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**Reno Beach-1994-01**

**US Army Corps  
of Engineers  
Buffalo District**

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**FLOOD PROTECTION PROJECT  
RENO BEACH-HOWARD FARMS, OHIO**

**Operation  
And  
Maintenance  
Manual**

**January 1994**

**Flood Protection  
Reno Beach-Howard Farms, Ohio**

**OPERATIONS AND MAINTENANCE MANUAL**

**U.S. Army Engineer District, Buffalo  
1776 Niagara Street  
Buffalo, NY 14207-3199**

**OPERATIONS AND MAINTENANCE MANUAL  
FOR  
FLOOD PROTECTION  
RENO BEACH-HOWARD FARMS, OHIO**

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# **Flood Protection Reno Beach-Howard Farms, Ohio**

## **PREFACE**

The Flood Protection Project at Reno Beach-Howard Farms, Ohio, was completed in October 1992. The project was designed and constructed under the supervision of the Buffalo District Corps of Engineers. The Lake Erie Conservancy District Number 1 and the Howard Farms Conservancy District, as the local sponsors, have inspected the completed project and acknowledged satisfaction with the project. The Federal Government transferred the project to the Conservancy Districts on 26 March 1993.

This manual has been compiled to assist the Conservancy Districts' officials in complying with the requirements for maintaining the protective works.

The manual contains a copy of the drawings and references pertaining to this project.

The project will provide and protect the shoreline at Reno Beach-Howard Farms, Ohio. However, the successful functioning of the project will depend upon how it is maintained by the Conservancy Districts' officials.

Erosion and revetment damage, which could result from failure of part of the project, can be prevented through careful inspection and proper and timely maintenance. The Buffalo District Corps of Engineers will conduct annual inspections of the completed works to insure the structural integrity of the project and compliance with local assurances that have been provided by the local sponsors.

**Flood Protection  
Reno Beach-Howard Farms, Ohio  
Operation and Maintenance Manual**

**I - INTRODUCTION**

1. Project Authorization.

The Flood Protection Project at Reno Beach-Howard Farms, Jerusalem Township, Lucas County, Ohio, was authorized under Section 203 of the 1948 Flood Control Act, Public Law 858, in accordance with House Document Numbered 554 (80th Congress, 2nd Session).

2. Location.

The Reno Beach-Howard Farms project site is located along the southwest shore of Lake Erie in Jerusalem Township, Lucas County, Ohio, approximately 15 miles east of Toledo.

3. Description.

The project (see Appendix D, sheets 1 through 28) consists of the rebuilt "Operation Foresight" dikes, some foreslope work on the Cooley Canal, and a portion of the Wards Canal Levee which now provides a permanent level of protection. The lakeshore dikes in existence at the time this authorized project was under taken, were the result of construction over a long period of time, the latest being the emergency work of 1973. These dikes were found to be in various stages of deterioration requiring the repair or reconstruction of the dikes, as necessary, to convert them to a permanent project. The as constructed project consists of about 7,520 feet of reconstructed dike generally involving large stones used for toe protection, new filter cloth, a 2.5-foot layer of underlayer stone, and a 3.3-foot layer of type "B" stone up to the design crest elevation (13.6 feet above Low Water Datum, L.W.D.) on a design slope of 1V : 2H. Approximately 4,278 feet of additional dike involved various levels of repair, including: 2,910 feet of berm at the base of the structure consisting of a 2.5-foot layer of underlayer stone and a 3.3-foot layer of type "A" stone to provide toe protection; 1,066 feet of berm containing underlayer and type "A" stone up to 5.0 feet above L.W.D., and type "B" stone up to the design crest elevation on a design slope of 1V : 2H; and, 302 feet of transition sections. Also, approximately 277 feet of work on Cooley Canal consisted of fill material in those areas where the slope had been eroded and placement of a 4.4-foot layer of riprap on top of a 2.5-foot layer of underlayer stone up to 12.3 feet above L.W.D. on a design slope of 1V : 2H. Finally, 3,753 feet of levee rehabilitation on the Wards Canal involved a 12-inch riprap layer on top of a 6-inch bedding stone layer up to the design crest elevation. The design crest elevation for all lakeshore dikes is at 13.6 feet above L.W.D., while the Wards Canal section is at 11 feet above L.W.D.

4. Protection Provided.

The project was designed to provide flood protection against high lake levels and wave action by reconstructing/repairing the shoreline revetment built under "Operation Foresight." The project protects 2,120 acres of agricultural land and residential development from flood damage caused by wind storms and high water stages on Lake Erie.

5. Construction History.

Construction was initiated by contract in September 1990, and was completed in October 1992. The prime Contractor was George Gradel Construction Co. of Toledo, Ohio. The constructed project is shown in Appendix D, sheets 1 through 28. The work was accomplished under the direction of the Buffalo District Corps of Engineers, under Construction Contract No. DACW 49-90-C-0023, dated 20 September 1990, at a total construction cost of \$4,052,693.87.

6. Local Cooperation.

The Local Cooperation Agreement (LCA) for the Flood Protection Project at Reno Beach-Howard Farms was executed between the Government and The Lake Erie Conservancy District Number 1 and the Howard Farms Conservancy District, Jerusalem Township, Lucas County, Ohio, on September 30, 1988. The agreement requires that the local sponsors accept, maintain, and operate the entire project, in accordance with regulations prescribed by the Secretary of the Army, and provides to the Government the right to inspect the project and to repair it at the sponsor's cost, in the event of the sponsor's failure to do so. A copy of the LCA is included in Appendix A.

The maintenance regulations which apply to this project are:

- a) Title 33, Code of Federal Regulations, Section 208.10(a) (See enclosure 2 in appendix A).
- b) Engineer Regulation No. 1130-2-303, Appendix I, Section 5, paragraph 5.11 (See enclosure 3 in Appendix A).

## II - PROCEDURES

7. General.

General rules for maintenance of civil works projects are stated in the Engineer Regulations (i.e., ER 1110-2-2902, see enclosure 4 in Appendix A). The purpose of a maintenance program is to preserve public benefits and return full value for the funds invested in the construction, and to minimize maintenance costs. The following paragraphs provide guidance for complying with the requirements.

## 8. Duties of the Superintendent.

The cooperating agencies, The Lake Erie Conservancy District Number 1 and the Howard Farms Conservancy District, shall appoint someone from their personnel as "Superintendent," to be responsible for carrying out the regulations for maintenance and operation of the completed flood protection project at Reno Beach-Howard Farms. The Superintendent shall be directly in charge of an organization responsible for the efficient operation, inspection and maintenance of the project works, all without cost to the Federal Government. The Superintendent will develop a storm emergency plan to cope with storm events greater than major lake storm. The plan shall cover measures that minimize the threat to life and damage to property and provide instruction for an orderly storm recovery effort.

It shall be the duty of the Superintendent to maintain organized records of activities and costs covering maintenance, operation, condition, inspection, repair and replacement of protective works. These records shall be available for the District Commander's or authorized representative's inspection and notation in the Superintendent's offices upon written request.

The District Commander, and authorized representatives, shall have access at all times to all portions of the project upon request or notification to inspect it.

The Superintendent shall assure that maintenance measures or repairs which the District Commander deems necessary are promptly taken or made. Failure to act within 30 calendar days after receipt of the District Commander's notice may result in the Federal Government completing the work and pursuing a remedy by law for cost reimbursement as provided in the local cooperation agreement contract.

In addition to specific duties outlined in other portions of this manual, the Superintendent shall have the responsibility for developing and sustaining an organization capable of efficiently maintaining structures and facilities, particularly during storm periods. The name, address, and telephone number of the Superintendent shall be furnished to the District Commander, U.S. Army Corps of Engineers, Buffalo, 1776 Niagara Street, Buffalo, New York, 14207-3199. The District Commander shall be notified of any change in this information, in writing, to the above address.

## 9. Improvements or Alterations to the Project.

No other improvement shall be constructed over, under, or through any protective feature, nor shall any excavation or construction be permitted within the limits of the project right-of-way, nor shall any change be made in the project without prior written approval of the District Commander, U.S. Army Corps of Engineers, Buffalo District, or an authorized representative. Advice regarding the effect of proposed improvements or alterations on the functioning of the project and information concerning methods of construction, acceptable under standard engineering practice, shall be obtained from the District Commander or, if otherwise obtained, shall be submitted for the District Commander's approval.



Drawings or prints of proposed improvements or alterations to the structure, shall be submitted in triplicate to the District Commander for approval. They shall be submitted prior to the proposed starting date of construction to permit sufficient and adequate study of the possible effects of the work. Drawings in duplicate or reproducible prints, which show the "As Constructed" improvements or alterations shall be furnished to the District Commander, after completion of the work.

10. Report to the Corps of Engineers.

A semi-annual report shall also be submitted to the District Commander. The semi-annual report periods shall be from 1 January through 30 June, and from 1 July through 31 December. Reports shall be submitted within 30 days after the end of each report period. The report shall cover inspection and maintenance of the project works and will include dated copies of inspection check sheets or report sheets prepared during the period covered by the report. In the event repairs have been made, either temporary or permanent, the nature, dates, and costs of such repairs shall be included. Prints of photographs showing the protective works in use during inspection or repair periods are desired whenever available.

11. Periodic Inspections.

It is suggested that periodic inspections be made by the Superintendent at the following times:

- a. Immediately following each major lake storm. A major lake storm is herein defined as having on-shore winds of 40 mph or greater wind speed for a 3-hour duration or having waves exceeding 5 to 6 feet;
- b. At least semi-annually; and,
- c. At such times as may be considered necessary by the Superintendent.

12. Joint Inspections.

A joint inspection of the project works shall be made annually by the District Commander, Buffalo District, Corps of Engineers, or his authorized representative, and the Superintendent. Arrangements for such inspections will be made by the District Commander, who will give advance notice to the Superintendent.

13. Check Sheets.

Appendix B shows a suggested form for check sheets, which can be used to facilitate routine and emergency inspections. This or similar forms should be used at each inspection to insure that no feature of the protective system has been overlooked. Any needed repairs should

be indicated thereon, with a check indicating satisfactory items. Factors such as the condition of the stone, evidence of structure settlement or deterioration, debris collection, etc., should be noted on the check sheet.

### III - PROJECT FEATURES

#### 14. General.

Details of the rebuilt lakeshore dikes as originally constructed, which now provide a permanent project, are shown on the "As-Constructed" drawings, sheets 1 through 28, in Appendix D.

#### 15. Stone Specifications.

Stone material for the revetment was specified as being sound, durable, and free from fractures, spalls, deleterious material and overburden spoil. The stone gradations used in the construction of the revetment are as described below:

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#### TYPE "A" & "C" ARMOR STONE

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Type	Size Range
A (Onsite)	2.0 - 6.0 Tons
C (Onsite)	0.25 - 2.0 Tons

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Specific Gravity varies for each stone source see paragraph 17 for more information.

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#### TYPE "B" ARMOR STONE

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##### WEIGHT RANGE

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Specific Gravity 2.13 - 2.35		Specific Gravity 2.36 - 2.60		Specific Gravity * 2.61 - 2.88	
<u>Minimum</u>	<u>Maximum</u>	<u>Minimum</u>	<u>Maximum</u>	<u>Minimum</u>	<u>Maximum</u>
2.2 Ton	4.8 Ton	1.4 Ton	3.1 Ton	1.0 Ton	2.2 Ton

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**TYPE "D" UNDERLAYER STONE**

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**WEIGHT RANGE**

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Specific Gravity 2.13 - 2.35		Specific Gravity 2.36 - 2.60		Specific Gravity * 2.61 - 2.88	
<u>Minimum</u>	<u>Maximum</u>	<u>Minimum</u>	<u>Maximum</u>	<u>Minimum</u>	<u>Maximum</u>
150 lbs	610 lbs	100 lbs	400 lbs	65 lbs	270 lbs

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\* Specific gravity and stone weight range actually used.

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**TYPE "F" RIPRAP STONE**

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WEIGHT OF STONES  
(LBS)

PERCENT LIGHTER BY WEIGHT  
(%)

84	100
34	65 - 100
18	35 - 55
7	0 - 23
1	0 - 5

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**TYPE "G" BEDDING STONE**

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SIEVE DESIGNATIONS  
(U. S. STANDARD SQUARE MESH)

PERCENT FINER BY WEIGHT  
(%)

4 inches	100
3 inches	70 - 100
¾ inch	40 - 65
No. 10	20 - 40
No. 40	5 - 20
No. 200	0 - 5

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Stone placement limits are indicated on sheets 18, 19 and 20 of Appendix D.

## 16. Geotextile Specification.

The geotextile fiber consists of a long chain synthetic polymer composed of at least 85 percent by weight of propylene, ethylene, ester, amide, or vinylidene-chloride and contains stabilizers and/or inhibitors added to the base plastic if necessary to make the filaments resistant to deterioration due to ultra-violet and heat exposure. The edges of the geotextile are finished to prevent the outer fiber from pulling away from the geotextile.

The specification for the geotextile is as shown on the table below:

Geotextile - Physical Requirements

Physical Property	Test Procedure	Acceptable Values++
Tensile Strength +(unaged geotextile)	ASTM D 1682 Grab Test Method using 1-inch square jaws and a 12-inches per minute constant rate of traverse.	200-Pound minimum in any principal direction.
Breaking Elongation (unaged geotextile)	ASTM D 1682 Determine Apparent Breaking Elongation.	20 percent minimum in any principal direction.
Puncture Strength +(unaged geotextile)	ASTM D 3787 except polished steel ball replaced with a 5/16-inch diameter solid steel cylinder with a hemispherical tip centered within the ring clamp.	120 pound minimum.
Abrasion Resistance	ASTM D 3884 Rubber-base abrasive wheels equal to CS-17 "Calibrase" by Taber Instrument Co.; 1 kilogram load per wheel; 1000 breaking load.	55 pound minimum Residual Breaking Load in any principal direction
Equivalent (Apparent) Opening Size (EGOS)	TF 25#6/CW-02215, U.S. Sieve Number Equip. ASTM .03.81.08 (Proposed)	No finer than the U.S. Standard Sieve No. 100 and no coarser than the U.S. Standard Sieve No. 30.
Tear Strength	ASTM D 4533 Trapezoidal tear strength.	65 pounds minimum in any principal directive.

+ Unaged geotextile is defined as geotextile in the condition received from the manufacturer or distributor.

++ All numerical values represents minimum average roll values (i.e., any roll in a lot should meet or exceed the minimum in the table).

17. Sources of Material.

The types, sizes, and specific gravities of stone, and geotextile used during the initial construction will generally be required for any repair work. The original sources for these materials are given herein for possible future reference. This information should not be construed as an assurance that the identified sources will be available in the future. It is solely the responsibility of The Lake Erie Conservancy District Number 1 and the Howard Farms Conservancy District to identify suitable sources of any required replacement materials so as to insure the protective qualities of the project.

<u>Material</u>	<u>Source</u>
"A" and "C" Armor Stone	The three sources are: (1) Edward Kraemer & Sons White Rock Quarry 3800 North Bolander Clay Center, OH 43408 Phone (419) 855-8388 Fax (419) 855-7102 Specific Gravity is 2.63 (2) StoneCo Incorporated P.O. Box 29A Lime City, OH 43537 Phone (419) 893-8731 Specific Gravity is 2.60 (3) Martin-Marietta Chemical Co. Refractories Division P.O. Box 187 755 Lime Road Woodville, OH 43469 Phone (419)849-3011 Specific Gravity is 2.67
"B" Stone Armor Stone	Edward Kraemer & Sons White Rock Quarry 3800 North Bolander Clay Center, OH 43406 Phone (419) 855-8388 Fax (419) 855-7102

<u>Material</u>	<u>Source</u>
"D" Stone Armor Stone	Edward Kraemer & Sons White Rock Quarry 3800 North Bolander Clay Center, OH 43406 Phone (419) 855-8388 Fax (419) 855-7102
"F" Stone Riprap Stone	"
"G" Stone Bedding Stone	"
Geotextile Mirafi 600X	United States Mirafi Inc. P.O. Box 240967 Charlotte, NC 28224 Phone (800) 234-0484

#### IV - MAINTENANCE

##### 18. General.

The Lake Erie Conservancy District Number 1 and Howard Farms Conservancy District are responsible, as the local cooperators, to ensure that the structures and facilities constructed by the United States for the Flood Protection project at Reno Beach-Howard Farms shall be continuously maintained in such a manner, and operated as may be necessary, to obtain the maximum benefits. The Superintendent is to make periodic inspections and take immediate steps to remedy any adverse conditions disclosed by such inspection. The Superintendent is to provide for any periodic repairs and adjustments that may be required to restore the dike to a form commensurate with its intent, and all structural works to their original condition. Any maintenance activities, which are not emergency repairs, should be undertaken from 1 April to 30 June, to avoid possible impacts to warm water fish species' spawning activities. Emergency repairs will be required when there is immediate danger of failure of the shore protection project due to damage to the dike. Providing new stone and geotextile equal to or better than the materials used in the original construction may be necessary.

## 19. Structural Features.

a. Inspection. The dike, which comprises the structural feature of the Reno Beach-Howard Farms project shall receive close visual inspection at least semi-annually. The semi-annual inspection shall note damage caused by ice or storms, and indications of failures due to normal deterioration. Where settlement or misalignment of the dike is observed, a detailed inspection shall be conducted to determine the cause. Detailed inspection may be performed by cross-sectional surveys of the structure. Back side of dike needs to be inspected for piping failure. When a flow path of water underneath a dike wall is established it is called piping. Evidence of piping is pooling of water along with the accumulation of fine soil material on the protected side. This may be the only indication of piping. There may not be any other indication of material loss or lowering of crest elevation of the dike. If evidence of piping exists it should continue to be monitored, especially during high lake levels.

b. Repair. When damage occurs to any structural feature such that its stability is endangered or that it no longer fulfills its intended purpose (i.e. the dike provides inadequate protection against high lake levels and wave action), it shall be rebuilt or repaired to the "as-constructed" condition (Appendix D). The structure may require the placement of additional armor stone as periodic maintenance.

## V - OPERATION

### 20. General.

There are no structures that require operation. However, the Superintendent should observe wave action during storms to note critical locations along the dike which may be susceptible to damage. All damaged areas shall be repaired immediately to prevent further damage.

## VI - HIGH WATER LEVEL PERIODS

### 21. General.

Due to the design and location of the project, high lake levels, and lake storms that accompany the high water levels, may impact on the structural protection. The Superintendent shall maintain the structure as required so that its protective qualities are insured.

## 22. Natural Disaster Procedure.

The Buffalo District has prepared standard operating procedures in which the policy and procedure relative to activities, before, during, and after any natural disaster, are outlined. The manual NCB Plan 500-1-1 includes information and organization for handling emergencies. Copies of this manual may be obtained from the Buffalo District, Corps of Engineers, 1776 Niagara Street, Buffalo, NY 14207-3199. Upon request, Buffalo District can provide technical advice.



**Flood Protection  
Reno Beach-Howard Farms, Ohio**

**Appendix A  
Agreement for Local Cooperation and Regulations**

**U. S. Army Engineer District, Buffalo  
1776 Niagara Street  
Buffalo, NY 14207-3199**

LOCAL COOPERATION AGREEMENT

BETWEEN

THE DEPARTMENT OF THE ARMY

AND

THE LAKE ERIE CONSERVANCY DISTRICT NUMBER 1

AND

THE HOWARD FARMS CONSERVANCY DISTRICT  
FOR CONSTRUCTION OF THE  
FLOOD PROTECTION PROJECT  
AT

RENO BEACH - HOWARD FARMS, OHIO

THIS AGREEMENT, entered into this 30th day of September 1988, by and between the Department of the Army (hereinafter referred to as the "Government"), acting by and through the Assistant Secretary of the Army (Civil Works) and the Lake Erie Conservancy District Number 1 (hereinafter referred to as "Lake Erie") and the Howard Farms Conservancy District (hereinafter referred to as "Howard Farms"),

WITNESSETH, THAT,

WHEREAS, the flood protection project at Reno Beach-Howard Farms, Ohio, (hereinafter referred to as the "Project") was authorized under Section 203 of the Flood Control Act of 1948, approved 30 June 1948 (Public Law 858, 80th Congress, 2nd Session), in accordance with House Document Numbered 554, (80th Congress, 2nd Session); and

WHEREAS, the Water Resources Development Act of 1986, Public Law 99-662, specifies the cost sharing requirements applicable to the project; and

Whereas, the General Design Memorandum for the project entitled "Reno Beach-Howard Farms, Ohio, Flood Protection Project", was approved 1 July 1986, and

WHEREAS, the project provides for protection of the Reno Beach-Howard Farms area and adjacent areas from floods caused by frequent windstorms and increases in the level of Lake Erie, by repair or reconstruction of the existing temporary dike, as necessary, to convert it to a permanent project; and

WHEREAS, Lake Erie and Howard Farms have the authority and capability to furnish the cooperation hereinafter set forth and are willing to participate in project cost-sharing and financing in accordance with the terms of this Agreement; and

WHEREAS, Lake Erie and Howard Farms agree to be held jointly and severally responsible for compliance with the terms of this Agreement;

NOW, THEREFORE, the parties agree as follows:

#### ARTICLE I - DEFINITIONS

For purposes of this Agreement:

a. The term "project" shall mean repair of 5,300 feet and reconstruction of 7,900 feet of the existing Reno Beach-Howard Farms, OH temporary dike, as necessary, to convert it to a permanent project which includes: dike reconstruction, installation of steel sheet pile, slope protection, toe protection, and reconstructive work on the Wards Canal levee as more fully set forth in the aforementioned General Design Memorandum.

b. The term "total project costs" shall mean all costs incurred by Lake Erie, Howard Farms, and the Government directly related to construction of the project.

Such costs shall include, but not necessarily be limited to, actual construction costs, costs of applicable engineering and design, continuing planning and engineering costs incurred after October 1, 1985, supervision and administration costs, costs of project construction contract dispute settlements or awards, and the value of lands, easements, rights-of-way, relocations, and disposal areas provided for the project by Lake Erie and Howard Farms, but shall not include any costs for betterments or operation and maintenance.

c. The term "period of construction" shall mean the time from the advertisement of the first construction contract to the time of acceptance of the project by the Contracting Officer.

d. The term "Contracting Officer" shall mean the Commander of the U.S. Army Engineer District, Buffalo, or his duly appointed representative.

e. The term "highway" shall mean any highway, thoroughfare, roadway, street, or other public or private road or way.

#### ARTICLE II - OBLIGATIONS OF PARTIES

a. The Government, subject to and using funds provided by Lake Erie and Howard Farms, and appropriated by the Congress, shall expeditiously construct the project, applying those procedures usually followed or applied in Federal projects, pursuant to Federal laws, regulations, and policies. Lake Erie and Howard Farms shall be afforded the opportunity to review and comment on all contracts, including relevant plans and specifications, prior to the issuance of invitations for bids. Lake Erie and Howard Farms also shall be afforded the opportunity to review and comment on all modifications and change orders prior to the issuance to the contractor of a Notice to Proceed. The Government will consider the views of Lake Erie and Howard Farms, but award of the contracts and performance of the work thereunder shall be exclusively within the control of the Government.

b. When the Government determines that the project, or functional element thereof, is complete, the Government shall turn the completed project or element over to Lake Erie and Howard Farms, which shall accept the project or element and be solely responsible for operating, maintaining, replacing, and rehabilitating the project in accordance with Article IX hereof.

c. As further specified in Article VII hereof, Lake Erie and Howard Farms shall provide, during the period of construction, a cash contribution of 5 percent of total project costs.

d. As further specified in Article III hereof, Lake Erie and Howard Farms shall provide all lands, easements, rights-of-way, and disposal areas, and perform all relocations and alterations of buildings, utilities, (other than those portions which pass under or through the project structure and which, if ruptured, would cause adverse effects to the project structures or provide a channel for flooding the projected area), highways, railroads, bridges (other than railroad bridges and approaches thereto), sewers and related and special facilities determined by the Government to be necessary for construction of the project.

e. If the value of the contributions provided under paragraphs c. and d. of this Article represents less than 25 percent of total project costs, Lake Erie and Howard Farms shall provide during the period of construction an additional cash contribution in the amount necessary to make their total contribution equal to 25 percent of total project costs.

f. No less than once each year, Lake Erie and Howard Farms shall inform affected interests of the limitations of the protection afforded by the project.

g. Lake Erie and Howard Farms shall publicize flood plain information in the areas concerned and shall provide this information to zoning and other regulatory agencies for their guidance and leadership in preventing unwise future development in the flood plain and in adopting such local regulations as may be necessary to prevent future development and to ensure compatibility with protection levels provided by the project.

