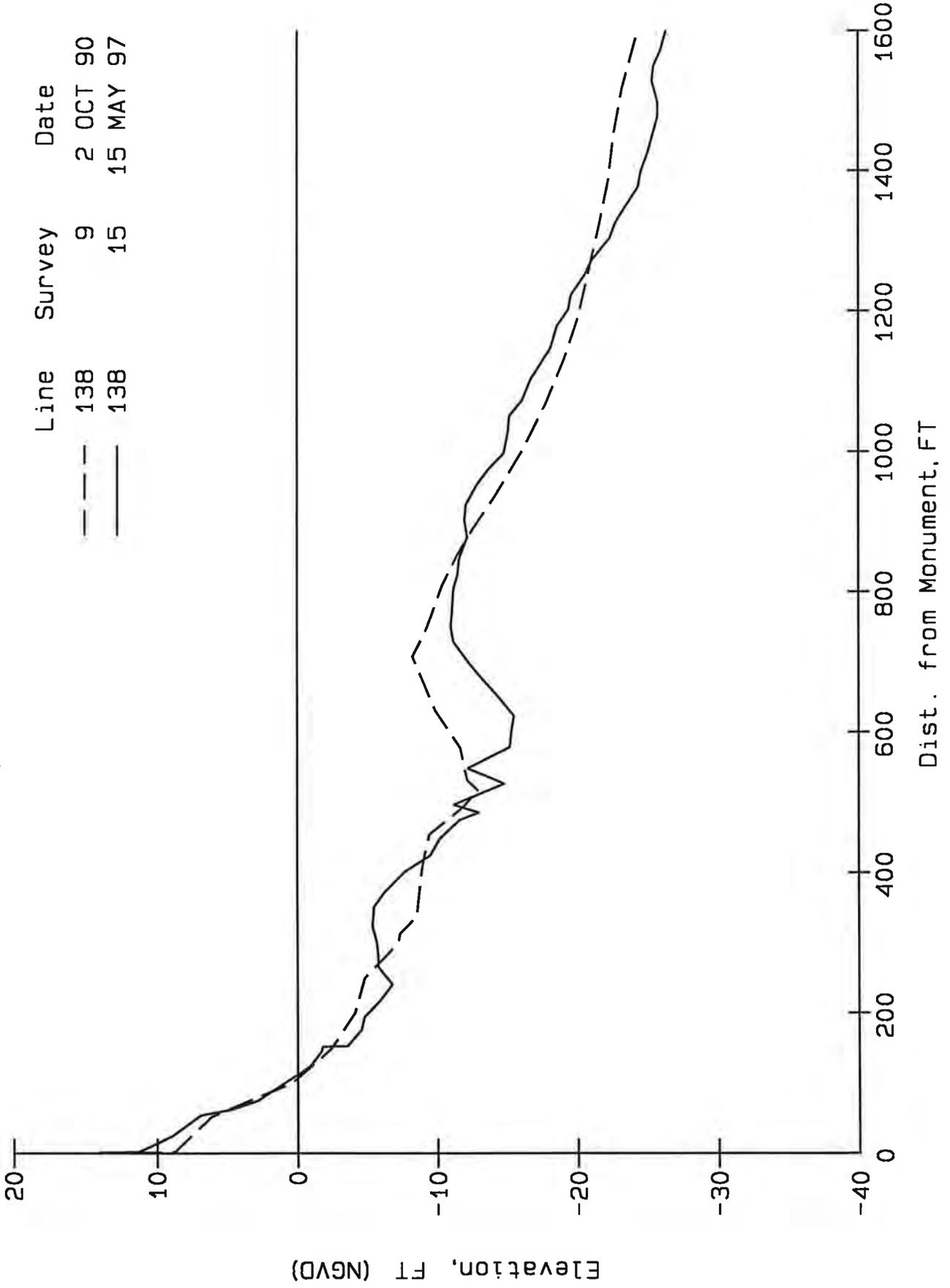
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Beach Profile Comparisons (1990 to 1997)



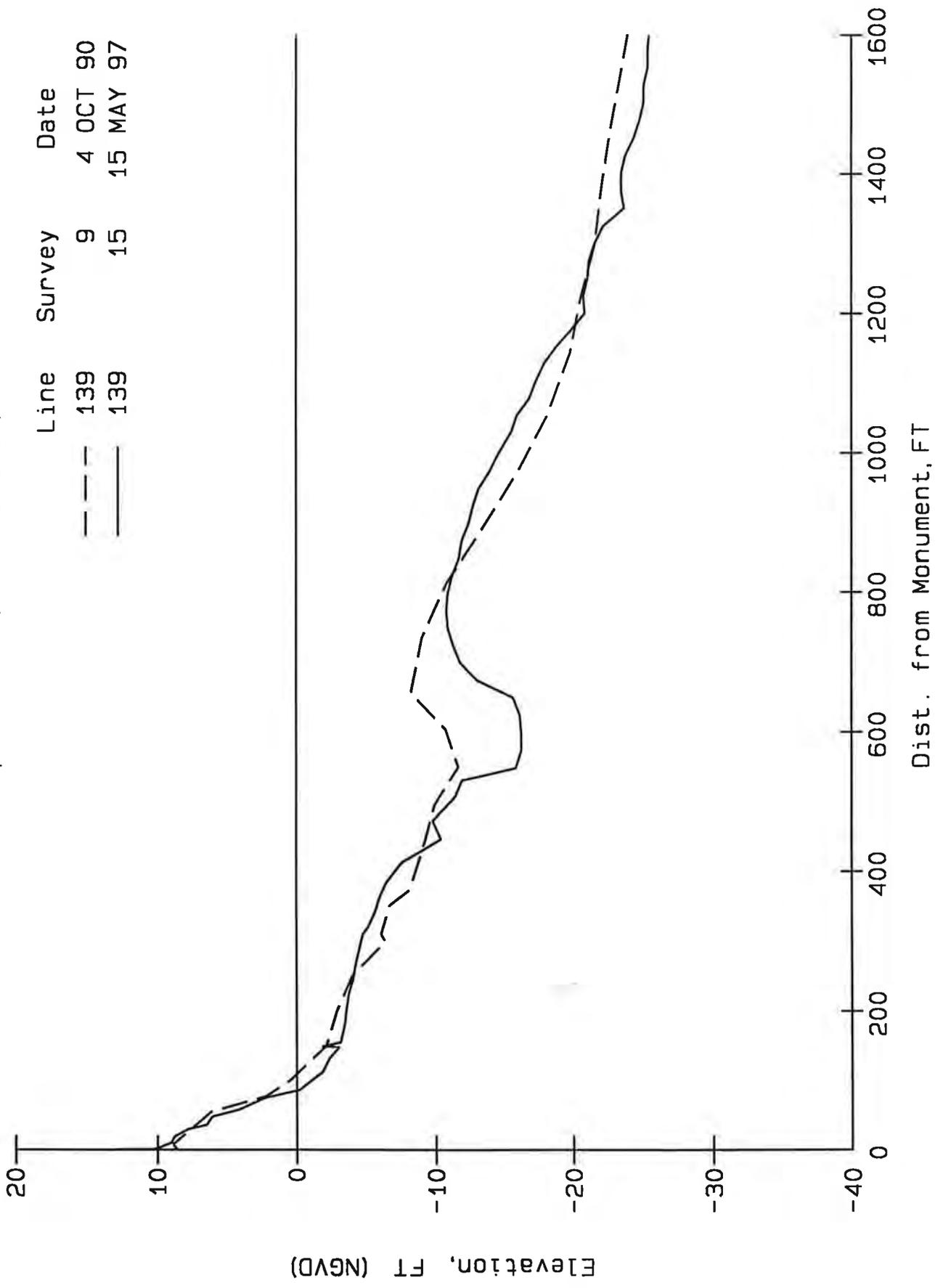
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Beach Profile Comparisons (1990 to 1997)



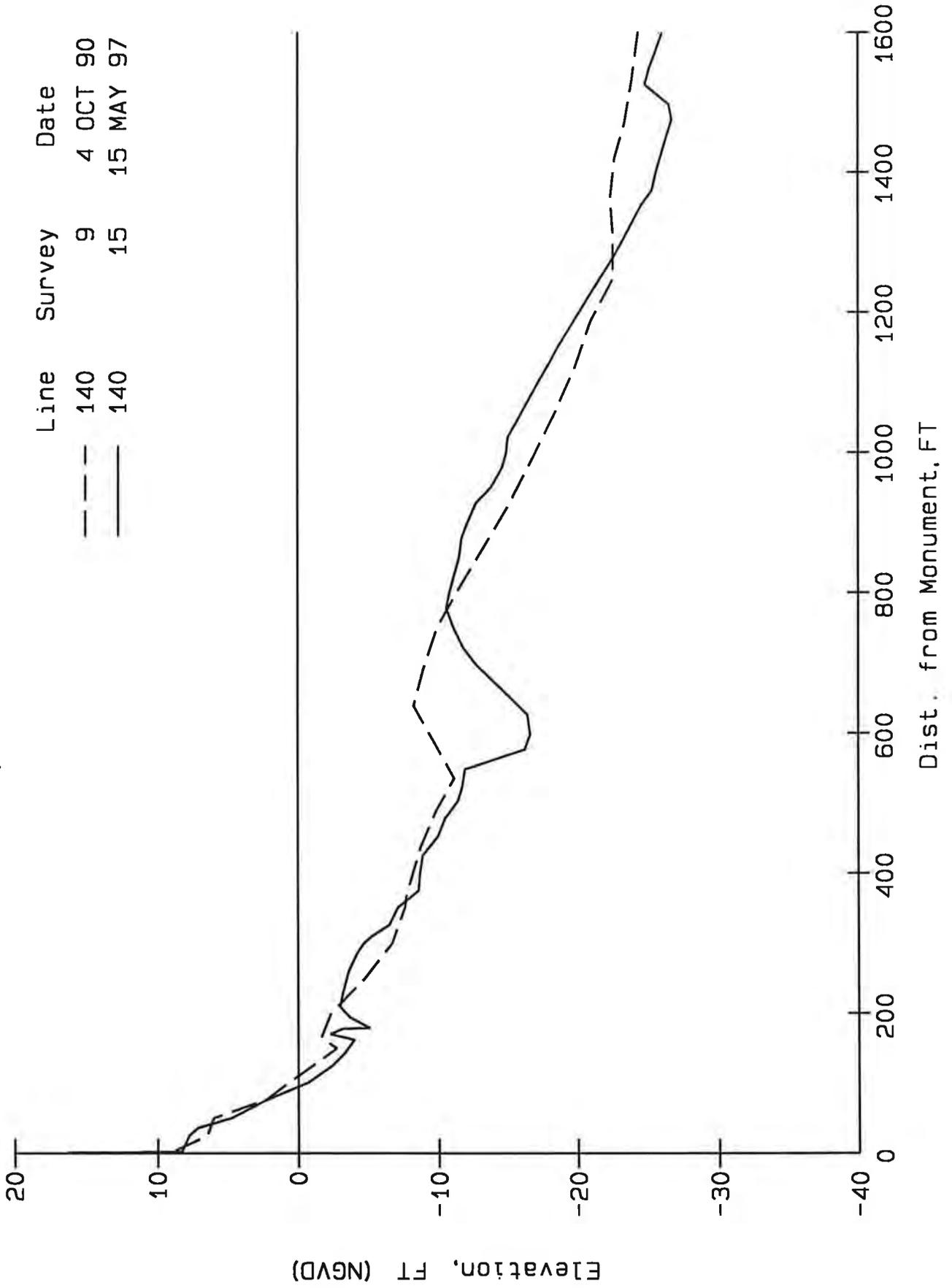
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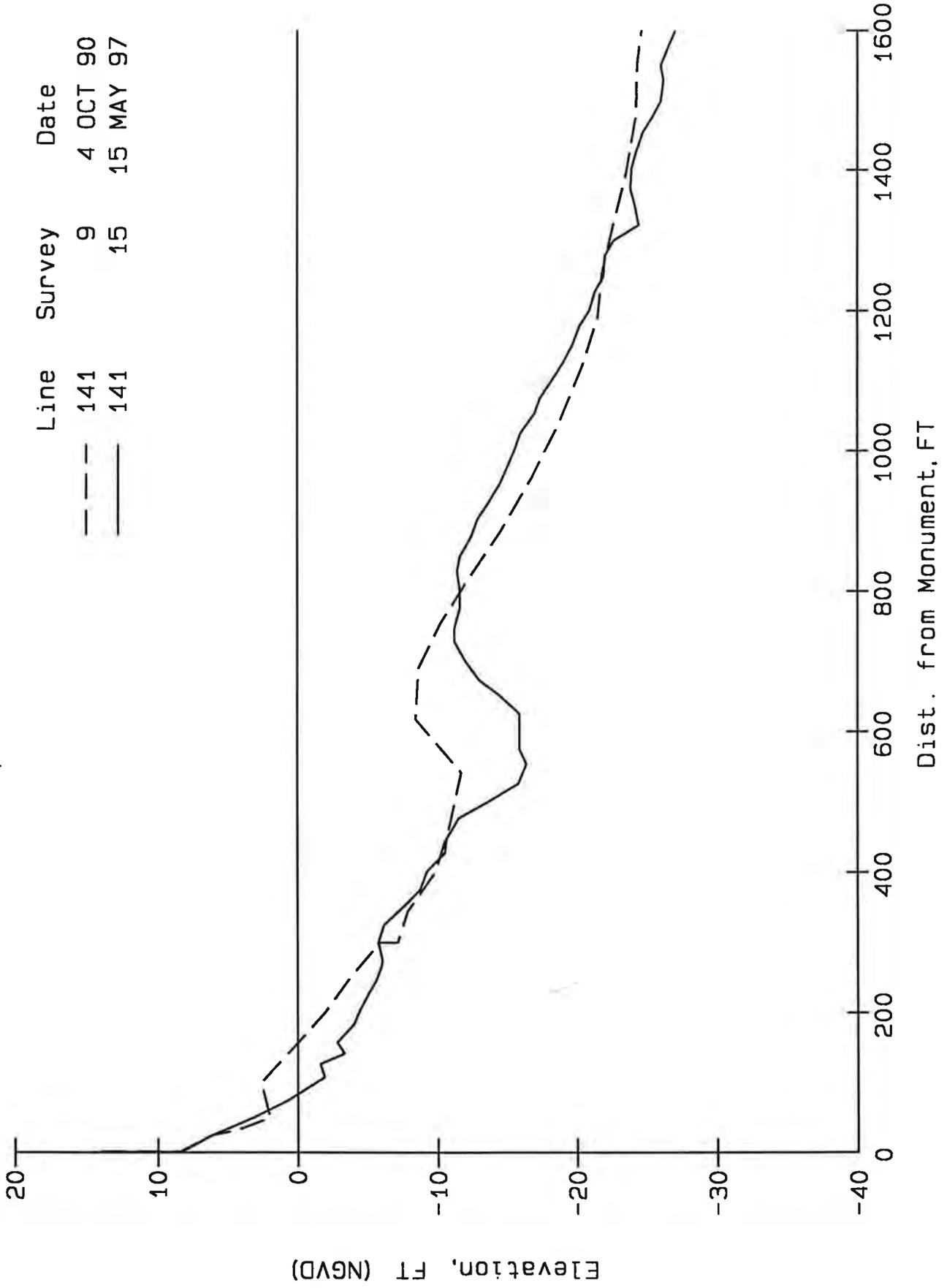
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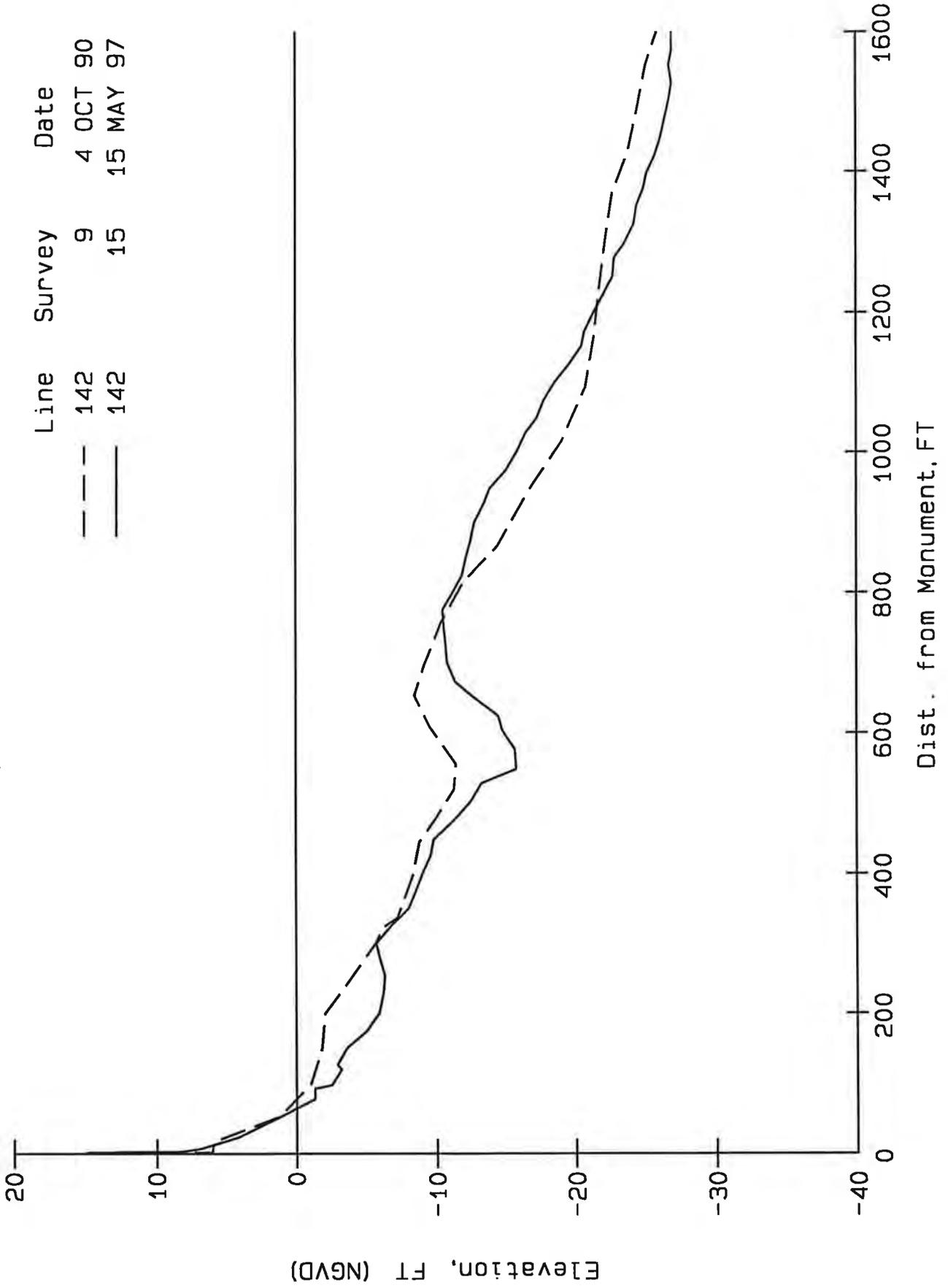
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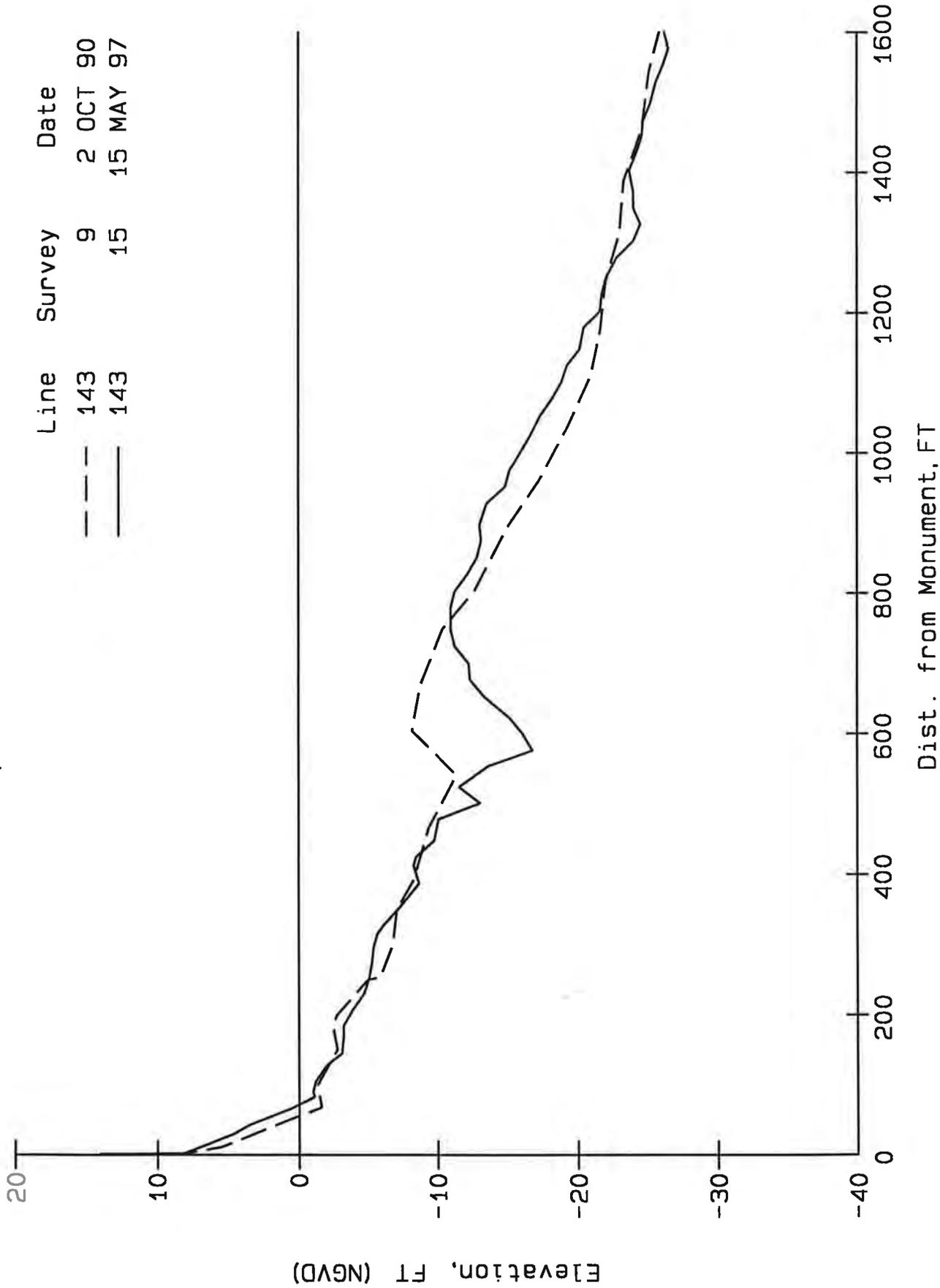
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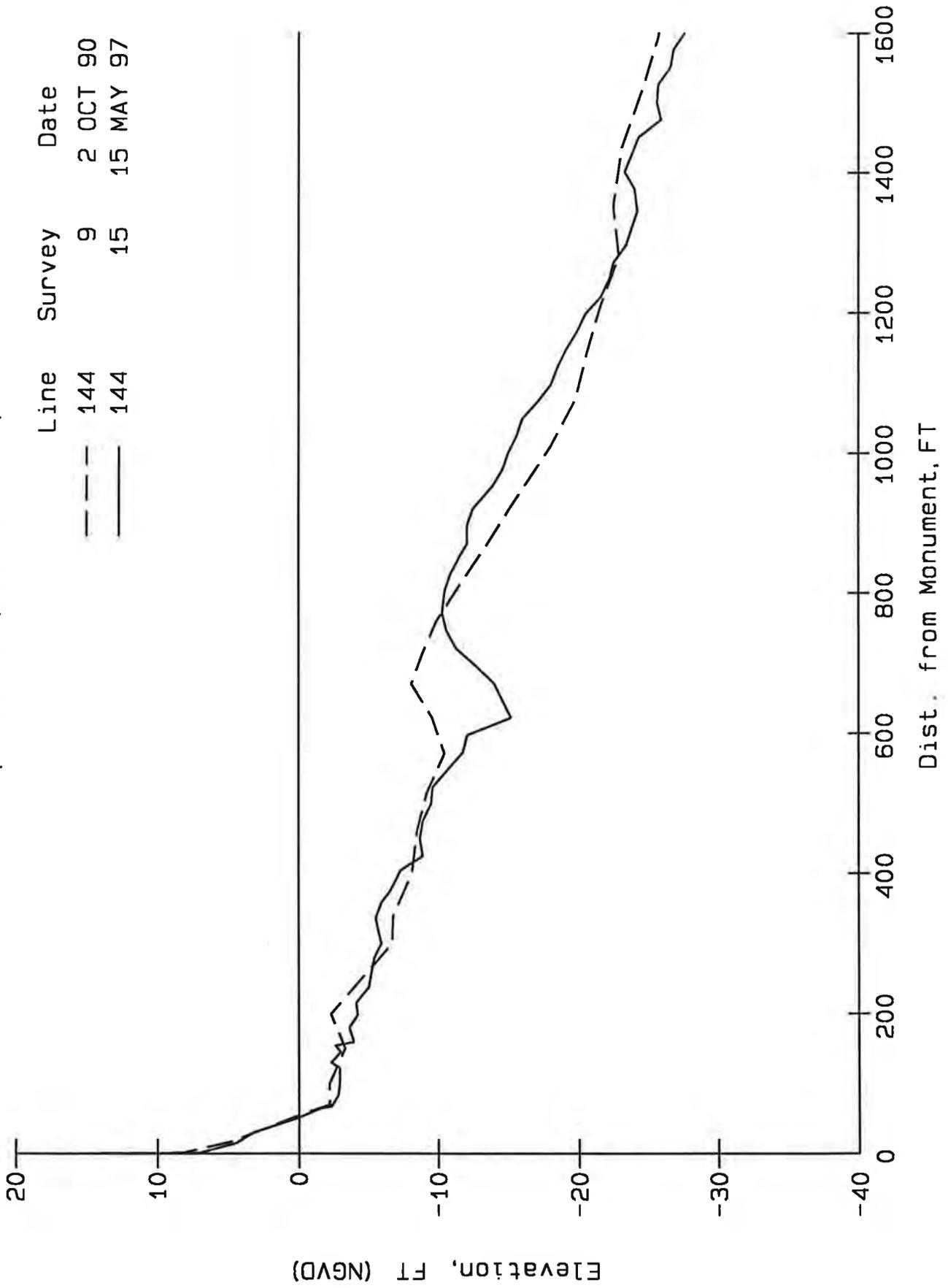
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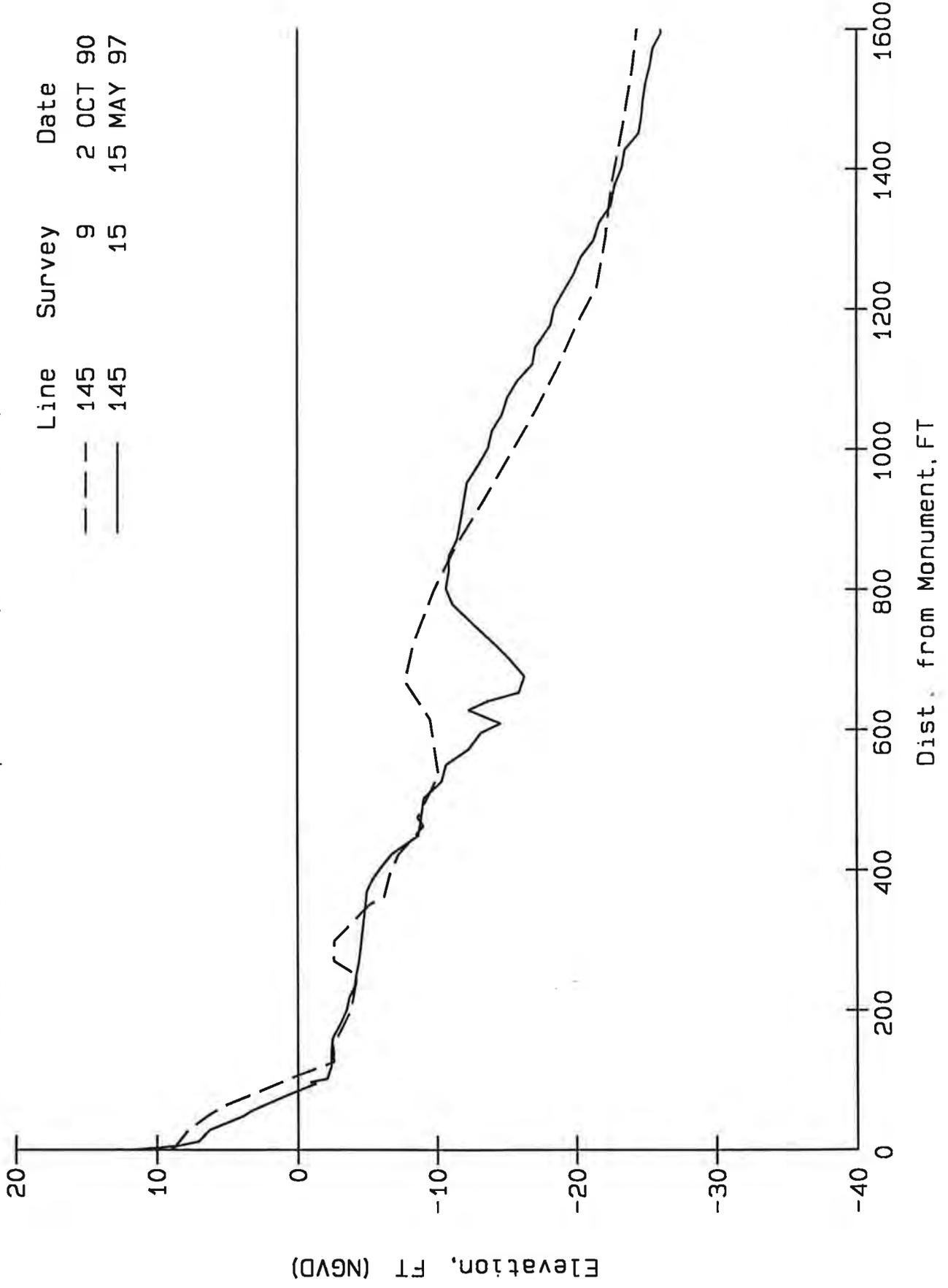
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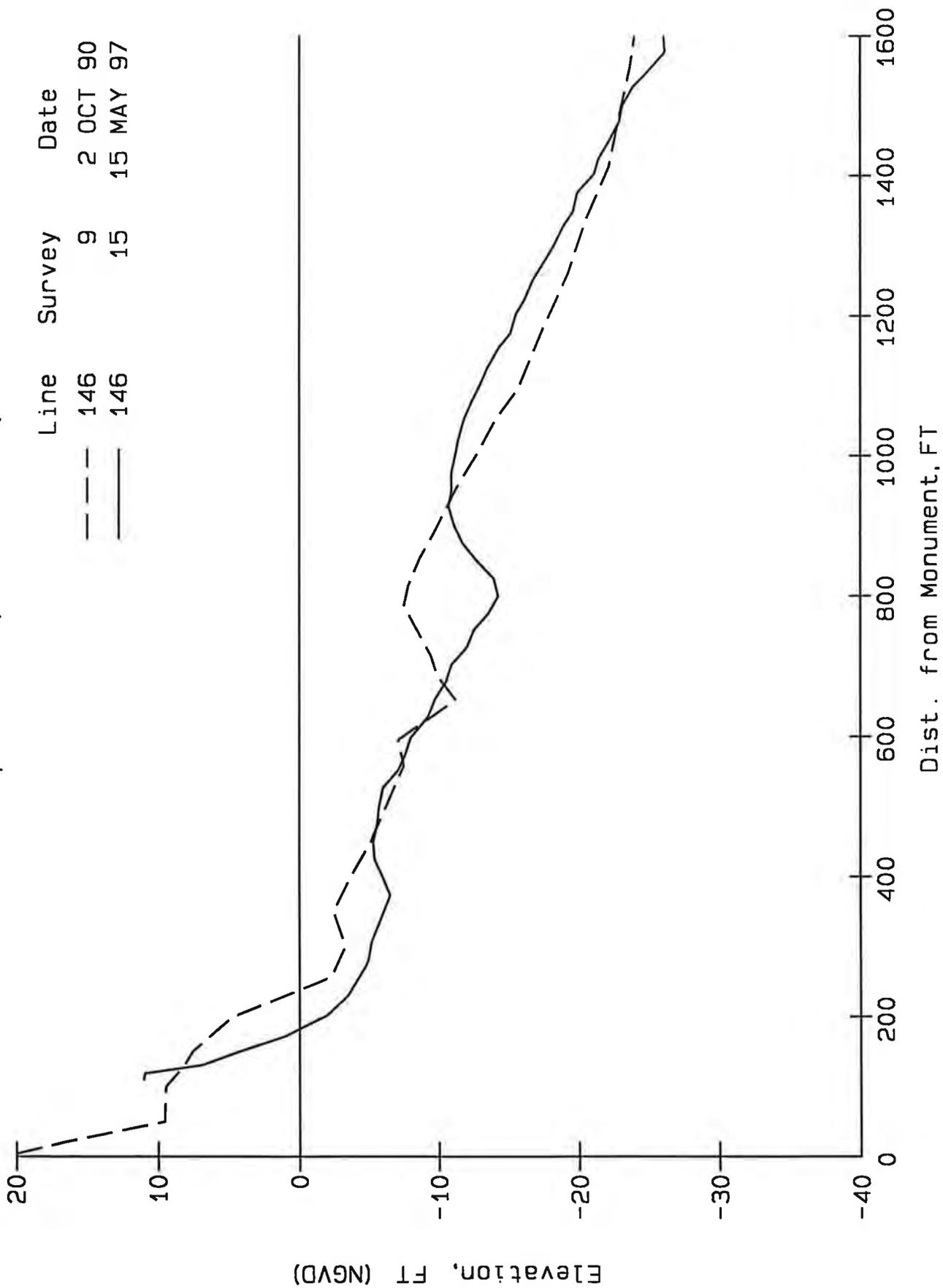
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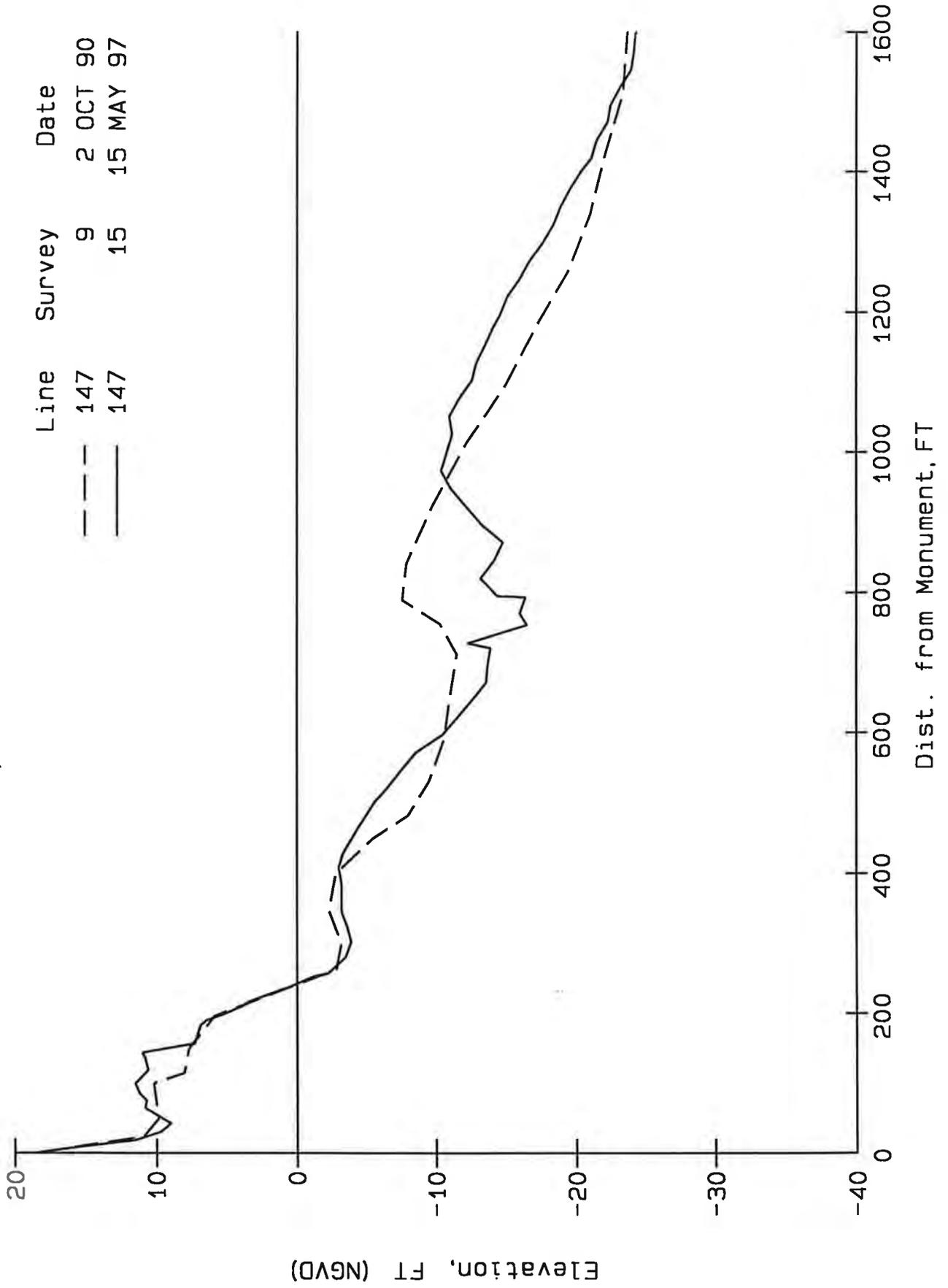
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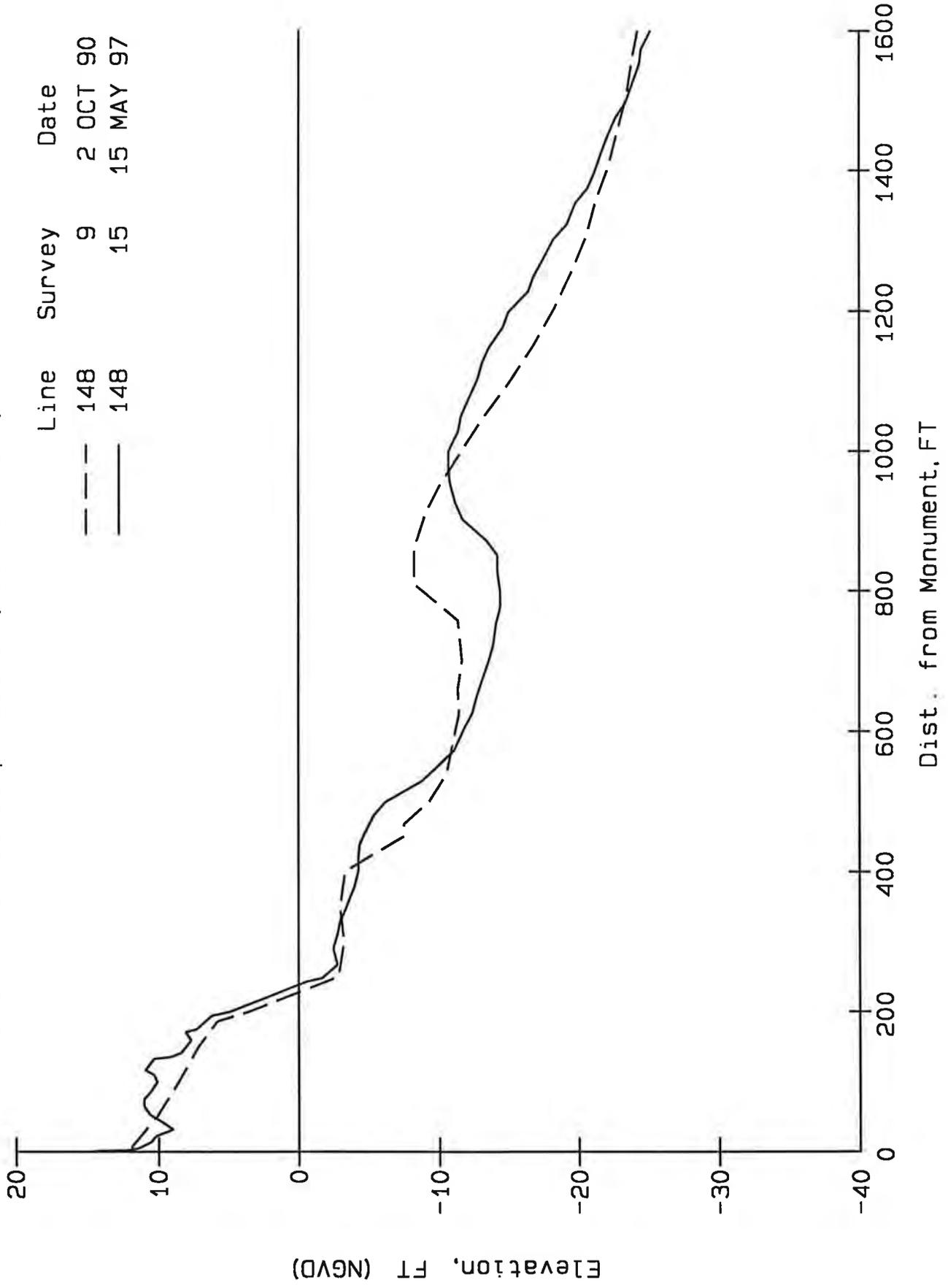
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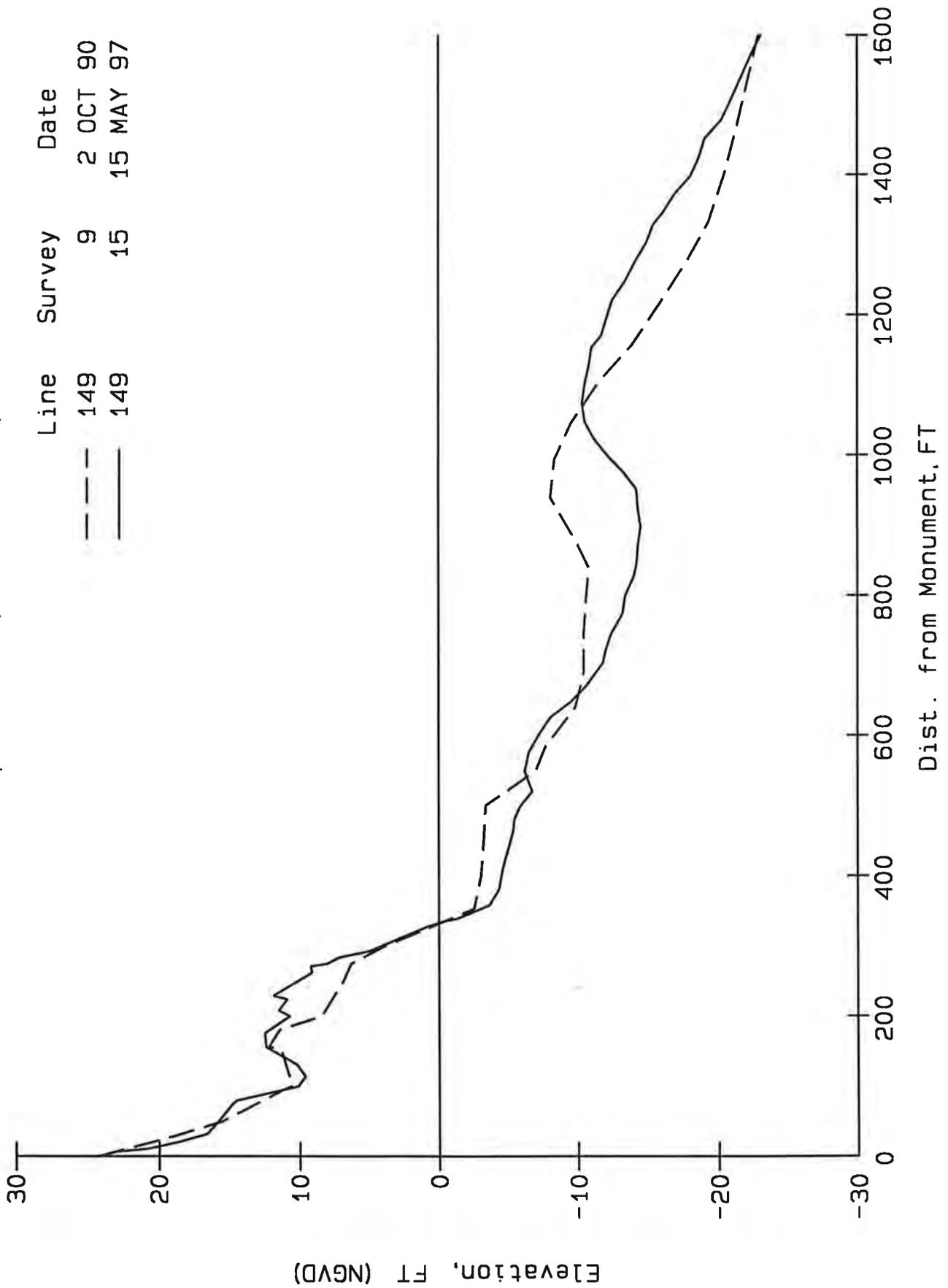
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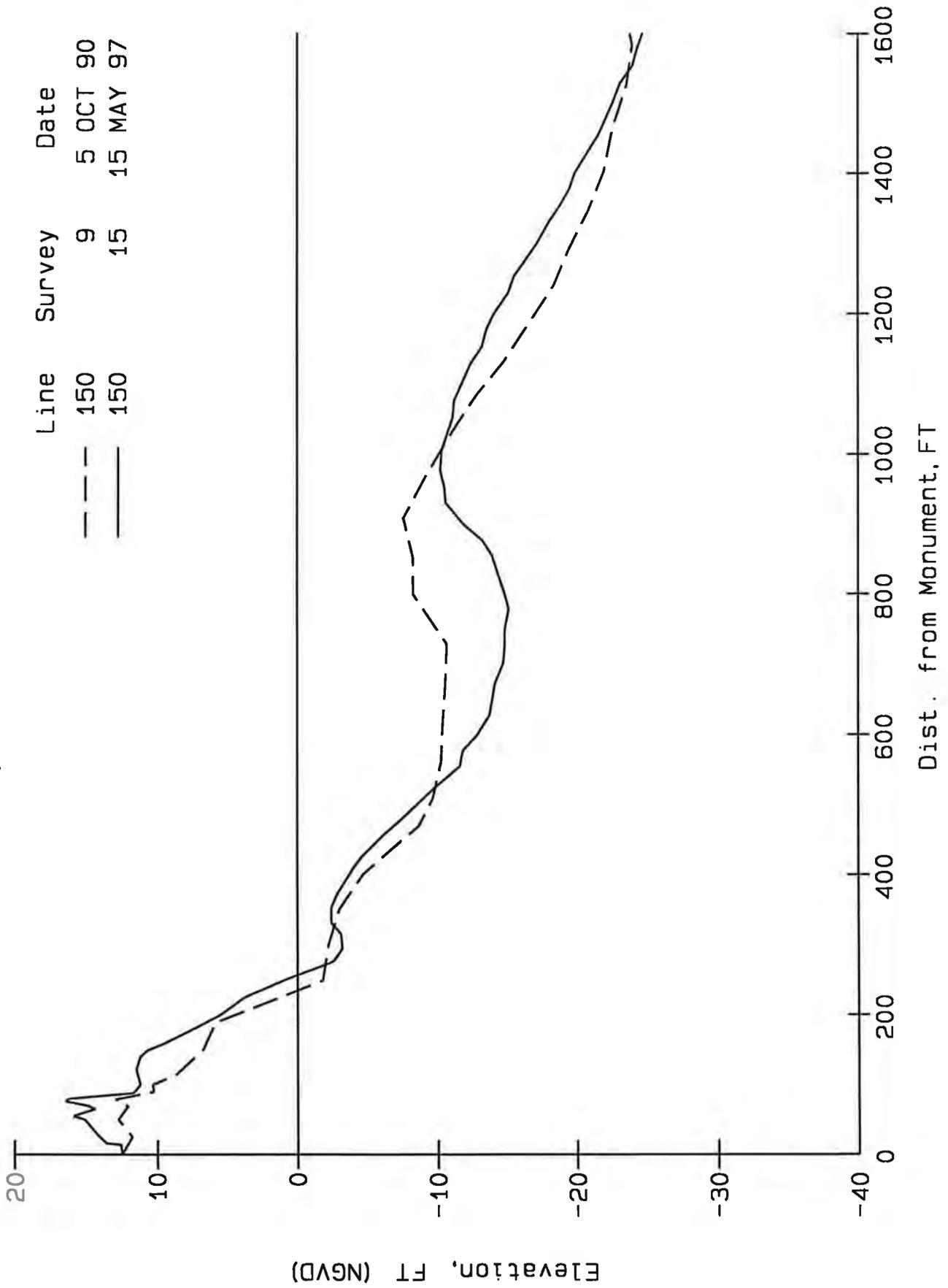
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Beach Profile Comparisons (1990 to 1997)



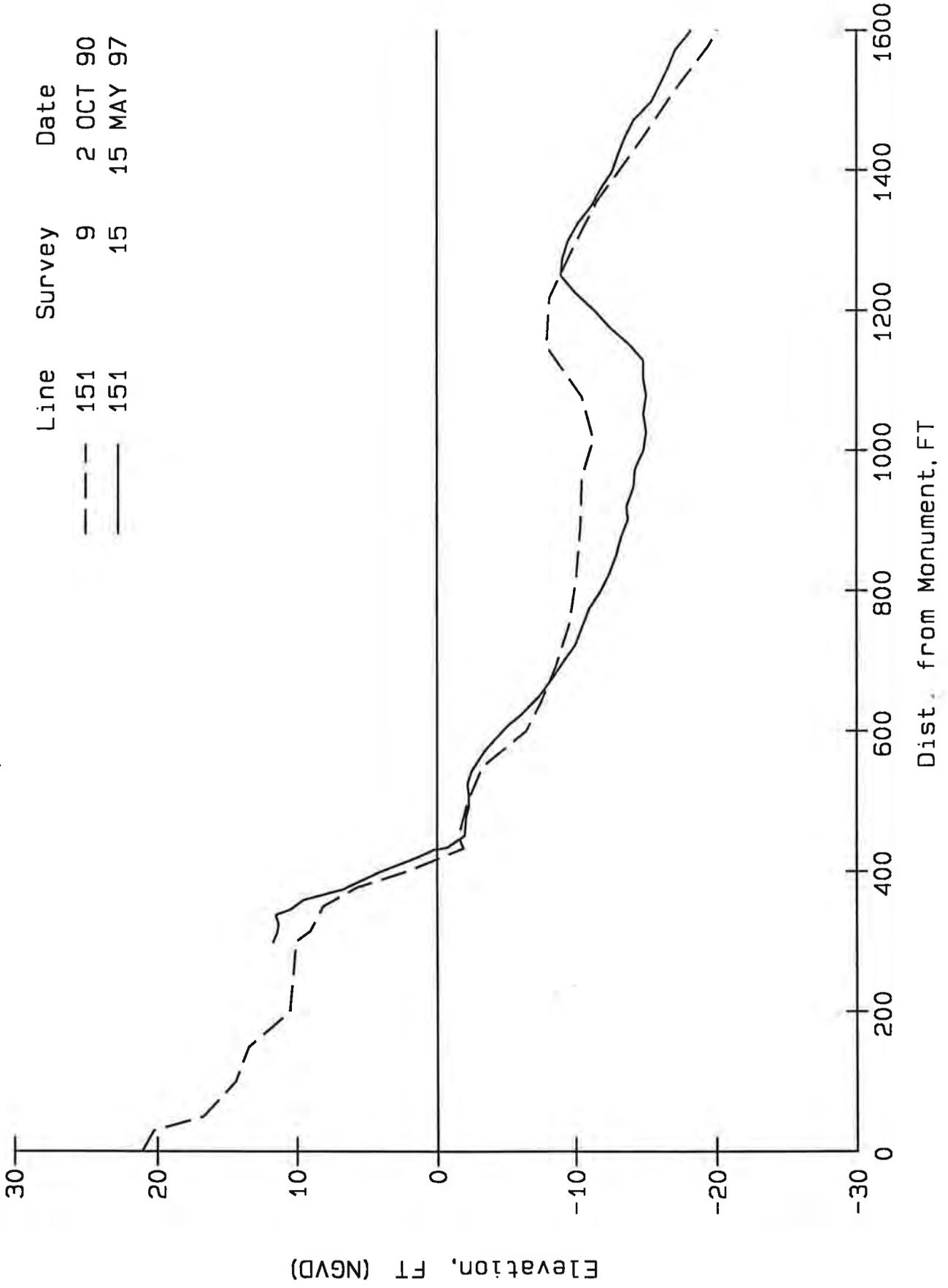
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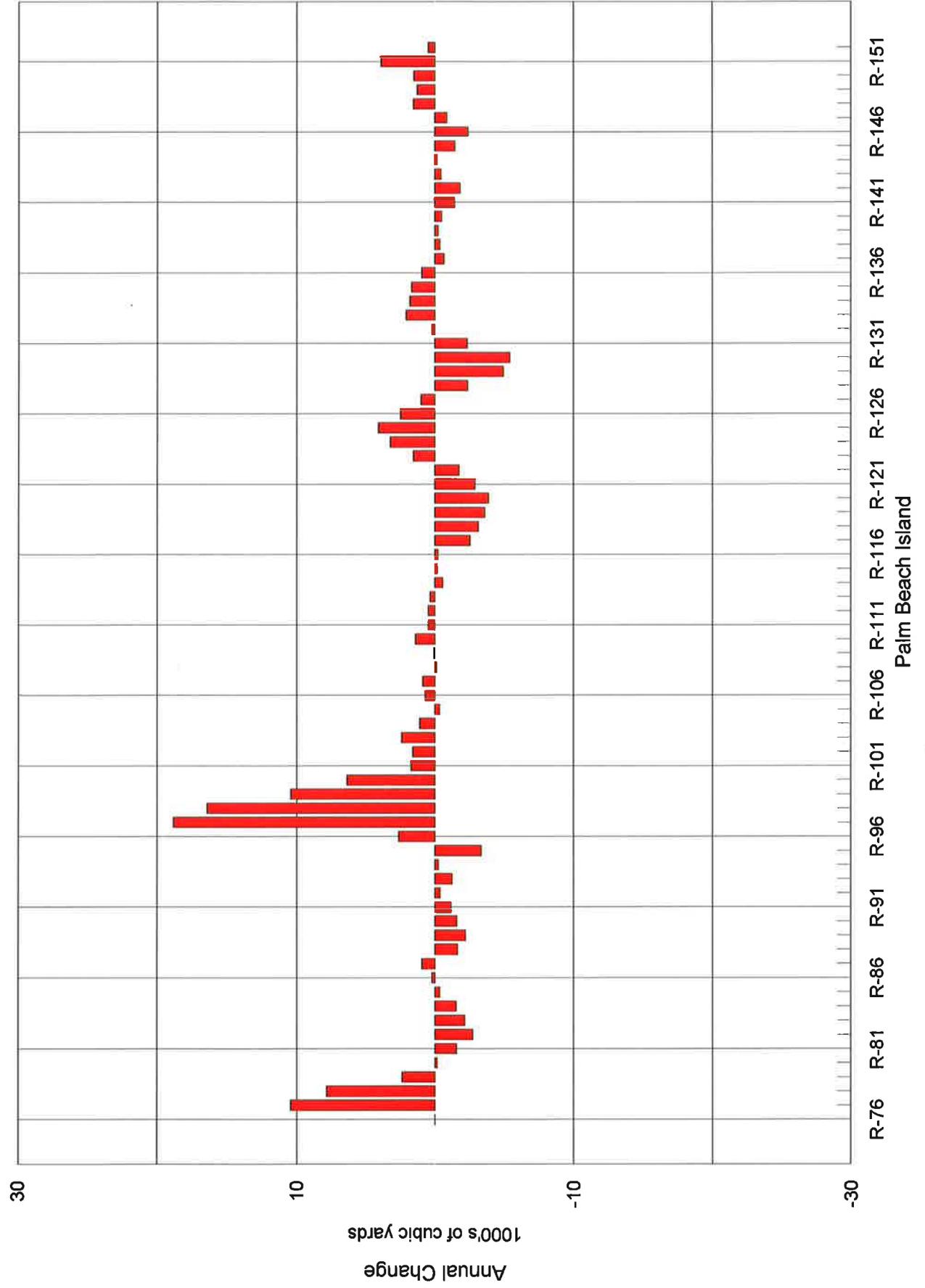
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Beach Profile Comparisons (1990 to 1997)



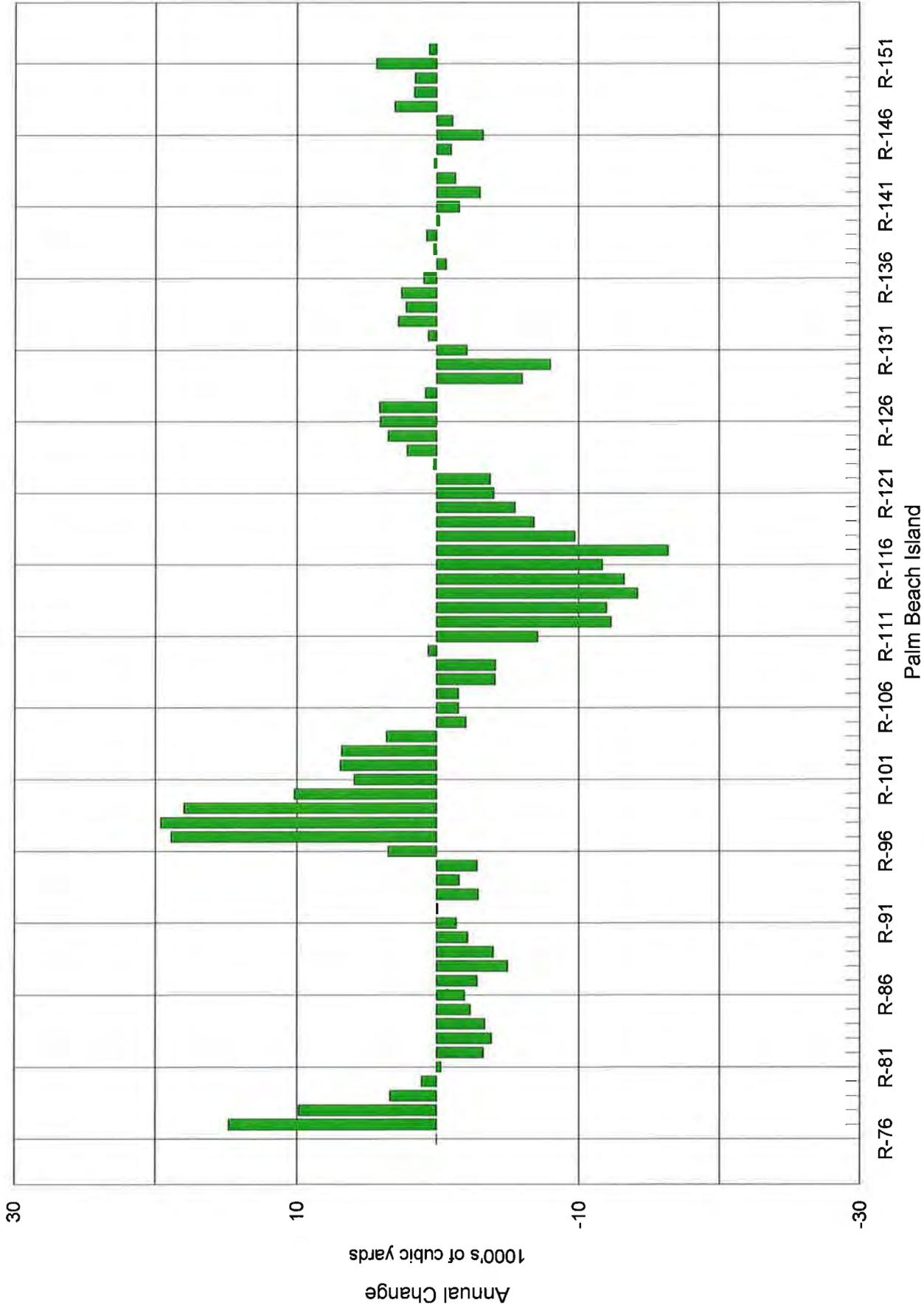
Palm Beach Island
Beach Profile Comparisons (1990 to 1997)



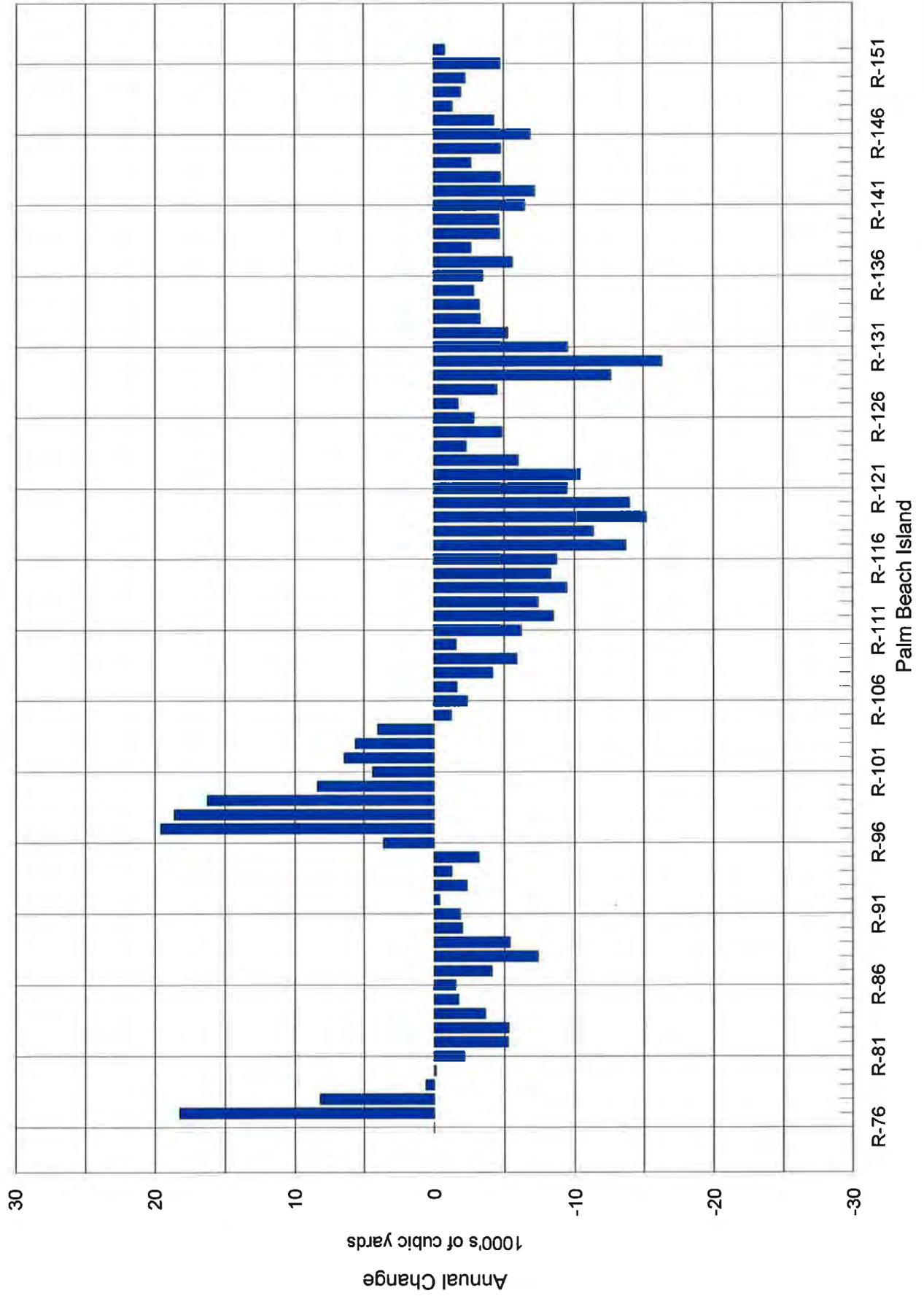
Cumulative Volume Change to -5 feet NGVD, 1990 to 1997



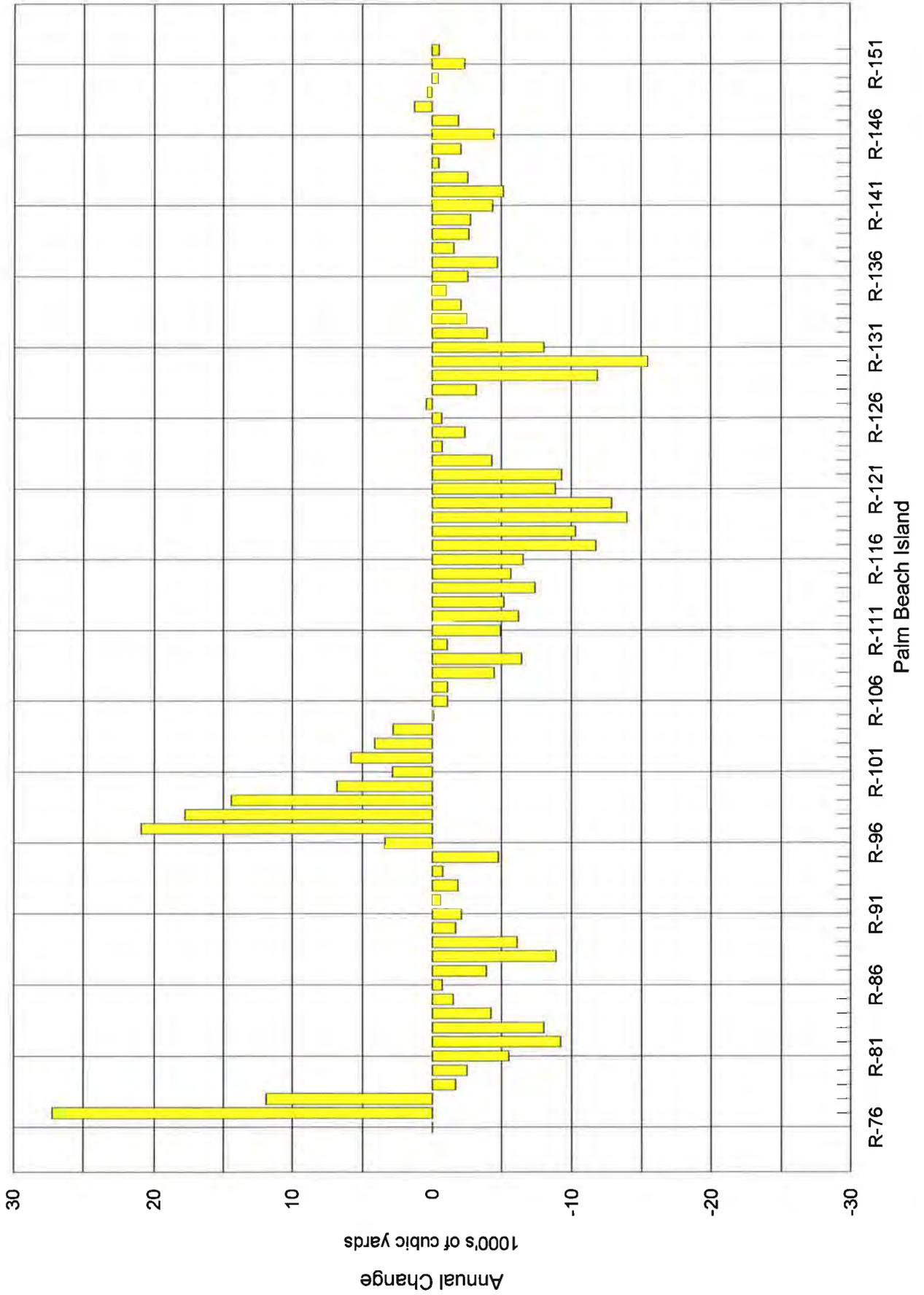
Cumulative Volume Change to -10 feet NGVD, 1990 to 1997



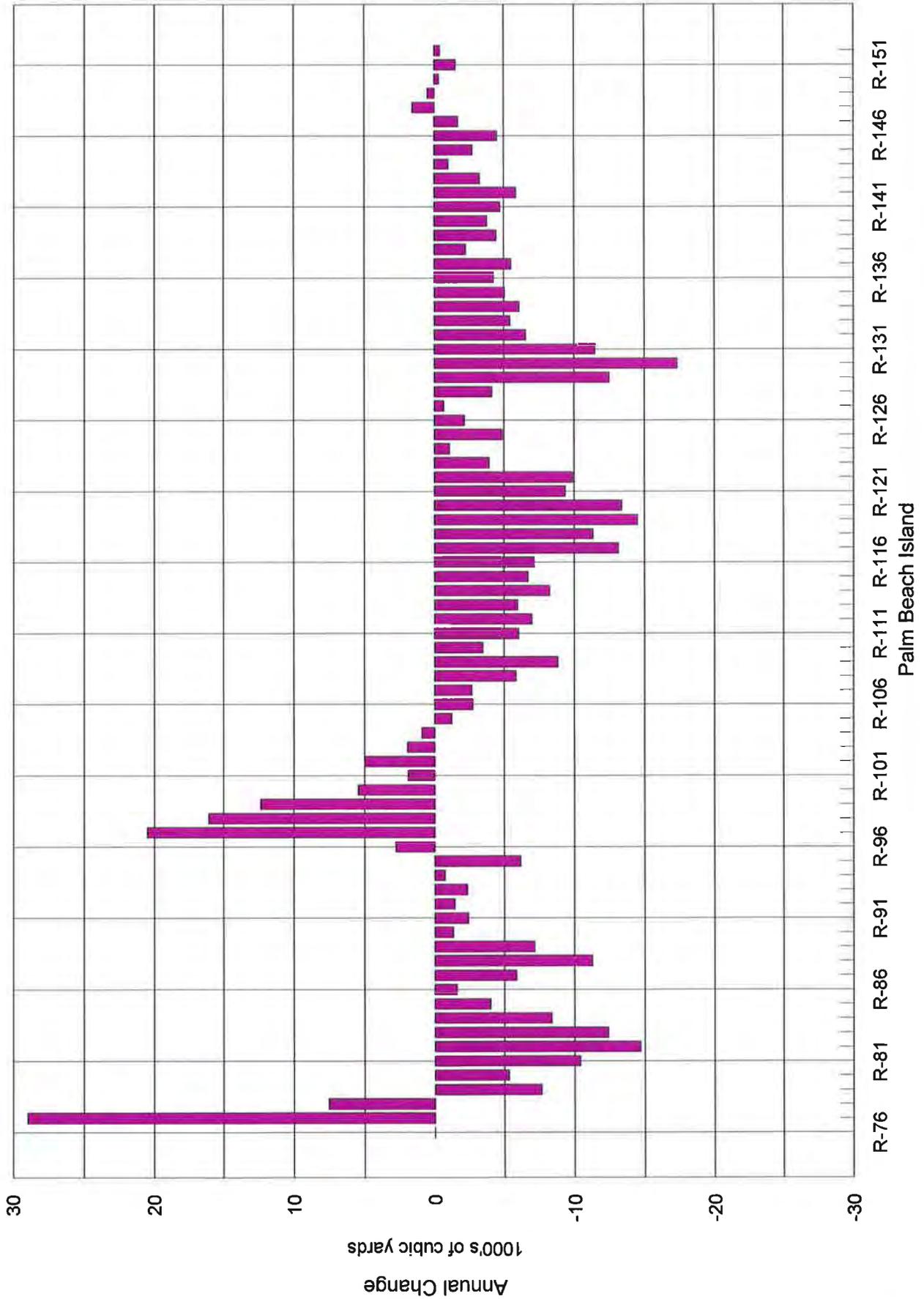
Cumulative Volume Change to -15 feet NGVD, 1990 to 1997