### ARTICLE III - LANDS, FACILITIES, AND RELOCATION ASSISTANCE

a. Prior to the advertisement of any construction contract, Lake Erie and Howard Farms shall furnish to the Government all lands, easements, and rights-of-way, including suitable disposal and material storage areas, as may be determined by the Government to be necessary for construction of the project, and shall furnish to the Government evidence supporting their legal authority to grant rights-of-entry to such lands.

b. Upon notification from the Government, Lake Erie and Howard Farms shall accomplish or arrange for accomplishment at no cost to the Government of all alterations and relocations of buildings, highways, bridges (other than railroad bridges and approaches thereto), storm drains, utilities (other than those which pass under or through the project structures), cemeteries, and other facilities, structures, and improvements determined by the Government to be necessary for construction of the project.

c. Lake Erie and Howard Farms shall comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisitions Policies Act of 1970, Public Law 91-646, approved January 2, 1971 in acquiring lands, easements, and rights-of-way for construction and subsequent operation and maintenance of the project and inform affected persons of pertinent benefits, policies, and procedures in connection with said Act.

### ARTICLE IV - VALUE OF LANDS AND FACILITIES

a. The value of the lands, easements, and rights-of-way to be included in total project costs and credited toward Lake Erie's and Howard Farms' share of total project costs will be determined in accordance with the following procedures:

(1) If the lands, easements, and rights-of-way are owned by Lake Erie or Howard Farms on the date this Agreement is signed, the credit shall be the fair market value of the interest at the time such interest is made available to the Government for construction of the project. The fair market value shall be determined by an appraisal to be obtained by Lake Erie or Howard Farms which has been prepared by an independent and qualified appraiser who is acceptable to both Lake Erie or Howard Farms and the Government. The appraisal shall be reviewed and approved by the Government.

(2) If the lands, easements, and rights-of-way are to be acquired by Lake Erie or Howard Farms after the date this Agreement is signed, the credit shall be the fair market value of the interest at the time such interest is made available to the Government for construction of the project. The fair market value shall be determined as specified in subparagraph (1) above. If Lake Erie or Howard Farms pays an amount in excess of the appraised fair market value, they may be entitled to a credit for the excess amount if Lake Erie or Howard Farms has secured prior written approval from the Government of its offer to purchase such interest.

(3) If Lake Erie or Howard Farms acquires more lands, easements, and rights-of-way than are necessary for project purposes, as determined by the Government, then only the value of such portions of those acquisitions as are necessary for project purposes shall be included in total project costs and credited to Lake Erie's and Howard Farms' share.

(4) Credit for lands, easements, and rights-of-way in the case of involuntary acquisitions which occur within a one-year period preceding the date this Agreement is signed, or which occur after the date this Agreement is signed will be based on court awards, or on stipulated settlements that have received prior Government approval.

(5) For lands, easements, or rights-of-way acquired by Lake Erie or Howard Farms within a five-year period preceding the date this Agreement is signed, or any time after this Agreement is signed, credits provided under this paragraph will also include the actual incidental costs of acquiring the interest, e.g. closing and title costs, appraisal costs, survey costs, attorney's fees, plat maps, and mapping costs, as well as the actual amounts expended for any relocation assistance provided in accordance with the obligations under this Agreement.

b. The costs of relocations, or modification of utilities or facilities that will be included in total project costs and credited towards Lake Erie's and Howard Farms' share of total project costs, shall be that portion of the actual costs incurred by Lake Erie or Howard Farms as set forth below:

(1) Highways and Highway Bridges: Only that portion of the cost as would be necessary to construct substitute bridges and highways to the design standard that the State of Ohio would use in constructing a new bridge or highway under similar conditions of geography and traffic loads.

(2) Utilities and Facilities (including Railroads): Actual relocation costs, less depreciation, less salvage value, plus the cost of removal, less the cost of betterments. With respect to betterments, new material shall not be used in any relocation or alteration if materials of value and usability equal to those in the existing facility are available or can be obtained as salvage from the existing facility or otherwise, unless the provision of new material is more economical. If, despite the availability of used material, new material is used, where the use of such new material represents an additional cost, such cost will not be included in total project costs.



## ARTICLE V - CONSTRUCTION PHASING AND MANAGEMENT

a. To provide for consistent and effective communication between Lake Erie, Howard Farms, and the Government during the term of construction, Lake Erie, Howard Farms, and the Government shall appoint representatives to coordinate on scheduling, plans, specifications, modifications, contract costs, and other matters relating to the project.

b. The representatives appointed above shall meet as necessary during the term of project construction and shall make such recommendations as they deem warranted to the Contracting Officer.

c. The Contracting Officer shall consider the recommendations of said representatives in all matters relating to the project, but the Contracting Officer, having ultimate responsibility for construction of the project, has complete discretion to accept, reject, or modify the recommendations.

## ARTICLE VI - ABILITY TO PAY

Since the Benefit to Cost Ratio for this project is greater than 2, the project does not qualify for a revision to the non-Federal cost share for flood control based on estimated flood control benefits and costs and on application of guidelines published as Flood Control Cost Sharing Requirements Under the Ability to Pay Provision; Interim Final Rule (Vol. 52 Federal Register pages 35872-35892, 1987 to be codified at (33 C.F.R., Sections 241.1-.6)), implementing Section 103 (m) of the Water Resources Development Act of 1986.

## ARTICLE VII - METHOD OF PAYMENT

a. Lake Erie and Howard Farms shall provide during the period of construction, the amounts required under Article IIc. and IIe. of this Agreement.

The total project costs are presently estimated to be \$7,410,000. In order to meet its share, Lake Erie and Howard Farms must provide a cash contribution presently estimated to be \$510,000.

b. Lake Erie and Howard Farms shall provide their required cash contribution in proportion to the rate of Federal expenditures during the construction period in accordance with the following provisions:

(1) For purposes of budget planning, the Government shall notify Lake Erie and Howard Farms by 1 August of each year of the estimated funds that will be required from Lake Erie and Howard Farms to meet their share of project costs for the corresponding Government fiscal year.

(2) 60 days prior to the award of the first construction contract, the Government shall notify Lake Erie and Howard Farms of their share of project costs, including costs attributable to the project incurred prior to the initiation of construction, for the first fiscal year of construction. Lake Erie and Howard Farms shall provide the requisite amount to the Government by a combination of cash payment and an escrow account. Within 30 days thereafter, Lake Erie and Howard Farms shall provide a portion of the requisite amount to the Government in cash by delivering a check payable to "FAO, USAED, Buffalo" to the Contracting Officer, and verify to the satisfaction of the Government that they have deposited the balance of the requisite amount in an escrow account acceptable to the Government, with interest accruing to Lake Erie and Howard Farms.

(3) For the second and subsequent fiscal years of project construction, the Government shall, 60 days prior to the beginning of the fiscal year, notify Lake Erie and Howard Farms of their share of project costs for that fiscal year.

No later than 30 days prior to the beginning of the fiscal year, Lake Erie and Howard Farms shall make the necessary funds available to the Government in the same manner as specified above. As construction of the project proceeds, the Government may adjust the amounts required to be provided under this paragraph to reflect actual project costs.

(4) If at any time during the period of construction the Government determines that additional funds will be needed from Lake Erie and Howard Farms to meet their required share of project costs, the Government shall so notify Lake Erie and Howard Farms, and Lake Erie and Howard Farms, within 30 days from receipt of notice, shall make the necessary funds available in the same manner as specified above.

c. The Government will draw on the funds and the escrow account provided by Lake Erie and Howard Farms such sums as it deems necessary to cover contractual and in-house fiscal obligations as they are incurred, as well as project costs incurred by the Government prior to the initiation of construction.

d. Upon completion of the project and resolution of all relevant contract claims and appeals, the Government shall compute the total project costs and tender to Lake Erie and Howard Farms a final accounting of their share of total project costs. In the event the total contribution by Lake Erie and Howard Farms is less than their minimum required share of project costs at the time of final accounting, Lake Erie and Howard Farms shall within 90 calendar days after receipt of written notice, make a cash payment to the Government of whatever sum is required to meet their minimum share of project costs. In the event Lake Erie and Howard Farms have made cash contributions in excess of 5 percent of total project costs, which result in Lake Erie and Howard Farms having provided more than their required share of

project costs, the Government shall within 90 calendar days of the final accounting, subject to the availability of appropriations, return said excess to Lake Erie and Howard Farms; however, Lake Erie and Howard Farms shall not be entitled to any refund of the 5 percent cash contribution required pursuant to Article IIc. hereof.

#### ARTICLE VIII - DISPUTES

Before any party to this Agreement may bring suit in any court concerning an issue relating to this Agreement, such party must first seek in good faith to resolve the issue through negotiation or through other forms of nonbinding alternative dispute resolution mutually acceptable to the parties.

#### ARTICLE IX- OPERATION, MAINTENANCE, AND REHABILITATION

a. After it is turned over by the Government, Lake Erie and Howard Farms shall operate, maintain, replace, and rehabilitate the project, or functional element thereof, in accordance with regulations and/or directions prescribed by the Government, including the project operation and maintenance manual.

b. Lake Erie and Howard Farms hereby give the Government a right to enter, at reasonable times and in a reasonable manner, upon land which they own or control for access to the project for the purpose of inspection and, if necessary, for the purpose of completing, operating, repairing, maintaining, replacing, or rehabilitating the project. If an inspection shows that Lake Erie and Howard Farms, for any reason, are failing to fulfill their obligations under this Agreement without receiving prior written approval from the Government, the Government will send a written notice to Lake Erie and Howard Farms. If Lake Erie and Howard Farms persist in such failure for 30 calendar days after receipt of the notice, then the Government shall have

a right to enter, at reasonable times and in a reasonable manner, upon lands Lake Erie or Howard Farms owns or controls for access to the project for the purpose of completing, operating, repairing, maintaining, replacing or rehabilitating the project. No completion, operation, repair, maintenance, replacement or rehabilitation by the Government shall operate to relieve Lake Erie and Howard Farms of responsibility to meet their obligations as set forth in this Agreement, or to preclude the Government from pursuing any other remedy at law or equity to assure faithful performance pursuant to this Agreement.

#### ARTICLE X - RELEASE OF CLAIMS

Lake Erie and Howard Farms shall hold and save the Government free from all damages arising from the construction, operation, and maintenance of the project, except for damages due to the fault or negligence of the Government or its contractors.

#### ARTICLE XI- MAINTENANCE OF RECORDS

The Government, and Lake Erie, and Howard Farms shall keep books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to this Agreement to the extent and in such detail as will properly reflect total project costs. The Government, and Lake Erie, and Howard Farms shall maintain such books, records, documents, and other evidence for a minimum of three years after completion of construction of the project and resolution of all claims arising therefrom, and shall make available at their offices at reasonable times, such books, records, documents, and other evidence for inspection and audit by authorized representatives of the parties to this Agreement.

## ARTICLE XII - FEDERAL AND STATE LAWS

In acting under its rights and obligations hereunder, Lake Erie and Howard Farms agree to comply with all applicable Federal and State Laws and regulations including Section 601 of Title VI of the Civil Rights Act of 1964 (Public Law 88-352) and Department of Defense Directive 5500.II issued pursuant thereto and published in part 300 of Title 32, Code of Federal Regulations, as well as Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army."

## ARTICLE XIII - RELATIONSHIP OF PARTIES

The parties to this Agreement act in an independent capacity in the performance of their respective functions under this Agreement, and neither party is to be considered the officer, agent, or employee of the other.

## ARTICLE XIV - OFFICIALS NOT TO BENEFIT

No member of or delegate to the Congress, or resident commissioner, shall be admitted to any share or part of this Agreement or to any benefit that may arise therefrom.

## ARTICLE XV - COVENANT AGAINST CONTINGENT FEES

Lake Erie and Howard Farms warrant that no person or selling agency has been employed or retained to solicit or secure this Agreement upon agreement or understanding for a commission, percentage, brokerage, or contingent fee, excepting bona fide employees or bona fide established commercial or selling agencies maintained by Lake Erie or Howard Farms for the purpose of securing business. For breach or violation of this warranty, the Government shall have the right to annul this Agreement without liability, or in its

discretion, to add to the Agreement or consideration, or otherwise recover, the full amount of such commission, percentage, brokerage, or contingent fee.

#### ARTICLE XVI - TERMINATION OR SUSPENSION

a. If at any time Lake Erie and Howard Farms fail to make the payments required under this Agreement, the Secretary of the Army shall terminate or suspend work on the project until Lake Erie and Howard Farms are no longer in arrears, unless the Secretary determines that continuation of work on the project is in the interest of the United States. Any delinquent payment shall be charged interest at a rate, to be determined by the Secretary of the Treasury, equal to 150 percentum of the average bond equivalent rate of the 13-week Treasury Bills auctioned immediately prior to the date on which such payment became delinquent, or auctioned immediately prior to the beginning of each additional 3 month period if the period of delinquency exceeds 3 months.

b. If the Government fails to receive annual appropriations in amounts sufficient to meet project expenditures for the then current or upcoming fiscal year, the Government shall so notify Lake Erie and Howard Farms. After 60 days either the Government or Lake Erie and Howard Farms may elect without penalty to terminate this Agreement or to suspend performance thereunder, and the parties shall conclude their activities relating to the project and proceed to a final accounting in accordance with Article VIId.

#### ARTICLE XVII - NOTICES

a. All notices, request, demands, and other communications required or permitted to be given under this Agreement shall be deemed to have been duly given if in writing and delivered personally, given by prepaid telegram, or mailed by first-class (Postage-prepaid), registered, or certified mail, as follows:

If to Lake Erie and Howard Farms:

Lake Erie Conservancy District No.1 or Howard Farms  
Conservancy District

145 Lagoon Drive  
Curtice, OH 43412

145 Lagoon Drive  
Curtice, OH 43412

If to the Government:

U.S. Army Engineer District, Buffalo  
1776 Niagara Street  
Buffalo, NY 14207

b. A party may change the address to which such communications are to be directed by giving written notice to the other in the manner provided in this section.

c. Any notice, request, demand, or other communication made pursuant to this Article shall be deemed to have been received by the addressee at such time as it is personally delivered or on the third business day after it is mailed, as the case may be.


#### ARTICLE XVIII - CONFIDENTIALITY

To the extent permitted by the law governing each party, the parties agree to maintain the confidentiality of exchanged information when requested to do so by the providing party.



IN WITNESS WHEREOF, the parties hereto have executed this Agreement  
as of the day and year first above written.

THE DEPARTMENT OF THE ARMY

By: 

Robert W. Page  
Assistant Secretary  
of the Army(Civil Works)

Date: 9-20-52


THE LAKE ERIE CONSERVANCY DISTRICT  
NUMBER 1

By: 

Roger Van Hoose  
President

Date: July 21, 1952

THE HOWARD FARMS CONSERVANCY DISTRICT

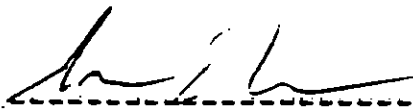
By: 

Daniel L. Warner  
President

CERTIFICATE OF AUTHORITY

I, MARK E. LUPE, do hereby certify that I am an Attorney for the Howard Farms Conservancy District, that the District is a legally constituted public body with full authority and legal capability to perform the terms of the Agreement between the Department of the Army and the Howard Farms Conservancy District in connection with the Flood Protection Project at Reno Beach - Howard Farms, Ohio, and to pay damages if necessary in the event of failure to perform in accordance with Section 221 of Public Law 91-611, and that the person who has executed the Agreement on behalf of the District has acted within his statutory authority.

IN WITNESS WHEREOF, I have made and executed this certificate this 21 day of September, 1988.



-----  
Counsel for the Howard Farms  
Conservancy District

CODE OF FEDERAL REGULATIONS

TITLE 33 - NAVIGATION AND NAVIGABLE WATERS  
Chapter II - Corps of Engineers, Department of the Army  
Part 208 - Flood Control Regulations

**§ 208.10 Local flood protection works; maintenance and operation of structures and facilities.**

(a) **General.** (1) The structures and facilities constructed by the United States for local flood protection shall be continuously maintained in such a manner and operated at such times and for such periods as may be necessary to obtain the maximum benefits.

(2) The State, political subdivision thereof, or other responsible local agency, which furnished assurance that it will maintain and operate flood control works in accordance with regulations prescribed by the Secretary of the Army, as required by law, shall appoint a permanent committee consisting of or headed by an official hereinafter called the "Superintendent," who shall be responsible for the development and maintenance of, and directly in charge of, an organization responsible for the efficient operation and maintenance of all of the structures and facilities during flood periods; and for continuous inspection and maintenance of the project works during periods of low water, all without cost to the United States.

(3) A reserve supply of materials needed during a flood emergency shall be kept on hand at all times.

(4) No encroachment or trespass which will adversely affect the efficient operation or maintenance of the project works shall be permitted upon the rights-of-way for the protective facilities.

(5) No improvement shall be passed over, under, or through the walls, levees, improved channels or floodways, nor shall any excavation or construction be permitted within the limits of the project right-of-way, nor shall any change be made in any feature of the works without prior determination by the District Engineer of the Department of the Army or his authorized representative that such improvement, excavation, construction, or alteration will not adversely affect the functioning of the protective facilities. Such improvements or alterations as may be found to be desirable and permissible under the above determination shall be constructed in accordance with standard engineering practice. Advice regarding the effect of proposed improvements or alterations on the functioning of the project and information concerning methods of construction acceptable under standard engineering practice shall be obtained from the District Engineer or, if otherwise obtained, shall be submitted for his approval. Drawings or prints showing such improvements or alterations as finally constructed shall be furnished the District Engineer after completion of the work.

(6) It shall be the duty of the superintendent to submit a semiannual report to the District Engineer covering inspection, maintenance, and operation of the protective works.

(7) The District Engineer or his authorized representatives shall have access at all times to all portions of the protective works.

(8) Maintenance measures or repairs which the District Engineer deems necessary shall be promptly taken or made.

(9) Appropriate measures shall be taken by local authorities to insure that the activities of all local organizations operating public or private facilities connected with the protective works are coordinated with those of the Superintendent's organization during flood periods.

(10) The Department of the Army will furnish local interests with an Operation and Maintenance Manual for each completed project, or separate useful part thereof, to assist them in carrying out their obligations under this part.

Engineer Regulation No. 1130-2-303, Appendix I, Section 1,  
Paragraph 1.11

1.11 Project Components. For convenient reference the following pages contain a comprehensive listing of project components for which guide frequencies for inspection are suggested. The number before the decimal under the Column headed Procedure Reference Number corresponds with the Section number listed in the table of contents. The maintenance priorities A and B are defined in paragraph 4 of this manual and restated below:

Priority A: Those items of equipment or project facilities where a failure would be critical with respect to the functioning of the project to accomplish its assigned mission; would endanger the health and safety of the public or project employees; or would result in substantial losses.

Priority B: Those items of equipment or project facilities where a failure may cause considerable inconvenience but would not affect functioning of the project in performing its assigned mission; would not seriously affect the health and safety of the public or project employees; or would cause moderate or insignificant losses.

Engineer Regulation No. 1130-2-303, Appendix I, Section 5,  
Paragraph 5.11

5.11 Bank Protection General

Priority A (Annually), Priority B (Annually): Inspect upper bank protection visually for breaks, cracked or broken paving, disarranged stone, exposed banks, erosion or other damage. During the low-water season, determine the condition of the lower bank protection. Make soundings over the underwater area of the bank.

Priority A (Not Scheduled), Priority B (Not Scheduled): Any employee who has occasion to be at or near bank protection works should inspect for damage to the upper bank and for any indications of failures in the underwater area.

Repair and otherwise remedy failures, breaks, disarranged stone, exposed banks or other damage as required.

CEEC-EH-D

Engineer Regulation  
No. 1110-2-2902

30 June 1989

Engineering and Design  
PRESCRIBED PROCEDURES FOR THE MAINTENANCE AND  
OPERATION OF SHORE PROTECTION WORKS

1. Purpose. This regulation provides specific performance requirements and guidance for accomplishing the satisfactory maintenance and operation of shore protection works, including coastal structures, beach fill projects, and protective dunes.
2. Applicability. This regulation is applicable to all HQUSACE and field operating activities (FOA) responsible for the planning, design, construction, operation, and maintenance of Civil Works projects on the tidal and Great Lakes shores of the United States, the tidal shores of the Federated States of Micronesia and the Marshall Islands, the Commonwealths of Puerto Rico and Northern Marianas Islands, and the Territories of the United States (U.S. Virgin Islands, Guam, American Samoa). This regulation is applicable for the above purpose to local cooperation agreements (LCA) signed more than 60 days after publication of this regulation in the Federal Register.
3. References.
  - a. Public Law 79-727, 13 August 1946, as amended
  - b. Public Law 84-826, 28 July 1956
  - c. Public Law 87-874, 23 October 1962
  - d. Public Law 89-298, 27 October 1965
  - e. Public Law 91-611, 31 December 1970
  - f. Public Law 99-662, 17 November 1986
4. Background. The Federal role in beach erosion control has been defined primarily by Public Law 727, 79th Congress as subsequently amended. The Act provides for Federal assistance in the construction but not the maintenance of work for restoration and protection against wave induced erosion of non-Federal public shores. The law specifies that when the most suitable and economic remedial measure would be provided by periodic beach nourishment, the term "construction" is construed to include the deposit of sand fill at suitable intervals of time. Thus, the Corps, while not responsible for the maintenance of shore protection projects, is involved in the periodic reconstruction or nourishment of many such projects. The Federal participation is conditioned

on non-Federal interest assuring operation, maintenance, replacement, and repair of improvements during the economic life of the project as required to serve the intended purposes. The sponsor of such a project is required to enter into a legally binding agreement with the Secretary of the Army to provide required items of local cooperation and cost sharing (PL 91-611 and PL 99-662).

5. Objective. This regulation prescribes operations, maintenance, inspection, and record keeping procedures required to obtain the intended purposes of shore protection projects.

6. Scope. The Department of the Army will furnish local interest with an operation and maintenance manual for each completed project, or separate useful part thereof, to assist them in carrying out their obligations under these regulations. The efforts prescribed in the following paragraphs should be incorporated into the local operations and maintenance manual and into the planning, design, construction, operation and maintenance, and inspection of all shore protection projects, as applicable.

7. Authority. Section 912(b)(1) of the Water Resources Development Act of 1986 (PL 99-662) amended Section 221 of PL 91-611 to include the following :

"The Secretary may require compliance with any requirements pertaining to cooperation by non-Federal interests in carrying out any water resources project authorized before, on, or after the date of enactment of this Act."

8. Shore protection works; maintenance and operation of structures and facilities.

a. General.

(1) The structures and facilities constructed by or with the financial assistance of the United States for local shore protection and required locally furnished appurtenant facilities shall be maintained and operated in such a manner and for such periods as necessary to obtain the anticipated project benefits.

(2) The agency, which furnished assurances that it will maintain and operate shore protection works in accordance with Federal law, shall appoint a permanent official, hereinafter called the "Superintendent", who shall be directly in charge of an organization responsible for the efficient operation of all of the structures and facilities, and for inspection and maintenance of the project works, all without cost to the United States. The Superintendent may be established from within the existing governmental organization.

(3) The Superintendent will develop a storm emergency plan to cope with storm events greater than the project design storm. The plan should cover measures that minimize the threat to life and damage to property and provide

instructions for an orderly storm recovery effort. Depending on circumstances, it may be desirable to acquire and store certain types of goods, materials, and equipment for evacuation, flood fighting, emergency food, water and sanitary needs, and security.

(4) No other improvement shall be constructed over, under, or through the beach fill or other protective feature, nor shall any excavation or construction be permitted within the limits of the project right-of-way, nor shall any change be made in the project without prior written approval of the District Commander, U.S. Army Corps of Engineers or an authorized representative. Advice regarding the effect of proposed improvements or alterations on the functioning of the project and information concerning methods of construction, acceptable under standard engineering practice, shall be obtained from the District Commander or, if otherwise obtained, shall be submitted for the District Commander's approval. Standard engineering drawings showing such improvements or alterations as finally constructed shall be furnished the District Commander not more than 90 days after completion of the work.

(5) It shall be the duty of the Superintendent to maintain organized records of activities and costs covering maintenance, operation, condition, inspection, repair and replacement of protective works available for the District Commander's or authorized representative's inspection and notation in the Superintendent's offices upon written request.

(6) The District Commander, and authorized representatives, shall have access at all times to all portions of the project.

(7) The Superintendent shall assure that maintenance measures or repairs which the District Commander deems necessary are promptly taken or made. Failure to act within 30 calendar days after receipt of the District Commander's notice may result in the Government completing the work and pursuing a remedy by law as provided in the local agreement contract.

b. Beach berm and foreshore.

(1) Operation. A beach fill project anticipates erosion of the sand directly in front of, or beneath, the beach front development. The rate and extent of erosion depends on the water elevations, storm wave climate, storm durations, and characteristics of the shore material. The level of storm protection obtained will depend on the fill volume in the beach berm and its elevation. During the recreation season, appropriate beach conditions shall be provided to promote and encourage healthful public recreation. The Superintendent should be certain that:

(a) At least one complete survey of profiles (identified in the operations and maintenance manual) is made each year prior to the storm season.

(b) The dry beach width above normal high tide is measured periodically to determine seasonal changes and storm induced sand deficiencies. This is accomplished by direct measurement at predetermined stations along the length of the project and repeated as prescribed in the operation and maintenance manual.

(c) Conditions such as a beach scarp, steepening of the beach face, or the presence of runnels or beach cusps are noted and recorded at each profile during the above surveys.

(d) If the beach berm fails to naturally build back to the minimum cross section within 14 days after the passage of a storm, beach nourishment action is initiated.

(e) No drains discharge onto the beach berm (the intent is to prevent erosion of the beach berm). Health and safety restrictions determine if storm and/or sanitary drains are permitted to discharge into recreational waters.

(f) Sand stockpiles and other resources and equipment required for flood fighting, storm warnings, and evacuations are adequate and maintained in serviceable condition.

(g) Vehicle parking is restricted to parking areas which do not interfere with the function or recreational use of the project.

(2) Maintenance. The Superintendent shall provide such maintenance (excluding periodic nourishment when defined as construction) as is required to insure serviceability of the beach berm and foreshore for erosion control during storms and for recreation during non-storm periods. Measures shall be taken to prevent sand from blowing off the berm onto nearby streets and into gutters and yards. When the berm has narrowed to the point that its protective function is jeopardized, the Superintendent shall initiate action to accomplish maintenance or nourishment of the project. When periodic nourishment is construed as construction for project purposes, such action will be coordinated with the District Commander. Conditions for initiating early nourishment or delaying scheduled nourishment shall be outlined in the operation and maintenance manual. The Superintendent shall insure that:

(a) Prompt action is taken to correct localized, excessive loss or gain of berm cross section beyond that which is allowed in the operations and maintenance manual (this may include grading and reshaping the beach berm in order to move sand from areas of excessive accumulation to areas of depletion); prevent erosion from flanking structures; and placing needed additional sand fill when materials are stockpiled for this purpose.

(b) Devices and/or vegetation used to catch blowing sand are preserved and replaced where needed.



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(c) Hazardous conditions are eliminated where possible. Abrupt variations in berm grade are smoothed out and the beach berm and foreshore are kept free of trash and hazardous debris during periods of recreational use. Hazardous conditions which can not be eliminated are clearly marked and isolated from public access to the extent practicable.

c. Protective dune.

(1) Operation. During storm periods, particularly those which are accompanied by abnormal high tides, the storm protection dune may be eroded. The rate and extent of the erosion depends on the height and duration of the storm tide, the beach profile in front of the dune, the extent of vegetative or sand fence stabilization, and characteristics of the material in the dune and berm. The protection provided depends on the volume of material in the dune and its height. To insure satisfactory performance of the storm protection dune, periodic inspections shall be made by the Superintendent to insure maintenance measures are carried out and that:

(a) At least one complete survey of profiles (identified in the operations and maintenance manual) is made each year prior to the storm season.

(b) Post storm surveys are made as required by the operations and maintenance manual.

(c) No action is being taken, such as burning, grazing, or mowing, which is retarding or preventing the growth of vegetation on the dune or promoting erosion on the dune.

(d) No action such as mining of dune sand or degrading the dune is permitted without specific advance written approval of the District Commander.

(e) Encroachments are not made on the dune right-of-way which might hinder its proper functioning during storms or hinder necessary repairs and maintenance.

(f) There is no unauthorized pedestrian or vehicular traffic on the dune and authorized access crossovers are open and safe.

(2) Maintenance. The protective dune (when combined with beach erosion control works) is designed to withstand the project design storm. The protection provided by the dune depends on the crown elevation and the amount and characteristics of sand maintained within the project cross section. Maintenance and repair of the protective dune cross section is a local responsibility. A predetermined minimum cross section must be maintained to obtain the anticipated storm protection benefits. Pedestrian and vehicle traffic on the dune must be limited to the minimum necessary. This requires specific designated crossovers at controlled access points through or over the dune. Areas found to be below minimum grade and which pose a threat to the

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integrity of the dune shall be repaired expeditiously and revegetated, if required. The Superintendent will take immediate steps to insure the following maintenance:

(a) Damage to the dune is repaired immediately. Trapping wind blown sand in the dune section by use of devices or, sometimes more effectively, by use of vegetation is appropriate for maintaining the minimum cross section or building a larger cross section.

(b) Designated access walkways and roads over or through the dunes are properly repaired and replaced as needed.

(c) Devices and/or vegetation used to catch blowing sand and stabilize the dune cross section are repaired and replaced as needed.

d. Coastal structures.

(1) Operation. The Superintendent will insure the proper functioning of sand bypass systems, closure structures, and other features requiring operation or adjustment as prescribed in the operations and maintenance manual. The Superintendent shall inspect the structures incorporated into the shore protection project (such as, but not limited to, groins, revetments, seawalls, bulkheads, breakwaters, closure structures, and sand bypassing systems) prior to the storm season, immediately following each major storm, and otherwise at intervals not exceeding 90 days. During such inspections the Superintendent should be certain that:

(a) Post storm condition surveys are made as required by the operations and maintenance manual.

(b) No seepage, saturated areas, piping, or scour are endangering the structure.

(c) No undue settlement has occurred which affects the stability of the structure.

(d) Concrete is not cracking, spalling, or breaking to an extent which might affect the integrity of the structure.

(e) There are no encroachments upon the structure or its right-of-way which might endanger the structure or hinder its function or repair.

(f) Care is being exercised to prevent accumulation of trash and debris adjacent to the structures.

(g) No bank caving, toe scour, or flanking erosion exist which may endanger stability or functioning of the structure.

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(h) The drainage systems and mechanical features such as pumps or flood gates are in good working condition.

(i) No excessive loss of materials such as stones or armor units exist that may endanger stability or functioning of the structures.

(j) No floating plant or boats are allowed to lie against or tie up to the structures unless they are designed for such use or it is necessary for repair efforts.

(2) Maintenance. The possibility of one coastal storm closely following another requires that coastal structures, particularly those which provide storm protection, be maintained to the extent practicable in a state of readiness. Measures to eliminate unauthorized encroachments and to effect repairs found necessary by inspection shall be undertaken immediately. All repairs shall be accomplished by methods acceptable to the District Commander or an authorized representative. The Superintendent shall insure the following maintenance is carried out expeditiously:

(a) Causes of seepage, saturated areas, piping, or scour which endanger the stability or functioning of structures are removed.

(b) Areas of undue settlement or material loss are filled.

(c) Cracking, chipping, or breaking of concrete which affects the integrity or functioning of structures is repaired.

(d) Trash and debris adjacent to the structure are removed and disposed of properly.

(e) Bank caving, toe scour, or flanking erosion which endangers structure stability or functioning is remedied.

(f) Drainage systems and mechanical features are repaired or replaced as needed and maintained in working condition.

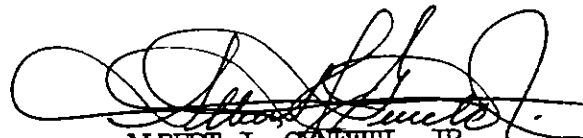
e. Appurtenant facilities and services. To assure realization of public recreation benefits, certain appurtenant facilities and services are required at local expense, such as: public access, parking areas, and sanitary facilities. The required items are considered self liquidating and therefore not included in the project cost.

(1) Operation. Appurtenant facilities shall be operated to provide safe and healthful public recreation on a nondiscriminatory basis. Facilities should be sized and operated to produce the recreation benefits anticipated for the justification of the project. Those facilities dedicated to support the beach erosion control project shall not be used for conflicting purposes or otherwise diverted without the approval of the District Commander.

(2) Maintenance. The Superintendent shall provide such maintenance as is required to insure safety and serviceability of required public access, parking areas and sanitary facilities during periods of recreational use of the project beach. The facilities shall be inspected 20 to 30 days prior to the recreation season and at least once a month during the recreation season to insure that all required facilities are providing safe, serviceable public use. Proper measures shall be taken to provide for the prompt maintenance or repair of deficiencies noted during such inspections. Violations of public health and building codes shall be treated as evidence of inadequate project maintenance.

9. Compliance. District Commanders shall keep informed as to the extent of compliance with provisions of this regulation and the project Operation and Maintenance Manuals through periodic inspections of the projects, and analysis of project records maintained by the Superintendents. These actions shall be included in the continuing inventory of local cooperation agreements and the status of their performance, transmitted to Congress annually in compliance with Section 221(e) of PL 91-611. The agreements, upon being accepted on behalf of the Secretary of the Army, become enforceable in a court of law. Federal funds are withheld on projects with documented accumulated deficient maintenance. Federal expenditures may be resumed upon correction.

FOR THE COMANDER:



ALBERT J. GENETTI, JR.  
Colonel, Corps of Engineers  
Chief of Staff

**Flood Protection  
Reno Beach-Howard Farms, Ohio**

**Appendix B  
Check Sheet for Inspection**

**U. S. Army Engineer District, Buffalo  
1776 Niagara Street  
Buffalo, NY 14207-3199**

**THE LAKE ERIE CONSERVANCY DISTRICT NUMBER 1 AND  
HOWARD FARMS CONSERVANCY DISTRICT**

**FLOOD PROTECTION PROJECT  
RENO BEACH-HOWARD FARMS, OHIO**

**APPENDIX B**

**CHECK SHEET FOR INSPECTION**

Inspected by: \_\_\_\_\_  
Department: \_\_\_\_\_

Date: \_\_\_\_\_

Inspection reach: From: \_\_\_\_\_ To: \_\_\_\_\_

Type of Inspection (check only one)

- Emergency/Disaster
- Semi-annual
- Other (describe)
- Joint/Annual

Item Description	OK	Condition*/Recommendation
1) Settlement, loss of grade		
2) Stone Protection		
3) Erosion		
4) Structure Integrity		
5) Debris		
6) Unauthorized Changes		

Cont'd

Item Description	OK	Condition*/Recommendation
7) Unauthorized dumping/filling		
8) Unauthorized right-of-way encroachment		
9) Weeds or undesirable vegetation		
10) Other		

\* Indicate satisfactory condition with a check; briefly describe conditions that are other than satisfactory; use additional sheets if more space is needed.

Corrective Work Completed During Period:

Beginning: \_\_\_\_\_ Ending: \_\_\_\_\_

A. Structure (include plates)

Additional Remarks:

Submitted By \_\_\_\_\_  
Project Superintendent

Date \_\_\_\_\_

**Flood Protection  
Reno Beach-Howard Farms, Ohio**

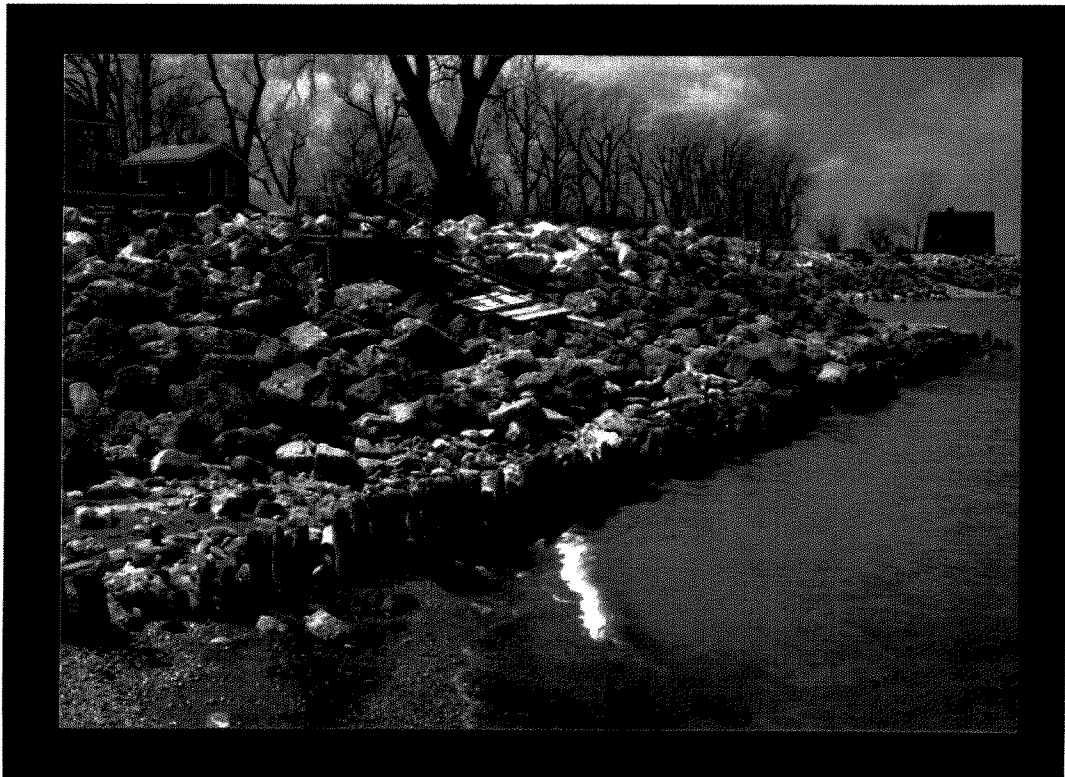
**Appendix C  
Project Photographs**

**U. S. Army Engineer District, Buffalo  
1776 Niagara Street  
Buffalo, NY 14207-3199**





Approximately at sta. 1+08, facing west.



Approximately at sta. 1+45, facing west.

B  
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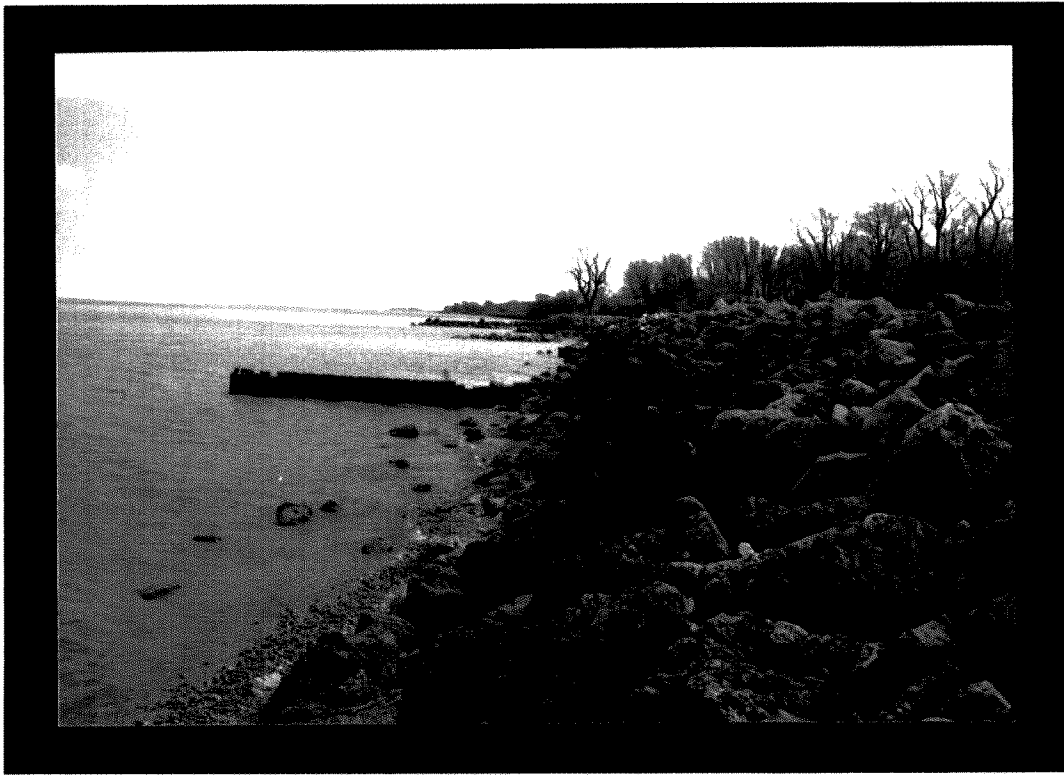


Aerial view of sta. 37+50 to sta 51+50, approximately.



Aerial view of Wards Canal and rest of project.

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Approximately at sta. 1+45, facing east.



Approximately at sta. 63+00, facing west.

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Approximately at sta. 63+00, facing east.



Approximately at sta. 97+00, facing east.

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Cooley Canal - Aerial view of end of project.



Aerial view of approximately sta. 58+50 to end of project.

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Section at approximately sta. 70+00.



Wards Canal - Rehabilitated levee.

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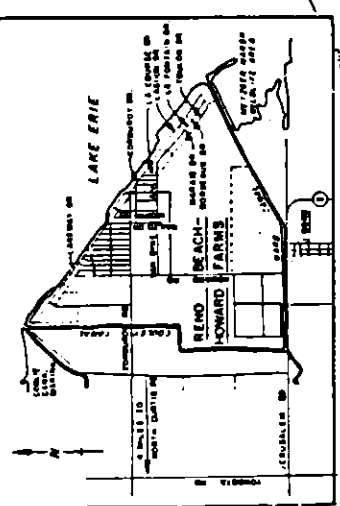
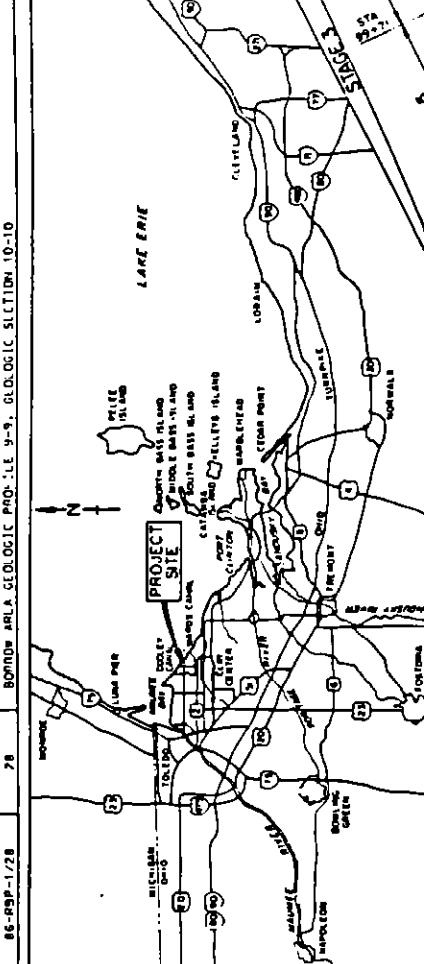
**Flood Protection  
Reno Beach-Howard Farms, Ohio**

**Appendix D  
As-Constructed Drawings**

**U. S. Army Engineer District, Buffalo  
1776 Niagara Street  
Buffalo, NY 14207-3199**

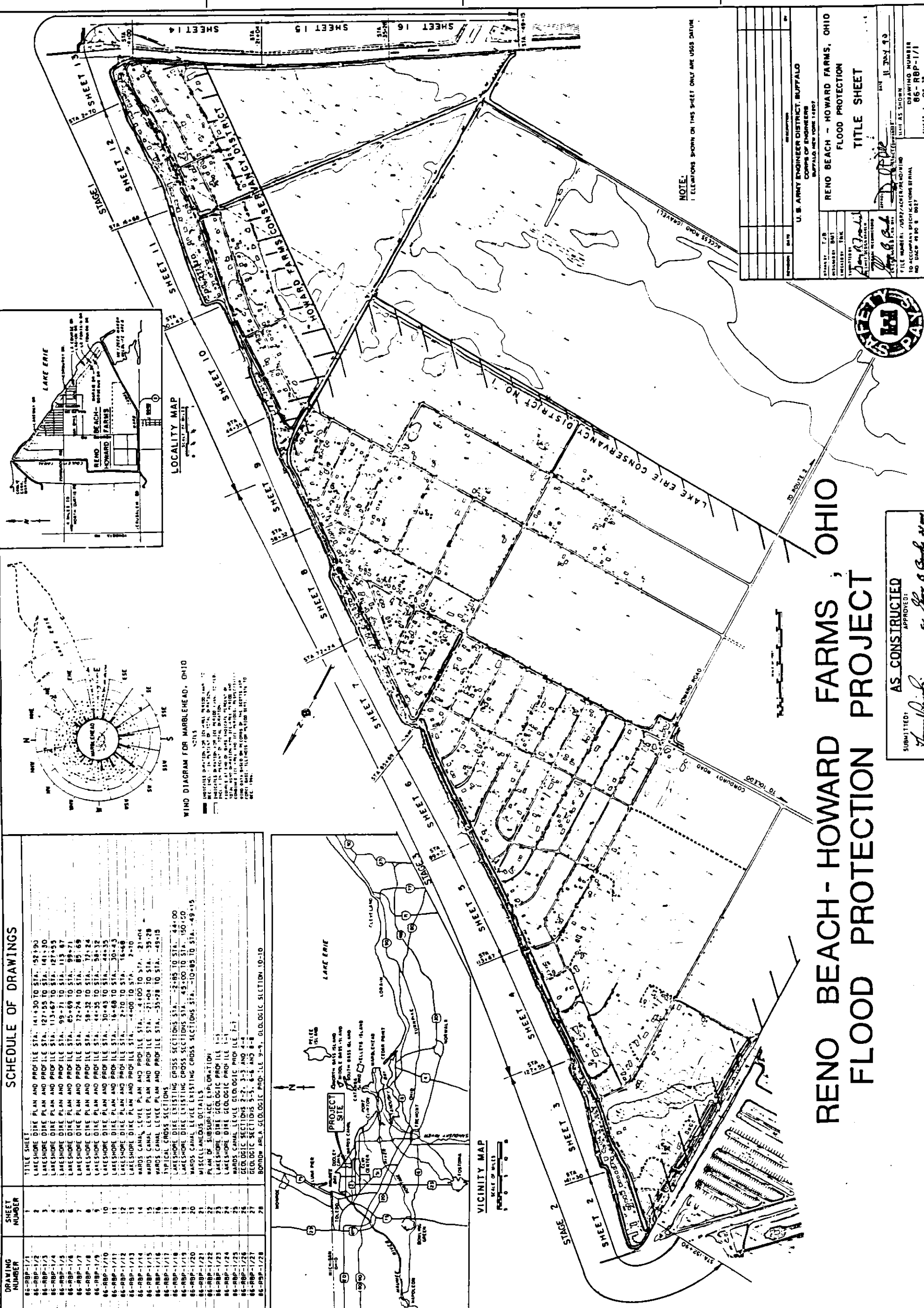
**SCHEDULE OF DRAWINGS**

DRAWING NUMBER	SHEET NUMBER	DESCRIPTION
86-RBP-1/1	1	TITLE SHEET
86-RBP-1/2	2	LAKESHORE DIKE PLAN AND PROFILE STA. 141+30 TO STA. 152+90
86-RBP-1/3	3	LAKESHORE DIKE PLAN AND PROFILE STA. 127+55 TO STA. 141+30
86-RBP-1/4	4	LAKESHORE DIKE PLAN AND PROFILE STA. 113+87 TO STA. 127+55
86-RBP-1/5	5	LAKESHORE DIKE PLAN AND PROFILE STA. 99+71 TO STA. 113+87
86-RBP-1/6	6	LAKESHORE DIKE PLAN AND PROFILE STA. 85+69 TO STA. 99+71
86-RBP-1/7	7	LAKESHORE DIKE PLAN AND PROFILE STA. 72+24 TO STA. 85+69
86-RBP-1/8	8	LAKESHORE DIKE PLAN AND PROFILE STA. 58+32 TO STA. 72+24
86-RBP-1/9	9	LAKESHORE DIKE PLAN AND PROFILE STA. 44+35 TO STA. 58+32
86-RBP-1/10	10	LAKESHORE DIKE PLAN AND PROFILE STA. 30+43 TO STA. 44+35
86-RBP-1/11	11	LAKESHORE DIKE PLAN AND PROFILE STA. 16+68 TO STA. 30+43
86-RBP-1/12	12	LAKESHORE DIKE PLAN AND PROFILE STA. 2+10 TO STA. 16+68
86-RBP-1/13	13	WARDS CANAL LEVEL PLAN AND PROFILE STA. 4+00 TO STA. 2+10
86-RBP-1/14	14	WARDS CANAL LEVEL PLAN AND PROFILE STA. 21+04 TO STA. 4+00
86-RBP-1/15	15	WARDS CANAL LEVEL PLAN AND PROFILE STA. 21+04 TO STA. 39+28
86-RBP-1/16	16	WARDS CANAL LEVEL PLAN AND PROFILE STA. 39+28 TO STA. 48+15
86-RBP-1/17	17	TYPICAL CROSS SECTIONS
86-RBP-1/18	18	LAKESHORE DIKE EXISTING CROSS SECTIONS STA. 2+85 TO STA. 44+00
86-RBP-1/19	19	LAKESHORE DIKE EXISTING CROSS SECTIONS STA. 45+00 TO STA. 150+20
86-RBP-1/20	20	WARDS CANAL LEVEL EXISTING CROSS SECTIONS STA. 10+85 TO STA. 49+15
86-RBP-1/21	21	MISCELLANEOUS DETAILS
86-RBP-1/22	22	PLAN OF SUBSURFACE EXPLORATION
86-RBP-1/23	23	LAKESHORE DIKE GEOLOGIC PROFILE 1-1
86-RBP-1/24	24	LAKESHORE DIKE GEOLOGIC PROFILE 2-2
86-RBP-1/25	25	LAKESHORE DIKE GEOLOGIC PROFILE 3-3
86-RBP-1/26	26	WARDS CANAL LEVEL GEOLOGIC PROFILE 4-4
86-RBP-1/27	27	GEOLOGIC SECTIONS 5-5, 6-6 AND 7-7
86-RBP-1/28	28	BOTTOM AREA GEOLOGIC PROFILE 9-9, GEOLOGIC SECTION 10-10