Cumulative Volume Change to -20 feet NGVD, 1990 to 1997



Cumulative Volume Change to -25 feet NGVD, 1990 to 1997



APPENDIX C

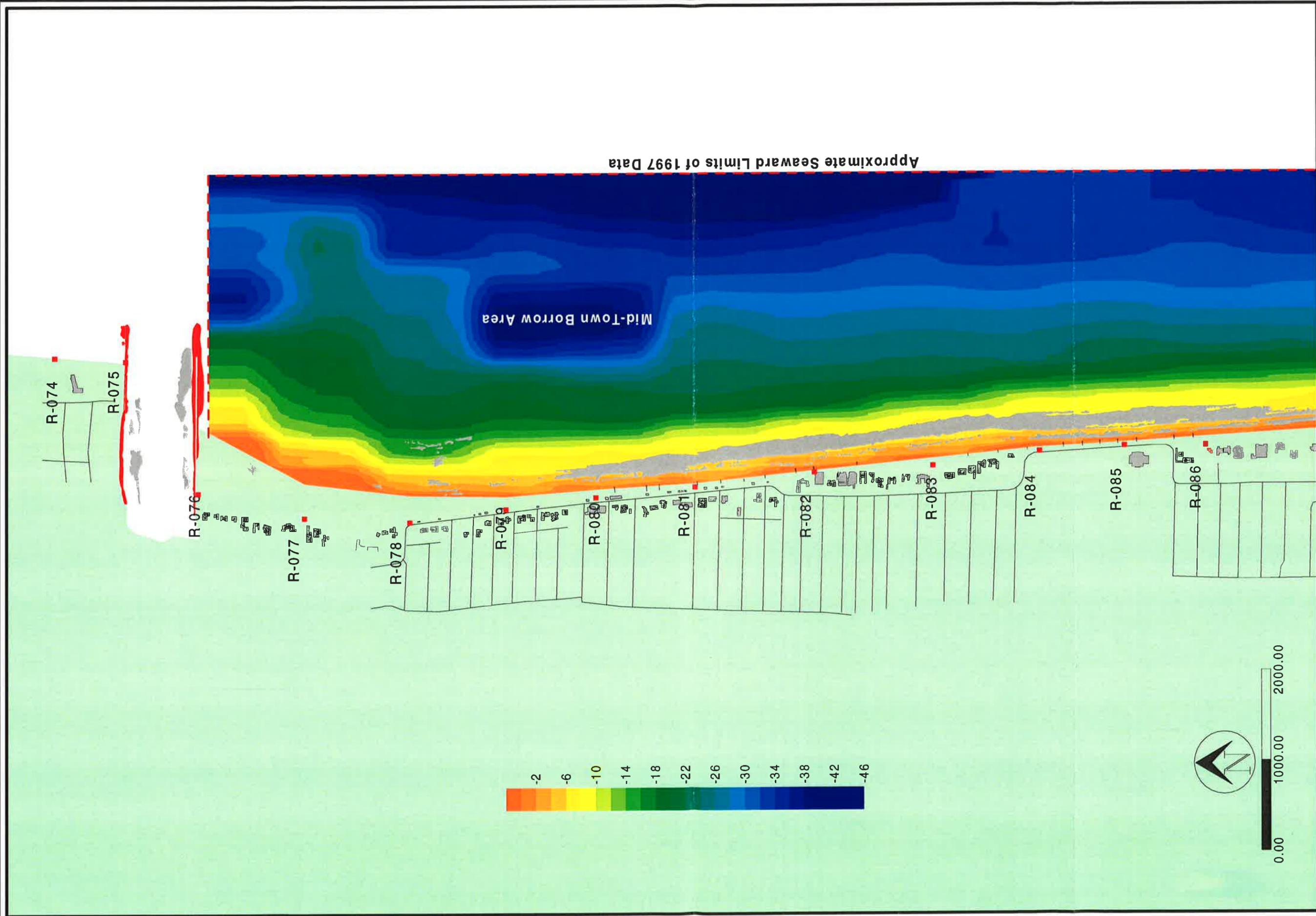
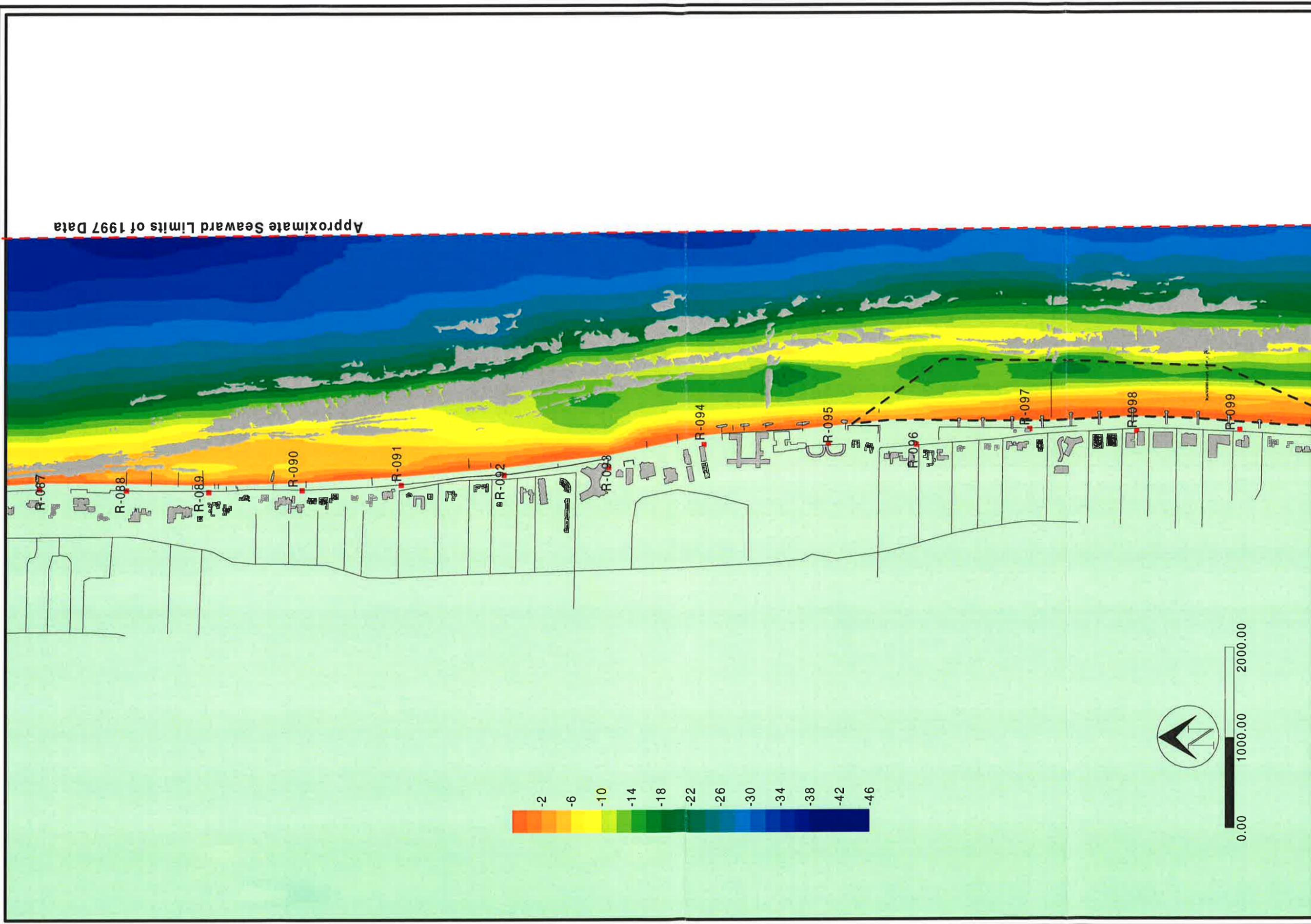


Figure 1
Palm Beach Island Bathymetry (April/May 1997)



Approximate Seaward Limits of 1997 Data

Figure 2
Palm Beach Island Bathymetry (April/May 1997)

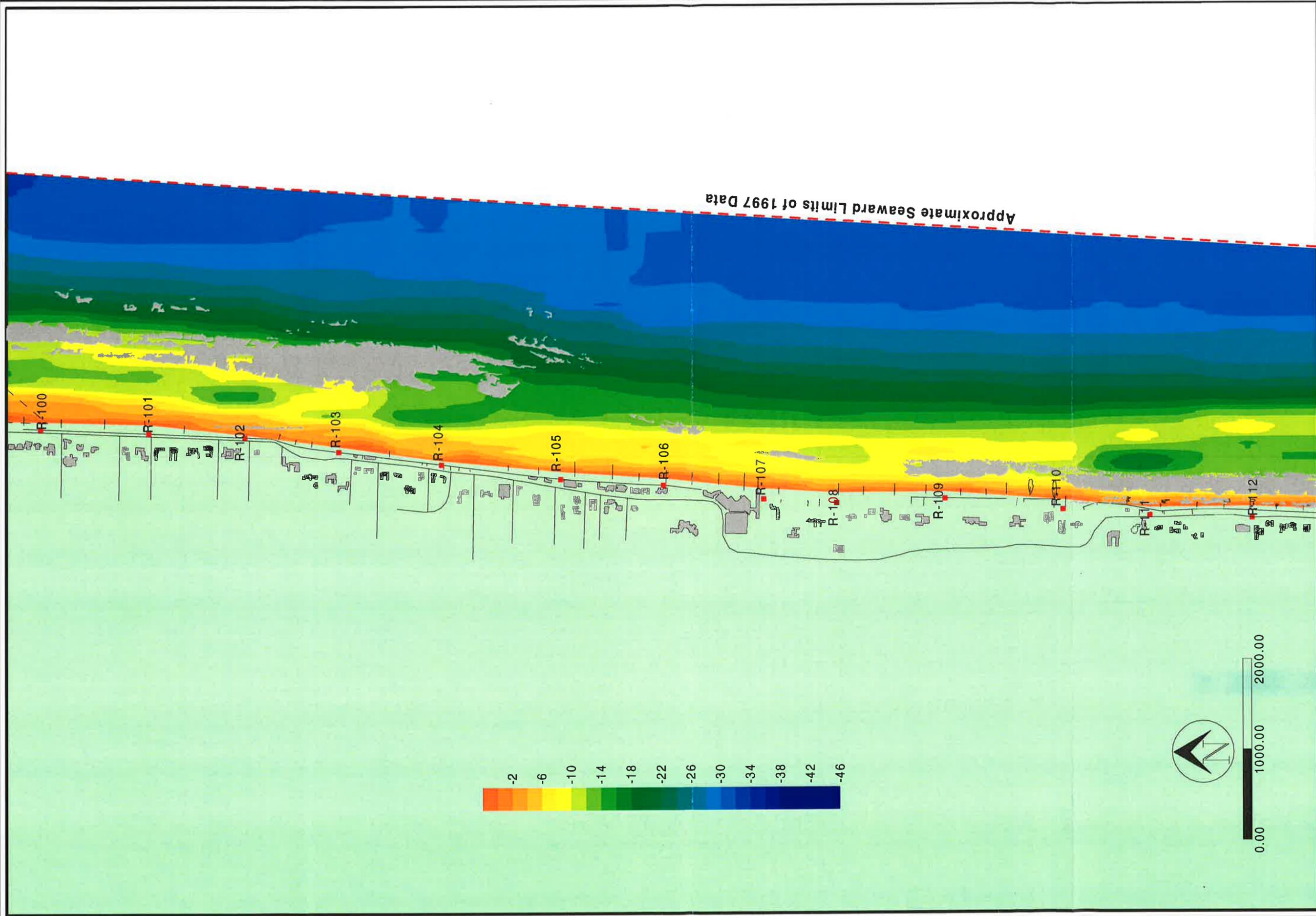
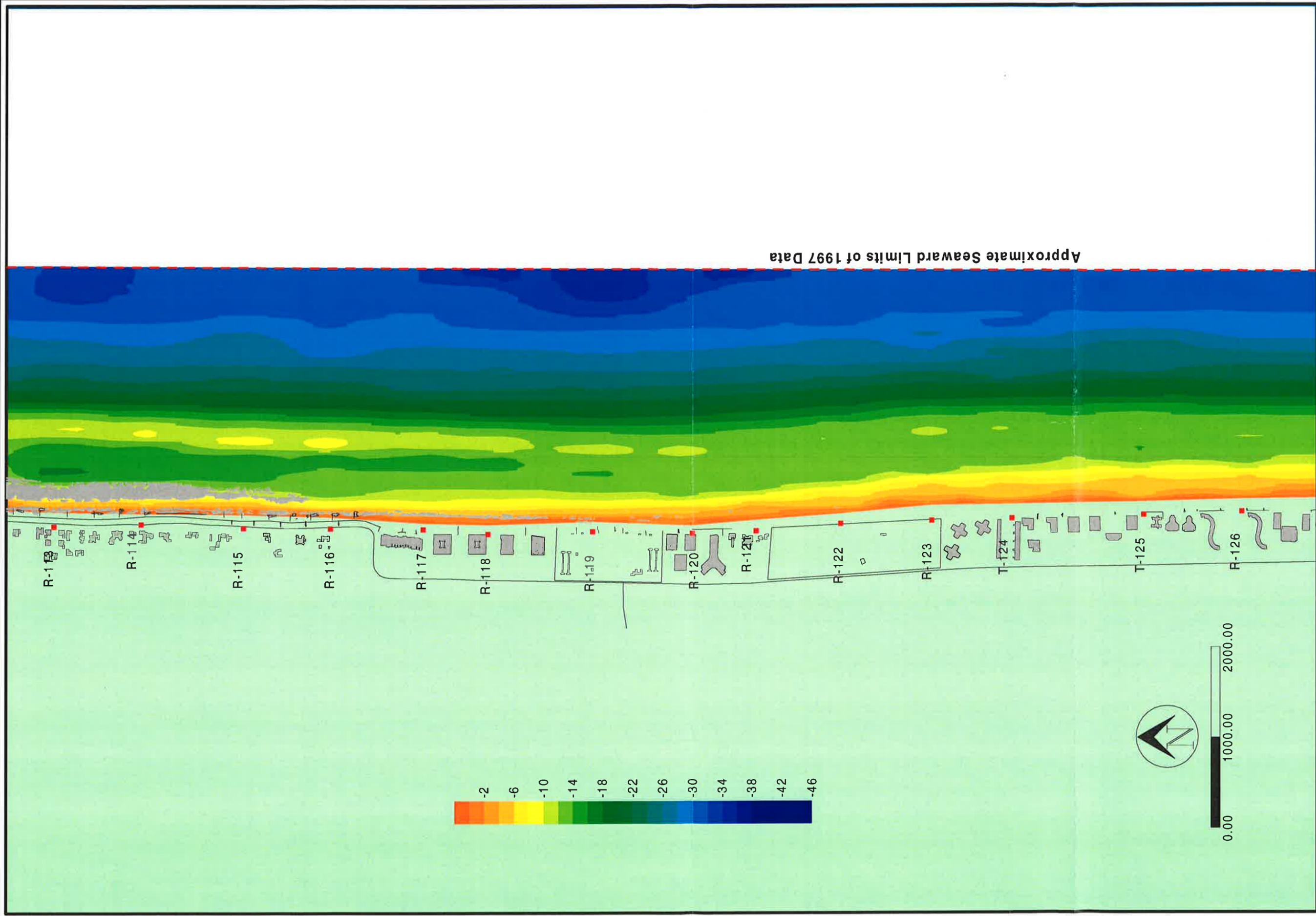


Figure 3
Palm Beach Island Bathymetry (April/May 1997)



Approximate Seaward Limits of 1997 Data



Figure 4
Palm Beach Island Bathymetry (April/May 1997)

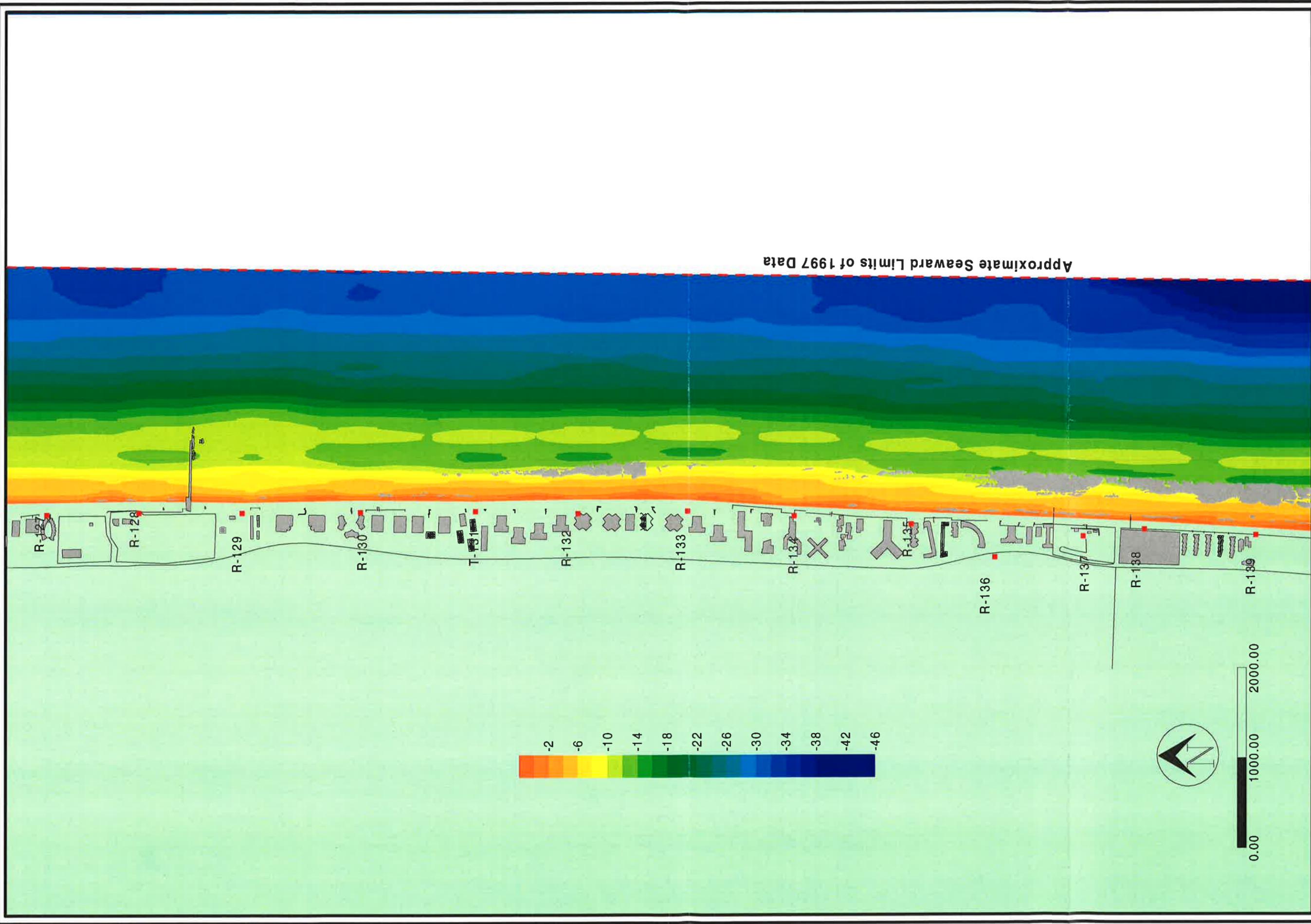


Figure 5
Palm Beach Island Bathymetry (April/May 1997)

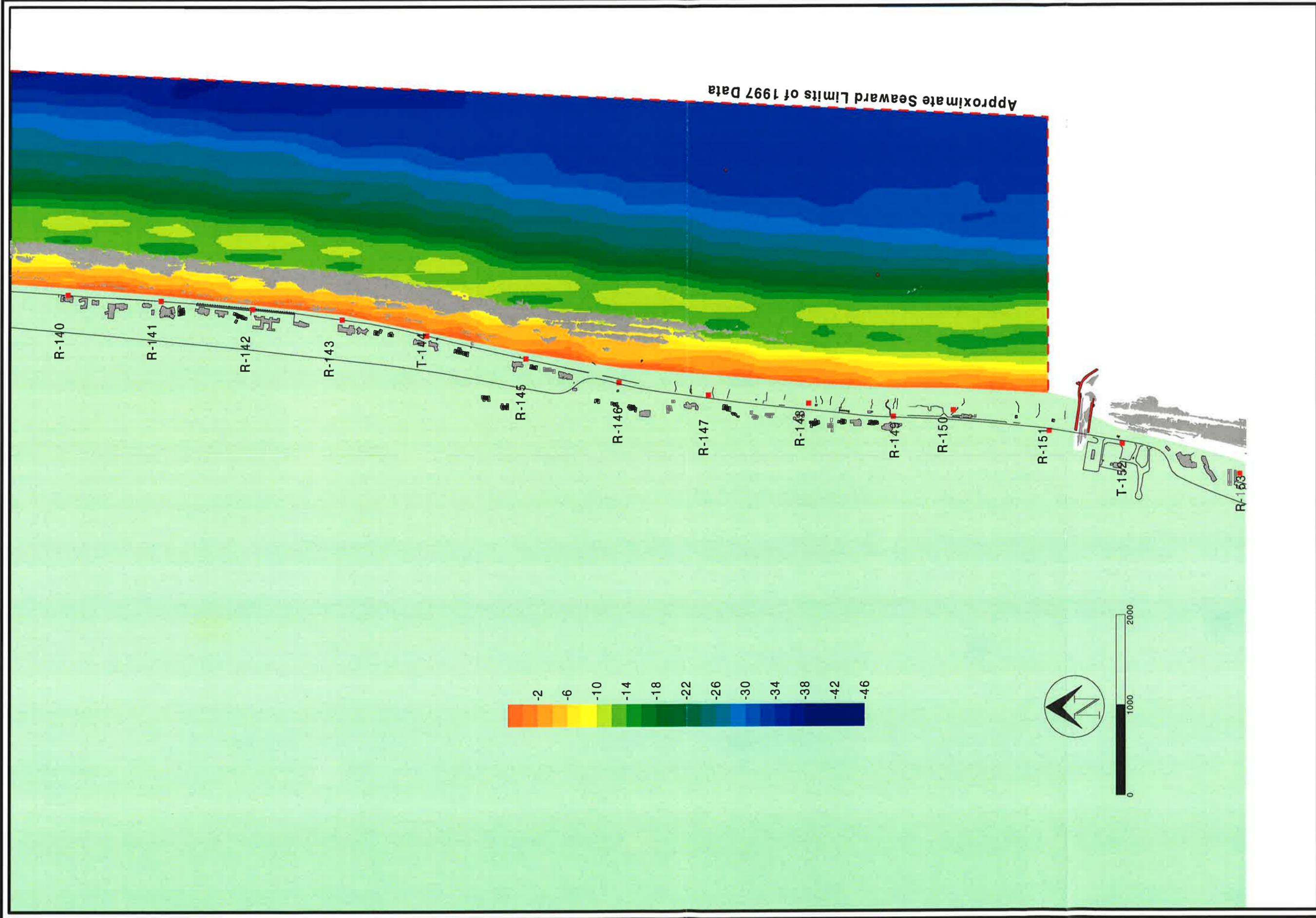
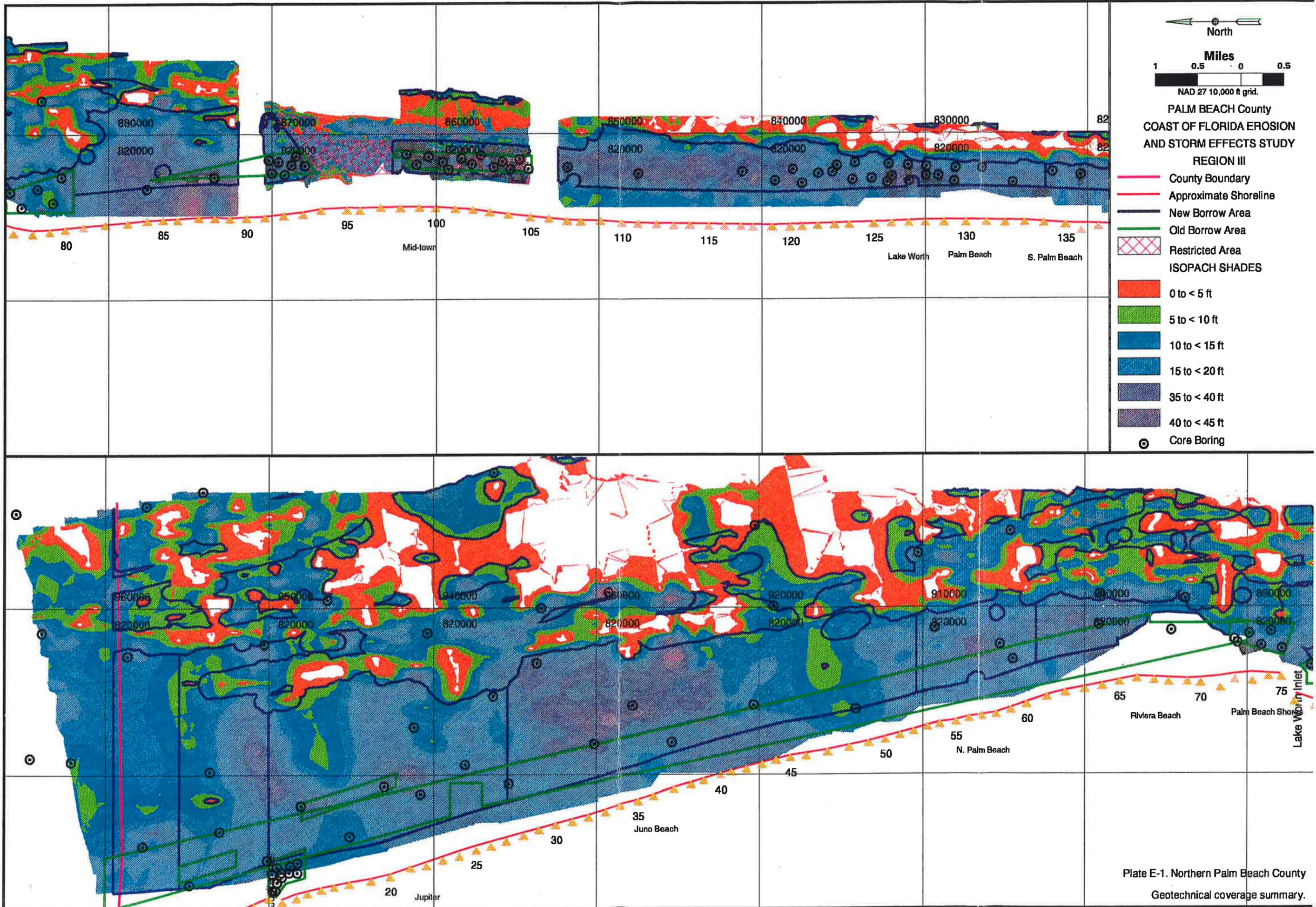


Figure 6
Palm Beach Island Bathymetry (April/May 1997)

APPENDIX D



North

Miles

1 0.5 0 0.5

NAD 27 10,000 ft grid.

PALM BEACH County
COAST OF FLORIDA EROSION
AND STORM EFFECTS STUDY
REGION III

- County Boundary
- Approximate Shoreline
- New Borrow Area
- Old Borrow Area
- Restricted Area

ISOPACH SHADES

- 0 to < 5 ft
- 5 to < 10 ft
- 10 to < 15 ft
- 15 to < 20 ft
- 35 to < 40 ft
- 40 to < 45 ft
- Core Boring

Plate E-1. Northern Palm Beach County
 Geotechnical coverage summary.

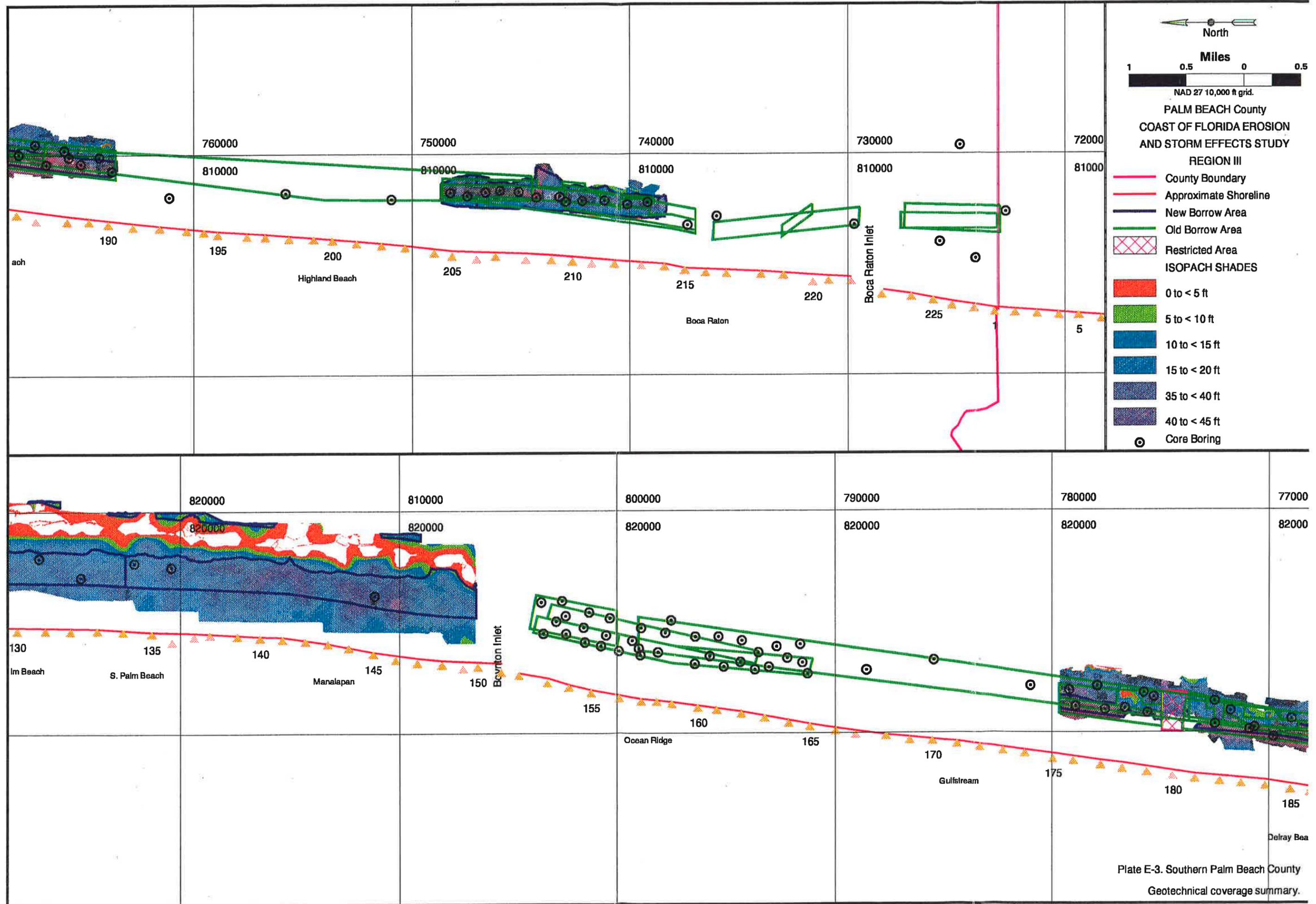


Plate E-3. Southern Palm Beach County
Geotechnical coverage summary.

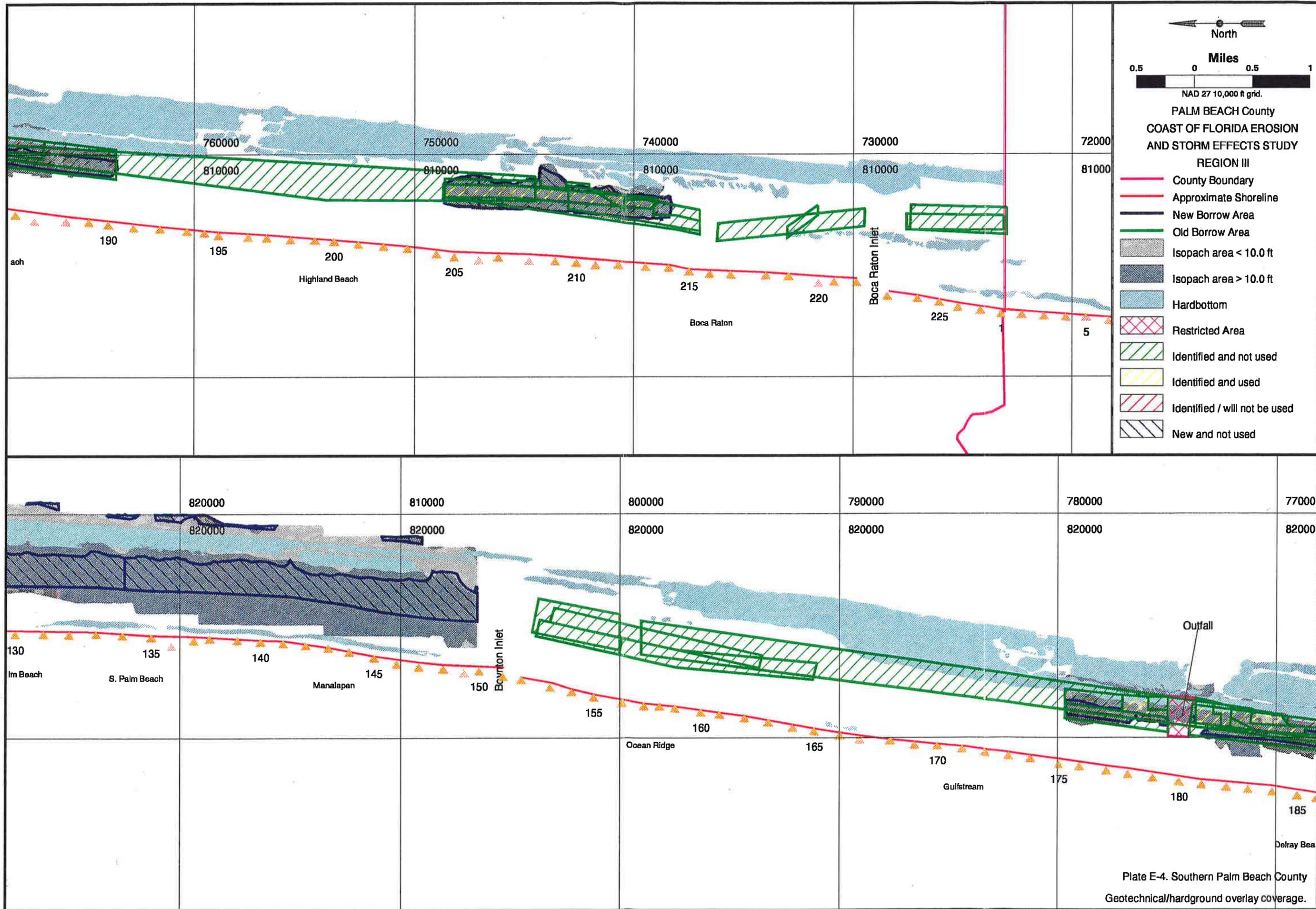
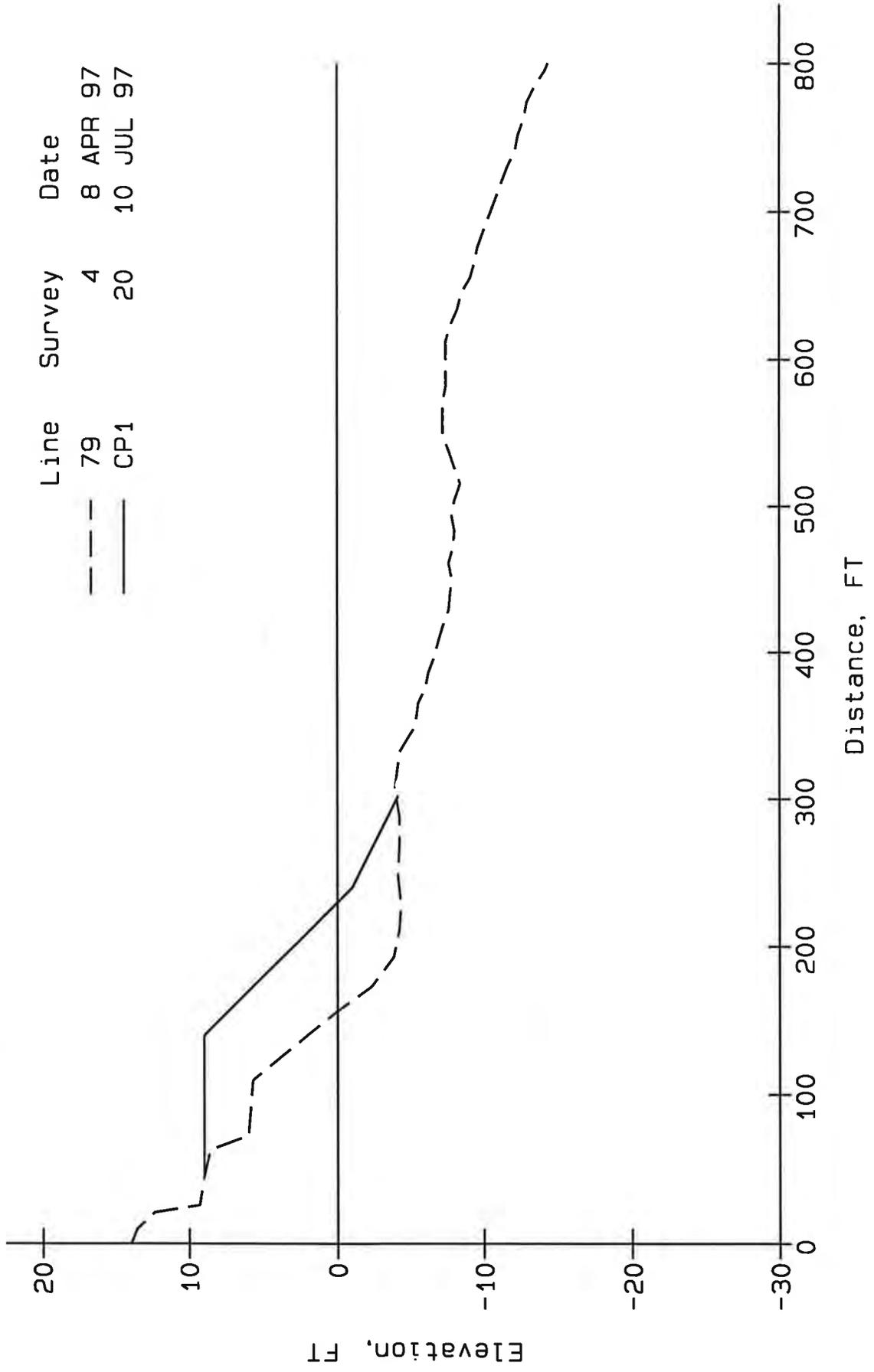


Plate E-4. Southern Palm Beach County
Geotechnical/hardground overlay coverage.

APPENDIX E

REACH 2

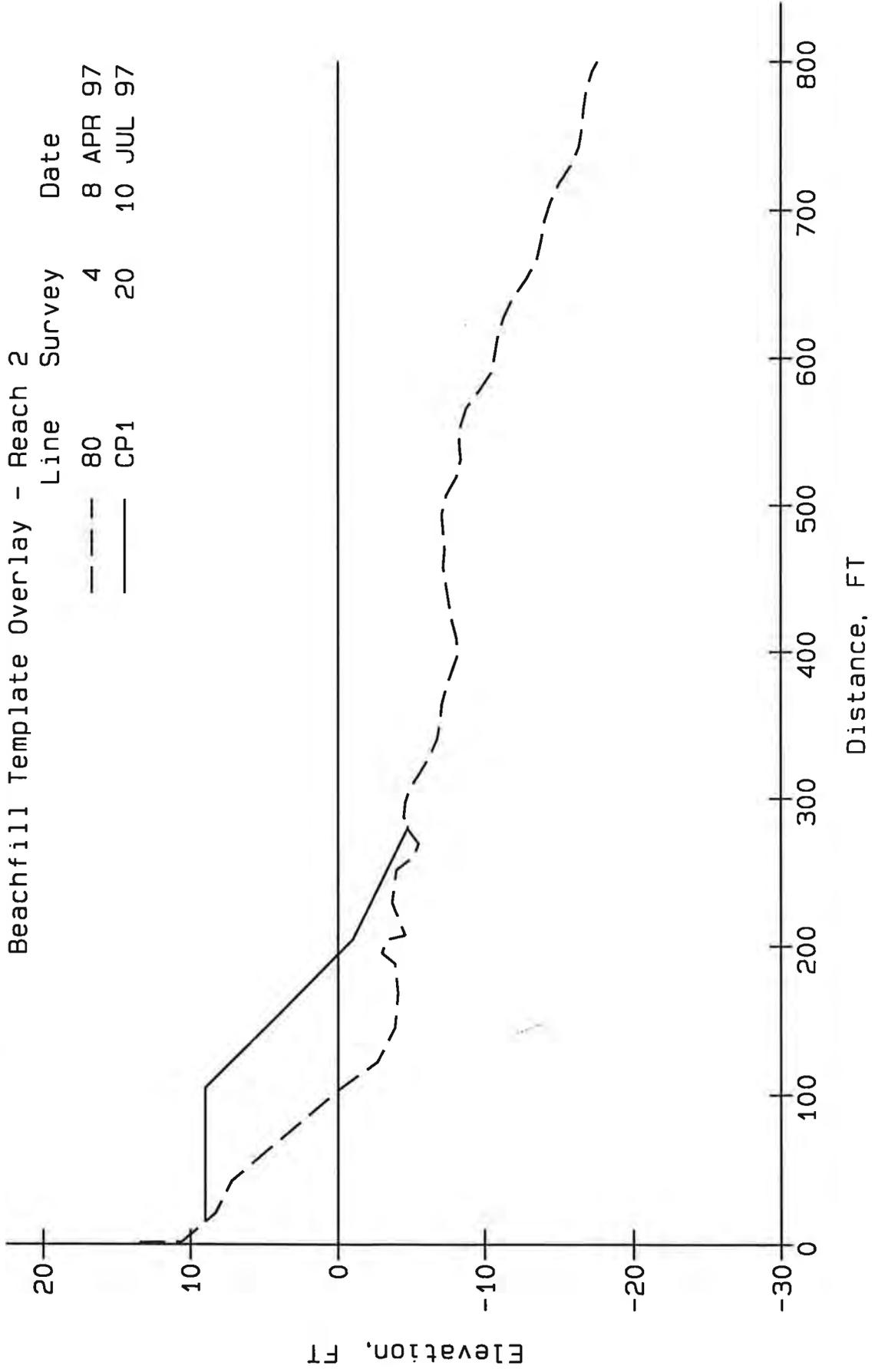
Palm Beach Island



Palm Beach Island

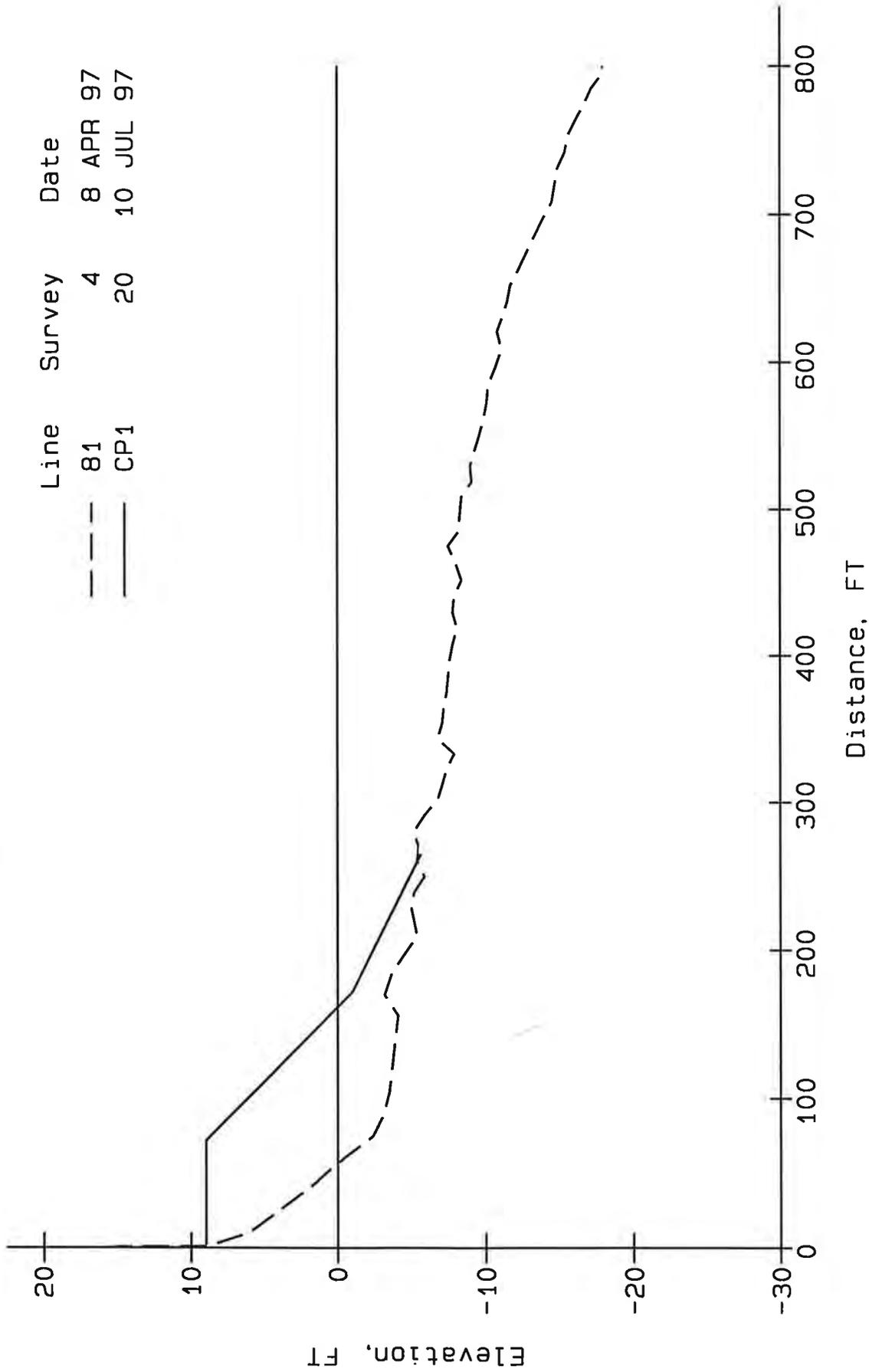
Beachfill Template Overlay - Reach 2

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—	CP1	20 10 JUL 97

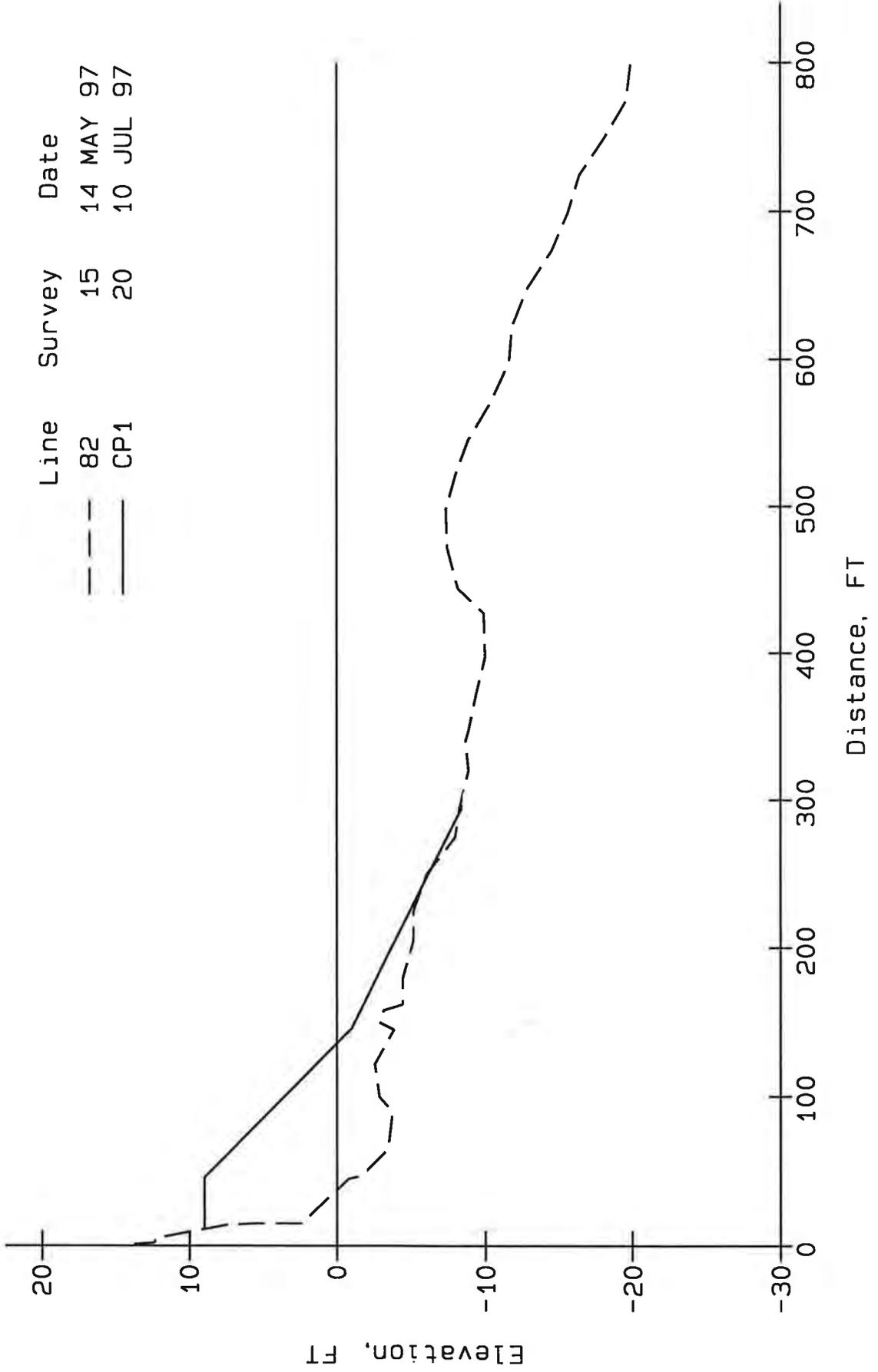


Palm Beach Island

Line	Survey	Date
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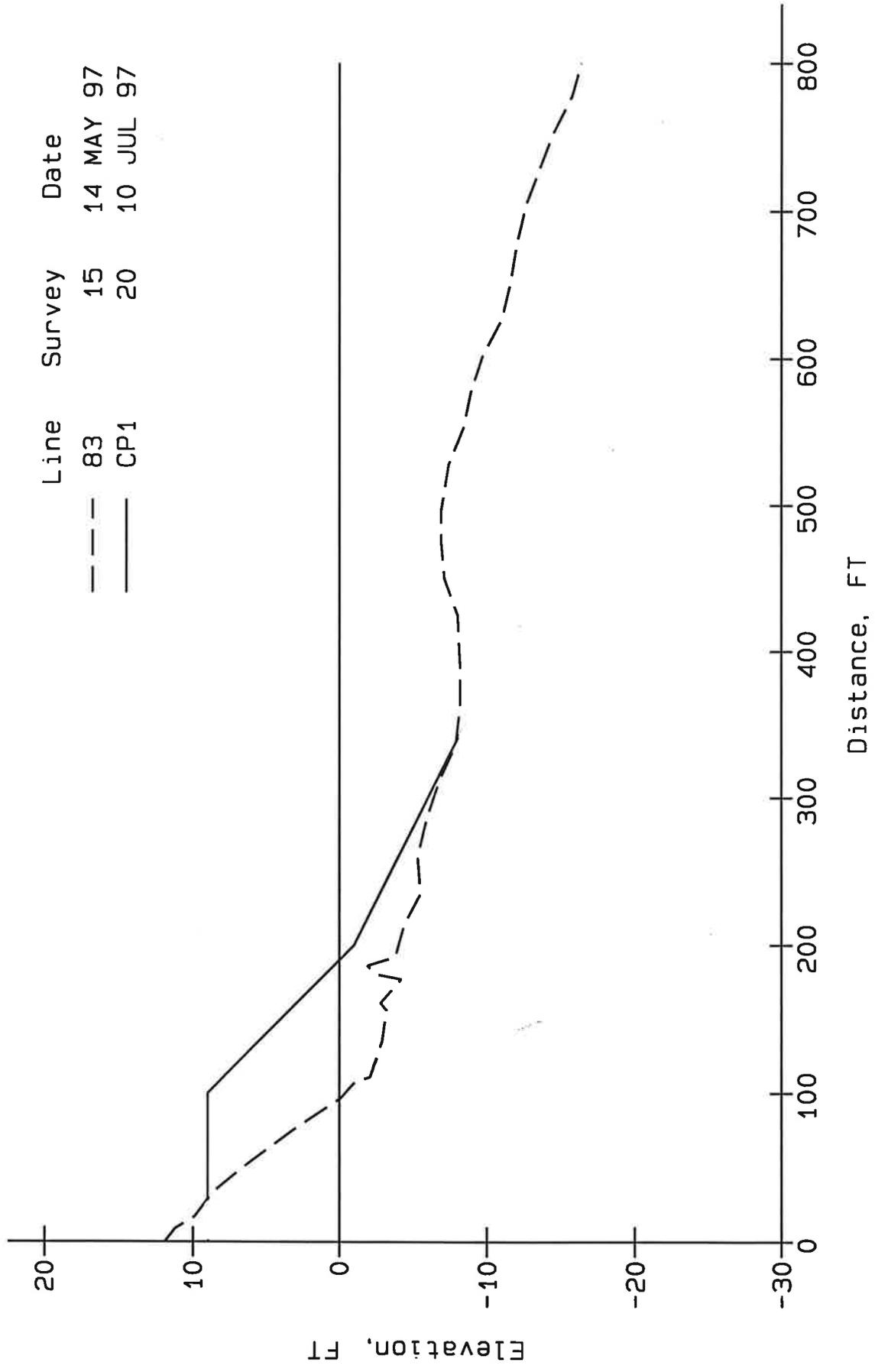


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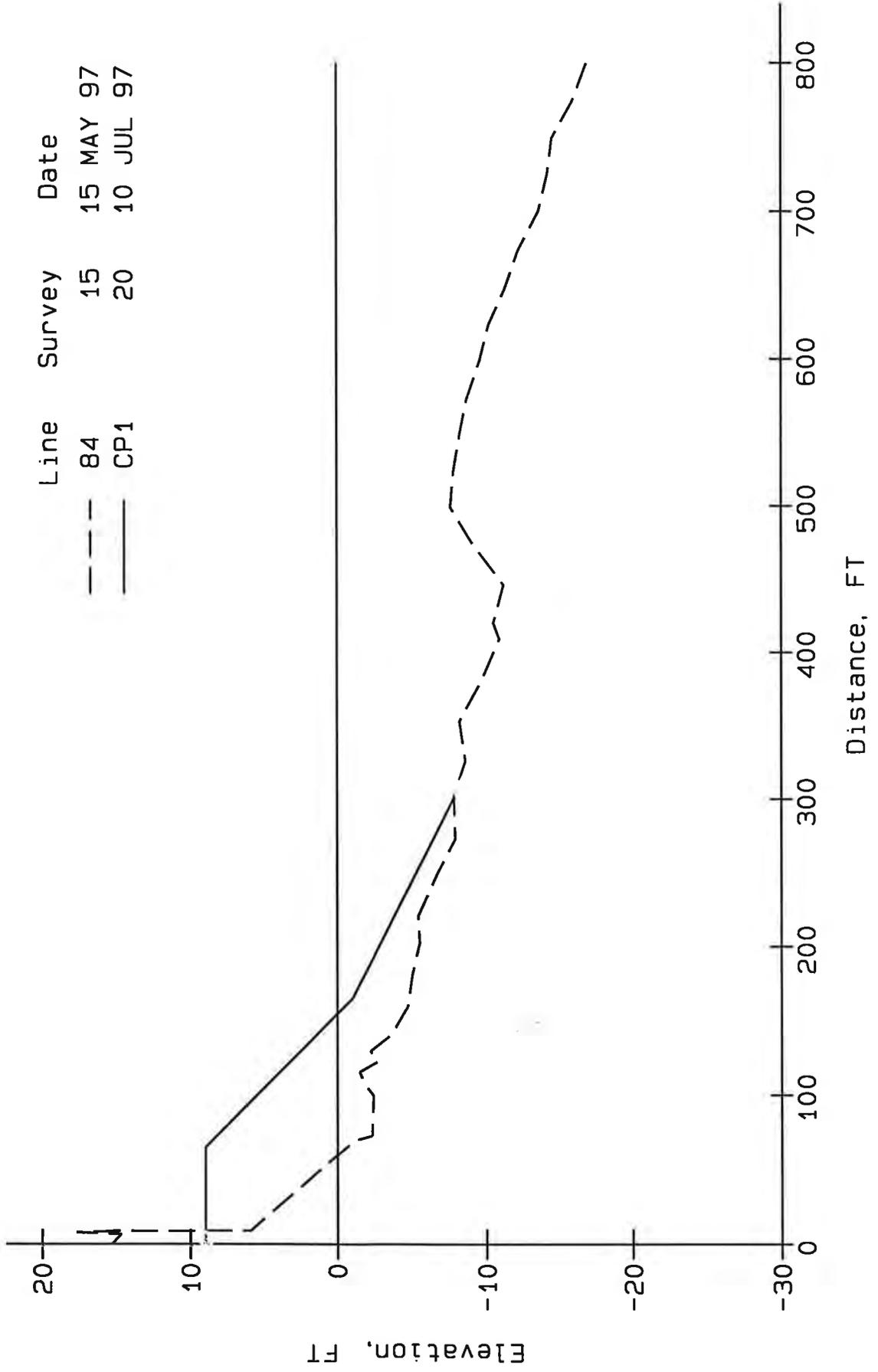


Palm Beach Island

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—	CP1	20 JUL 97



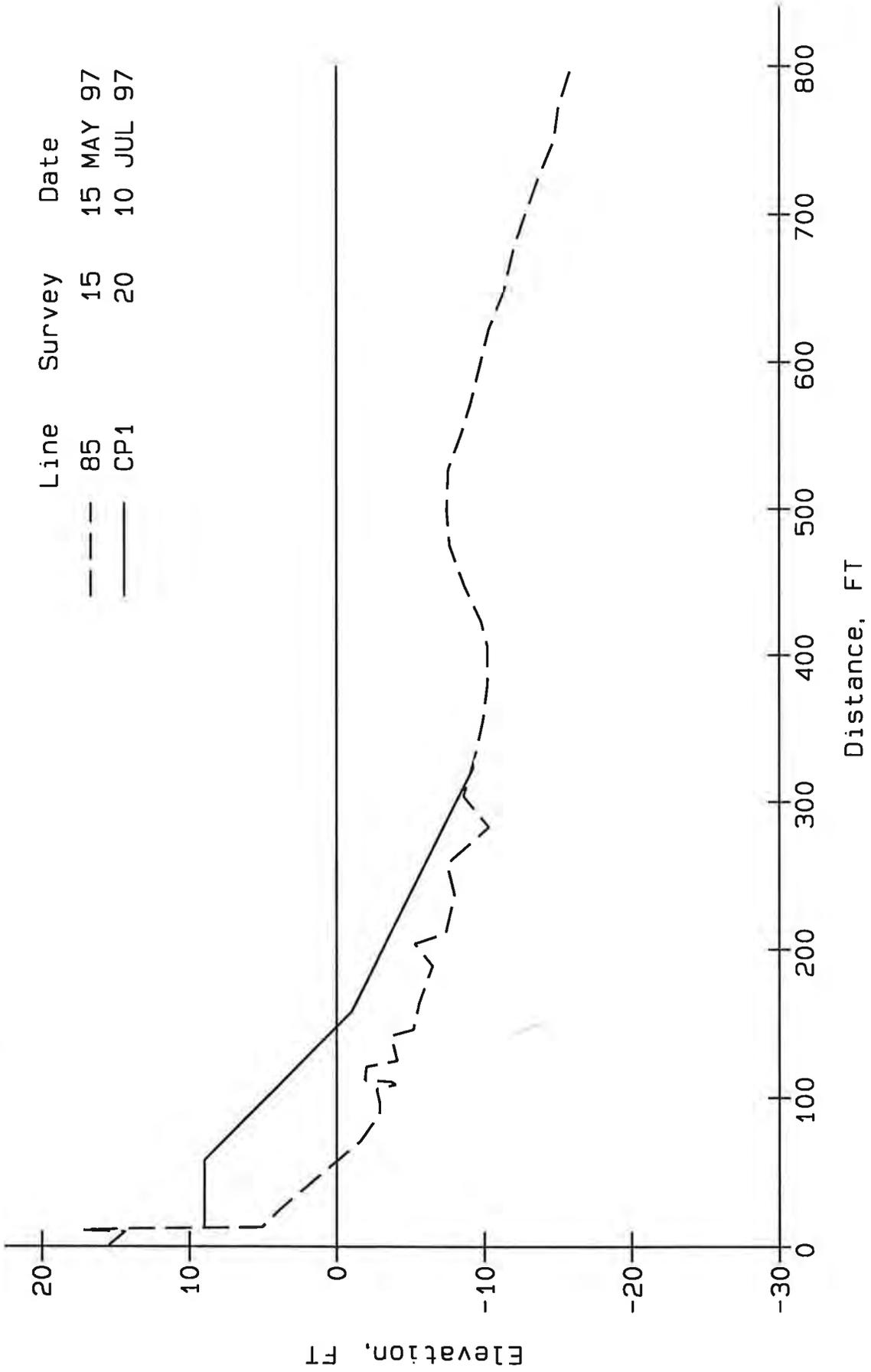
Palm Beach Island



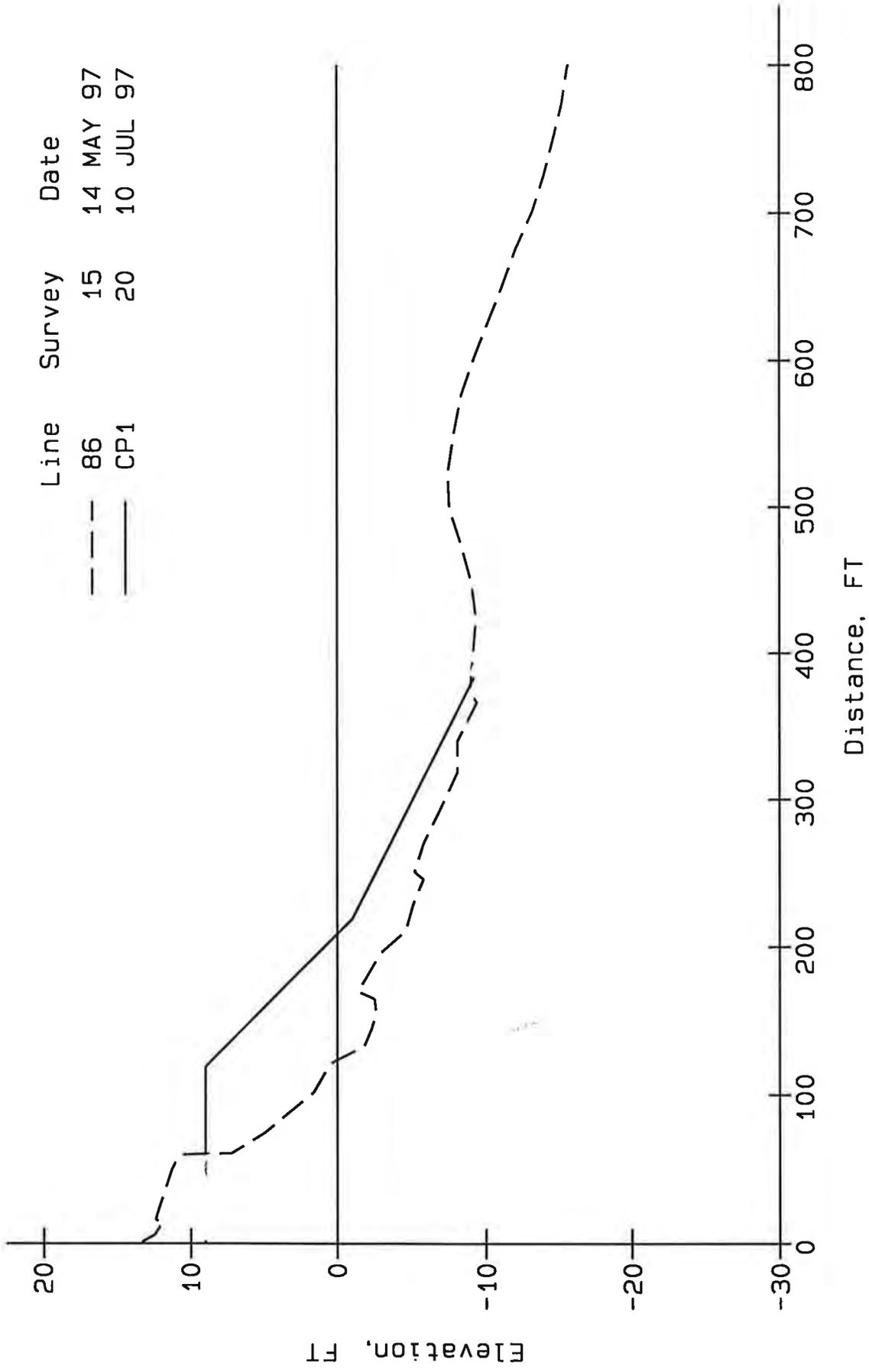
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—	CP1	10 JUL 97

Palm Beach Island

Line	Survey	Date
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—	CP1	20 JUL 97

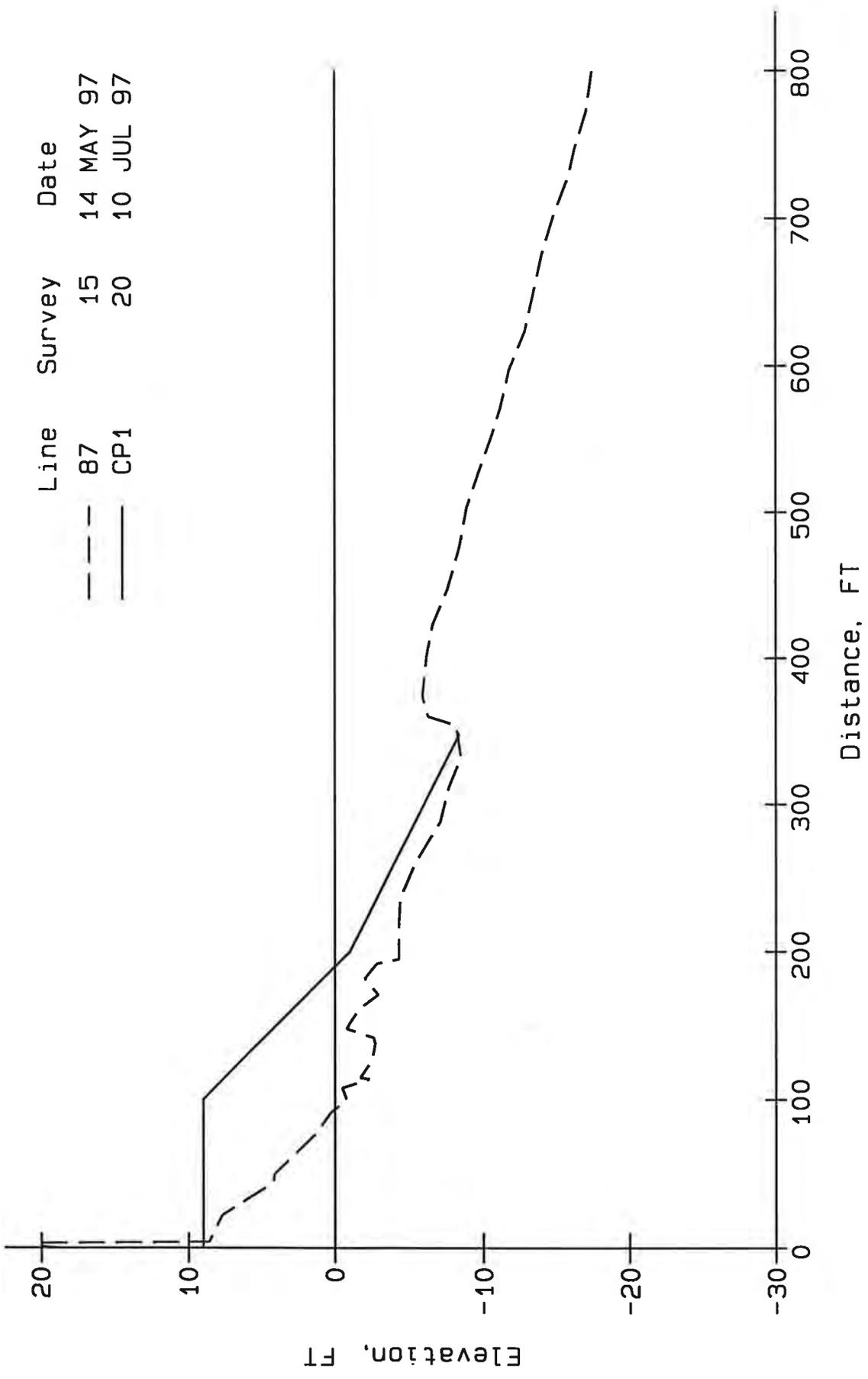


Palm Beach Island



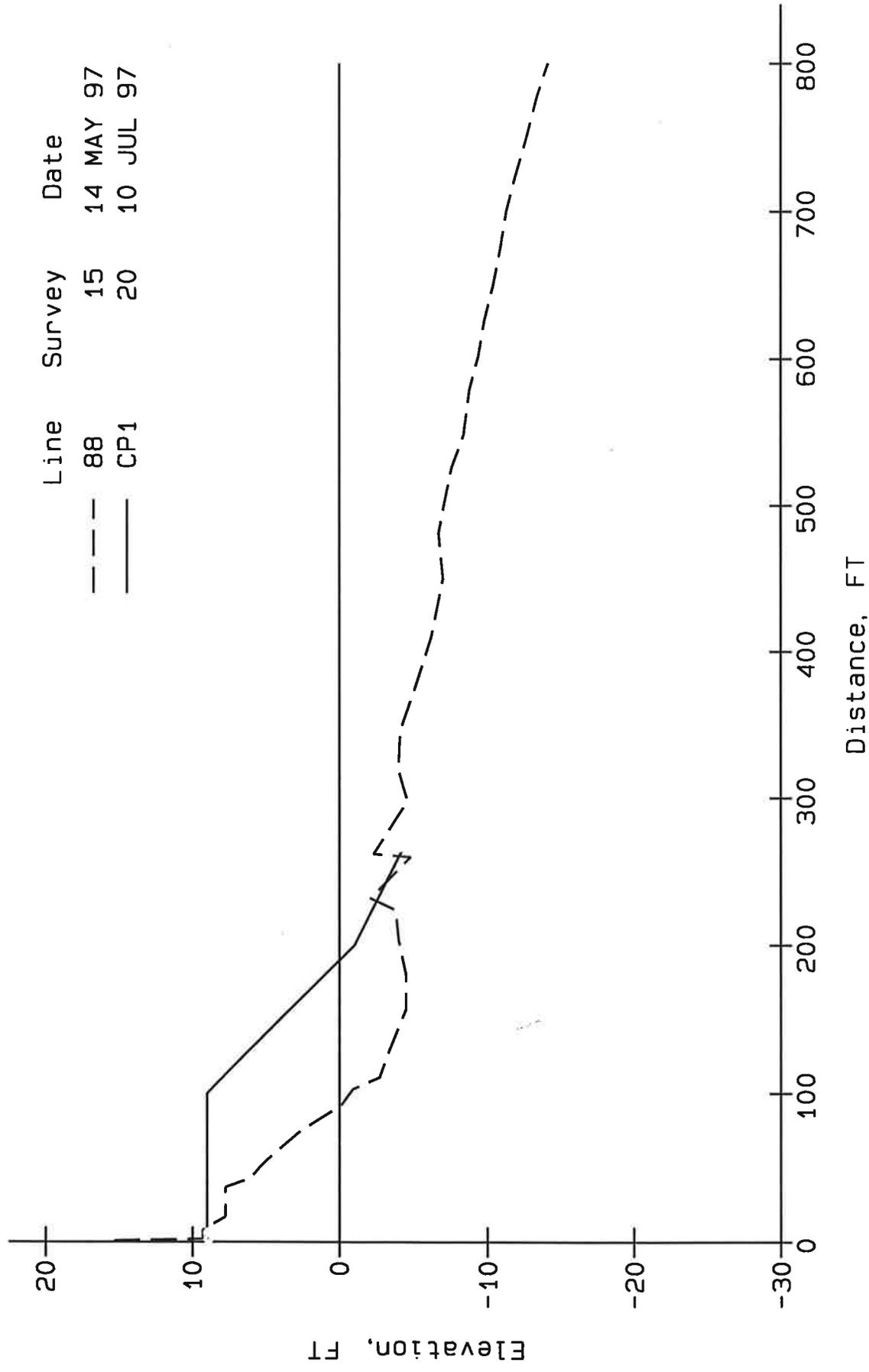
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Palm Beach Island

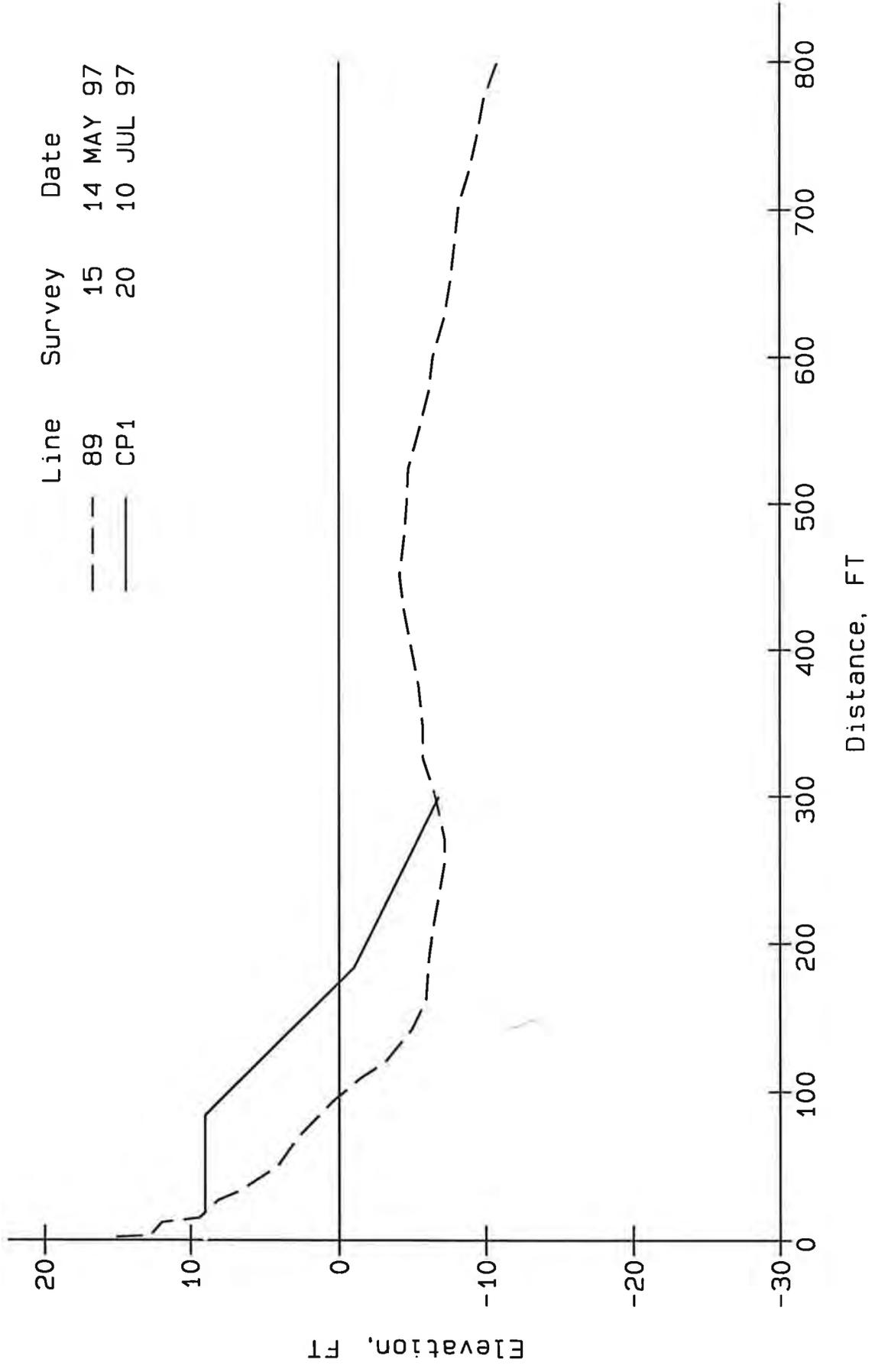


Palm Beach Island

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—	CP1	20 JUL 97

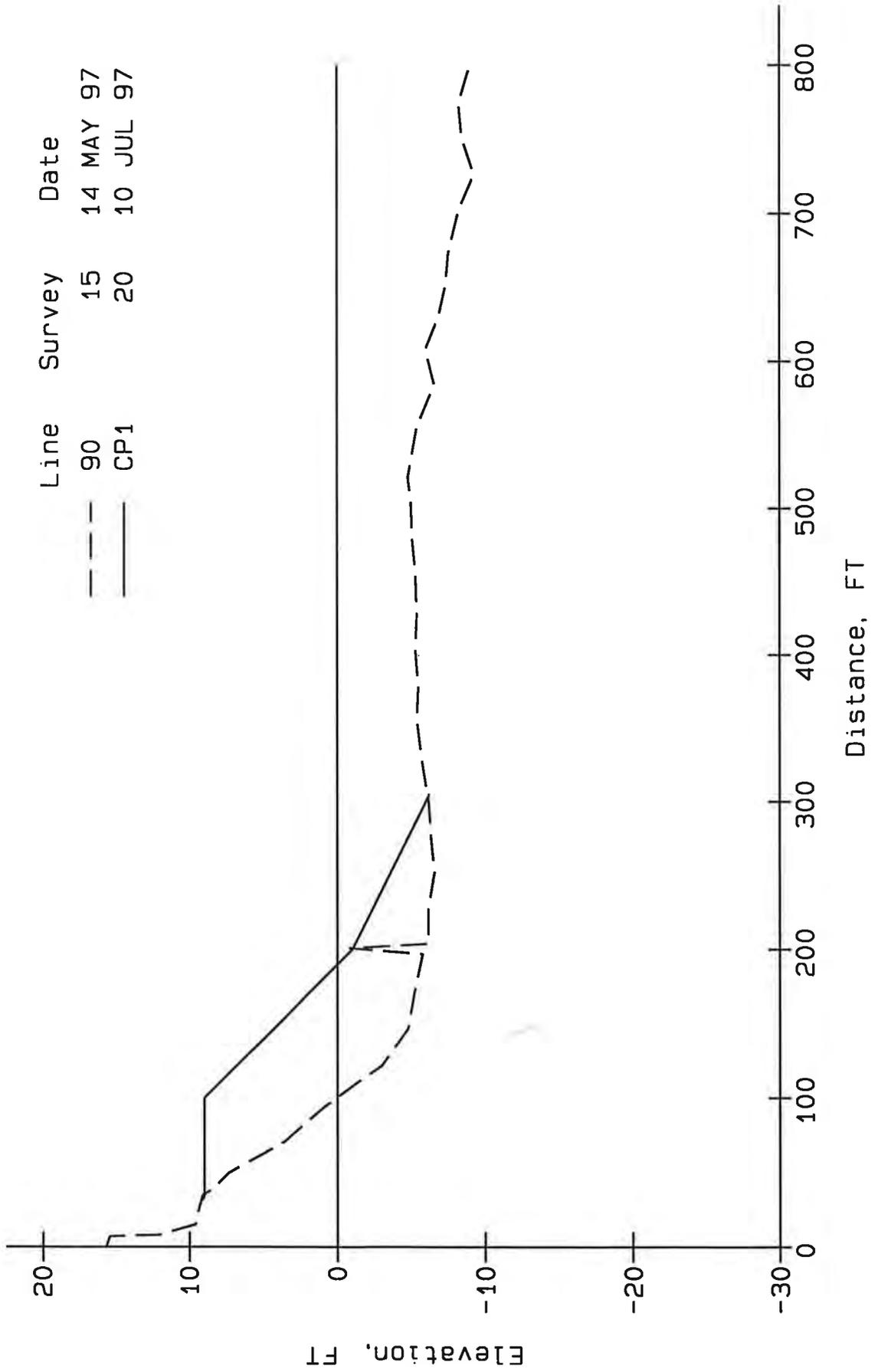


Palm Beach Island



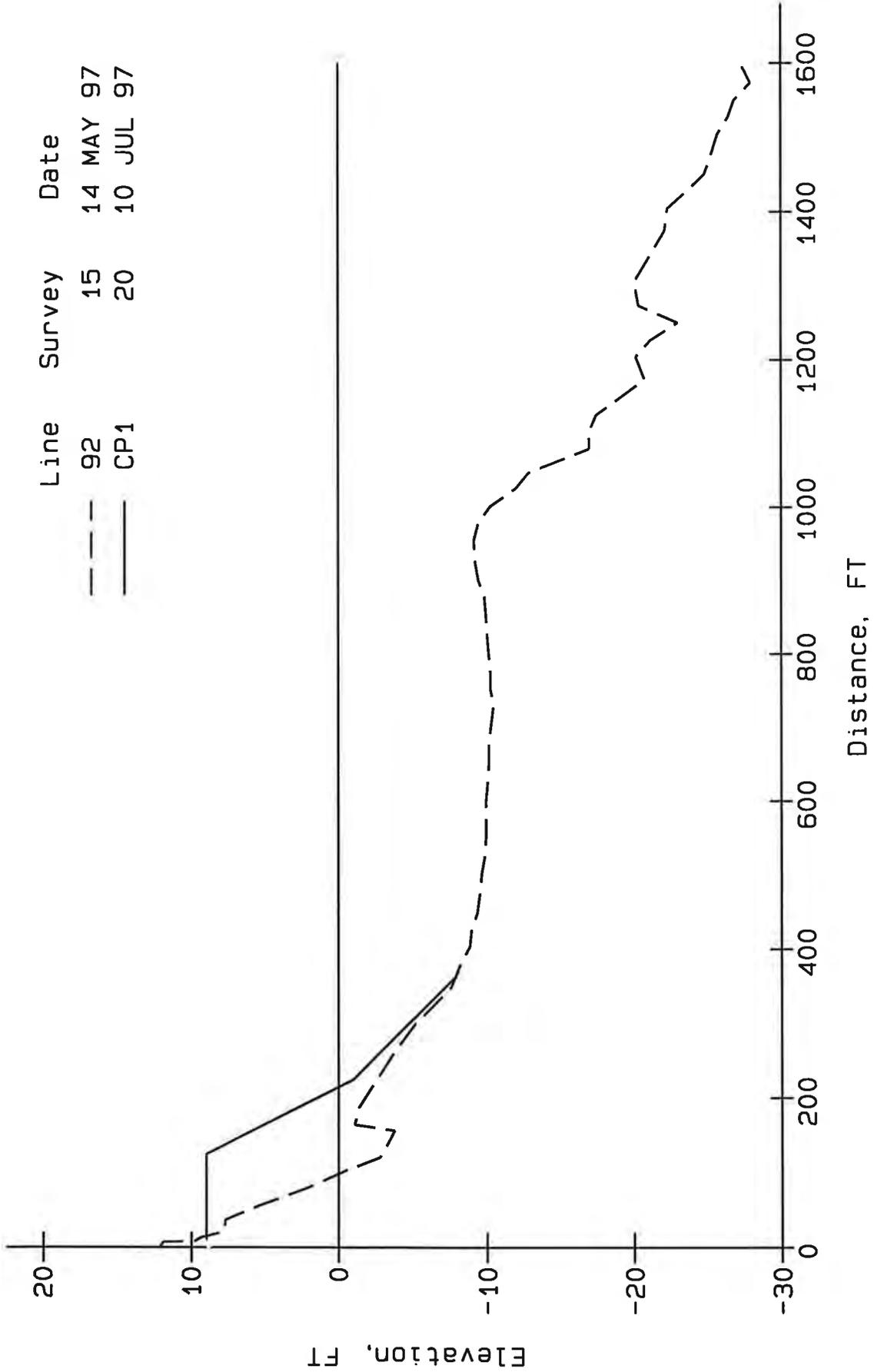
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—	CP1	20 JUL 97

Palm Beach Island



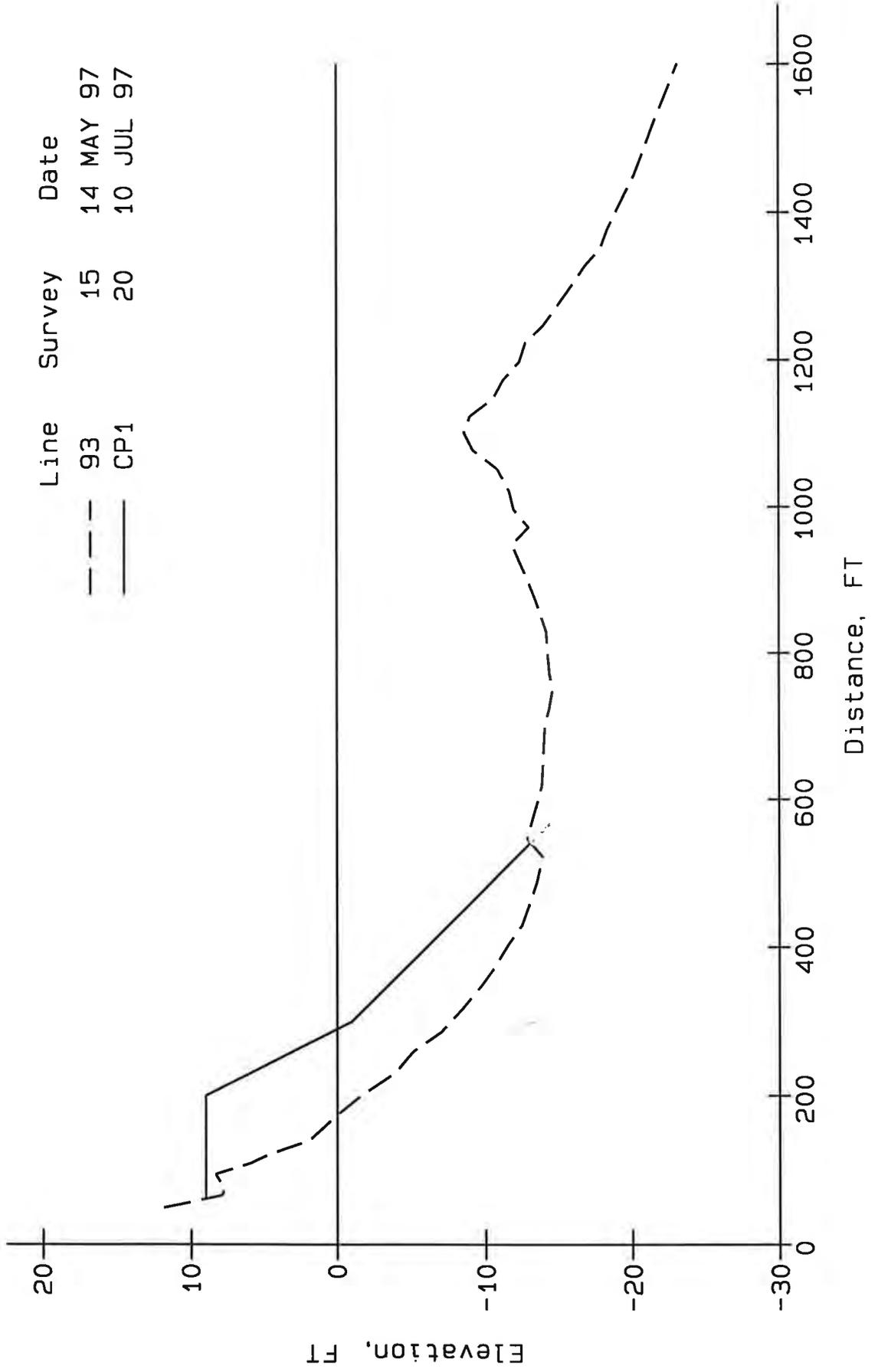
**REACH 3
AND
REACH 4**

Palm Beach Island



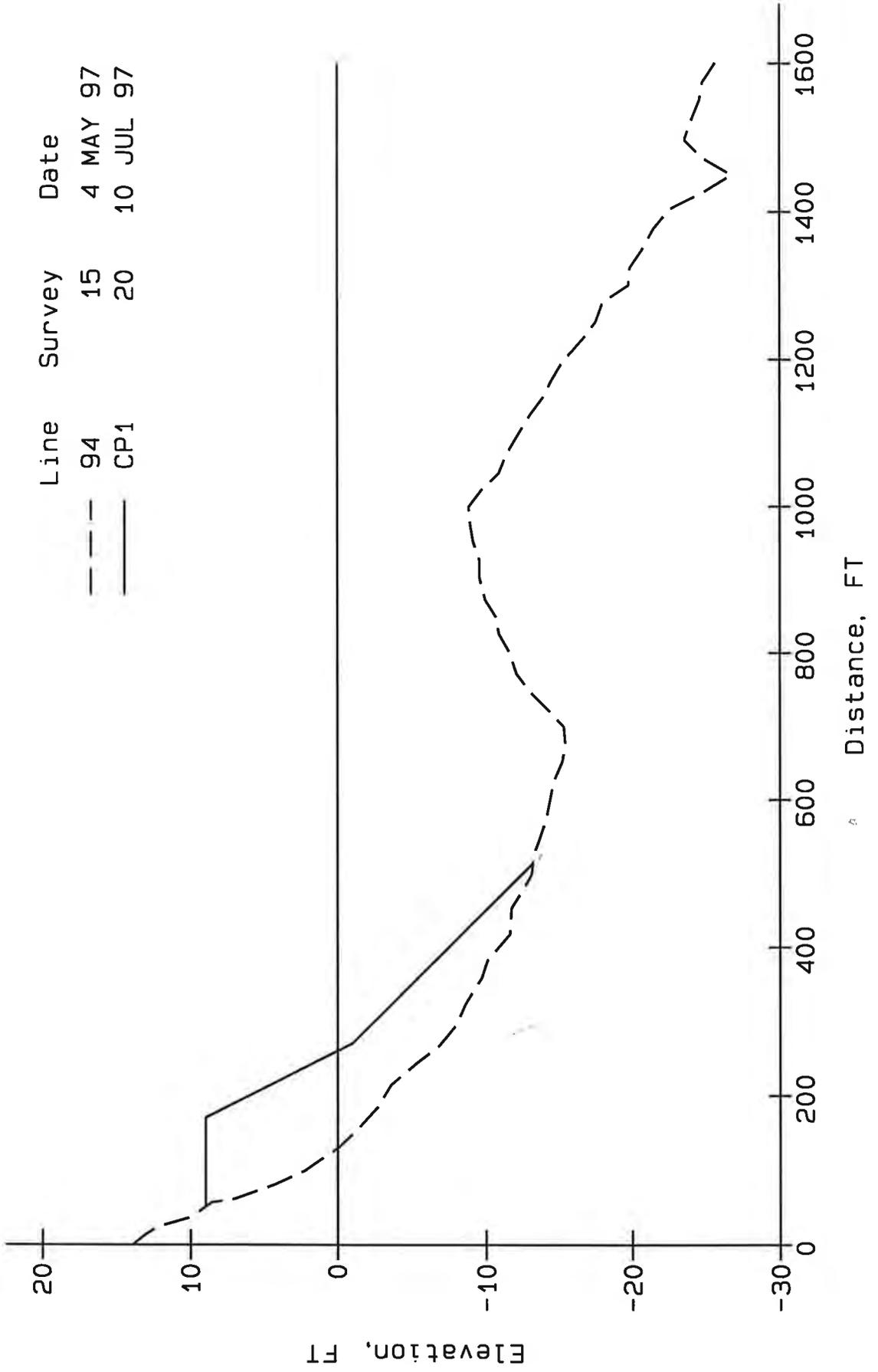
Line	Survey	Date
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—	20	10 JUL 97

Palm Beach Island

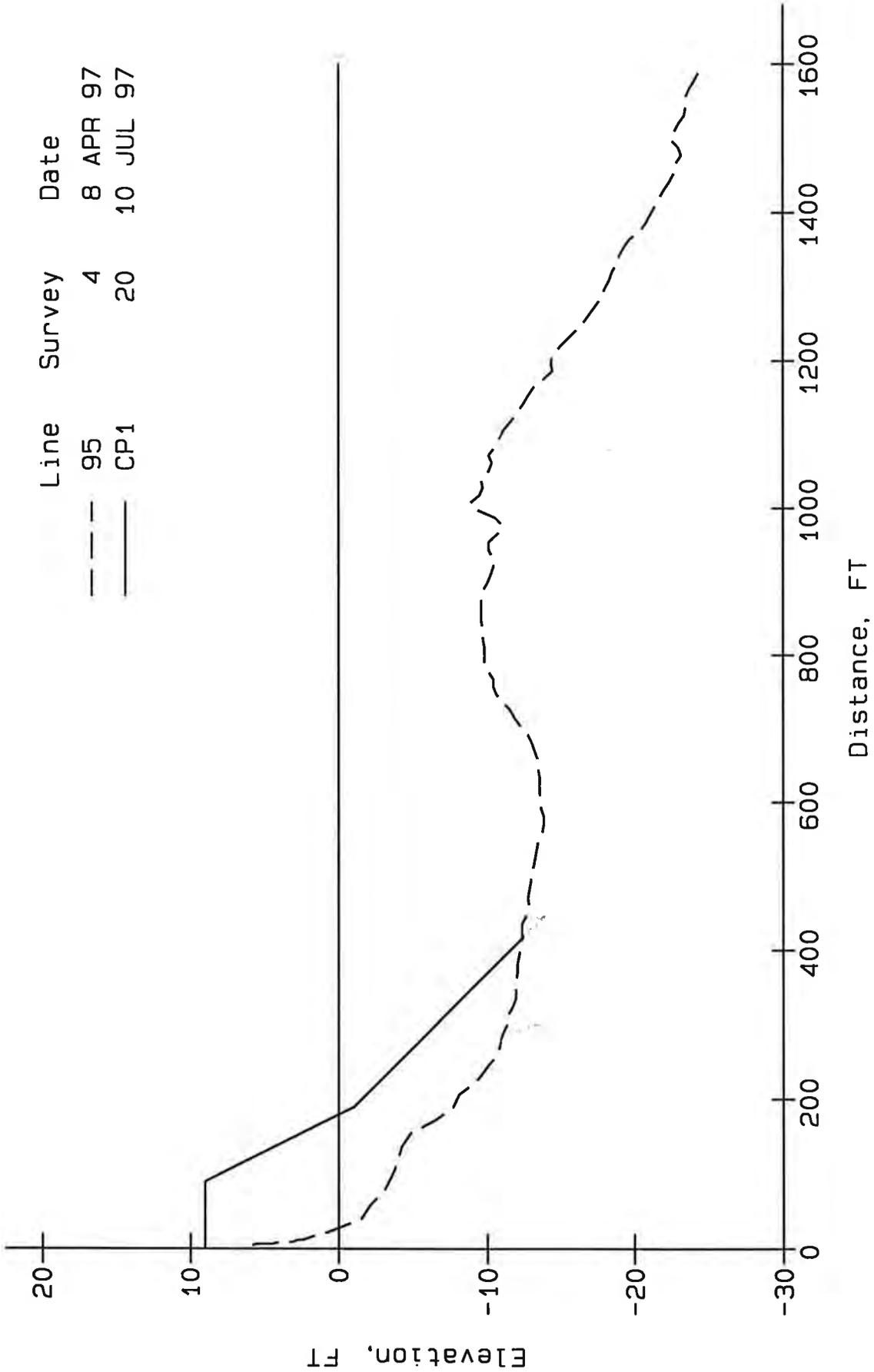


Line	Survey	Date
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—	CP1	20 JUL 97

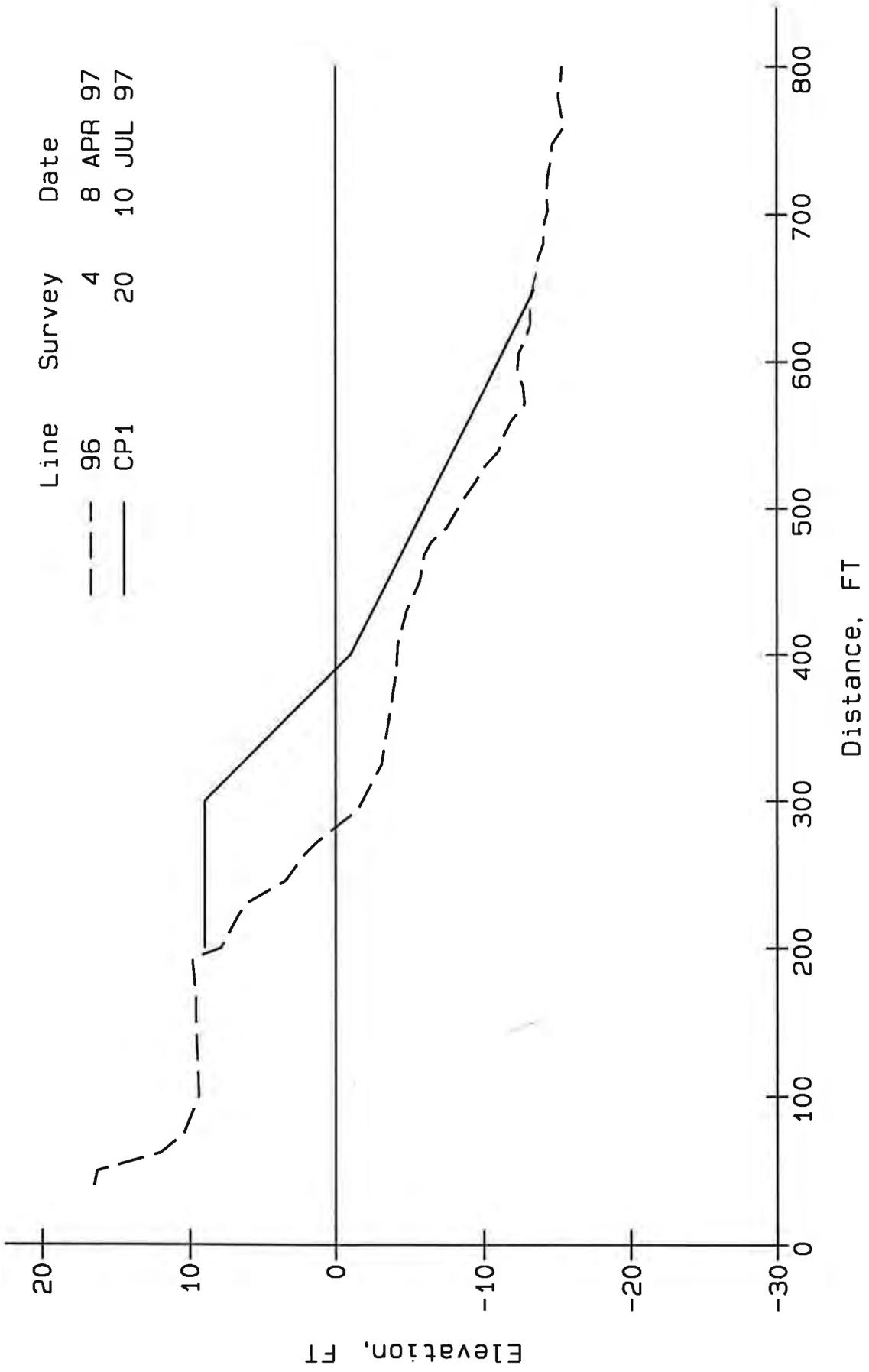
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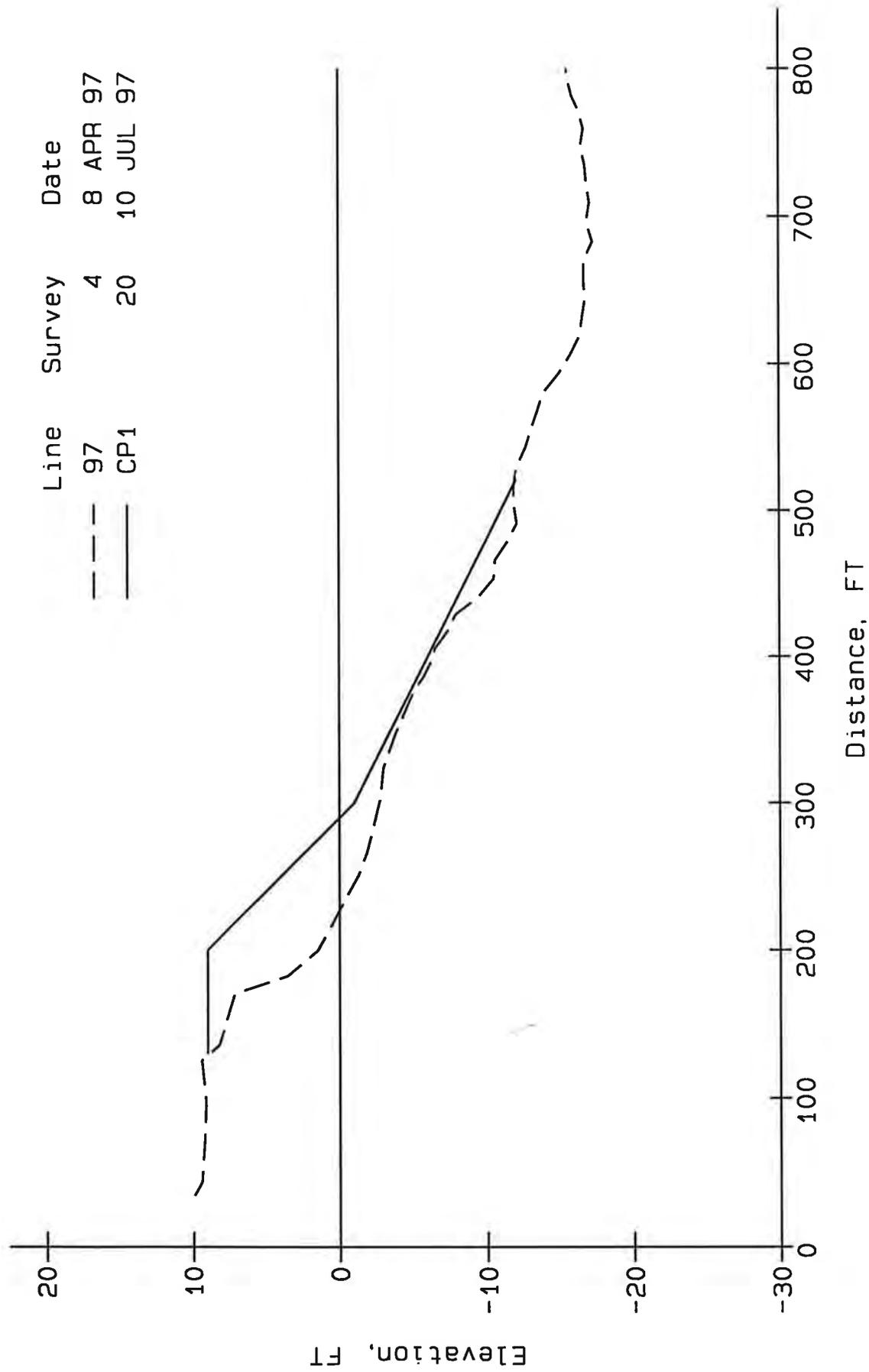
Palm Beach Island



Palm Beach Island

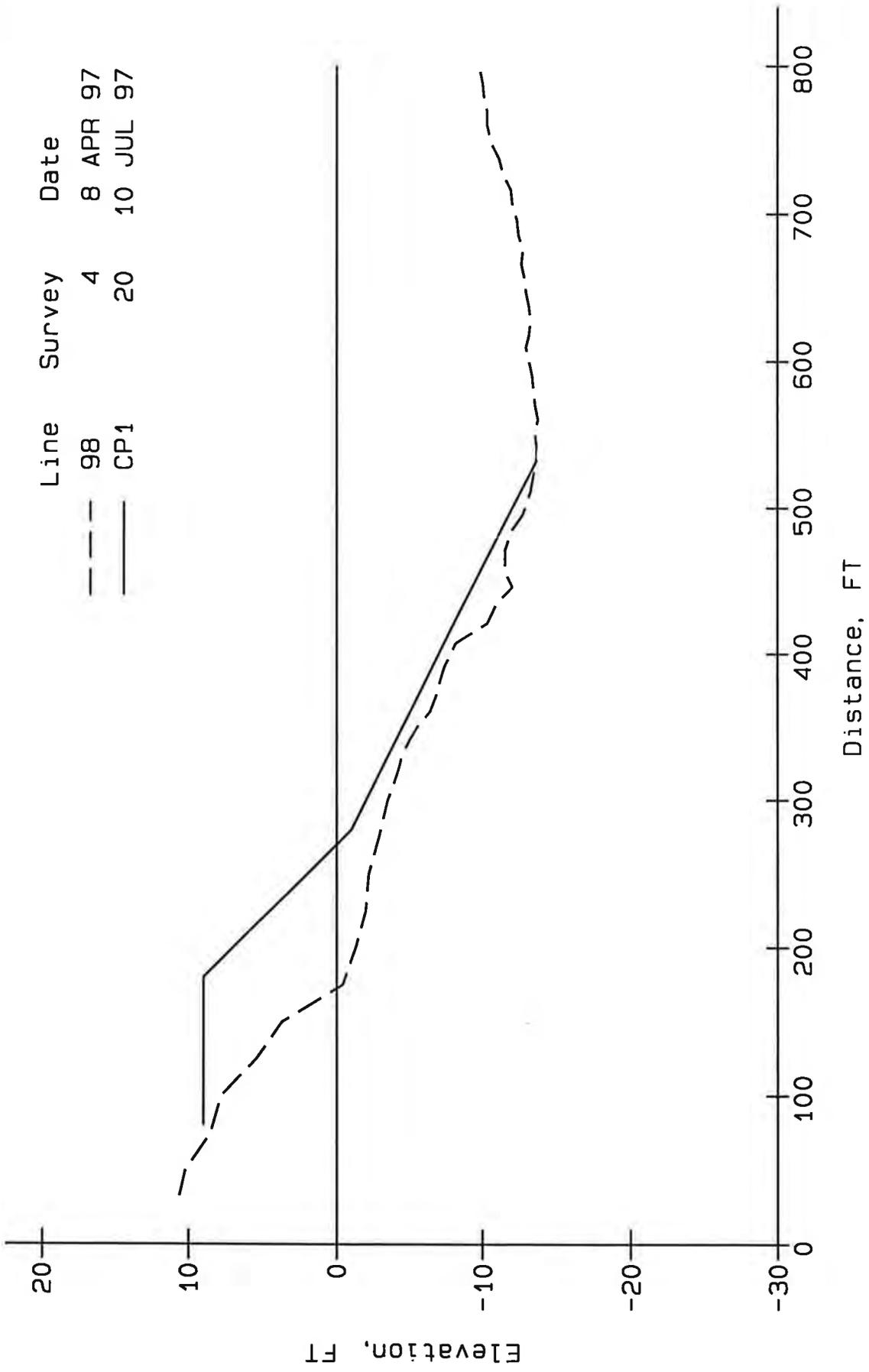


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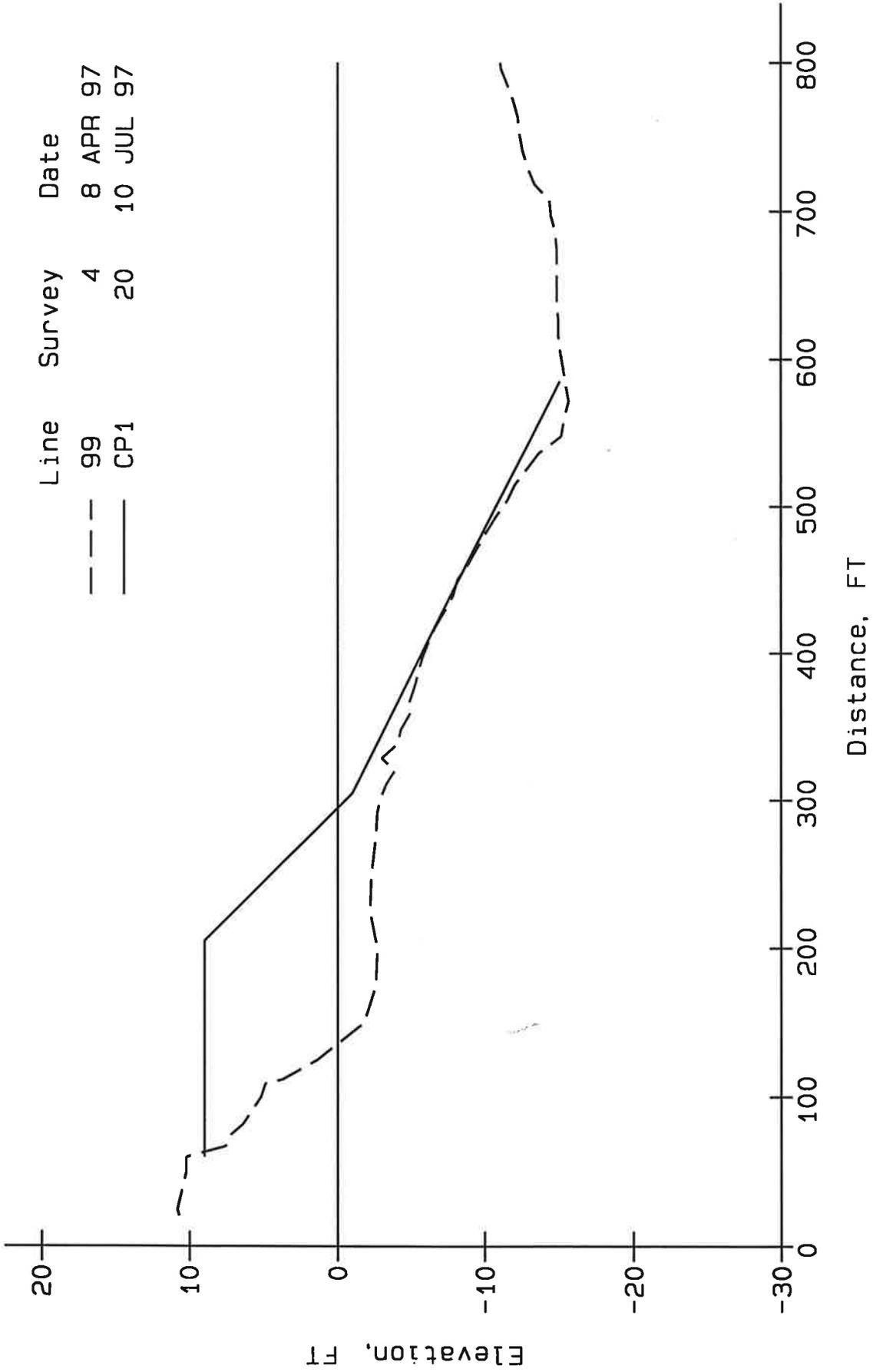
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—	CP1	20 10 JUL 97

Palm Beach Island



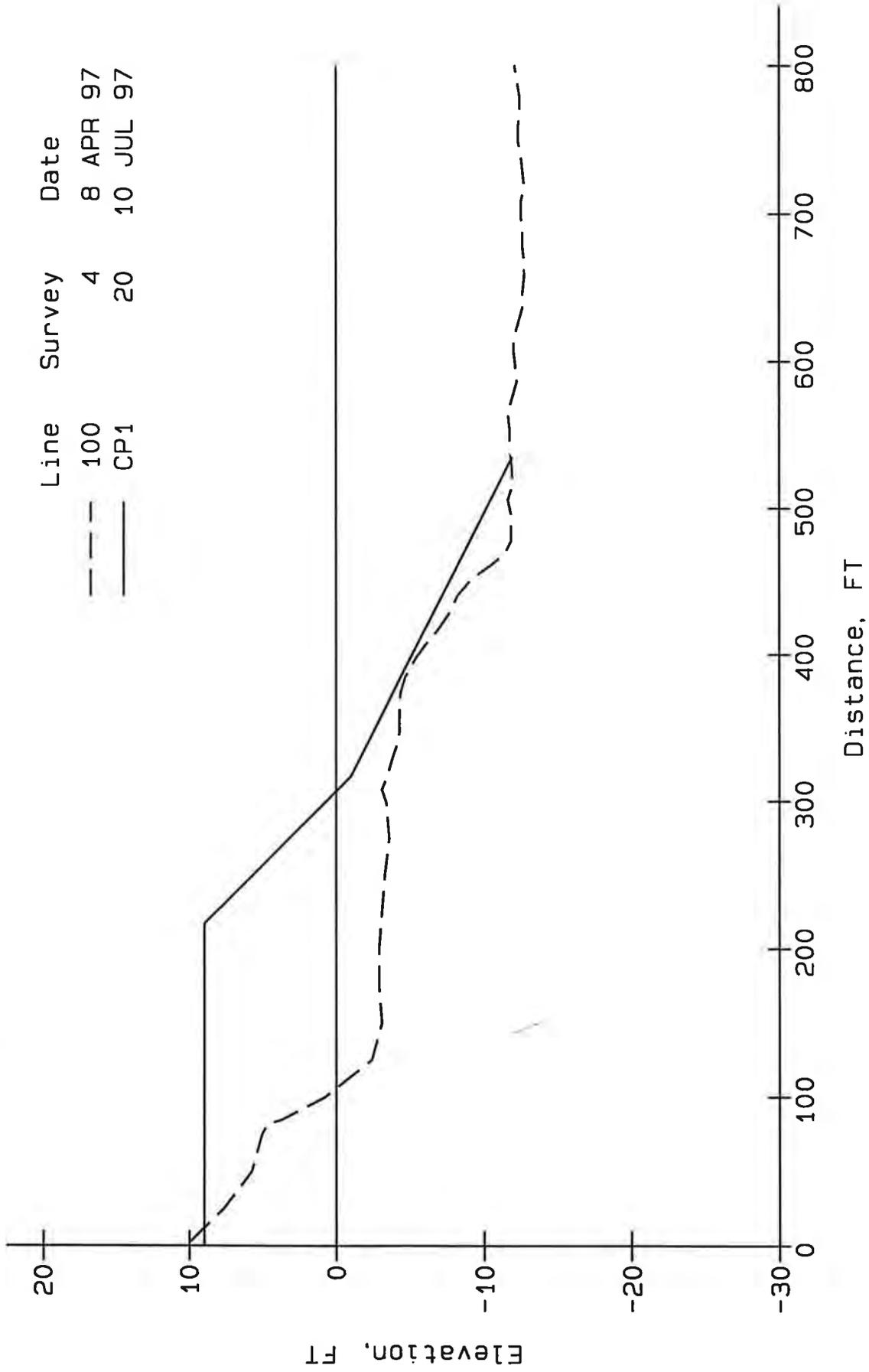
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---	20	10 JUL 97

Palm Beach Island

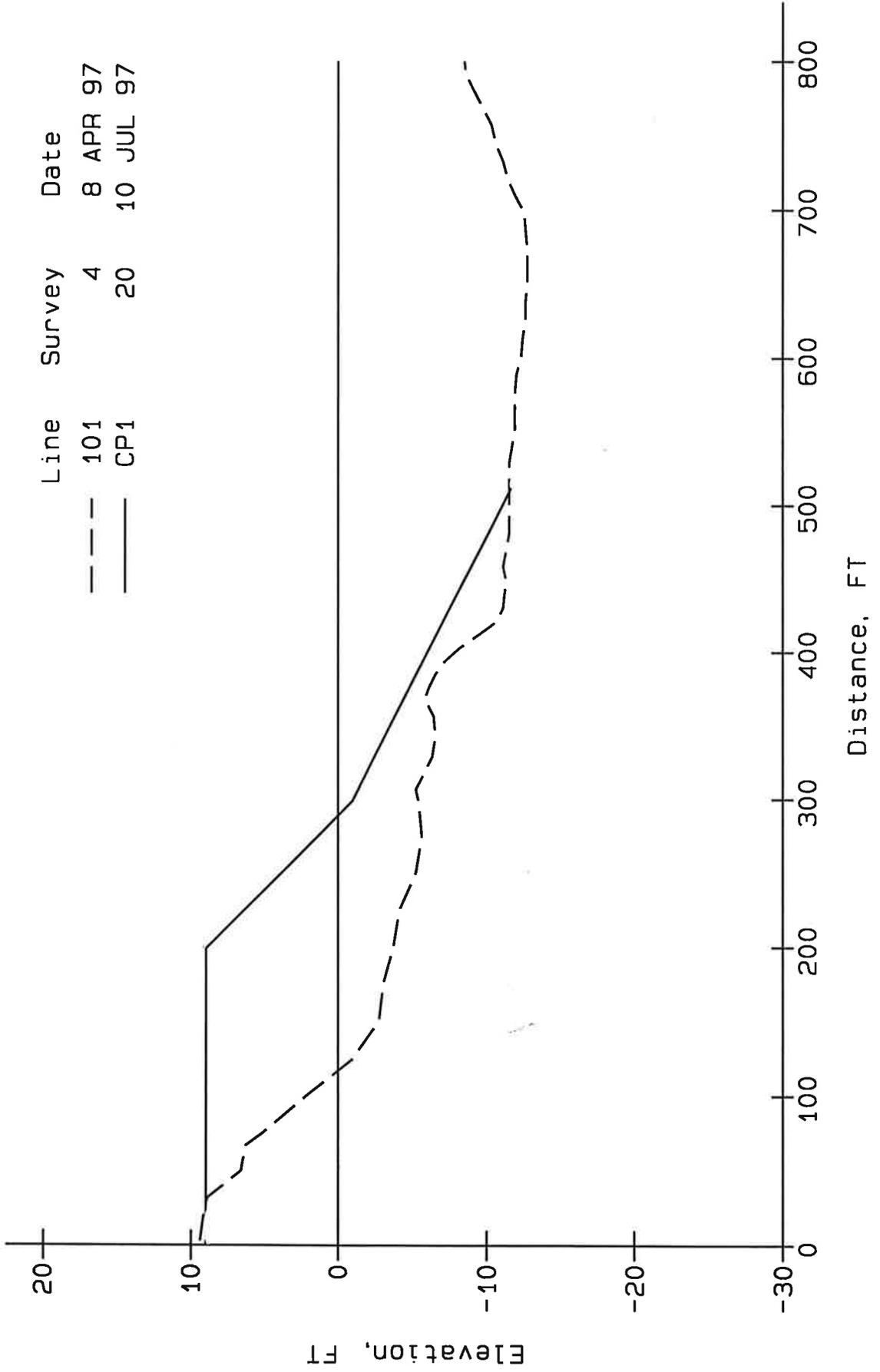


Palm Beach Island

Line	Survey	Date
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—	CP1	20 10 JUL 97



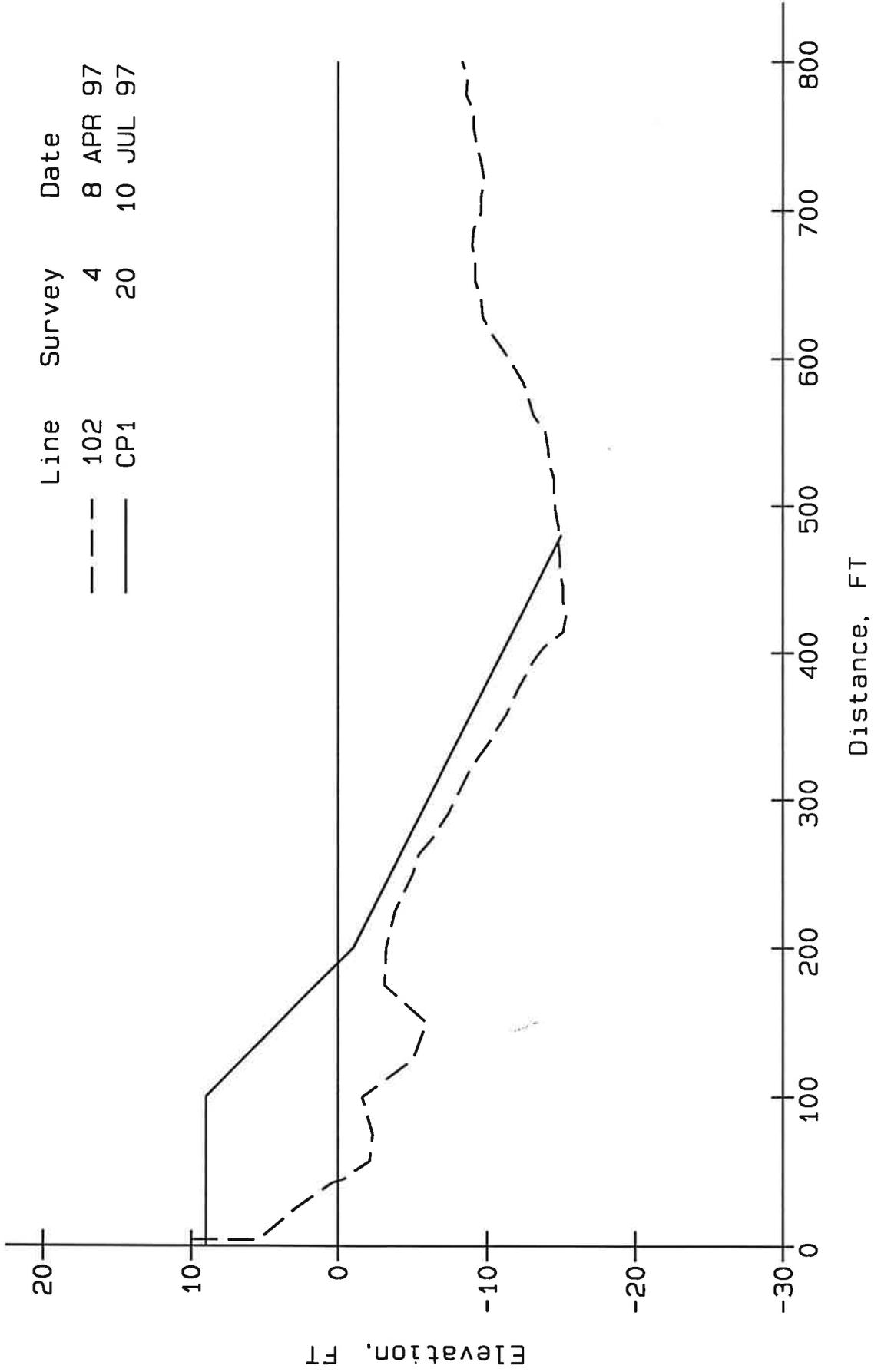
Palm Beach Island



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—	CP1	10 JUL 97

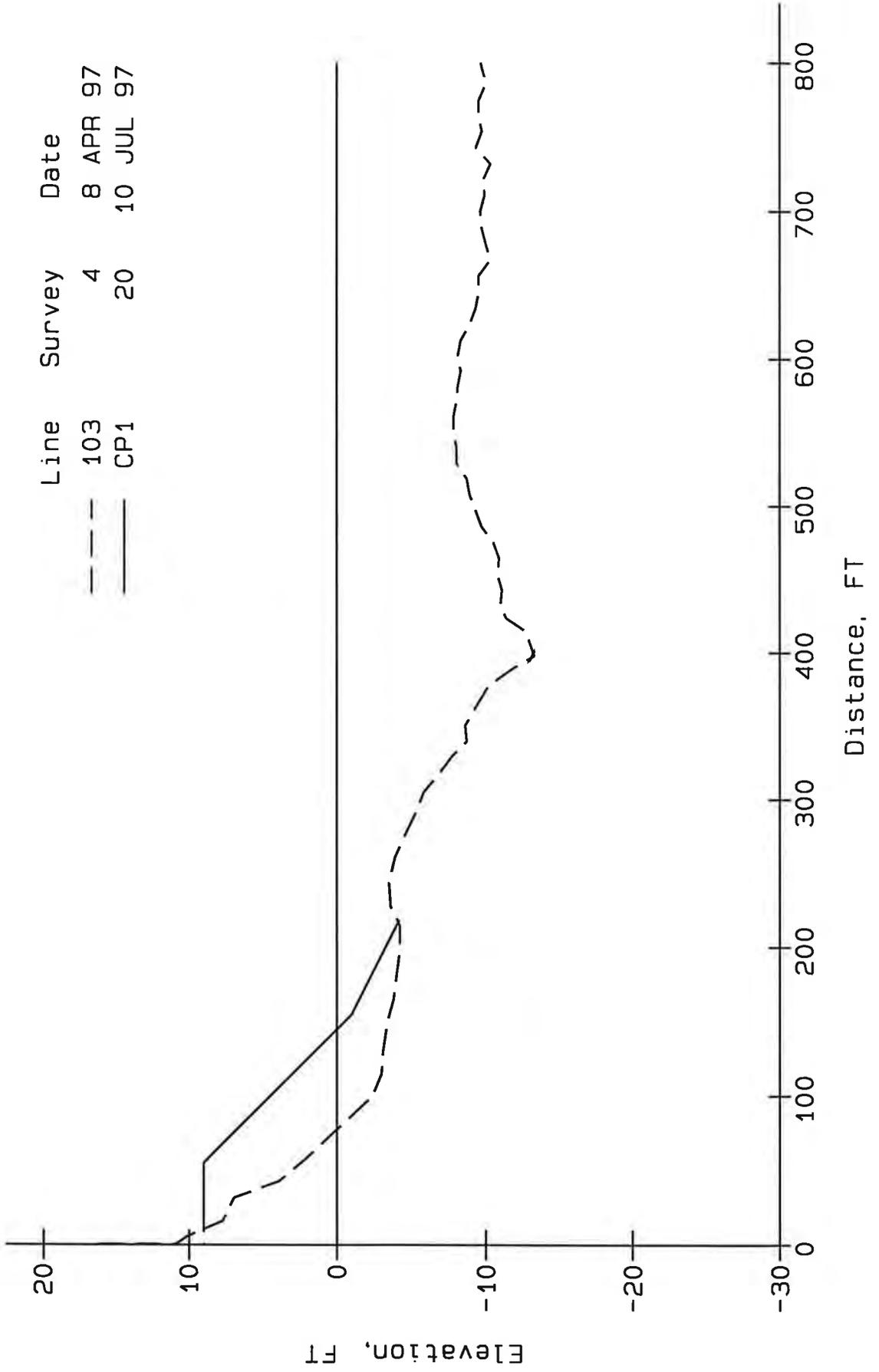
Palm Beach Island

Line	Survey	Date
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—	20	10 JUL 97



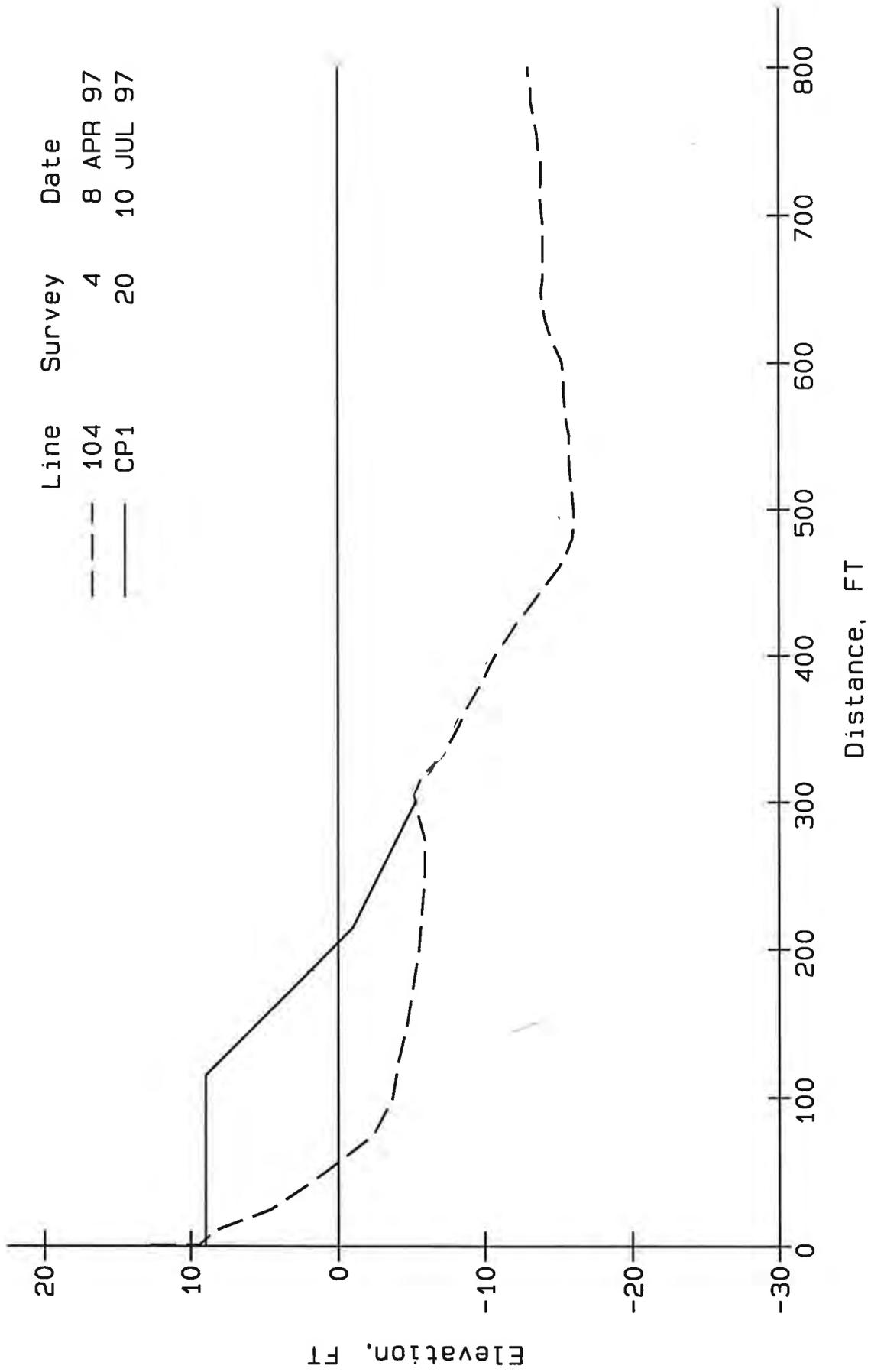
REACH 5

Palm Beach Island

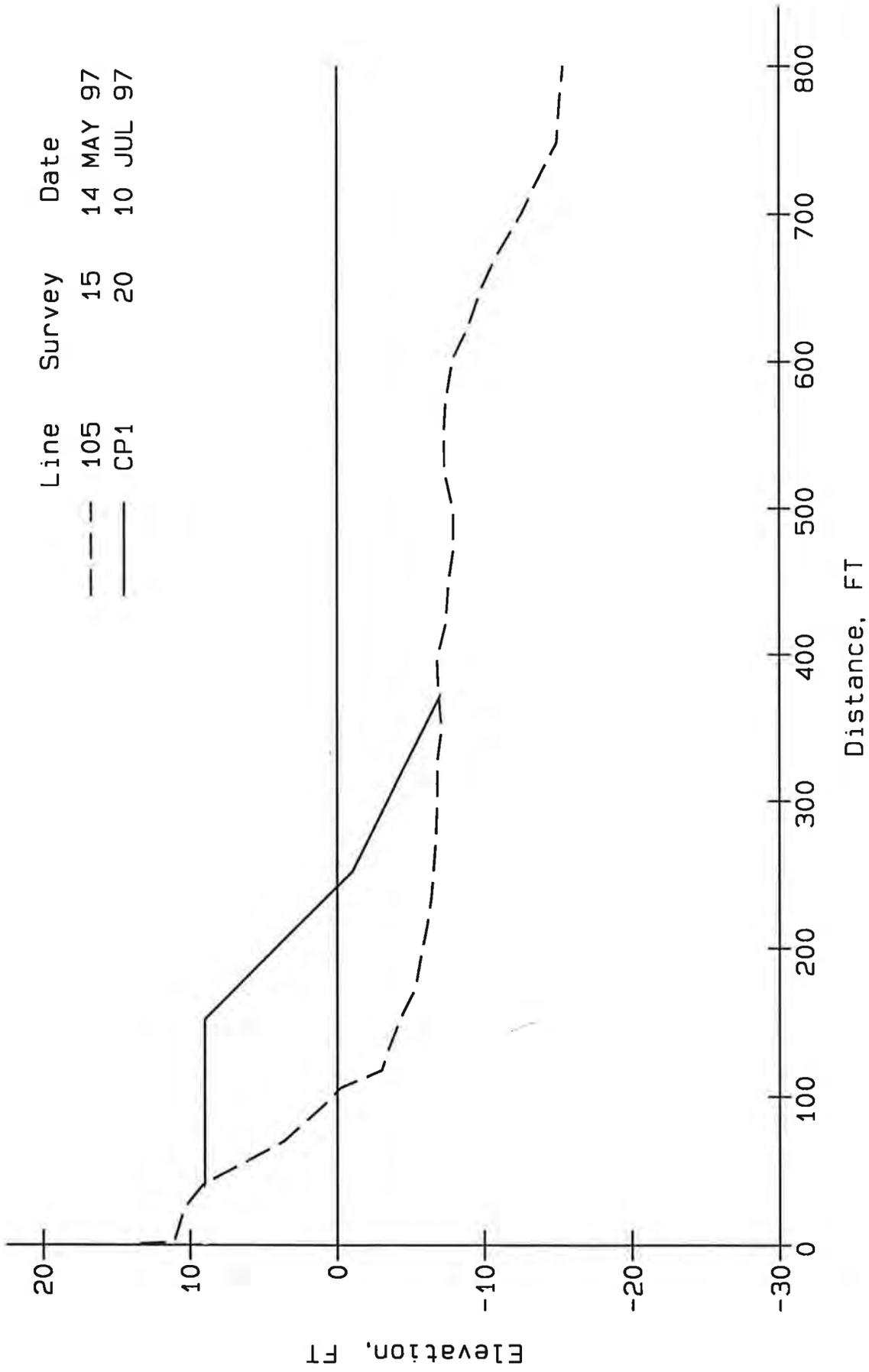


Palm Beach Island

Line	Survey	Date
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—	20	10 JUL 97



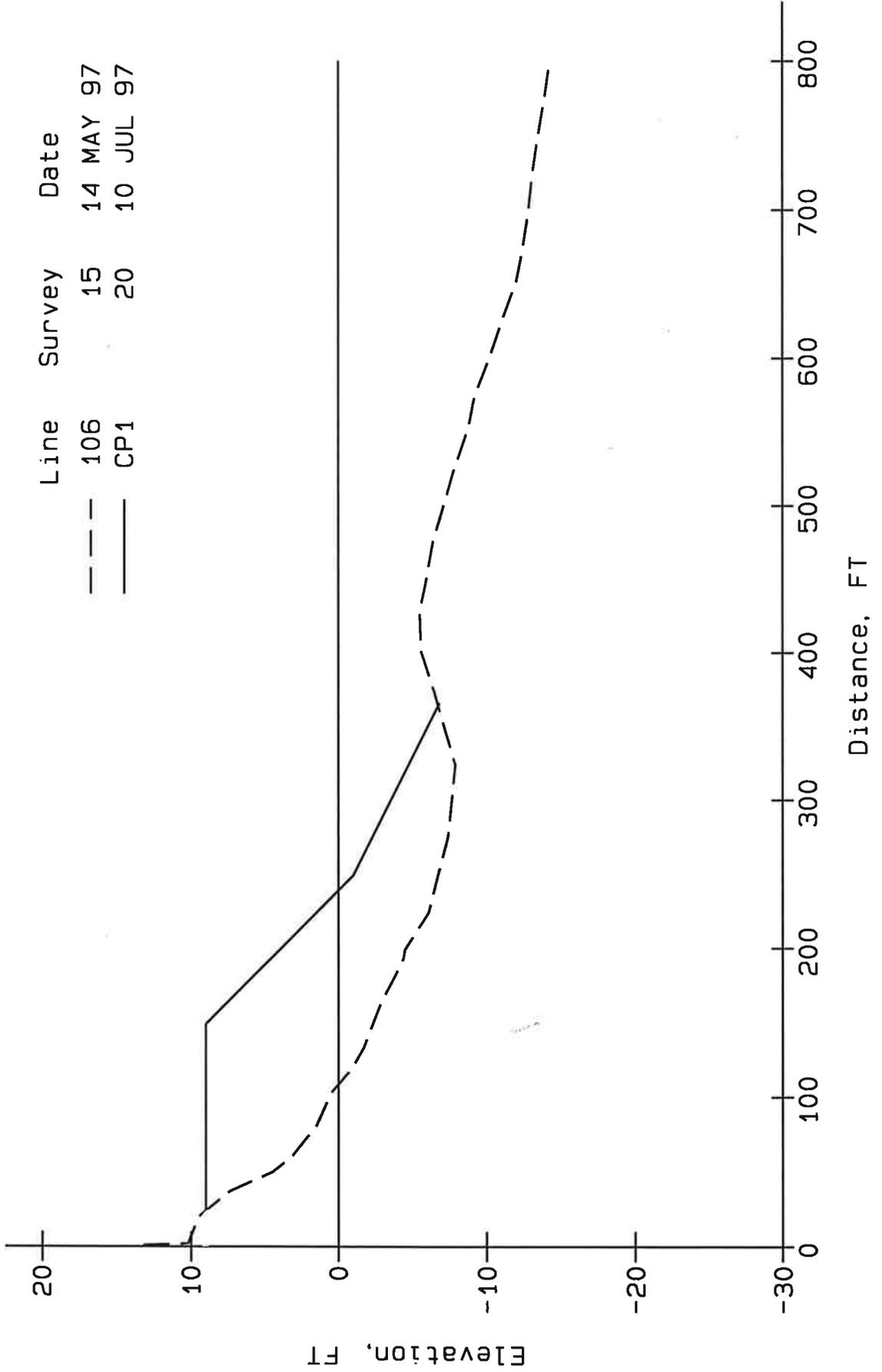
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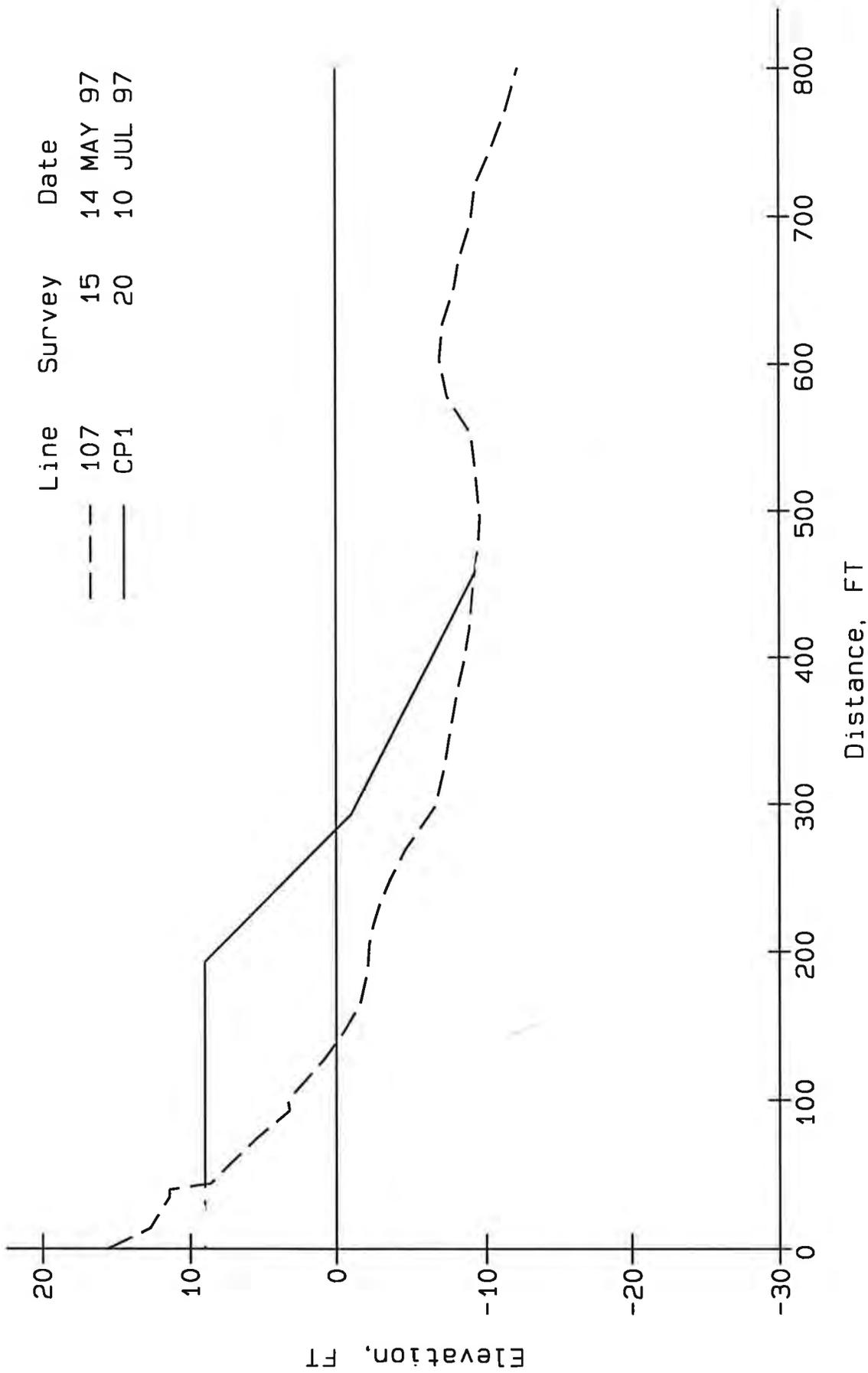
Line	Survey	Date
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---	CP1	20 JUL 97

Palm Beach Island

Line	Survey	Date
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—	20	10 JUL 97

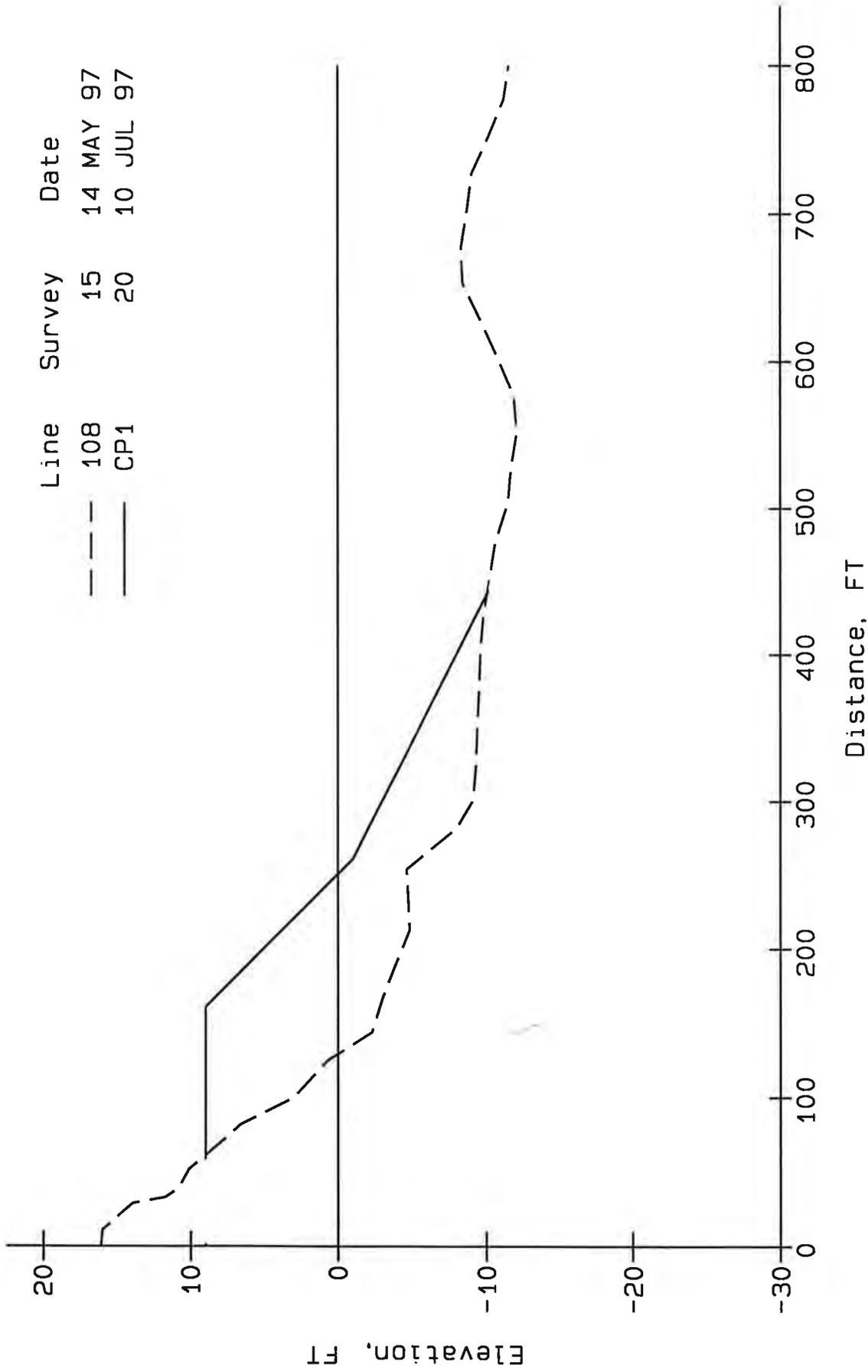


Palm Beach Island

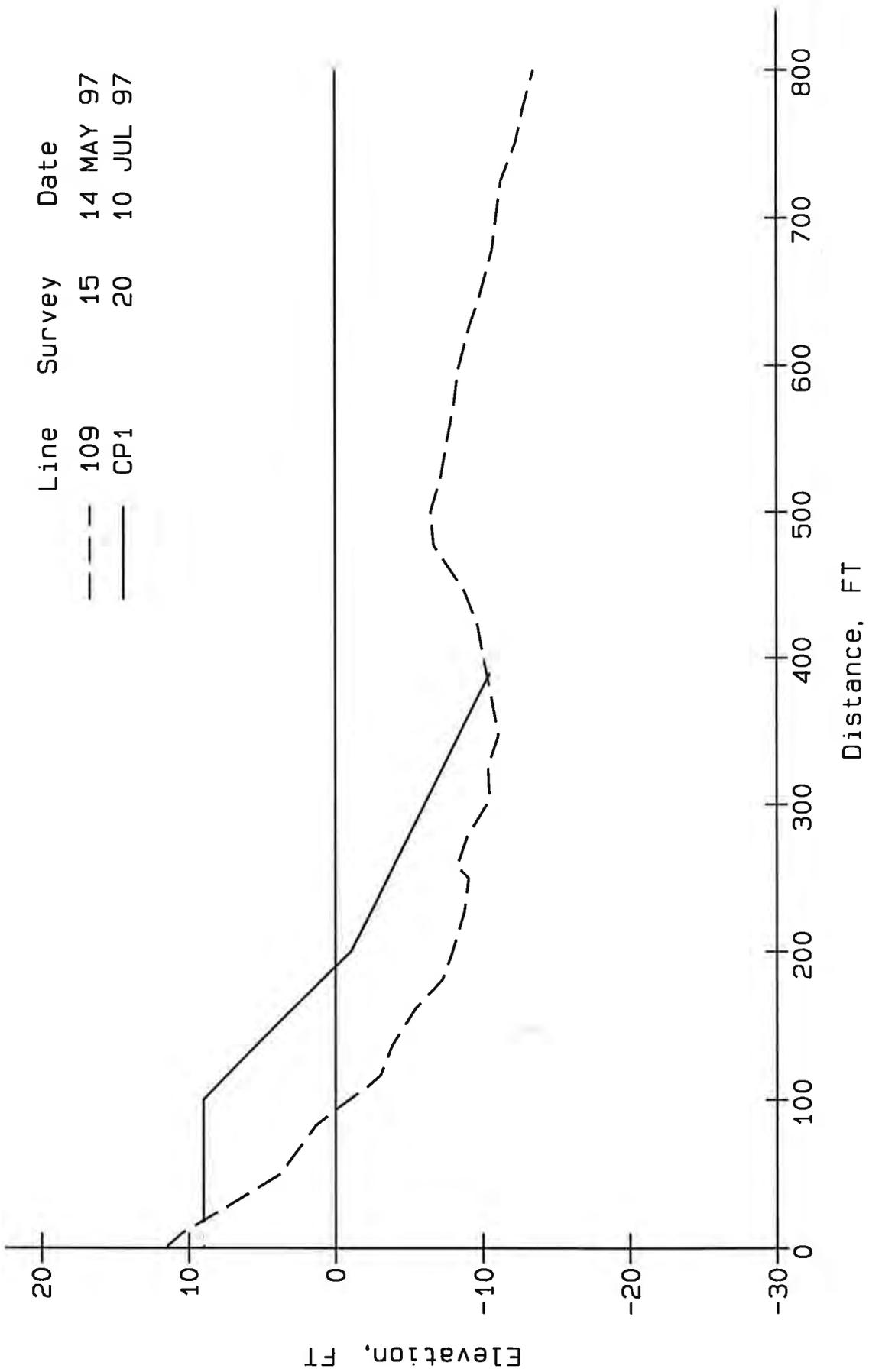


Palm Beach Island

Line	Survey	Date
---	15	14 MAY 97
—	20	10 JUL 97



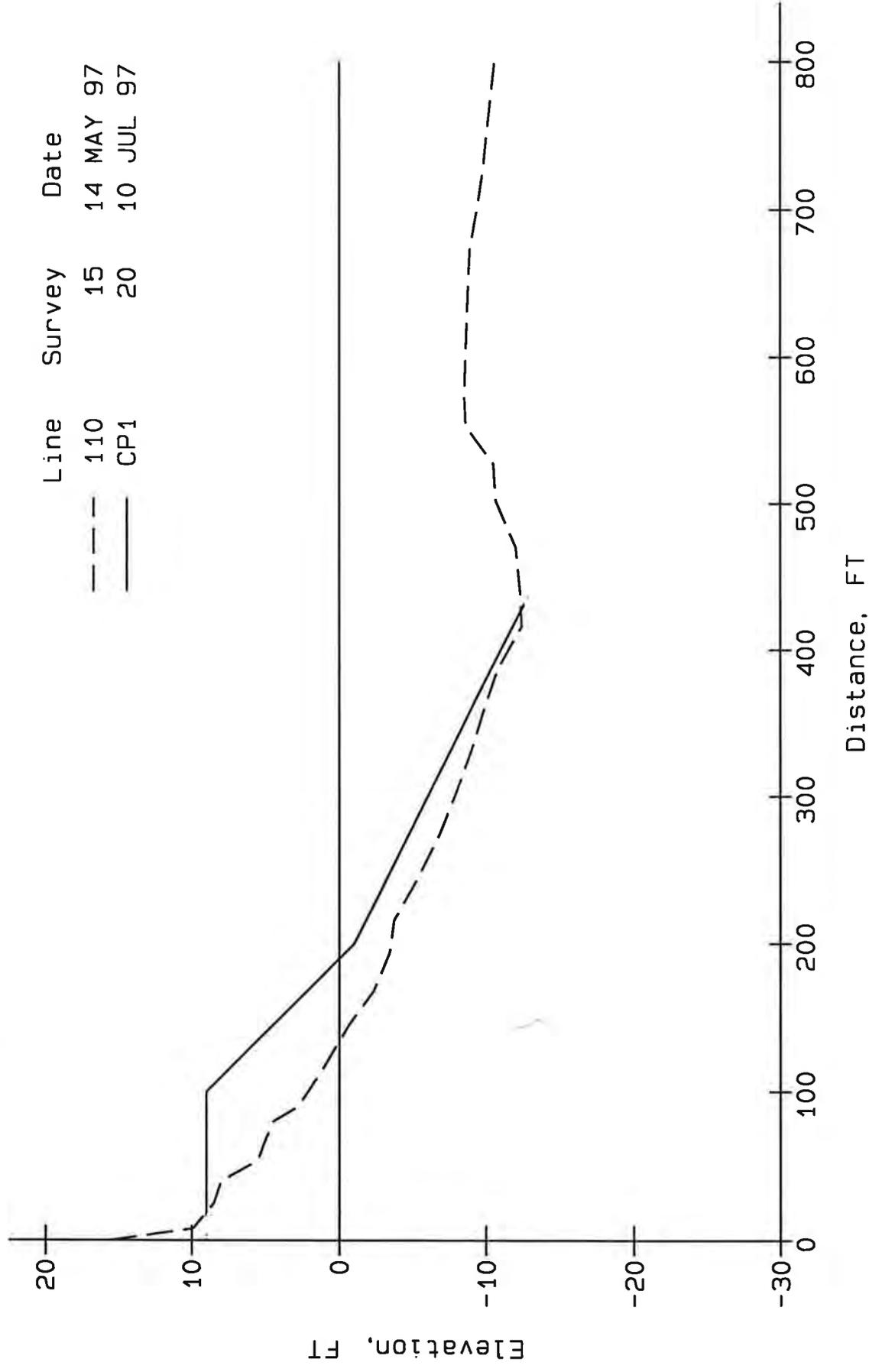
Palm Beach Island



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Palm Beach Island

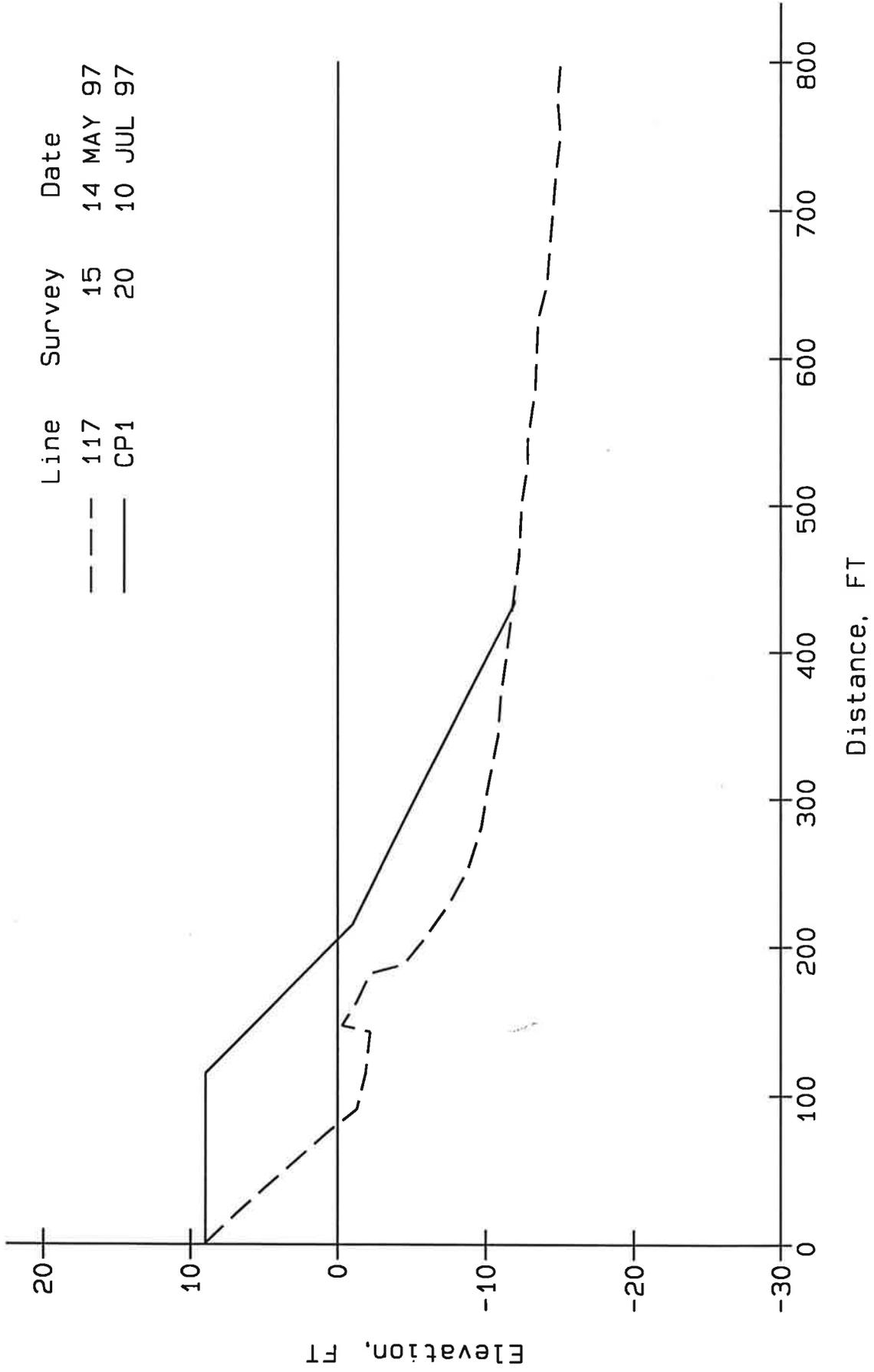
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---	CP1	20 JUL 97