**WIND DIAGRAM FOR MARBLEHEAD, OHIO**

WINDS INDICATED ON THIS DIAGRAM ARE BASED ON RECORDS FOR MARBLEHEAD, OHIO, FROM 1941 TO 1957. THE WINDS ARE INDICATED BY THE LENGTH OF THE ARROWS AND THE DIRECTION OF THE ARROWS. THE WINDS ARE INDICATED BY THE LENGTH OF THE ARROWS AND THE DIRECTION OF THE ARROWS. THE WINDS ARE INDICATED BY THE LENGTH OF THE ARROWS AND THE DIRECTION OF THE ARROWS.



**NOTE:**  
ELEVATIONS SHOWN ON THIS SHEET ONLY ARE USGS DATUM

U.S. ARMY ENGINEER DISTRICT, BUFFALO  
CORPS OF ENGINEERS  
BUFFALO OFFICE 12007

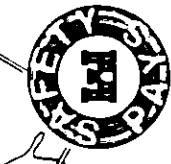
RENO BEACH - HOWARD FARMS, OHIO  
FLOOD PROTECTION  
TITLE SHEET

DATE: 11 JULY 50  
DRAWING NUMBER: 86-RBP-1/1  
SHEET 1 OF 28

DESIGNED BY: [Signature]  
CHECKED BY: [Signature]  
APPROVED BY: [Signature]

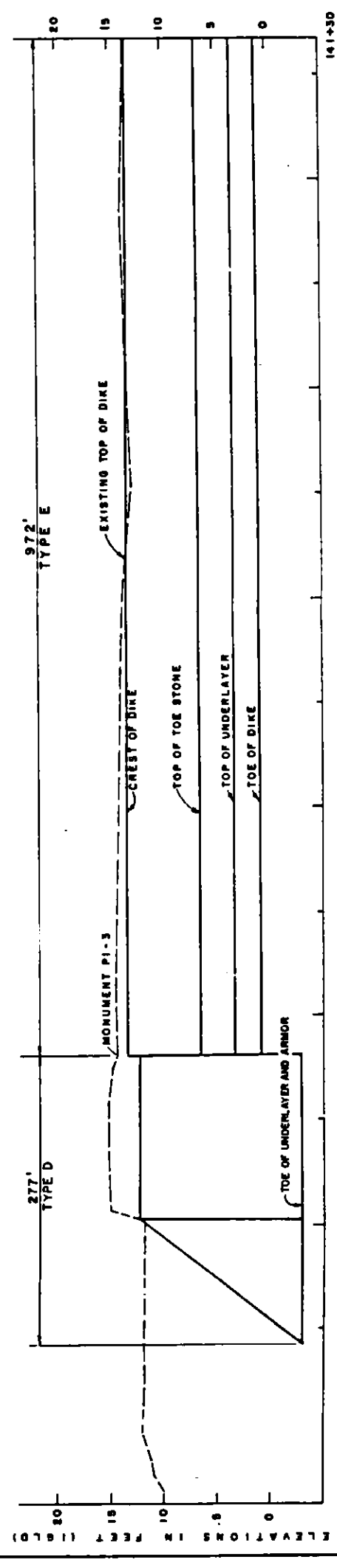
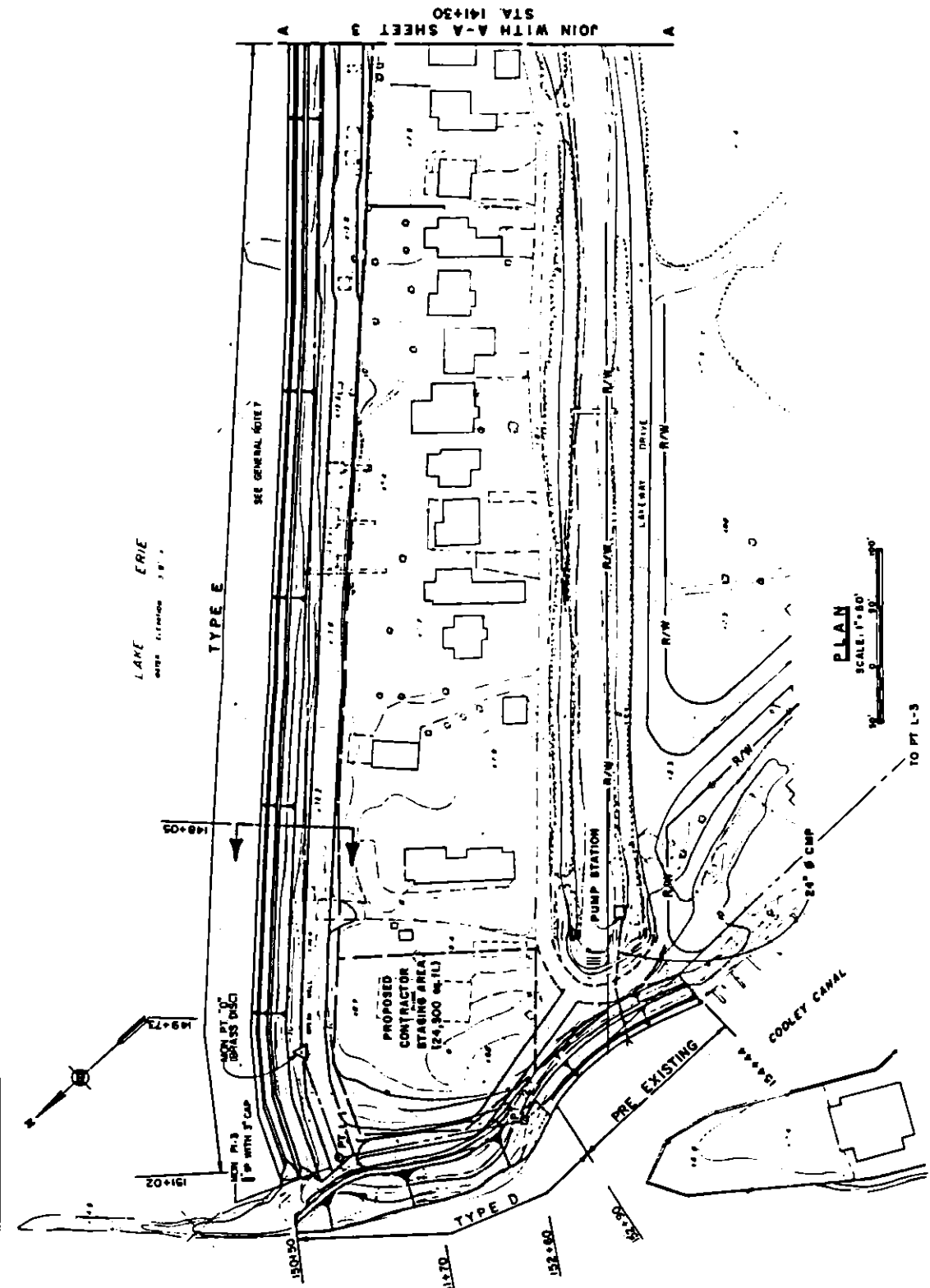
# RENO BEACH - HOWARD FARMS, OHIO FLOOD PROTECTION PROJECT

AS CONSTRUCTED  
APPROVED: [Signature]  
SUBMITTED: [Signature]





- LEGEND**
- NEW CONSTRUCTION AND/OR RECONSTRUCTION DIKE
  - CENTERLINE
  - PERMANENT EASEMENT LINE
  - TEMPORARY EASEMENT AND/OR STAGING AREA
  - SHORELINE
  - CROSS SECTION (SEE NOTES)
  - SURVEY MONUMENTS
  - SURVEY POINTS
  - RIGHT-OF-WAY
  - PROPERTY LINE



**GENERAL NOTES:**

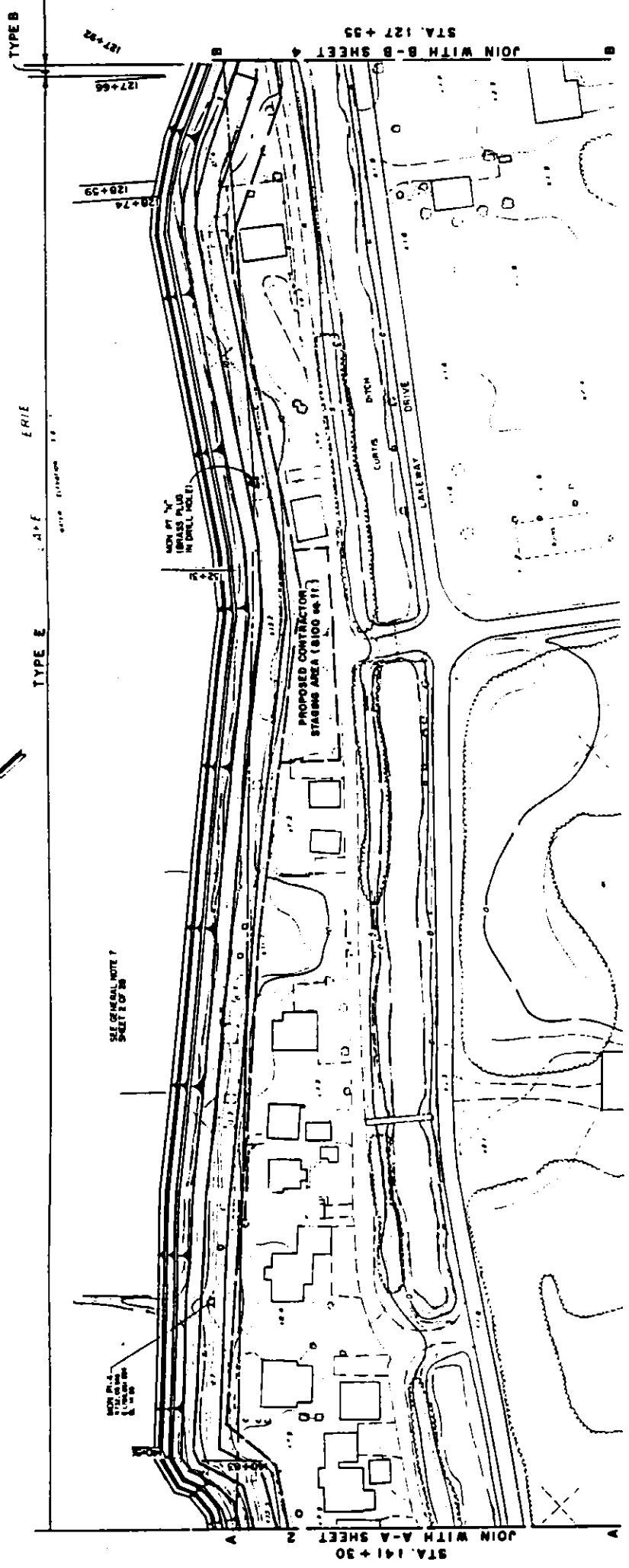
- ELEVATION AND CONTOURS SHOWN IN PLAN AND PROFILE ARE REFERRED TO LOW WATER DATUM ELEVATION 58.5 FEET ABOVE MEAN WATER LEVEL AT FATHER POINT, QUEBEC, INTERNATIONAL GREAT LAKES DATUM (IGLD).
- EXPLANATION OF NEW WORK--ALL TYPES, SEE SHEET 17.
- STATIONING FOR THE LAKESHORE DIKE, WARDS CANAL LEVEE AND COOLEY CANAL DIKE IS ALONG THE SURVEY BASELINE AS SHOWN IN PLAN. ALL STATIONING IS FROM STATION 0+00. THE SURVEY BASELINE DATA IS GIVEN ON SHEET 15.
- THE DIMENSIONS SHOWN IN PROFILE ARE THE ACTUAL LENGTHS OF THE CONSTRUCTION AND/OR RECONSTRUCTIVE WORK. DIMENSIONS DO NOT NECESSARILY CORRESPOND TO STATIONING.
- EXISTING CROSS SECTIONS OF THE DIKE AND LEVEE ARE SHOWN ON SHEETS 16, 17 AND 18. COMPLETE SET OF CROSS SECTIONS ARE SEPARATELY BOUND.
- NEW WORK GENERALLY FOLLOWED THE EXISTING ALIGNMENT AND NEW WORK WAS MADE TO COMPLY WITH SPECIAL CONDITIONS SUCH AS ROCK JETTIES OR ABRUPT ALIGNMENT CHANGES.

U.S. ARMY ENGINEER DISTRICT, BUFFALO BUFFALO, NEW YORK 14207	
DESIGNED BY: T.L.J.	CHECKED BY: T.B.C.
DATE: 11 JULY 90	SCALE AS SHOWN
REMO BEACH - HOWARD FARMS, OHIO LAKESHORE DIKE	
PLAN AND PROFILE STA 141+30 TO STA 152+90	
PROJECT NO: 86-RBP-1/2	DRAWING NUMBER: 86-RBP-1/2
SHEET 2 OF 20	

AS CONSTRUCTED

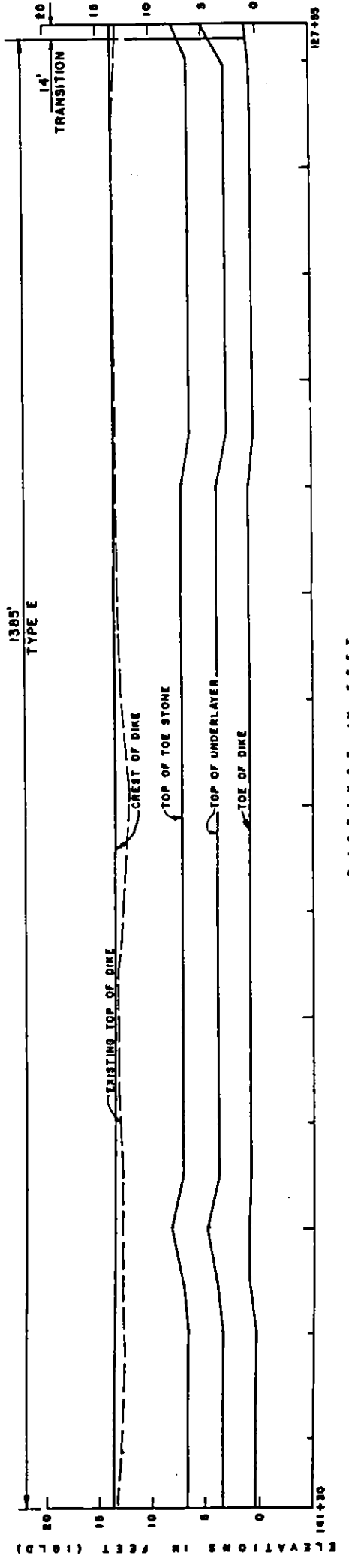
APPROVED: *[Signature]*

DATE: 11 JULY 90



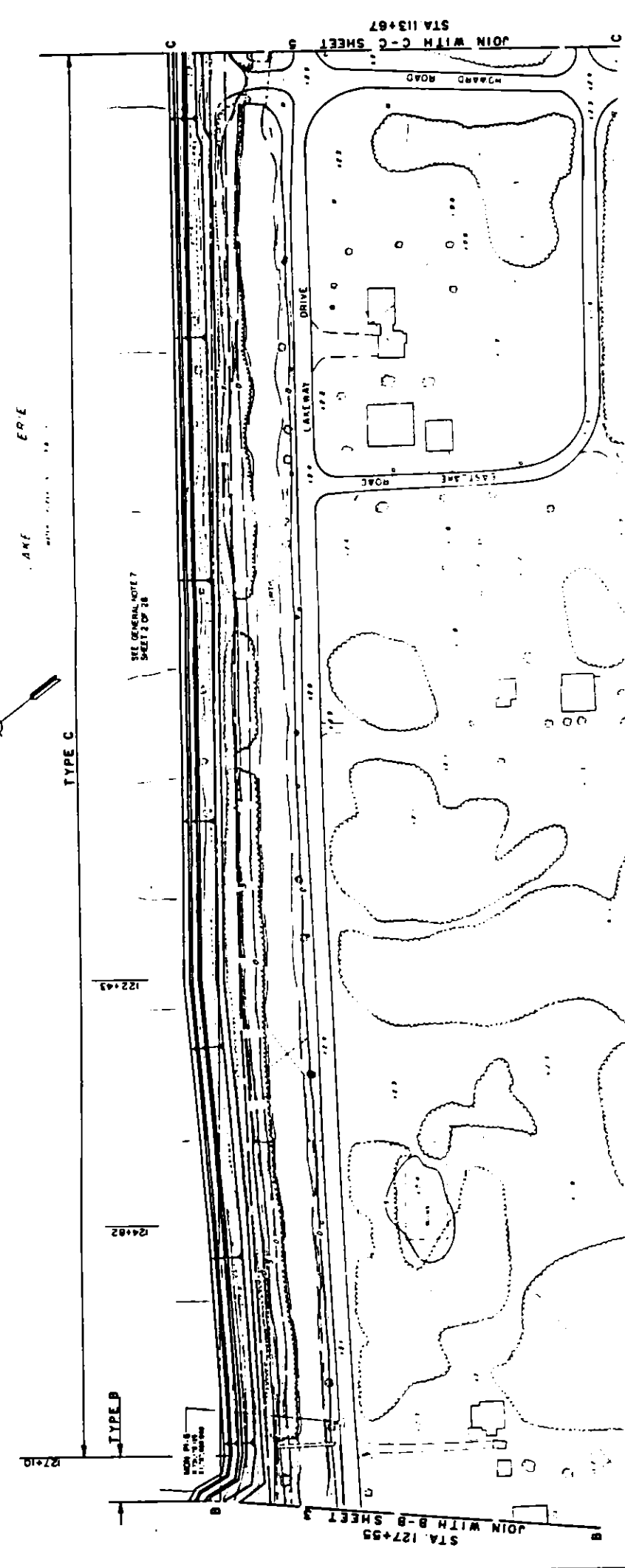
PLAN  
SCALE OF FEET  
1" = 100'

NOTES:  
1. FOR GENERAL NOTES, SEE SHEET 2  
2. CROSS SECTIONS OF THE LAKESHORE DIKE ARE SHOWN ON SHEET 15.



AS CONSTRUCTED  
APPROVED  
[Signature]

PROJECT	RENO BEACH - HOWARD FARMS, OHIO
DESIGNED BY	U.S. ARMY ENGINEER DISTRICT, BUFFALO
CHECKED BY	CORPS OF ENGINEERS
DATE	BUFFALO, NEW YORK 1937
<b>PLAN AND PROFILE</b>	
STA. 127+55 TO STA. 141+30	
DATE	JULY 1937
DRAWING NUMBER 86-RBP-1/3	
SHEET 3 OF 28	



NOTES:  
 1. FOR GENERAL NOTES, SEE SHEET 2  
 2. CROSS SECTIONS OF THE LAKESHORE DIKE  
 3. ARE SHOWN ON SHEET 18.