REACH 7

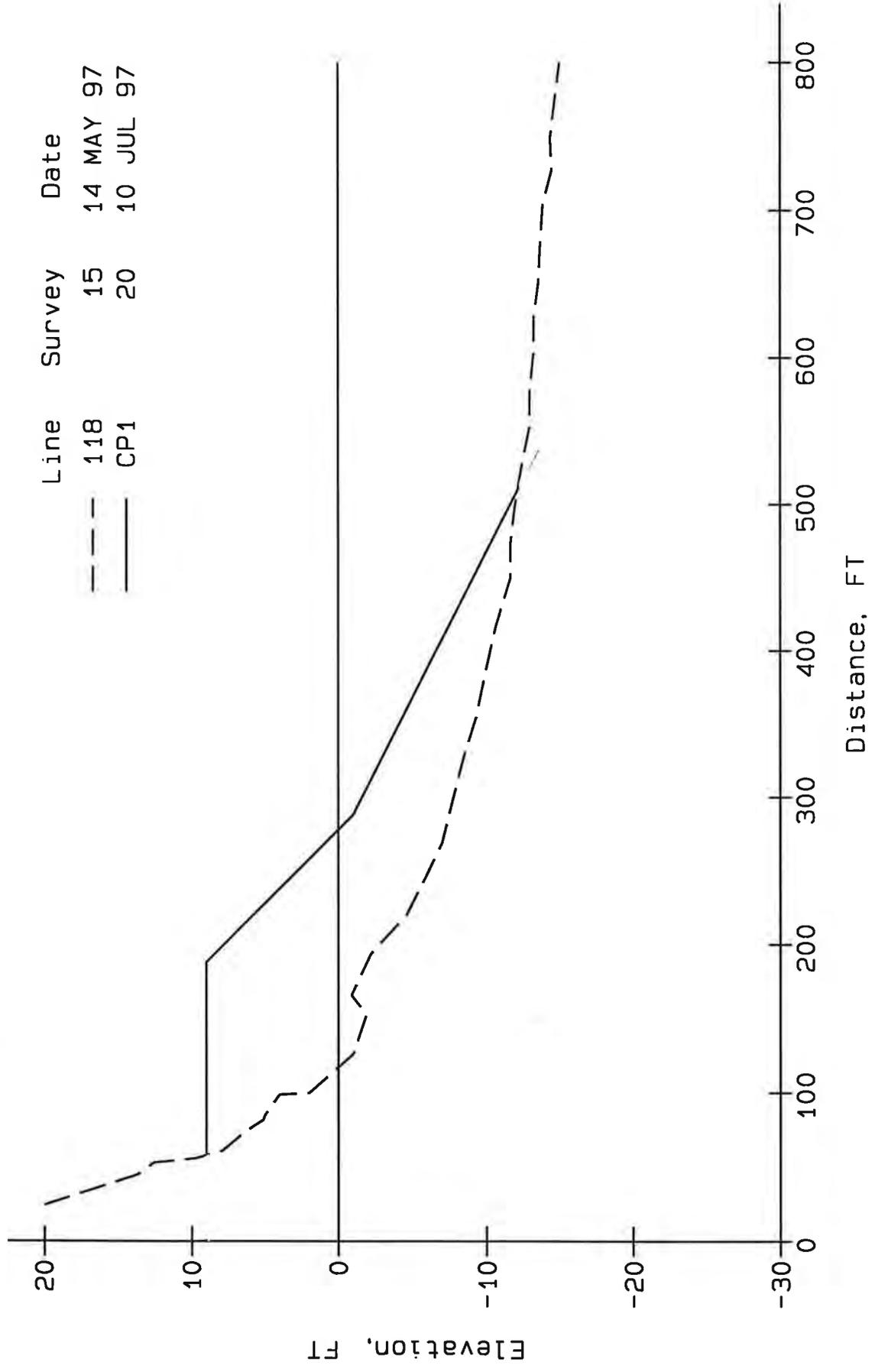
Palm Beach Island

Line	Survey	Date
---	15	14 MAY 97
---	20	10 JUL 97



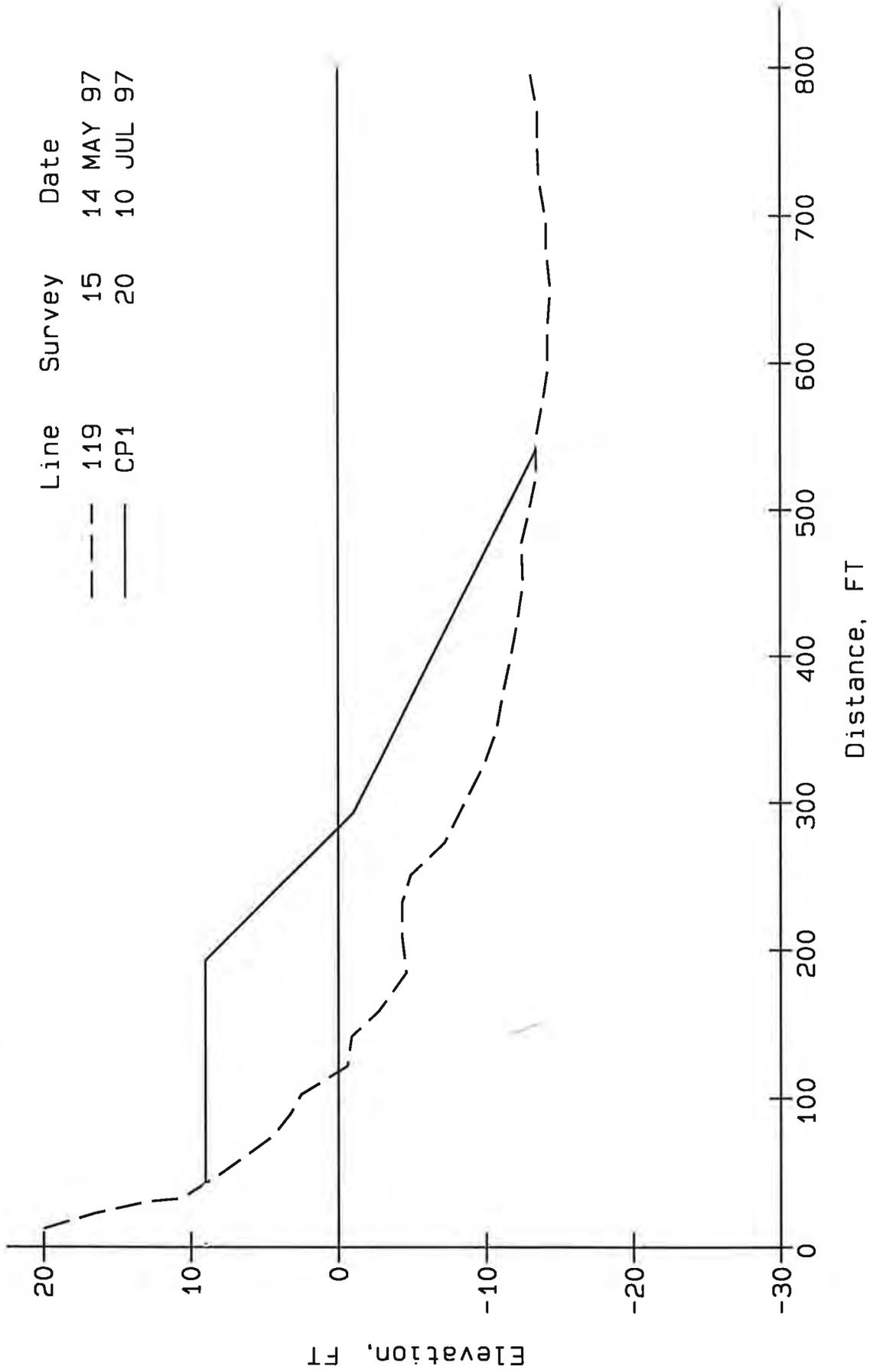
Palm Beach Island

Line	Survey	Date
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—	20	10 JUL 97



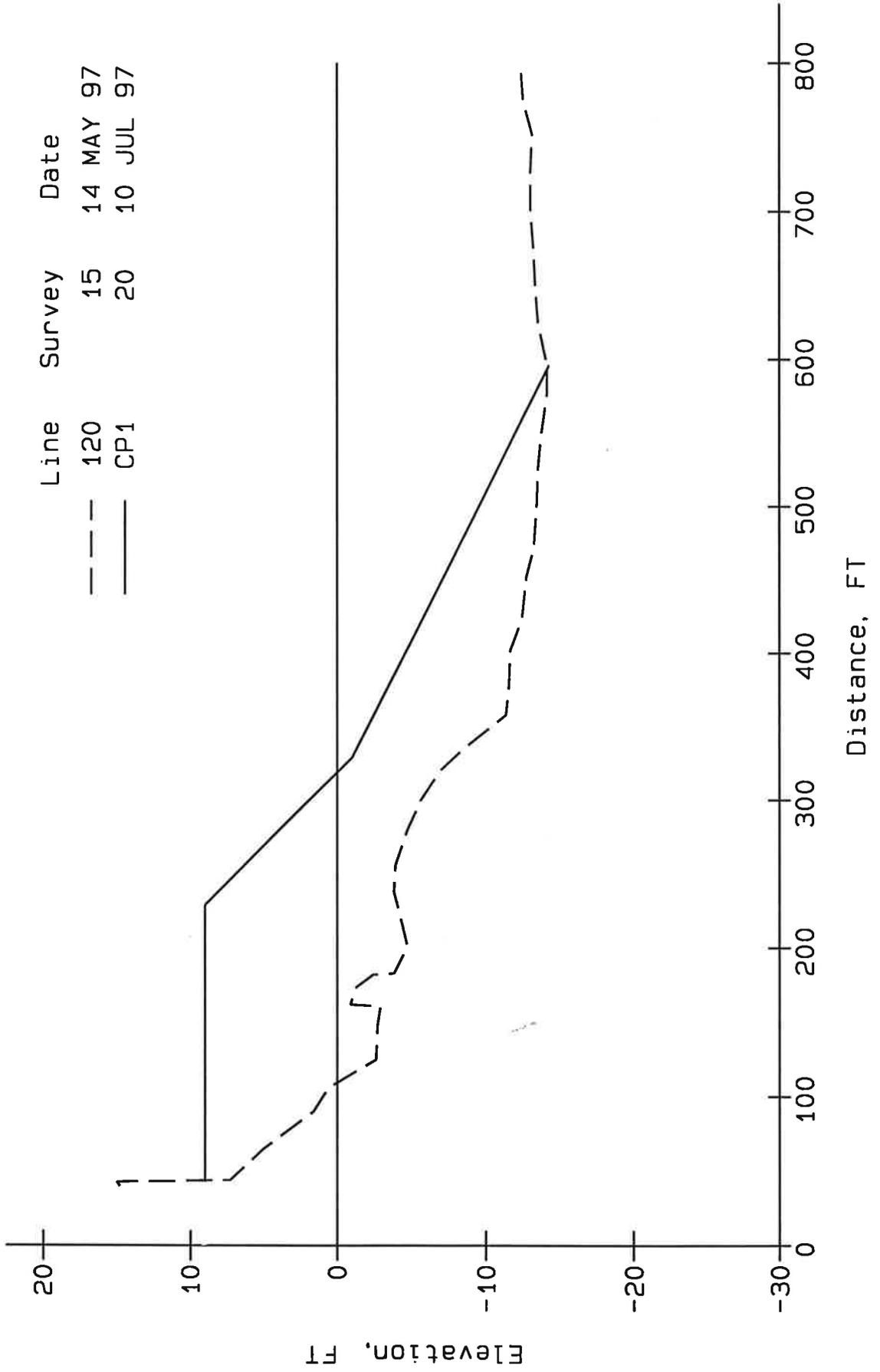
Palm Beach Island

Line	Survey	Date
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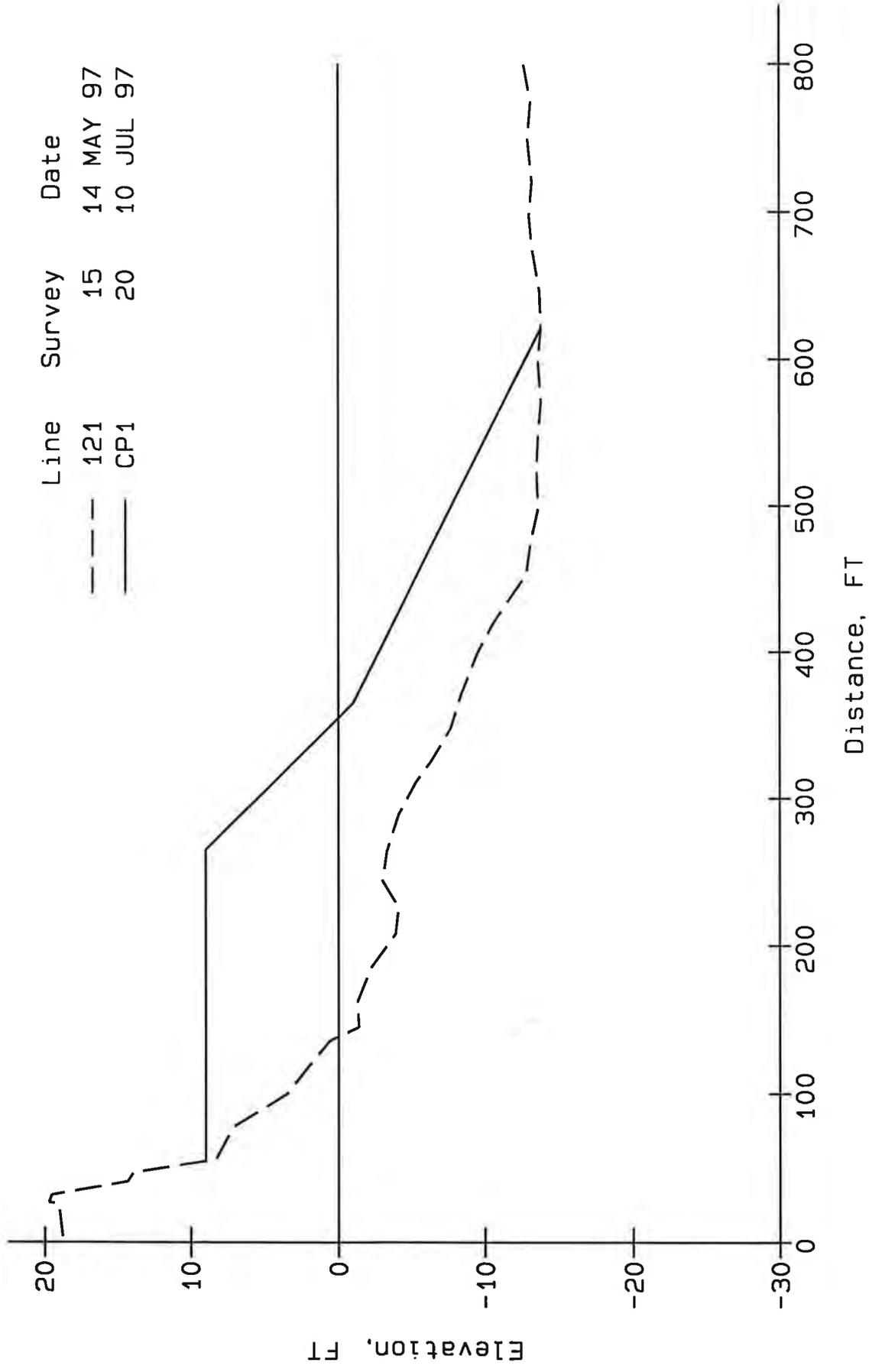


Palm Beach Island

Line	Survey	Date
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---	15	14 MAY 97
---	CP1	20
---	20	10 JUL 97

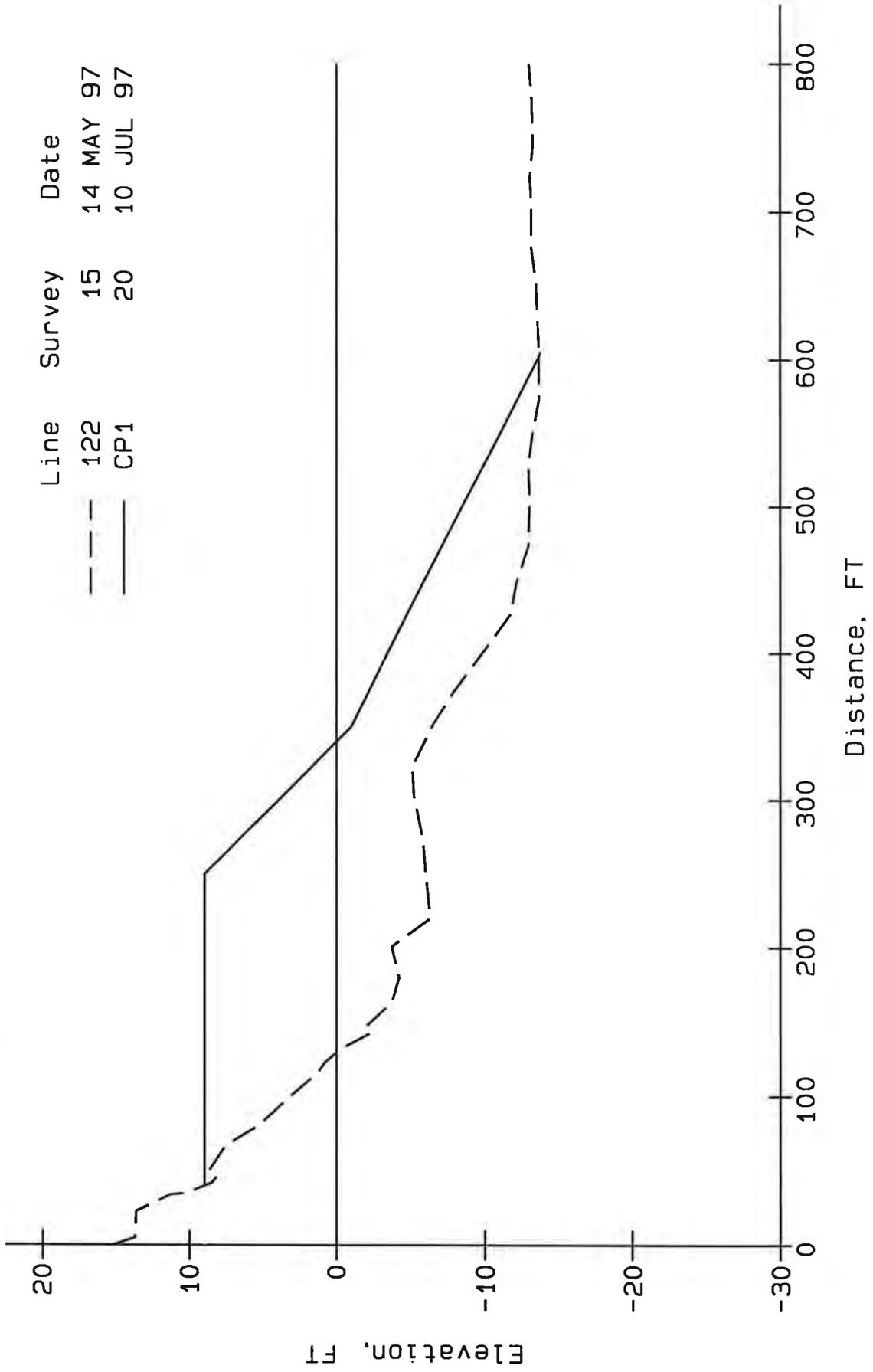


Palm Beach Island



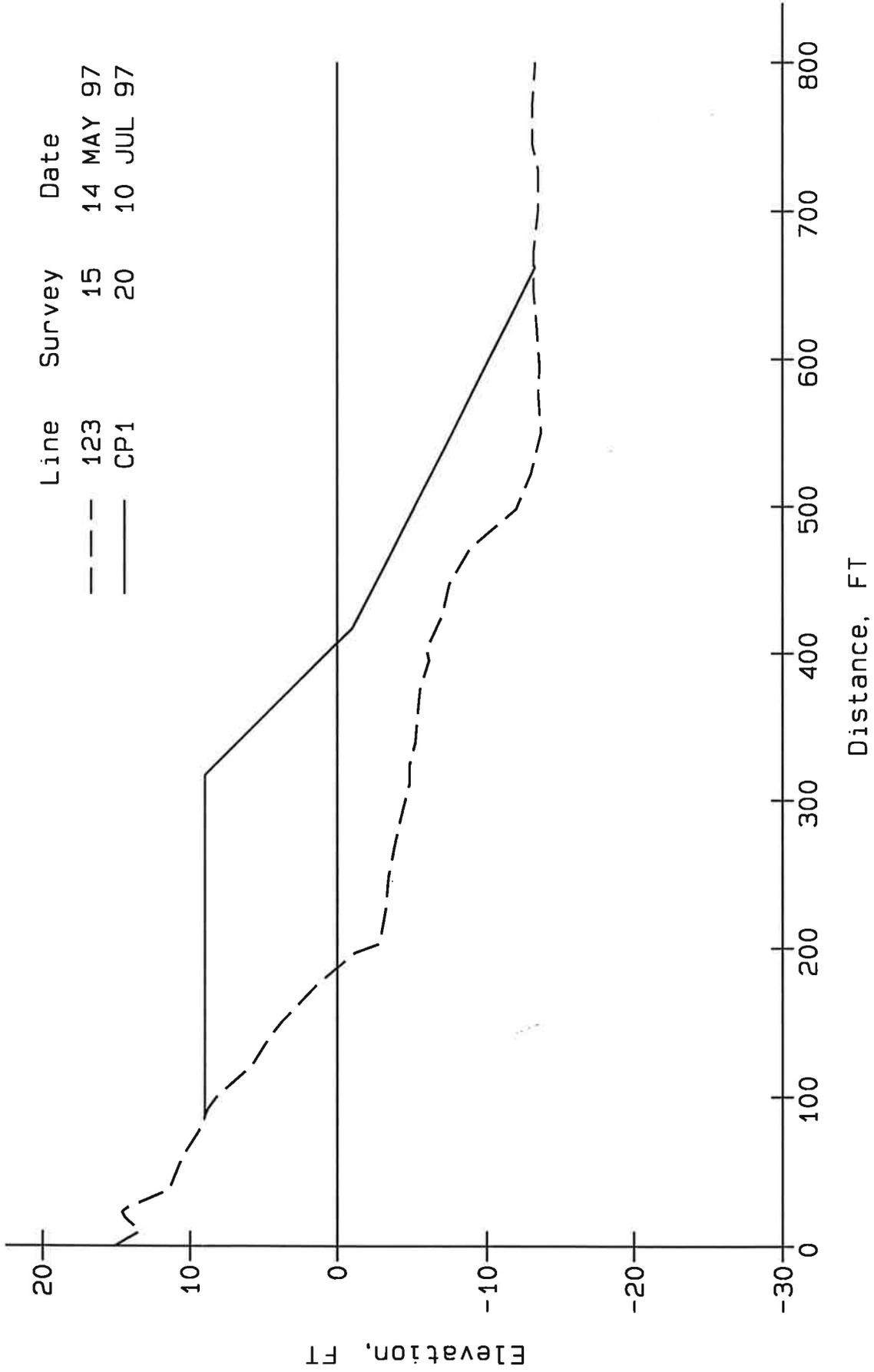
Line	Survey	Date
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—	CP1	20 JUL 97

Palm Beach Island



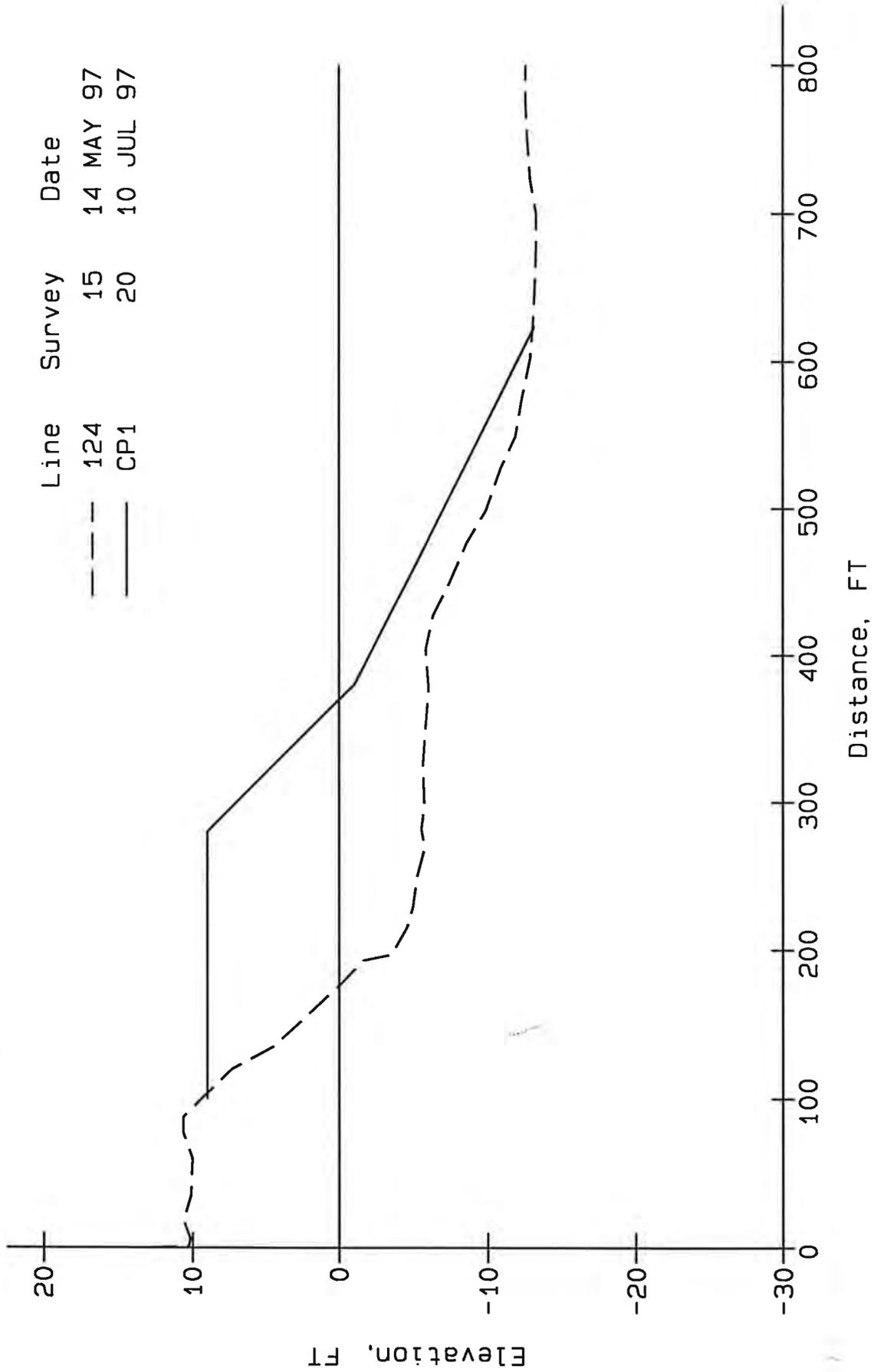
Palm Beach Island

Line	Survey	Date
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---	20	10 JUL 97

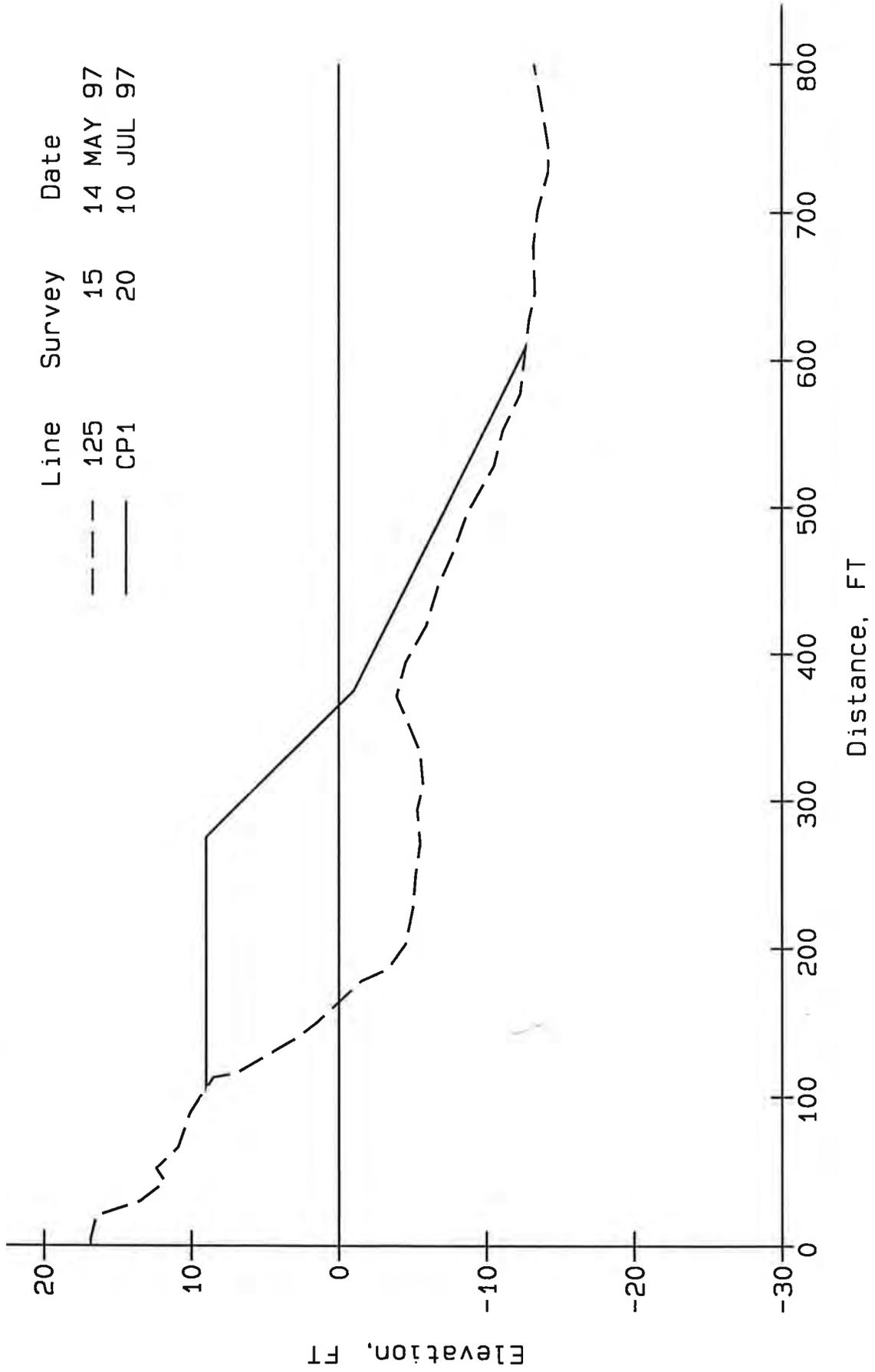


Palm Beach Island

Line	Survey	Date
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—	CP1	20 JUL 97



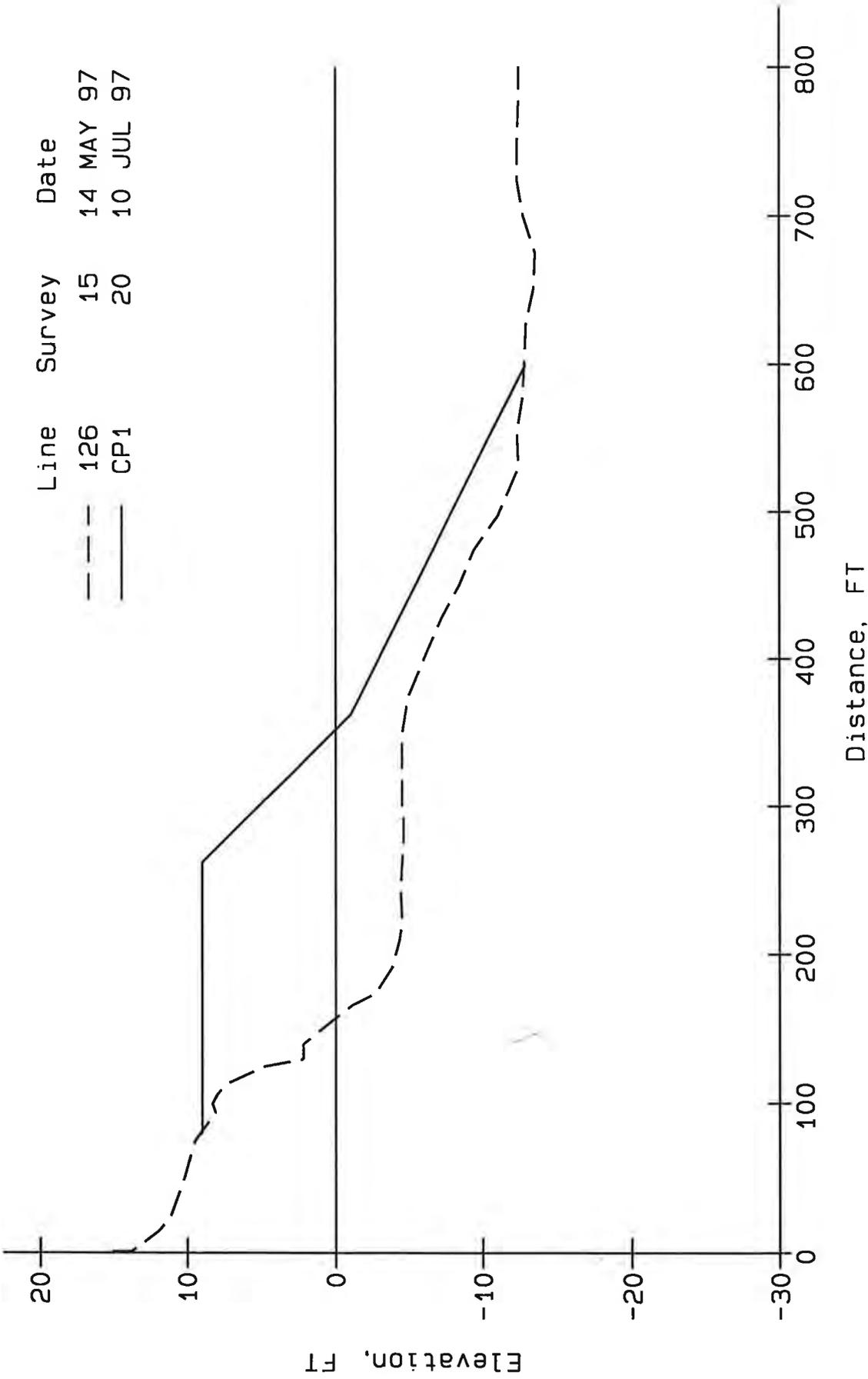
Palm Beach Island



REACH 8

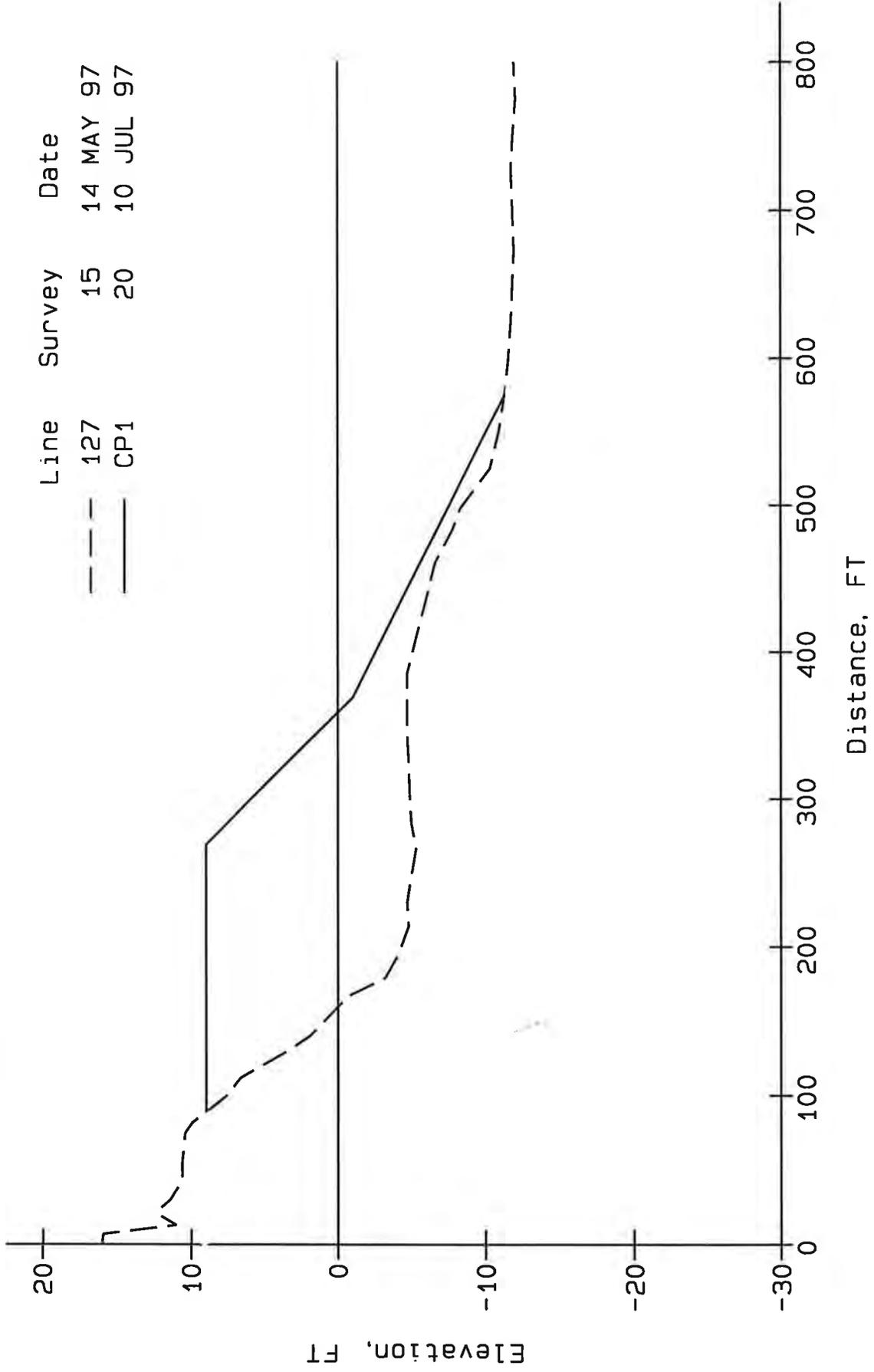
Palm Beach Island

Line	Survey	Date
--	126	15
—	CP1	20



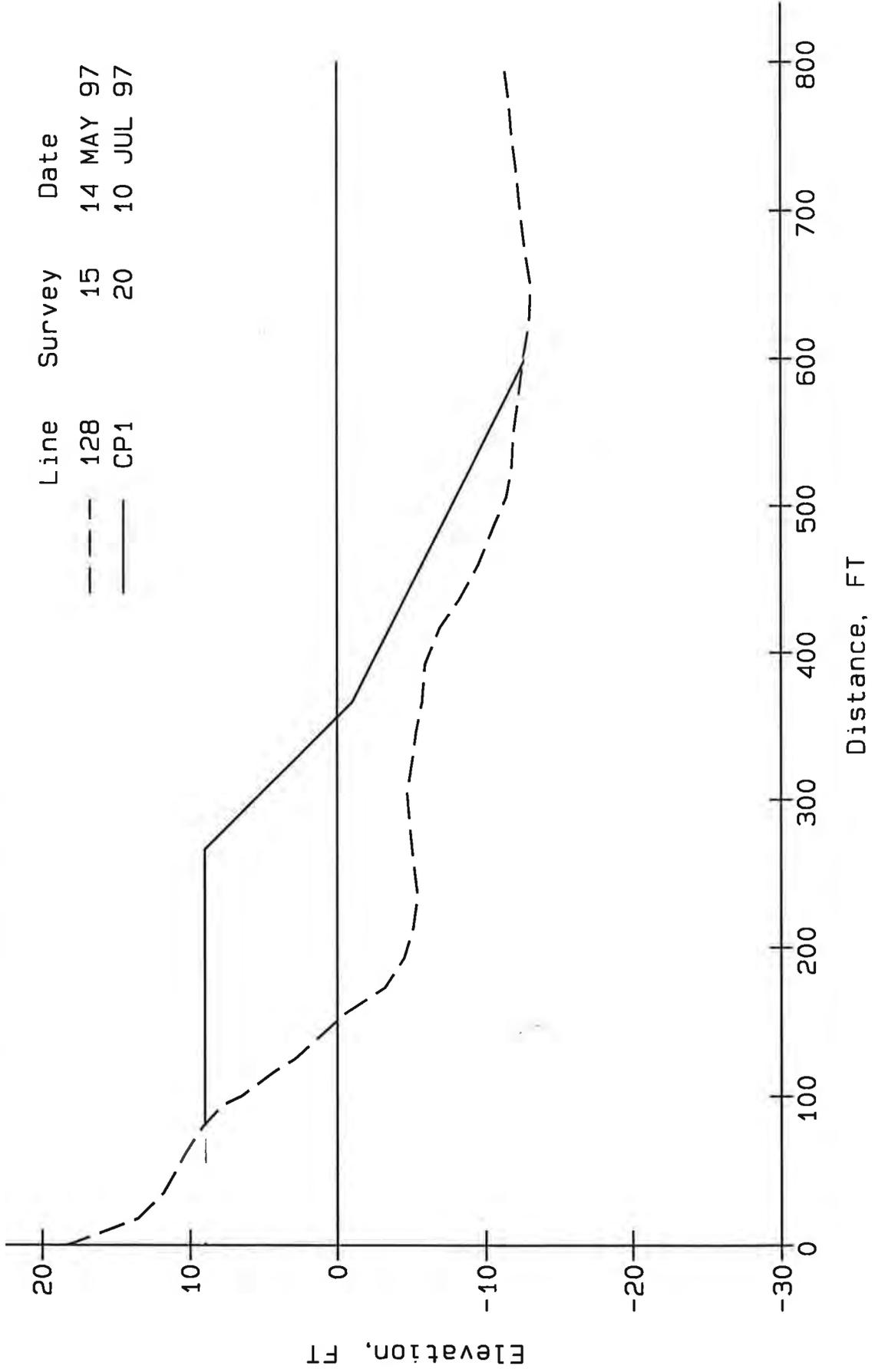
Palm Beach Island

Line	Survey	Date
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—	CP1	20 JUL 97



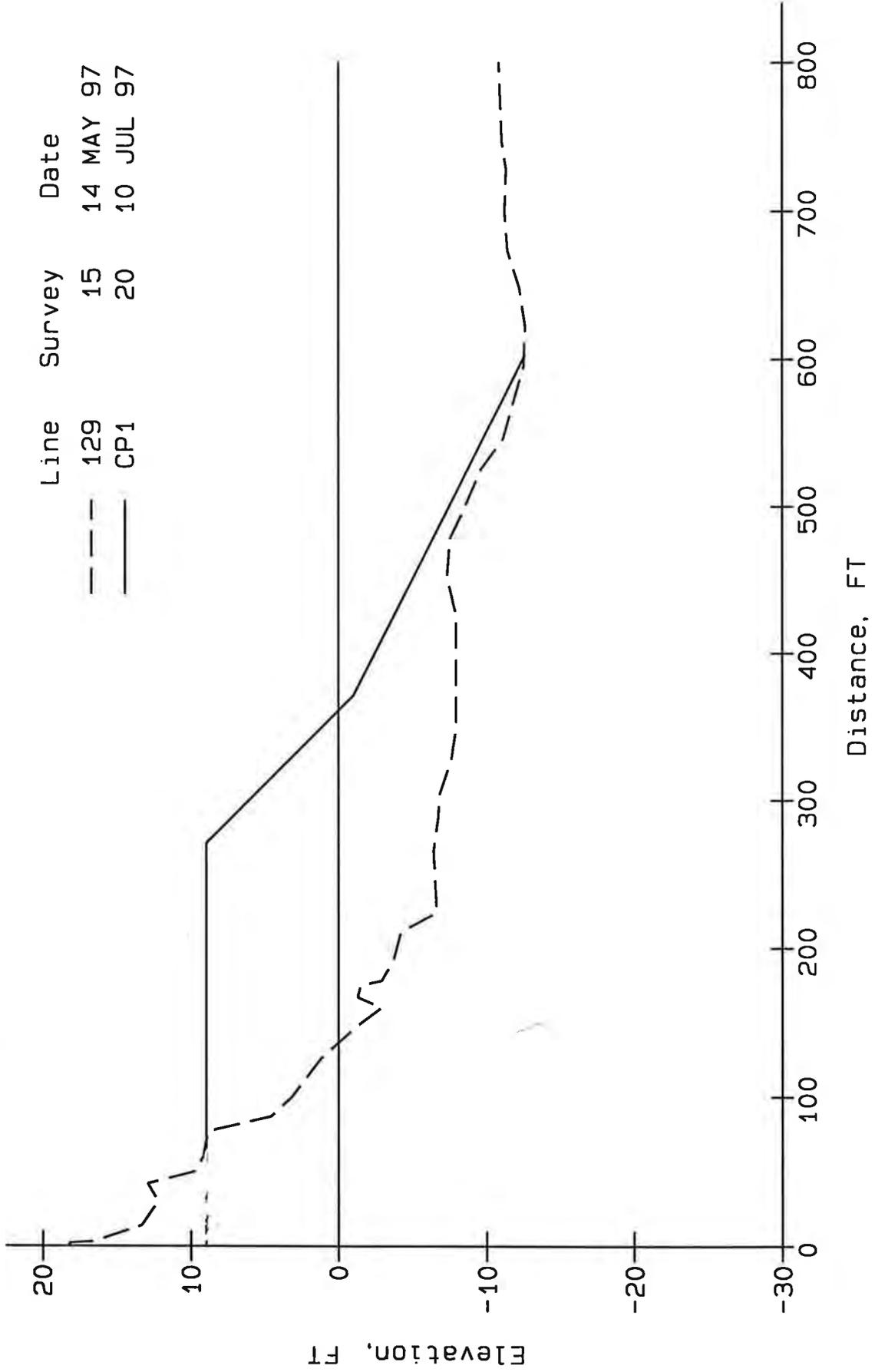
Palm Beach Island

Line	Survey	Date
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—	CP1	20 JUL 97



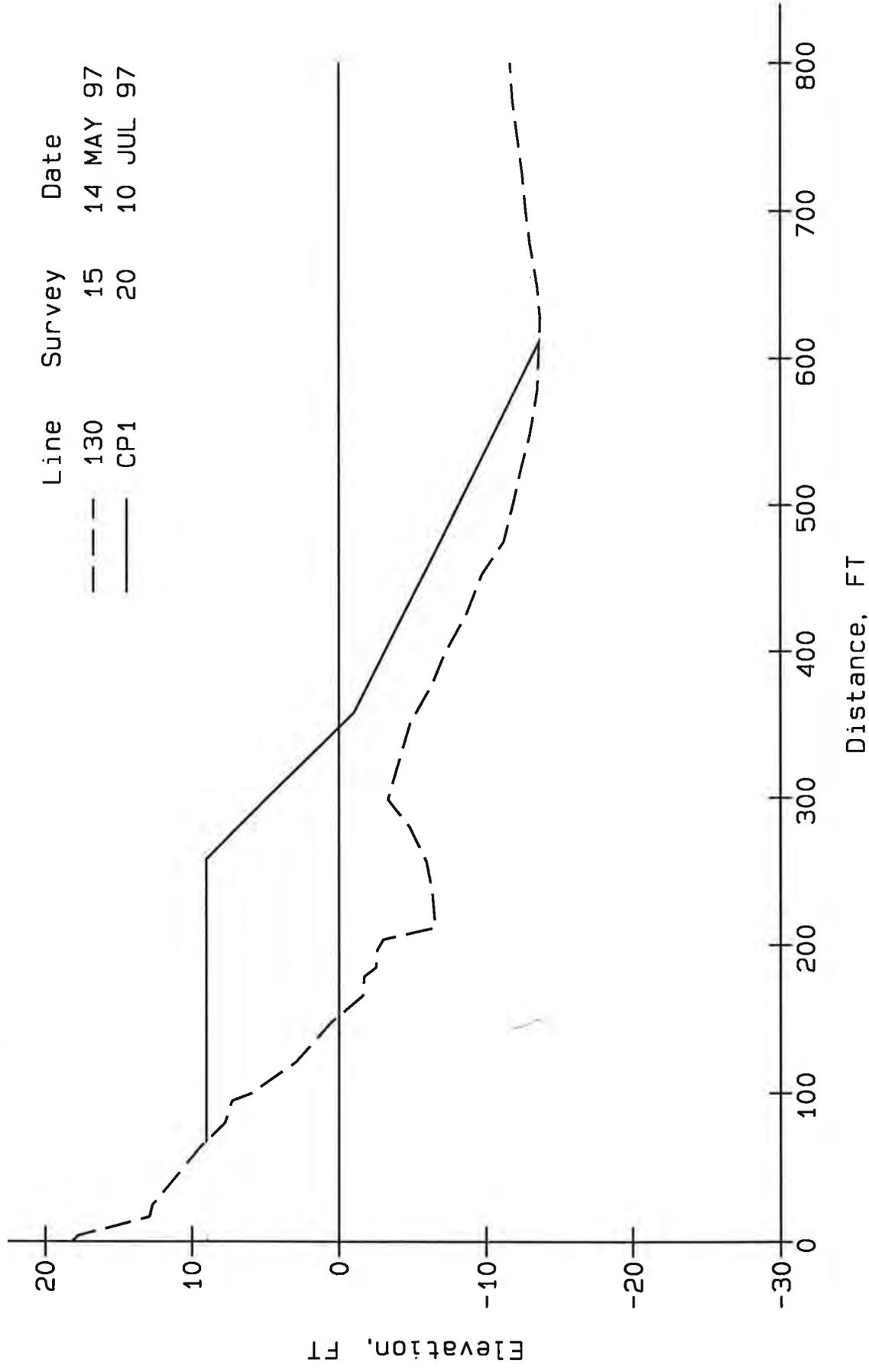
Palm Beach Island

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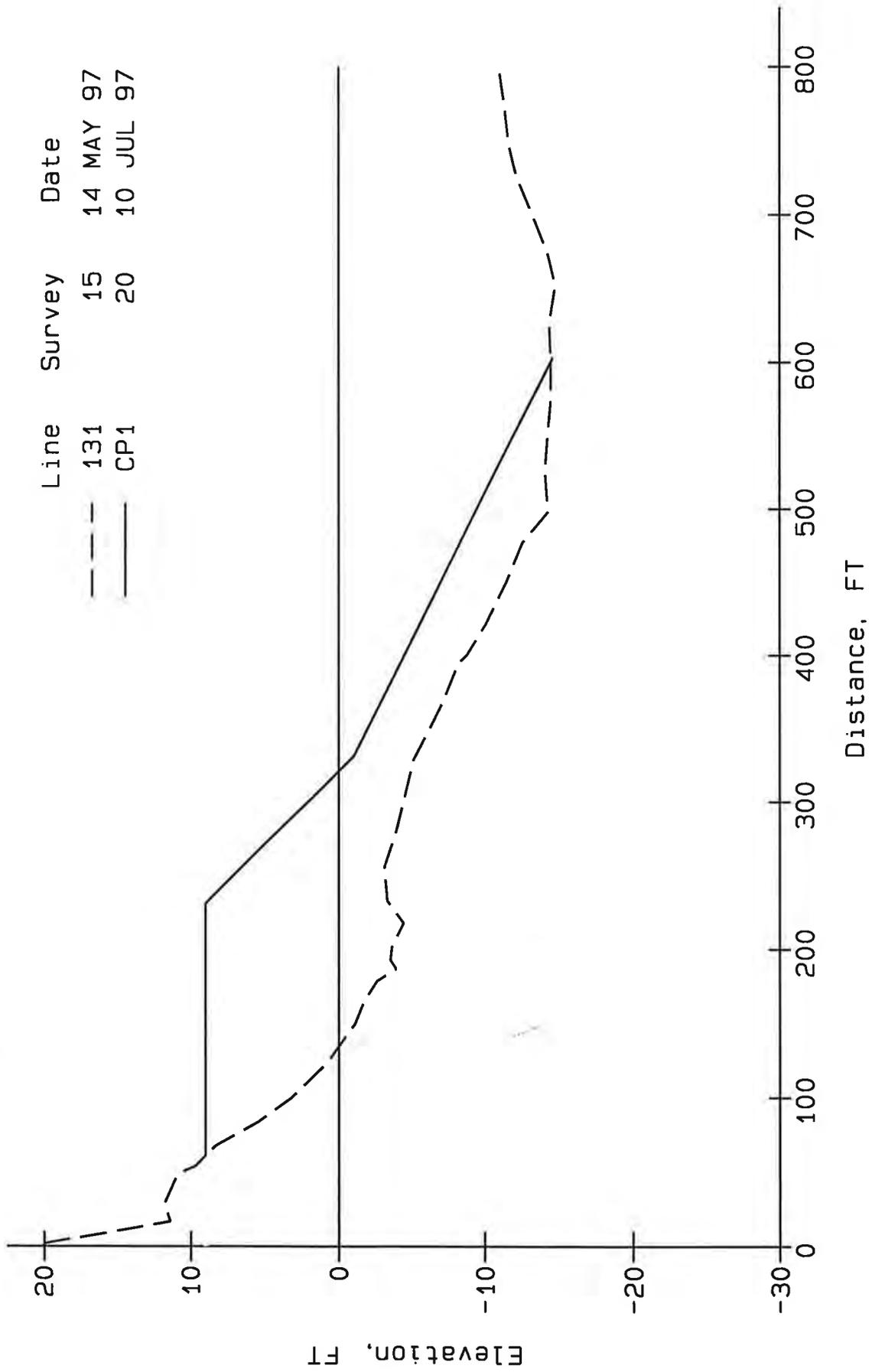
Palm Beach Island

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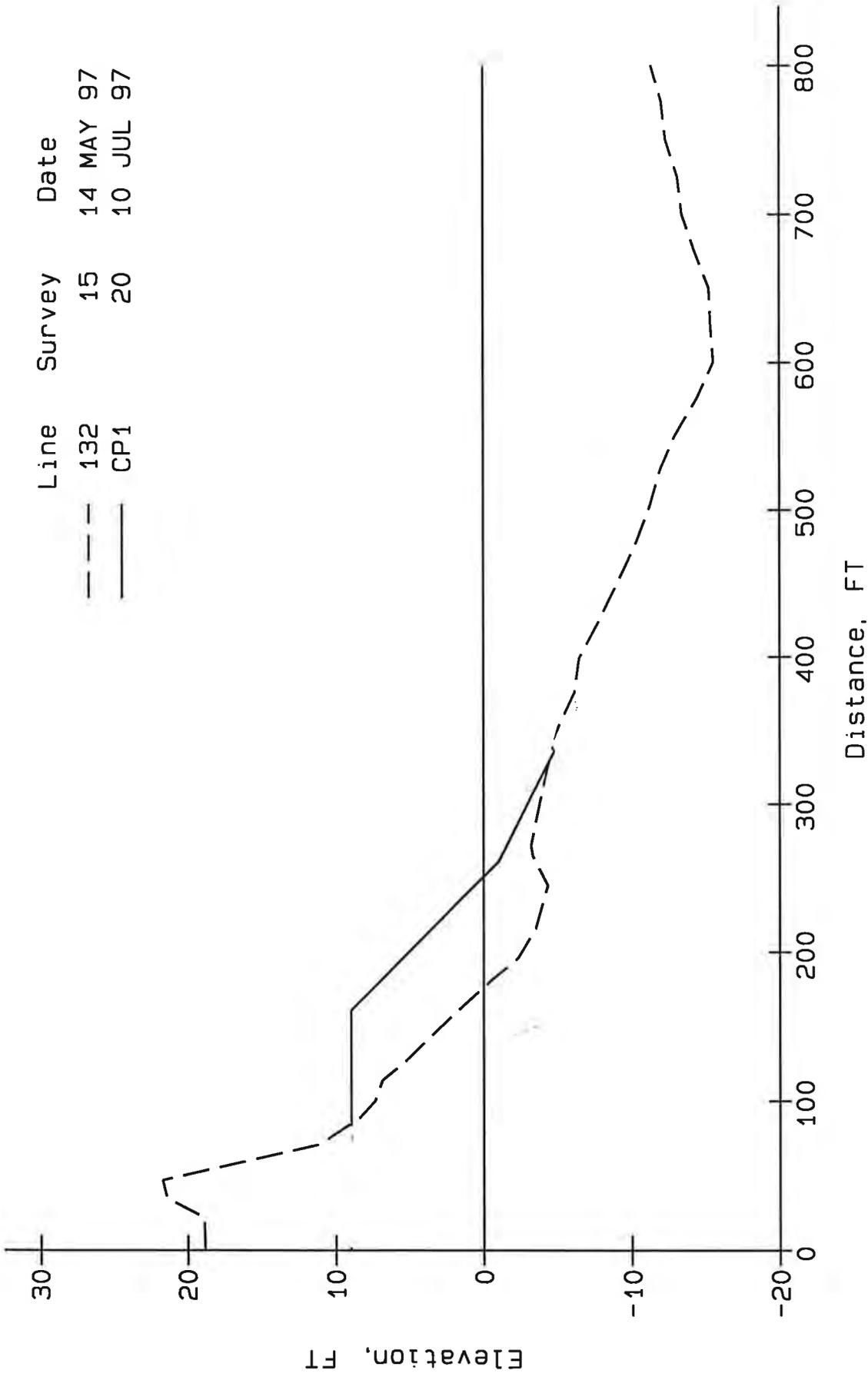


Palm Beach Island

Line	Survey	Date
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—	20	10 JUL 97



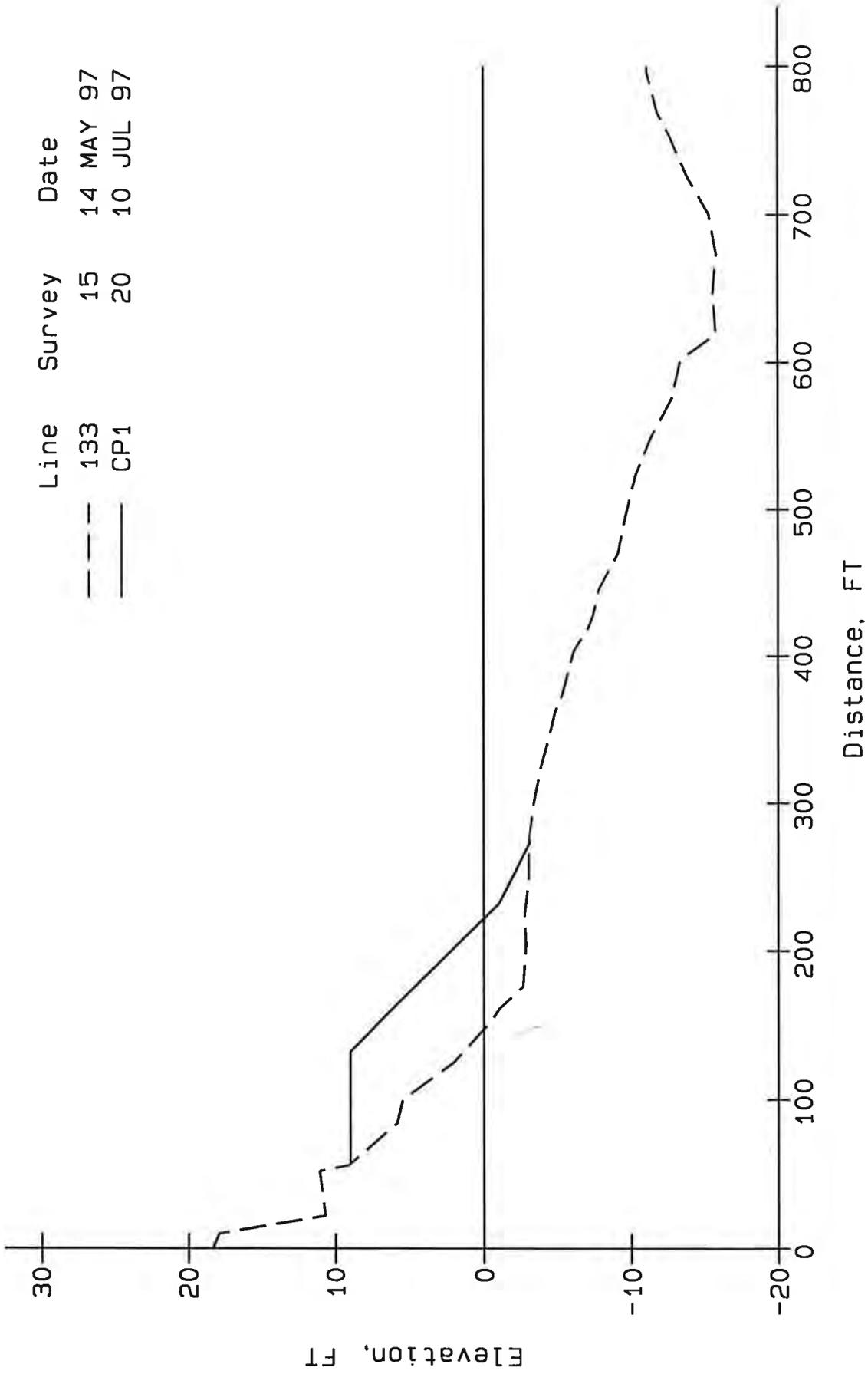
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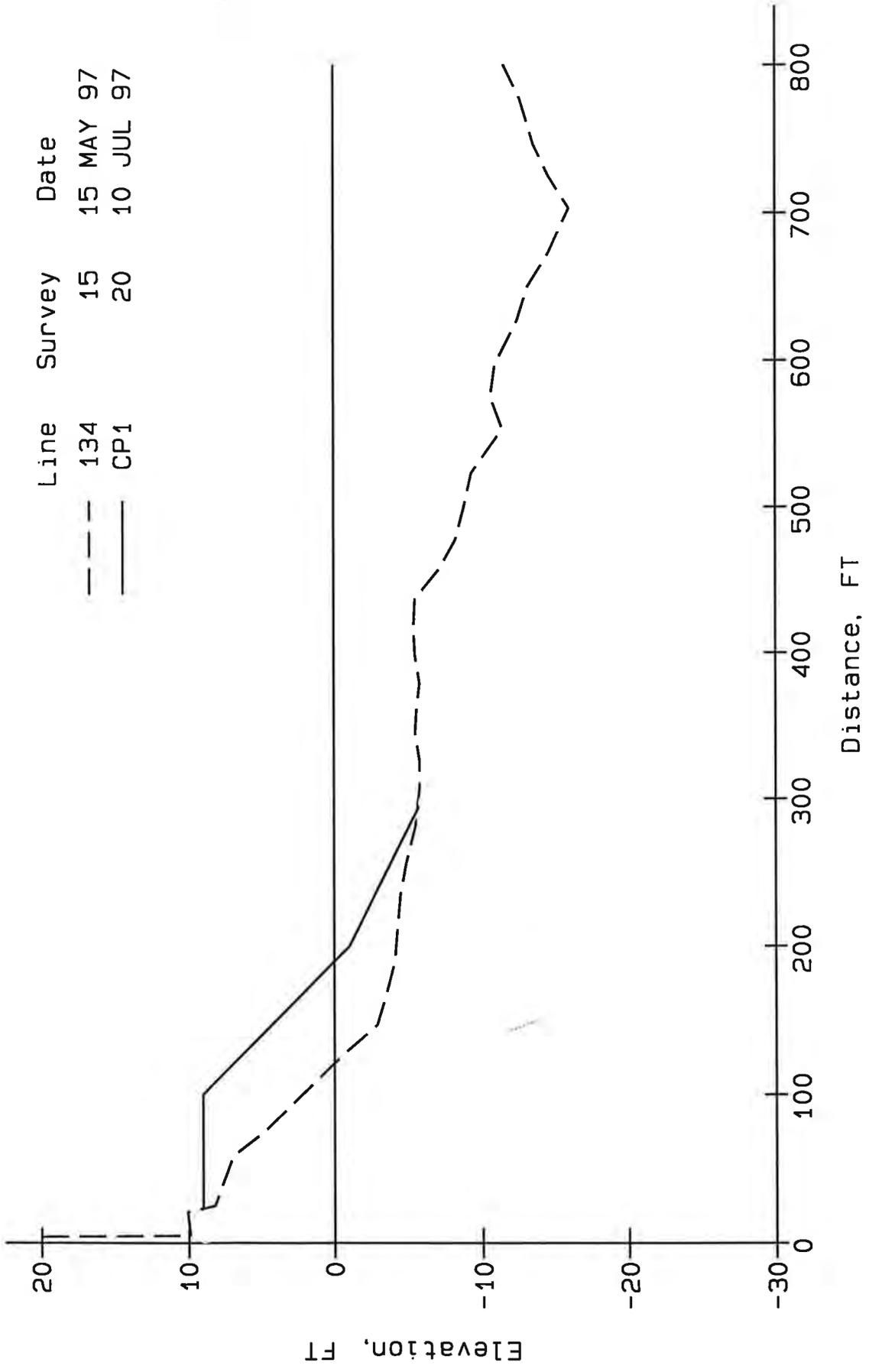
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Palm Beach Island

Line	Survey	Date
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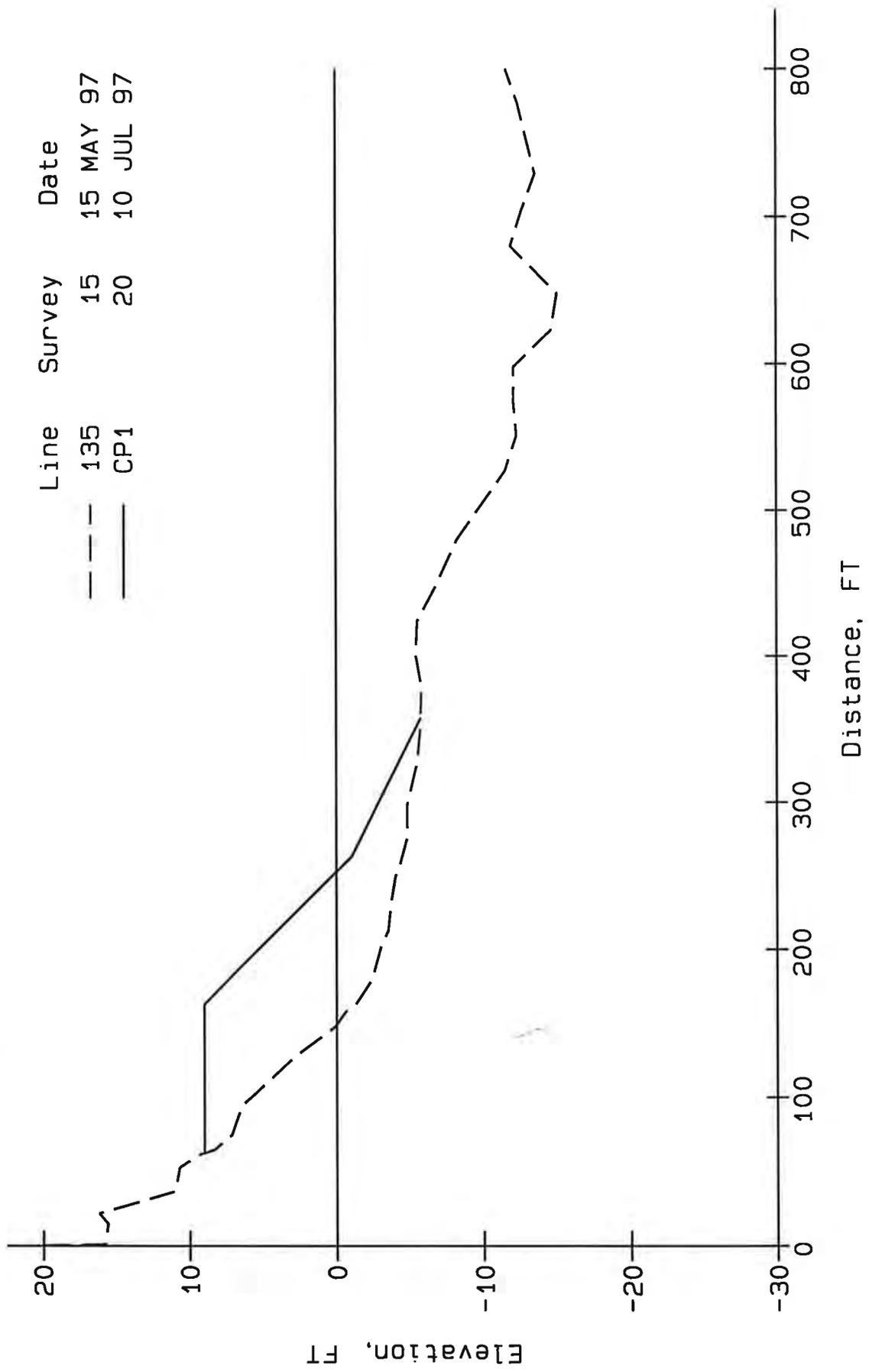