**AS CONSTRUCTED**

DESIGNED BY: *[Signature]*  
 CHECKED BY: *[Signature]*  
 APPROVED BY: *[Signature]*

U.S. ARMY ENGINEER DISTRICT, BUFFALO  
 CORPS OF ENGINEERS  
 BUFFALO, NEW YORK 14207

RENO BEACH - HOWARD FARMS, OHIO  
 LAKESHORE DIKE

PLAN AND PROFILE  
 STA. 113 + 67 TO STA. 127 + 55

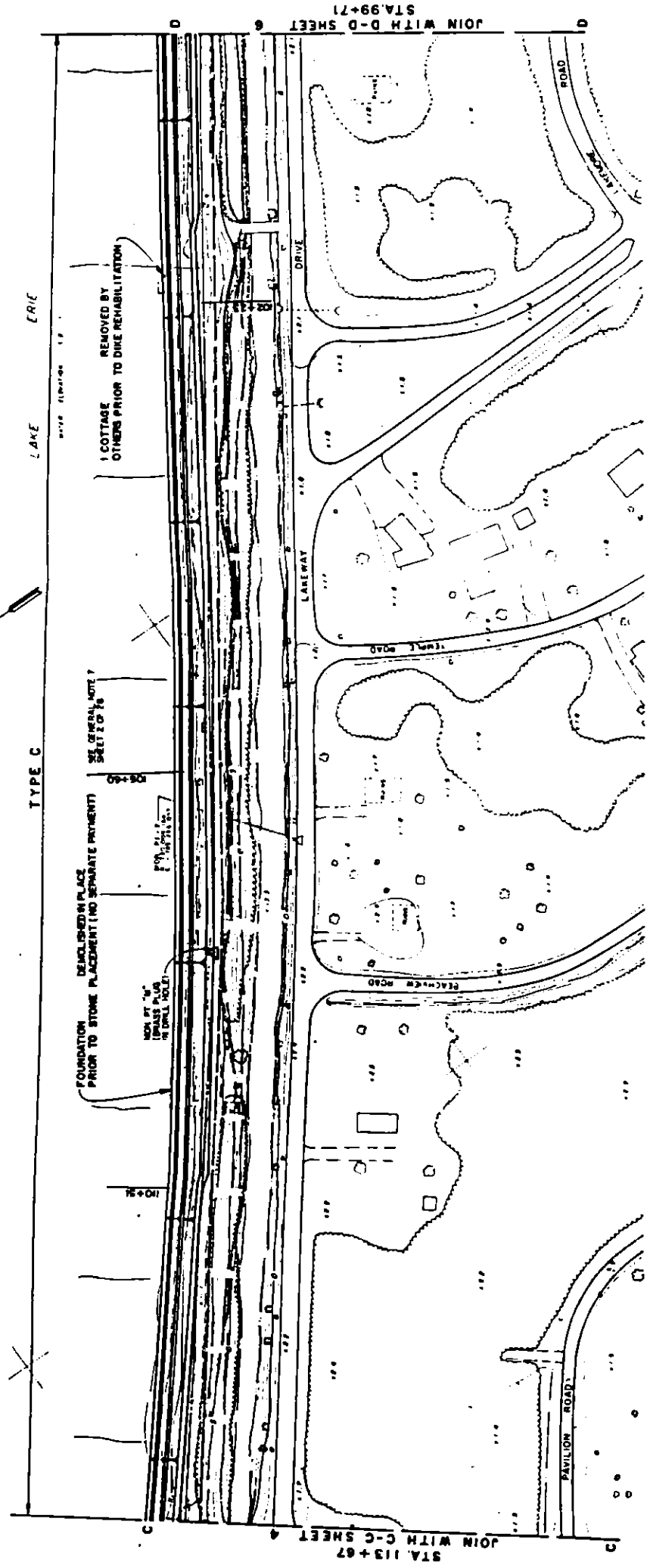
DATE: 11 MAY 50

NO. 1138

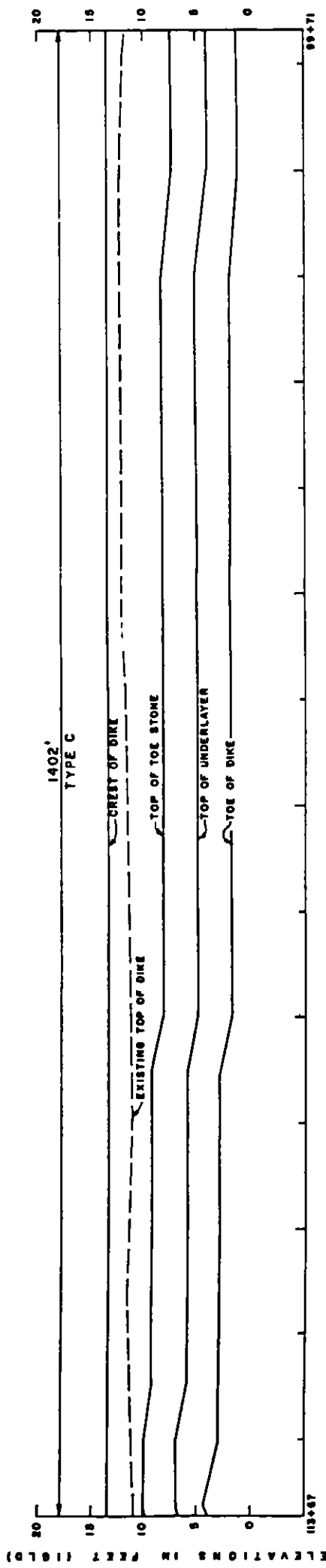
DRAWING NUMBER: 65-RBP-1/A

SHEET 4 OF 20





PLAN  
SCALE OF FEET  
1" = 100'



NOTES:  
1. FOR GENERAL NOTES, SEE SHEET 2  
2. CROSS SECTIONS OF THE LAKESHORE DIKE ARE SHOWN ON SHEET 19.

AS CONSTRUCTED

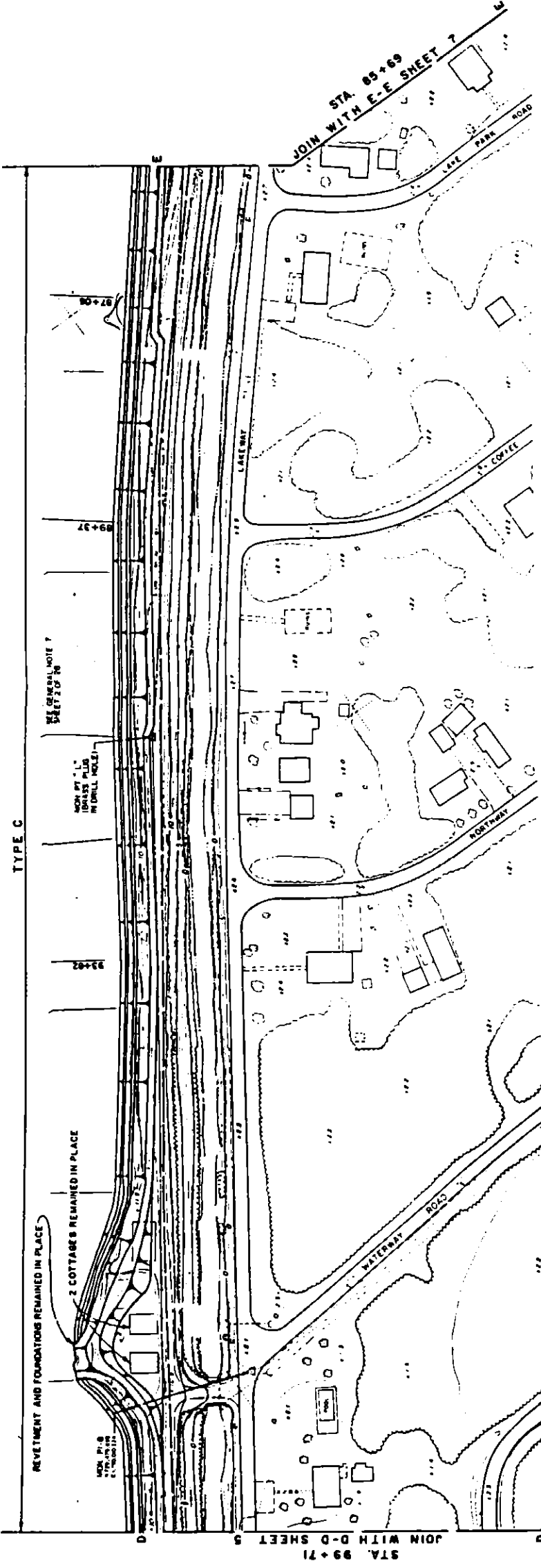
U.S. ARMY ENGINEER DISTRICT, BUFFALO  
CORPS OF ENGINEERS  
BUFFALO, NEW YORK 14203

RENO BEACH - HOWARD FARMS, OHIO  
LAKESHORE DIKE  
PLAN AND PROFILE  
STA. 99+71 TO STA. 113+67

DATE: 11 MAY 54

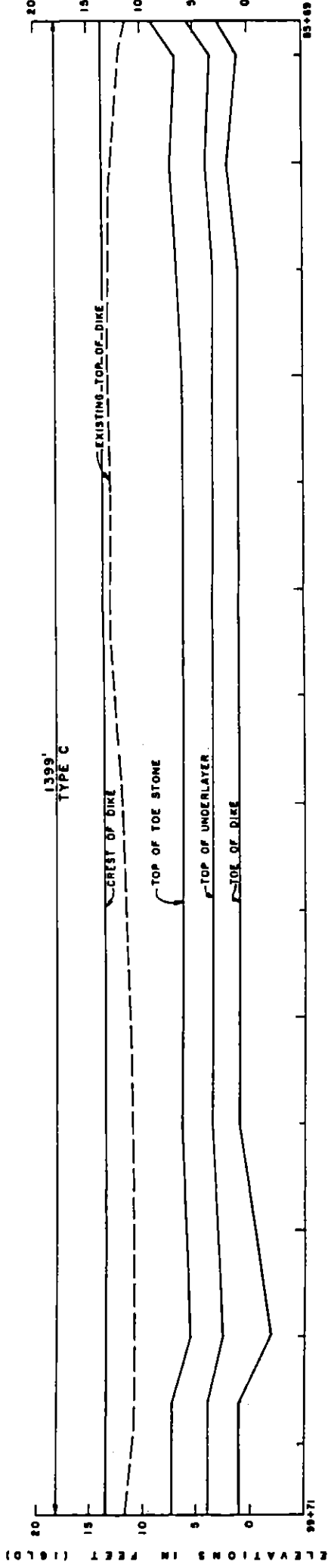
DRAWING NUMBER: 86-RBP-175  
SHEET 5 OF 20

LAKE ERIE  
WATER ELEVATION 18.0



PLAN  
SCALE OF FEET  
1" = 100'

- NOTES:  
1 FOR GENERAL NOTES, SEE SHEET 2  
2 CROSS SECTIONS OF THE LAKESHORE DIKE  
ARE SHOWN ON SHEET 10



DISTANCE IN FEET

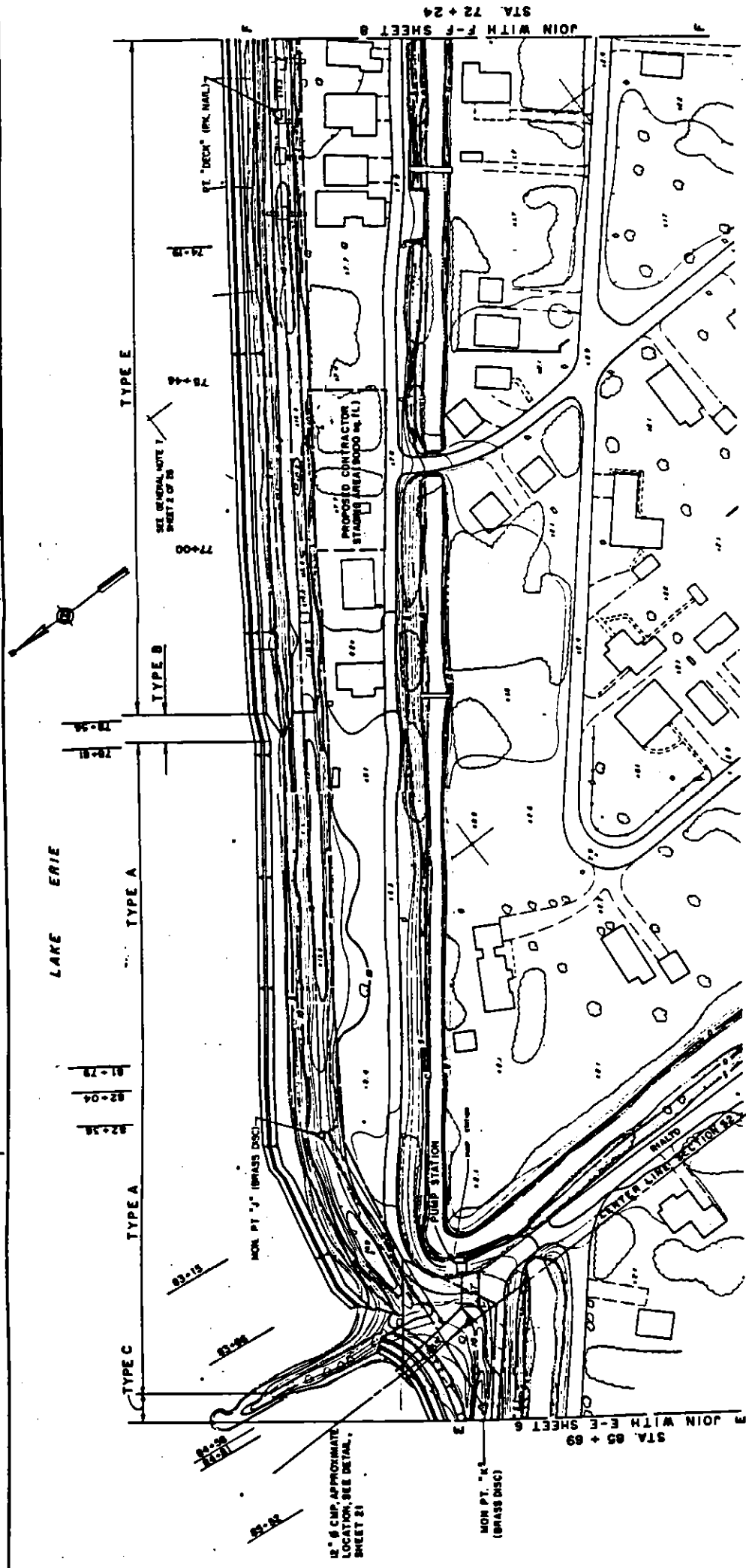
PROFILE

AS CONSTRUCTED  
APPROVED

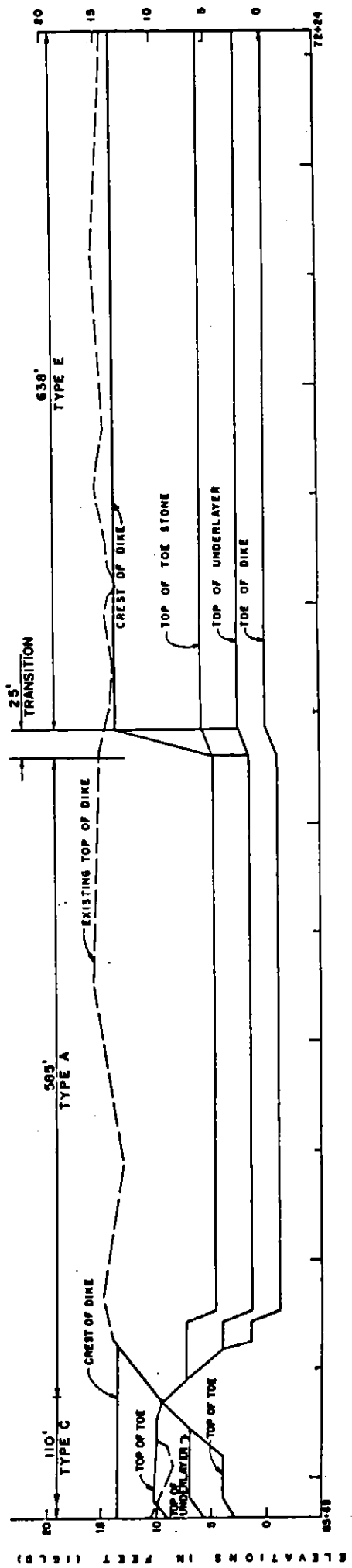
*H. R. P. R.*  
*E. J. Wood*

DESIGNED BY	DATE	REVISION
CHECKED BY		
DRAWN BY		
CALCULATED BY		
DATE		
U. S. ARMY ENGINEER DISTRICT, BUFFALO CORPS OF ENGINEERS BUFFALO NEW YORK 14207		
RENO BEACH - HOWARD FARMS, OHIO LAKESHORE DIKE		
PLAN AND PROFILE STA. 85+69 TO STA. 99+71		
DATE AS SHOWN	11 JULY 52	
DRAWING NUMBER 86-RBP-176		
SHEET 6 OF 20		





PLAN  
SCALE OF FEET  
1" = 100'



NOTES:  
1. FOR GENERAL NOTES, SEE SHEET 2.  
2. CROSS SECTIONS OF THE LAKESHORE DIKE ARE SHOWN ON SHEET 19.

**AS CONSTRUCTED**

APPROVED: *[Signature]*  
DATE: 11.20.43

U.S. ARMY ENGINEER DISTRICT, BUFFALO  
CORPS OF ENGINEERS  
BUFFALO, NEW YORK 14201

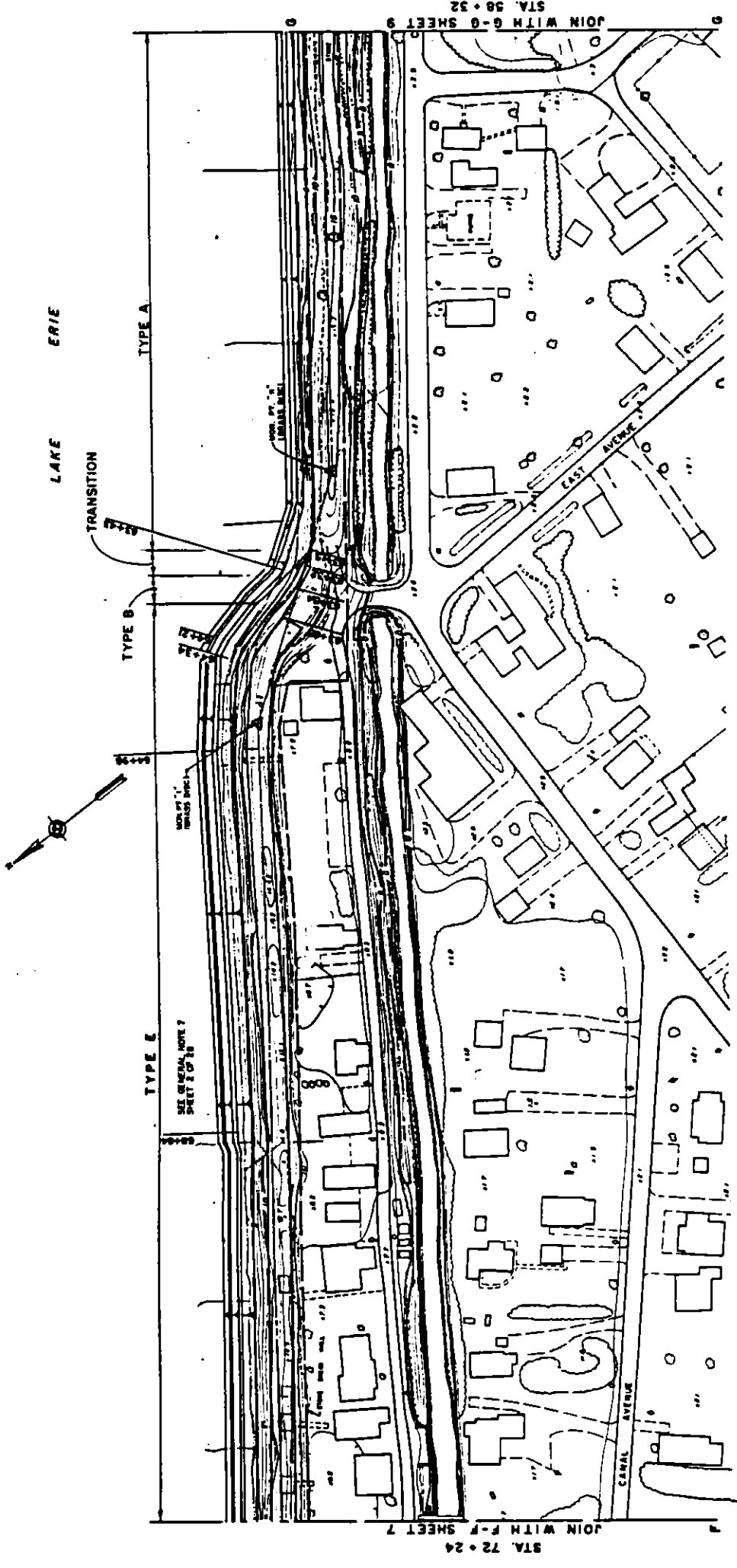
RENO BEACH - HOWARD FARMS, OHIO  
LAKESHORE DIKE

**PLAN AND PROFILE**  
STA. 72+24 TO STA. 85+69

DATE: 11.20.43

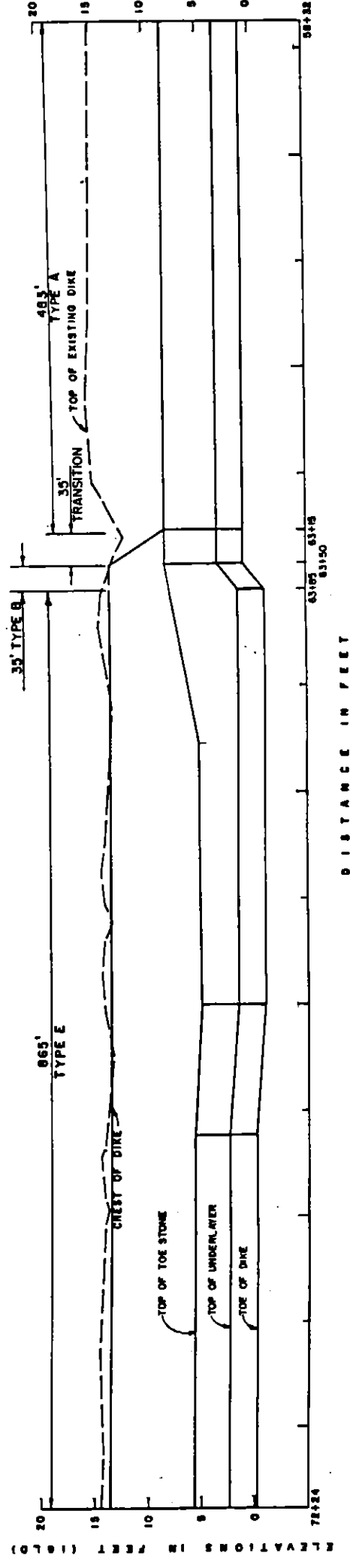
U.S. ARMY ENGINEER DISTRICT, BUFFALO  
CORPS OF ENGINEERS  
BUFFALO, NEW YORK 14201

DRAWING NUMBER: 66-RBP-177  
SHEET 7 OF 28



PLAN  
SCALE OF FEET  
1" = 10'

NOTES:  
1. FOR GENERAL NOTES, SEE SHEET 2  
2. CROSS SECTIONS OF THE LAKESHORE DIKE  
ARE SHOWN ON SHEETS 16 & 19.