Palm Beach Island



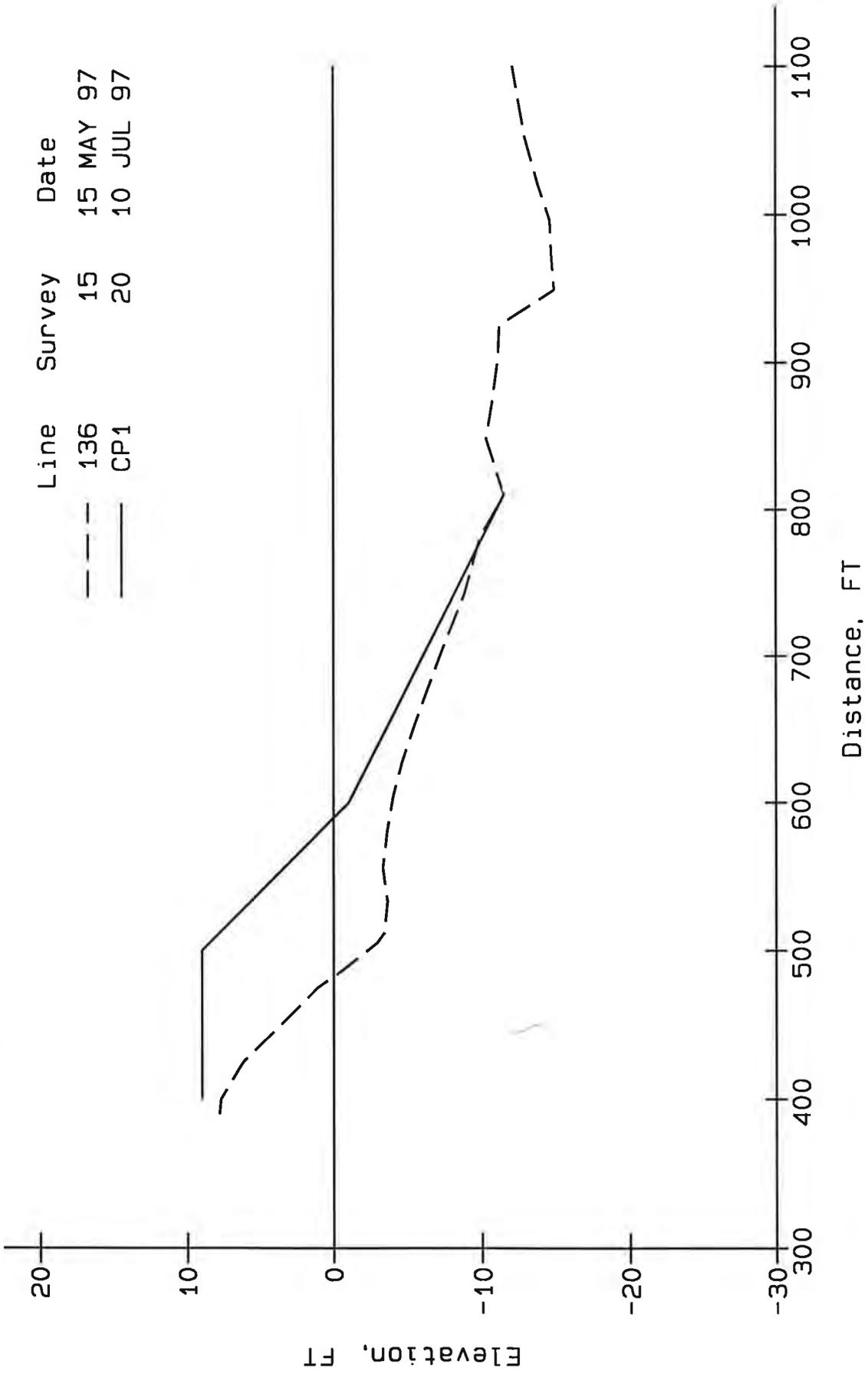
**REACH 9
AND
REACH 10**

Palm Beach Island



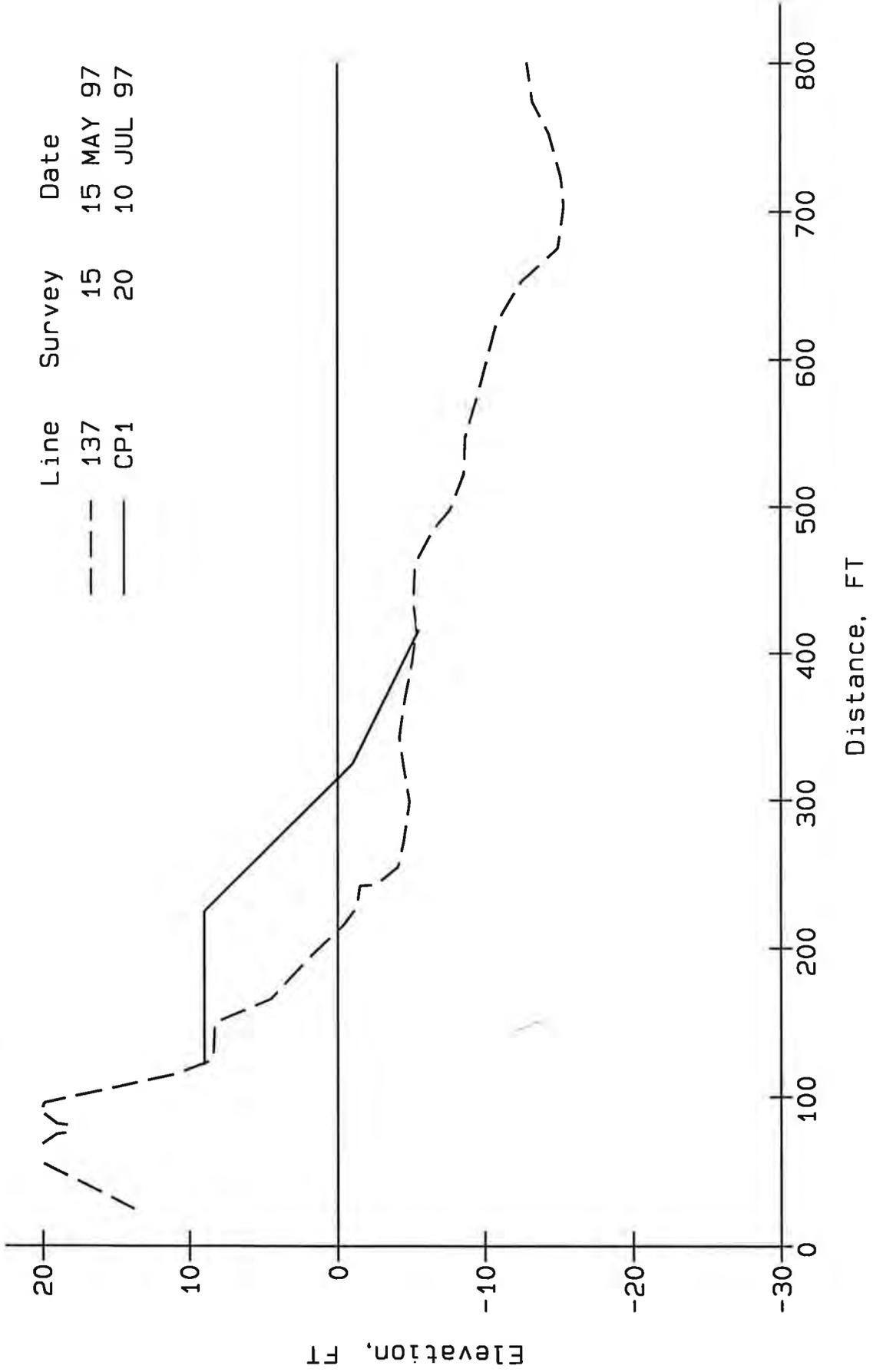
Palm Beach Island

Line	Survey	Date
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—	CP1	20 JUL 97



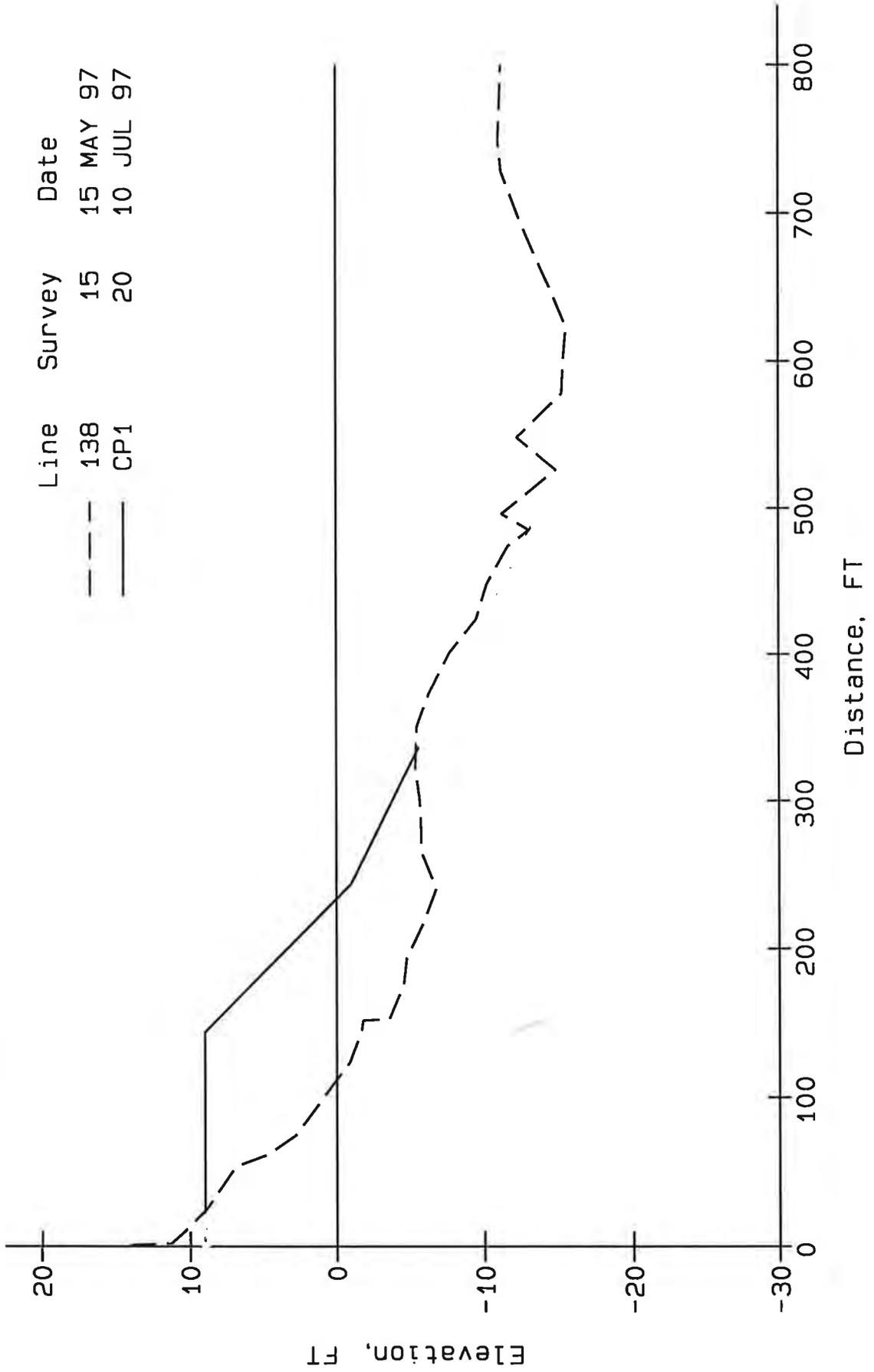
Palm Beach Island

Line	Survey	Date
---	15	15 MAY 97
---	20	10 JUL 97



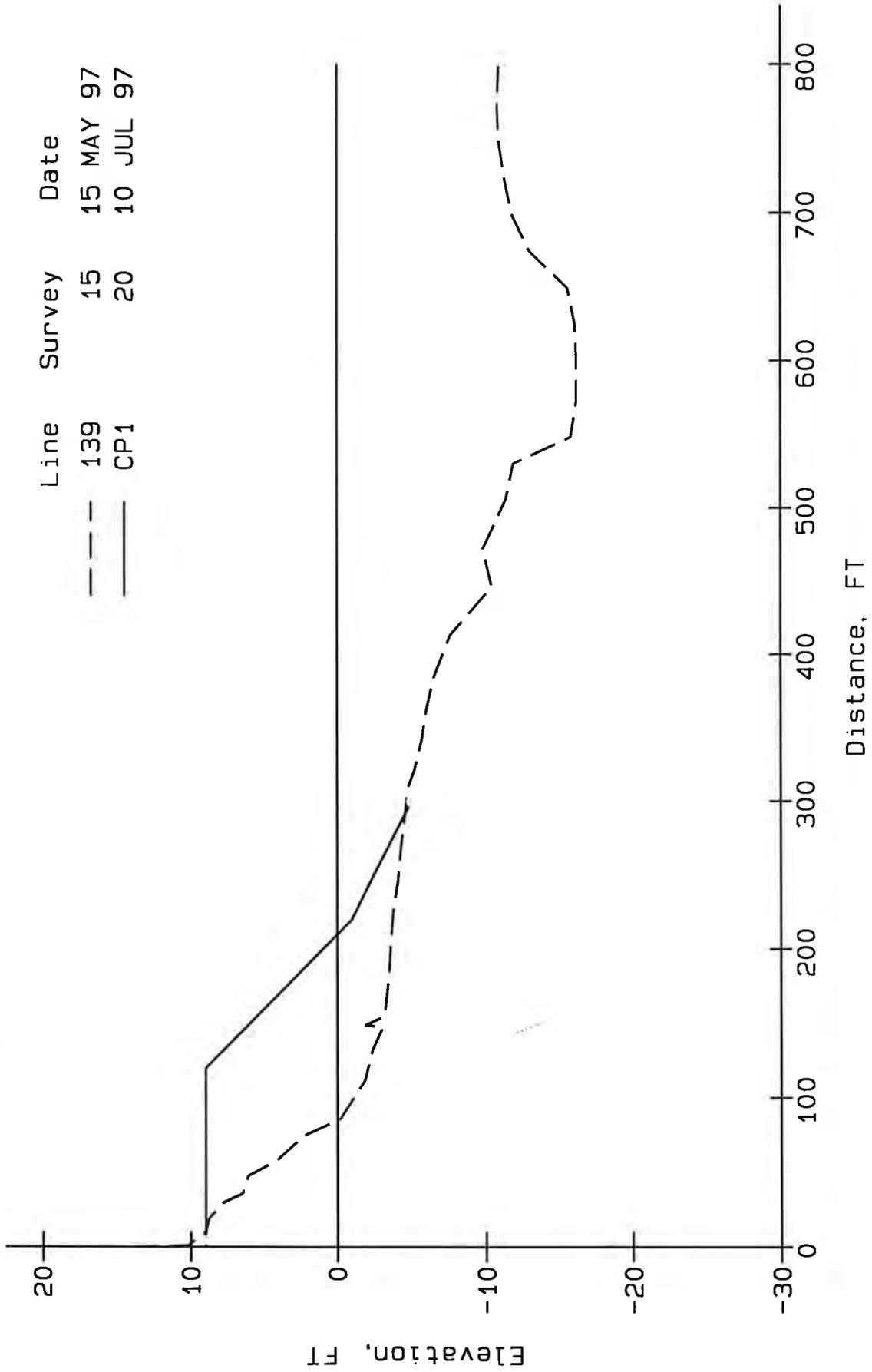
Palm Beach Island

Line	Survey	Date
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—	CP1	20 JUL 97



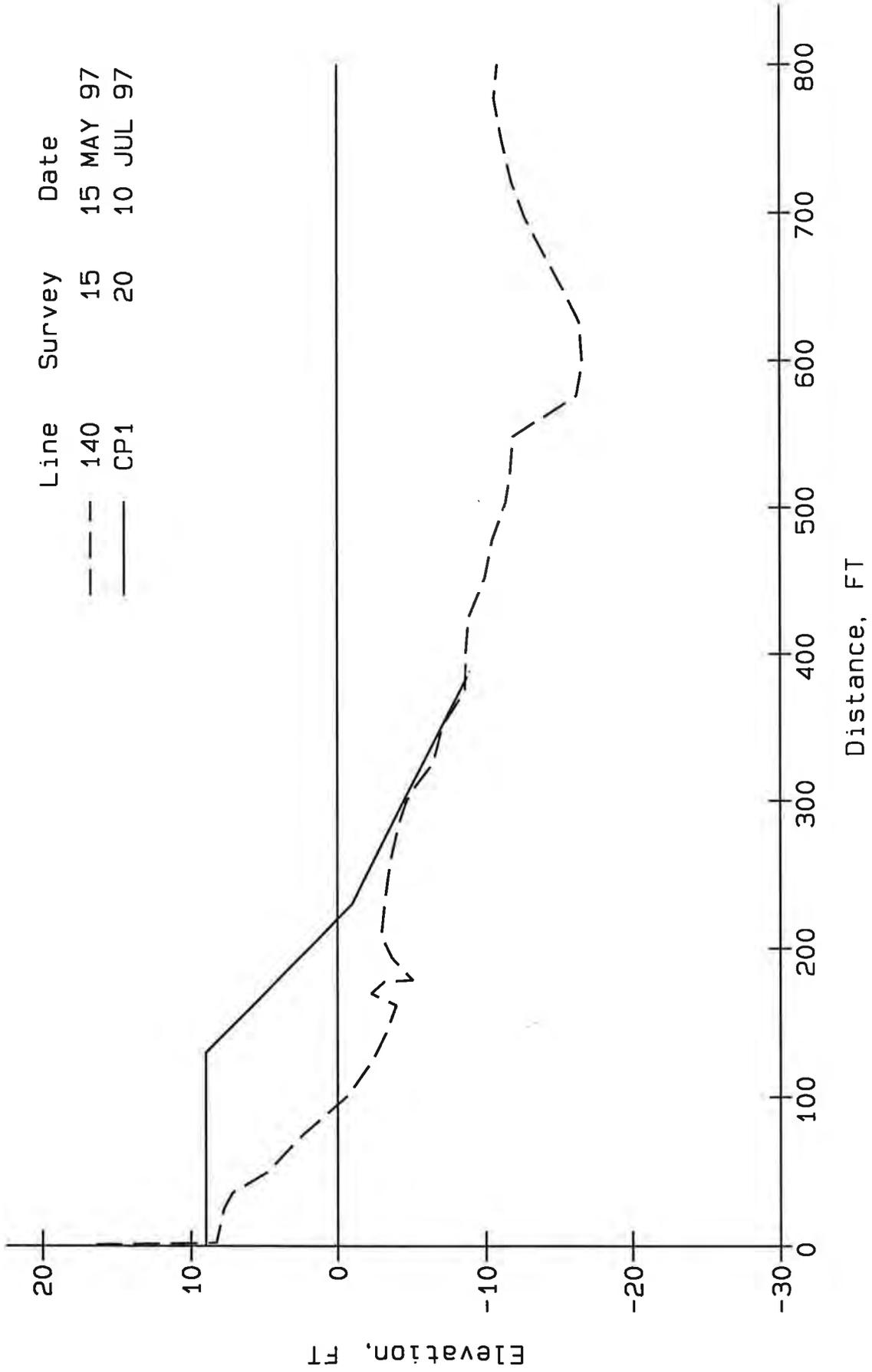
Palm Beach Island

Line	Survey	Date
- - -	15	15 MAY 97
—	20	10 JUL 97

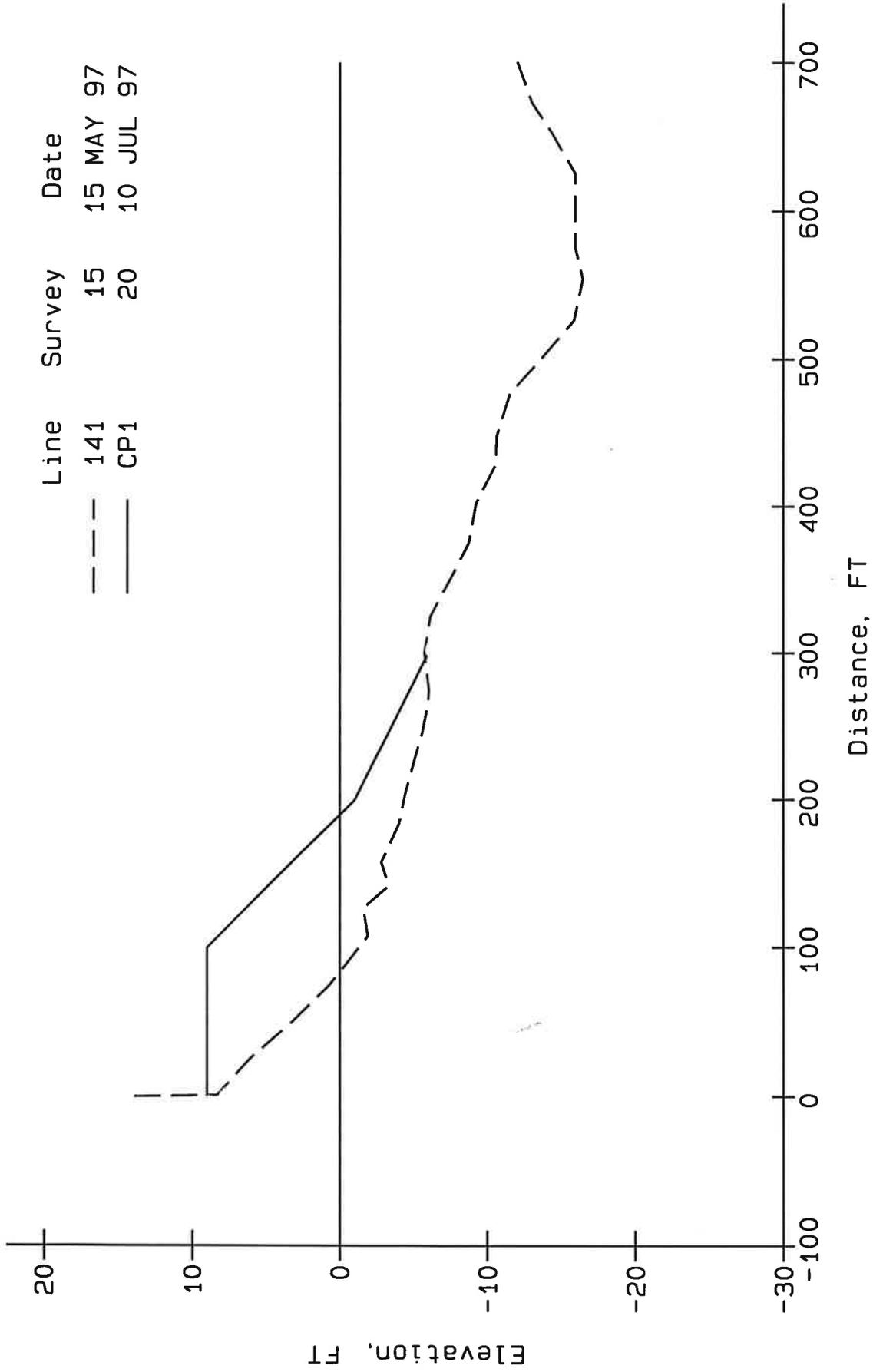


Palm Beach Island

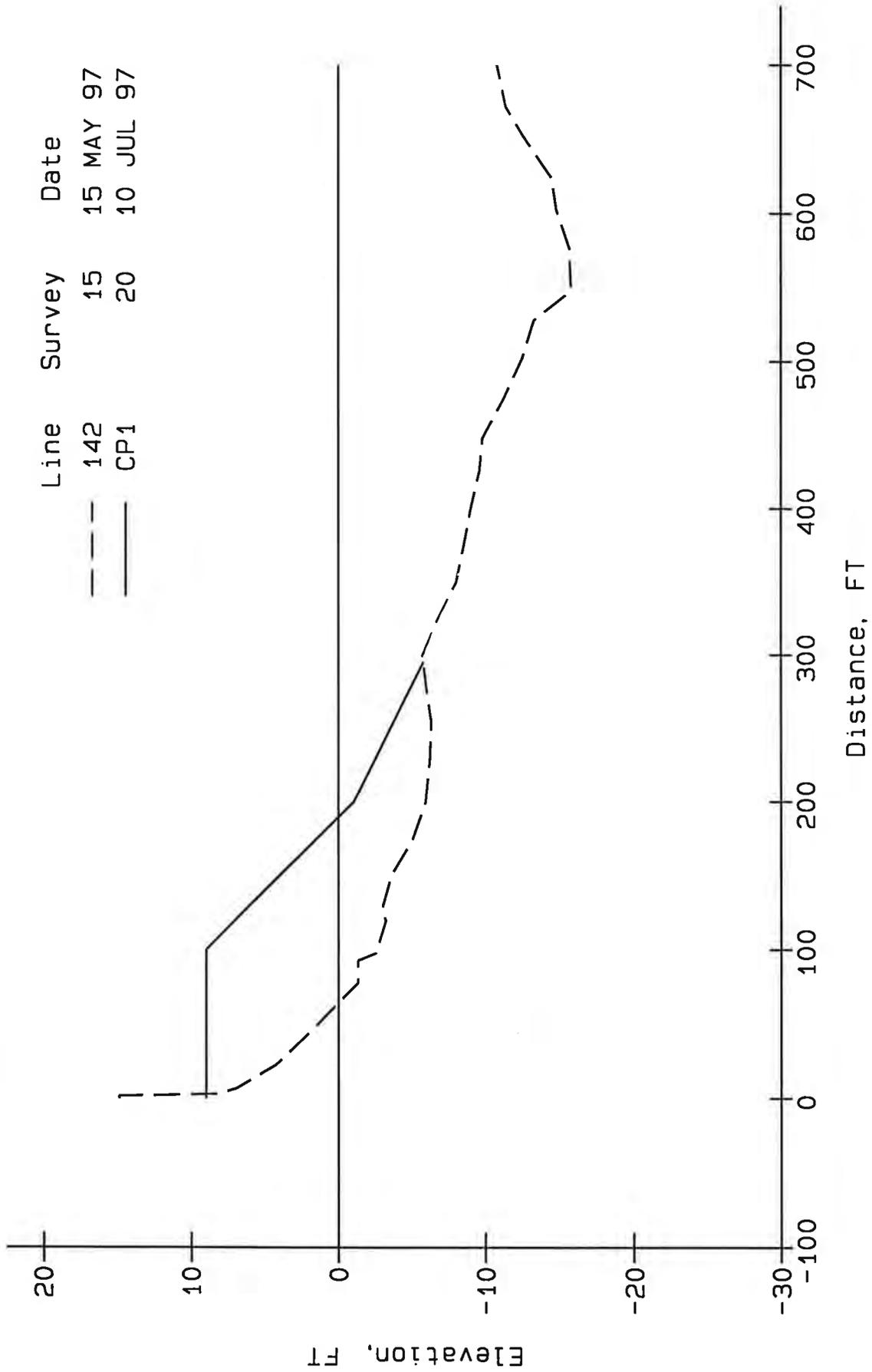
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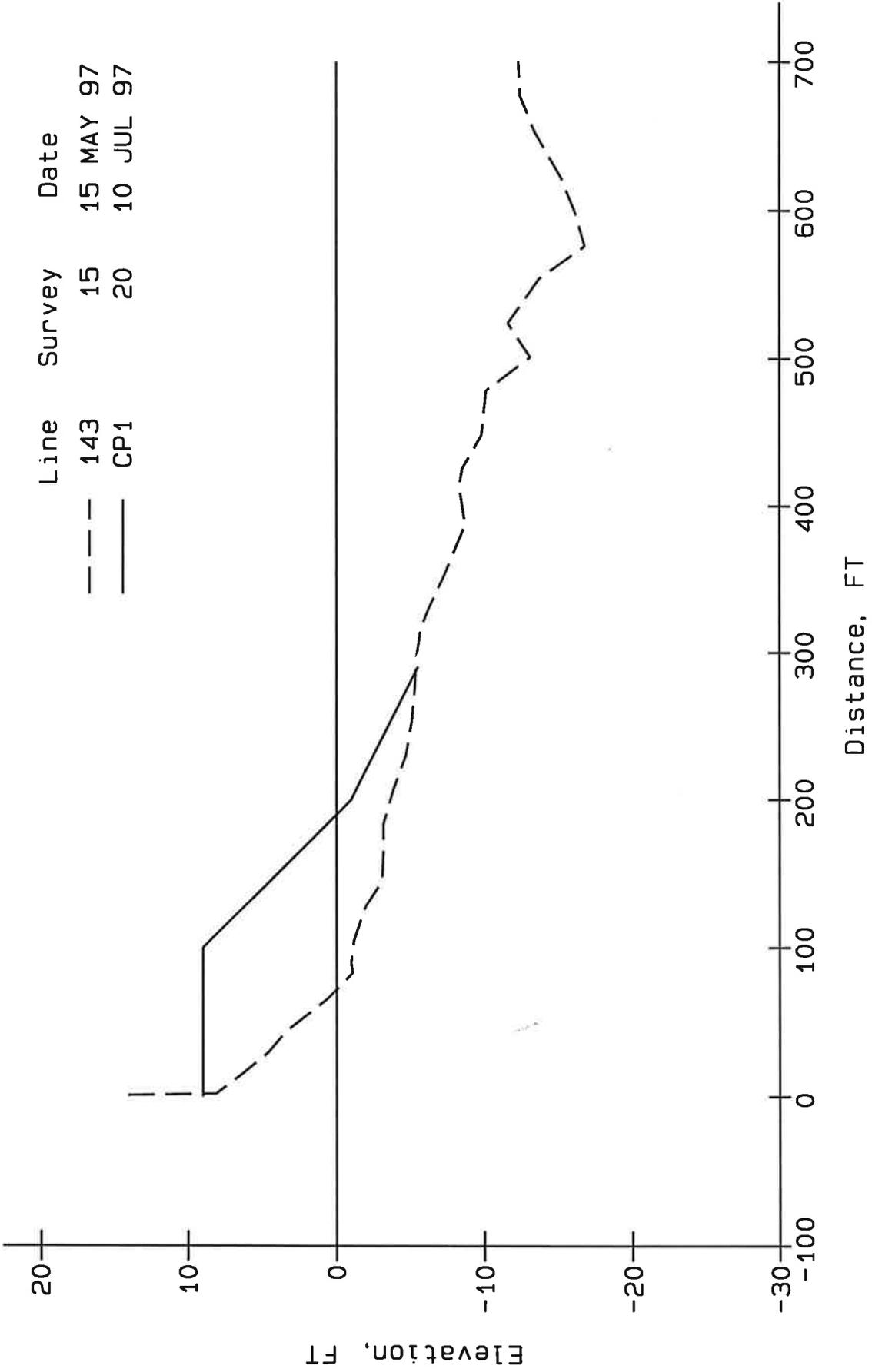
Palm Beach Island



Palm Beach Island

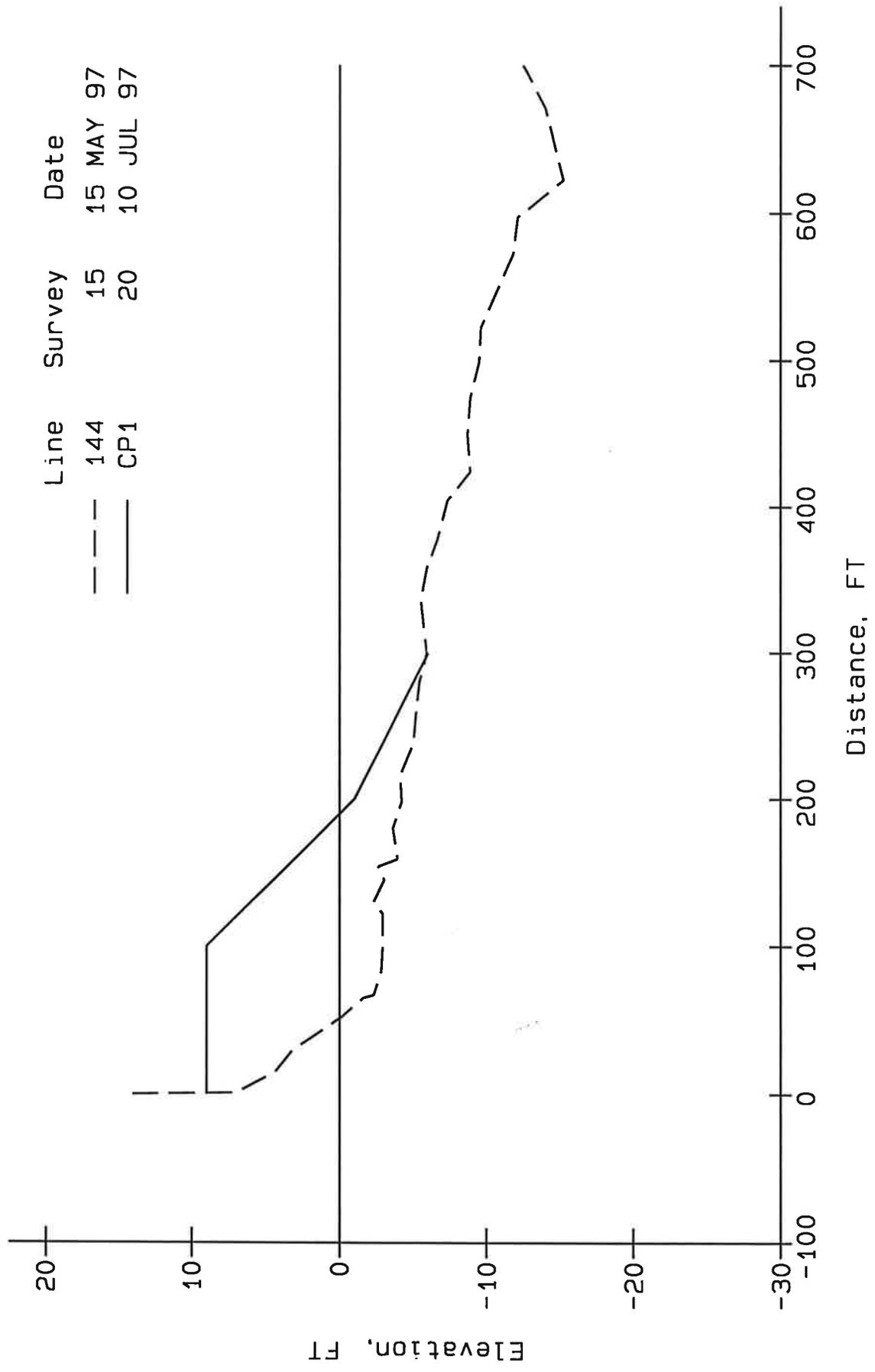


Palm Beach Island



Line	Survey	Date
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---	CP1	20 JUL 97

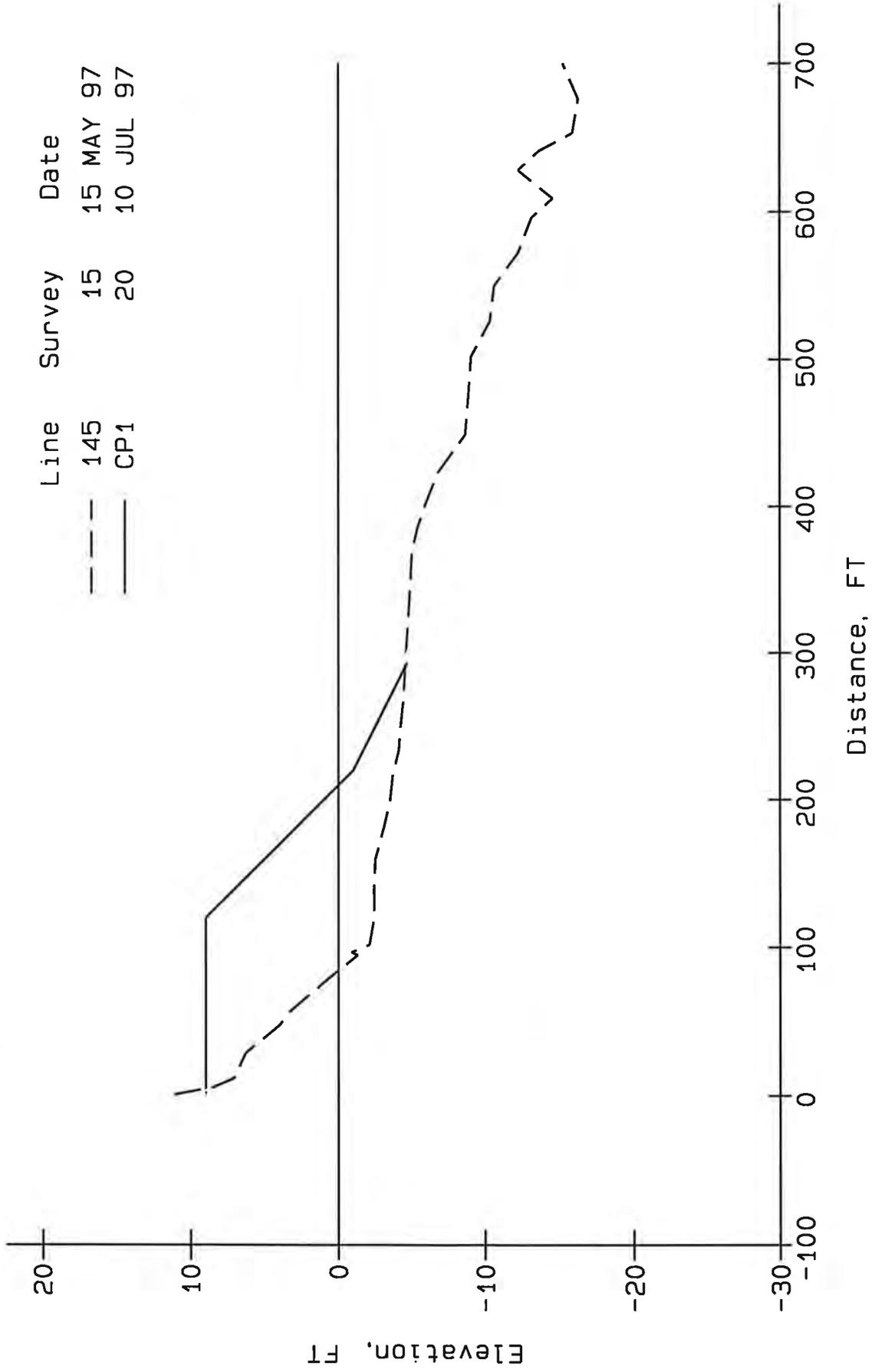
Palm Beach Island



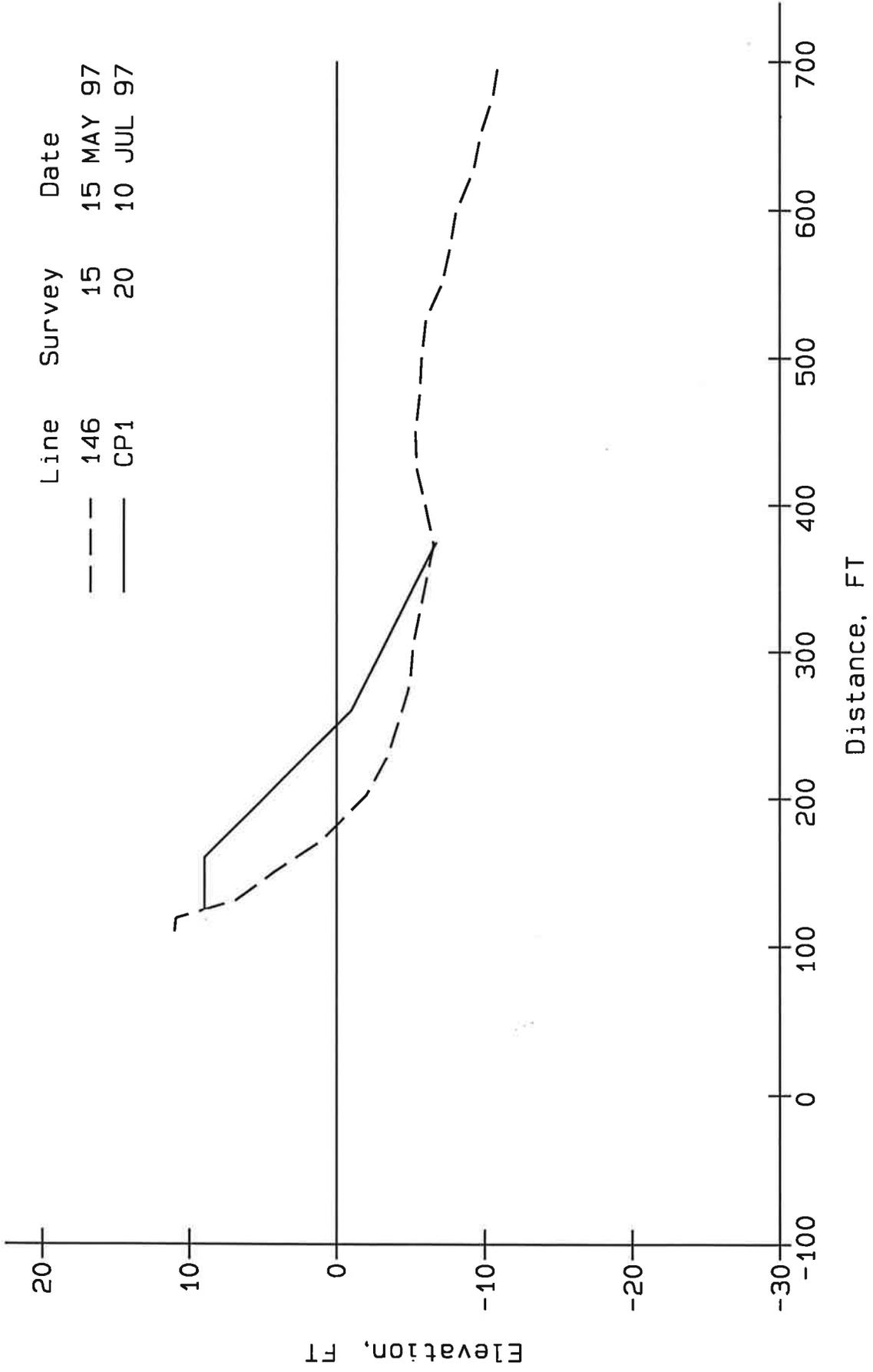
Line	Survey	Date
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—	20	10 JUL 97

Palm Beach Island

Line	Survey	Date
---	145	15 MAY 97
—	CP1	20 10 JUL 97



Palm Beach Island



APPENDIX F

TABLE F-1: OCEANFRONT PROPERTY VALUES ALONG PALM BEACH ISLAND

PALM BEACH COUNTY PROPERTY NUMBER	DESCRIPTION	Approx. Acres	SEA- WALL	Dist. from 1990 W.L. to Bldg. (FEET)	SHORE LINE (FEET)	1990 VALUATION			1996 VALUATION			TOTAL VALUE (\$)	LAST SALE YEAR	Market Value Factor	
						LAND VALUE (\$)	BUILDING VALUE (\$)	TOTAL VALUE (\$)	LAND VALUE (\$)	BUILDING VALUE (\$)	TOTAL VALUE (\$)				
TOWN OF PALM BEACH															
50-43-42-34-01-000-0260	PRIVATE	0.6	N	740	90	814,968	257,069	1,072,037	1,700,000	61,972	1,761,972				
50-43-42-34-01-000-0280	PRIVATE	0.27	N	710	100	616,000	241,457	857,457	1,100,000	367,033	1,467,033				
50-43-42-34-01-000-0290	PRIVATE	0.27	N	660	100	616,000	0	616,000	1,100,000	545,086	1,645,086				
50-43-42-34-01-000-0300	PRIVATE	0.24	N	600	90	616,000	208,288	824,288	1,100,000	194,628	1,294,628				
EAST INLET DRIVE	UNDEVELOPED PUB. ACCESS		N		10										
50-43-42-34-02-000-0011	PRIVATE	1.39	N	590	140	1,586,060	485,288	2,071,348	2,400,000	345,137	2,745,137				
INDIAN ROAD	UNDEVELOPED PUB. ACCESS		N		15										
50-43-42-34-02-000-0020	PRIVATE	1.24	N	620	120	1,318,800	148,356	1,467,156	1,800,000	44,429	1,844,429				
50-43-42-34-02-000-0031	PRIVATE	1.76	N	590	170	2,025,660	2,565,895	4,591,555	3,400,000	359,948	3,759,948				
ARABIAN ROAD	UNDEVELOPED PUB. ACCESS		N		15										
50-43-42-34-02-000-0050	PRIVATE	2.64	N	500	290	2,025,660	256,895	2,282,555	5,100,000	207,949	5,307,949				
CARIBBEAN ROAD	UNDEVELOPED PUB. ACCESS		N		15										
50-43-42-34-02-000-0081	PRIVATE	0.41	N	460	90	1,043,000	482,625	1,525,625	1,800,000	1,280,054	3,080,054				
50-43-42-34-02-000-0083	PRIVATE	0.77	N	440	100	1,103,340	251,180	1,354,520	1,900,000	217,109	2,117,109				
50-43-42-34-02-000-0100	PRIVATE	0.74	N	460	90	1,094,800	377,773	1,472,573	1,900,000	282,140	2,182,140				
MEDITERRANEAN ROA	UNDEVELOPED PUB. ACCESS		N		15										
50-43-42-34-02-000-0110	PRIVATE	1.08	N	420	135	1,452,500	0	1,452,500	2,500,000	0	2,500,000				
50-43-42-34-04-000-0030	PRIVATE	0.95	N	500	115	1,152,300	0	1,152,300	2,300,000	2,359,449	4,659,449				
50-43-42-34-04-000-0100	PRIVATE	2.31	N	500	180	2,060,800	356,478	2,417,278	2,600,000	454,870	3,054,870				
50-43-42-34-04-000-0010	PRIVATE	1.99	N	280	155	1,680,000	46,127	1,726,127	2,700,000	290,771	2,990,771				
50-43-42-34-05-000-0020	PRIVATE	0.46	N	320	75	672,000	98,539	770,539	1,350,000	32,319	1,382,319				
50-43-42-34-05-000-0011	PRIVATE	1.12	N	240	180	2,161,600	624,383	2,785,983	2,600,000	521,849	3,121,849				
REACH 1															
TOTAL VALUES		18.24			2,280	22,039,488	6,400,353	28,439,841	37,350,000	7,564,743	44,914,743			avg. =	1.18
Average 1996 PRIVATE Land Value = \$/ft ² 47															
50-43-42-34-07-000-0030	PRIVATE	0.86	N	200	150	895,800	370,439	1,266,239	1,100,000	192,606	1,292,606				
50-43-42-34-07-000-0021	PRIVATE	0.41	N	160	120	620,700	73,527	694,227	800,000	28,539	828,539				
50-43-42-34-07-000-0013	PRIVATE	0.51	N	160	140	510,000	159,239	669,239	750,000	153,342	903,342			1996	1.05
50-43-42-34-09-000-0062	PRIVATE	0.35	N	130	100	395,640	149,102	544,742	800,000	314,243	1,114,243				
50-43-42-34-08-000-0050	PRIVATE	0.71	N	120	115	640,320	2,376	642,696	900,000	2,376	902,376				
50-43-42-34-08-000-0040	PRIVATE	0.22	N	130	70	34,080	0	34,080	650,000	0	650,000				
50-43-42-34-08-000-0071	PRIVATE	0.11	N	120	90	48,000	6,944	54,944	40,000	6,944	46,944				
50-43-42-34-08-000-0030	PRIVATE	0.45	Y	75	75	34,080	5,322	39,402	1,050,000	51,765	1,101,765				
50-43-42-34-08-000-0020	PRIVATE	0.33	Y	240	240	58,080	0	58,080	700,000	255,838	955,838				
50-43-43-02-01-000-0110	PRIVATE	0.37	Y	100	100	242,802	106,966	349,768	800,000	147,940	947,940				
ANGLER AVE ACCESS	PUBLIC		Y		30										
50-43-43-03-03-000-0251	PRIVATE	0.09	Y	55	55	12,000	1,998	13,998	100,000	2,653	102,653				
50-43-43-03-03-000-0081	PRIVATE	0.31	Y	55	55	559,680	273,575	833,255	800,000	344,765	1,144,765				
50-43-43-03-03-000-0092	PRIVATE	0.45	Y	110	110	570,720	184,314	755,034	800,000	0	800,000				
50-43-43-03-03-000-0252	PUBLIC	0.15	Y	120	120	8,000	2,000	10,000	50,000	3,850	53,850				
OCEAN TERRACE ACCE	PUBLIC		Y		30										
50-43-43-03-03-000-0242	PRIVATE	0.4	Y	115	115	613,680	173,240	786,920	765,000	54,431	819,431				
50-43-42-34-11-000-0010	PRIVATE	0.59	Y	90	90	609,120	147,459	756,579	1,060,000	737,408	1,817,408				
50-43-42-34-11-000-0150	PALM BEACH COUNTY	0.1	Y	45	45	20,000	2,472	22,472	70,000	2,472	72,472				
50-43-42-34-11-000-0141	PRIVATE	0.37	Y	75	75	536,280	206,839	743,119	675,000	120,572	795,572				
50-43-42-03-05-000-0010	PRIVATE	0.6	Y	200	200	976,500	0	976,500	1,000,000	875,242	1,875,242				
MERRAIN ROAD ACCESS			Y		25										
50-43-43-03-06-000-0251	PRIVATE	0.51	Y	100	100	69,660	7,377	77,037	850,000	621,652	1,471,652			1994	1.09
50-43-43-03-06-000-0240	PRIVATE	0.624	Y	100	100	80,214	8,555	88,769	900,000	40,104	940,104				

TABLE F-1: OCEANFRONT PROPERTY VALUES ALONG PALM BEACH ISLAND

PALM BEACH COUNTY PROPERTY NUMBER	DESCRIPTION	Approx. Acres	SEA- WALL	Dist. from 1990 W.L. to Bldg. (FEET)	SHORE LINE (FEET)	1990 VALUATION			1996 VALUATION			TOTAL VALUE (\$)	LAST SALE (\$)	SALE YEAR	Market Value Factor	
						LAND VALUE (\$)	BUILDING VALUE (\$)	TOTAL VALUE (\$)	LAND VALUE (\$)	BUILDING VALUE (\$)	TOTAL VALUE (\$)					
KENLYN ROAD ACCESS			Y													
50-43-43-03-06-000-0011	PRIVATE	0.75	Y		25	78,600	27,283	105,883	1,150,000	61,180	1,211,180					
50-43-43-03-08-000-0261	PRIVATE	0.485	Y		70	553,000	0	553,000	1,100,000	676,329	1,776,329					
50-43-43-03-08-000-0250	PRIVATE	0.526	Y		70	511,000	370,883	881,883	900,000	628,378	1,528,378					
PALMO WAY ACCESS			Y													
50-43-43-03-08-000-0010	PRIVATE	0.984	Y		140	1,022,000	501,196	1,523,196	1,350,000	409,563	1,759,563					
50-43-43-03-04-000-0040	PRIVATE	0.464	Y		90	660,462	179,335	839,797	900,000	201,325	1,101,325					
50-43-43-03-09-000-0191	PRIVATE	0.579	Y		70	783,288	176,850	960,138	1,000,000	47,868	1,047,868					
50-43-43-03-09-000-0241	PRIVATE	0.165	Y		160	9,120	1,350	10,470	3,000	0	3,000					
50-43-43-03-09-000-0203	PRIVATE	0.431	Y		30	15,000	1,860	16,860	40,000	1,860	41,860					
50-43-43-03-09-000-0202	PRIVATE	0.137	Y		40	729,456	262,944	992,400	1,050,000	266,432	1,316,432					
50-43-43-03-09-000-0411	PRIVATE	0.059	Y		45	24,000	2,476	26,476	30,000	2,476	32,476					
50-43-43-03-09-000-0410	PRIVATE	0.519	Y		160	822,800	206,021	1,028,821	869,861	59,478	929,339					
50-43-43-03-09-000-0423	PRIVATE	0.579	Y		70	49,000	31,954	80,954	1,100,000	600,090	1,700,090					
50-43-43-03-10-000-0030	PRIVATE	0.66	Y		125	813,840	252,255	1,066,095	900,000	282,846	1,182,846		915,000	1985		
LA PUERTA WAY ACCESS			Y													
50-43-43-03-10-000-0060	PRIVATE	0.459	Y		95	621,840	188,399	810,239	800,000	174,429	974,429					
50-43-43-03-10-000-0091	PRIVATE	0.384	Y		70	445,320	0	445,320	1,100,000	697,956	1,797,956					
50-43-43-03-10-000-0121	PRIVATE	0.497	Y		90	390,840	792	391,632	400,000	1,000	401,000					
EL PUEBLO WAY ACCESS			Y													
50-43-43-02-01-000-0015	PRIVATE	0.663	Y		40	671,300	0	671,300	950,000	528,361	1,478,361					
50-43-43-02-01-000-0011	PRIVATE	0.075	Y		80	283,500	22,717	306,217	70,000	29,016	99,016					
50-43-43-03-12-000-0012	PRIVATE	0.446	Y		60	686,880	361,996	1,048,876	1,050,000	296,611	1,346,611					
50-43-43-03-12-000-0011	PRIVATE	0.076	Y		40	31,311	0	31,311	30,000	0	30,000					
QUEENS LANE ACCESS			Y													
50-43-43-03-12-000-0013	PRIVATE	0.117	Y		55	46,809	4,772	51,581	35,000	4,772	39,772					
50-43-43-03-12-000-1060	PRIVATE	0.422	Y		40	713,400	426,018	1,139,418	950,000	719,343	1,669,343					
50-43-43-02-00-001-0011	PRIVATE	1.1	Y		250	1,971,620	1,942	1,973,562	2,800,000	1,942	2,801,942					
50-43-43-02-00-001-0020	PRIVATE	1.048	Y		200	2,240,000	678,603	2,918,603	3,700,000	448,715	4,148,715					
50-43-43-03-14-000-0350	PRIVATE	0.686	Y		130	1,349,460	212,449	1,561,909	2,400,000	75,146	2,475,146					
50-43-43-03-14-000-0360	PRIVATE	0.551	Y		120	1,332,800	198,799	1,531,599	2,400,000	59,088	2,459,088					
50-43-43-02-00-001-0030	PRIVATE	0.716	Y		125	1,377,600	618,622	1,996,222	2,400,000	0	2,400,000					
50-43-43-02-00-001-0031	PRIVATE	0.785	Y		105	1,354,640	1,009,539	2,364,179	2,400,000	2,268,701	4,668,701					
VIA MARILA ACCESS			Y													
50-43-43-03-18-000-0011	PRIVATE	0.447	Y		80	1,021,720	349,909	1,371,629	2,000,000	352,390	2,352,390					
50-43-43-03-18-000-0012	PRIVATE	0.421	Y		90	1,010,240	334,137	1,344,377	2,000,000	588,421	2,588,421					
50-43-43-03-20-000-0011	PRIVATE	0.537	Y		105	1,193,920	193,333	1,387,253	2,200,000	188,718	2,388,718		2,700,000	1992		1.95
50-43-43-03-20-000-0012	PRIVATE	1.12	Y		185	2,169,720	955,369	3,125,089	3,900,000	855,654	4,755,654					
50-43-43-03-20-000-0021	PRIVATE	0.621	Y		100	1,148,000	532,521	1,680,521	2,100,000	380,574	2,480,574					
50-43-43-03-20-000-0031	PRIVATE	1.21	Y		210	2,720,760	945,628	3,666,388	4,700,000	728,866	5,428,866					
50-43-43-03-20-000-0640	PRIVATE	0.224	Y		20	65,520	0	65,520	0	65,000	65,000					
50-43-43-10-00-001-0021	PRIVATE	0.832	N	180	120	1,452,500	989,008	2,441,508	2,600,000	717,882	3,317,882					
50-43-43-10-00-001-0023	PRIVATE	0.916	N	200	150	1,785,000	555,534	2,340,534	3,100,000	563,585	3,663,585					
50-43-43-10-00-001-0024	PRIVATE	0.712	N	120	110	1,237,600	1,326,618	2,564,218	2,100,000	0	2,100,000					
50-43-43-10-00-001-0022	PRIVATE	0.858	Y		110	1,355,200	713,398	2,068,598	4,500,000	1,236,998	5,796,998					
50-43-43-10-00-001-0020	PRIVATE	2.4	Y		260	3,080,000	1,906,689	4,986,689	6,000,000	1,658,468	7,658,468					
50-43-43-10-00-001-0025	PRIVATE	1.94	Y		300	2,758,602	1,434,147	4,192,749	4,500,000	837,466	5,337,466					
50-43-43-10-00-001-0040	PALM BEACH COUNTRY CLUB	84.01	Y		1,660	5,125,220	1,743,811	6,869,031	4,032,480	1,931,953	5,964,433					
50-43-43-11-01-000-0030	BEACH CLUB	3.61	Y		340	3,243,940	2,188,822	5,432,762	5,100,000	2,264,295	7,364,295					
50-43-43-11-02-000-0011	PRIVATE	0.436	Y		100	1,050,000	194,807	1,244,807	1,600,000	197,091	1,797,091					

TABLE F-1: OCEANFRONT PROPERTY VALUES ALONG PALM BEACH ISLAND

PALM BEACH COUNTY PROPERTY NUMBER	DESCRIPTION	Approx. Acres	SEA- WALL	Dist. from 1990 W.L. to Bldg. (FEET)	SHORE LINE (FEET)	1990 VALUATION			1996 VALUATION			TOTAL VALUE (\$)	BUILDING VALUE (\$)	LAND VALUE (\$)	TOTAL VALUE (\$)	LAST SALE YEAR	LAST SALE (\$)	Market Value Factor
						LAND VALUE (\$)	BUILDING VALUE (\$)	TOTAL VALUE (\$)	LAND VALUE (\$)	BUILDING VALUE (\$)	TOTAL VALUE (\$)							
50-43-43-11-02-000-0050	PRIVATE	1.06	Y	200	21,556,280	389,993	21,946,273	3,200,000	267,689	3,467,689								
50-43-43-11-00-002-0040	PRIVATE	1.61	Y	190	2,464,000	932,115	3,396,115	4,750,000	2,683,437	7,433,437								
50-43-43-11-00-002-0090	ECKES SCHOOL	2.4	Y	240	3,207,120	2,685,521	5,892,641	6,100,000	3,193,702	9,293,702								
50-43-43-10-05-000-0021	PRIVATE	0.866	Y	150	1,636,680	939,994	2,576,674	3,400,000	665,167	4,065,167								
50-43-43-10-05-000-0032	PRIVATE	0.25	Y	30	358,248	0	358,248	800,000	0	800,000								
50-43-43-10-05-000-0040	PRIVATE	2.22	Y	210	2,743,440	990,816	3,734,256	5,400,000	1,159,697	6,559,697								
50-43-43-10-05-000-0054	PRIVATE	2.08	Y	195	2,576,000	1,032,129	3,608,129	5,400,000	3,361,142	8,761,142								
50-43-43-10-05-000-0053	PRIVATE	0.246	N	25	177,000	0	177,000	42,500	0	42,500								
50-43-43-10-05-000-0052	PRIVATE	3.7	N	210	3,864,000	1,118,074	4,982,074	7,800,000	961,050	8,761,050								
50-43-43-11-00-002-0010	PRIVATE	2.5	Y	295	3,773,840	39,348	3,813,188	7,600,000	4,301,220	11,901,220								
50-43-43-11-00-002-0020	PRIVATE	1.44	Y	150	1,932,000	367,367	2,299,367	4,000,000	217,990	4,217,990								
50-43-43-11-00-002-0070	PRIVATE	7.25	Y	600	8,071,160	5,324,247	13,395,407	11,400,000	5,870,653	17,270,653								
50-43-43-14-16-000-0010	PRIVATE	6.23	Y	474	6,118,000	273,842	6,391,842	13,000,000	12,114,576	25,114,576								
50-43-43-14-00-001-0060	PRIVATE	1.44	Y	150	2,001,552	837,755	2,839,307	3,900,000	1,340,270	5,240,270								
50-43-43-14-00-001-0080	PRIVATE	3.37	Y	233	3,262,000	1,285,766	4,547,766	6,400,000	2,104,629	8,504,629								
50-43-43-14-14-000-0060	PRIVATE	0.795	Y	180	1,646,400	282,145	1,928,545	3,500,000	66,834	3,566,834								
50-43-43-14-14-000-0072	PRIVATE	0.872	Y	195	2,217,600	442,769	2,660,369	3,500,000	0	3,500,000								
50-43-43-14-20-000-0070	PRIVATE	2.41	Y	372	4,381,306	2,884,043	7,265,349	7,400,000	2,317,044	9,717,044								
50-43-43-14-22-000-0050	PRIVATE	0.628	Y	125	1,400,000	816,086	2,216,086	2,500,000	1,740,358	4,240,358								
50-43-43-14-22-000-0060	PRIVATE	0.628	Y	125	1,400,000	897,134	2,297,134	2,500,000	2,088,936	4,588,936								
REACH 2		81.14		13,544	132,329,010	43,523,674	175,852,684	199,332,841	69,521,602	268,854,443								1.33
Average 1996 PRIVATE Land Value = \$/ Ft ²																		
50-43-43-14-19-000-0090	PRIVATE	0.48	Y	113	1,144,181	489,980	1,634,161	2,300,000	632,234	2,932,234								
50-43-43-14-19-000-0080	PRIVATE	0.402	Y	140	1,337,370	0	1,337,370	2,300,000	0	2,300,000								
50-43-43-14-19-000-0070	PRIVATE	0.51	Y	110	1,217,642	359,644	1,577,286	2,300,000	329,833	2,629,833								
50-43-43-14-00-002-0090	PRIVATE	1.34	Y	195	2,234,400	523,509	2,757,909	4,000,000	626,523	4,626,523								
50-43-43-14-17-000-0030	PRIVATE	0.77	Y	195	1,965,600	889,475	2,855,075	2,800,000	610,463	3,410,463								
WELLS ROAD ACCESS																		
50-43-43-14-08-000-0040	PRIVATE	0.45	Y	130	627,960	160,397	788,357	1,000,000	753,562	1,753,562								
50-43-43-14-07-000-0361	PRIVATE	0.84	Y	130	84,960	660,536	745,496	1,500,000	1,436,935	2,936,935								
50-43-43-14-07-000-0371	PRIVATE	0.8	N	235	886,560	414,868	1,301,428	1,500,000	205,113	1,705,113								
DUNBAR ROAD ACCESS																		
50-43-43-14-07-000-0740	PRIVATE	0.37	N	240	1,385,280	1,337,500	2,722,780	2,700,000	964,351	3,664,351								
50-43-43-14-09-000-0190	PRIVATE	0.32	Y	100	627,960	1,638	629,598	850,000	1,057,293	1,907,293								
ATLANTIC AVENUE ACCESS																		
50-43-43-14-26-000-0010	PRIVATE	0.37	Y	25	630,764	594,990	1,225,754	1,000,000	852,522	1,852,522								
50-43-43-14-26-000-0020	PRIVATE	0.34	Y	25	500,168	243,118	743,286	900,000	802,262	1,702,262								
EVERGLADES AVENUE ACCESS																		
50-43-43-14-26-000-0050	PRIVATE	0.23	Y	25	279,378	0	279,378	400,000	642,000	1,042,000								
50-43-43-14-26-000-0061	PRIVATE	0.23	Y	25	256,620	0	256,620	400,000	537,949	937,949								
50-43-43-14-26-000-0040	PRIVATE	0.25	Y	25	281,100	476,687	737,787	400,000	567,582	967,582								
50-43-43-14-26-000-0020	PRIVATE	0.34	Y	55	636,467	473,198	1,109,665	900,000	802,262	1,702,262								
50-43-43-14-10-006-0011	PRIVATE	0.85	Y	160	98,049	0	98,049	1,400,000	1,277	1,401,277								
50-43-43-14-10-006-0013	PRIVATE	0.78	Y	125	68,796	0	68,796	1,400,000	12,475	1,412,475								
50-43-43-14-25	WARDEN HOUSE CONDOMINIUM	1.265	Y	230	1,877,325	625,775	2,503,100			2,429,250								
ROOT TRAIL ACCESS																		
50-43-43-14-23	OCEAN TOWERS CONDOMINIUM	2.02	Y	230	9,438,375	3,146,125	12,584,500			15,637,630								
GRACE TRAIL CONDO ACCESS																		
50-43-43-15-23	NORTH OCEAN CONDOMINIUM	6.7	Y	160	4,854,300	1,618,100	6,472,400			6,934,455								
50-43-43-14-21	SUN AND SURF CONDOMINIUM	3.26	Y	575	53,322,233	17,774,078	71,096,311			94,671,436								

TABLE F-1: OCEANFRONT PROPERTY VALUES ALONG PALM BEACH ISLAND

PALM BEACH COUNTY PROPERTY NUMBER	DESCRIPTION	Approx. Acres	SEA- WALL	Dist. from 1990 W.L. to Bldg. (FEET)	1990 VALUATION			1996 VALUATION			LAST SALE (\$)	SALE YEAR	Market Value Factor
					SHORE LINE (FEET)	LAND VALUE (\$)	BUILDING VALUE (\$)	TOTAL VALUE (\$)	LAND VALUE (\$)	BUILDING VALUE (\$)			
50-43-43-15-11-000-2240	TOWN OF PALM BEACH	0.124	N	180	186,531	0	196,531	200,000	0	200,000			
50-43-43-15-27	PB BILTMORE	0.606	N	200	8,430,945	2,693,181	11,124,126			38,323,287			
50-43-43-23-13	LEVERETT HOUSE	2.64	Y	120	10,625,400	3,541,800	14,167,200			19,573,452			
50-43-43-22-25	TWO NORTH BREAKERS ROW	5.05	N	140	****UNABLE TO OBTAIN VALUES****					105,640,000			
50-43-43-22-02-0000	BREAKERS TRACT 2	4.00	N	80	19,066,872	13,092,790	32,159,662			29,000,000			
50-43-43-22-24-004-0000	BREAKERS TRACT 4 (HOTEL)	9.04	Y	910	15,956,922	31,637,939	47,594,861	20,000,000	23,800,000	43,800,000			
50-43-43-22-24-006-0000	BREAKERS TRACT 5/6	3.68	N	130	8,666,760	213,077	8,879,837			4,439,000			
VIA BETHESDA ACCESS				15									
REACH 3	TOTAL VALUES	48.06		6,008	146,678,918	80,968,405	227,647,323	48,250,000	34,634,636	399,533,146		1.37	
					Average 1996 PRIVATE Land Value =		67	\$ / R ²					
					Average 1996 CONDO Land Value =		87	\$ / R ²					
50-43-43-23-01-000-0190	PRIVATE	1.96	Y	165	1,848,000	1,100,697	2,948,697	2,800,000	1,206,358	4,006,358			
50-43-43-23-01-000-0180	PRIVATE	1.83	Y	180	1,982,400	1,247,315	3,229,715	2,800,000	1,252,157	4,052,157			
50-43-43-22-05-000-0330	TOWN OF PB - CLARK AVE	2.31	N	120	732,000	0	732,000	750,000	0	750,000			
50-43-43-22-05-000-0320	PRIVATE	1.46	Y	50	50,000	0	50,000	60,000	0	60,000			
50-43-43-22-06-000-2200	PRIVATE	0.66	Y	125	1,065,000	1,130,935	2,195,935	2,000,000	604,447	2,604,447			
50-43-43-22-07-000-5290	PRIVATE	0.68	Y	335	345,600	0	345,600	250,000	0	250,000			
50-43-43-22-07-000-5271	PRIVATE	0.676	Y	135	1,057,800	438,823	1,496,623	1,100,000	88,047	1,188,047			
50-43-43-22-08-000-8260	PRIVATE	0.733	Y	100	114,000	0	114,000	1,250,000	1,036,907	2,286,907			
50-43-43-23-00-004-0100	PRIVATE	0.44	Y	125	148,890	391	149,281	900,000	211,188	1,111,188			
50-43-43-23-00-004-0060	PRIVATE	0.88	Y	120	1,083,240	611,743	1,694,983	1,400,000	606,246	2,006,246			
50-43-43-23-00-004-0110	PRIVATE	0.417	Y	65	784,720	204,236	988,956	1,000,000	205,002	1,205,002			
50-43-43-26-00-001-0170	TOWN OF P B PUBLIC BEACH	7.9	Y	1,930	131,600	41,167	172,767	200,000	0	200,000	1,070,000	1988	
50-43-43-26-00-001-0010	TOWN OF P B PUBLIC BEACH	0.06	Y	60	65,800	0	65,800	100,000	0	100,000			
50-43-43-26-00-001-0010	TOWN OF P B PUBLIC BEACH	4.01	Y	740	65,800	0	65,800	100,000	0	100,000			
50-43-43-26-03-000-0012	PRIVATE	0.321	Y	100	667,800	106,817	774,617	800,000	164,717	964,717			
50-43-43-26-03-000-0011	PRIVATE	0.642	Y	150	1,090,740	307,134	1,397,874	1,600,000	217,688	1,817,688			
50-43-43-26-03-000-0030	PRIVATE	0.62	Y	100	742,000	984,582	1,726,582	1,300,000	1,242,472	2,542,472			
50-43-43-26-03-000-0040	PRIVATE	0.62	Y	100	742,000	367,896	1,109,896	1,275,000	841,173	2,116,173			
50-43-43-26-03-000-0050	PRIVATE	0.62	Y	100	742,000	201,727	943,727	1,275,000	19,166	1,294,166			
50-43-43-26-03-000-0060	PRIVATE	0.62	Y	100	742,000	381,305	1,123,305	1,275,000	420,154	1,695,154			
50-43-43-26-03-000-0070	PRIVATE	1.61	Y	220	1,484,000	1,005,547	2,489,547	3,000,000	1,501,394	4,501,394			
50-43-43-26-03-000-0091	PRIVATE	0.42	Y	95	742,000	806,038	1,548,038	1,200,000	1,022,971	2,222,971			
50-43-43-26-03-000-0100	PRIVATE	0.916	Y	190	1,484,000	581,953	2,065,953	2,500,000	45,026	2,545,026			
50-43-43-26-00-002-0010	PRIVATE	0.757	Y	150	1,113,000	307,330	1,420,330	1,900,000	1,954,021	3,854,021			
50-43-43-27-05-000-0012	PRIVATE	0.878	Y	180	1,132,100	0	1,132,100	1,900,000	1,532,681	3,432,681			
50-43-43-27-05-000-0020	PRIVATE	0.918	Y	170	1,270,500	552,007	1,822,507	1,900,000	1,600,000	3,500,000			
50-43-43-27-05-000-0191	PRIVATE	0.86	Y	160	1,270,500	609,745	1,880,245	1,900,000	1,500,000	3,400,000			
50-43-43-27-05-000-0200	PRIVATE	0.895	Y	165	1,270,500	603,187	1,873,687	1,900,000	1,400,000	3,300,000			
50-43-43-26-00-002-0020	PRIVATE	0.918	Y	160	1,232,537	1,123,537	2,355,537	2,250,000	1,287,814	3,537,814			
50-43-43-26-00-002-0050	PRIVATE	0.896	Y	190	1,354,080	441,723	1,795,803	2,250,000	425,784	2,675,784			
50-43-43-26-00-002-0080	PRIVATE	0.896	Y	200	1,354,080	1,092,812	2,446,892	2,250,000	1,238,152	3,488,152			
50-43-43-26-00-002-0010	PRIVATE	0.74	Y	325	1,113,000	307,330	1,420,330	1,900,000	1,532,681	3,432,681			
50-43-43-26-00-002-0170	PRIVATE	0.61	Y	110	854,700	332,295	1,186,995	1,300,000	462,868	1,762,868			
50-43-43-26-00-002-0190	PRIVATE	1.95	Y	90	654,500	11,089	665,589	3,700,000	1,379,005	5,079,005			
50-43-43-26-00-002-0470	PRIVATE	1.42	Y	300	1,694,000	1,303,638	2,997,638	2,700,000	2,036,953	4,736,953			
50-43-43-35-00-001-0370	PRIVATE	3.9	Y	270	1,729,608	2,213,554	3,943,162	4,500,000	4,568,005	9,068,005			
50-43-43-35-00-001-0040	PRIVATE	2.6	Y	300	2,012,400	1,864,664	3,877,064	3,900,000	3,077,479	6,977,479			
50-43-43-35-00-001-0080	PRIVATE	1.02	Y	165	936,000	381,645	1,317,645	1,800,000	364,090	2,164,090			
50-43-43-35-00-001-0100	PRIVATE	0.72	Y	130	936,000	723,168	1,659,168	1,700,000	584,219	2,284,219			

TABLE F-1: OCEANFRONT PROPERTY VALUES ALONG PALM BEACH ISLAND

PALM BEACH COUNTY PROPERTY NUMBER	DESCRIPTION	Approx. Acres	SEA- WALL	Dist. from 1990 W.L. to Bldg. (FEET)	1990 VALUATION			1996 VALUATION			LAST SALE (\$)	SALE YEAR	Market Value Factor
					LAND VALUE (\$)	BUILDING VALUE (\$)	TOTAL VALUE (\$)	LAND VALUE (\$)	BUILDING VALUE (\$)	TOTAL VALUE (\$)			
50-43-43-35-00-001-0150	PRIVATE	1.14	Y	150	1,029,600	1,013,844	2,043,444	2,100,000	1,065,038	3,165,038			
50-43-43-35-00-001-0200	PRIVATE	0.96	Y	140	1,029,600	432,229	1,461,829	2,200,000	122,367	2,322,367			
50-43-43-35-00-001-0220	PRIVATE	3.86	Y	350	1,714,080	2,000,570	3,714,650	2,700,000	1,478,102	4,178,102			
50-43-43-35-02-000-0220	PRIVATE	0.39	Y	100	589,440	409,412	998,852	950,000	280,904	1,230,904			
REACH 4					56.73	25,242,085	67,423,163	74,835,000	38,575,266	113,210,266		avg. = 1.58	
					Average 1996 PRIVATE Land Value = 41			\$ / ft ²					
50-43-43-35-02-000-0232	PRIVATE	0.735	Y	60	528,000	195,434	723,434	925,000	31,856	956,856			
50-43-43-35-03-000-0030	PRIVATE	0.07	Y	75	2,086,200	138,120	2,224,320	1,500,000	1,500,000	3,000,000			
50-43-43-35-03-000-0010	PRIVATE	0.705	Y	265	1,500,000	1,890,484	3,390,484	2,600,000	1,313,856	3,913,856			
50-43-43-35-03-000-0020	PRIVATE	0.64	Y	260	1,764,048	230,554	1,994,602	1,500,000	0	1,500,000			
50-43-43-35-00-001-0250	PRIVATE	0.784	Y	160	967,200	1,250,480	2,217,680	2,000,000	1,475,321	3,475,321			
50-43-43-35-00-001-0300	PRIVATE	0.234	Y	170	538,560	91,349	629,909	540,000	58,195	598,195			
50-43-43-35-00-001-0360	PRIVATE	1.291	Y	150	1,557,552	994,451	2,552,003	1,900,000	695,649	2,595,649			
50-43-43-35-00-002-0010	PRIVATE	0.193	Y	170	855,015	112,940	967,955	900,000	92,093	992,093			
50-43-43-35-00-002-0090	PRIVATE	0.2	Y	190	555,000	133,162	688,162	1,100,000	90,810	1,190,810			
50-43-43-35-00-002-0120	PRIVATE	0.55	Y	150	900,000	404,081	1,304,081	2,000,000	639,717	2,639,717			
50-43-43-35-00-002-0140	PRIVATE	0.29	Y	120	1,410,000	42,080	1,452,080	1,100,000	5,938	1,105,938			
50-43-43-35-00-002-0150	PRIVATE	0.298	Y	100	684,000	686,976	1,370,976	900,000	574,119	1,474,119			
50-43-43-35-00-002-0430	PRIVATE	0.3	Y	100	684,000	483,145	1,167,145	1,200,000	895,430	2,095,430			
50-43-43-35-00-002-0370	PRIVATE	0.482	Y	150	1,060,200	638,565	1,698,765	1,800,000	655,170	2,455,170			
50-43-43-35-00-002-0300	PRIVATE	0.45	Y	140	957,600	576,464	1,534,064	1,715,000	777,310	2,492,310			
50-43-43-35-05-000-0240	PRIVATE	0.475	Y	160	991,800	1,165,032	2,156,832	1,750,000	1,509,263	3,258,263			
50-43-43-35-05-000-0240	PRIVATE	0.477	Y	155	1,026,000	1,027,679	2,053,679	1,750,000	1,251,152	3,001,152			
50-43-43-35-00-002-0391	PRIVATE	0.16	Y	45	277,020	0	277,020	277,000	0	277,000			
50-43-43-35-00-002-0390	PRIVATE	17.48	Y	360	9,352,894	4,645,181	13,998,075	12,000,000	3,623,453	15,623,453	12,000,000	1995	
50-43-43-35-00-002-0392	BATH & TENNIS CLUB	0.132	N	50	362,520	0	362,520	360,000	0	360,000			
50-43-43-35-00-002-0400	BATH & TENNIS CLUB	9.54	N	80	1,053,360	31,694	1,085,054	1,000,000	0	1,000,000			
50-43-43-35-06-000-0010	BATH & TENNIS CLUB	2.16	N	75	7,143,834	3,860,660	11,004,494	10,600,000	3,686,634	14,286,634			
50-43-43-35-00-002-0410	PRIVATE	2.17	N	65	2,471,040	859,017	3,324,057	5,220,000	1,674,617	6,894,617			
50-43-44-02-09-000-0030	PRIVATE	2.01	N	175	1,953,000	75,139	2,028,139	4,350,000	68,716	4,418,716			
50-43-44-02-00-001-0051	PRIVATE	5.16	N	300	2,713,200	802,965	3,516,165	7,400,000	0	7,400,000			
50-43-44-02-00-001-0022	PRIVATE	3.72	N	275	2,741,760	244,969	2,986,629	6,700,000	29,490	6,729,490			
50-43-44-02-10-000-0010	PRIVATE	2.25	N	250	1,808,800	2,311,975	4,120,775	3,800,000	1,428,047	5,228,047			
50-43-44-02-10-000-0020	PRIVATE	2.04	N	215	1,808,800	1,218,977	3,027,777	3,800,000	317,619	4,117,619			
50-43-44-02-10-000-0030	PRIVATE	1.98	N	210	1,808,800	0	1,808,800	3,800,000	977,607	4,777,607			
50-43-44-02-00-001-0040	PRIVATE	4.36	Y	295	2,501,856	374,061	2,875,917	6,500,000	4,198,670	10,698,670	5,100,000	1989	
50-43-44-02-00-001-0052	PRIVATE	9.77	Y	815	11,300,800	2,291,323	13,592,123	16,400,000	19,581,740	35,981,740			
50-43-44-02-01-000-0010	PRIVATE	2.21	N	250	1,904,000	771,365	2,675,365	4,400,000	3,953,061	8,353,061			
50-43-44-02-01-000-0090	PRIVATE	1.85	Y	85	972,230	10,335	982,565	3,800,000	10,335	3,810,335			
50-43-44-02-01-000-0151	PRIVATE	1.87	Y	250	2,048,466	172,780	2,221,246	3,800,000	4,582,603	8,382,603			
50-43-44-02-01-000-0211	PRIVATE	1.49	N	210	2,446,360	0	2,446,360	3,200,000	2,747,878	5,947,878			
REACH 5					78.53	72,733,915	27,725,337	100,459,252	122,587,000	58,445,349		avg. = 1.77	
					Average 1996 PRIVATE Land Value = 46			\$ / ft ²					
50-43-44-02-00-002-0050	PRIVATE	2.15	N	190	1,904,000	392,619	2,296,619	4,300,000	287,404	4,587,404			
50-43-44-02-00-002-0070	PRIVATE	1.47	Y	155	1,213,800	582,177	1,795,977	2,175,000	2,000,814	4,175,814			
50-43-44-02-00-002-0030	PRIVATE	5	Y	340	3,216,780	7,204,535	10,421,315	6,000,000	4,141,967	14,563,282			
50-43-44-02-00-002-0040	PRIVATE	1.94	Y	130	1,424,500	900,312	2,324,812	2,300,000	1,741,870	4,041,870			
50-43-44-02-00-000-0010	PRIVATE	0.44	Y	30	693,000	171,446	864,446	696,500	491,868	1,188,368			
50-43-44-02-02-000-0020	PRIVATE	0.34	Y	30	263,200	62,765	325,965	300,000	198,021	498,021			

TABLE F-1: OCEANFRONT PROPERTY VALUES ALONG PALM BEACH ISLAND

PALM BEACH COUNTY PROPERTY NUMBER	DESCRIPTION	Approx. Acres	SEA- WALL	Dist. from 1990 W.L. to Bldg. (FEET)	SHORE LINE (FEET)	1990 VALUATION				1996 VALUATION				LAST SALE YEAR	LAST SALE (\$)	Market Value Factor
						LAND VALUE (\$)	BUILDING VALUE (\$)	TOTAL VALUE (\$)	LAND VALUE (\$)	BUILDING VALUE (\$)	TOTAL VALUE (\$)	LAND VALUE (\$)	BUILDING VALUE (\$)			
50-43-44-02-02-000-0030	PRIVATE	0.34	Y		20	255,304	143,575	398,879	300,000	172,336	472,336					
50-43-44-02-02-000-0040	PRIVATE	0.46	Y		35	907,200	176,408	1,083,608	911,000	6,990	917,990			961,000	1996	1.05
50-43-44-02-02-000-0050	PRIVATE	0.46	Y		25	907,200	161,822	1,069,022	911,000	131,635	1,042,635					
50-43-44-02-02-000-0060	PRIVATE	0.34	Y		35	255,304	211,732	467,036	300,000	298,903	598,903					
50-43-44-02-02-000-0070	PRIVATE	0.34	Y		25	263,200	122,674	385,874	300,000	260,729	560,729					
50-43-44-02-02-000-0080	PRIVATE	0.47	Y		35	693,000	158,939	851,939	696,500	142,779	839,279					
50-43-44-02-04-000-0012	PRIVATE	0.32	Y		15	268,121	203,163	471,284	400,000	866,615	1,266,615					
50-43-44-02-04-000-0011	PRIVATE	1.54	Y		100	689,500	551,988	1,241,488	1,200,000	1,094,691	2,294,691					
50-43-44-02-04-000-0021	PRIVATE	0.33	Y		30	518,021	638,179	1,156,200	520,000	116,918	636,918					
50-43-44-02-04-000-0022	PRIVATE	0.35	Y		40	511,161	180,317	691,478	515,000	140,627	655,627					
50-43-44-02-04-000-0014	PRIVATE	0.27	Y		15	185,101	363,779	548,880	275,000	480,438	755,438					
50-43-44-02-04-000-0013	PRIVATE	0.39	Y		10	185,101	325,891	510,992	300,000	331,322	631,322					
50-43-44-02-04-000-0090	PRIVATE	0.29	Y		15	861	0	861	1,500	0	1,500					
50-43-44-02-04-000-0080	PRIVATE	0.29	Y		15	861	0	861	1,500	0	1,500					
50-43-44-02-04-000-0070	PRIVATE	0.36	Y		20	861	0	861	1,500	0	1,500					
50-43-44-02-04-000-0060	PRIVATE	0.5	Y		10	861	0	861	1,500	0	1,500					
EASEMENT		0.06	Y		15											
50-43-44-02-04-000-0050	PRIVATE	0.36	Y		10	861	0	861	1,500	0	1,500					
50-43-44-02-04-000-0040	PRIVATE	0.35	Y		15	861	0	861	1,500	0	1,500					
50-43-44-02-04-000-0030	PRIVATE	0.34	Y		80	2,590	870	3,460	600,000	717,881	1,317,881					
50-43-44-02-02-002-0090	PRIVATE	2.76	Y		200	2,072,000	666,559	2,738,559	3,600,000	0	3,600,000					
50-43-44-02-00-002-0010	PRIVATE	1.83	Y		145	2,343,600	640,830	2,984,430	2,700,000	0	2,700,000					
50-43-44-02-00-002-0080	PRIVATE	1.89	Y		150	1,554,000	2,952,077	4,506,077	2,700,000	2,466,867	5,166,867					
50-43-44-02-00-002-0110	PRIVATE	1.79	Y		50	466,200	0	466,200	950,000	0	950,000					
50-43-44-11-00-001-0080	PRIVATE	0.69	Y		50	518,000	0	518,000	500,000	0	500,000					
50-43-44-11-00-001-0010	PRIVATE	0.89	Y		140	1,554,000	1,816,185	3,370,185	2,700,000	1,943,621	4,643,621					
50-43-44-11-00-001-0030	PRIVATE	0.87	Y		25	163,800	0	163,800	200,000	0	200,000					
50-43-44-11-03-000-1003	PRIVATE	0.47	Y		35	464,100	157,255	621,355	1,100,000	47,002	1,147,002					
50-43-44-11-03-000-1004	PRIVATE	0.57	Y		70	627,900	251,359	879,259	1,000,000	435,056	1,435,056			1,700,000	1995	1.18
50-43-44-11-01-000-0040	PRIVATE	2.82	Y		70	627,900	792,456	1,420,356	1,000,000	1,089,279	2,089,279					
50-43-44-11-03-000-1011	PRIVATE		Y		65	1,020,110	243,349	1,263,459	1,500,000	71,701	1,571,701					
50-43-44-11-01-000-0011	PRIVATE		Y		70	349,578	7,320	356,898	500,000	0	500,000					
50-43-44-11-01-000-0052	PRIVATE		Y		65	840	0	840	1,000	0	1,000					
50-43-44-11-01-000-0070	PRIVATE		Y		65	627,900	411,030	1,038,930	1,000,000	346,331	1,346,331					
50-43-44-11-02-000-0010	PRIVATE		Y		125	546,000	269,563	815,563	1,000,000	510,324	1,510,324					
50-43-44-11-02-000-0090	PRIVATE		Y		115	840	730	1,570	2,000	0	2,000					
50-43-44-11-03-000-1041	PRIVATE	0.54	Y		100	546,000	201,931	747,931	1,000,000	535,004	1,535,004					
50-43-44-11-03-000-1051	PRIVATE	0.54	Y		65	860,950	616,498	1,477,428	1,300,000	602,127	1,902,127			2,390,000	1989	1.62
50-43-44-11-03-000-1052	PRIVATE	0.5	Y		60	546,000	628,961	1,174,961	1,000,000	374,943	1,374,943					
50-43-44-11-03-000-1061	PRIVATE	1.38	Y		180	1,739,500	482,988	2,222,488	2,800,000	150,935	2,950,935					
50-43-44-11-00-001-0040	PRIVATE	3.13	Y		300	2,663,800	1,355,868	4,039,668	4,800,000	2,158,463	6,958,463					
50-43-44-11-00-001-0050	PRIVATE	2.72	Y		300	2,648,016	931,812	3,579,828	4,800,000	2,590,113	7,390,113					
50-43-44-11-00-001-0060	PRIVATE	3.06	Y		320	2,821,966	1,446,263	4,268,229	5,300,000	1,776,911	7,076,911					
50-43-44-11-00-001-0070	PRIVATE	2.54	Y		300	2,415,420	669,700	3,085,120	5,270,000	414,972	5,684,972					
50-43-44-11-00-002-0010	PRIVATE	3.76	Y		390	3,180,800	1,939,527	5,120,327	6,200,000	511,027	6,711,027					
50-43-44-11-00-002-0060	PRIVATE	1.74	Y		190	1,824,984	4,498	1,829,482	2,900,000	6,003	2,906,003					
50-43-44-11-00-002-0020	PRIVATE	1.12	Y		120	1,232,560	437,396	1,669,956	2,000,000	308,195	2,308,195					
50-43-44-11-00-002-0030	PRIVATE	1.68	Y		185	1,874,600	414,238	2,288,838	2,610,000	306,203	2,916,203					
50-43-44-11-00-002-0050	PRIVATE	2.68	Y		190	2,732,800	2,368,861	5,101,661	4,800,000	1,838,771	6,638,771					
50-43-44-11-03-000-1070	PRIVATE	1.84	Y		200	1,988,000	1,501,892	3,489,892	3,200,000	1,741,220	4,941,220			3,740,000	1987	1.07

TABLE F-1: OCEANFRONT PROPERTY VALUES ALONG PALM BEACH ISLAND

PALM BEACH COUNTY PROPERTY NUMBER	DESCRIPTION	Approx. Acres	SEA- WALL	Dist. from 1990 W.L. to Bldg. (FEET)	1980 VALUATION			1996 VALUATION			TOTAL VALUE (\$)	LAST SALE (\$)	SALE YEAR	Market Value Factor
					LAND VALUE (\$)	BUILDING VALUE (\$)	TOTAL VALUE (\$)	LAND VALUE (\$)	BUILDING VALUE (\$)	TOTAL VALUE (\$)				
REACH 6														
50-43-44-11-03-000-1080	PRIVATE	2.57	Y	280	2,451,204	1,832,824	4,284,028	91,442,000	33,848,878	125,290,878			1.23	
50-43-44-11-03-000-1091	PRIVATE	2.24	Y	135	1,491,000	0	1,491,000	4,384,000	0	4,384,000				
50-43-44-11-03-110-0000	SLOANS CURVE TOWNHOUSES	1.12	N	165	***UNABLE TO OBTAIN VALUE***			1,500,000	0	1,500,000				
50-43-44-11-05	2000 CONDO SLOANS CURVE	6.7	N	185	37,786,275	12,595,425	50,381,700			50,157,600				
50-43-44-14-02	2100 CONDO SLOANS CURVE	6.7	N	200	37,326,300	12,442,100	49,768,400			52,807,200				
50-43-44-11-03-000-1201	TOWN OF P B PHIPPS PARK	15.98	N	170	6,768,000	126,360	6,894,360	20,000,000	352,152	20,352,152				
50-43-44-14-01	THE REEF CONDO	4.04	N	160	10,873,500	3,624,500	14,498,000			16,268,200				
50-43-44-14-04	2295 S. OCEAN BLVD (HARBOR HOUSE)	4.04	Y	340	***UNABLE TO OBTAIN VALUE***					22,137,425				
50-43-44-11-03-000-1291	SEA LORD HOTEL		Y	100	564,000	572,474	1,136,474	660,000	432,132	1,092,132				
REACH 7														
50-43-44-14-03-000-0010	TRES DIVIDAS OF PALM BEACH	3.9	N	150	125	63,097	63,222	125	60,133	60,258				
50-43-44-11-03-000-1321	TPB - GOLF COURSE (PAR 3)	237.43	N	115	2,054,000	57,873	2,111,873	1,284,000	121,453	1,385,453				
50-43-44-23-07-000	2500 SOUTH OCEAN BLVD COND	6.55	N	160	17,057,100	5,685,700	22,742,800			24,005,100				
50-43-44-11-03-000-1451	2545 SOUTH OCEAN BLVD	2.4	N	135	703,500	0	703,500	703,500	0	703,500				
50-43-44-11-04	PALM BEACH WHITE HOUSE 3	0.86	N	140	3,012,450	1,004,150	4,016,600			2,898,800				
50-43-44-23-09	PALM BEACH STRATFORD	3.24	N	175	10,973,625	3,657,875	14,631,500			19,227,338				
50-43-44-23-06	OCEAN COVE (2600 CONDO)	4.45	N	175	14,154,675	4,718,225	18,872,900			27,175,568				
50-43-44-23-08	OCEAN POINT	8.88	N	200	27,280,500	9,093,500	36,374,000			51,624,350				
TOTAL VALUES					172,496,254	55,474,103	227,970,357	28,511,625	965,870	322,594,527				
					Average 1996 CONDO Land Value = \$ / ft ² 66									
50-43-44-23-13	AMBASSADOR HOTEL	2.53	N	170	4,257,825	1,419,275	5,677,100			5,794,425				
50-43-44-23-00-002-0020	2770 SOUTH OCEAN BLVD.	4.11	N	175	3,819,000	0	3,819,000			31,995,000				
50-43-44-23-11	AMBASSADOR SOUTH COOP	6.56	N	280	9,475,200	3,158,400	12,633,600			12,959,566				
50-43-44-23-00-002-0081	OUTDR/REC PARK	0.19	N	200	2,814,000	0	2,814,000	2,814,000	23,960	2,837,960				
50-43-44-23-10	SUTTON PLACE EASEMENT	3.72	N	150	1,000	0	1,000	1,000	0	1,000				
50-43-44-23-12	AMBASSADOR II COOP	7.4	N	290	9,136,819	3,045,606	12,182,425			9,970,834				
50-43-44-23-00-002-0120	OCEAN GRAND HOTEL	7.4	N	180	5,092,000	0	5,092,000	5,092,000	16,945,116	22,037,116				
50-43-44-23-00-002-0160	HILTON	2.33	Y	200	4,080,000	3,711,734	7,791,734	4,080,000	3,572,555	7,652,555	6,000,000	1993		
50-43-44-23-14	PALM WORTH INC COOP	6.29	N	160	3,007,875	1,002,625	4,010,500			3,795,922				
50-43-44-23-00-002-0200	PBC - KREUSLER PARK	6.29	N	160	4,581,000	63,961	4,644,961	4,581,000	49,871	4,630,871				
LAKE WORTH														
38-43-44-26-00-001-0010	LAKE WORTH MUN. BEACH	0.6	Y	410	1,240,800	928,315	2,169,115	1,240,800	785,296	2,026,096				
38-43-44-26-00-001-0020	LAKE WORTH MUN. BEACH	0.3	Y	990	3,722,400	504,626	4,227,026	3,722,400	477,462	4,199,862				
TOWN OF PALM BEACH														
50-43-44-26-00-001-0050	BEACHCOMBER	4.13	N	175	2,814,000	391,074	3,205,074	2,814,000	473,953	3,287,953				
50-43-44-26-10	PALM BEACHER APTS. INC	5.7	Y	100	2,249,550	749,850	2,999,400			3,531,378				
50-43-44-26-09	PALM BEACH HAMPTON	4.25	N	200	810,000	270,000	1,080,000			58,659,542				
50-43-44-26-07	OASIS III OF PALM BEACH	4.23	Y	340	8,742,825	2,914,275	11,657,100			14,336,209				
50-43-44-26-05	CARLTON PLACE	4.23	N	430	12,800,025	4,266,675	17,066,700			26,646,719				
50-43-44-26-08	ENCLAVE OF PALM BEACH	3.41	N	170	20,010,375	6,670,125	26,680,500			31,440,348				
50-43-44-26-02	PATRICIANS OF PALM BEACH	3.41	N	280	7,023,450	2,341,150	9,364,600			9,200,258				
50-43-44-26-01	LA RENAISSANCE #1	2.27	N	80	4,565,400	1,521,800	6,087,200			7,393,557				
50-43-44-26-03	DORCHESTER OF PALM BEACH	4.67	N	120	13,009,650	4,336,550	17,346,200			19,529,624				
50-43-44-26-04	MERIDIAN OF PALM BEACH	6.31	N	130	13,971,300	4,657,100	18,628,400			15,038,248				
50-43-44-35-19	ATRIUM OF PALM BEACH II	6.98	N	70	16,681,875	5,560,625	22,242,500			26,873,172				
50-43-44-35-24	EMERAUDE CONDO	1.82	N	110	4,648,425	1,549,475	6,197,900			9,950,290				
50-43-44-35-13	ATRIUMS OF PALM BEACH	7.23	N	600	17,485,050	5,828,350	23,313,400			31,634,811				

TABLE F-1: OCEANFRONT PROPERTY VALUES ALONG PALM BEACH ISLAND

PALM BEACH COUNTY PROPERTY NUMBER	DESCRIPTION	Approx. Acres	SEA- WALL	Dist. from 1990 W.L. to Bldg. (FEET)	SHORE LINE (FEET)	1990 VALUATION			1996 VALUATION			LAST SALE (\$)	SALE YEAR	Market Value Factor	
						LAND VALUE (\$)	BUILDING VALUE (\$)	TOTAL VALUE (\$)	LAND VALUE (\$)	BUILDING VALUE (\$)	TOTAL VALUE (\$)				
50-43-44-35-18	HALCYON OF PALM BEACH	6.27	N	100	500	17,447,625	5,815,875	23,263,500			26,322,210				
50-43-44-35-03	PATRICIAN OF PALM BEACH		Y	275		4,443,300	13,329,900	17,773,200			16,347,506				
50-43-44-35-05	PATRICIAN TOWERS #1		Y	175		5,488,200	1,829,400	7,317,600			6,177,200				
50-43-44-35-05-001-0010	RECREATIONAL AREA		Y	100		125	223,584	223,709	125	152,449	152,574				
50-43-44-35-02	LA BONNE VIE		Y	265		7,598,700	2,532,900	10,131,600			12,871,695				
REACH 8	TOTAL VALUES	91.30		10715		211,017,794	78,623,250	289,641,044	24,345,325	22,480,662	427,294,601				
						Average 1996 CONDO Land Value =			44	\$ / ft ²					
SOUTH PALM BEACH															
62-43-44-35-00-002-0110	PRIVATE	0.08	Y	90		355,320	107,362	462,682	450,000	16,440	466,440	100			
62-43-44-35-00-002-0080	PRIVATE	0.08	Y	90		319,788	98,926	418,714	475,000	61,831	536,831	100			
62-43-44-35-00-002-0060	PRIVATE	0.07	Y	90		341,107	88,392	429,499	500,000	96,631	596,631	550,000	1982		1.28
62-43-44-35-04	PALM SEA CONDO		Y	280		***UNABLE TO OBTAIN VALUE***					11,549,500				
62-43-44-35-04	LE CHATEAU ROYAL CONDO		Y	180		***UNABLE TO OBTAIN VALUE***					9,552,400				
62-43-44-35-12	PATRICIAN (BARCLAY)		Y	380		***UNABLE TO OBTAIN VALUE***					28,461,600				
62-43-44-35-25	3560 CONDO (CONCORDIA EAS	5.52	N	80		***UNABLE TO OBTAIN VALUE***					15,898,400				
62-43-44-35-29	TUSCANY OF PALM BEACH	2.18	Y	200		***UNABLE TO OBTAIN VALUE***					7,473,025				
62-43-44-35-00-002-0190	PRIVATE	0.8	Y	100		1,718,772	630,772	2,349,544	1,000,000	497,315	1,497,315	3,200,000	1996		1.36
62-43-44-35-01	HORIZONS EAST CONDO		Y	100		***UNABLE TO OBTAIN VALUE***					4,291,700				
62-43-44-35-10	MAYFAIR HOUSE CONDO	2.76	Y	300		***UNABLE TO OBTAIN VALUE***					21,041,000				
62-43-44-35-00-002-0140	3600 SOUTH OCEAN CONDO		Y	150		1,250,016	0	1,250,016			8,691,000				
62-43-44-35-22	DUNE DECK OF PLM BEACHES	1.95	N	80		***UNABLE TO OBTAIN VALUE***					9,442,300				
62-43-44-35-17	LA PENSEE CONDO	0.71	N	100		***UNABLE TO OBTAIN VALUE***					5,703,600				
62-43-44-35-26	PALM BEACH WINDEMERE	0.75	N	75		***UNABLE TO OBTAIN VALUE***					2,344,200				
62-43-45-02-03	IMPERIAL HOUSE CONDO	1.09	N	120		2,211,975	737,325	2,949,300			3,585,825				
LANTANA															
40-43-45-02-00-001-0010	LANTANA PUBLIC BEACH	0.07	N	110		4,305,351	4,305,351	8,610,702	836,352	77,722	914,074				
REACH 9	TOTAL VALUES	16.06		3,324		10,502,329	5,968,128	16,470,457	3,261,352	749,939	132,045,841			avg. =	1.32
						Average 1996 PRIVATE Land Value =			35	\$ / ft ²					
						Average 1996 CONDO Land Value =			50	\$ / ft ²					
40-43-45-02-00-001-0020	LANTANA PUBLIC BEACH	0.69	N	100		240,451	0	240,451	240,451	0	240,451				
LANTANA AVENUE ACCESS			N	30											
MANALAPAN															
42-43-45-02-00-001-0021	RITZ-CARLTON	6.86	Y	690		4,246,540	0	4,246,540	8,100,000	26,300,730	34,400,730	12,000,000	1988		2.83
42-43-45-02-04	LA CONQUILL CLUB VILLAS	3.22	Y	380		7,516,200	2,505,400	10,021,600			11,930,125				
42-43-45-02-05	LA CONQUILL CLUB VILLAS II	2.4	Y	293		5,472,300	1,824,100	7,296,400			8,690,125				
42-43-45-02-01-000-0013	PRIVATE	0.57	Y	60		483,912	631,666	1,115,578	725,000	794,158	1,519,158	1,750,000	1988		1.57
42-43-45-02-01-000-0011	PRIVATE	0.45	Y	160		650,642	554,073	1,204,715	675,000	900,750	1,575,750	2,100,000	1991		1.74
42-43-45-02-01-000-0014	PRIVATE	0.38	Y	75		549,900	0	549,900	675,000	1,169,548	1,844,548	2,250,000	1992		
42-43-45-02-01-000-0022	PRIVATE	1.24	Y	150		879,840	0	879,840	1,950,000	0	1,950,000	3,200,000	1989		
42-43-45-02-01-000-0021	PRIVATE	1.87	Y	239		1,407,744	0	1,407,744	2,800,000	0	2,800,000	3,200,000	1989		1.14
42-43-45-02-01-000-0040	PRIVATE	3.57	Y	420		2,492,880	0	2,492,880	5,400,000	0	5,400,000	100			
42-43-45-02-01-000-0061	PRIVATE	1.92	Y	210		1,319,760	723,013	2,042,773	2,900,000	529,392	3,429,392	3,500,000	1992		1.71
42-43-45-02-01-000-0071	PRIVATE		Y	150		879,840	330,715	1,210,555	2,050,000	268,150	2,338,150				
42-43-45-02-01-000-0081	PRIVATE		Y	150		879,840	244,709	1,124,549	2,025,000	60,393	2,085,393	100			
42-43-45-02-01-000-0082	PRIVATE	1.24	Y	150		879,840	896,999	1,776,839	2,025,000	1,132,617	3,157,617	3,500,000	1994		1.11
42-43-45-02-01-000-0092	PRIVATE		Y	150		879,840	717,942	1,597,782	2,050,000	703,778	2,753,778	3,500,000	1979		
42-43-45-02-01-000-0101	PRIVATE		Y	150		879,840	0	879,840	2,050,000	2,095,579	4,145,579	1,750,000	1991		1.99
42-43-45-02-01-000-0113	PRIVATE		Y	156		879,840	168,505	1,048,345	2,050,000	81,909	1,900,000	1,900,000	1988		1.81
42-43-45-02-01-000-0111	PRIVATE		Y	250		1,466,400	21,312	1,487,712	3,400,000	3,640,366	7,040,366	4,000,000	1990		

TABLE F-1: OCEANFRONT PROPERTY VALUES ALONG PALM BEACH ISLAND

PALM BEACH COUNTY PROPERTY NUMBER	DESCRIPTION	Approx. Acres	SEA- WALL	Dist. from 1990 W.L. to Bldg. (FEET)	SHORE LINE (FEET)	1990 VALUATION			1996 VALUATION			TOTAL VALUE (\$)	BUILDING VALUE (\$)	LAND VALUE (\$)	LAST SALE (\$)	SALE YEAR	Market Value Factor
						LAND VALUE (\$)	BUILDING VALUE (\$)	TOTAL VALUE (\$)	LAND VALUE (\$)	BUILDING VALUE (\$)	TOTAL VALUE (\$)						
42-43-45-02-01-000-0112	PRIVATE		Y		200	1,173,120	554,265	1,727,385	2,700,000	361,399	3,061,399	5,000,000	1995	1.63			
42-43-45-02-01-000-0121	PRIVATE		Y		200	1,173,120	674,286	1,847,406	2,700,000	1,013,075	3,713,075	2,994,000	1987	1.62			
42-43-45-02-01-000-0123	PRIVATE		Y		200	1,173,120	638,026	1,811,146	2,700,000	560,636	3,260,636	10,000	1973				
42-43-45-02-01-000-0122	PRIVATE		Y		200	1,173,120	306,564	1,479,684	2,700,000	229,603	2,929,603	100	1988				
42-43-45-02-01-000-0130	PRIVATE		Y		510	2,932,800	3,226,224	6,159,024	6,450,000	4,788,800	11,238,800	6,000,000	1986				
42-43-45-02-01-000-0143	PRIVATE		Y		190	1,114,464	514,855	1,629,319	2,600,000	372,777	2,972,777	100	1990				
42-43-45-02-01-000-0144	PRIVATE	1.45	Y		150	879,840	0	879,840	2,050,000	2,867,747	4,917,747	5,708,500	1994	1.16			
42-43-45-02-01-000-0141	PRIVATE	1.54	Y		160	938,496	0	938,496	2,150,000	5,391,822	7,541,822	1,064,600	1987	1.13			
42-43-45-02-01-000-0151	PRIVATE		Y		200	1,173,120	731,516	1,904,636	2,700,000	1,395,294	4,095,294	4,350,000	1995	1.06			
42-43-45-02-01-000-0153	PRIVATE		Y		150	879,840	156,501	1,036,341	2,050,000	7,800	2,057,800	1,910,000	1989	1.84			
42-43-45-02-01-000-0152	PRIVATE	2.09	Y		212	1,237,642	279,607	1,517,249	2,700,000	460,341	3,160,341	3,800,000	1991	1.20			
42-43-45-02-01-000-0161	PRIVATE		Y		155	909,168	730,726	1,639,894	2,025,000	702,041	2,727,041	750,000	1977				
42-43-45-02-01-000-0171	PRIVATE		Y		160	883,125	0	883,125	2,000,000	0	2,000,000	150,000	1978				
42-43-45-02-01-000-0172	PRIVATE		Y		165	915,034	465,994	1,381,028	2,300,000	674,760	2,974,760	400,000	1978				
42-43-45-10-01-000-0132	PRIVATE	2	Y		260	1,472,266	249,988	1,722,254	3,000,000	78,973	3,078,973	100	1993				
42-43-45-10-01-000-0133	PRIVATE		Y		300	1,495,728	880,192	2,375,920	3,800,000	4,846,800	8,646,800	210,000	1970				
42-43-45-10-01-000-0134	PRIVATE		Y		200	977,600	359,481	1,337,081	2,200,000	74,661	2,274,661						
42-43-45-10-01-000-0131	PRIVATE		Y		166	811,408	654,142	1,465,550	2,000,000	397,164	2,397,164	2,700,000	1990	1.84			
42-43-45-10-01-000-0122	PRIVATE		Y		132	821,184	289,018	1,110,202	2,000,000	1,715,963	3,715,963	3,450,000	1993				
42-43-45-10-01-000-0121	PRIVATE		Y		168	821,184	187,777	1,008,961	2,000,000	1,904	2,001,904	2,600,000	1993	1.30			
42-43-45-10-01-000-0123	PRIVATE		Y		175	855,400	331,503	1,186,903	2,000,000	2,322,456	4,722,456	1,715,000	1987	1.30			
42-43-45-10-01-000-0125	PRIVATE		Y		395	1,128,000	186,797	1,314,797	2,400,000	2,322,456	4,722,456	1,715,000	1987	1.30			
REACH 10		31.49			8,661	56,944,388	20,035,876	76,980,264	96,340,451	66,000,265	182,960,966		avg. =	1.56			
						Average 1996 PRIVATE Land Value =		34		\$ / ft ²							
						Average 1996 CONDO Land Value =		44		\$ / ft ²							
42-43-45-10-01-000-0124	PRIVATE	0.86	N	200	150	451,200	66,912	518,112	1,300,000	15,562	1,315,562	100	1992				
42-43-45-10-01-000-0111	PRIVATE		Y		390	875,280	408,358	1,283,638	1,870,000	426,835	2,296,835	100	1989				
42-43-45-10-01-000-0101	PRIVATE	1.52	N	200	150	507,600	226,686	734,286	1,650,000	0	1,650,000	1,300,000	1993	1.77			
42-43-45-10-01-000-0102	PRIVATE	1.37	N	220	150	507,600	0	507,600	1,650,000	0	1,650,000	635,000	1993	1.25			
42-43-45-10-00-004-0010	PRIVATE	1.51	N	220	150	507,600	426,159	933,759	1,650,000	429,466	2,079,466	100	1984				
42-43-45-10-00-004-0020	PRIVATE	2.87	N	200	350	1,184,400	285,384	1,469,784	3,850,000	517,403	4,367,403	1,550,000	1985				
42-43-45-15-00-001-0017	PRIVATE	1.17	N	225	150	710,640	0	710,640	1,650,000	0	1,650,000	825,000	1986	1.16			
42-43-45-15-00-001-0012	PRIVATE	2.35	N	240	355	1,184,400	206,696	1,391,096	3,400,000	128,673	3,528,673	1,100,000	1985				
42-43-45-10-01-000-0091	PRIVATE	1.21	N	240	100	511,661	212,904	724,565	1,640,000	158,419	1,798,419	1,880,000	1986	1.05			
42-43-45-10-01-000-0092	PRIVATE	1.32	N	250	170	758,016	200,270	958,286	1,760,000	175,943	1,935,943	1,875,000	1989	1.96			
42-43-45-10-01-000-0083	PRIVATE	1.21	N	250	160	705,902	120,886	826,788	1,650,000	3,596,907	5,246,907	5,950,000	1990	1.13			
42-43-45-10-01-000-0081	PRIVATE	1.4	N	260	200	947,520	240,619	1,188,139	1,800,000	90,614	1,890,614	620,000	1978				
42-43-45-10-01-000-0082	PRIVATE	1.06	N	250	145	947,520	240,619	1,188,139	1,650,000	2,612,843	4,262,843	5,475,000	1992	1.28			
42-43-45-10-01-000-0072	PRIVATE	1.12	N	280	150	710,640	0	710,640	1,650,000	1,811,298	3,461,298	750,000	1987				
42-43-45-10-01-000-0071	PRIVATE	1.14	N	280	150	710,640	215,496	926,136	1,650,000	204,051	1,854,051	2,200,000	1993	1.19			
42-43-45-15-00-001-0013	PRIVATE	1.17	N	280	150	507,600	569,010	1,076,610	1,650,000	825,923	2,475,923	3,000,000	1994	1.21			
42-43-45-15-00-001-0014	PRIVATE	1.51	N	290	200	676,800	233,105	909,905	1,800,000	227,051	2,027,051	1,500,000	1988	1.65			
42-43-45-15-00-001-0015	PRIVATE	1.03	N	280	145	431,460	1,403	432,863	1,300,000	3,399,544	4,699,544	5,500,000	1994	1.17			
42-43-45-10-01-000-0031	PRIVATE	0.81	N	280	165	568,512	455,244	1,023,756	1,250,000	665,900	1,915,900	525,000	1983				
42-43-45-10-01-000-0032	PRIVATE	10.4	N	275	1,185	4,334,904	1,115,902	5,450,806	6,400,000	1,409,862	7,809,862	100	1992				
42-43-45-10-01-000-0052	PRIVATE	0.96	N	260	75	257,936	122,702	380,638	700,000	43,834	743,834	100	1986				
42-43-45-10-01-000-0053	PRIVATE	0.8	N	250	100	342,160	413,278	755,438	800,000	24,591	824,591	350,000	1988				
42-43-45-10-01-000-0061	PRIVATE	0.29	N	250	80	249,514	52,596	302,110	475,000	12,280	487,280	47,000	1994				
42-43-45-10-01-000-0062	PRIVATE	0.55	N	250	95	249,514	52,596	302,110	500,000	0	500,000	100	1984				
42-43-45-10-01-000-0069	PRIVATE	0.61	N	380	75	236,880	0	236,880	500,000	0	500,000	500,000	1987	2.11			

TABLE F-1: OCEANFRONT PROPERTY VALUES ALONG PALM BEACH ISLAND

PALM BEACH COUNTY PROPERTY NUMBER	DESCRIPTION	Approx. Acres	SEA- WALL	Dist. from 1990 W.L. to Bidg. (FEET)	SHORE LINE (FEET)	1990 VALUATION			1996 VALUATION			LAST SALE (\$)	SALE YEAR	Market Value Factor	
						LAND VALUE (\$)	BUILDING VALUE (\$)	TOTAL VALUE (\$)	LAND VALUE (\$)	BUILDING VALUE (\$)	TOTAL VALUE (\$)				
42-43-45-10-01-000-0064	PRIVATE	0.48	N	370	70	236,880	0	236,880	650,000	433,327	1,083,327	1,350,000	1990		
42-43-45-10-01-000-0063	PRIVATE	1.61	N	370	160	564,564	324,266	888,860	950,000	390,554	1,340,554	500,000	1985		
00-43-45-15-00-004-0010	SLWID PARK	1.65	N	380	225	1,589,000	58,172	1,647,172	1,589,000	40,789	1,629,789				
REACH 11	TOTAL VALUES	41.98			5,645	21,466,343	5,907,133	27,373,476	47,384,000	17,641,669	65,025,669		avg. =	1.41	
						Average 1996 PRIVATE Land Value =			\$ / ft ²						
TOTALS FOR ALL REACHES						1831.892	82,002	942,782,910	379,885,880	1,322,678,790	773,439,594	2,262,757,427	avg. factor =	1.42	

15.5 miles
 32,229 ft = no seawalls 39.3%
 49,773 ft = seawalls 60.7%

TABLE F-2: SUMMARY OF ESTIMATED BENEFITS FOR BEACH RESTORATION PROJECT IMPROVEMENTS BY SHORELINE REACH
15-YEAR PROJECT HORIZON

PALM BEACH COUNTY PROPERTY NUMBER	DESCRIPTION	Approx. Acres	SEA- WALL	1990 to 1997 Shoreline Change Rate (ft/yr)	FDNR SURVEY MON.	Dist. from 1990 W.L. to Bldg. (FEET)	SHORE LINE (FEET)	1996 VALUATION			Seawall Const. Cost (\$ Present)	No. of Years to Compute Land Loss	Expected Land Loss next 15 years (\$ Present)	Seawall/Revet. Repair for 15 year life (\$ Present)	One-Time Major Repair 15 year life (\$ Present)	Expected Savings for Seawall Repair/ Maint. - 15 yr life (\$ Present)	TOTAL COST (\$ Present)
								LAND VALUE (\$)	BUILDING VALUE (\$)	TOTAL VALUE (\$)							
TOWN OF PALM BEACH																	
50-43-42-34-01-000-0260	PRIVATE	0.6	N	25.81	R-76	740	90	1,700,000	61,972	1,761,972						0	
50-43-42-34-01-000-0280	PRIVATE	0.27	N			710	100	1,100,000	367,033	1,467,033						0	
50-43-42-34-01-000-0290	PRIVATE	0.27	N			660	100	1,100,000	545,086	1,645,086						0	
50-43-42-34-01-000-0300	PRIVATE	0.24	N			600	90	1,100,000	184,628	1,284,628						0	
50-43-42-34-02-000-0011	UNDEVELOPED PUB. ACCESS	1.39	N			590	140	2,400,000	345,137	2,745,137						0	
50-43-42-34-02-000-0020	UNDEVELOPED PUB. ACCESS	1.24	N			620	15	1,800,000	44,428	1,844,428						0	
50-43-42-34-02-000-0031	PRIVATE	1.76	N			590	170	3,400,000	359,948	3,759,948						0	
50-43-42-34-02-000-0060	UNDEVELOPED PUB. ACCESS	2.64	N			500	290	5,100,000	207,949	5,307,949						0	
50-43-42-34-02-000-0081	UNDEVELOPED PUB. ACCESS	0.41	N	20.81	R-77	460	90	1,800,000	1,280,054	3,080,054						0	
50-43-42-34-02-000-0083	PRIVATE	0.77	N			440	100	1,900,000	217,109	2,117,109						0	
50-43-42-34-02-000-0100	PRIVATE	0.74	N			460	90	1,900,000	282,140	2,182,140						0	
50-43-42-34-02-000-0110	UNDEVELOPED PUB. ACCESS	1.08	N			420	135	2,500,000	0	2,500,000						0	
50-43-42-34-04-000-0030	PRIVATE	0.95	N			500	115	2,300,000	2,359,449	4,659,449						0	
50-43-42-34-04-000-0100	PRIVATE	2.31	N			500	180	2,600,000	454,870	3,054,870						0	
50-43-42-34-04-000-0010	PRIVATE	1.99	N			280	155	2,700,000	290,771	2,990,771						0	
50-43-42-34-05-000-0020	PRIVATE	0.46	N			320	75	1,350,000	32,318	1,382,318						0	
50-43-42-34-05-000-0011	PRIVATE	1.12	N			240	180	2,600,000	521,849	3,121,849						0	
REACH 1								37,950,000	7,564,743	44,914,743	0	0	0	0	0	0	
								47	\$/ft ²								
50-43-42-34-07-000-0030	PRIVATE	0.86	N	6.54	R-78	200	150	1,100,000	192,606	1,292,606						0	
50-43-42-34-07-000-0021	PRIVATE	0.41	N			160	120	800,000	28,539	828,539						0	
50-43-42-34-07-000-0013	PRIVATE	0.51	N			160	140	750,000	153,342	903,342						0	
50-43-42-34-09-000-0062	PRIVATE	0.35	N			130	100	800,000	314,243	1,114,243						0	
50-43-42-34-08-000-0060	PRIVATE	0.71	N			120	115	900,000	2,376	902,376						0	
50-43-42-34-08-000-0040	PRIVATE	0.22	N			130	70	650,000	0	650,000						0	
50-43-42-34-08-000-0071	PRIVATE	0.11	N			120	90	40,000	6,944	46,944						0	
50-43-42-34-08-000-0030	PRIVATE	0.45	Y			75	75	1,050,000	51,765	1,101,765						22,181	
50-43-42-34-08-000-0020	PRIVATE	0.33	Y			240	240	700,000	255,838	955,838						70,980	
50-43-42-01-000-0110	PRIVATE	0.37	Y	-2.12	R-79	100	100	800,000	147,940	947,940						30,865	
ANGLER AVE ACCESS PUBLIC																	
50-43-43-03-000-0251	PALM BEACH COUNTY	0.09	Y			30	30	100,000	2,653	102,653						9,645	
50-43-43-03-000-0081		0.31	Y			55	55	800,000	344,765	1,144,765						30,865	
50-43-43-03-000-0252	PRIVATE	0.45	Y			110	110	800,000	0	800,000						70,980	
50-43-43-03-000-0252	PUBLIC	0.15	Y			120	120	50,000	3,850	53,850						29,575	
OCEAN TERRACE ACCE PUBLIC																	
50-43-43-03-000-0242	PRIVATE	0.4	Y			115	115	765,000	54,431	819,431						8,873	
50-43-42-34-11-000-0010	PRIVATE	0.59	Y			90	90	1,080,000	737,408	1,817,408						16,266	
50-43-42-34-11-000-0150	PALM BEACH COUNTY	0.1	Y			45	45	70,000	2,472	72,472						16,266	
50-43-42-34-11-000-0141	PRIVATE	0.37	Y			75	75	675,000	120,572	795,572						16,266	
50-43-42-05-000-0010	PRIVATE	0.6	Y			200	200	1,000,000	875,242	1,875,242						16,266	
MERRIN ROAD ACCESS																	
50-43-43-03-000-0251	PRIVATE	0.51	Y			25	25	850,000	621,852	1,471,852						35,490	
50-43-43-03-000-0240	PRIVATE	0.624	Y	-1.08	R-80	100	100	900,000	40,104	940,104						8,873	
KENLYN ROAD ACCESS																	
50-43-43-03-000-0011	PRIVATE	0.75	Y			125	125	1,150,000	61,180	1,211,180						32,533	
50-43-43-03-000-0251	PRIVATE	0.465	Y			70	70	1,100,000	676,329	1,776,329						32,533	
50-43-43-03-000-0250	PRIVATE	0.526	Y			70	70	900,000	628,378	1,528,378						32,533	
PALMO WAY ACCESS																	
50-43-43-03-000-0010	PRIVATE	0.964	Y			25	25	1,350,000	409,563	1,759,563						35,490	
50-43-43-03-000-0040	PRIVATE	0.464	Y			140	140	900,000	201,325	1,101,325						16,266	
50-43-43-03-000-0191	PRIVATE	0.579	Y			70	70	1,000,000	47,868	1,047,868						16,266	
50-43-43-03-000-0241	PRIVATE	0.165	Y			160	160	3,000	0	3,000						16,266	
50-43-43-03-000-0203	PRIVATE	0.431	Y			30	30	40,000	1,860	41,860						8,873	
50-43-43-03-000-0202	PRIVATE	0.137	Y			40	40	1,050,000	266,432	1,316,432						8,873	
50-43-43-03-000-0411	PRIVATE	0.059	Y			45	45	30,000	2,476	32,476						13,309	
50-43-43-03-000-0410	PRIVATE	0.519	Y	-5.20	R-81	160	160	869,861	59,478	929,339						47,320	

TABLE F-2: SUMMARY OF ESTIMATED BENEFITS FOR BEACH RESTORATION PROJECT IMPROVEMENTS BY SHORELINE REACH
15-YEAR PROJECT HORIZON

PALM BEACH COUNTY PROPERTY NUMBER	DESCRIPTION	Approx. Acres	SEA-WALL	1990 to 1997 Shoreline Change Rate (ft/yr)	FDNR SURVEY MON.	Dist. from 1990 W.L. to Bldg. (FEET)	1996 VALUATION			Seawall Const. Cost (\$ Present)	No. of Years to Compute Land Loss	Expected Land Loss next 15 years (\$ Present)	Seawall/Revet Repair for 15 year life (\$ Present)	One-Time Major Repair 15 year life (\$ Present)	Expected Savings for Seawall Repair/ Maint. - 15 yr life (\$ Present)	TOTAL COST (\$ Present)
							LAND VALUE (\$)	BUILDING VALUE (\$)	TOTAL VALUE (\$)							
50-43-43-03-09-000-0023	PRIVATE	0.579	Y			70	1,100,000	600,090	1,700,090			11,700	16,076	20,703	20,703	
50-43-43-03-10-000-0030	PRIVATE	0.56	Y			125	900,000	282,846	1,182,846			20,893	16,076	36,969	36,969	
LA PUERTA WAY ACCESS			Y			25			4,179			4,179	3,215	7,394	7,394	
50-43-43-03-10-000-0060	PRIVATE	0.459	Y			95	800,000	174,429	974,429			15,879	12,218	28,096	28,096	
50-43-43-03-10-000-0091	PRIVATE	0.384	Y			70	1,100,000	697,956	1,797,956			11,700	9,002	20,703	20,703	
50-43-43-03-10-000-0121	PRIVATE	0.497	Y			90	400,000	1,000	401,000			13,043	11,574	26,618	26,618	
EL PUEBLO WAY ACCESS			Y			20			3,343			3,343	2,572	5,915	5,915	
50-43-43-02-01-000-0015	PRIVATE	0.663	Y			40	950,000	528,361	1,478,361			6,686	5,144	11,830	11,830	
50-43-43-02-01-000-0011	PRIVATE	0.075	Y			80	70,000	99,016	169,016			10,229	10,288	23,660	23,660	
50-43-43-03-12-000-0012	PRIVATE	0.446	Y			60	1,050,000	286,611	1,346,611			10,229	7,716	17,745	17,745	
50-43-43-03-12-000-0011	PRIVATE	0.076	Y			40	30,000	0	30,000			6,686	5,144	11,830	11,830	
QUEJENS LANE ACCESS			Y			10			1,671			1,671	1,286	2,958	2,958	
50-43-43-03-12-000-0013	PRIVATE	0.117	Y			55	35,000	4,772	39,772			9,193	7,073	16,266	16,266	
50-43-43-03-12-000-1060	PRIVATE	0.422	Y			40	950,000	719,343	1,669,343			6,686	5,144	11,830	11,830	
50-43-43-02-00-001-0011	PRIVATE	1.1	Y			250	2,800,000	1,942	2,801,942			41,787	32,151	73,938	73,938	
50-43-43-02-00-001-0020	PRIVATE	1.048	Y			200	3,700,000	448,715	4,148,715			33,429	25,721	59,150	59,150	
50-43-43-03-14-000-0350	PRIVATE	0.686	Y	-4.64	R-82	130	2,400,000	75,146	2,475,146			21,729	16,719	38,448	38,448	
50-43-43-03-14-000-0350	PRIVATE	0.551	Y			120	2,400,000	59,088	2,459,088			20,058	15,433	35,490	35,490	
50-43-43-02-00-001-0030	PRIVATE	0.716	Y			125	2,400,000	2,400,000	2,400,000			20,893	16,076	36,969	36,969	
50-43-43-02-00-001-0031	PRIVATE	0.785	Y			105	2,400,000	2,268,701	4,668,701			17,550	13,504	31,054	31,054	
VIA MARILIA ACCESS			Y			30		65,000	65,000			5,014	3,858	8,873	8,873	
50-43-43-03-18-000-0011	PRIVATE	0.447	Y			80	2,000,000	352,390	2,352,390			13,372	10,288	23,660	23,660	
50-43-43-03-18-000-0012	PRIVATE	0.421	Y			90	2,000,000	588,421	2,588,421			15,043	11,574	26,618	26,618	
50-43-43-03-20-000-0011	PRIVATE	0.537	Y			105	2,200,000	188,718	2,388,718			17,550	13,504	31,054	31,054	
50-43-43-03-20-000-0021	PRIVATE	1.12	Y			185	3,900,000	855,654	4,755,654			30,922	23,752	54,714	54,714	
50-43-43-03-20-000-0012	PRIVATE	0.621	Y			100	2,100,000	380,574	2,480,574			16,715	12,861	29,575	29,575	
50-43-43-03-20-000-0031	PRIVATE	1.21	Y			210	4,700,000	728,868	5,428,868			35,101	27,007	62,108	62,108	
50-43-43-03-20-000-0040	PRIVATE	0.224	Y			20	0	65,000	65,000			3,343	2,572	5,915	5,915	
50-43-43-10-000-0021	PRIVATE	0.832	N	-3.54	R-83	180	2,600,000	717,892	3,317,892	15	246,921			246,921	246,921	
50-43-43-10-000-0022	PRIVATE	0.916	N	-3.19	R-83	200	3,100,000	563,585	3,663,585	15	278,134			278,134	278,134	
50-43-43-10-000-0024	PRIVATE	0.712	N	-3.07	R-83	120	2,100,000	0	2,100,000	15	178,448			178,448	178,448	
50-43-43-10-000-0022	PRIVATE	0.858	Y	-2.93	R-83	110	4,500,000	1,236,998	5,736,998			18,386	14,147	32,533	32,533	
50-43-43-10-000-0020	PRIVATE	2.4	Y	-2.60	R-83	260	6,000,000	837,468	6,837,468			43,458	33,437	76,895	76,895	
50-43-43-10-000-0025	PRIVATE	1.84	Y	-2.30	R-84/5	300	4,500,000	837,468	5,337,468			50,144	38,582	88,725	88,725	
50-43-43-10-000-0040	PALM BEACH COUNTRY CLUB	84.01	Y	-2.01	R-84/5	1,660	4,032,480	1,931,953	5,964,433			277,462	213,485	490,948	490,948	
50-43-43-11-000-0000	PALM BEACH COUNTRY CLUB	3.61	Y	1.19	R-86	340	5,100,000	2,264,295	7,364,295			56,830	43,726	100,556	100,556	
50-43-43-11-02-000-0011	PRIVATE	0.436	Y	-0.25	R-86	100	1,600,000	197,091	1,797,091			16,715	12,861	29,575	29,575	
50-43-43-11-02-000-0050	PRIVATE	1.06	Y			200	3,200,000	267,689	3,467,689			33,429	25,721	59,150	59,150	
50-43-43-11-02-000-0040	PRIVATE	1.61	Y			190	4,750,000	2,683,437	7,433,437			31,758	24,435	56,193	56,193	
50-43-43-11-02-000-0060	ECKES SCHOOL	2.4	Y			240	6,100,000	3,193,702	9,293,702			40,115	30,865	70,980	70,980	
50-43-43-10-05-000-0021	PRIVATE	0.866	Y			150	3,400,000	665,167	4,065,167			25,072	19,291	44,363	44,363	
50-43-43-10-05-000-0032	PRIVATE	0.25	Y			30	800,000	0	800,000			5,014	3,858	8,873	8,873	
50-43-43-10-05-000-0040	PRIVATE	2.22	Y			210	5,400,000	1,159,697	6,559,697			35,101	27,007	62,108	62,108	
50-43-43-10-05-000-0054	PRIVATE	2.08	Y	3.56	R-87	195	5,400,000	3,361,142	8,761,142			32,593	25,078	57,672	57,672	
50-43-43-10-05-000-0053	PRIVATE	0.246	N	1.66	R-87	25	42,500	0	42,500			49,308	37,939	87,247	87,247	
50-43-43-10-05-000-0052	PRIVATE	3.7	N	1.41	R-87	295	7,800,000	961,050	8,761,050			25,072	19,291	44,363	44,363	
50-43-43-11-00-002-0010	PRIVATE	2.5	Y	-1.47	R-88	285	7,600,000	4,301,220	11,901,220			100,288	77,163	177,451	177,451	
50-43-43-11-00-002-0020	PRIVATE	1.44	Y	-4.35	R-88	150	4,000,000	217,990	4,217,990			60,959	46,186	107,145	107,145	
50-43-43-11-00-002-0070	PRIVATE	7.25	Y			600	11,400,000	5,870,653	17,270,653			79,227	60,959	140,186	140,186	
50-43-43-14-16-000-0010	PRIVATE	6.23	Y	0.17	R-89	474	13,000,000	12,114,576	25,114,576			25,072	19,291	44,363	44,363	
50-43-43-14-000-0060	PRIVATE	1.44	Y			150	3,900,000	1,340,270	5,240,270			38,945	29,965	68,910	68,910	
50-43-43-14-000-0050	PRIVATE	3.37	Y			233	6,400,000	2,104,629	8,504,629			30,066	23,149	53,235	53,235	
50-43-43-14-000-0060	PRIVATE	0.795	Y			180	3,250,000	66,834	3,316,834			32,593	25,078	57,672	57,672	
50-43-43-14-000-0070	PRIVATE	0.872	Y			195	3,500,000	0	3,500,000			62,178	47,841	110,020	110,020	
50-43-43-14-20-000-0070	PRIVATE	2.41	Y			372	7,400,000	2,317,044	9,717,044			20,893	16,076	36,969	36,969	
50-43-43-14-20-000-0050	PRIVATE	0.628	Y	-5.43	R-90	125	2,500,000	1,740,358	4,240,358			20,893	16,076	36,969	36,969	
50-43-43-14-22-000-0060	PRIVATE	0.628	Y			125	2,000,000	2,088,936	4,088,936			20,893	16,076	36,969	36,969	
REACH 2	TOTAL VALUES	81.14		Average 1996 PRIVATE Land Value =	13,544	15,544	199,332,841	69,521,502	268,854,443	0	703,503	2,017,285	1,552,140	3,569,426	4,272,928	
50-43-43-14-19-000-0090	PRIVATE	0.46	Y			113	2,300,000	632,234	2,932,234			18,688	14,532	33,220	33,220	
50-43-43-14-19-000-0080	PRIVATE	0.402	Y			140	2,300,000	0	2,300,000			23,400	18,005	41,405	41,405	
50-43-43-14-19-000-0070	PRIVATE	0.51	Y			110	2,300,000	329,833	2,629,833			18,386	14,147	32,533	32,533	

TABLE F-2: SUMMARY OF ESTIMATED BENEFITS FOR BEACH RESTORATION PROJECT IMPROVEMENTS BY SHORELINE REACH
15-YEAR PROJECT HORIZON

PALM BEACH COUNTY PROPERTY NUMBER	DESCRIPTION	Approx. Acres	SEA- WALL	1990 to 1997 Shoreline Change Rate (ft/yr)	FDNR SURVEY MON.	Dist. from 1990 W.L. to Bldg. (FEET)	SHORE LINE (FEET)	1996 VALUATION			Seawall Const. Cost (\$ Present)	No. of Years to Compute Land Loss	Expected Land Loss next 15 years (\$ Present)	Seawall/Revel. Repair for 15 year life (\$ Present)	One-Time Major Repair 15 year life (\$ Present)	Expected Savings for Seawall Repair/ Maint. - 15 yr life (\$ Present)	TOTAL COST (\$ Present)
								LAND VALUE (\$)	BUILDING VALUE (\$)	TOTAL VALUE							
50-43-43-14-00-002-0060	PRIVATE	1.34	Y			195	4,000,000	626,523	4,626,523	32,593	25,078	32,593	25,078	57,672	57,672	57,672	
50-43-43-14-17-000-0030	PRIVATE	0.77	Y			40	2,800,000	610,463	3,410,463	6,686	11,830	6,686	11,830	11,830	11,830	11,830	
50-43-43-14-08-000-0040	PRIVATE	0.45	Y	1.14	R-91	130	1,000,000	753,562	1,753,562	21,729	16,719	21,729	16,719	38,448	38,448	38,448	
50-43-43-14-07-000-0031	PRIVATE	0.8	N	-0.56		235	1,500,000	205,113	1,705,113	15	50,628			38,448	38,448	50,628	
50-43-43-14-07-000-0031	PRIVATE	0.37	N	-1.52		240	2,700,000	964,351	3,664,351	4,179	3,215	4,179	3,215	7,394	7,394	7,394	
50-43-43-14-09-000-0190	PRIVATE	0.32	Y			100	850,000	1,057,293	1,907,293	16,715	12,861	16,715	12,861	29,575	29,575	29,575	
50-43-43-14-26-000-0010	PRIVATE	0.37	Y			25	1,000,000	852,522	1,852,522	8,357	6,430	8,357	6,430	14,788	14,788	14,788	
50-43-43-14-26-000-0020	PRIVATE	0.34	Y			25	900,000	802,262	1,702,262	4,179	3,215	4,179	3,215	7,394	7,394	7,394	
50-43-43-14-26-000-0050	PRIVATE	0.23	Y			25	400,000	642,000	1,042,000	9,193	7,073	9,193	7,073	16,266	16,266	16,266	
50-43-43-14-26-000-0061	PRIVATE	0.23	Y			25	400,000	537,949	937,949	26,743	20,577	26,743	20,577	47,320	47,320	47,320	
50-43-43-14-26-000-0040	PRIVATE	0.25	Y			25	400,000	567,582	967,582	20,893	16,076	20,893	16,076	36,969	36,969	36,969	
50-43-43-14-26-000-0020	PRIVATE	0.34	Y			55	900,000	802,262	1,702,262	38,444	29,579	38,444	29,579	68,023	68,023	68,023	
50-43-43-14-10-006-0011	PRIVATE	0.85	Y	-4.31	R-92	125	1,400,000	1,277	1,401,277	4,179	3,215	4,179	3,215	7,394	7,394	7,394	
50-43-43-14-10-006-0011	PRIVATE	0.78	Y			230	1,400,000	12,475	1,412,475	96,109	73,948	96,109	73,948	170,057	170,057	170,057	
50-43-43-14-25	WARDEN HOUSE CONDOMINIUM	1.265	Y			230			2,429,250	15,637,630	26,743	20,577	26,743	20,577	47,320	47,320	
50-43-43-14-23	OCEAN TOWERS CONDOMINIUM	2.02	Y			230			15,637,630	6,934,455	26,743	20,577	26,743	20,577	47,320	47,320	
50-43-43-14-23	GRACE TRAIL CONDO ACCESS	6.7	Y			160	200,000	0	200,000	50,000	13	225,630		170,057	170,057	275,630	
50-43-43-14-21	NORTH OCEAN CONDOMINIUM	0.124	N	-7.17	R-93	180	200,000	0	200,000	50,000	13	225,630		170,057	170,057	275,630	
50-43-43-15-11-000-2240	TOWN OF PALM BEACH	0.606	N	-7.99		200			38,323,287	120,000	15	744,345		35,490	864,345	864,345	
50-43-43-15-27	PB BILTMORE	2.64	Y	-8.19		120			18,573,452	105,640,000	4	3,909,691		4,429,691	550,000	550,000	
50-43-43-22-02-002-0000	TWO NORTH BREAKERS ROW	5.05	Y	-9.20		140	20,000,000	23,800,000	43,800,000	43,800,000	0	0	117,031	269,134	269,134	435,000	
50-43-43-22-24-004-0000	BREAKERS TRACT 2	9.04	Y	-10.03	T-94	80	20,000,000	23,800,000	43,800,000	43,800,000	0	0	117,031	269,134	269,134	435,000	
50-43-43-22-24-004-0000	BREAKERS TRACT 4 (HOTEL)	3.68	N	-21.84		130	435	4,439,000	4,439,000	435,000	0	0	15,000	15,000	15,000		
50-43-43-22-24-006-0000	BREAKERS TRACT 5/6	3.68	N	-25.35		110	15	6,008	399,533,146	1,890,000	0	5,136,423	667,414	513,522	1,180,936	8,007,359	
REACH 3																	
								Average 1996 PRIVATE Land Value =	67	\$/ft ²	67	\$/ft ²					
								Average 1996 CONDO Land Value =	87	\$/ft ²	87	\$/ft ²					
50-43-43-23-01-000-0190	PRIVATE	1.96	Y	-26.81	R-95	165	2,800,000	1,206,358	4,006,358	27,579	21,220	27,579	21,220	48,799	48,799	48,799	
50-43-43-23-01-000-0180	PRIVATE	1.83	Y			180	2,800,000	1,252,157	4,052,157	30,086	23,149	30,086	23,149	53,235	53,235	53,235	
50-43-43-22-05-000-0030	TOWN OF PB - CLARK AVE	2.31	N	14.06	R-96	120	750,000	0	750,000	755,040(1)	6,430	14,788	6,430	14,788	14,788	755,040	
50-43-43-22-05-000-0020	PRIVATE	1.46	Y			50	60,000	0	60,000	6,357	6,076	6,357	6,076	12,433	12,433	12,433	
50-43-43-22-07-000-5270	PRIVATE	0.68	Y			125	2,000,000	604,447	2,604,447	20,893	16,076	20,893	16,076	36,969	36,969	36,969	
50-43-43-22-07-000-5271	PRIVATE	0.676	Y			135	1,100,000	88,047	1,188,047	55,994	43,083	55,994	43,083	99,077	99,077	99,077	
50-43-43-22-08-000-8260	PRIVATE	0.733	Y			100	1,250,000	1,036,907	2,286,907	22,565	17,362	22,565	17,362	39,926	39,926	39,926	
50-43-43-23-00-004-0100	PRIVATE	0.44	Y			125	900,000	211,168	1,111,168	16,715	12,861	16,715	12,861	29,575	29,575	29,575	
50-43-43-23-00-004-0060	PRIVATE	0.88	Y			120	1,400,000	608,246	2,008,246	20,058	15,433	20,058	15,433	35,490	35,490	35,490	
50-43-43-23-00-004-0110	PRIVATE	0.417	Y	28.30	R-97	65	200,000	205,002	2,005,002	10,864	8,359	10,864	8,359	19,224	19,224	19,224	
50-43-43-26-00-001-0170	TOWN OF P B PUBLIC BEACH	7.9	Y	9.16	R-98	60	100,000	0	200,000	322,592	248,209	322,592	248,209	570,801	570,801	570,801	
50-43-43-26-00-001-0100	TOWN OF P B PUBLIC BEACH	4.01	Y	7.58	R-99	740	100,000	0	100,000	10,029	7,716	10,029	7,716	17,745	17,745	17,745	
50-43-43-26-03-000-0012	PRIVATE	0.321	Y			150	800,000	164,717	964,717	123,698	95,168	123,698	95,168	218,856	218,856	218,856	
50-43-43-26-03-000-0011	PRIVATE	0.542	Y			150	1,600,000	1,217,688	2,817,688	16,715	12,861	16,715	12,861	29,575	29,575	29,575	
50-43-43-26-03-000-0030	PRIVATE	0.62	Y			100	1,300,000	2,442,472	2,542,472	25,072	19,291	25,072	19,291	44,363	44,363	44,363	
50-43-43-26-03-000-0040	PRIVATE	0.62	Y			100	1,275,000	841,173	2,116,173	16,715	12,861	16,715	12,861	29,575	29,575	29,575	
50-43-43-26-03-000-0060	PRIVATE	0.62	Y			100	1,275,000	19,166	1,294,166	16,715	12,861	16,715	12,861	29,575	29,575	29,575	
50-43-43-26-03-000-0070	PRIVATE	1.61	Y	-2.69		220	3,000,000	420,154	3,420,154	36,772	28,293	36,772	28,293	65,065	65,065	65,065	
50-43-43-26-03-000-0091	PRIVATE	0.42	Y			95	1,200,000	1,022,971	2,222,971	15,879	12,218	15,879	12,218	28,096	28,096	28,096	
50-43-43-26-03-000-0100	PRIVATE	0.916	Y			190	2,500,000	46,026	2,546,026	31,758	24,435	31,758	24,435	56,193	56,193	56,193	
50-43-43-26-00-002-0010	PRIVATE	0.757	Y			150	1,900,000	1,954,021	3,854,021	25,072	19,291	25,072	19,291	44,363	44,363	44,363	
50-43-43-27-05-000-0012	PRIVATE	0.878	Y			180	1,900,000	1,532,681	3,432,681	30,086	23,149	30,086	23,149	53,235	53,235	53,235	
50-43-43-27-05-000-0020	PRIVATE	0.918	Y	1.58	R-101	170	1,900,000	1,600,000	3,500,000	28,415	21,863	28,415	21,863	50,278	50,278	50,278	

TABLE F-2: SUMMARY OF ESTIMATED BENEFITS FOR BEACH RESTORATION PROJECT IMPROVEMENTS BY SHORELINE REACH
15-YEAR PROJECT HORIZON

PALM BEACH COUNTY PROPERTY NUMBER	DESCRIPTION	Approx Acres	SEA- WALL	1990 to 1997 Shoreline Change Rate (ft/yr)	FDNR SURVEY MON	Dist. from 1990 W.L. to Bldg. (FEET)	SHORE LINE (FEET)	1996 VALUATION			Seawall Const. Cost (\$ Present)	No. of Years to Compute Land Loss	Expected Loss next 15 years (\$ Present)	Seawall/Revet Repair for 15 year life (\$ Present)	One-Time Major Repair 15 year life (\$ Present)	Expected Savings for Seawall Repair/ Maint. - 15 yr life (\$ Present)	TOTAL COST (\$ Present)
								LAND VALUE (\$)	BUILDING VALUE (\$)	TOTAL VALUE (\$)							
50-43-43-27-05-000-0191	PRIVATE	0.86	Y			160	160	1,900,000	1,500,000	3,400,000	0	26,743	20,577	47,320	47,320	47,320	
50-43-43-27-05-000-0200	PRIVATE	0.895	Y			165	165	3,000,000	1,400,000	3,300,000	0	27,579	21,220	48,799	48,799	48,799	
50-43-43-26-00-002-0020	PRIVATE	0.918	Y			160	160	2,500,000	1,287,814	3,537,814	0	26,743	20,577	47,320	47,320	47,320	
50-43-43-26-00-002-0030	PRIVATE	0.896	Y			180	180	2,250,000	425,784	2,675,784	0	31,758	24,435	56,193	56,193	56,193	
50-43-43-26-00-002-0040	PRIVATE	0.896	Y			200	200	2,250,000	1,238,152	3,488,152	0	33,429	25,721	59,150	59,150	59,150	
50-43-43-26-00-002-0010	PRIVATE	0.74	Y	-3.53	R-102	325	325	1,900,000	1,532,681	3,432,681	0	41,797	31,522	73,319	73,319	73,319	
50-43-43-26-00-002-0170	PRIVATE	0.61	Y			110	110	1,300,000	462,868	1,762,868	0	14,147	10,853	25,000	25,000	25,000	
50-43-43-26-00-002-0190	PRIVATE	1.95	Y			300	300	3,700,000	1,379,005	5,079,005	0	15,043	11,574	26,618	26,618	26,618	
50-43-43-26-00-002-0470	PRIVATE	1.42	Y			300	300	2,700,000	2,036,953	4,736,953	0	50,144	38,582	88,726	88,726	88,726	
50-43-43-35-00-001-0370	PRIVATE	3.9	Y			270	270	4,500,000	4,568,005	9,068,005	0	45,129	34,723	79,853	79,853	79,853	
50-43-43-35-00-001-0040	PRIVATE	2.6	Y	0.73	R-103	300	300	3,900,000	3,077,479	6,977,479	0	50,144	38,582	88,726	88,726	88,726	
50-43-43-35-00-001-0080	PRIVATE	1.02	Y			165	165	1,800,000	364,080	2,164,080	0	27,579	21,220	48,799	48,799	48,799	
50-43-43-35-00-001-0100	PRIVATE	0.72	Y			130	130	1,700,000	584,219	2,284,219	0	16,719	12,861	29,575	29,575	29,575	
50-43-43-35-00-001-0150	PRIVATE	1.14	Y			150	150	2,100,000	1,065,038	3,165,038	0	25,072	19,291	44,363	44,363	44,363	
50-43-43-35-00-001-0200	PRIVATE	0.96	Y			140	140	2,200,000	1,223,367	3,423,367	0	32,400	25,072	57,472	57,472	57,472	
50-43-43-35-00-001-0220	PRIVATE	3.86	Y			350	350	2,700,000	1,478,102	4,178,102	0	58,501	45,012	103,513	103,513	103,513	
50-43-43-35-02-000-0220	PRIVATE	0.38	Y			100	100	950,000	280,904	1,230,904	0	16,715	12,861	29,575	29,575	29,575	
REACH 4								TOTAL VALUES	56.73	74,635,000	38,575,268	113,210,268	0	1,519,357	1,169,024	3,443,422	3,443,422
50-43-43-35-02-000-0232	PRIVATE	0.735	Y	-1.41	R-104	60	60	925,000	31,856	956,856	0	10,029	7,716	17,745	17,745	17,745	
50-43-43-35-03-000-0030	PRIVATE	0.07	Y			75	75	1,500,000	1,500,000	3,000,000	0	12,536	9,645	22,181	22,181	22,181	
50-43-43-35-03-000-0010	PRIVATE	0.705	Y			265	265	2,600,000	1,313,856	3,913,856	0	44,294	34,080	78,374	78,374	78,374	
50-43-43-35-03-000-0020	PRIVATE	0.64	Y			160	160	1,500,000	0	1,500,000	0	26,743	20,577	47,320	47,320	47,320	
50-43-43-35-00-001-0050	PRIVATE	0.284	Y			170	170	540,000	58,195	598,195	0	28,415	21,863	50,278	50,278	50,278	
50-43-43-35-00-001-0080	PRIVATE	1.291	Y			150	150	1,900,000	695,649	2,595,649	0	28,415	21,863	50,278	50,278	50,278	
50-43-43-35-00-002-0010	PRIVATE	0.193	Y	0.08	R-105	170	170	900,000	92,093	992,093	0	28,415	21,863	50,278	50,278	50,278	
50-43-43-35-00-002-0020	PRIVATE	0.2	Y			190	190	1,100,000	90,810	1,190,810	0	28,415	21,863	50,278	50,278	50,278	
50-43-43-35-00-002-0030	PRIVATE	0.55	Y			120	120	2,000,000	639,717	2,639,717	0	25,072	19,291	44,363	44,363	44,363	
50-43-43-35-00-002-0420	PRIVATE	0.28	Y			100	100	1,100,000	5,938	1,105,938	0	16,715	12,861	29,575	29,575	29,575	
50-43-43-35-00-002-0140	PRIVATE	0.288	Y			100	100	900,000	574,119	1,474,119	0	16,715	12,861	29,575	29,575	29,575	
50-43-43-35-00-002-0040	PRIVATE	0.3	Y			100	100	1,200,000	895,430	2,095,430	0	16,715	12,861	29,575	29,575	29,575	
50-43-43-35-00-002-0030	PRIVATE	0.482	Y			140	140	1,800,000	655,170	2,455,170	0	25,072	19,291	44,363	44,363	44,363	
50-43-43-35-00-002-0070	PRIVATE	0.45	Y			160	160	1,715,000	777,310	2,492,310	0	25,072	19,291	44,363	44,363	44,363	
50-43-43-35-05-000-0020	PRIVATE	0.477	Y	2.76	R-106	155	155	1,500,000	1,508,263	3,258,263	0	26,743	20,577	47,320	47,320	47,320	
50-43-43-35-00-002-0390	PRIVATE	0.16	Y			45	45	277,000	1,251,152	3,001,152	0	25,908	19,934	45,841	45,841	45,841	
50-43-43-35-00-002-0390	PRIVATE	17.48	Y			360	360	12,000,000	3,623,453	15,623,453	0	60,173	46,298	106,471	106,471	106,471	
50-43-43-35-00-002-0392	BATH & TENNIS CLUB	0.132	N			80	80	360,000	0	360,000	0	0	0	0	0	0	
50-43-43-35-00-002-0400	BATH & TENNIS CLUB	9.54	N			80	80	1,000,000	0	1,000,000	0	0	0	0	0	0	
50-43-43-35-06-000-0010	BATH & TENNIS CLUB	2.16	N			75	75	10,600,000	3,686,634	14,286,634	0	14,787	11,309	26,096	26,096	26,096	
50-43-43-35-00-002-0410	PRIVATE	2.17	N	0.82	R-107	65	345	5,220,000	1,674,617	6,894,617	0	41,731	31,522	73,253	73,253	73,253	
50-43-44-02-09-000-0030	PRIVATE	2.01	N	-0.54		175	250	4,350,000	68,716	4,418,716	0	49,308	37,939	87,247	87,247	87,247	
50-43-44-02-00-001-0051	PRIVATE	5.16	N	-1.26		300	315	7,400,000	0	7,400,000	0	136,224	104,814	241,038	241,038	241,038	
50-43-44-02-00-001-0021	PRIVATE	3.72	N	-2.04	R-108	340	340	6,700,000	29,490	6,729,490	0	41,731	31,522	73,253	73,253	73,253	
50-43-44-02-10-000-0020	PRIVATE	2.25	N	-0.87		250	190	3,600,000	1,428,047	5,228,047	0	49,308	37,939	87,247	87,247	87,247	
50-43-44-02-10-000-0030	PRIVATE	2.04	N	-0.46		215	190	3,800,000	317,619	4,117,619	0	49,308	37,939	87,247	87,247	87,247	
50-43-44-02-10-000-0040	PRIVATE	1.98	N	-0.07		210	175	3,800,000	977,607	4,777,607	0	49,308	37,939	87,247	87,247	87,247	
50-43-44-02-00-001-0052	PRIVATE	4.36	Y	0.58	R-109	295	295	6,500,000	4,198,670	10,698,670	0	136,224	104,814	241,038	241,038	241,038	
50-43-44-02-01-000-0010	PRIVATE	9.77	Y	2.37		815	815	15,400,000	19,581,740	35,981,740	0	14,207	10,931	25,139	25,139	25,139	
50-43-44-02-01-000-0010	PRIVATE	2.21	N			200	200	4,400,000	3,953,061	8,353,061	0	41,787	32,151	73,938	73,938	73,938	
50-43-44-02-01-000-0080	PRIVATE	1.85	Y			85	85	3,600,000	10,335	3,610,335	0	41,787	32,151	73,938	73,938	73,938	
50-43-44-02-01-000-0151	PRIVATE	1.87	Y			250	250	3,800,000	4,987,603	8,387,603	0	41,787	32,151	73,938	73,938	73,938	
50-43-44-02-01-000-0211	PRIVATE	1.49	N	4.22	R-110	210	130	3,200,000	2,747,878	5,947,878	0	569,079	438,814	1,007,893	1,007,893	1,007,893	
REACH 5								TOTAL VALUES	78.53	122,587,000	58,445,349	181,032,349	0	739,621	569,079	1,308,701	1,308,701
50-43-44-02-00-002-0050	PRIVATE	2.15	N			190	190	4,300,000	287,404	4,587,404	0	25,908	19,934	45,841	45,841	45,841	
50-43-44-02-00-002-0070	PRIVATE	1.47	Y			155	155	2,175,000	2,000,814	4,175,814	0	25,908	19,934	45,841	45,841	45,841	
50-43-44-02-00-002-0030	PRIVATE	5	Y			340	340	6,000,000	4,141,967	10,141,967	0	56,930	43,726	100,656	100,656	100,656	
50-43-44-02-00-002-0040	PRIVATE	1.94	Y			130	130	2,300,000	1,741,870	4,041,870	0	21,729	16,719	38,448	38,448	38,448	
50-43-44-02-02-000-0010	PRIVATE	0.44	Y			30	30	696,500	491,868	1,188,368	0	5,014	3,858	8,873	8,873	8,873	