AS CONSTRUCTED

U.S. ARMY ENGINEER DISTRICT BUFFALO  
CORPS OF ENGINEERS  
BUFFALO, NEW YORK 14207

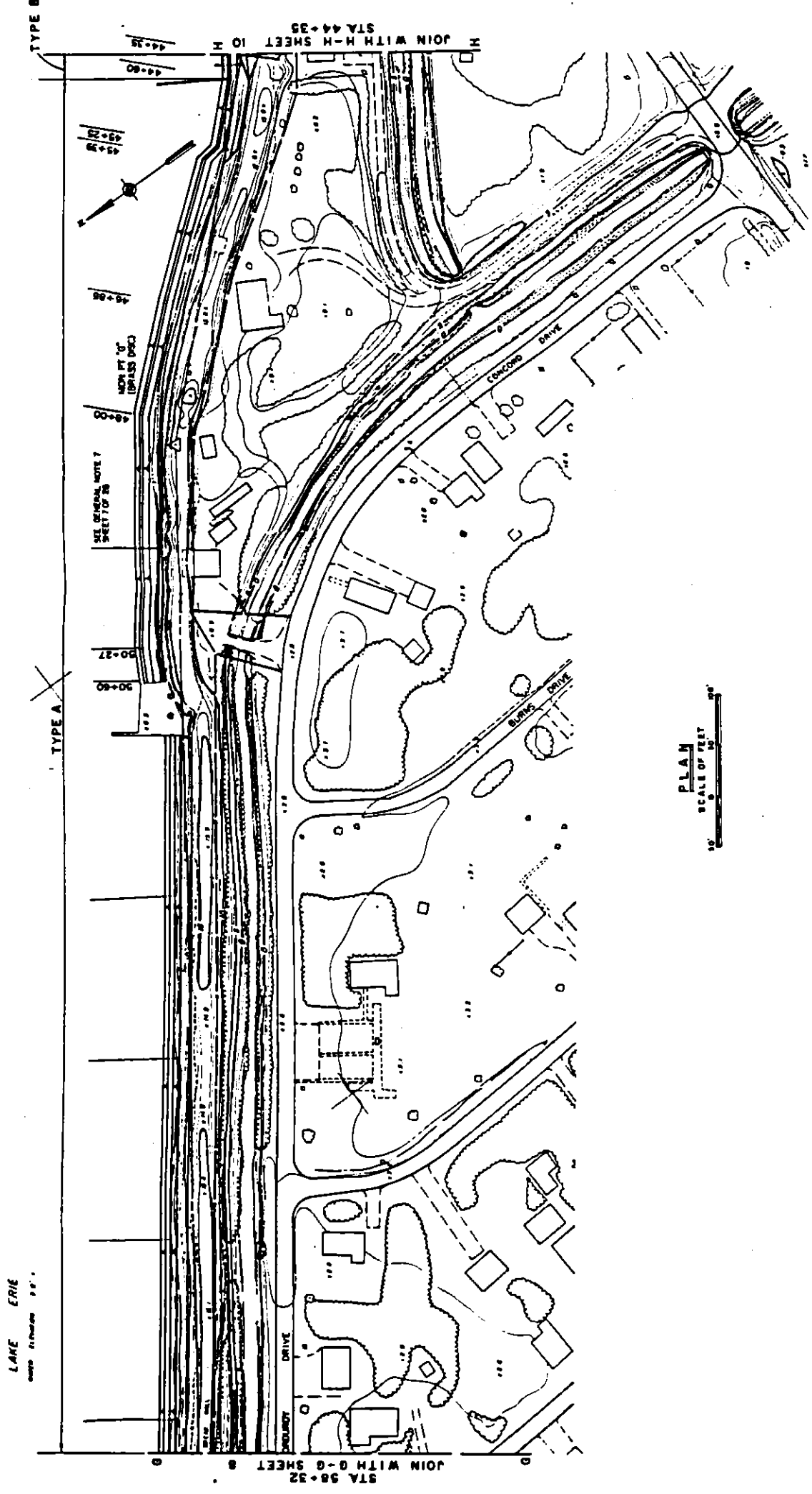
RENO BEACH - HOWARD FARMS, OHIO  
LAKESHORE DIKE

PLAN AND PROFILE  
STA. 58+32 TO STA. 72+24

DESIGNED BY: [Signature]  
CHECKED BY: [Signature]  
DATE: [Signature]

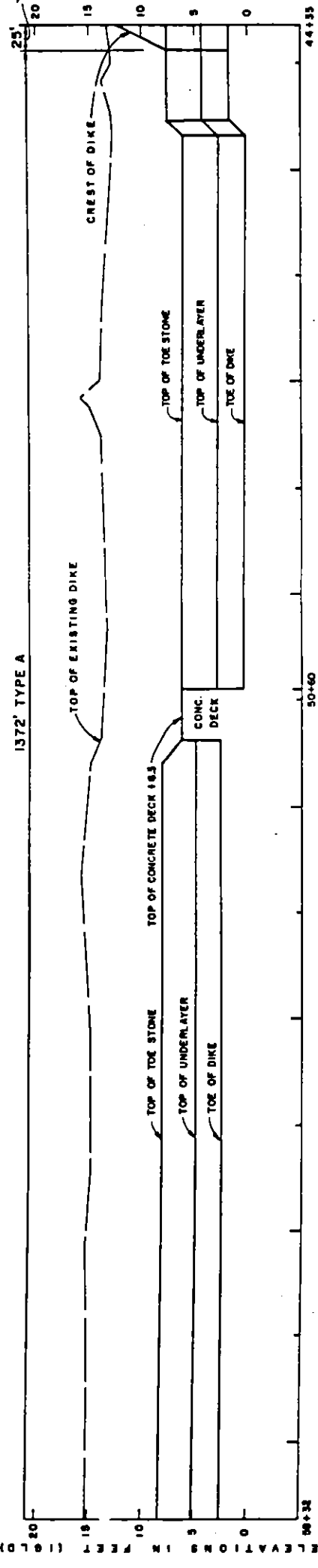
APPROVED BY: [Signature]

NO. 1000-0-10-100  
DRAWING NUMBER  
86-RBP-178  
SHEET 9 OF 20



NOTES:  
1. FOR GENERAL NOTES, SEE SHEET 2

1372' TRANSITION



AS CONSTRUCTED

U.S. ARMY ENGINEER DISTRICT, BUFFALO  
CORPS OF ENGINEERS  
BUFFALO, NEW YORK 14207

RENO BEACH - HOWARD FARMS, OHIO  
LAKESHORE DIKE

PLAN AND PROFILE  
STA 44+35 TO STA 50+32

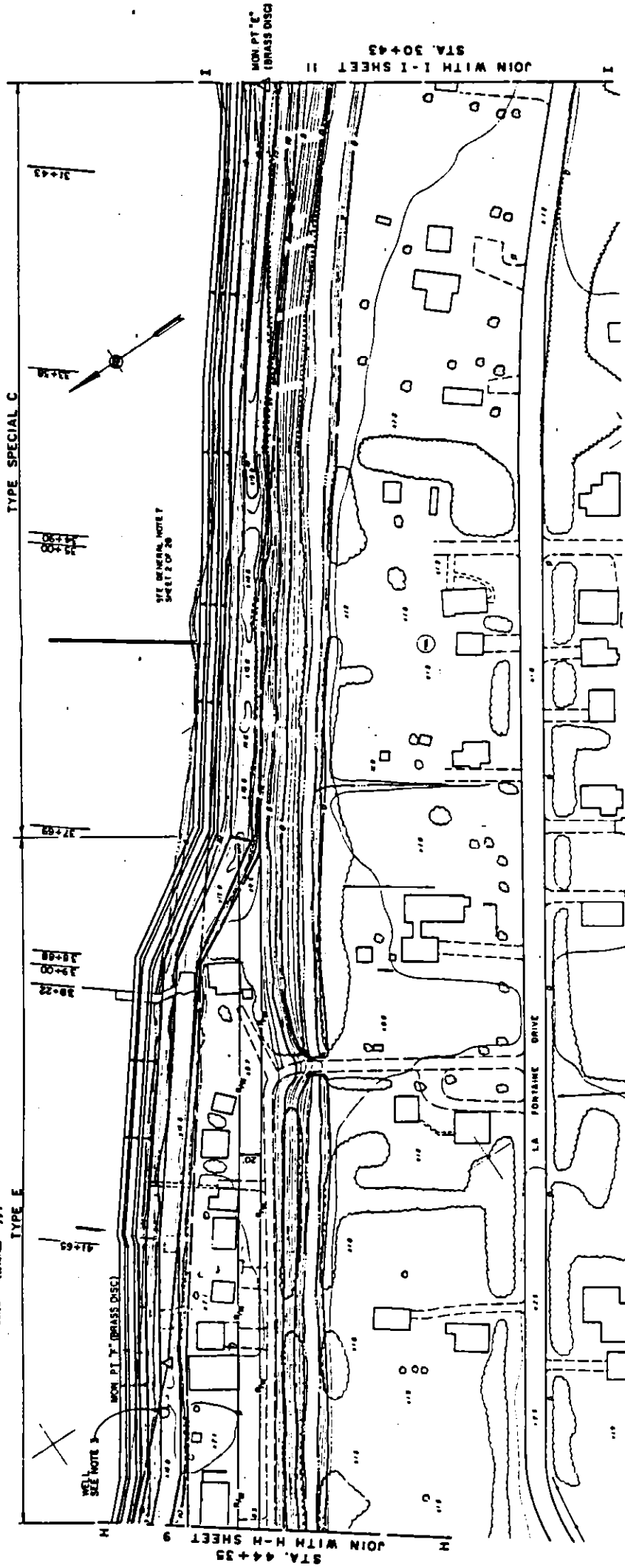
DATE: 11/24/16

DRAWING NUMBER: 66-RBP-1/9

SHEET 9 OF 29



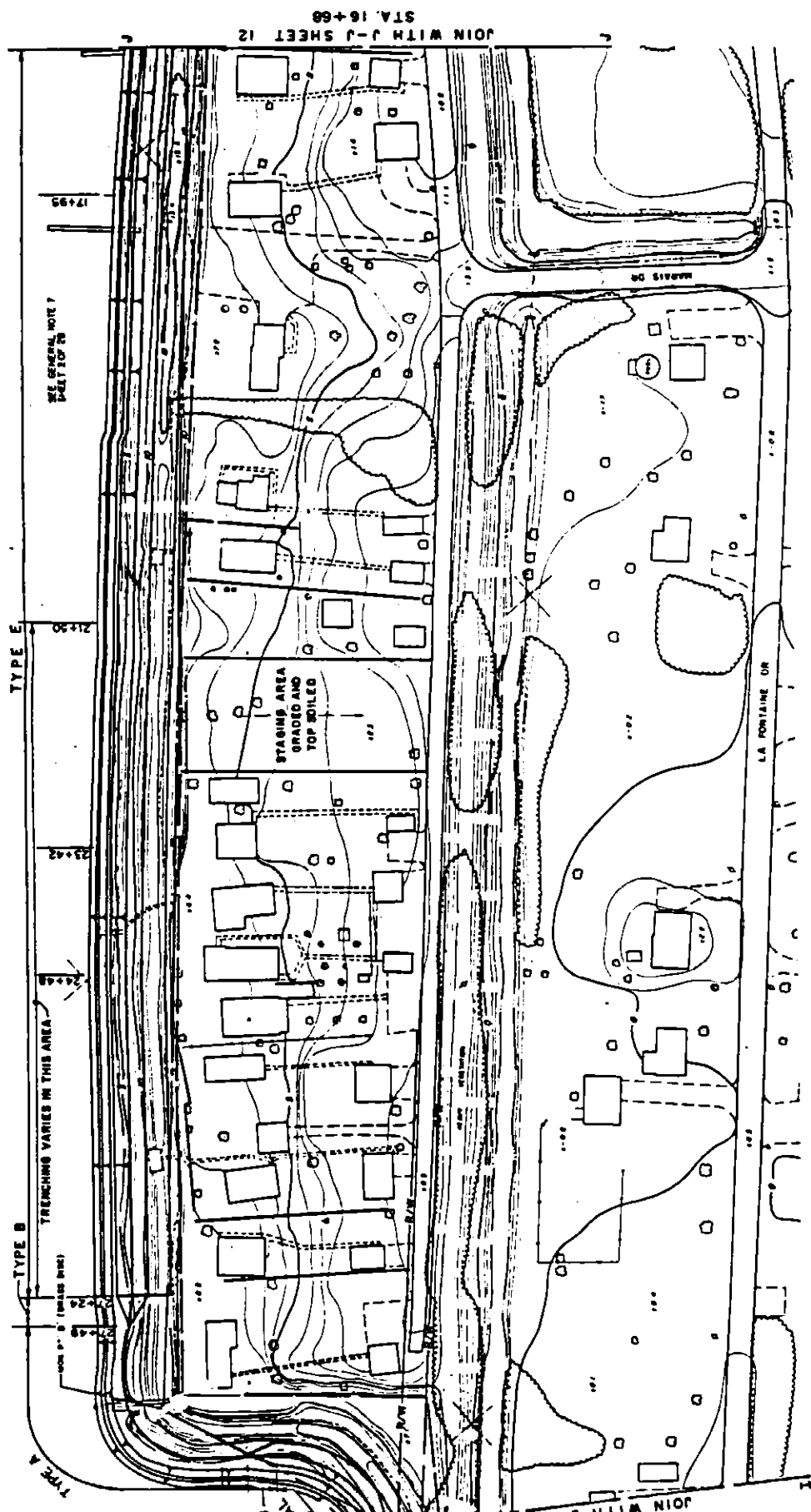
LAKE ERIE  
 WATER DIVISION DIST.  
 TYPE E



NOTES:  
 1 FOR GENERAL NOTES, SEE SHEET 2  
 2 EXISTING CROSS SECTIONS OF THE LAKESHORE DIKE ARE SHOWN ON SHEET 18.  
 3 THE WELL WAS PROTECTED DURING CONSTRUCTION AND TURNED OVER TO THE OWNER IN OPERATING CONDITION AFTER CONSTRUCTION COMPLETION.

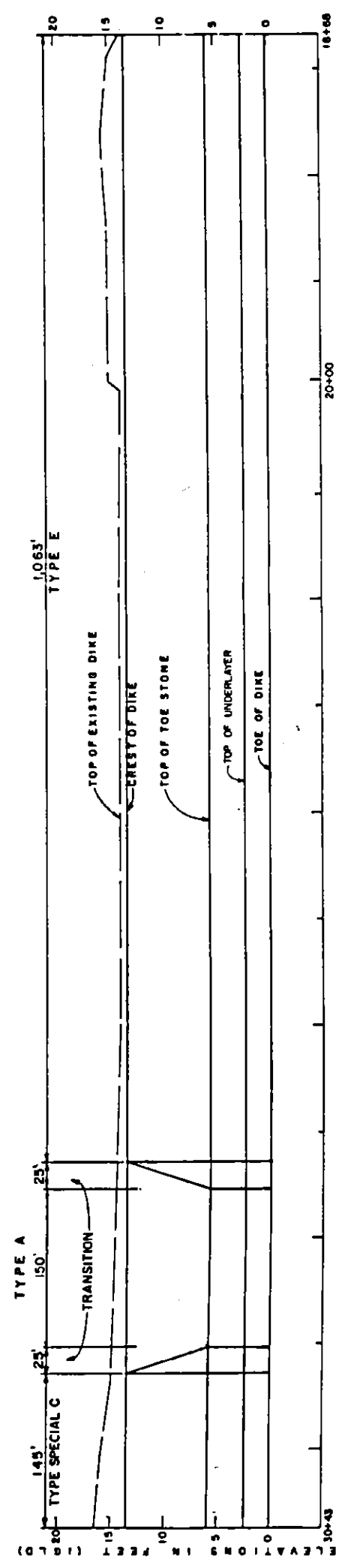
SUBMITTED BY: <i>[Signature]</i>		APPROVED BY: <i>[Signature]</i>	
DATE: 11-20-70		SCALE: AS SHOWN	
U.S. ARMY ENGINEER DISTRICT, BUFFALO CORPS OF ENGINEERS BUFFALO, NEW YORK 14207			
RENO BEACH - HOWARD FARMS, OHIO LAKESHORE DIKE			
PLAN AND PROFILE STA. 30+43 TO STA. 44+35			
DRAWING NUMBER 66-REP-1/10		SHEET NO. 01 OF 05	





PLAN  
SCALE OF FEET  
1" = 40'

NOTES:  
1. FOR GENERAL NOTES SEE SHEET 2  
2. EXISTING CROSS SECTIONS OF THE LAKESHORE DIKE ARE SHOWN ON SHEET 10.



DISTANCE IN FEET

PROFILE



AS CONSTRUCTED APPROVED

U.S. ARMY ENGINEER DISTRICT, BUFFALO  
CORPS OF ENGINEERS  
BUFFALO, NEW YORK 14207

REMO BEACH - HOWARD FARMS, OHIO  
LAKESHORE DIKE

PLAN AND PROFILE  
STA. 16+68 TO STA. 30+43

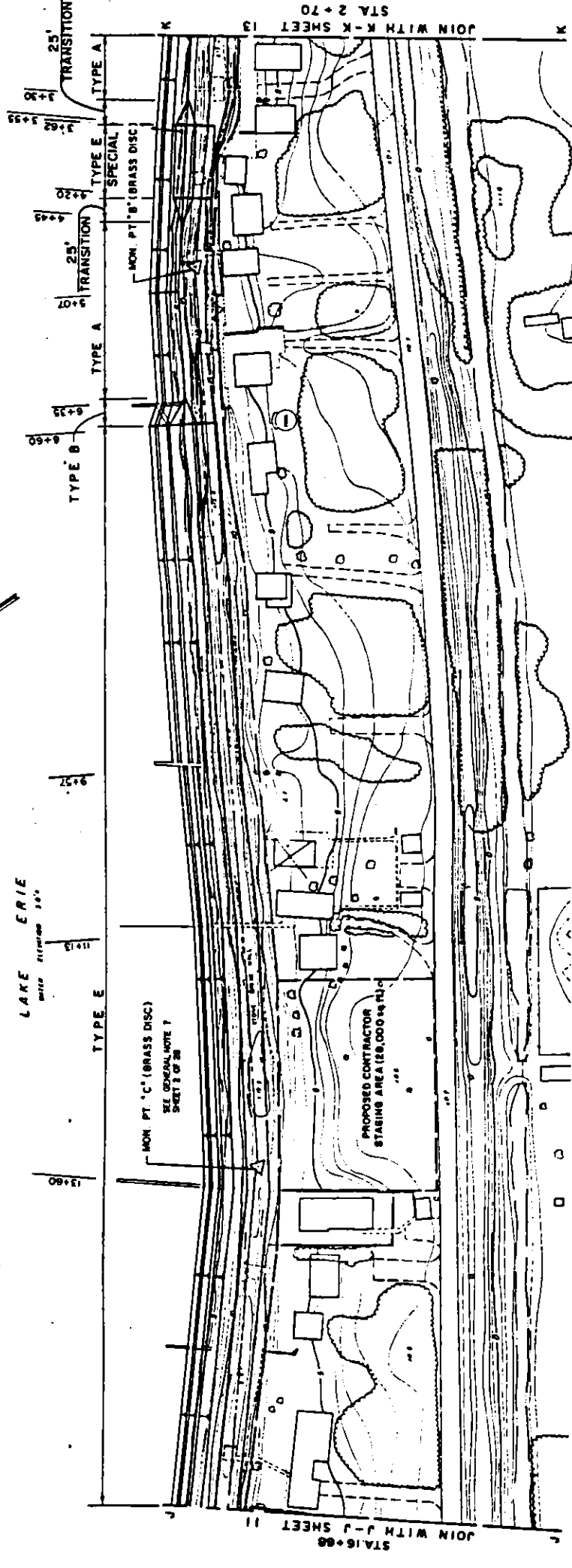
U.S. ARMY ENGINEER DISTRICT, BUFFALO  
CORPS OF ENGINEERS  
BUFFALO, NEW YORK 14207

DESIGNED BY: [Signature]  
CHECKED BY: [Signature]  
DATE: [Signature]

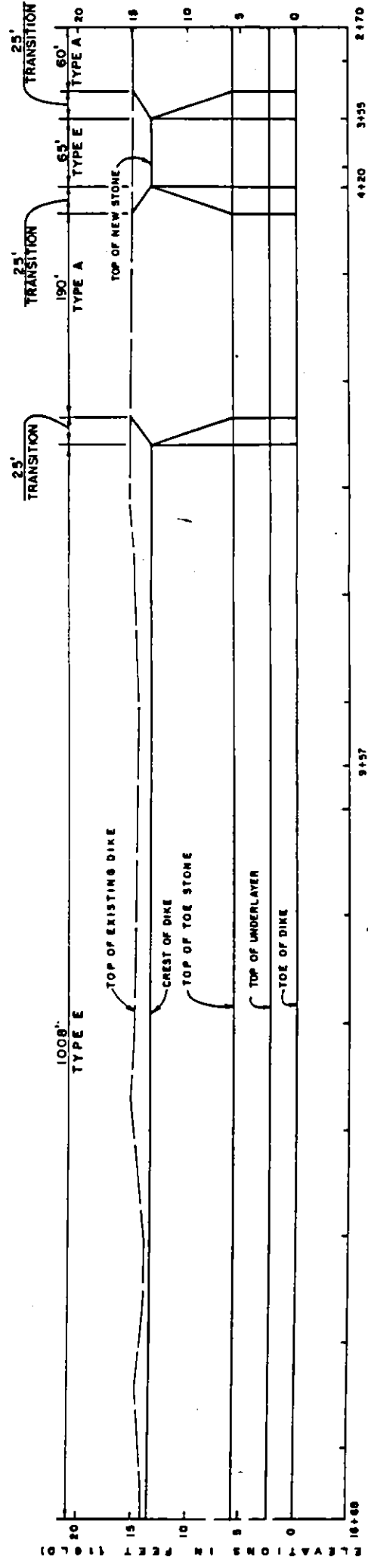
NO. SHEET 4 OF 5 SHEETS

DRAWING NUMBER  
88-RBP-1/11

SHEET 4 OF 5



PLAN  
SCALE OF FEET  
0 10 20 30 40 50 60 70 80 90 100



DISTANCE IN FEET

PROFILE



NOTES:  
1. FOR GENERAL NOTES, SEE SHEET 2  
2. EXISTING CROSS SECTIONS OF THE LAKESHORE DIKE ARE SHOWN ON SHEET 16.

SUPPLIED: **AS CONSTRUCTED**

APPROVED: *[Signature]*

U.S. ARMY ENGINEER DISTRICT, BUFFALO  
CORPS OF ENGINEERS  
BUFFALO, NEW YORK 14207

RENO BEACH - HOWARD FARMS, OHIO  
LAKESHORE DIKE

PLAN AND PROFILE  
STA 2+70 TO STA. 16+68

DATE AS SHOWN: 11-30-70

DRAWING NUMBER: 86-RBP-1712

SHEET 12 OF 20

**SURVEY BASE LINE DATA (SEE NOTE 3)**

MONUMENT POINT	STA FROM	COORDINATES		LINE	BEARING	DISTANCE (feet)
		NORTH	EAST			
LAKESHORE DIKE						
L-1	150+87.42	733,378.19	1,785,952.08	L-1 to 0	S88-28-32.7E	88.0
0	149+99.42	733,339.064	1,786,022.778	0 to M	S48-18-32.7E	1,351.68
M	131+47.84	731,540.124	1,787,981.488	M to N	S48-18-32.7E	2,350.84
N	108+27.04	730,131.733	1,790,326.787	N to L	S52-00-58.5E	1,870.16
L	81+58.84	728,187.408	1,793,908.282	L to K	S55-34-00.8E	602.03
K	85+54.81	728,813.884	1,791,076.480	K to J	S51-39-53.1E	402.03
J	82+54.54	728,708.281	1,791,088.075	J to I	S52-44-37.7E	350.37
I	72+54.83	728,333.857	1,792,133.808	I to Deck	S52-09-24.7E	956.91
Deck	64+48.88	727,770.788	1,792,870.534	Deck to H	S55-09-28.6E	808.95
H	62+28.14	727,517.128	1,792,889.811	H to G	S37-10-20.4E	248.74
G	48+28.44	726,737.239	1,794,123.848	G to F	S54-44-01.8E	1,413.86
F	42+28.58	726,364.231	1,794,508.453	F to E	S54-44-01.8E	348.84
E	30+48.87	725,603.607	1,794,773.870	E to D	S51-49-37.0E	1,300.71
D	28+21.81	725,891.161	1,794,880.421	D to C	S48-04-38.0E	1,481.81
C	13+29.80	724,701.128	1,794,782.848	C to B	S56-30-00.7E	850.32
B	4+89.48	724,231.813	1,797,482.074	B to A	S48-34-32.4E	489.48
A	0+00	723,814.413	1,797,884.847	A to Synchro	S78-39-02.1E	518.25
WARDS CANAL LEVEE						
E-1	-1+12	723,827.26	1,797,835.72	A to E-1	S38-23-32E	112.0
E-2	-3+12	723,848.12	1,797,825.89	E-1 to E-2	S78-39-28W	200.0
L-37	-4+58	723,558.80	1,797,750.01	E-2 to L-37	S52-05-28W	147.0
L-38	-10+63	723,281.71	1,797,666.08	L-37 to L-38	S64-38-28W	824.0
L-39	-18+63	722,907.68	1,794,374.29	L-38 to L-39	S84-07-28W	800.0
L-34	-25+40	723,817.28	1,795,878.83	L-39 to L-34	S58-12-28W	377.0
L-33	-48+80	721,435.76	1,794,878.08	L-34 to L-33	S54-48-28W	2,150.0
L-32				L-33 to L-32	S57-33-28W	
COOLEY CANAL DIKE						
L-1	150+87.42	733,378.19	1,785,952.08	0 to L-1	S68-28-32E	88.0
L-2	152+98.42	733,339.064	1,786,022.778	L-1 to L-2	S48-18-32E	1,351.68
L-3	131+47.84	731,540.124	1,787,981.488	L-2 to L-3	S48-18-32E	2,350.84
L-4	108+27.04	730,131.733	1,790,326.787	L-3 to L-4	S52-00-58.5E	1,870.16
L-5	81+58.84	728,187.408	1,793,908.282	L-4 to L-5	S55-34-00.8E	602.03
L-6	85+54.81	728,813.884	1,791,076.480	L-5 to L-6	S51-39-53.1E	402.03
L-7	82+54.54	728,708.281	1,791,088.075	L-6 to L-7	S52-44-37.7E	350.37
L-8	72+54.83	728,333.857	1,792,133.808	L-7 to Deck	S52-09-24.7E	956.91
L-9	64+48.88	727,770.788	1,792,870.534	Deck to H	S55-09-28.6E	808.95
L-10	62+28.14	727,517.128	1,792,889.811	H to G	S37-10-20.4E	248.74
L-11	48+28.44	726,737.239	1,794,123.848	G to F	S54-44-01.8E	348.84
L-12	42+28.58	726,364.231	1,794,508.453	F to E	S54-44-01.8E	348.84
L-13	30+48.87	725,603.607	1,794,773.870	E to D	S51-49-37.0E	1,300.71
L-14	28+21.81	725,891.161	1,794,880.421	D to C	S48-04-38.0E	1,481.81
L-15	13+29.80	724,701.128	1,794,782.848	C to B	S56-30-00.7E	850.32
L-16	4+89.48	724,231.813	1,797,482.074	B to A	S48-34-32.4E	489.48
L-17	0+00	723,814.413	1,797,884.847	A to Synchro	S78-39-02.1E	518.25