TABLE F-2: SUMMARY OF ESTIMATED BENEFITS FOR BEACH RESTORATION PROJECT IMPROVEMENTS BY SHORELINE REACH
15-YEAR PROJECT HORIZON

PALM BEACH COUNTY PROPERTY NUMBER	DESCRIPTION	Approx. Acres	SEA- WALL	1990 to 1997 Shoreline Change Rate (ft/yr)	FDNR SURVEY MON.	Dist. from 1990 W.L. to Bldg. (FEET)	SHORE LINE (FEET)	1995 VALUATION			Seawall Const. Cost (\$ Present)	No. of Years to Compute Land Loss	Expected Land Loss next 15 years (\$ Present)	Seawall/Revel Repair for 15 year life (\$ Present)	One-Time Major Repair 15 year life (\$ Present)	Expected Savings for Seawall Repair/ Maint. 15 yr life (\$ Present)	TOTAL COST (\$ Present)
								LAND VALUE (\$)	BUILDING VALUE (\$)	TOTAL VALUE (\$)							
50-43-44-02-02-000-0020	PRIVATE	0.34	Y				30	300,000	198,021	498,021			5,014	3,858	8,873	8,873	
50-43-44-02-02-000-0030	PRIVATE	0.34	Y				20	300,000	172,336	472,336			3,343	2,572	5,915	5,915	
50-43-44-02-02-000-0040	PRIVATE	0.46	Y				35	911,000	6,990	917,990			5,850	4,501	10,351	10,351	
50-43-44-02-02-000-0050	PRIVATE	0.46	Y				25	911,000	131,635	1,042,635			4,179	7,354	7,354	7,354	
50-43-44-02-02-000-0060	PRIVATE	0.34	Y	-1.46	R-111		35	300,000	298,903	598,903			5,850	4,501	10,351	10,351	
50-43-44-02-02-000-0070	PRIVATE	0.34	Y				25	300,000	260,729	560,729			4,179	7,354	7,354	7,354	
50-43-44-02-02-000-0080	PRIVATE	0.47	Y				35	696,500	142,779	839,279			5,850	4,501	10,351	10,351	
50-43-44-02-04-000-0012	PRIVATE	0.32	Y				15	400,000	866,615	1,266,615			2,507	4,436	4,436	4,436	
50-43-44-02-04-000-0011	PRIVATE	1.54	Y				100	1,200,000	1,094,691	2,294,691			5,014	12,861	29,575	29,575	
50-43-44-02-04-000-0021	PRIVATE	0.33	Y				30	520,000	116,918	636,918			5,014	3,858	8,873	8,873	
50-43-44-02-04-000-0022	PRIVATE	0.35	Y				40	515,000	140,627	655,627			6,686	5,144	11,830	11,830	
50-43-44-02-04-000-0014	PRIVATE	0.27	Y				15	275,000	480,438	755,438			2,507	1,929	4,436	4,436	
50-43-44-02-04-000-0013	PRIVATE	0.39	Y				10	300,000	331,322	631,322			1,671	1,286	2,958	2,958	
50-43-44-02-04-000-0090	PRIVATE	0.29	Y				15	1,500	0	1,500			1,500	1,929	4,436	4,436	
50-43-44-02-04-000-0070	PRIVATE	0.36	Y				20	1,500	0	1,500			2,507	2,572	5,915	5,915	
50-43-44-02-04-000-0060	PRIVATE	0.5	Y				10	1,500	0	1,500			1,671	1,286	2,958	2,958	
50-43-44-02-04-000-0050	EASEMENT	0.06	Y				15	1,500	0	1,500			2,507	4,436	4,436	4,436	
50-43-44-02-04-000-0050	PRIVATE	0.36	Y				10	1,500	0	1,500			1,671	1,286	2,958	2,958	
50-43-44-02-04-000-0040	PRIVATE	0.35	Y				15	1,500	0	1,500			2,507	4,436	4,436	4,436	
50-43-44-02-04-000-0030	PRIVATE	0.34	Y				80	600,000	717,881	1,317,881			13,372	10,288	23,660	23,660	
50-43-44-02-00-002-0060	PRIVATE	2.76	Y				200	3,600,000	0	3,600,000			33,429	25,721	59,150	59,150	
50-43-44-02-00-002-0010	PRIVATE	1.83	Y				145	2,700,000	0	2,700,000			24,236	18,648	42,884	42,884	
50-43-44-02-00-002-0080	PRIVATE	1.89	Y	3.99	R-112		150	2,700,000	2,468,867	5,168,867			25,072	19,291	44,363	44,363	
50-43-44-02-00-002-0110	PRIVATE	1.79	Y				50	950,000	0	950,000			8,357	6,430	14,788	14,788	
50-43-44-11-00-001-0080	PRIVATE	0.69	Y				50	500,000	0	500,000			8,357	6,430	14,788	14,788	
50-43-44-11-00-001-0010	PRIVATE	0.89	Y				140	2,700,000	1,943,621	4,643,621			23,400	18,005	41,405	41,405	
50-43-44-11-00-001-0030	PRIVATE	0.87	Y				25	200,000	0	200,000			4,179	7,394	7,394	7,394	
50-43-44-11-03-000-1003	PRIVATE	0.47	Y				35	1,000,000	47,002	1,047,002			5,850	4,501	10,351	10,351	
50-43-44-11-03-000-1004	PRIVATE	0.57	Y				70	1,000,000	435,056	1,435,056			11,700	9,002	20,703	20,703	
50-43-44-11-01-000-0040	PRIVATE	2.82	Y				70	1,000,000	1,089,279	2,089,279			11,700	9,002	20,703	20,703	
50-43-44-11-03-000-1011	PRIVATE	0.54	Y				65	1,500,000	71,701	1,571,701			10,964	8,359	19,224	19,224	
50-43-44-11-01-000-0011	PRIVATE	0.69	Y				70	500,000	0	500,000			11,700	9,002	20,703	20,703	
50-43-44-11-01-000-0053	PRIVATE	0.89	Y				65	1,000	0	1,000			10,964	8,359	19,224	19,224	
50-43-44-11-01-000-0070	PRIVATE	0.87	Y				65	1,000,000	346,331	1,346,331			10,964	8,359	19,224	19,224	
50-43-44-11-02-000-0090	PRIVATE	1.25	Y	-1.65	R-113		125	1,000,000	510,324	1,510,324			20,893	16,076	36,969	36,969	
50-43-44-11-02-000-0090	PRIVATE	0.54	Y				115	2,000	0	2,000			19,222	14,790	34,011	34,011	
50-43-44-11-03-000-1041	PRIVATE	0.54	Y				100	1,000,000	535,004	1,535,004			16,715	12,861	29,575	29,575	
50-43-44-11-03-000-1051	PRIVATE	0.5	Y				65	1,300,000	602,127	1,902,127			10,864	8,359	19,224	19,224	
50-43-44-11-03-000-1053	PRIVATE	0.5	Y				60	1,000,000	374,943	1,374,943			10,029	7,716	17,745	17,745	
50-43-44-11-03-000-1061	PRIVATE	1.38	Y				180	2,800,000	150,935	2,950,935			30,086	23,149	53,235	53,235	
50-43-44-11-00-001-0040	PRIVATE	3.13	Y				300	4,800,000	2,158,463	6,958,463			50,144	38,582	88,725	88,725	
50-43-44-11-00-001-0050	PRIVATE	2.72	Y	-1.02	R-114		300	4,800,000	2,580,113	7,380,113			50,144	38,582	88,725	88,725	
50-43-44-11-00-001-0060	PRIVATE	3.06	Y				320	5,270,000	1,776,911	7,046,911			53,487	41,154	94,641	94,641	
50-43-44-11-00-001-0070	PRIVATE	2.54	Y				300	5,270,000	414,972	5,684,972			50,144	38,582	88,725	88,725	
50-43-44-11-00-002-0010	PRIVATE	3.76	Y	1.29	R-115		390	6,200,000	511,027	6,711,027			65,187	50,155	115,343	115,343	
50-43-44-11-00-002-0020	PRIVATE	1.74	Y				180	2,900,000	6,003	2,906,003			31,758	24,435	56,193	56,193	
50-43-44-11-00-002-0020	PRIVATE	1.12	Y				120	2,900,000	308,195	3,208,195			20,058	15,433	35,490	35,490	
50-43-44-11-00-002-0030	PRIVATE	1.68	Y				165	2,610,000	306,203	2,916,203			30,922	23,792	54,714	54,714	
50-43-44-11-00-002-0050	PRIVATE	2.68	Y				190	4,800,000	1,838,771	6,638,771			31,758	24,435	56,193	56,193	
50-43-44-11-03-000-1070	PRIVATE	1.84	Y	-2.55	R-116		200	3,200,000	1,741,220	4,941,220			33,429	25,721	59,150	59,150	
TOTAL VALUES		61.31		Average 1996 PRIVATE Land Value = \$/ft²			5785	91,442,000	33,848,876	125,290,876	0	934,346	718,905	1,653,251	1,653,251		
50-43-44-11-03-000-1080	PRIVATE	2.57	Y				280	4,384,000	0	4,384,000			46,801	36,010	82,810	82,810	
50-43-44-11-03-000-1091	PRIVATE	2.24	Y				135	1,500,000	0	1,500,000			22,565	17,362	39,926	39,926	
50-43-44-11-03-000-1091	PRIVATE	1.12	N	-6.33	R-117		165	26,815,450	570,000	27,385,450			2,600,995	2,600,995	2,600,995	2,600,995	
50-43-44-11-03-110-0000	SLOANS CURVE TOWNHOUSES	6.7	N	-9.47	R-118		800	50,157,600	800,000	50,957,600			3,554,014	3,554,014	3,554,014	3,554,014	
50-43-44-11-03-000-1051	2000 CONDO SLOANS CURVE	6.7	N	-7.17	R-119		725	52,807,200	200,000	53,007,200			3,561,114	3,561,114	3,561,114	3,561,114	
50-43-44-11-03-000-1201	TOWN OF P B PHILIPPS PARK	15.98	N	-4.86	R-119		1,200	20,000,000	352,152	20,352,152			3,995,271	3,995,271	3,995,271	3,995,271	
50-43-44-11-03-000-1201	THE REF CONDO	4.04	N	-7.89	R-120		340	16,268,200	355,000	16,623,200			1,691,995	1,691,995	1,691,995	1,691,995	
50-43-44-11-03-000-1291	2295 S. OCEAN BLVD (HARBOR HOUSE)	0.92	Y	-9.92	R-120		340	22,137,425	1,092,132	23,229,557			100,556	100,556	100,556	100,556	
50-43-44-11-03-000-1291	SEA LORD HOTEL	0.89	Y	-6.69	R-120		100	660,000	432,132	1,092,132			12,861	12,861	25,721	25,721	

TABLE F-2: SUMMARY OF ESTIMATED BENEFITS FOR BEACH RESTORATION PROJECT IMPROVEMENTS BY SHORELINE REACH
15-YEAR PROJECT HORIZON

PALM BEACH COUNTY PROPERTY NUMBER	DESCRIPTION	Approx. Acres	SEA- WALL	1990 to 1997 Shoreline Change Rate (ft./yr)	FDNR SURVEY MON.	Dist. from 1990 W.L. to Bldg. (FEET)	1996 VALUATION			Seawall Const. Cost (\$ Present)	No. of Years to Compute Land Loss	Expected Land Loss next 15 years (\$ Present)	Seawall/Revet Repair for 15 year life (\$ Present)	One-Time Major Repair 15 year life (\$ Present)	Expected Savings for Seawall Repair/ Maint. - 15 yr life (\$ Present)	TOTAL COST (\$ Present)
							LAND VALUE (\$)	BUILDING VALUE (\$)	TOTAL VALUE (\$)							
REACH 7																
50-43-44-23-13	AMBASSADOR HOTEL	2.53	N	4.56	T-125	170	215									0
50-43-44-23-00-002-0020	2770 SOUTH OCEAN BLVD.	4.11	N			175	395									0
50-43-44-23-11	AMBASSADOR SOUTH COOP	6.56	N	3.95	R-126	200	230	23,960								0
50-43-44-23-00-002-0081	OUTDRIVEC PARK	0.19	N	3.67		150	1,000	0								0
50-43-44-23-10	SUTTON PLACE EASEMENT	3.72	N	2.56		175	290	0								0
50-43-44-23-12	AMBASSADOR II COOP	7.4	N	-1.02		180	500	16,945,116		15	232,920	33,429	25,721	59,150	232,920	
50-43-44-23-00-002-0120	OCEAN GRAND HOTEL		Y	-2.70	R-127	160	200	3,572,555		15	262,241				262,241	
50-43-44-23-00-002-0160	HILTON	2.33	N	-3.19		160	180	3,795,922		15	1,373,432				1,373,432	
50-43-44-23-14	PALM WORTH INC COOP	6.29	N	-5.23		160	575	4,581,000								0
50-43-44-23-00-002-0200	PBC - KREUSLER PARK	0.6	Y	-6.10		410		785,296								0
38-43-44-26-00-001-0010	LAKE WORTH MUN. BEACH	0.3	Y	-7.32	R-128	990		477,462								0
38-43-44-26-00-001-0020	LAKE WORTH MUN. BEACH															0
TOWN OF PALM BEACH																
50-43-44-26-00-001-0050	BEACHCOMBER	4.13	N	-12.53	R-129	175	300	473,953		4	568,494	16,715	12,861	29,575	866,494	
50-43-44-26-10	PALM BEACHER APTS. INC	5.7	N	-9.50		200	790	3,531,378							29,575	
50-43-44-26-09	PALM BEACH HAMPTON	4.25	N	-7.68	R-130	175	340	14,336,209		10	954,346	71,873	55,300	127,173	3,532,939	
50-43-44-26-07	OASIS III OF PALM BEACH		Y	-6.64		430		26,646,719							1,294,346	
50-43-44-26-05	CARLTON PLACE	4.23	N	-5.53		170	500	31,440,348		15	1,262,794				1,262,794	
50-43-44-26-02	ENCLAVE OF PALM BEACH	3.41	N	-4.82		125	280	9,200,258		12	526,324				806,324	
50-43-44-26-01	PATRICIANS OF PALM BEACH	2.27	N	-3.77	R-131	80	150	7,393,557		5	107,727				257,727	
50-43-44-26-03	LA RENAISSANCE #1	4.67	N	-2.87		120	405	19,529,624		15	530,853				530,853	
50-43-44-26-04	DORCHESTER OF PALM BEACH	6.31	N	-1.59		130	500	15,038,248		15	363,082				363,082	
50-43-44-35-19	MERIDIAN OF PALM BEACH II	6.98	N	-0.52		70	580	26,873,172		15	137,743				137,743	
50-43-44-35-24	ATRIUM OF PALM BEACH II	1.82	N	0.05		110	150	9,850,290							0	
50-43-44-35-13	EMERALDE CONDO	7.23	N	0.61	R-133	75	600	31,634,911							0	
50-43-44-35-18	ATRIUMS OF PALM BEACH	6.27	N			100	500	28,322,210							0	
50-43-44-35-03	PALCYON OF PALM BEACH		Y			175		6,177,200							81,332	
50-43-44-35-05	PATRICIAN OF PALM BEACH		Y			100		152,574							51,757	
50-43-44-35-05	PATRICIAN TOWERS #1		Y			100		125							29,575	
50-43-44-35-02	RECREATIONAL AREA		Y	2.43	R-134	265		16,347,508							29,575	
REACH 8																
TOTAL VALUES							91.30	107.15	24,345,325	22,480,662	427,294,501	492,245	378,743	870,988	11,811,883	
Average 1996 CONDO Land Value =							66	\$/ft ²								
Average 1996 CONDO Land Value =							44	\$/ft ²								
SOUTH PALM BEACH																
62-43-44-35-00-002-0110	PRIVATE	0.08	Y			90		450,000								26,618
62-43-44-35-00-002-0080	PRIVATE	0.08	Y			90		475,000								26,618
62-43-44-35-00-002-0060	PRIVATE	0.07	Y			90		500,000								26,618
62-43-44-35-08	PALM SEA CONDO		Y			280		11,549,500								82,810
62-43-44-35-04	LE CHATEAU ROYAL CONDO		Y			180		9,552,400								53,235
62-43-44-35-12	PATRICIAN (BARCLAY)		Y			360		28,461,600								112,386
62-43-44-35-25	3560 CONDO (CONCORDIA EAS	5.52	N	3.20		200		15,898,400								0
62-43-44-35-29	TUSCANY OF PALM BEACH	2.18	Y			200		7,473,025								59,150
62-43-44-35-00-002-0190	PRIVATE	0.8	Y			100		1,000,000								29,575
62-43-44-35-10	HORIZONS EAST CONDO		Y			100		4,291,315								29,575
62-43-44-35-10	MAYFAIR HOUSE CONDO	2.76	Y			300		21,041,000								88,725
62-43-44-35-00-002-0140	3600 SOUTH OCEAN CONDO	1.95	N	0.81	R-136	150		8,691,000								44,363
62-43-44-35-22	DUNE DECK OF P.M BEACHES	0.71	N	0.32		284		9,442,300								0
62-43-44-35-27	LA PENSEE CONDO	0.71	N	-0.12		100		5,703,600								6,228
62-43-44-35-16	PALM BEACH WINDEMERE	0.75	N	-0.58		100		2,344,200								30,101

TABLE F-2: SUMMARY OF ESTIMATED BENEFITS FOR BEACH RESTORATION PROJECT IMPROVEMENTS BY SHORELINE REACH
15-YEAR PROJECT HORIZON

PALM BEACH COUNTY PROPERTY NUMBER	DESCRIPTION	Approx Acres	SEA- WALL	1990 to 1997 Shoreline Change Rate (ft./yr)	FONR SURVEY MON.	Dist. from 1990 W.L. to Bldg. (FEET)	1996 VALUATION			Seawall Const. Cost (\$ Present)	No. of Years to Compute Land Loss	Expected Land Loss next 15 years (\$ Present)	Repair for 15 year life (\$ Present)	One-Time Major Repair 15 year life (\$ Present)	Expected Savings for Sewall Repair/ Maint. - 15 yr life (\$ Present)	TOTAL COST (\$ Present)
							LAND VALUE (\$)	BUILDING VALUE (\$)	TOTAL VALUE (\$)							
62-43-45-02-03	IMPERIAL HOUSE CONDO	1.09	N	-1.34		70				15	83,453				83,453	
40-43-45-02-00-001-0010	LANTANA REACH 9	0.07	N	-2.17	R-137	110	660	77,722	914,074	0	630,671	327,606	252,067	579,673	1,330,125	
TOTAL VALUES																
40-43-45-02-00-001-0020	LANTANA PUBLIC BEACH	0.69	N	-1.60		100	150	240,451	0	15	109,610	5,014	3,858	8,873	109,610	
40-43-45-02-00-001-0021	LANTANA AVENUE ACCESS		N			30									8,873	
42-43-45-02-00-001-0021	MANALAPAN RITZ-CARLTON	6.86	Y	0.79	R-138	690	8,100,000	26,300,730	34,400,730			115,331	88,738	204,069	204,069	
42-43-45-02-00-001-0022	LA CONQUILL CLUB VILLAS	3.22	Y			380		11,930,125	11,930,125			63,515	48,870	112,386	112,386	
42-43-45-02-00-001-0023	LA CONQUILL CLUB VILLAS II	2.4	Y			293		8,690,125	8,690,125			48,974	37,681	86,655	86,655	
42-43-45-02-01-000-0013	PRIVATE	0.57	Y			60	725,000	794,158	1,519,158			10,029	7,716	17,745	17,745	
42-43-45-02-01-000-0014	PRIVATE	0.45	Y			160	675,000	900,750	1,575,750			26,743	20,577	47,320	47,320	
42-43-45-02-01-000-0022	PRIVATE	0.38	Y	-3.59	R-139	75	675,000	1,169,548	1,844,548			25,586	9,645	22,181	22,181	
42-43-45-02-01-000-0021	PRIVATE	1.24	Y			150	1,950,000	0	1,950,000			25,072	19,291	44,363	44,363	
42-43-45-02-01-000-0021	PRIVATE	1.87	Y			239	2,800,000	0	2,800,000			39,948	30,737	70,685	70,685	
42-43-45-02-01-000-0040	PRIVATE	3.57	Y			420	5,400,000	529,392	5,929,392			70,201	54,014	124,216	124,216	
42-43-45-02-01-000-0061	PRIVATE	1.92	Y	-2.33	R-140	210	2,900,000	288,150	3,188,150			35,101	27,007	62,108	62,108	
42-43-45-02-01-000-0071	PRIVATE	1.92	Y			150	2,050,000	2,338,150	4,388,150			25,072	19,291	44,363	44,363	
42-43-45-02-01-000-0081	PRIVATE	1.24	Y			150	2,025,000	60,393	2,085,393			25,072	19,291	44,363	44,363	
42-43-45-02-01-000-0082	PRIVATE	1.24	Y			150	2,025,000	1,132,617	3,157,617			25,072	19,291	44,363	44,363	
42-43-45-02-01-000-0092	PRIVATE		Y			150	2,050,000	703,778	2,753,778			25,072	19,291	44,363	44,363	
42-43-45-02-01-000-0101	PRIVATE		Y			150	2,050,000	2,095,579	4,145,579			25,072	19,291	44,363	44,363	
42-43-45-02-01-000-0113	PRIVATE		Y			156	2,050,000	81,909	2,131,909			26,075	20,062	46,137	46,137	
42-43-45-02-01-000-0111	PRIVATE		Y	-11.03	R-141	250	3,400,000	3,640,366	7,040,366			41,787	32,151	73,938	73,938	
42-43-45-02-01-000-0112	PRIVATE		Y			200	2,700,000	361,399	3,061,399			33,429	25,721	59,150	59,150	
42-43-45-02-01-000-0121	PRIVATE		Y			200	2,700,000	1,013,075	3,713,075			33,429	25,721	59,150	59,150	
42-43-45-02-01-000-0122	PRIVATE		Y			200	2,700,000	560,636	3,260,636			33,429	25,721	59,150	59,150	
42-43-45-02-01-000-0123	PRIVATE		Y			200	2,700,000	229,603	2,929,603			33,429	25,721	59,150	59,150	
42-43-45-02-01-000-0130	PRIVATE		Y			510	6,450,000	4,788,800	11,238,800			85,244	65,569	150,833	150,833	
42-43-45-02-01-000-0143	PRIVATE		Y	-2.03	R-142	190	2,600,000	372,777	2,972,777			31,758	24,435	56,193	56,193	
42-43-45-02-01-000-0144	PRIVATE	1.45	Y			150	2,050,000	2,867,747	4,917,747			25,072	19,291	44,363	44,363	
42-43-45-02-01-000-0141	PRIVATE	1.54	Y	2.45	R-143	160	2,150,000	5,391,822	7,541,822			26,743	20,577	47,320	47,320	
42-43-45-02-01-000-0151	PRIVATE		Y			200	2,700,000	1,385,294	4,085,294			33,429	25,721	59,150	59,150	
42-43-45-02-01-000-0153	PRIVATE		Y			190	2,050,000	7,600	2,057,600			25,072	19,291	44,363	44,363	
42-43-45-02-01-000-0152	PRIVATE	2.09	Y			212	2,700,000	460,341	3,160,341			35,418	27,252	62,670	62,670	
42-43-45-02-01-000-0161	PRIVATE		Y			155	2,025,000	702,041	2,727,041			25,908	19,934	45,841	45,841	
42-43-45-02-01-000-0171	PRIVATE		Y			160	2,000,000	0	2,000,000			26,743	20,577	47,320	47,320	
42-43-45-02-01-000-0172	PRIVATE		Y	-0.42	R-144	165	2,300,000	674,760	2,974,760			27,579	21,220	48,799	48,799	
42-43-45-10-01-000-0132	PRIVATE	2	Y			260	3,000,000	78,973	3,078,973			43,458	33,437	76,895	76,895	
42-43-45-10-01-000-0133	PRIVATE		Y			300	3,800,000	4,846,800	8,646,800			50,144	38,582	88,726	88,726	
42-43-45-10-01-000-0134	PRIVATE		Y			200	2,200,000	74,661	2,274,661			33,429	25,721	59,150	59,150	
42-43-45-10-01-000-0131	PRIVATE		Y			166	2,000,000	397,164	2,397,164			27,746	21,349	49,095	49,095	
42-43-45-10-01-000-0122	PRIVATE		Y	-3.33	R-145	132	2,000,000	1,715,963	3,715,963			22,063	16,976	39,039	39,039	
42-43-45-10-01-000-0121	PRIVATE		Y			168	2,000,000	38,879	2,038,879			28,081	21,606	49,686	49,686	
42-43-45-10-01-000-0123	PRIVATE		Y			175	2,000,000	1,904	2,001,904			29,251	22,506	51,757	51,757	
42-43-45-10-01-000-0125	PRIVATE		Y			395	2,400,000	2,322,456	4,722,456			66,023	50,799	116,822	116,822	
TOTAL VALUES																
42-43-45-10-01-000-0124	PRIVATE	0.88	N	-5.42		200	1,300,000	15,562	1,315,562			15,562	11,315	26,877	26,877	
42-43-45-10-01-000-0111	PRIVATE	1.62	N	-6.50	R-146	390	1,870,000	426,835	2,296,835			65,187	50,156	115,343	115,343	
42-43-45-10-01-000-0101	PRIVATE	1.37	N	-4.89		220	1,650,000	0	1,650,000			289,486	220,792	510,278	510,278	
42-43-45-10-00-004-0010	PRIVATE	1.51	N	-2.56		150	1,650,000	429,466	2,079,466			220,792	174,745	395,537	395,537	
42-43-45-10-00-004-0020	PRIVATE	2.87	N	0.19	R-147	200	3,850,000	517,403	4,367,403			115,588	90,453	206,041	206,041	
42-43-45-15-00-001-0017	PRIVATE	1.17	N			225	1,650,000	0	1,650,000			0	0	0	0	
42-43-45-15-00-001-0012	PRIVATE	2.35	N			240	3,400,000	128,673	3,528,673			0	0	0	0	
42-43-45-10-01-000-0091	PRIVATE	1.21	N			240	1,640,000	158,419	1,798,419			0	0	0	0	
42-43-45-10-01-000-0092	PRIVATE	1.32	N			250	1,760,000	175,943	1,935,943			0	0	0	0	

TABLE F-2: SUMMARY OF ESTIMATED BENEFITS FOR BEACH RESTORATION PROJECT IMPROVEMENTS BY SHORELINE REACH
15-YEAR PROJECT HORIZON

PALM BEACH COUNTY PROPERTY NUMBER	DESCRIPTION	Approx. Acres	SEA- WALL	1950 to 1997 Shoreline Change Rate (ft./yr)	FDNR SURVEY MON.	Dist. (from 1990 W.L. to Bldg.) (FEET)	SHORE LINE (FEET)	1996 VALUATION			Seawall Const. Cost (\$ Present)	No. of Years to Compute Land Loss	Expected Land Loss next 15 years (\$ Present)	Seawall/Revet. Repair for 15 year life (\$ Present)	One-Time Major Repair 15 year life (\$ Present)	Expected Savings for Seawall Repair/ Maint. - 15 yr life (\$ Present)	TOTAL COST (\$ Present)
								LAND VALUE (\$)	BUILDING VALUE (\$)	TOTAL VALUE (\$)							
42-43-45-10-01-000-0083	PRIVATE	1.21	N			250	180	1,650,000	3,566,907	5,246,907						0	
42-43-45-10-01-000-0081	PRIVATE	1.4	N			260	200	1,800,000	90,614	1,890,614						0	
42-43-45-10-01-000-0082	PRIVATE	1.06	N			250	145	1,650,000	2,612,843	4,262,843						0	
42-43-45-10-01-000-0072	PRIVATE	1.12	N	1.62	R-148	280	150	1,650,000	1,811,298	3,461,298						0	
42-43-45-10-01-000-0071	PRIVATE	1.14	N			280	150	1,650,000	204,051	1,854,051						0	
42-43-45-15-00-001-0013	PRIVATE	1.17	N			280	150	1,650,000	825,923	2,475,923						0	
42-43-45-15-00-001-0014	PRIVATE	1.51	N			280	200	1,800,000	227,051	2,027,051						0	
42-43-45-15-00-001-0015	PRIVATE	1.03	N	0.14	R-149	290	145	1,300,000	3,399,544	4,699,544						0	
42-43-45-10-01-000-0031	PRIVATE	0.81	N			280	165	1,250,000	665,900	1,915,900						0	
42-43-45-10-01-000-0032	PRIVATE	10.4	N	3.31	R-150	275	1,185	6,400,000	1,409,862	7,809,862						0	
42-43-45-10-01-000-0052	PRIVATE	0.96	N			260	75	700,000	43,834	743,834						0	
42-43-45-10-01-000-0053	PRIVATE	0.8	N			250	100	800,000	24,591	824,591						0	
42-43-45-10-01-000-0061	PRIVATE	0.28	N			250	80	475,000	12,280	487,280						0	
42-43-45-10-01-000-0062	PRIVATE	0.55	N			250	95	500,000	0	500,000						0	
42-43-45-10-01-000-0069	PRIVATE	0.61	N	2.14	R-151	380	75	500,000	0	500,000						0	
42-43-45-10-01-000-0064	PRIVATE	0.48	N			370	70	650,000	433,327	1,083,327						0	
42-43-45-10-01-000-0063	PRIVATE	1.81	N			370	160	950,000	390,564	1,340,564						0	
00-43-45-15-00-004-0010	SLIMD PARK	1.85	N			380	225	1,588,000	40,789	1,629,789						0	
REACH 11		41.98				5,645		47,384,000	17,641,668	65,025,668		874,588	65,187	50,156	115,343	869,831	
TOTALS FOR ALL REACHES		831.892		Average 1996 PRIVATE Land Value =		82,002		773,439,594	350,428,877	2,262,757,427	5,680,000	34,953,657	8,328,536	6,408,144	15,491,719	56,125,377	

NOTES:

1. Expected savings Town of PB - Clark Ave was calculated as \$5.20/cy as a nourishment cost (220 cy/FT) @ 15 yrs

15.5 miles

32,229 ft = no seawall (39.3 %)

49,773 ft = seawalls (60.7 %)

190.02 = Structure repair per storm (\$/LF)-one time cost (1997)

17.73 = Annual seawall maintenance (\$/LF)

1000.00 = Structure replacement (\$/LF) - one time cost

10.3797 = (PIA, 5%, 15yr)

0.9524 = (PIF, 5%, 1yr)

0.6768 = (PIF, 5%, 8yr)

TABLE F-3: SUMMARY OF ESTIMATED BENEFITS FOR BEACH RESTORATION PROJECT IMPROVEMENTS BY SHORELINE REACH
30-YEAR PROJECT HORIZON

PALM BEACH COUNTY PROPERTY NUMBER	DESCRIPTION	Approx. Acres	SEA- WALL	1990 to 1997 Shoreline Change Rate (ft./yr)	FDNR SURVEY MON.	Dist. from 1990 W/L SURVEY to Bldg. (FEET)	SHORE LINE (FEET)	1986 VALUATION			Seawall Const. Cost (\$ Present)	No. of Years to Complete Land Loss	Expected Land Loss next 30 years (\$ Present)	Seawall/Revel. Repair for 30 year life (\$ Present)	One-Time Const. Cost at year 15 (\$ Present)	Expected Savings for Seawall Repair/ Maint. - 30 yr life (\$ Present)	TOTAL COST (\$ Present)
								LAND VALUE (\$)	BUILDING VALUE (\$)	TOTAL VALUE (\$)							
TOWN OF PALM BEACH																	
50-43-42-34-01-000-0260	PRIVATE	0.6	N	25.81	R-76	710	90	1,700,000	61,972	1,761,972						0	
50-43-42-34-01-000-0280	PRIVATE	0.27	N			740	100	1,100,000	367,033	1,467,033						0	
50-43-42-34-01-000-0290	PRIVATE	0.27	N			660	100	1,100,000	545,086	1,645,086						0	
50-43-42-34-01-000-0300	PRIVATE	0.24	N			600	90	1,100,000	194,628	1,294,628						0	
EAST INLET DRIVE UNDEVELOPED PUB. ACCESS																	
50-43-42-34-02-000-0011	PRIVATE	1.39	N			590	140	2,400,000	345,137	2,745,137						0	
INDIAN ROAD UNDEVELOPED PUB. ACCESS																	
50-43-42-34-02-000-0020	PRIVATE	1.24	N			620	120	1,800,000	44,429	1,844,429						0	
50-43-42-34-02-000-0031	PRIVATE	1.76	N			590	170	3,400,000	359,948	3,759,948						0	
ARABIAN ROAD UNDEVELOPED PUB. ACCESS																	
50-43-42-34-02-000-0050	PRIVATE	2.84	N			500	290	5,100,000	207,949	5,307,949						0	
CARIBBEAN ROAD UNDEVELOPED PUB. ACCESS																	
50-43-42-34-02-000-0061	PRIVATE	0.41	N	20.81	R-77	460	90	1,800,000	1,280,054	3,080,054						0	
50-43-42-34-02-000-0083	PRIVATE	0.77	N			440	100	1,900,000	217,109	2,117,109						0	
50-43-42-34-02-000-0100	PRIVATE	0.74	N			460	90	1,900,000	282,140	2,182,140						0	
MEDITERRANEAN ROAD UNDEVELOPED PUB. ACCESS																	
50-43-42-34-02-000-0110	PRIVATE	1.08	N			420	135	2,500,000	0	2,500,000						0	
50-43-42-34-04-000-0030	PRIVATE	0.95	N			500	115	2,300,000	2,359,449	4,659,449						0	
50-43-42-34-04-000-0100	PRIVATE	2.31	N			500	180	2,600,000	454,870	3,054,870						0	
50-43-42-34-04-000-0101	PRIVATE	1.99	N			280	155	2,700,000	290,771	2,990,771						0	
50-43-42-34-05-000-0020	PRIVATE	0.46	N			320	75	1,350,000	32,319	1,382,319						0	
50-43-42-34-05-000-0011	PRIVATE	1.12	N			240	280	2,600,000	521,849	3,121,849						0	
REACH 1								37,350,000	7,964,743	44,914,743	0	0	0	0	0	0	
TOTAL VALUES								47	\$17.2								
REACH 2																	
50-43-42-34-07-000-0030	PRIVATE	0.86	N	6.54	R-78	200	150	1,100,000	192,606	1,292,606						0	
50-43-42-34-07-000-0021	PRIVATE	0.41	N			160	120	800,000	828,539	1,628,539						0	
50-43-42-34-07-000-0013	PRIVATE	0.51	N			140	100	750,000	153,342	903,342						0	
50-43-42-34-08-000-0062	PRIVATE	0.35	N			130	100	800,000	314,243	1,114,243						0	
50-43-42-34-08-000-0050	PRIVATE	0.71	N			120	115	900,000	2,376	902,376						0	
50-43-42-34-08-000-0040	PRIVATE	0.22	N			130	70	650,000	0	650,000						0	
50-43-42-34-08-000-0071	PRIVATE	0.11	N			120	90	40,000	6,944	46,944						0	
50-43-42-34-08-000-0030	PRIVATE	0.45	Y			75	75	1,050,000	51,765	1,101,765				36,075	55,250	176,800	
50-43-42-34-08-000-0020	PRIVATE	0.33	Y			240	240	700,000	255,838	955,838				48,100	176,800	176,800	
50-43-42-01-000-0110	PUBLIC	0.37	Y	-2.12	R-79	100	100	800,000	147,940	947,940				22,100	73,667	73,667	
ANGLER AVE ACCESS																	
50-43-43-03-000-0251	PALM BEACH COUNTY	0.09	Y			30	30	765,000	54,431	819,431				84,717	84,717	84,717	
50-43-43-03-000-0061		0.31	Y			55	55	100,000	2,663	102,663				29,402	29,402	29,402	
50-43-43-03-000-0062		0.45	Y			110	110	800,000	344,765	1,144,765				43,290	66,300	66,300	
50-43-43-03-000-0252	PUBLIC	0.15	Y			120	30	50,000	3,850	53,850				22,100	22,100	22,100	
OCEAN TERRACE ACC. PUBLIC																	
50-43-43-03-000-0242	PRIVATE	0.4	Y			115	115	765,000	737,408	1,502,408				84,717	84,717	84,717	
50-43-42-34-11-000-0100	PRIVATE	0.59	Y			90	90	1,080,000	72,472	1,152,472				43,290	66,300	66,300	
PALM BEACH COUNTY																	
50-43-42-34-11-000-0150	PRIVATE	0.1	Y			45	45	70,000	2,472	72,472				33,150	33,150	33,150	
50-43-42-34-11-000-0141	PRIVATE	0.37	Y			75	75	675,000	120,572	795,572				36,075	55,250	55,250	
50-43-42-03-05-000-0010	PRIVATE	0.6	Y			200	200	1,000,000	875,242	1,875,242				88,400	88,400	88,400	
MERRIN ROAD ACCESS																	
50-43-43-03-000-0251	PRIVATE	0.51	Y			25	25	850,000	621,852	1,471,852				48,100	73,667	73,667	
50-43-43-03-000-0240	PRIVATE	0.624	Y	-1.08	R-80	100	100	900,000	40,104	940,104				48,100	73,667	73,667	
KENLYN ROAD ACCESS																	
50-43-43-03-000-0011	PRIVATE	0.75	Y			125	25	1,150,000	61,180	1,211,180				12,025	18,417	18,417	
50-43-43-03-000-0261	PRIVATE	0.485	Y			70	70	1,100,000	675,328	1,775,328				33,670	51,567	51,567	
50-43-43-03-000-0250	PRIVATE	0.526	Y			70	70	900,000	628,378	1,528,378				33,670	51,567	51,567	
PALMO WAY ACCESS																	
50-43-43-03-000-0010	PRIVATE	0.964	Y			25	25	1,350,000	409,563	1,759,563				12,025	18,417	18,417	
50-43-43-03-000-0040	PRIVATE	0.464	Y			90	90	900,000	201,325	1,101,325				35,794	103,134	103,134	
50-43-43-03-000-0191	PRIVATE	0.579	Y			70	70	1,000,000	47,868	1,047,868				23,010	43,290	43,290	
50-43-43-03-000-0241	PRIVATE	0.165	Y			160	160	3,000	0	3,000				33,670	51,567	51,567	
50-43-43-03-000-0203	PRIVATE	0.431	Y			30	30	40,000	1,860	41,860				40,807	76,960	76,960	
50-43-43-03-000-0202	PRIVATE	0.137	Y			40	40	1,050,000	266,432	1,316,432				14,430	22,100	22,100	
50-43-43-03-000-0411	PRIVATE	0.059	Y			45	45	30,000	2,476	32,476				19,240	29,467	29,467	
50-43-43-03-000-0410	PRIVATE	0.519	Y	-5.20	R-81	160	160	869,861	59,478	929,339				21,645	33,150	33,150	
50-43-43-03-000-0410	PRIVATE		Y										40,907	76,960	117,867		

TABLE F-3: SUMMARY OF ESTIMATED BENEFITS FOR BEACH RESTORATION PROJECT IMPROVEMENTS BY SHORELINE REACH
30-YEAR PROJECT HORIZON

PALM BEACH COUNTY PROPERTY NUMBER	DESCRIPTION	Approx. Acres	SEA- WALL	1990 to 1997 Shoreline Change Rat (ft/yr)	FDNR SURVEY MON	Dist. from 1990 W.L. to Bldg. (FEET)	1996 VALUATION			Seawall Const. Cost (\$ Present)	No. of Years to Compute Land Loss	Expected Land Loss next 30 years (\$ Present)	Seawall/Revet Repair for 30 year life (\$ Present)	One-Time Const. Cost at year 15 (\$ Present)	Expected Savings for Seawall Repair/ Maint. - 30 yr life (\$ Present)	TOTAL COST (\$ Present)
							LAND VALUE (\$)	BUILDING VALUE (\$)	TOTAL VALUE (\$)							
50-43-43-14-00-002-0090	PRIVATE	1.34	Y			195	4,000,000	626,523	4,626,523			49,855	83,795	143,650	143,650	
50-43-43-14-17-000-0030	PRIVATE	0.77	Y			40	2,800,000	610,463	3,410,463			49,855	83,795	143,650	143,650	
50-43-43-14-08-000-0040	PRIVATE	0.45	Y	1.14	R-91	130	1,000,000	753,562	1,753,562			10,227	19,240	29,467	29,467	
50-43-43-14-07-000-0061	PRIVATE	0.84	Y			130	1,500,000	1,436,935	2,936,935			33,237	62,530	95,767	95,767	
50-43-43-14-07-000-0071	PRIVATE	0.8	N	-0.56		235	1,500,000	205,113	1,705,113		30	33,237	62,530	95,767	95,767	
50-43-43-14-00-000-0010	PRIVATE	0.37	N	-1.52		25	2,700,000	964,351	3,664,351		30	6,392	12,025	18,417	18,417	
50-43-43-14-08-000-0190	PRIVATE	0.32	Y			100	850,000	1,057,293	1,907,293		30	25,567	48,100	73,667	73,667	
50-43-43-14-26-000-0010	PRIVATE	0.37	Y			25	1,000,000	852,522	1,852,522			6,392	12,025	18,417	18,417	
50-43-43-14-26-000-0020	PRIVATE	0.34	Y			25	900,000	802,262	1,702,262			6,392	12,025	18,417	18,417	
50-43-43-14-26-000-0050	PRIVATE	0.23	Y			25	400,000	642,000	1,042,000			6,392	12,025	18,417	18,417	
50-43-43-14-26-000-0061	PRIVATE	0.23	Y			25	400,000	537,949	937,949			6,392	12,025	18,417	18,417	
50-43-43-14-26-000-0040	PRIVATE	0.24	Y			25	400,000	567,582	967,582			6,392	12,025	18,417	18,417	
50-43-43-14-26-000-0020	PRIVATE	0.34	Y			55	900,000	802,262	1,702,262			40,907	76,960	117,867	117,867	
50-43-43-14-10-006-0011	PRIVATE	0.85	Y			160	1,400,000	1,277	1,401,277			31,959	60,125	92,084	92,084	
50-43-43-14-10-006-0013	PRIVATE	0.78	Y	-4.31	R-92	125	1,400,000	12,475	1,412,475			59,804	110,630	169,434	169,434	
50-43-43-14-25	WARDEN HOUSE CONDOMINIUM	1.265	Y			230			2,429,250			6,392	12,025	18,417	18,417	
50-43-43-14-23	OCEAN TOWERS CONDOMINIUM	2.02	Y			230			15,637,630			58,804	110,630	169,434	169,434	
50-43-43-15-23	NORTH OCEAN CONDOMINIUM	6.7	Y			160			6,834,455			40,907	76,960	117,867	117,867	
50-43-43-14-21	SUN AND PALM CONDOMINIUM	3.26	Y	-7.17	R-93	180	200,000	0	94,671,436	11	199,516	30,680	57,720	88,400	88,400	
50-43-43-15-11	TOWN OF PALM BEACH	0.124	N	-7.59		200			200,000	13	744,345				249,516	
50-43-43-15-27	PB BILTMORE	0.606	N	-8.19		120			38,323,287						864,345	
50-43-43-23-13	LEVERETT HOUSE	2.64	Y	-8.20		120			19,973,452						1,853,418	
50-43-43-23-25	TWO NORTH BREAKERS ROW	5.05	N	-10.43	T-94	80	20,000,000	23,800,000	43,800,000	3	550,000	232,658	437,710	670,368	550,000	
50-43-43-22-24-002-0000	BREAKERS TRACT 2	4.00	Y	-14.45		910			29,000,000	0					435,000	
50-43-43-22-24-004-0000	BREAKERS TRACT 4 (HOTEL)	9.04	Y	-21.84		130			4,439,000	0					15,000	
50-43-43-22-24-006-0000	BREAKERS TRACT 5/6	3.68	N	-25.35		110				0					15,000	
50-43-43-22-24-008-0000	VIA BETHESDA ACCESS		N			15				0					15,000	
REACH 3																
							48,250,000	34,634,636	399,533,146	1,690,000		2,457,539	1,020,884	1,920,633	2,941,517	7,089,055
							Average 1996 PRIVATE Land Value =	67	\$/ft ²							
							Average 1996 CONDO Land Value =	87	\$/ft ²							
50-43-43-23-01-000-0180	PRIVATE	1.96	Y	-26.81	R-95	165	2,800,000	1,206,358	4,006,358			42,185	79,365	121,550	121,550	
50-43-43-23-01-000-0180	PRIVATE	1.83	Y			160	2,800,000	1,282,157	4,082,157			46,020	86,580	132,600	132,600	
50-43-43-22-05-000-0330	TOWN OF PB - CLARK AVE	2.31	N	14.06	R-96	120	750,000	0	750,000					755,040 (1)	755,040	
50-43-43-22-05-000-0320	PRIVATE	1.46	Y			50	60,000	0	60,000					36,833	36,833	
50-43-43-22-06-000-2200	PRIVATE	0.68	Y			125	2,000,000	604,447	2,604,447					92,084	92,084	
50-43-43-22-07-000-5290	PRIVATE	0.68	Y			335	250,000	0	250,000					36,833	36,833	
50-43-43-22-07-000-5271	PRIVATE	0.676	Y			135	1,100,000	88,047	1,188,047					92,084	92,084	
50-43-43-22-08-000-8260	PRIVATE	0.733	Y			100	1,250,000	1,036,907	2,286,907					99,450	99,450	
50-43-43-23-00-004-0100	PRIVATE	0.44	Y			125	900,000	211,188	1,111,188					92,084	92,084	
50-43-43-23-00-004-0060	PRIVATE	0.68	Y			120	1,400,000	606,246	2,006,246					88,400	88,400	
50-43-43-23-00-004-0010	PRIVATE	0.417	Y	28.30	R-97	65	1,000,000	205,002	1,205,002					47,863	47,863	
50-43-43-23-00-004-0110	PRIVATE	0.417	Y	9.16	R-98	1,930	200,000	0	200,000					421,770	421,770	
50-43-43-26-00-001-0170	TOWN OF P B PUBLIC BEACH	7.9	Y			60	100,000	0	100,000					44,200	44,200	
50-43-43-26-00-001-0010	TOWN OF P B PUBLIC BEACH	0.06	Y			740	100,000	0	100,000					545,135	545,135	
50-43-43-26-00-001-0010	TOWN OF P B PUBLIC BEACH	4.01	Y	7.58	R-99	150	1,600,000	164,717	1,764,717					73,667	73,667	
50-43-43-26-03-000-0011	PRIVATE	0.321	Y			100	800,000	217,688	1,017,688					110,500	110,500	
50-43-43-26-03-000-0030	PRIVATE	0.62	Y			100	1,300,000	1,242,472	2,542,472					73,667	73,667	
50-43-43-26-03-000-0040	PRIVATE	0.62	Y			100	1,275,000	841,173	2,116,173					73,667	73,667	
50-43-43-26-03-000-0050	PRIVATE	0.62	Y			100	1,275,000	19,166	1,294,166					73,667	73,667	
50-43-43-26-03-000-0060	PRIVATE	0.62	Y			100	1,275,000	420,154	1,695,154					73,667	73,667	
50-43-43-26-03-000-0070	PRIVATE	0.62	Y			220	3,000,000	1,501,394	4,501,394					162,067	162,067	
50-43-43-26-03-000-0081	PRIVATE	1.61	Y	-2.69	R-100	95	1,200,000	1,022,971	2,222,971					69,983	69,983	
50-43-43-26-03-000-0100	PRIVATE	0.42	Y			190	2,500,000	45,026	2,545,026					45,026	45,026	
50-43-43-26-00-002-0010	PRIVATE	0.916	Y			160	1,900,000	1,954,021	3,854,021					139,967	139,967	
50-43-43-26-00-002-0012	PRIVATE	0.757	Y			160	1,900,000	1,532,681	3,432,681					110,500	110,500	
50-43-43-27-05-000-0012	PRIVATE	0.978	Y			170	1,900,000	1,600,000	3,500,000					132,600	132,600	
50-43-43-27-05-000-0020	PRIVATE	0.916	Y	1.58	R-101	170	1,900,000	1,600,000	3,500,000					125,234	125,234	

TABLE F-3: SUMMARY OF ESTIMATED BENEFITS FOR BEACH RESTORATION PROJECT IMPROVEMENTS BY SHORELINE REACH
30-YEAR PROJECT HORIZON

PALM BEACH COUNTY PROPERTY NUMBER	DESCRIPTION	Approx Acres	SEA- WALL	1980 to 1997 Shoreline Change Rate (ft./yr)	FDNR SURVEY MON.	Dist. from 1980 W.L. to Bldg. (FEET)	SHORE LINE (FEET)	1996 VALUATION			Seawall Const. Cost (\$ Present)	No. of Years to Complete Land Loss	Expected Land Loss next 30 years (\$ Present)	One-Time Const. Cost at year 15 (\$ Present)	Expected Savings for Sewall Repair/ Maint. - 30 yr life (\$ Present)	TOTAL COST (\$ Present)
								LAND VALUE (\$)	BUILDING VALUE (\$)	TOTAL VALUE (\$)						
REACH 4																
TOTAL VALUES: 56.73								74,535,000	38,575,268	113,210,268	0	0	2,324,026	4,372,290	6,696,316	6,696,316
Average 1996 PRIVATE Land Value = 41								925,000	31,856	956,856	44,200	28,860	44,200	28,860	44,200	44,200
50-43-43-02-000-0232	PRIVATE	0.735	Y	-1.41	R-104	60	75	1,500,000	3,000,000	4,500,000	15,340	19,175	36,075	55,250	55,250	
50-43-43-03-000-0030	PRIVATE	0.07	Y			265	265	3,913,856	1,500,000	5,413,856	67,752	127,465	195,217	195,217	195,217	
50-43-43-03-000-0020	PRIVATE	0.64	Y			280	280	1,500,000	0	1,500,000	66,474	125,060	191,534	191,534	191,534	
50-43-43-35-001-0250	PRIVATE	0.784	Y			170	170	2,000,000	1,475,321	3,475,321	40,907	76,960	117,867	117,867	117,867	
50-43-43-35-001-0300	PRIVATE	0.234	Y			150	150	1,900,000	598,195	2,498,195	38,350	72,150	110,500	110,500	110,500	
50-43-43-35-001-0360	PRIVATE	1.291	Y			170	170	900,000	92,093	992,093	43,464	81,770	125,234	125,234	125,234	
50-43-43-35-002-0010	PRIVATE	0.2	Y	0.08	R-105	190	190	1,100,000	90,810	1,190,810	48,577	91,390	139,967	139,967	139,967	
50-43-43-35-002-0120	PRIVATE	0.55	Y			120	120	1,100,000	5,938	1,105,938	38,350	72,150	110,500	110,500	110,500	
50-43-43-35-002-0420	PRIVATE	0.29	Y			100	100	900,000	574,119	1,474,119	25,567	48,100	73,667	73,667	73,667	
50-43-43-35-002-0140	PRIVATE	0.298	Y			100	100	1,200,000	895,430	2,095,430	25,567	48,100	73,667	73,667	73,667	
50-43-43-35-002-0150	PRIVATE	0.3	Y			100	100	1,800,000	655,170	2,455,170	38,350	72,150	110,500	110,500	110,500	
50-43-43-35-002-0430	PRIVATE	0.482	Y			150	150	1,715,000	777,310	2,492,310	35,794	67,340	103,134	103,134	103,134	
50-43-43-35-002-0370	PRIVATE	0.45	Y			160	160	1,508,263	3,258,263	4,766,526	40,907	76,960	117,867	117,867	117,867	
50-43-43-35-000-0240	PRIVATE	0.475	Y	2.76	R-106	155	155	1,750,000	1,251,152	3,001,152	39,629	74,555	114,184	114,184	114,184	
50-43-43-35-002-0391	PRIVATE	0.16	Y			45	45	277,000	0	277,000	11,505	21,645	33,150	33,150	33,150	
50-43-43-35-002-0380	PRIVATE	17.48	Y			360	360	12,000,000	3,623,453	15,623,453	92,041	173,160	265,201	265,201	265,201	
50-43-43-35-002-0382	BATH & TENNIS CLUB	0.132	N			80	80	360,000	0	360,000	0	0	0	0	0	
50-43-43-35-002-0400	BATH & TENNIS CLUB	9.54	N			80	160	1,000,000	0	1,000,000	0	0	0	0	0	
50-43-43-35-002-0010	PRIVATE	2.16	N			75	410	10,600,000	3,686,634	14,286,634	0	0	0	0	0	
50-43-43-35-002-0410	PRIVATE	2.17	N	0.82	R-107	65	345	5,220,000	1,674,617	6,894,617	0	0	0	0	0	
50-43-44-02-000-0030	PRIVATE	2.01	N	-0.54		175	250	4,350,000	88,716	4,438,716	95,463	180,662	280,662	280,662	280,662	
50-43-44-02-001-0051	PRIVATE	5.16	N	-1.26		300	315	7,400,000	0	7,400,000	0	0	0	0	0	
50-43-44-02-001-0022	PRIVATE	3.72	N	-2.04	R-108	275	340	6,700,000	29,490	6,729,490	0	0	0	0	0	
50-43-44-02-10-000-0010	PRIVATE	2.25	N	-0.87		250	190	3,800,000	1,428,047	5,228,047	30	490,469	490,469	490,469	490,469	
50-43-44-02-10-000-0020	PRIVATE	2.04	N	-0.46		215	190	3,800,000	317,619	4,117,619	30	116,889	116,889	116,889	116,889	
50-43-44-02-10-000-0030	PRIVATE	1.98	N	-0.07		210	175	3,800,000	977,607	4,777,607	30	61,804	61,804	61,804	61,804	
50-43-44-02-001-0040	PRIVATE	4.36	Y	0.58	R-109	295	295	6,900,000	4,198,670	10,998,670	75,422	141,895	217,317	217,317	217,317	
50-43-44-02-001-0052	PRIVATE	9.77	Y	2.37		815	815	16,400,000	35,981,740	52,381,740	208,370	392,015	600,385	600,385	600,385	
50-43-44-02-01-000-0010	PRIVATE	2.21	N			250	200	4,400,000	3,953,061	8,353,061	0	0	0	0	0	
50-43-44-02-01-000-0090	PRIVATE	1.85	Y			85	85	3,800,000	10,335	3,810,335	21,732	40,885	62,617	62,617	62,617	
50-43-44-02-01-000-0151	PRIVATE	1.87	Y			250	250	3,800,000	4,582,603	8,382,603	63,917	120,250	184,167	184,167	184,167	
50-43-44-02-01-000-0211	PRIVATE	1.49	N	4.22	R-110	210	130	3,200,000	2,747,878	5,947,878	0	0	0	0	0	
50-43-44-02-01-000-0211	PRIVATE	1.83	N			170	170	122,587,000	58,445,349	181,032,349	1,131,333	2,128,425	3,259,758	3,259,758	3,259,758	
TOTAL VALUES: 78.53								122,587,000	58,445,349	181,032,349	0	1,063,949	2,128,425	4,313,707	4,313,707	
Average 1996 PRIVATE Land Value = 46								4,300,000	287,404	4,587,404	0	0	0	0	0	
50-43-44-02-002-0050	PRIVATE	2.15	N			190	155	4,300,000	2,000,814	6,300,814	39,629	74,555	114,184	114,184	114,184	
50-43-44-02-002-0070	PRIVATE	1.47	Y			340	340	6,000,000	4,141,967	10,141,967	86,927	163,540	250,467	250,467	250,467	
50-43-44-02-002-0030	PRIVATE	5	Y			130	130	2,300,000	1,741,870	4,041,870	33,237	62,530	95,767	95,767	95,767	
50-43-44-02-002-0040	PRIVATE	1.94	Y			30	30	696,500	491,868	1,188,368	7,670	14,430	22,100	22,100	22,100	
50-43-44-02-002-0010	PRIVATE	0.44	Y			30	30	300,000	198,021	498,021	14,430	22,100	36,530	36,530	36,530	

TABLE F-3: SUMMARY OF ESTIMATED BENEFITS FOR BEACH RESTORATION PROJECT IMPROVEMENTS BY SHORELINE REACH
30-YEAR PROJECT HORIZON

PALM BEACH COUNTY PROPERTY NUMBER	DESCRIPTION	Approx Acres	SEA- WALL	1990 to 1997 Shoreline Change Rate (ft/yr)	FDNR SURVEY MON.	Dist. from 1990 W/L to Bldg (FEET)	SHORE LINE (FEET)	1996 VALUATION			Seawall Const. Cost (\$ Present)	No. of Years to Complete Land Loss	Expected Loss next 30 years (\$ Present)	Seawall/Revet Repair for 30 year life (\$ Present)	One-Time Const. Cost at year 15 (\$ Present)	Expected Savings for Seawall Repair/ Maint. - 30 yr life (\$ Present)	TOTAL COST (\$ Present)
								LAND VALUE (\$)	BUILDING VALUE (\$)	TOTAL VALUE (\$)							
50-43-44-02-02-000-0030	PRIVATE	0.34	Y			20	300,000	172,336	472,336	6,948	172,336	5,113	16,835	14,733	14,733	14,733	
50-43-44-02-02-000-0040	PRIVATE	0.46	Y			35	911,000	6,980	917,980	6,980	917,980	5,113	16,835	14,733	14,733	25,783	
50-43-44-02-02-000-0050	PRIVATE	0.46	Y			25	1,042,635	1,316,355	2,358,990	6,980	1,316,355	5,113	16,835	14,733	14,733	25,783	
50-43-44-02-02-000-0060	PRIVATE	0.34	Y	-1.46	R-111	35	300,000	288,903	588,903	6,980	288,903	5,113	16,835	14,733	14,733	14,733	
50-43-44-02-02-000-0070	PRIVATE	0.34	Y			25	300,000	260,729	560,729	6,980	260,729	5,113	16,835	14,733	14,733	14,733	
50-43-44-02-02-000-0080	PRIVATE	0.47	Y			35	686,500	142,779	829,279	6,980	142,779	5,113	16,835	14,733	14,733	14,733	
50-43-44-02-04-000-0012	PRIVATE	0.32	Y			15	400,000	866,615	1,266,615	6,980	866,615	5,113	16,835	14,733	14,733	14,733	
50-43-44-02-04-000-0011	PRIVATE	1.54	Y			100	1,200,000	1,094,691	2,294,691	6,980	1,094,691	5,113	16,835	14,733	14,733	14,733	
50-43-44-02-04-000-0021	PRIVATE	0.33	Y			30	520,000	116,918	636,918	6,980	116,918	5,113	16,835	14,733	14,733	14,733	
50-43-44-02-04-000-0022	PRIVATE	0.35	Y			40	515,000	140,627	655,627	6,980	140,627	5,113	16,835	14,733	14,733	14,733	
50-43-44-02-04-000-0014	PRIVATE	0.27	Y			15	275,000	480,438	755,438	6,980	480,438	5,113	16,835	14,733	14,733	14,733	
50-43-44-02-04-000-0013	PRIVATE	0.39	Y			10	300,000	331,322	631,322	6,980	331,322	5,113	16,835	14,733	14,733	14,733	
50-43-44-02-04-000-0090	PRIVATE	0.29	Y			15	1,500	0	1,500	6,980	0	5,113	16,835	14,733	14,733	14,733	
50-43-44-02-04-000-0080	PRIVATE	0.29	Y			15	1,500	0	1,500	6,980	0	5,113	16,835	14,733	14,733	14,733	
50-43-44-02-04-000-0070	PRIVATE	0.36	Y			20	1,500	0	1,500	6,980	0	5,113	16,835	14,733	14,733	14,733	
50-43-44-02-04-000-0060	PRIVATE	0.5	Y			15	1,500	0	1,500	6,980	0	5,113	16,835	14,733	14,733	14,733	
50-43-44-02-04-000-0050	PRIVATE	0.06	Y			15	1,500	0	1,500	6,980	0	5,113	16,835	14,733	14,733	14,733	
50-43-44-02-04-000-0050	PRIVATE	0.36	Y			10	1,500	0	1,500	6,980	0	5,113	16,835	14,733	14,733	14,733	
50-43-44-02-04-000-0040	PRIVATE	0.35	Y			15	1,500	0	1,500	6,980	0	5,113	16,835	14,733	14,733	14,733	
50-43-44-02-04-000-0030	PRIVATE	0.34	Y			80	600,000	717,881	1,317,881	6,980	717,881	5,113	16,835	14,733	14,733	14,733	
50-43-44-02-00-002-0090	PRIVATE	2.76	Y			200	3,600,000	0	3,600,000	6,980	0	5,113	16,835	14,733	14,733	14,733	
50-43-44-02-00-002-0010	PRIVATE	1.83	Y			145	2,700,000	0	2,700,000	6,980	0	5,113	16,835	14,733	14,733	14,733	
50-43-44-02-00-002-0080	PRIVATE	1.89	Y	3.99	R-112	150	2,700,000	2,466,867	5,166,867	6,980	2,466,867	5,113	16,835	14,733	14,733	14,733	
50-43-44-02-00-002-0110	PRIVATE	1.79	Y			50	950,000	0	950,000	6,980	0	5,113	16,835	14,733	14,733	14,733	
50-43-44-11-00-001-0080	PRIVATE	0.69	Y			50	500,000	0	500,000	6,980	0	5,113	16,835	14,733	14,733	14,733	
50-43-44-11-00-001-0010	PRIVATE	0.89	Y			140	2,700,000	1,943,621	4,643,621	6,980	1,943,621	5,113	16,835	14,733	14,733	14,733	
50-43-44-11-00-001-0030	PRIVATE	0.87	Y			25	200,000	0	200,000	6,980	0	5,113	16,835	14,733	14,733	14,733	
50-43-44-11-03-000-1003	PRIVATE	0.47	Y			35	1,100,000	47,002	1,147,002	6,980	47,002	5,113	16,835	14,733	14,733	14,733	
50-43-44-11-03-000-1004	PRIVATE	0.57	Y			70	1,000,000	495,056	1,495,056	6,980	495,056	5,113	16,835	14,733	14,733	14,733	
50-43-44-11-01-000-0040	PRIVATE	2.82	Y			70	1,000,000	1,089,279	2,089,279	6,980	1,089,279	5,113	16,835	14,733	14,733	14,733	
50-43-44-11-03-000-1011	PRIVATE	1.74	Y			65	1,500,000	71,701	1,571,701	6,980	71,701	5,113	16,835	14,733	14,733	14,733	
50-43-44-11-01-000-0011	PRIVATE	1.89	Y			70	500,000	0	500,000	6,980	0	5,113	16,835	14,733	14,733	14,733	
50-43-44-11-01-000-0052	PRIVATE	1.12	Y			65	1,000	0	1,000	6,980	0	5,113	16,835	14,733	14,733	14,733	
50-43-44-11-01-000-0070	PRIVATE	2.88	Y			65	1,000,000	346,331	1,346,331	6,980	346,331	5,113	16,835	14,733	14,733	14,733	
50-43-44-11-02-000-0010	PRIVATE	1.15	Y	-1.65	R-113	125	1,000,000	510,324	1,510,324	6,980	510,324	5,113	16,835	14,733	14,733	14,733	
50-43-44-11-02-000-0090	PRIVATE	0.54	Y			115	2,000	0	2,000	6,980	0	5,113	16,835	14,733	14,733	14,733	
50-43-44-11-03-000-1051	PRIVATE	0.54	Y			100	1,000,000	535,004	1,535,004	6,980	535,004	5,113	16,835	14,733	14,733	14,733	
50-43-44-11-03-000-1052	PRIVATE	0.5	Y			65	1,300,000	602,127	1,902,127	6,980	602,127	5,113	16,835	14,733	14,733	14,733	
50-43-44-11-03-000-1061	PRIVATE	1.38	Y			180	2,800,000	1,374,943	4,174,943	6,980	1,374,943	5,113	16,835	14,733	14,733	14,733	
50-43-44-11-00-001-0040	PRIVATE	3.13	Y			300	4,800,000	2,158,463	6,958,463	6,980	2,158,463	5,113	16,835	14,733	14,733	14,733	
50-43-44-11-00-001-0050	PRIVATE	2.72	Y	-1.02	R-114	300	4,800,000	2,590,113	7,390,113	6,980	2,590,113	5,113	16,835	14,733	14,733	14,733	
50-43-44-11-00-001-0060	PRIVATE	3.06	Y			320	5,300,000	1,776,911	7,076,911	6,980	1,776,911	5,113	16,835	14,733	14,733	14,733	
50-43-44-11-00-002-0010	PRIVATE	2.54	Y	1.29	R-115	390	6,200,000	511,027	6,711,027	6,980	511,027	5,113	16,835	14,733	14,733	14,733	
50-43-44-11-00-002-0020	PRIVATE	1.74	Y			190	2,900,000	6,003	2,906,003	6,980	6,003	5,113	16,835	14,733	14,733	14,733	
50-43-44-11-00-002-0030	PRIVATE	1.12	Y			120	2,000,000	308,195	2,308,195	6,980	308,195	5,113	16,835	14,733	14,733	14,733	
50-43-44-11-00-002-0030	PRIVATE	1.68	Y			185	2,610,000	306,203	2,916,203	6,980	306,203	5,113	16,835	14,733	14,733	14,733	
50-43-44-11-00-002-0050	PRIVATE	2.68	Y			190	4,800,000	1,836,771	6,636,771	6,980	1,836,771	5,113	16,835	14,733	14,733	14,733	
50-43-44-11-00-000-1070	PRIVATE	1.84	Y	-2.55	R-116	200	3,200,000	1,741,220	4,941,220	6,980	1,741,220	5,113	16,835	14,733	14,733	14,733	
REACH 6																	
TOTAL VALUES:								51.31	34	125,290,876	0	1,428,186	4,117,976	2,688,790	4,117,976	4,117,976	
Average 1995 Private Land Value =								5,785	34	3,848,876	0	1,428,186	4,117,976	2,688,790	4,117,976	4,117,976	
50-43-44-11-03-000-1060	PRIVATE	2.57	Y			250	4,384,000	0	4,384,000	6,980	0	5,113	16,835	14,733	14,733	14,733	
50-43-44-11-03-000-1091	PRIVATE	2.24	Y			135	1,500,000	0	1,500,000	6,980	0	5,113	16,835	14,733	14,733	14,733	
50-43-44-11-03-110-000	SLOANS CURVE TOWNHOUSES	1.12	N	-9.33	R-117	165	28,815,450	570,000	29,385,450	6,980	570,000	5,113	16,835	14,733	14,733	14,733	
50-43-44-11-05	2000 CONDO SLOANS CURVE	6.7	N	-9.47	R-118	800	50,157,600	800,000	50,957,600	6,980	800,000	5,113	16,835	14,733	14,733	14,733	
50-43-44-14-02	2100 CONDO SLOANS CURVE	6.7	N	-7.17	R-118	200	52,807,200	725,000	53,532,200	6,980	725,000	5,113	16,835	14,733	14,733	14,733	
50-43-44-11-03-000-1201	TOWN OF P B PHIPPS PARK	15.98	N	-4.86	R-119	170	20,000,000	352,152	20,352,152	6,980	352,152	5,113	16,835	14,733	14,733	14,733	
50-43-44-14-01	THE REEF CONDO	4.04	N	-7.39	R-119	160	16,269,200	355,000	16,624,200	6,980	355,000	5,113	16,835	14,733	14,733	14,733	
50-43-44-14-04	2295 S. OCEAN BLVD (HARBOR HOUSE)	1.84	Y	-9.82	R-120	340	22,137,425	432,132	22,569,557	6,980	432,132	5,113	16,835	14,733	14,733	14,733	
50-43-44-11-03-000-1291	SEA LORD HOTEL	1.00	Y	-8.69	R-120	100	660,000	0	660,000	6,980	0	5,113	16,835	14,733	14,733	14,733	
50-43-44-11-03-000-1291	SOUTH OCEAN BLVD ACCESS	0.60															

TABLE F-3: SUMMARY OF ESTIMATED BENEFITS FOR BEACH RESTORATION PROJECT IMPROVEMENTS BY SHORELINE REACH

PALM BEACH COUNTY PROPERTY NUMBER	DESCRIPTION	Approx. Acres	SEA-WALL	1990 to 1997 Shoreline Change Rate (ft./yr)	FDNR SURVEY MON.	Dist. from 1990 W.L. to Bldg. (FEET)	1996 VALUATION		Seawall Const. Cost (\$ Present)	No of Years to Compute Land Loss	Expected Loss next 30 years (\$ Present)	Seawall/Revel Repair for 30 year life (\$ Present)	One-Time Const. Cost at year 15 (\$ Present)	Expected Savings for Sewall Repair/ Maint. - 30 yr life (\$ Present)	TOTAL COST (\$ Present)
							LAND VALUE (\$)	BUILDING VALUE (\$)							
REACH 7															
TOTAL VALUES							28,511,625	965,870	4,055,000	17,268,479	218,596	411,255	628,851	21,953,330	
Average 1996 CONDO Land Value = \$/ft ²							56								
50-43-44-23-13	AMBASSADOR HOTEL	2.53	N	4.36	T-125	170		5,764,425						0	
50-43-44-23-00-0020	2770 SOUTH OCEAN BLVD.	4.11	N			215		31,995,000						0	
50-43-44-23-11	AMBASSADOR SOUTH COOP	6.56	N			395		12,959,566						0	
50-43-44-23-00-002-0081	OUTDR/REC PARK	0.19	N	3.95	R-126	200	23,960	2,814,000						0	
50-43-44-23-10	SUTTON PLACE EASEMENT	3.72	N	3.87		150	0	1,000						0	
50-43-44-23-12	AMBASSADOR II COOP	7.4	N	2.96		299		9,970,934						0	
50-43-44-23-00-002-0120	OCEAN GRAND HOTEL	7.4	N	-1.02		500		5,092,000						344,959	
50-43-44-23-00-002-0160	HILTON	2.33	N	-2.70		200		4,080,000						147,334	
50-43-44-23-14	PALM WORTH INC COOP	6.29	N	-3.19	R-127	160		3,795,922						556,398	
50-43-44-23-00-002-0200	PBC - KREUSLER PARK	6.29	N	-5.23		575		4,581,000						1,854,773	
LAKE WORTH															
38-43-44-26-00-001-0010	LAKE WORTH MUN. BEACH	0.6	Y	-6.10		410		1,240,800						302,034	
38-43-44-26-00-001-0020	LAKE WORTH MUN. BEACH	0.3	Y	-7.32	R-128	990		3,722,400						729,302	
TOWN OF PALM BEACH															
50-43-44-26-00-001-0050	BEACHCOMBER	4.13	N	-12.53	R-129	175		2,814,000						750,406	
50-43-44-26-10	PALM BEACHER APTS. INC	5.7	Y	-9.50		300		3,287,953						3,137,138	
50-43-44-26-09	PALM BEACH HAMPTON	4.25	N	-6.64	R-130	175		58,659,542						1,156,635	
50-43-44-26-05	OASIS III OF PALM BEACH	4.23	N	-5.93		340		14,336,209						316,167	
50-43-44-26-08	CARLTON PLACE	3.41	N	-4.82		430		26,646,719						1,752,764	
50-43-44-26-02	ENCLAVE OF PALM BEACH	2.27	N	-3.77		170		31,440,348						702,078	
50-43-44-26-03	PATRICIANS OF PALM BEACH	4.67	N	-2.87		500		9,200,258						173,696	
50-43-44-26-04	PATRICIANS OF PALM BEACH #1	2.27	N	-3.77	R-131	80		7,393,557						981,996	
50-43-44-26-03	DORCHESTER OF PALM BEACH	6.31	N	-1.59		120		19,529,624						537,730	
50-43-44-26-04	MERIDIAN OF PALM BEACH	6.98	N	-0.52	R-132	70		15,038,248						203,999	
50-43-44-35-19	ATRIUM OF PALM BEACH II	1.82	N	0.05		150		26,873,172						0	
50-43-44-35-24	EMERAUDE CONDO	7.23	N	0.61	R-133	75		9,950,290						0	
50-43-44-35-13	ATRIUMS OF PALM BEACH	6.27	N			600		31,634,911						0	
50-43-44-35-18	HALCYON OF PALM BEACH	6.27	N			100		26,322,210						0	
50-43-44-35-03	PATRICIAN OF PALM BEACH	0.71	Y			275		16,347,506						202,584	
50-43-44-35-05	PATRICIAN TOWERS #1	0.71	Y			175		6,177,200						128,917	
50-43-44-35-05-001-0010	RECREATIONAL AREA	1.09	Y	2.43	R-134	265		152,574						195,217	
50-43-44-35-02	LA BONNE VIE	91.30	Y			10715		12,871,695						14,361,692	
TOTAL VALUES							24,345,325	22,480,662	3,520,000	8,672,204	752,943	1,416,545	2,169,488	14,361,692	
Average 1996 CONDO Land Value = \$/ft ²							44								
REACH 8															
SOUTH PALM BEACH															
62-43-44-35-00-002-0110	PRIVATE	0.08	Y			90		466,440						66,300	
62-43-44-35-00-002-0090	PRIVATE	0.08	Y			90		475,000						66,300	
62-43-44-35-00-002-0060	PRIVATE	0.07	Y			90		500,000						66,300	
62-43-44-35-08	PALM SEA CONDO	2.76	Y			280		11,549,500						206,267	
62-43-44-35-04	LE CHATEAU ROYAL CONDO	2.18	Y			180		9,552,400						132,600	
62-43-44-35-12	PATRICIAN (GARCLA)	5.52	Y	3.20	R-135	80		28,461,600						279,934	
62-43-44-35-25	3560 CONDO (CONCORDIA EAS)	2.18	Y			200		15,998,400						0	
62-43-44-35-29	TUSCANY OF PALM BEACH	0.8	Y			100		7,473,025						147,334	
62-43-44-35-00-002-0190	PRIVATE	2.76	Y			300		4,291,700						73,667	
62-43-44-35-01	HORIZONS EAST CONDO	2.76	Y			100		21,041,000						221,001	
62-43-44-35-10	MAYFAIR HOUSE CONDO	1.95	N	0.81	R-136	150		8,691,000						110,500	
62-43-44-35-00-002-0140	3500 SOUTH OCEAN CONDO	0.71	N	0.32		284		9,442,300						0	
62-43-44-35-27	DUNE DECK OF PALM BEACHES	0.71	N	-0.12		100		5,703,600						9,224	
62-43-44-35-16	PALM BEACH WINDEMERE	0.75	N	-0.58		100		2,344,200						44,580	
62-43-45-02-03	IMPERIAL HOUSE CONDO	1.09	N	-1.34		70		3,585,825						171,964	
LANTANA															

TABLE F-3: SUMMARY OF ESTIMATED BENEFITS FOR BEACH RESTORATION PROJECT IMPROVEMENTS BY SHORELINE REACH
30-YEAR PROJECT HORIZON

PALM BEACH COUNTY PROPERTY NUMBER	DESCRIPTION	Approx Acres	SEA- WALL	1990 to 1997 Shoreline Change Rat (ft./yr)	FONR SURVEY MON.	Dist. from 1990 W.L. to Bldg (FEET)	SHORE LINE (FEET)	1996 VALUATION			Seawall Const. Cost (\$ Present)	No. of Years to Compute Land Loss	Expected Loss next 30 years (\$ Present)	Seawall/Revel. Repair for 30 year life (\$ Present)	One-Time Const. Cost at year 15 (\$ Present)	Expected Savings for Seawall Repair/ Maint. - 30 yr life (\$ Present)	TOTAL COST (\$ Present)			
								LAND VALUE (\$)	BUILDING VALUE (\$)	TOTAL VALUE (\$)										
REACH 9																				
40-43-45-02-00-001-0020	LANTANA PUBLIC BEACH	0.69	N	-1.60		100	150	35	240,451	0	240,451	150,000	24	145,713	7,670	14,430	295,713			
								Average 1996 PRIVATE Land Value = 35 \$/ft ²												
								Average 1996 CONDO Land Value = 50 \$/ft ²												
MANALAPAN																				
42-43-45-02-00-001-0021	TRITZ-CARLTON	6.86	Y	0.79	R-138	690	380	34	400,730	26,300,730	34,400,730	8,100,000	60	176,411	331,890	508,301	508,301			
42-43-45-02-04	LA CONQUILL CLUB VILLAS	3.22	Y			293	293	8,690,125	11,930,125	11,930,125	182,780	279,934	215,844	140,933	215,844	215,844	215,844			
42-43-45-02-05	LA CONQUILL CLUB VILLAS II	2.4	Y			60	60	725,000	794,158	1,519,158	15,340	28,860	44,200	44,200	117,867	117,867	55,250			
42-43-45-02-01-000-0013	PRIVATE	0.45	Y	-3.59	R-139	75	150	675,000	900,750	1,574,548	1,844,548	1,950,000	72,150	38,350	72,150	110,500	110,500			
42-43-45-02-01-000-0014	PRIVATE	0.38	Y			150	150	1,950,000	0	2,800,000	2,800,000	61,105	114,959	176,064	176,064	309,401	309,401			
42-43-45-02-01-000-0022	PRIVATE	1.24	Y			239	239	2,800,000	0	2,800,000	2,800,000	107,381	154,700	110,500	110,500	110,500	110,500			
42-43-45-02-01-000-0040	PRIVATE	3.57	Y			420	420	5,400,000	529,392	3,429,392	3,429,392	53,690	101,010	154,700	154,700	154,700	154,700			
42-43-45-02-01-000-0063	PRIVATE	1.92	Y	-2.33	R-140	150	150	2,050,000	288,150	2,338,150	2,338,150	38,350	72,150	110,500	110,500	110,500	110,500			
42-43-45-02-01-000-0071	PRIVATE		Y			150	150	2,025,000	60,393	2,085,393	2,085,393	38,350	72,150	110,500	110,500	110,500	110,500			
42-43-45-02-01-000-0082	PRIVATE	1.24	Y			150	150	2,025,000	1,132,617	3,157,617	3,157,617	38,350	72,150	110,500	110,500	110,500	110,500			
42-43-45-02-01-000-0092	PRIVATE		Y			150	150	2,050,000	703,778	2,753,778	2,753,778	38,350	72,150	110,500	110,500	110,500	110,500			
42-43-45-02-01-000-0113	PRIVATE		Y			150	150	2,050,000	2,095,579	4,145,579	4,145,579	39,864	75,036	114,920	114,920	114,920	114,920			
42-43-45-02-01-000-0114	PRIVATE		Y			156	156	2,050,000	81,909	2,131,909	2,131,909	63,917	120,250	184,167	184,167	184,167	184,167			
42-43-45-02-01-000-0111	PRIVATE		Y	-11.03	R-141	250	250	3,400,000	3,640,366	7,040,366	7,040,366	51,134	96,200	147,334	147,334	147,334	147,334			
42-43-45-02-01-000-0121	PRIVATE		Y			200	200	2,700,000	361,399	3,061,399	3,061,399	51,134	96,200	147,334	147,334	147,334	147,334			
42-43-45-02-01-000-0123	PRIVATE		Y			200	200	2,700,000	1,013,075	3,713,075	3,713,075	51,134	96,200	147,334	147,334	147,334	147,334			
42-43-45-02-01-000-0122	PRIVATE		Y			200	200	2,700,000	560,636	3,260,636	3,260,636	51,134	96,200	147,334	147,334	147,334	147,334			
42-43-45-02-01-000-0130	PRIVATE		Y	-2.03	R-142	510	510	6,450,000	4,788,800	11,238,800	11,238,800	130,391	245,310	375,701	375,701	375,701	375,701			
42-43-45-02-01-000-0143	PRIVATE		Y			190	190	2,600,000	372,777	2,972,777	2,972,777	48,577	91,390	139,967	139,967	139,967	139,967			
42-43-45-02-01-000-0144	PRIVATE	1.45	Y			150	150	2,050,000	2,867,747	4,917,747	4,917,747	38,350	72,150	110,500	110,500	110,500	110,500			
42-43-45-02-01-000-0141	PRIVATE	1.54	Y			160	160	2,150,000	5,991,822	8,141,822	8,141,822	40,907	76,960	117,867	117,867	117,867	117,867			
42-43-45-02-01-000-0151	PRIVATE		Y	2.45	R-143	200	200	2,700,000	1,395,294	4,095,294	4,095,294	51,134	96,200	147,334	147,334	147,334	147,334			
42-43-45-02-01-000-0153	PRIVATE		Y			150	150	2,050,000	7,600	2,057,600	2,057,600	38,350	72,150	110,500	110,500	110,500	110,500			
42-43-45-02-01-000-0152	PRIVATE	2.09	Y			212	212	2,700,000	460,341	3,160,341	3,160,341	54,176	101,924	156,100	156,100	156,100	156,100			
42-43-45-02-01-000-0161	PRIVATE		Y			155	155	2,025,000	702,041	2,727,041	2,727,041	39,629	74,555	114,184	114,184	114,184	114,184			
42-43-45-02-01-000-0171	PRIVATE		Y			160	160	2,000,000	0	2,000,000	2,000,000	40,907	76,960	117,867	117,867	117,867	117,867			
42-43-45-02-01-000-0172	PRIVATE		Y	-0.42	R-144	260	260	3,000,000	674,760	3,674,760	3,674,760	66,474	125,060	191,534	191,534	191,534	191,534			
42-43-45-02-01-000-0179	PRIVATE	2	Y			300	300	3,800,000	4,846,800	8,646,800	8,646,800	76,701	144,300	221,001	221,001	221,001	221,001			
42-43-45-10-01-000-0132	PRIVATE		Y			200	200	2,000,000	4,846,800	6,846,800	6,846,800	51,134	96,200	147,334	147,334	147,334	147,334			
42-43-45-10-01-000-0133	PRIVATE		Y			200	200	2,000,000	74,661	2,074,661	2,074,661	42,441	79,846	122,287	122,287	122,287	122,287			
42-43-45-10-01-000-0131	PRIVATE		Y	-3.33	R-145	166	166	2,000,000	397,164	2,397,164	2,397,164	42,441	79,846	122,287	122,287	122,287	122,287			
42-43-45-10-01-000-0122	PRIVATE	1.51	Y			132	132	2,000,000	1,715,963	3,715,963	3,715,963	33,748	63,452	97,240	97,240	97,240	97,240			
42-43-45-10-01-000-0121	PRIVATE		Y			168	168	2,000,000	38,879	2,038,879	2,038,879	42,962	80,908	123,760	123,760	123,760	123,760			
42-43-45-10-01-000-0123	PRIVATE		Y			175	175	2,000,000	1,904	2,001,904	2,001,904	44,742	84,175	128,917	128,917	128,917	128,917			
42-43-45-10-01-000-0125	PRIVATE		Y			395	395	2,400,000	2,322,456	4,722,456	4,722,456	100,969	189,985	290,984	290,984	290,984	290,984			
								Average 1996 PRIVATE Land Value = 8,661 \$/ft ²												
								Average 1996 CONDO Land Value = 34 \$/ft ²												
REACH 10																				
42-43-45-10-01-000-0124	PRIVATE	0.86	N	-5.42	R-146	200	150	1,300,000	15,562	1,315,562	1,315,562	150,000	21	302,285	187,590	287,301	452,285			
42-43-45-10-01-000-0111	PRIVATE		Y	-6.50		200	150	1,870,000	426,835	2,296,835	2,296,835	150,000	16	306,439	456,439	456,439	456,439			
42-43-45-10-01-000-0101	PRIVATE	1.37	N	-4.89		220	150	1,650,000	0	1,650,000	1,650,000	150,000	28	316,905	466,905	466,905	466,905			
42-43-45-10-01-000-0102	PRIVATE	1.51	N	-2.56		220	150	1,650,000	429,466	2,079,466	2,079,466	150,000	30	171,188	171,188	171,188	171,188			
42-43-45-10-00-004-0010	PRIVATE	2.87	N	0.19	R-147	200	350	3,850,000	517,403	4,367,403	4,367,403	1,650,000	0	0	0	0	0			
42-43-45-10-00-001-0017	PRIVATE	1.17	N			225	150	1,650,000	0	1,650,000	1,650,000	128,673	3,528,673	1,788,418	0	0	0			
42-43-45-10-00-001-0013	PRIVATE	2.35	N			240	355	3,400,000	128,673	3,528,673	3,528,673	1,650,000	0	0	0	0	0			
42-43-45-10-01-000-0091	PRIVATE	1.21	N			240	100	1,640,000	168,419	1,808,419	1,808,419	1,935,943	175,943	1,760,000	0	0	0			
42-43-45-10-01-000-0092	PRIVATE	1.32	N			250	170	1,760,000	175,943	1,935,943	1,935,943	5,246,907	5,246,907	0	0	0	0			
42-43-45-10-01-000-0083	PRIVATE	1.21	N			250	160	1,650,000	3,696,907	5,346,907	5,346,907	1,890,614	90,614	1,890,614	1,890,614	1,890,614				
42-43-45-10-01-000-0081	PRIVATE	1.4	N			260	200	1,800,000	2,612,843	4,412,843	4,412,843	150,000	145,713	4,093,743	6,289,711	6,289,711	6,289,711			
42-43-45-10-01-000-0082	PRIVATE	1.06	N			250	145	1,650,000	2,612,843	4,262,843	4,262,843	150,000	145,713	4,093,743	6,289,711	6,289,711	6,289,711			

TABLE F-3: SUMMARY OF ESTIMATED BENEFITS FOR BEACH RESTORATION PROJECT IMPROVEMENTS BY SHORELINE REACH
30-YEAR PROJECT HORIZON

PALM BEACH COUNTY PROPERTY NUMBER	DESCRIPTION	Approx Acres	SEA- WALL	1990 to 1997 Shoreline Change Rat (ft/yr)	FDR SURVEY MON	Dist from 1990 W/L to Bldg. (FEET)	SHORE LINE (FEET)	1995 VALUATION			TOTAL VALUE (\$)	Seawall Const Cost (\$ Present)	No. of Years to Compute Land Loss	Expected Land Loss next 30 years (\$ Present)	Seawall/Rewet Repair for 30 year life (\$ Present)	One-Time Const. Cost at year 15 (\$ Present)	Expected Savings for Sewall Repair/ Maint. - 30 yr life (\$ Present)	TOTAL COST (\$ Present)
								LAND VALUE (\$)	BUILDING VALUE (\$)	1995 TOTAL VALUE (\$)								
42-43-45-10-01-000-0072	PRIVATE	1.12	N	1.62	R-148	280	150	1,650,000	1,811,298	3,461,298							0	
42-43-45-10-01-000-0071	PRIVATE	1.14	N			280	150	1,650,000	204,051	1,854,051							0	
42-43-45-15-00-001-0013	PRIVATE	1.17	N			280	150	1,650,000	825,923	2,475,923							0	
42-43-45-15-00-001-0014	PRIVATE	1.51	N			280	200	1,800,000	227,051	2,027,051							0	
42-43-45-15-00-001-0015	PRIVATE	1.03	N	0.14	R-149	280	145	1,300,000	3,599,544	4,899,544							0	
42-43-45-10-01-000-0031	PRIVATE	0.81	N			280	165	1,250,000	665,900	1,915,900							0	
42-43-45-10-01-000-0032	PRIVATE	10.4	N	3.31	R-150	275	1,185	6,400,000	1,409,862	7,809,862							0	
42-43-45-10-01-000-0052	PRIVATE	0.96	N			260	75	700,000	43,834	743,834							0	
42-43-45-10-01-000-0053	PRIVATE	0.8	N			250	100	800,000	24,591	824,591							0	
42-43-45-10-01-000-0061	PRIVATE	0.29	N			250	80	475,000	12,260	487,260							0	
42-43-45-10-01-000-0063	PRIVATE	0.55	N			250	95	500,000	0	500,000							0	
42-43-45-10-01-000-0069	PRIVATE	0.61	N	2.14	R-151	380	75	500,000	433,327	1,033,327							0	
42-43-45-10-01-000-0064	PRIVATE	0.48	N			370	70	650,000	390,554	1,340,554							0	
42-43-45-10-01-000-0063	PRIVATE	1.61	N			380	160	950,000	40,769	1,629,769							0	
00-43-45-15-00-004-0010	SILWID PARK	1.65	N			380	225	1,589,000									0	
REACH 11		41.98				5,645	5,645	47,384,000	17,641,669	65,025,669	450,000	1,096,817	99,711	187,590	287,301	1,834,118		
TOTALS FOR ALL REACHES																		
								82,002	773,439,594	350,428,877	2,262,757,427	10,645,000	32,543,423	12,739,418	23,967,220	36,706,638	79,895,061	

NOTES:
1. Expected savings Town of PB - Clark Ave was calculated as \$5.20/cy as a nourishment cost (220 cy/FT) @30 yr

17.73 = Annual seawall maintenance (\$/LF)
1000.00 = Structure replacement (\$/LF) - one time cost

15.5 miles
32,229 ft = no seawall (39.3 %)
49,773 ft = seawalls (60.7 %)

15.3725 = (P/A, 5%, 30yr)
0.9524 = (P/F, 5%, 1yr)
0.4810 = (P/F, 5%, 15yr)

REVIEW

Peer Review Comments



January 16, 1998

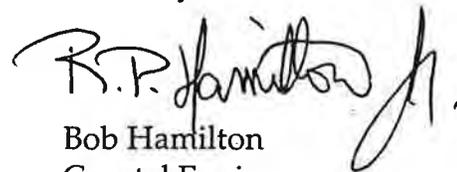
Town of Palm Beach Public Works Department
Attn: Mr. James M. Bowser, P.E., Town Engineer
Post Office Box 2029
360 South County Road
Palm Beach, Florida 33480

Dear Mr. Bowser,

Aubrey Consulting, Inc. (ACI) is pleased to submit six (6) copies of our peer review of the Comprehensive Coastal Management Plan (CCMP) Update for Palm Beach Island. Our intention was to provide informative and thought-provoking recommendations to ensure that the technical basis for the CCMP Update was sound, and that performance- and cost-effective projects will be implemented to benefit a local shoreline reach as well as Palm Beach Island as a whole.

As you examine this peer review, please don't hesitate to contact me with any questions. We will appreciate discussing our comments with all interested parties, particularly Town staff, the Shore Protection Board, and ATM. Also, we look forward to meeting at Town offices to discuss the peer review and determine next steps. Please let me know if I can help with the distribution of the peer review to other interested parties.

Sincerely,



Bob Hamilton
Coastal Engineer

enclosed: six (6) copies of the peer review

cc: Mr. Dave Decker, ATM
Mr. Garrison Lickle, Shore Protection Board
Mr. Wayne Dimm, Shore Protection Board



**PEER REVIEW OF THE
COMPREHENSIVE COASTAL MANAGEMENT
PLAN UPDATE**

**Aubrey Consulting, Incorporated
Falmouth Technology Park
P.O. Box 689
Falmouth, MA 02541**

JANUARY 1998

**PEER REVIEW OF THE
COMPREHENSIVE COASTAL MANAGEMENT PLAN UPDATE**

FOR:

THE TOWN OF PALM BEACH, FLORIDA

JANUARY, 1998

BY:

**AUBREY CONSULTING, INC.
FALMOUTH TECHNOLOGY PARK
P.O. BOX 689
FALMOUTH, MA 02541
(508) 540-8080**

**PRINCIPAL INVESTIGATOR:
ROBERT P. HAMILTON JR.**

TABLE OF CONTENTS

1. EXECUTIVE SUMMARY	1
2. AUTHORIZATION/INTRODUCTION	5
3. DISCUSSION OF COMMENTS	7
3.1 COASTAL ENGINEERING PLANNING AND DESIGN	7
3.1.1 Overview of Erosional Processes Worldwide	7
3.1.2 Choice to Manage Coastal Erosion	8
3.1.3 Regulatory Requirements	8
3.1.4 Tools for Coastal Engineering Planning and Design	8
3.1.4.1 Regional sediment budget analysis	10
3.1.4.2 Detailed wave modeling	12
3.1.4.3 Regional sediment transport and shoreline change model	12
3.2 ALTERNATIVES ANALYSIS	14
3.3 ENVIRONMENTAL CONCERNS AND PERMITTING	16
3.4 COST ESTIMATE AND FUNDING ANALYSIS	17
3.5 MONITORING AND ADAPTIVE MANAGEMENT	20
4. REFERENCES	22
APPENDIX A. ECONOMIC MONITORING REFERENCE (NRC, 1995)	

1. EXECUTIVE SUMMARY

1. EXECUTIVE SUMMARY

Aubrey Consulting, Inc. (ACI) has reviewed the Draft Comprehensive Coastal Management Plan (CCMP) Update for Palm Beach Island, Florida, submitted by Applied Technology and Management, Inc. (ATM) (September, 1997). The Plan provides a valuable update to the original CCMP that was prepared by Cubit Engineering Limited (August, 1986). The CCMP Update is comprised of ten sections, which outline how erosion of Palm Beach Island should be managed for the next thirty years. The CCMP Update recommends specific actions for shoreline erosion mitigation along eleven specific shoreline segments, defined as Reaches. A timeline for project implementation has been recommended as well.

Our focus when reviewing the CCMP Update was to ensure that the technical approach used for developing recommended projects is sound, and that implementation of proposed projects is consistent with a regional, inlet-to-inlet approach for managing erosion of the Island. We feel the Town should review our recommendations carefully, and that we should discuss the peer review in detail at a meeting to be held between ACI, the Town, and ATM. Fundamentally, ACI believes ATM has identified many of the erosion problems associated with the beaches fronting Palm Beach Island, Florida. In order to derive the most effective solutions, though, specific modifications to the proposed implementation plan are recommended for consideration by the Town of Palm Beach. For instance, rather than implementing the solutions proposed in the CCMP Update immediately, some improved planning is suggested before project approval. We understand the CCMP Update was not intended to serve as a design document; however, additional knowledge of the local and regional effects of the recommended projects should be gained to ensure the recommended projects are the most appropriate and cost-effective solutions.

Specifically, we recommend following a slightly modified process prior to implementing projects proposed in the CCMP Update. We have identified five high priority items that we believe should be addressed immediately in order to provide the basis for improved engineering planning and design. We then propose three medium priority items that should be implemented following the high priority items.

We present these recommendations with the understanding that the Town of Palm Beach does not want to be delayed by additional "studies," and that there are strong political, financial, and social arguments for implementing some aspects of the total solution as soon as possible. In this context, we concur with ATM that reaches 2, 3, 4 and 7 presently are experiencing the most critical erosion. If the Town wishes to implement a beach project immediately, in

parallel with addressing the high priority items identified below, we recommend that the Town prioritize these four erosional reaches and select one or more for immediate project commencement. Based on the greatest anticipated public benefit and least resistant permitting path, Reach 7 may be identified as the highest priority segment for immediate protection.

We recommend that the following high priority items be undertaken immediately:

a. **Tools for engineering planning and design (Section 3.1):** Shoreline erosion mitigation, whether it consists of beach replenishment and/or structures, requires advanced modeling tools to investigate the size of projects, the performance of projects, and the regional effects of projects. These tools also provide a greater understanding of the existing coastal processes that cause beach erosion, which is required to select appropriate erosion mitigation alternatives. Without such tools, project design will remain qualitative and generally unacceptable by regulatory agencies. We recommend the application of regional, inlet-to-inlet wave, current, and beach response models using the historical database, to provide effective engineering planning and design tools. Examples of existing models accepted by the coastal engineering community that can be applied to the Palm Beach Island region are REF/DIF-S (a spectral wave model (Kirby and Ozkan, 1994)) and GENESIS (a longshore sediment transport and shoreline change model(Hanson and Kraus, 1989)). Also, it is imperative that these models be maintained over the long-term, by checking and recalibrating the models with monitoring data sets as they are collected. These regional tools can be prepared in concert with the design of initial projects. The cost of implementing regional models will likely be similar to the cost of using individual models for individual projects, with the added advantage of having significant improvements in short- and long-term project planning and design.

b. **Alternatives analysis (Section 3.2):** A formalized alternatives analysis should be conducted to investigate the benefits and costs of a variety of shoreline erosion mitigation options, rather than assuming T-groins plus replenishment is the universal solution. The alternatives analysis will provide a technical and economic basis for selecting appropriate shoreline protection solutions on a site-by-site basis. The alternatives analysis must rely on proper engineering planning and design tools (b. above) and an adequate understanding of available sand resources (a. above). The primary focus of the alternatives analysis should be to select projects that protect a well-defined local erosion problem, as well as benefit Palm Beach Island as a whole. Another key element of the alternatives analysis should be to consider whether groins are appropriate relative to the defined erosion problem. The alternatives analysis should also consider cost-effectiveness and environmental concerns.

c. **Sand resource investigation (Sections 3.3 and 3.4):** An improved knowledge of the quantity of beach-compatible sand available from offshore sources is required before beach replenishment project planning can proceed. Offshore sand investigations completed to date show that much of the offshore sediment is relatively fine-grained compared with native beach sand. A sand search should be carried out immediately, with the goal of determining whether sufficient sand sources exist to satisfy the requirements of the recommended beach replenishment projects (according to the CCMP Update, more than 15 million cubic yards of beach-compatible sand are required over the next thirty years).

d. **Regional hardbottom resources identification (Section 3.3):** Besides beach resources, Palm Beach enjoys valuable offshore hardbottom resources that serve as habitat for sea life. These resources might be impacted, either positively or negatively, by shoreline erosion mitigation projects. The resource areas should be identified, and their areal extent updated periodically using aerial photography, with diver verification as required. This documentation is required immediately in areas where recommended projects might impact these resources. The quality and extent of hardbottom resources will dictate the types of projects that can be permitted along much of the shoreline, particularly the northern part of the shoreline.

e. **Funding analysis (Section 3.4):** We recommend that the Town of Palm Beach revisit the funding sources available for the CCMP, since the funding climate has changed since the previous analysis in 1986. In particular, similar to Jupiter Island's situation, the analysis should include the participation of state, federal and county agencies, in addition to resources from Palm Beach and neighboring municipalities. This analysis should not preclude efforts of the Town to implement shoreline management solutions; however, a summary of available alternative funding sources and an estimate of realistic expected contributions from other interest groups should be compiled as part of the CCMP Update. Additionally, the cost estimate should be revised to a realistic range of costs that includes the recommendations in Section 3.4. The costs estimated in the CCMP Update are likely the worse-case scenario. Uncertainties in the cost estimate should be clarified to provide a reliable estimate of project costs that can be presented to Town Council.

Following completion of these highest priority items, we recommend that the following medium priority items should be undertaken immediately:

a. **Derive Town consensus on goals/priorities of beach management (Section 3.1.2):** The CCMP Update should include social, political, aesthetic, and economic perspectives, in addition to the sand management strategies presented in the CCMP Update. The Town's approach to management will be stronger

based on a consensus derived by a broader CCMP. We encourage the Town to consider putting together a broader plan as a consensus-building document to enter the 21st century.

b. Adaptive management plan (Section 3.5): We recommend that the CCMP include an adaptive management plan. Adaptive management is an active commitment to improve future projects based on the performance of previous projects. Beach replenishment and coastal structure design, as well as inlet management alternatives, can be improved through an adaptive management approach. The longevity and economic benefits of shoreline management projects will likely be improved using this approach.

c. Project performance evaluation (Section 3.5): Erosion mitigation projects require detailed performance evaluation to determine whether projects perform as expected, whether proposed economic benefits were achieved, and to fine-tune and improve future projects (see c. Adaptive management plan below and Section 3.5). Specific monitoring and modeling tasks are recommended for project performance evaluation.

We encourage you to read the detailed descriptions of the above issues and additional recommendations that are provided in this peer review report. Section 2 provides a brief introduction to the purpose and contents of this peer review. Section 3 provides a detailed discussion of the comments, and Section 4 provides a list of the references consulted when preparing this peer review. Finally, Appendix A provides an excerpt pertaining to economic monitoring from a book, entitled *Beach Nourishment and Protection* (NRC, 1995). We look forward to discussing and incorporating the recommendations presented in this peer review, and to working with the Town and its consultants to implement the CCMP.

2. AUTHORIZATION/INTRODUCTION

2. AUTHORIZATION/INTRODUCTION

Aubrey Consulting, Inc. (ACI) has completed this peer review of the Comprehensive Coastal Management Plan (CCMP) Update for the Town of Palm Beach, Florida (ATM, 1997). The Town selected ACI as its peer review consultant for coastal engineering projects through the Consultants Competitive Negotiation Act (CCNA) process (pursuant to Florida Statute 287.055). ACI was issued a Professional Services Agreement (PSA) with the Town that is valid for a five-year period. This peer review of the CCMP was authorized by the Town of Palm Beach Public Works Department under Purchase Order No. 32577. The role of ACI as the peer review consultant is to provide expert coastal science and engineering services to review and improve the basis for planning, design, and implementation of coastal projects. The goal is for ACI to work cooperatively with the Town and its other consultants to implement projects that are effective from a performance and cost perspective.

The CCMP Update peer review was the first project issued to ACI as the Town's peer review consultant. ACI's focus on the CCMP peer review was to ensure that the technical approach used for developing recommendations presented in the plan is sound, and that implementation of proposed projects is consistent with a regional approach. For instance, the plan was reviewed with the understanding that the Town of Palm Beach and adjacent communities are striving to manage coastal erosion and damages for the entire length of coast spanning Lake Worth Inlet to South Lake Worth Inlet. In this light, our comments have been organized and discussed according to five categories that are required for effective shoreline management:

1. Coastal engineering planning and design
2. Alternatives analysis
3. Environmental concerns and permitting
4. Cost estimate and funding analysis
5. Monitoring and adaptive management

Section 3 provides a detailed discussion of our comments regarding each of these recommendations that we believe are important to improve the effectiveness of coastal projects. Recommendations are presented regarding components of the plan that are sufficient, as well as areas where additional information may be required. An Executive Summary of these recommendations is provided in Section 1. Section 4 provides a list of references consulted during this peer review. Finally, Appendix A provides an excerpt pertaining to economic monitoring from a book, entitled *Beach Nourishment and Protection* (NRC, 1995).

This peer review report is intended to be a working document. It should be the basis for discussions on how the Town should proceed with implementing its coastal management plan. The CCMP should be a working document as well, that allows changes to be added as more information is obtained. This is consistent with an adaptive management approach. We request that the Town and ATM examine our recommendations, and that we begin a dialogue to discuss the recommendations presented herein. Once all parties have a chance to examine our peer review, we recommend having a meeting at Town offices to discuss these recommendations as well as other issues raised throughout this cooperative peer review process. One goal of the meeting should be to determine how the Town should proceed with implementing the CCMP.

3. DISCUSSION OF COMMENTS

3. DISCUSSION OF COMMENTS

This section provides a synthesis of the specific comments that were compiled from our peer review of the CCMP Update and related documents. The specific comments have been grouped into five categories that are required to manage the region effectively.

3.1 COASTAL ENGINEERING PLANNING AND DESIGN

3.1.1 Overview of Erosional Processes Worldwide

Physical processes continually shape the coast. Waves break on the shoreline, and sediment is moved as the wave energy is dissipated. Waves generate currents that can transport sediment onshore, offshore, and alongshore. Tides affect the level of the sea surface, allowing waves and wave-generated currents to impact various areas of the beach through the continuous high to low tide cycle. Sea-level is rising relative to the elevation of the land, which contributes to the ongoing erosion of the shoreline. Tidal inlets also affect the coast dramatically by altering littoral sediment transport patterns and controlling sediment budgets.

For a hypothetical natural coast, given an unlimited supply of sediment and constant sea level, the coast would eventually establish an equilibrium shape relative to local wave, tide, and current processes. For instance, in the vicinity of a natural tidal inlet system, ebb and flood tidal shoals can be formed that provide a pathway for natural sand bypassing from updrift to downdrift beaches. On continuous sections of coast, a dynamic equilibrium can be achieved whereby the shape of the shoreline remains constant as sediment is moved alongshore. This equilibrium shape might fluctuate seasonally and be interrupted by storms; however, a general dynamic equilibrium condition could be maintained for the long-term.

In reality, though, shorelines around the world do not have an unlimited supply of sand and have been disturbed. Coastal structures have been built to control shoreline migration. Inlets are cut artificially and dredged periodically. Some shoreline disturbances severely limit the supply of sediment to the coast. Inappropriate inlet management strategies may prevent sediment from being bypassed to downdrift beaches. Seawalls may prevent the erosion of upland sediment required to maintain downdrift beaches; therefore, beaches may erode at the expense of protecting upland property. All the while, sea level continues to rise worldwide and inundate beaches. Many beaches are constantly eroding due to combined effects of human intervention and relative sea-level rise.

3.1.2 Choice to Manage Coastal Erosion

We have the choice to retreat from the shoreline, or attempt to protect our beach property. Many authors have documented substantial economic advantages to managing coastal erosion (e.g., Houston, 1995). It is essential to define regional goals for shoreline management. For instance, one of the goals for the National Seashore on eastern Cape Cod is to maintain a natural dune/beach system. Alternatively, one of the goals for Ocean City, Maryland is to protect the beaches to maintain the lucrative tourism industry. Where decisions are made to protect against erosion, the key is to implement coastal erosion management alternatives that are effective from physical performance and economic points of view. Projects that are deemed effective from a physical performance point of view should have a specified finite design life, and should be monitored to determine whether design expectations were realized. Projects that are deemed cost-effective should have a justifiable and realized economic benefit. At Palm Beach, Florida, coastal property is extremely valuable, and the importance of the beach for tourism is vast. Therefore, one of the goals should be to help protect the beaches and upland property by managing shoreline erosion. Other goals for Palm Beach Island need to be identified and prioritized (e.g., storm protection, recreation, aesthetics, economic, environmental, etc.) Palm Beach also needs a long-term commitment to monitoring and maintaining coastal projects, and hence its coastal resources.

3.1.3 Regulatory Requirements

Today's environmental regulatory climate requires a defensible understanding of physical coastal processes and associated impacts of proposed projects on processes and adjacent beaches before permits can be granted. For instance, coastal structures generally are not permitted without a scientifically-defensible argument showing how structures will help mitigate erosion, that there will be no adverse impacts on adjacent beaches or environmental resources, and that the structures represent the most feasible alternative. Significant sensitive environmental resources at Palm Beach Island are nearshore hardbottom habitat and endangered species of sea turtles, among others.

3.1.4 Tools for Coastal Engineering Planning and Design

To recommend and design appropriate shoreline management alternatives, and to satisfy the requirements of regulatory agencies, a quantitative understanding of coastal processes is expected. Only with a defensible knowledge of processes can alternative shore protection projects be evaluated, and effective projects be selected for implementation.

Numerous investigations have been conducted to gain an understanding of coastal processes along Palm Beach Island. A Comprehensive Coastal Management Plan (CCMP) was completed and accepted (Cubit Engineering Limited, 1986). An Inlet Management Plan for Lake Worth Inlet also was completed and is in the stages of being accepted (ATM, 1995). Plans for a South Lake Worth Inlet Management Plan are underway, and the CCMP Update report has been completed (ATM, 1997), which is the specific subject of this peer review. During the past 20 years, numerous individual project design reports, monitoring data collection efforts, and other studies have been completed for Palm Beach Island. These previous reports provide adequate information to initiate shore protection measures at Palm Beach.

Although we understand the Town does not want to be delayed by additional "studies," some additional coastal engineering planning and design tools are recommended. The 1986 CCMP refers to coastal processes in general; however, there are existing analysis tools that provide a better understanding of the impacts of coastal projects on sediment transport dynamics.

Computer models provide one of the most effective means for evaluating various forces governing wave climate and sediment transport processes, as well as predicting the performance of alternative beach replenishment and coastal structure designs. Quantitative information produced from numerical models can be used to maximize the design life of beach replenishment projects, determine the need for and location of shoreline structures, and examine the effects of dredging offshore borrow sites. One of the primary advantages of numerical models is the ability to simulate multiple scenarios. Once a model has been calibrated to simulate existing conditions adequately, it can be modified to determine the effectiveness of various projects (e.g., comparison of pre- and post-dredging scenarios, different structural configurations, evaluation of varying beach replenishment templates, etc.). Modeling and analysis procedures recommended for improving engineering planning and design at Palm Beach are discussed in the following sections:

- Regional sediment budget analysis (Section 3.1.4.1)
- Detailed wave modeling (Section 3.1.4.2)
- Regional sediment transport and shoreline change model (Section 3.1.4.3)

These tools are recommended for determining appropriate solutions for managing coastal erosion on a regional, inlet-to-inlet basis. Application of these regional planning and design tools should begin with the design and permitting phases of the initial shore protection projects. With these tools, the most appropriate shore protection alternatives should be selected through an alternatives analysis (see Section 3.2). Projects recommended based on an

understanding of the physical processes and an alternatives analysis are more likely to provide lasting and cost-effective solutions. Future projects then can be refined based on the results of monitoring data and reapplication of the engineering planning and design tools discussed above. The approach whereby future projects are improved based on the performance of previous projects is termed adaptive management (Section 3.5).

Modeling tools provide for project costs to be estimated more accurately for planning purposes. The cost of implementing these regional modeling tools will likely be similar to the cost of using individual models for individual projects, with the significant added benefit of improved project planning and design.

Engineering planning and design tools also will provide information to refine the shoreline Reach classification. Presently, shoreline reaches have been defined primarily based on the types of coastal structures that exist. With information provided by the sediment budget, wave, and shoreline change models, shoreline reaches may be more appropriately defined based on the coastal processes. For example, areas with similar wave characteristics and sediment transport processes could be classified as a shoreline reach. Also, hot-spot areas could be identified and characterized as a shoreline reach. Erosion management projects would be more appropriately recommended for shoreline reaches with similar processes than for shoreline reaches based on present characteristics. Selecting reaches based on processes also may reduce the total number of shoreline reaches; therefore, making the region easier to manage.

3.1.4.1 Regional sediment budget analysis: Similar to the site-specific sediment budget estimated for Lake Worth Inlet, a sediment budget should be developed for Palm Beach Island as a whole, including the sources and sinks of sediment associated with bounding inlets. The sediment budget will provide:

- **Improved predictions of the beach replenishment quantities required to manage erosion of Palm Beach Island:** This is important because the combined effects of improved sediment bypassing at Lake Worth Inlet and the initial large-scale beach replenishment projects will likely supply enough sediment to reduce the frequency of future beach replenishment proposed in the CCMP Update, hence reducing long-term maintenance costs significantly.
- **Refined shoreline change rates:** The shoreline change rates presented in the CCMP indicate a consistent trend of erosion along much of the Island for a relatively short time period between 1990 and 1997. Between 1974 and 1990, however, erosion rates were drastically different. In fact, some areas that eroded between 1990 and 1997

accreted prior to 1990. The regional sediment budget will provide a refined long-term estimate of shoreline change rates along the Island that will be valuable for planning purposes. These erosion rates strongly influence the anticipated quantity of future beach replenishment, hence anticipated future project costs.

- **Input data for regional sediment transport and shoreline change models:** The regional sediment budget analysis will provide information necessary to calibrate the regional numerical models. For instance, the models will require an estimate of the quantity of sand lost/gained from the inlets, as well as the quantity of sand lost/gained on- and offshore. Data from the sediment budget also will be used to calibrate the model to ensure that it predicts natural trends of erosion and accretion along Palm Beach Island.

A number of primary data sets and analysis procedures will be required to conduct this comprehensive sediment budget evaluation. Hydrographic surveys of regional nearshore morphology provide the direct source of data for quantifying net coastal sediment transport dynamics. Historically, these data have been collected in conjunction with regional shoreline position surveys by the National Ocean Service.

Bathymetric survey data also are important. These data sets are often overlooked as a primary source of information for assessing regional coastal evolution or site-specific response to natural and human-induced processes. This neglect may be related to the amount of analysis necessary to attain an accurate result, but modern computer mapping and surface modeling software provide an effective means for analyzing these data. Overall, comparison of digital bathymetric and shoreline data for the same region but different time periods can be conducted for calculating net movements of sediment into (accretion) and out of (erosion) a study area. Comparison of data over long time periods is essential for developing a sediment budget suitable for long-term project planning purposes. Historic bathymetric data sets for this area are available from 1894, 1922, and 1967. We recommend the Town consider pursuing an up-to-date bathymetric survey offshore of Palm Beach Island. It is possible that a cost-sharing relationship for this survey could be established in cooperation with the USACE. The sediment budget can be fine-tuned with future data as well.

One example where a detailed sediment budget was compiled is the St. Marys Entrance, GA/FL. Historic shoreline and bathymetric data sets were compared to quantify sediment deposition and erosion associated with channel dredging operations, ebb-tidal delta evolution, and shoreline change along the downdrift shoreline (Byrnes and Hilard, 1995). A regional sediment budget was used to determine spatial variations in longshore sand transport and the extent

of sediment bypassed across the entrance, essential parameters for project planning.

3.1.4.2 Detailed wave modeling: Wave modeling provides essential information for developing effective shore protection projects. A wave model is used to estimate the nearshore refraction, diffraction, shoaling, and breaking wave patterns. These nearshore wave transformation processes govern sediment transport and consequent shoreline change. A quantitative understanding of these wave processes is needed to identify appropriate shore protection alternatives. Results from a wave model can provide:

- **Engineering design parameters** - Example: The wave model would provide wave height and direction information required to design beach replenishment projects and coastal structures. Various wave conditions can be simulated. Seasonal wave climate changes and storm events can be simulated. The model should be used to evaluate a series of storm conditions (e.g., 10-year, 15-year, 25-year, etc.) to determine appropriate project design conditions.
- **Hot-spot locations** - Example: The wave model would help identify the existence of hot-spot areas, such as those south of Lake Worth Inlet and along Reach 6. Combined with a sediment transport model, results could then be used to determine where sand bypassed from Lake Worth Inlet should be deposited on Palm Beach Island.
- **Input data for a sediment transport model** (required)
- **Effects of offshore dredging on nearshore wave conditions** - Example: The model could be used to select offshore sand borrow sites that will not adversely effect shoreline erosion by focusing wave energy and creating hot-spots.

A spectral wave model (such as REF/DIF-S (Kirby and Ozkan, 1994) or SWAN), rather than a monochromatic ("single wave") model, is the state-of-the-art tool that can greatly improve the understanding of water waves propagating over irregular bottom contours. The spectral approach makes it possible to model the sea surface more accurately, which is composed of a large variety of waves moving in different directions and with different frequencies, phases, and heights. By simulating all the wave components that propagate towards the shoreline, accurate nearshore statistical parameters can be calculated for engineering design parameters and as input for sediment transport modeling.

3.1.4.3 Regional sediment transport and shoreline change model: A model should be implemented to simulate sediment transport and shoreline

change on Palm Beach Island as a region. This model would provide the fundamental tool necessary to design each project implemented as part of the management plan. Application of this regional model could be initiated in the design stages of the first project. Rather than develop project-specific models, one regional model should be developed that can be improved for various reaches as new projects are designed and implemented. The model should be improved over time as monitoring data are collected, and used as part of an adaptive management plan to improve future projects based on the performance of previous projects.

This model would require the regional sediment budget, including an understanding of how inlets interact with adjacent shorelines and the detailed evaluation of wave processes. GENESIS (Hanson and Kraus, 1989) is an example of a model accepted by the coastal engineering community that could be applied to Palm Beach Island. Other models are available as well, and a consensus should be reached regarding what model to use, as the model will provide a design/analysis tool for the present and future.

The model should be applied first to understand existing processes that contribute to the erosion of Palm Beach. Once the existing processes are well-understood, the model should be used to evaluate appropriate alternatives for managing erosion. The model should be considered a work in progress, and be maintained/improved for the long-term. As projects are implemented and additional monitoring data become available, the model should be checked and recalibrated, and used to refine future projects. This kind of model will be required by regulatory agencies, and also should be desired by the Town to ensure that the physical performance and cost-effectiveness of projects are optimized.

One particular need for such a model is to resolve the apparent contradiction in shoreline change trends between 1974 and 1990 and 1990 to 1997. While most of Palm Beach apparently accreted between 1974 and 1990, severe erosion was experienced between 1990 and 1997. Given the available information, it was not possible to provide an explanation for this significant difference in the CCMP Update. Perhaps to characterize the worse-case scenario, the 1990 to 1997 shoreline change rate estimates provide the sole basis for projects recommended in the CCMP Update, as well as the cost estimates for required beach replenishment. Shoreline change rates based on a long-term data set and a shoreline change model should be computed for planning purposes. Since there appears to be substantial uncertainty in rate of shoreline change estimates, and this uncertainty strongly governs the type, design, and cost of coastal projects, a model should be applied to provide a more reliable understanding of shoreline change (combined with the regional sediment budget analysis (Section 3.1.4.1)).

In addition to providing the tool necessary to evaluate various alternatives for managing shoreline erosion for a particular section of coast, a regional model also would provide the tool to determine the effects of projects in one area on adjacent beaches. For instance, the model could be used to determine how improved sediment bypassing methods at Lake Worth Inlet would affect erosion along the northern section of the Island. Specifically, by considering the benefits of improved sediment bypassing, the three-year maintenance cycle for Reach 2 beach replenishment may be extended.

3.2 ALTERNATIVES ANALYSIS

An extremely aggressive, unprecedented set of shore protection projects has been recommended in the CCMP Update. Over fifteen million cubic yards of beach replenishment and forty-six or forty-seven T-groins, costing over one hundred million dollars have been recommended to manage the shoreline over the next thirty years. As the CCMP Update was not intended to be a design document, its recommendations were based upon limited existing information regarding coastal processes. The engineering planning and design tools discussed in Section 3.1.4 should be used to complete a project alternatives analysis to refine the series of recommended projects. The alternatives analysis would ensure that the most appropriate projects are recommended to protect individual shoreline reaches, as well as benefit Palm Beach Island as a whole. From a coastal processes point-of-view, the alternatives analysis should be geared toward answering the following three questions:

- Does each project represent the most effective alternative for managing erosion in a particular section of beach?
- How will each project affect adjacent beaches?
- Are projects consistent with other projects implemented in this region, including inlet management alternatives, that benefit the local shoreline reaches in the short-term and the entire Palm Beach Island region in the long-term?

Because the Town may wish to implement projects as soon as possible, this is not a recommendation to delay projects until the coastal processes analysis tools are implemented and the alternatives analysis is completed. Rather, high priority beach replenishment projects needed to address emergency situations can be implemented where deemed appropriate. The planning and design tools can be applied along with implementing the initial high priority projects. Future projects can be improved using the advanced coastal processes analysis tools.

In addition to environmental and cost concerns, specific coastal processes issues the alternatives analysis should address include:

- **Selection of appropriate design conditions:** All beach replenishment projects in the CCMP Update have been designed to withstand the 15-year storm; however, the recommended plan spans a thirty year period, and it is unclear to what extent storm losses have been included in the anticipated maintenance schedule. Design conditions for various seasonal and storm events (e.g., 10-year, 15-year, 25-year, 50-year) should be characterized. Projects should be designed based on their response to these various conditions.
- **Beach replenishment project design:** Alternative beach fill configurations need to be evaluated to determine the most effective projects for implementation. Various beach fill lengths, widths, and berm elevations should be considered, and evaluated based on profile data and results from a regional shoreline change numerical model. Justification needs to be provided for the 15-year storm design criteria as described above. Also, the effects of beach replenishment on adjacent shoreline reaches need to be considered. For example, the beach replenishment plan for Reach 2 likely would be altered if the effects of improved sand bypassing at Lake Worth Inlet were considered. Also, the beach replenishment plan for Reaches 9 and 10 likely would be altered, considering the effects of multiple beach replenishment projects to the north.
- **Use of T-groins or other structures:** T-groins have been identified in the CCMP Update as the only means to help stabilize beach replenishment. Most often, groins have been recommended in areas where hardbottom resources are close to shore. Consequently, it seems the primary purpose of groins is to allow the shoreline to be stabilized using a more narrow beach replenishment project, thereby limiting coverage of nearshore hardbottom habitat. Typically, groins are recommended to help manage erosion rather than to protect resource areas. For instance, groins can be used to modulate longshore sediment transport for shoreline reaches where the longshore sediment transport rate is higher than surrounding areas (i.e., hot-spots). These areas need to be identified prior to installing groins.

More information is required to determine whether groins will be effective. An alternatives analysis is required to determine whether groins are appropriate, even on a conceptual level. For instance, it seems that a perched beach could alternatively be constructed to prevent excessive coverage of offshore hardbottom resources. Also, perhaps replenishment alone would provide a viable alternative, with

overflow at hot-spot areas. Some specific questions that need to be addressed regarding groins are: 1) Will groins allow a more narrow beach replenishment to stabilize the shoreline for the desired period of time?, 2) What effect will groins have on the offshore beach replenishment profile, and how will this affect shoreline stability, and 3) How will groins affect cross-shore sediment transport processes?

- **Solution for Reach 6:** The CCMP Update recommends essentially no action for Reach 6 other than repairing the existing revetment. Despite the apparent obstacles to implementing projects along Reach 6, such as the offshore trough, nearshore hardbottom resources, and believed hot-spot of beach erosion, additional effort should be put forth to determine a way to manage erosion in this area. The plan needs to make recommendations based on regional concerns to ensure there will be an adequate supply of sand transported to Reach 6 from updrift shorelines. The T-groins recommended north of Reach 6 intended to prevent sand from entering this area are likely in conflict with a regional approach.
- **Determine where sand bypassed from Lake Worth Inlet should be deposited:** Available information suggests there is a hot-spot area south of Lake Worth Inlet. The Draft Lake Worth Inlet Management Plan (ATM, 1995) includes a refraction/diffraction study that suggests there is a point south of the Inlet where the net direction of sediment transport changes. For some distance south of the inlet, sand is believed to be transported north, back to the inlet. Additional investigation is required to determine more accurately where this point is, and what the effect of recent dredging for the Mid-Town beach replenishment project had on this region. Based on this improved information, the most appropriate location for sediment bypassing can be specified. Regional engineering planning and design tools should be used to complete this analysis (Hamilton *et al.*, 1995).

3.3 ENVIRONMENTAL CONCERNS AND PERMITTING

In order to obtain permits for projects proposed in the CCMP Update, significant analysis of the effects of proposed projects on coastal processes, adjacent beaches, and natural resource areas should be completed. The tools for engineering planning and design discussed in Section 3.2 should be used to support environmental permit applications. Even with these tools, it is not certain that permits can be obtained for several of the recommended projects. For instance, it may not be acceptable to cover nearshore hardbottom habitat with beach replenishment sand. Also, it will not likely be acceptable to construct forty plus T-groins, as proposed in the CCMP Update.

In addition to the engineering planning and design tools, three items are recommended to address environmental concerns:

- **Regional hardbottom resources identification:** The fundamental environmental concern that needs to be addressed is the extent and quality of nearshore hardbottom habitat that exists offshore of Palm Beach Island. This is of particular concern at the northern reaches of the Island, where beach replenishment projects will likely result in hardbottom coverage. Consequently, we recommend that a detailed hardbottom habitat survey be completed immediately. Only with detailed information regarding hardbottom resources can appropriate projects be selected to manage shoreline erosion in these areas.
- **Evaluation of impacts of proposed groins:** T-groins have been proposed extensively in the CCMP Update to reduce hardbottom impacts. The assumption employed to recommend these structures is that T-groins will extend the design life of narrow beach replenishment projects that minimize coverage of hardbottom habitat. However, the benefits of not covering hardbottom should be weighed against the adverse impacts of constructing groins. Groins may have adverse impacts on downdrift beaches, sea turtles, or other resources. Also, it should be determined what effect groins will have on the offshore beach profile and cross-shore sediment transport processes, and how this may impact hardbottom resources. Furthermore, groins may not be permitted for the purposes of minimizing hardbottom coverage. Rather, groins are typically permitted at the end of a littoral cell, or to help manage severe erosion at hot-spot areas. It is likely that a balance can be achieved that allows some coverage of hardbottom resources (likely with mitigation) and the use of fewer groins.
- **Sand resource investigations:** Based upon the available data, the quantity of beach-compatible material from offshore borrow sites may be limited. Fine material will have a relatively flat offshore profile that will likely cover excessive hardbottom resources. The availability of sufficient beach material also significantly affects the extent of beach replenishment projects that can be implemented and the project costs. Consequently, a sand resource investigation is needed immediately.

3.4 COST ESTIMATE AND FUNDING ANALYSIS

Costs for the recommended projects are approximated in the CCMP Update. Initial projects are purported to cost approximately \$56,000,000 (present value). Over the course of the 30-year plan, total costs are estimated to be more than \$115,000,000 (present value). A plan of this magnitude essentially is

unprecedented. Consequently, strong conclusive scientific and economic information should be provided to defend expenditures of this magnitude. The items discussed in this peer review are intended to provide the scientific defense for appropriate coastal projects. The economic defense needs to be based on a more complete analysis of recommended projects and costs, as well as economic benefits. Since there is significant uncertainty associated with projects presented in the plan (i.e., it is not certain that the recommended projects are actually the most effective alternatives and whether the projects can be permitted), it may be premature to seek funding for the long-term plan at this time. Costs should be estimated more accurately, cost-sharing relationships between other interest groups should be explored, and economic benefits from shore protection projects should be estimated more accurately.

Nonetheless, the estimate provided in the CCMP Update provides initial costs for Town planning purposes. The initial cost estimate may be improved by incorporating the following recommendations:

- **Costs for future expected maintenance beach replenishment projects should consider storm damages:** Quantities of future maintenance replenishment projects, and hence costs, are based on background erosion rates between 1990 and 1997. There are significant uncertainties associated with these erosion rates, and it is unclear to what extent storm damages are included in these background erosion rates. Since the beach fill designs have been based on a 15-year storm, and the maintenance plan is for 30 years, it is likely that some additional beach replenishment will be required to mitigate storm damages. This additional replenishment will significantly affect costs.
- **Structural repair and maintenance costs should be estimated:** It is likely that some of the existing coastal structures and proposed groins will require maintenance over the course of the thirty year plan. These costs should be included in the cost estimate.
- **Costs for alternative sand borrow sites should be estimated:** Since the sand source surveys to date suggest there may be a limited supply of beach-compatible sand, the cost of using alternative borrow sites should be estimated.
- **Over-fill costs should be estimated more accurately:** When dredged material grain size is finer than native beach sand, additional fill is required to supply an equivalent amount of beach-compatible material. This is the overfill factor concept. An overfill factor of 1.0 to 1.2 was assumed in the CCMP Update. Offshore sand source studies to date suggest the actual overfill factor may be higher. Results from a

detailed sand resource investigation would provide a more accurate estimate of the overfill factor.

The recommendations listed above would likely increase the cost of implementing the plan. There are other considerations that would likely reduce the range of realistic costs. For instance, once appropriate tools for engineering planning and design are applied, the effects of a project in one area on adjacent areas can be estimated. It is likely that these tools would show that improved sand bypassing at Lake Worth Inlet will benefit Reach 2 such that maintenance replenishment projects would not be required every three years, as estimated in the CCMP Update. Similarly, Reaches 8, 9, and 10 would benefit tremendously from replenishment projects updrift. If millions of cubic yards of sand are used to replenish updrift reaches of the Island, it is unlikely that Reaches 8, 9, and 10 will require all of the proposed maintenance replenishment projects near the middle to end of the 30-year plan. Both of these examples would reduce costs; hence, the cost estimate provided in the CCMP Update is likely a worse-case scenario.

Although the above recommendations may not have an exact dollar value, a realistic range of costs should be estimated for planning purposes. Uncertainties in the cost estimate should be clarified to provide a reliable estimate of project costs that can be presented to Town Council. Decisions need to be made regarding whether funding for the initial projects or the thirty-year plan will be sought. Also, different funding models should be explored, such as special taxing districts, bonds, private contributions, or other. We understand at the time of this writing that an economic assessment is being proposed to Town Council that will address some of these issues.

A final recommendation regarding the cost estimate tables is to provide a column of costs in future value. Many people who read the plan may not understand present value type estimates. Providing future value estimates as well will eliminate the risk of having complaints in the future that projects cost much more than proposed in the initial plan. It also would be useful to tabulate future value, because it is not certain when the funds for the plan will be secured. For instance, assuming the project cost estimates are accurate, 8% return on investments can be achieved, and inflation stays at 3%, projects could be funded if the total 30-year budget in 1997 dollars were collected today. However, if funds are to be secured at a later date or on an annual basis, actual required contributions would exceed the 1997 present value estimate.

One note regarding expected benefits is to exercise caution when factoring rising property values into the equation to justify the expense of shore protection projects. There are numerous economic factors unrelated to the beach that control property values.

3.5 MONITORING AND ADAPTIVE MANAGEMENT

Adaptive management is a process whereby future projects are improved based on the performance of previous projects. For instance, when an initial beach replenishment project reaches the end of its design life, maintenance replenishment is typically required. The maintenance replenishment can either be constructed according to the initial design, or be changed to improve the design. Appropriate design changes can be determined based on analysis of data collected during monitoring of the initial project, re-application of engineering planning and design tools (e.g., numerical models), and other concerns. An adaptive management plan should be included as part of the CCMP, which essentially states a commitment to considering these factors prior to implementing future projects. Initial projects should be designed and implemented based upon the best available information (e.g., a coastal processes analysis and an evaluation of possible alternatives), then monitored to compare actual performance to design expectations. Future projects should be improved based on the performance of previous projects and evolving needs for the shoreline (e.g., storm protection, environmental concerns, recreational needs, etc.). The net result should be a realized improvement in the longevity and economic benefits of shoreline management projects.

Specific areas that should be considered for adaptive management are:

- **Beach replenishment projects:** Monitoring data, such as beach profiles and/or bathymetry data, should be analyzed to determine whether beach replenishment projects are performing according to design expectations. Reasons for unexpected erosion should be identified, such as storm damage or hot-spots. Future projects should be improved specifically to address the shortfalls of previous projects by incorporating appropriate design changes.
- **Coastal structures:** Monitoring data should be evaluated carefully to determine whether coastal structures are beneficial, and to evaluate impacts to adjacent and downdrift beaches and other sensitive environmental resources. It will likely be beneficial to try structures at one location and monitor the performance. Initially, the performance of the groins at the Mid-Town project should be evaluated. It would be useful to compare the performance of the Mid-Town project to a beach replenishment project without groins at another location.
- **Hot-spots:** Adaptive management will particularly help mitigate erosion at hot-spot areas. For example, hot-spots were identified at Jupiter Island, Florida. A plan was developed to protect these hot-spots using overfill and rock headlands. Implementation of this plan

was phased such that initially only overfill was used. The performance of the overfill has been monitored to determine whether additional protection is required. One hot-spot has performed well with the overfill. Another hot-spot has experienced significant erosion. A more complete evaluation of the data may suggest that structures are required to stabilize the hot-spot where overfill alone may not be adequate. This approach ensures that appropriate projects are implemented, and saves costs.

- **Influence of nearby projects:** Effects of updrift and downdrift projects should be included in the adaptive management plan. For instance, an initial beach replenishment project in Reach 7 may perform better than expected as a result of an additional source of sand from the updrift Mid-Town project. Future projects at Reach 7 may be reduced in scope if updrift beaches provide a continuing sand source, or may have to remain the same or increase in size if updrift beaches are no longer providing a significant source of sand.
- **Environmental impacts:** Monitoring data that characterizes the impact of initial projects on environmental resources should be utilized to improve future designs that minimize impacts. For instance, the extent of hardbottom coverage associated with a beach replenishment project may be minimized by using a different fill template, sand grain size, or varying coastal structure design.
- **Economic monitoring:** Projects should be evaluated carefully to determine whether expected economic benefits were realized, whether project costs were estimated accurately, and generally whether projects are economically justified. The decision of whether to implement future projects can be guided by economic monitoring information. The National Research Council (1995) published a book, entitled *Beach Nourishment and Protection*, that included discussions of the importance of economic monitoring. These authors identified some of the key economic questions that need to be addressed regarding coastal projects. These questions are related to recreational benefits, property values, the value of storm damage reduction, identifying unanticipated costs, examining cost-sharing relationships, etc. An excerpt from the NRC book related to economic monitoring has been included in Appendix A. We recommend the Town consider this information, decide which components of economic monitoring are most applicable to the interests of the community, and implement economic monitoring as part of the CCMP.

4. REFERENCES

4. REFERENCES

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APPENDIX A

Economic Monitoring Reference (NRC, 1995)

term effects have been noted, or the nearshore zone in areas where there are sensitive habitats that may be disturbed.

The extent, duration, and frequency of pre- and postconstruction monitoring will largely depend on the size of the project, the habitats to be affected, and the projected frequency of renourishment. Determining the sampling precision for the biological monitoring effort merits specific consideration. Elliot (1979), Green (1979), and Nelson (1991, 1993) provide more comprehensive information on recommended sampling designs, sample size, and sampling frequency and on statistical constraints that merit consideration in developing a biological monitoring program. Sampling precision is especially important because many previous studies involved the collection of only a few replicate samples per site. The low number of replicates used was probably not sufficient to detect statistically even major changes in the biological parameters being monitored. In addition, many studies have focused more on characterizing community structure such as faunal abundance, biomass, and measures of species diversity than on identifying and assessing trends and changes in the faunal communities with respect to trophic structure and function.

There is a large variability in the physical characteristics and biological resources of beach and nearshore habitats along the coastline of the United States. The conditions that exist at a beach nourishment site need to be considered in forming the specific sampling approaches that are incorporated into a biological monitoring program. Based on the limited data available from previous monitoring efforts, several key questions need to be addressed in developing the biological study design:

- What is the duration of disturbance to the biological resources of concern, and is it compatible with the anticipated frequency of redisturbance resulting from subsequent renourishment operations?
- Are biological resources adjacent to the project area affected by construction activities or subsequent movement of sediments from the project area?
- Do turbidity levels associated with nourishment operations exceed levels known to be harmful to the indigenous biota of concern, or, if that is not known, do the levels exceed those naturally observed over various seasons at the site of concern?

Monitoring programs that are designed to address these questions adequately and that are relevant to the area where a project is planned will greatly improve our understanding of the biological consequences of beach nourishment activities.

ECONOMIC MONITORING

A well-designed economic monitoring program would attempt to answer the following questions:

- How large are the realized recreational benefits, and do they approximate those predicted for the project?
- What are the effects of the project on property values, and to what extent are these effects linked with storm damage reduction, enhanced aesthetics, and recreational amenities?
- What were the construction and other related costs, and were they well approximated by the cost estimates?
- Are there other significant but perhaps unanticipated costs and/or benefits accruing from the project?
- From the locality's standpoint, did the project stimulate growth, and, if so, what desirable or undesirable effects did the growth have on the community?
- Did the project encourage construction that places more property at risk from storm destruction?
- What was the actual distribution of the costs and benefits of the project—that is, who benefited and who paid?

Although the USACE is charged with conducting preconstruction cost-benefit analyses, there have been few follow-up analyses of projects to determine whether projected benefits were actually realized, whether secondary benefits occurred, or whether unanticipated costs could be attributed to the project (Haveman, 1979; Stronge, 1992b, 1994). Without such follow-up studies, it is difficult to determine whether USACE methodologies for assessing recreational and storm damage reduction benefits are sufficiently accurate for beach nourishment analysis, and it is impossible to determine whether its cost-benefit analyses incorporate all significant categories of costs and benefits that usually accrue from these projects. Although full-scale follow-up analyses may not be warranted for all projects, postconstruction analysis of a sampling of projects is necessary to answer these questions.

As discussed in Chapter 2, none of these categories of costs and benefits is easy to estimate. Analysis of recreational benefits is in some ways the easiest because this methodology is the most well developed. The purpose of the recreational monitoring component would be to quantify the actual recreational benefits accruing specifically to the beach nourishment activity and whether the benefits were well approximated by the preconstruction analysis. This analysis requires valuing the change in use directly associated with the change in the quality/size of the beach brought about by the nourishment.

Ideally, both before and after the nourishment activity, surveys based on random samples of the area's population need to be taken in conjunction with onsite surveys of beach users. The surveys would provide both information on participation rates for beach use that are unavailable from onsite surveys and a means of extrapolating survey sample to total beach use. However, onsite surveys are still useful because they provide a means of oversampling users, thus ensuring adequate coverage of this group. Both types of surveys would need to collect

information on the total number of beach trips to different beaches in the area on a seasonal basis as well as the location of household residence, travel costs, and household socioeconomic variables.

Given access to respondents, contingent valuation questions might also be included in the survey. Such questions are a useful way to elicit information on how individuals value quality aspects of the beach and the surrounding area that may have changed owing to the nourishment activity. As explained in Appendix E, contingent valuation questions ask people how much they would be willing to pay (in increased entrance fees, parking fees, or some other payment vehicle) for a change in quality characteristics of the beach. A pertinent experiment would be to ask such a question before construction, describing the expected outcome of the nourishment activity, and then to ask a similar postconstruction question when individuals can witness the results of the nourishment project directly.

It is, of course, difficult even after construction to assess the accuracy of estimated storm damage reduction benefits. The reason is that storm events are random, and estimates must be based on expectations. However, it is possible to attempt to assess the effects of a nourishment project on property values by collecting property value data before and after the project and completing a hedonic analysis. A hedonic analysis attempts to explain property values as specific functions of characteristics of the property (see Appendix E for further discussion of hedonic analysis). Data on important property characteristics are required, including distance to, view of, and accessibility of the beach. The intent would be to see how changes in the quality of the beach affect property values, controlling for all other features of the properties.

There are several difficulties with hedonic analyses of this sort, however, not the least of which is timing; the added value of a beach nourishment project will begin being capitalized into property values as soon as a potential project is announced. Nonetheless, it would be useful to design a hedonic study that attempts to reveal the marginal value associated with beach nourishment, although it may require incorporating a lagged response in the model. It would also be useful if the hedonic analysis could be designed to separate the storm damage reduction benefits from the aesthetic and recreational benefits of the nourishment; however, the high correlation between these two characteristics may preclude doing so.

Beach nourishment projects can potentially have additional effects on an area although few, if any, studies have attempted to even list them. Projects may stimulate new construction and/or commercial development, for example. Such activity may have positive or negative net benefits for the community depending on the nature and size of the development and the type of community. A post-construction survey of these effects would be useful, including an assessment of their fiscal impacts (increases in the tax base and employment versus increased costs of infrastructure and services). If a nourishment project stimulates construction that increases the risk to property of storm damage, then this increase needs

accounted for. Further, it would be especially useful to survey the population to determine the community effects of the beach nourishment project.

Because there is increasing debate over the share of beach nourishment costs incurred by federal and local partners, an analysis of the recipients of the costs and benefits would be useful. First, of course, the construction and related costs of the project need to be tallied, compared to original cost estimates, and attributed to the sponsoring parties. They would then be compared with the incidence of the benefits. If properly done, such an analysis will provide accurate information as to who benefits from the project. One caveat is necessary here. If the project was made necessary by actions elsewhere (e.g., USACE dredging), these negative externalities must be taken into account. For example, some of the nourishment operations may have been dredged-material disposal operations in which sand was deposited on the beach only because doing so was the cheapest disposal option. Alternatively, the need for a particular project may be due to interruption of the natural sand flow by a navigational project. Information on the distribution of costs and benefits from beach nourishment projects of different types would help inform the cost-sharing policy makers in the future.

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February 27, 1998

Mr. Albert P. Dusey, P.E.
Director of Public Works
P.O. Box 2029
Palm Beach, FL 33480

Re: Peer Review Comments
Comprehensive Coastal Management Plan

Dear Al:

Enclosed are ATM's follow up comments to Aubrey Consulting, Inc's. peer review of the draft Comprehensive Coastal Management Plan update. The attached sheets contain our general comments on many of the recommendations made in the Aubrey report. As you and I have discussed, ATM agrees with essentially all of Aubrey's recommendations.

A point of confusion is whether the resource investigations, additional monitoring and computer modeling should be included as a planning or design component of the project. The Aubrey report strongly implies that these should be considered planning exercises and should be undertaken prior to moving forward with the project design. While this approach is ideal, we have suggested that various monitoring and modeling elements be undertaken as the first component of the project design phase. The important thing is that there is agreement that much of the work needs to be accomplished. One consideration is that making these tasks part of the project design will make them eligible for supporting state and federal funds if available. If they are undertaken as planning efforts they will be the total responsibility of Palm Beach and any other participating municipalities.

We are anxious to meet with you and Mr. Hamilton to discuss our comments in detail. Please do not hesitate to contact me if you have any questions regarding the above attached.

Sincerely,
Applied Technology and Management, Inc.

David J. Decker, P. E.
Vice President

cc: Bob Hamilton, w/enclosures
Peter Elwell, w/enclosures

Enclosure

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Environmental & Coastal Engineers, Scientists & Management Consultants

**ATM COMMENTS ON PEER REVIEW
OF THE
COMPREHENSIVE COASTAL MANAGEMENT PLAN UPDATE**

The following comments are provided by Applied Technology and Management (ATM) in response to Aubrey Consulting, Inc.'s Peer Review of the draft Comprehensive Coastal Management Plan Update prepared by ATM and dated September 1997. Comments refer to individual page numbers and paragraphs of the Peer Review document.

Page 2 - Paragraph a:

ATM agrees with the value of applying wave, current and shoreline change models to assist with the design of the proposed improvement projects. In fact, such modeling typically is required to obtain necessary permits from the State of Florida. A detailed assessment of available data would be necessary prior to developing a meaningful model, be it regional or project specific. Individual modeling efforts can be initiated for each component of the project design. As the data set expands and modeling several projects is undertaken, the true regional model(s) can be developed.

Page 2- Paragraph b:

An alternatives analysis would, by necessity and in keeping with responsible engineering practice, be performed early in the design phase for each project. The application of modeling to evaluate economic and engineering aspects of alternatives should be considered.

Page 3 – Paragraph c:

ATM agrees that the first priority in implementing the overall plan is to complete a more in-depth sand source investigation.

Page 3 – Paragraph d:

In 1991, 1992 and 1993 Palm Beach County prepared maps of the nearshore hardbottom resources along Palm Beach Island by interpreting controlled aerial photography and by conducting limited diver verification. Some supplemental hardbottom survey work was also accomplished by ATM in conjunction with the preparation of the Lake Worth Inlet Management Plan. It is recommended that targeted site-specific surveys be deferred until individual design initiatives are undertaken for each element of the Plan.

Page 3 – Paragraph e:

The original scope for the CCMP update included review of potential funding methods. This task was removed from the scope of services and is currently being undertaken by Regional Research Associates (Dr. William Stronge) with the cooperation of ATM.

Page 3 – Paragraph a: (last paragraph)

It is recommended that the CCMP update include social, political, aesthetic, and economic perspectives. It was ATM's understanding that the CCMP update would focus on the engineering aspect of managing the Island's shoreline. Individual efforts to evaluate funding alternatives, public awareness initiatives, etc. are being pursued as separate components to the overall beach management initiative. We understand that the Town of Palm Beach's Shore Protection Board is moving forward to develop a broad approach as recommended by Aubrey.

Page 4 – Paragraph b:

ATM agrees with the adaptive management plan concept. This concept typically is implemented as subsequent data is gathered to support future project needs, feasibility and design.

Page 4 – Paragraph c:

Monitoring of the Island shoreline prior to and following various improvement projects (project performance evaluation) is recommended and will likely be a condition of state and federal permits. With regard to economic monitoring, we suspect that the need to perform this monitoring and evaluation will be determined by the selected funding mechanism. In other words, if a simple increase in millage is used to support the projects, a detailed analysis of the economic benefits associated with beach restoration is probably not necessary. However, if an apportionment plan is conceived where varying assessments are levied against property owners, an economic monitoring program may be helpful in justifying assessments and refining apportionment levels as appropriate.

Page 9 – Paragraph 3:

We generally agree with the value of computer models as a tool to help with the project design process. We feel compelled to point out that comprehensive beach profile, sediment budget and structure performance data available for the entire Island is limited. Considerable additional monitoring will need to be performed (especially around existing structures) to gain adequate

meaningful information to allow the application of computer models which seek to reasonably predict existing and future shoreline conditions.

Page 9 – Last Paragraph:

We concur that the application of regional planning and design tools should begin with the design and permitting phases of the initial shore protection project(s).

Page 10 – Paragraph 3:

Computer models can help refine shoreline reach delineation. The Reaches selected in the CCMP update were actually derived considering four principal components:

- a) Coastal Processes and planform
- b) Environmental considerations and mitigation requirements
- c) Extent and type of shore protection/shoreline stabilization structures
- d) Existing upland land use

These variables are mapped on Figures 6-1 through 6-13 in the draft plan. Reach refinement may evolve further, considering the various design, physical and political issues which may affect the extent of individual projects.

Page 10 – 3.1.4.1 – First Sub Paragraph:

ATM concurs with the Peer Review comment.

Page 10-3.1.4.1 – Second Sub Paragraph:

While the reviewers are correct that erosion rates between 1974 and 1990 were different than those computed between 1990 and 1997, we believe it is important to clarify several aspects of these two time periods of comparison:

1. The 1974 data set is incomplete in its coverage of the Island in that the beach profiles were only run out to a profile depth of closure at every third Range Monument, or at approximately 3,000 foot alongshore intervals.
2. The 1990 to 1997 comparison, while analyzing shoreline position and volumetric changes over a shorter time span, is more indicative of current trends along the Island than looking at 1974 to 1990. Inlet sand transfer practices have evolved over the years,

Page 13 – Last Paragraph:

As indicated above, we do not fully support the assertion that there is a contradiction in shoreline change trends between the 1974-1990 and 1990-1997 data. The lack of profiles for the older data set and the focus on shoreline change vs. volume change by Aubrey may cause one to question the Island's long-term erosion rates. However, the results of the recently acquired, comprehensive and reliable data sets in 1990-1997 present definitive volume losses along much of the study area.

Page 15 – Second Paragraph:

The projected renourishment intervals presented in the draft CCMP update consider the relative probability of significant storm events on an individual project's life. The 15-year design storm has become a somewhat typical improvement level based upon cost-benefit analyses performed on several other Southeast Florida shoreline restoration projects. Actual design levels for individual projects will be determined considering the sand source, upland land use, the use of structures, etc.

Page 15 Last Paragraph:

In general, the historic performance of groins on Palm Beach Island has been widely recognized. It is agreed that a more detailed analysis should be undertaken as part of the project design process on groin spacing, location, etc.

Page 18 – Third Paragraph:

There is no correlation between the selected 30-year project line and the 15-year design storm. The 30-year life has been established to help evaluate long-term costs vs. economic benefits. The 15-year design storm is an estimated level of storm protection required for a project at the end of the projected renourishment interval.