**WARDS CANAL LEVEE**

MONUMENT POINT	STA FROM	COORDINATES	LINE	BEARING	DISTANCE (feet)
E-1	-1+12	723,827.26	A to E-1	S38-23-32E	112.0
E-2	-3+12	723,848.12	E-1 to E-2	S78-39-28W	200.0
L-37	-4+58	723,558.80	E-2 to L-37	S52-05-28W	147.0
L-38	-10+63	723,281.71	L-37 to L-38	S64-38-28W	824.0
L-39	-18+63	722,907.68	L-38 to L-39	S84-07-28W	800.0
L-34	-25+40	723,817.28	L-39 to L-34	S58-12-28W	377.0
L-33	-48+80	721,435.76	L-34 to L-33	S54-48-28W	2,150.0
L-32			L-33 to L-32	S57-33-28W	

**COOLEY CANAL DIKE**

MONUMENT POINT	STA FROM	COORDINATES	LINE	BEARING	DISTANCE (feet)
L-1	150+87.42	733,378.19	0 to L-1	S68-28-32E	88.0
L-2	152+98.42	733,339.064	L-1 to L-2	S48-18-32E	1,351.68
L-3	131+47.84	731,540.124	L-2 to L-3	S48-18-32E	2,350.84
L-4	108+27.04	730,131.733	L-3 to L-4	S52-00-58.5E	1,870.16
L-5	81+58.84	728,187.408	L-4 to L-5	S55-34-00.8E	602.03
L-6	85+54.81	728,813.884	L-5 to L-6	S51-39-53.1E	402.03
L-7	82+54.54	728,708.281	L-6 to L-7	S52-44-37.7E	350.37
L-8	72+54.83	728,333.857	L-7 to Deck	S52-09-24.7E	956.91
L-9	64+48.88	727,770.788	Deck to H	S55-09-28.6E	808.95
L-10	62+28.14	727,517.128	H to G	S37-10-20.4E	248.74
L-11	48+28.44	726,737.239	G to F	S54-44-01.8E	348.84
L-12	42+28.58	726,364.231	F to E	S54-44-01.8E	348.84
L-13	30+48.87	725,603.607	E to D	S51-49-37.0E	1,300.71
L-14	28+21.81	725,891.161	D to C	S48-04-38.0E	1,481.81
L-15	13+29.80	724,701.128	C to B	S56-30-00.7E	850.32
L-16	4+89.48	724,231.813	B to A	S48-34-32.4E	489.48
L-17	0+00	723,814.413	A to Synchro	S78-39-02.1E	518.25

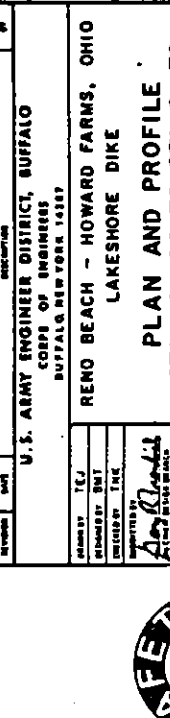
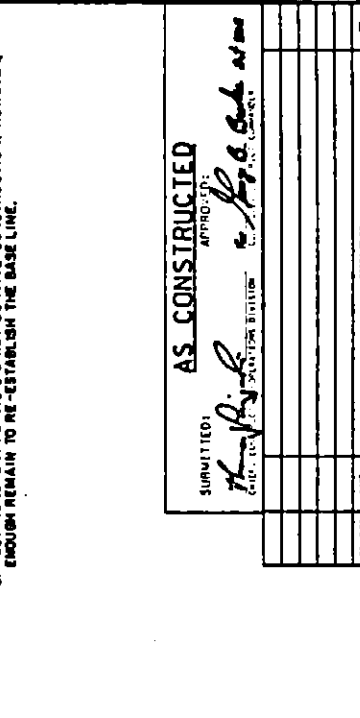
**BENCH MARKS**

- B.M. 575.78 (USGS) LOCATED ONE (1.0) MILE WEST OF YONKOTA ROAD ALONG FERRISER ROAD. THENCE 2.5 MILES NORTH ALONG CEDAR ROAD; BETWEEN SECTIONS 28 AND 27, T.8S., R.10E.; 25 FEET NORTH OF CENTERLINE OF CEDAR POINT ROAD, 8 FEET WEST OF DITCH IN FILL FILLED WITH CONCRETE, LUCAS COUNTY STANDARDS DISK NOT STAMPED, I.G.D. - USGS - 1.40 FEET.
- T.B.M. BOLT 574.2 (OLD) TOP OF BOLT ON WALL AT ENTRANCE TO WARDS CANAL.

**NOTES:**

- FOR GENERAL NOTES, SEE SHEET 2
- EXISTING CROSS SECTIONS OF THE LAKESHORE DIKE ARE SHOWN ON SHEET 18.
- MOST MONUMENT POINTS DID NOT SURVIVE CONSTRUCTION, HOWEVER, ENOUGH REMAIN TO RE-ESTABLISH THE BASE LINE.

**PLAN**  
SCALE OF FEET  
0 20 40 60 80 100



**AS CONSTRUCTED**

APPROVED BY: *[Signature]*

U.S. ARMY ENGINEER DISTRICT, BUFFALO  
CORPS OF ENGINEERS  
BUFFALO, NEW YORK 14207

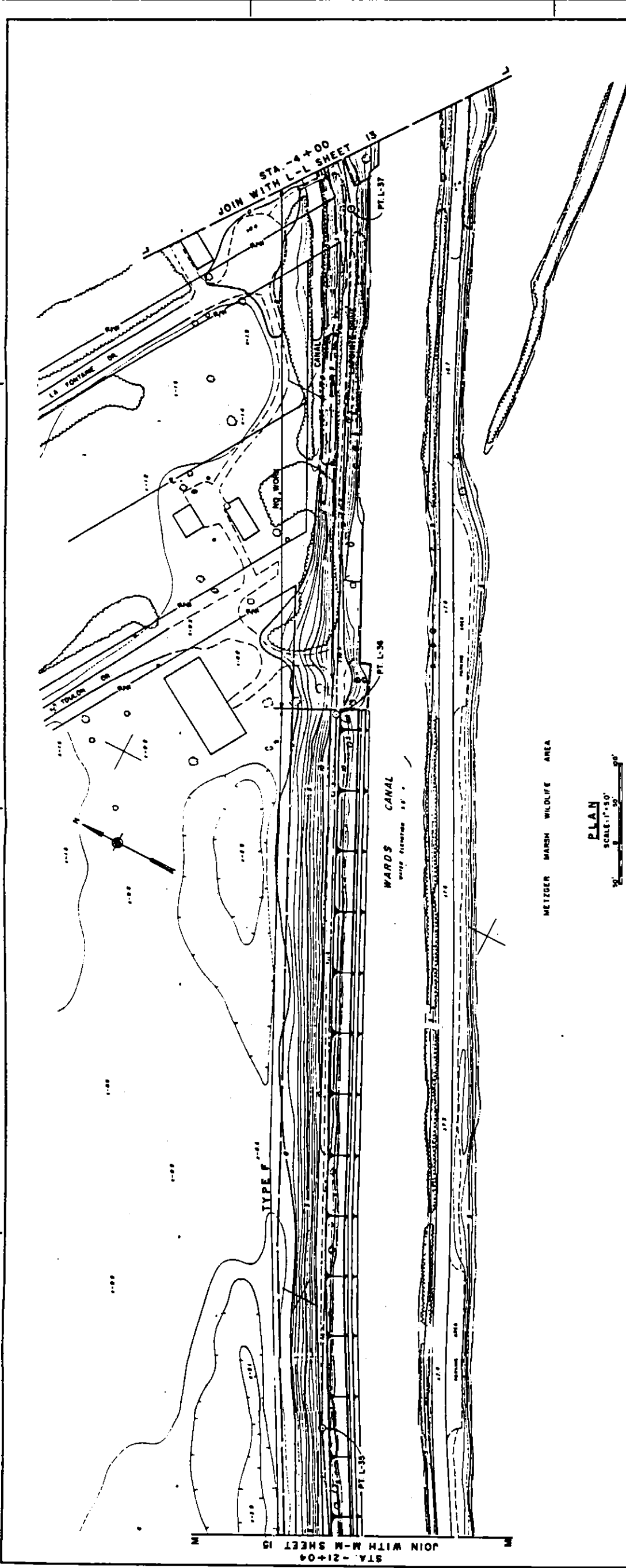
RENO BEACH - HOWARD FARMS, OHIO  
LAKESHORE DIKE

**PLAN AND PROFILE**  
STA - 4 + 00 TO STA. 2 + 70

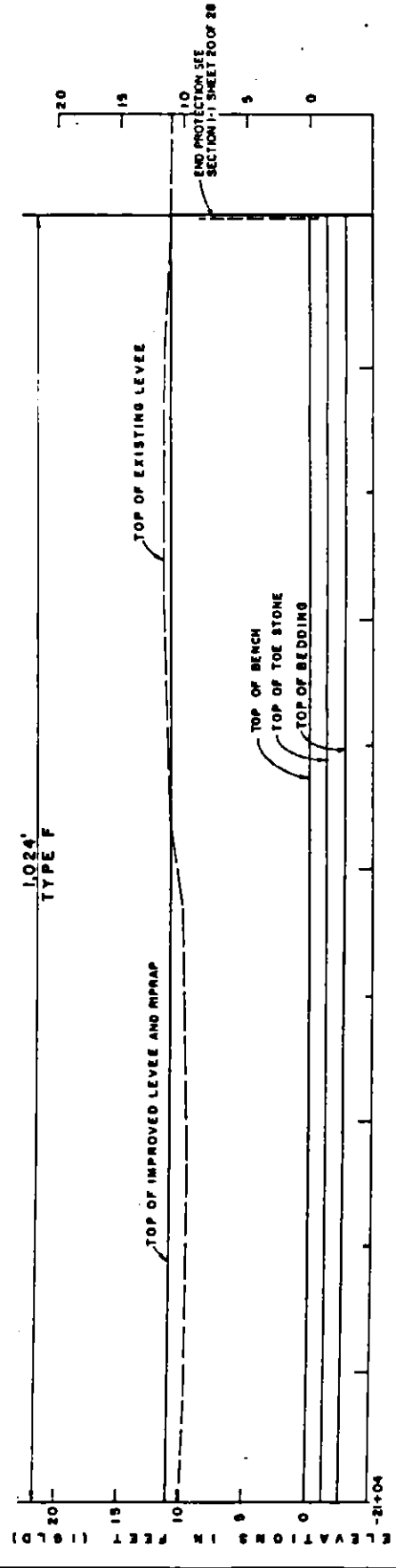
DATE: 11.20.13

FILE NUMBER: JPA/RENO/68RPH13  
DRAWING NUMBER: 66-RBP-17/3  
SHEET 13 OF 28





NOTES:  
 1. FOR GENERAL NOTES, SEE SHEET E  
 2. CROSS SECTIONS OF THE WARDS CANAL LEVEE ARE SHOWN ON SHEET 20.



**AS CONSTRUCTED**

APPROVED: *[Signature]*  
 SUBMITTED: *[Signature]*

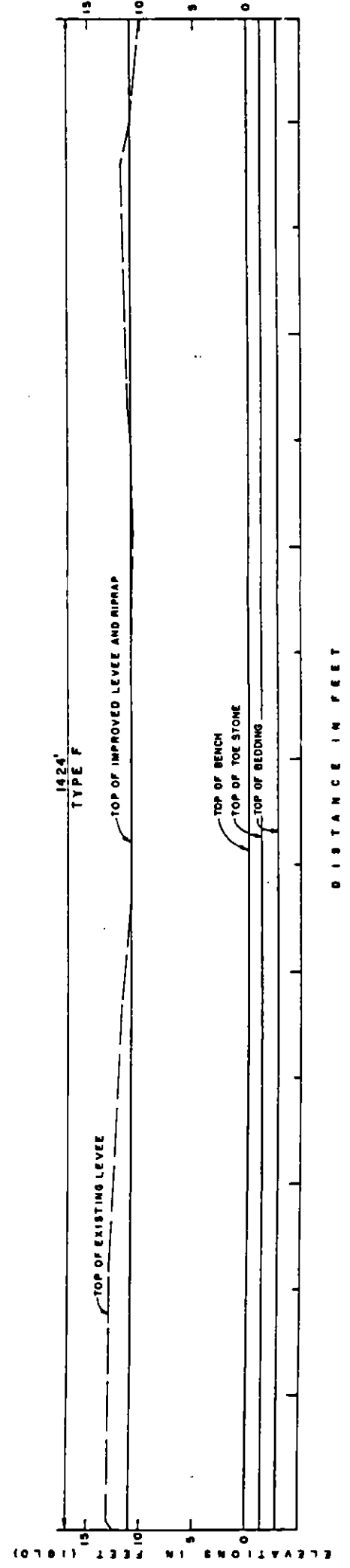
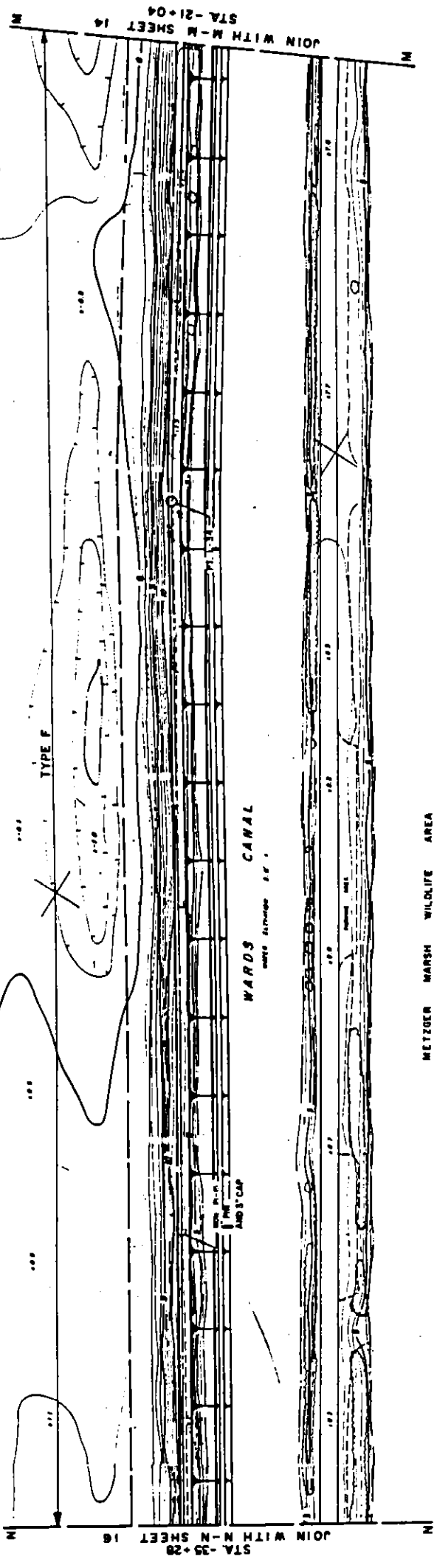
U.S. ARMY ENGINEER DISTRICT, BUFFALO  
 CORPS OF ENGINEERS  
 BUFFALO DISTRICT (2201)

RENO BEACH - HOWARD FARMS, OHIO  
 WARDS CANAL LEVEE

PLAN AND PROFILE  
 STA. 4+00 TO STA. -21+04

DATE: 11/24/10  
 SHEET NO. 11 OF 10

DRAWING NUMBER: 86-RBP-1/14  
 SHEET 10 OF 20



NOTES:

- FOR GENERAL NOTES, SEE SHEET 2
- CROSS SECTIONS OF THE WARDS CANAL LEVEE ARE SHOWN ON SHEET 20.

AS CONSTRUCTED

APPROVED

U.S. ARMY ENGINEER DISTRICT, BUFFALO

CORPS OF ENGINEERS

BUFFALO, NEW YORK 14207

RENO BEACH - HOWARD FARMS, OHIO

WARDS CANAL LEVEE

PLAN AND PROFILE

STA-21+04 TO STA.-35+28

DATE: 11.20.49

BY: [Signature]

U.S. ARMY ENGINEER DISTRICT, BUFFALO

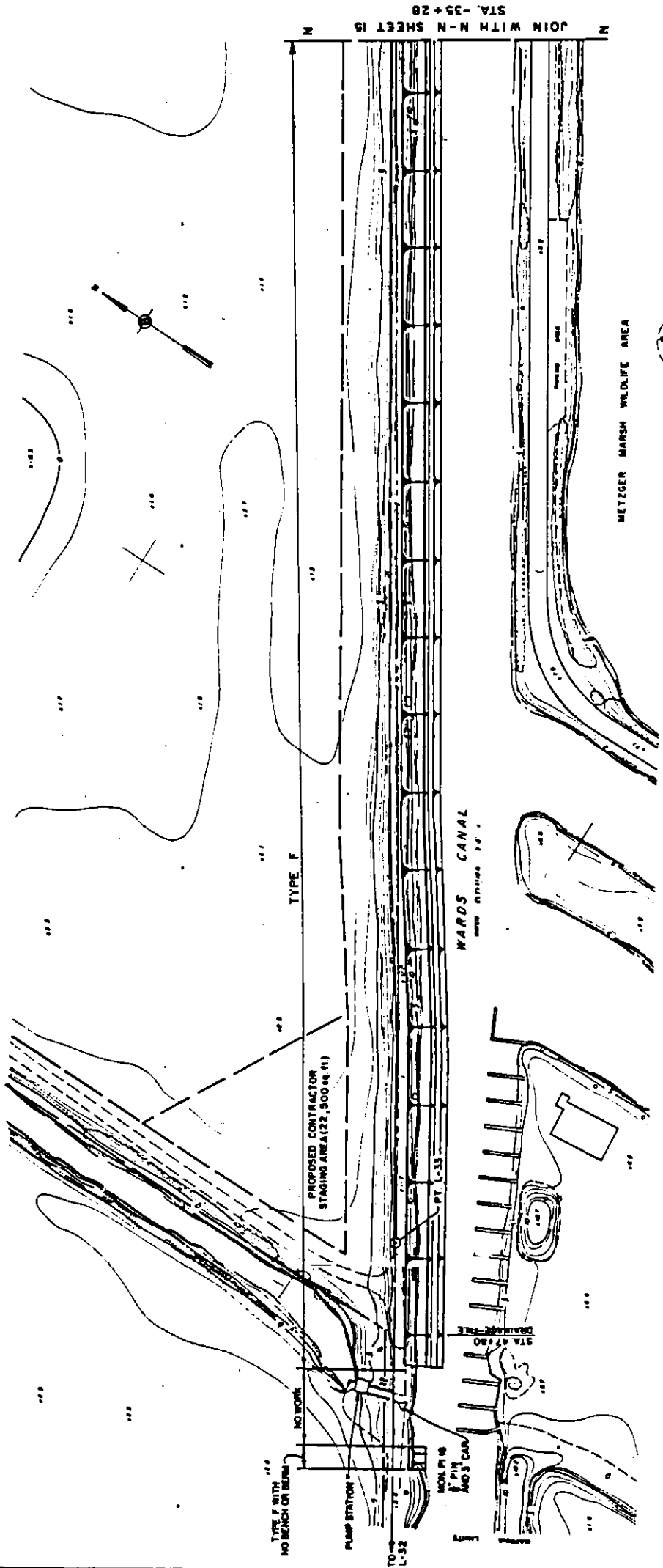
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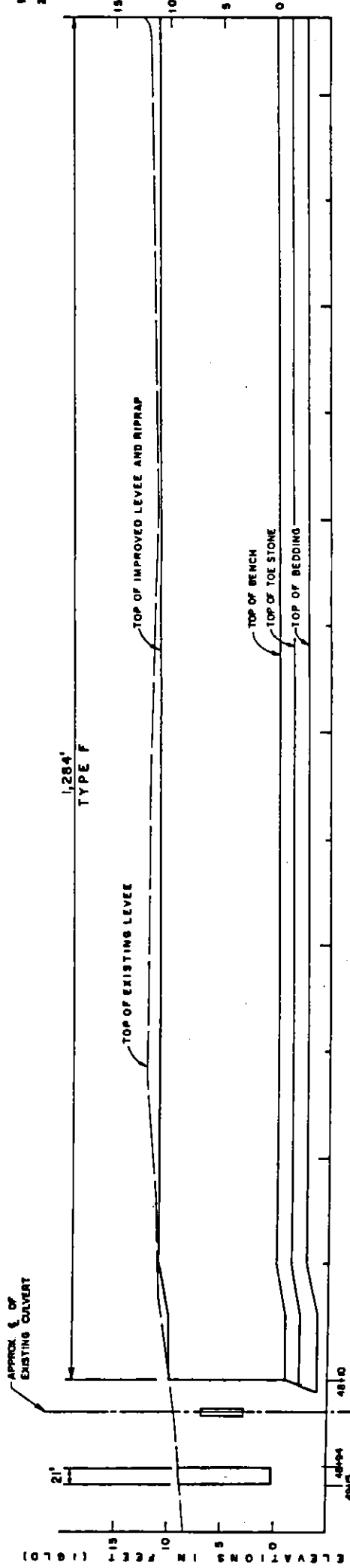
86-RBP-1/15

SHEET 15 OF 20





PLAN  
SCALE OF FEET  
1" = 30'



- NOTES:
1. FOR GENERAL NOTES, SEE SHEET 2
  2. CROSS SECTIONS OF THE WARDS CANAL LEVEE ARE SHOWN ON SHEET 20.

SUBMITTED: <i>[Signature]</i>		AS CONSTRUCTED	
APPROVED: <i>[Signature]</i>		APPROVED: <i>[Signature]</i>	
U.S. ARMY ENGINEER DISTRICT, BUFFALO CORPS OF ENGINEERS BUFFALO, NEW YORK 14207			
DESIGNED BY: TEL	CHECKED BY: THE	DATE: 11.20.41	BY:
RENO BEACH - HOWARD FARMS, OHIO WARDS CANAL LEVEE PLAN AND PROFILE STA. 35+28 TO STA. 49+15			
DRAWING NUMBER 66-RBP-1/16		SHEET 16 OF 23	

STONE SIZES	
TYPE	RANGE
A	TOP STONE, 2-4 TONS OR GREATER, EXISTING MATERIAL FROM DIKE ON SITE
B	FORESLOPE ARMOR STONE, 1-3 TONS, EXISTING MATERIAL FROM DIKE ON SITE, ADDITIONAL MATERIAL TO BE ORDERED LATER THICKNESS USING RELATIONS & STONE TO BE 85 FEET
C	FORESLOPE ARMOR STONE, 1-2 TONS, EXISTING MATERIAL FROM DIKE ON SITE, (FORESLOPE ARMOR STONE FOR COOLEY CANAL)
D	UNDERLAYER 65-270
E	IMPERVIOUS CORE
F	WRAP STONE, 1-84 LBS. (17' MAX)
G	BEDDING STONE, #100-4 BREVE
H	RANDOM FILL

NEW TYPE "B" STONE DIMENSIONS			
SPECIFIC GRAVITY	WEIGHT IN TONS	LAYER THICKNESS FT.	DEPTH
2.60 TO 2.80	2.8	4.0	14.0
2.81 TO 2.90	1.4	2.1	8.5
2.91 TO 2.99	1.0	2.8	4.7
EXIST. STONE			10.0

**NOTE:**

- ELEVATIONS ARE IN FEET AND ARE REFERRED TO LOW WATER DAM ELEVATION 506.5 FEET ABOVE MEAN SEA LEVEL AT THEIR POINT, QUENCH, INTERNAL-TIONAL, GREAT LAKES ON JAN. 15, 1939.
- DEPTH OF EXCAVATION FOR CORE MATERIAL VARIES DEPENDING ON LOCATION OF RECONSTRUCTIVE WORK. RECONSTRUCTIVE WORK SHALL BE USED IN THE AREA FROM STA. 30+00 TO STA. 30+100. RECONSTRUCTIVE WORK SHALL BE USED IN THE AREA FROM STA. 30+100 TO STA. 30+125. RECONSTRUCTIVE WORK SHALL BE USED IN THE AREA FROM STA. 30+125 TO STA. 30+150. RECONSTRUCTIVE WORK SHALL BE USED IN THE AREA FROM STA. 30+150 TO STA. 30+175. RECONSTRUCTIVE WORK SHALL BE USED IN THE AREA FROM STA. 30+175 TO STA. 30+200. RECONSTRUCTIVE WORK SHALL BE USED IN THE AREA FROM STA. 30+200 TO STA. 30+225. RECONSTRUCTIVE WORK SHALL BE USED IN THE AREA FROM STA. 30+225 TO STA. 30+250. RECONSTRUCTIVE WORK SHALL BE USED IN THE AREA FROM STA. 30+250 TO STA. 30+275. RECONSTRUCTIVE WORK SHALL BE USED IN THE AREA FROM STA. 30+275 TO STA. 30+300. RECONSTRUCTIVE WORK SHALL BE USED IN THE AREA FROM STA. 30+300 TO STA. 30+325. RECONSTRUCTIVE WORK SHALL BE USED IN THE AREA FROM STA. 30+325 TO STA. 30+350. RECONSTRUCTIVE WORK SHALL BE USED IN THE AREA FROM STA. 30+350 TO STA. 30+375. RECONSTRUCTIVE WORK SHALL BE USED IN THE AREA FROM STA. 30+375 TO STA. 30+400. RECONSTRUCTIVE WORK SHALL BE USED IN THE AREA FROM STA. 30+400 TO STA. 30+425. RECONSTRUCTIVE WORK SHALL BE USED IN THE AREA FROM STA. 30+425 TO STA. 30+450. RECONSTRUCTIVE WORK SHALL BE USED IN THE AREA FROM STA. 30+450 TO STA. 30+475. RECONSTRUCTIVE WORK SHALL BE USED IN THE AREA FROM STA. 30+475 TO STA. 30+500. RECONSTRUCTIVE WORK SHALL BE USED IN THE AREA FROM STA. 30+500 TO STA. 30+525. RECONSTRUCTIVE WORK SHALL BE USED IN THE AREA FROM STA. 30+525 TO STA. 30+550. RECONSTRUCTIVE WORK SHALL BE USED IN THE AREA FROM STA. 30+550 TO STA. 30+575. RECONSTRUCTIVE WORK SHALL BE USED IN THE AREA FROM STA. 30+575 TO STA. 30+600. RECONSTRUCTIVE WORK SHALL BE USED IN THE AREA FROM STA. 30+600 TO STA. 30+625. RECONSTRUCTIVE WORK SHALL BE USED IN THE AREA FROM STA. 30+625 TO STA. 30+650. RECONSTRUCTIVE WORK SHALL BE USED IN THE AREA FROM STA. 30+650 TO STA. 30+675. RECONSTRUCTIVE WORK SHALL BE USED IN THE AREA FROM STA. 30+675 TO STA. 30+700. RECONSTRUCTIVE WORK SHALL BE USED IN THE AREA FROM STA. 30+700 TO STA. 30+725. RECONSTRUCTIVE WORK SHALL BE USED IN THE AREA FROM STA. 30+725 TO STA. 30+750. RECONSTRUCTIVE WORK SHALL BE USED IN THE AREA FROM STA. 30+750 TO STA. 30+775. RECONSTRUCTIVE WORK SHALL BE USED IN THE AREA FROM STA. 30+775 TO STA. 30+800. RECONSTRUCTIVE WORK SHALL BE USED IN THE AREA FROM STA. 30+800 TO STA. 30+825. RECONSTRUCTIVE WORK SHALL BE USED IN THE AREA FROM STA. 30+825 TO STA. 30+850. RECONSTRUCTIVE WORK SHALL BE USED IN THE AREA FROM STA. 30+850 TO STA. 30+875. RECONSTRUCTIVE WORK SHALL BE USED IN THE AREA FROM STA. 30+875 TO STA. 30+900. RECONSTRUCTIVE WORK SHALL BE USED IN THE AREA FROM STA. 30+900 TO STA. 30+925. RECONSTRUCTIVE WORK SHALL BE USED IN THE AREA FROM STA. 30+925 TO STA. 30+950. RECONSTRUCTIVE WORK SHALL BE USED IN THE AREA FROM STA. 30+950 TO STA. 30+975. RECONSTRUCTIVE WORK SHALL BE USED IN THE AREA FROM STA. 30+975 TO STA. 30+1000.
- MATERIAL EXCAVATED FOR THE PLACEMENT OF THE IMPERVIOUS CORE CAN BE USED AS RANDOM FILL PROVIDED IT IS OF SUITABLE QUALITY. EXCESS EXCAVATED GRANULAR CORE MATERIAL MAY BE PLACED ON EXISTING STONE OR ON THE TOP HORIZONTAL SURFACE OF THE B AND S STONE.
- THE DELINEATION OF EXISTING STONE AND EXISTING CORE REPRESENTS AN EXISTING CONDITION AND MUST NOT BE INTERPRETED AS THE ACCURATE CONDITIONS EXISTING ON SITE.
- CROSS SECTIONS OF PREPARED CONDITIONS, DATED 29 NOVEMBER 1972, ARE AVAILABLE FOR INSPECTION AT THE CORPS OF ENGINEERS TOLEDO PROJECT OFFICE.

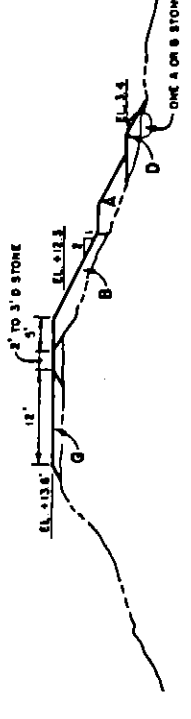
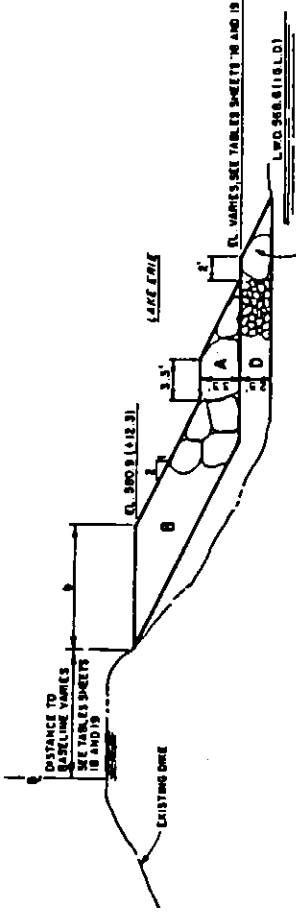
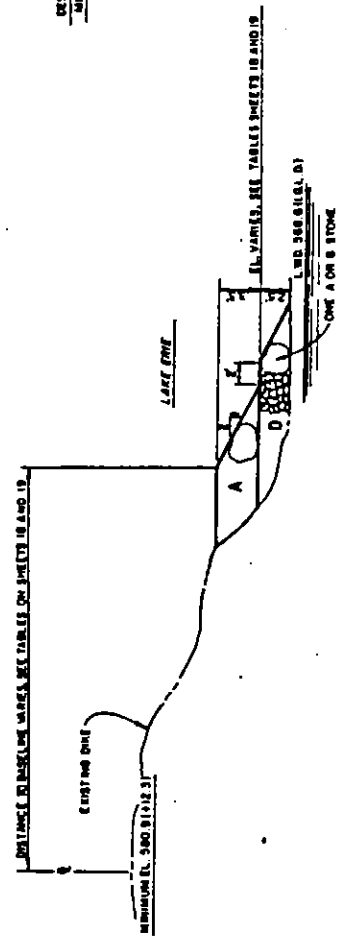
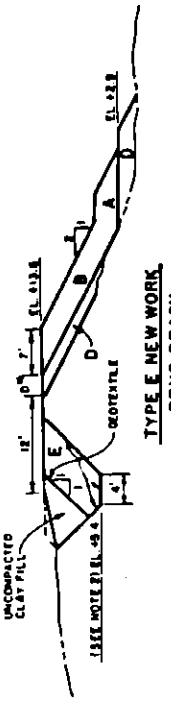
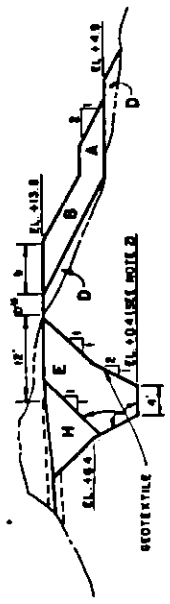
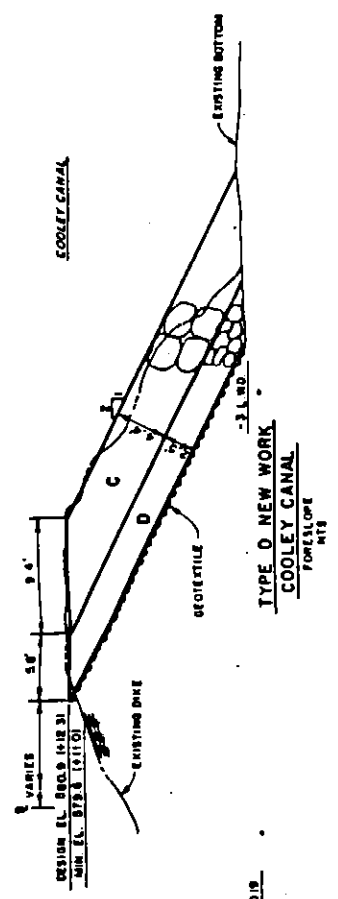
**AS CONSTRUCTED**

U.S. ARMY ENGINEER DISTRICT, BUFFALO  
CORPS OF ENGINEERS  
BUFFALO DISTRICT (223)

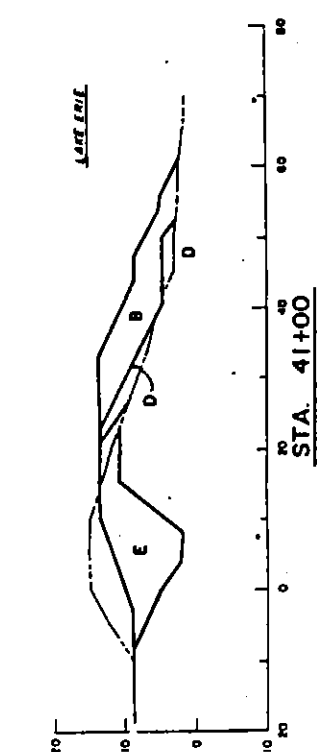
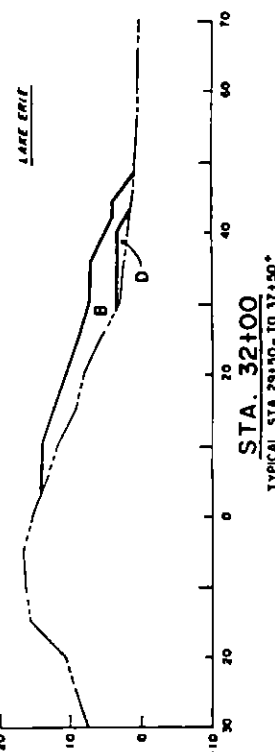
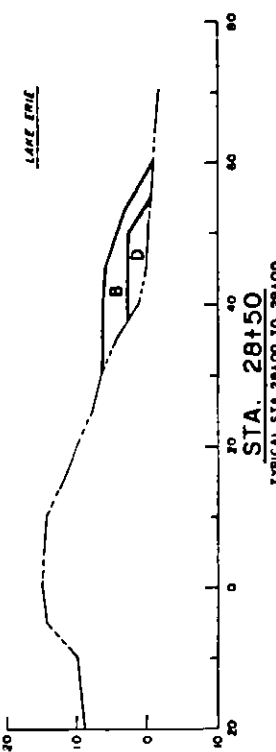
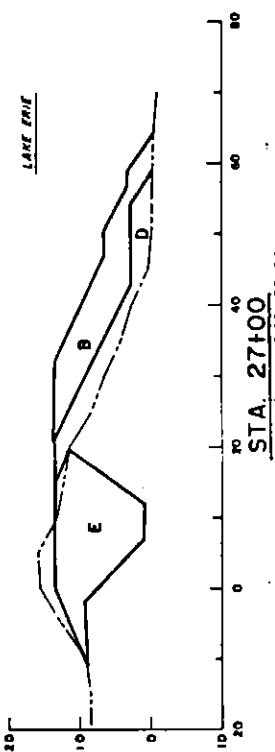
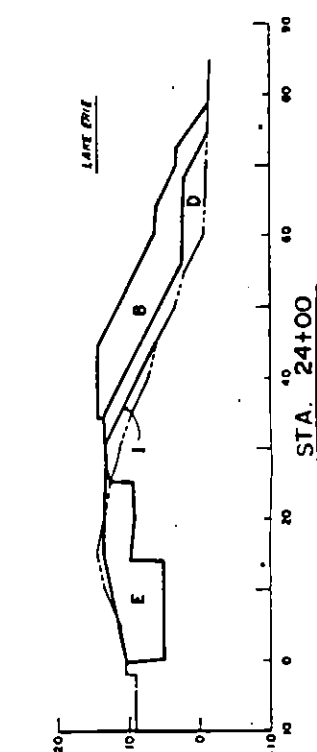
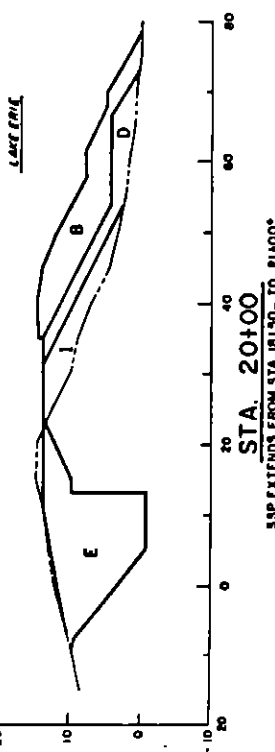
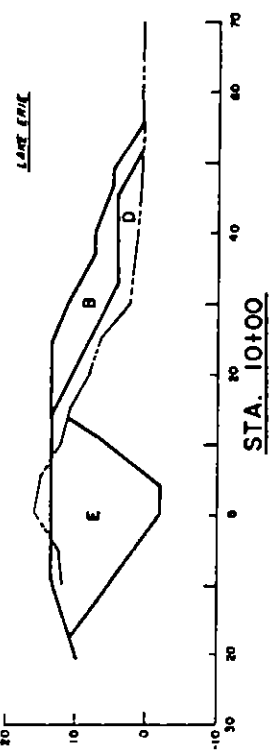
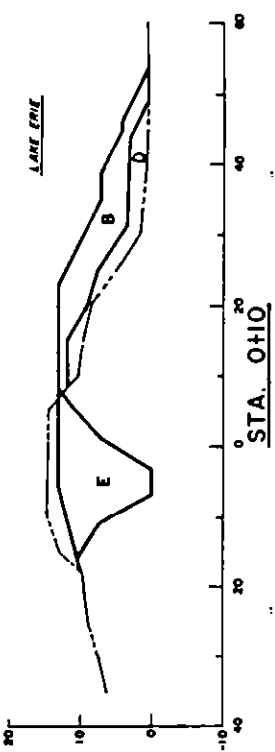
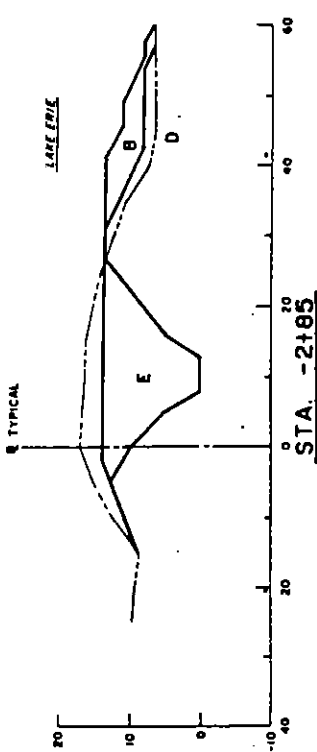
RENO BEACH - HOWARD FARMS, OHIO  
FLOOD PROTECTION

**TYPICAL CROSS SECTIONS**

DATE: JULY 12, 1972  
SCALE: 1" = 10'  
DRAWING NUMBER: 66-RBP-1/17  
SHEET 17 OF 20







**NOTES:**  
 1. ELEVATIONS ARE IN FEET AND ARE REFERRED TO LOW WATER OCEAN ELEVATION 2005. ALL ELEVATIONS ARE REFERRED TO FATHER POINT, QUEBEC, INTERNATIONAL GREAT LAKES DATUM (IGLD) 1955.  
 2. HORIZONTAL DISTANCES ARE IN FEET.  
 3. CROSS SECTIONS SHOWN ON THE DRAWINGS CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS AT THE TIME AND LOCATION THE ELEVATIONS AND SOUNDINGS WERE OBTAINED.  
 4. FOR TYPICAL CROSS SECTIONS, SEE SHEET 17.  
 5. AREAS EXCAVATED TO PERMIT CONSTRUCTION OF THE BEAMS WERE BACKFILLED TO THE EXISTING GROUND SURFACE.  
 6. PRIOR SANDSTONE WAS REMOVED TO EXTENT NECESSARY TO ALLOW SAFE RECONSTRUCTION OF THE LAKESHORE DIKE.

**AS CONSTRUCTED**

U.S. ARMY ENGINEER DISTRICT, BUFFALO  
 CORPS OF ENGINEERS  
 BUFFALO NEW YORK 14203

RENO BEACH - HOWARD FARMS, OHIO  
 LAKESHORE DIKE  
 CROSS SECTIONS  
 STA. -2+85 TO STA. 44+00

DATE: 11 JUN 1977

TO ACCOMPANY SPECIFICATIONS BRINA  
 NO. DACR 480 9 6887

DRAWING NUMBER  
 66-RBP-1/18

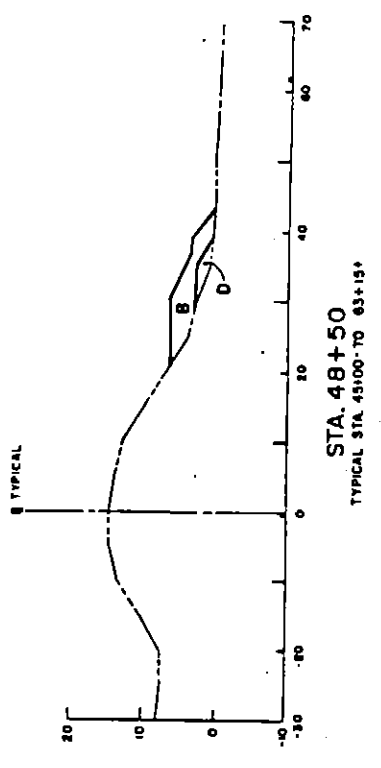
SHEET 18 OF 28



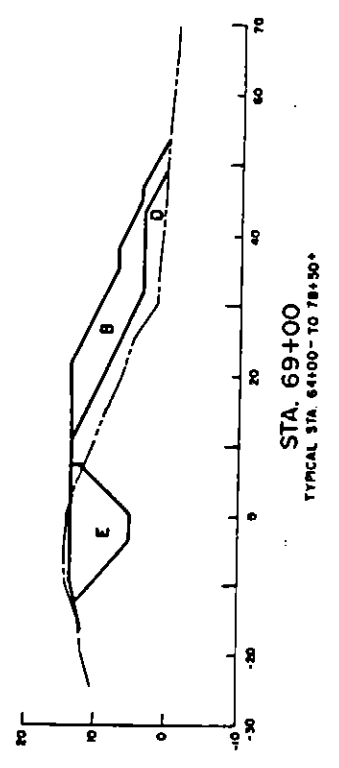
- LEGEND:**
- A TOE STONE 2-6 TON
  - B ARMOR STONE 1-3 TON
  - D UNDERLAY 100-400 LB.
  - E IMPERVIOUS CORE
  - G SECOND STONE #200-4" BEVE
  - J GEOTEXTILE
  - K TOPSOIL AND SEED
  - H RANDOM FILL
  - I STONE REMOVED FROM TRENCH

STATION	TYPE OF WORK	DISTANCE FROM BASELINE (FT.)	STATION	TYPE OF WORK	DISTANCE FROM BASELINE (FT.)	STATION	TYPE OF WORK	DISTANCE FROM BASELINE (FT.)	STATION	TYPE OF WORK	DISTANCE FROM BASELINE (FT.)	STATION	TYPE OF WORK	DISTANCE FROM BASELINE (FT.)	STATION	TYPE OF WORK	DISTANCE FROM BASELINE (FT.)
-2+50	E	28.3	21+00	E	42.3	47+00	A	31.4	74+00	E	22.5	101+00	C	16.8	127+00	E	21.0
-2+00	E	31.3	22+00	E	36.3	48+00	A	35.4	75+00	E	24.5	102+00	C	13.3	128+00	E	17.8
-1+50	E	28.3	23+00	E	46.3	49+00	A	28.4	76+00	E	28.5	103+00	C	19.0	129+00	E	46.0
-1+00	E	28.3	24+00	E	44.5	50+00	A	35.5	77+00	E	20.5	104+00	C	19.0	130+00	E	41.0
0+10	E	28.3	25+00	E	41.3	51+00	A	8.5	78+00	E	16.3	105+00	C	12.0	131+00	E	27.0
0+20	E	27.3	26+00	E	30.3	52+00	A	18.4	79+00	E	33.0	106+00	C	11.5	132+00	E	17.2
0+30	E	31.0	27+00	E	31.3	53+00	A	14.4	80+00	E	32.0	107+00	C	18.8	133+00	E	12.0
0+40	E	31.0	28+00	E	48.4	54+00	A	16.4	81+00	E	33.8	108+00	C	19.8	134+00	E	26.0
0+50	E	14.0	29+00	E	20.4	55+00	A	21.4	82+00	E	38.0	109+00	C	17.2	135+00	E	28.0
1+00	E	40.0	30+00	SPECIAL C	-12.5	56+00	A	17.4	83+00	E	44.4	110+00	C	17.2	136+00	E	38.8
1+10	E	34.0	31+00	SPECIAL C	10.8	57+00	A	23.4	84+00	E	50.2	111+00	C	17.3	137+00	E	42.0
1+20	E	25.0	32+00	SPECIAL C	8.2	58+00	A	24.4	85+00	E	32.8	112+00	C	17.0	138+00	E	48.5
1+30	E	27.7	33+00	SPECIAL C	10.0	59+00	A	21.4	86+00	E	28.0	113+00	C	24.8	139+00	E	58.2
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2+30	E	28.3	39+00	E	32.3	65+00	E	23.3	92+00	E	19.5	119+00	C	12.1	145+00	E	12.1
2+40	E	28.3	40+00	E	33.3	66+00	E	22.3	93+00	E	18.0	120+00	C	12.1	146+00	E	14.5
2+50	E	28.3	41+00	E	28.3	67+00	E	22.3	94+00	E	18.0	121+00	C	12.1	147+00	E	17.3
3+00	E	37.5	42+00	E	28.3	68+00	E	22.3	95+00	E	18.0	122+00	C	12.1	148+00	E	17.3
3+10	E	44.3	43+00	E	28.4	69+00	E	22.3	96+00	E	18.0	123+00	C	12.1	149+00	E	22.3
3+20	E	44.3	44+00	E	22.4	70+00	E	22.3	97+00	E	18.0	124+00	C	4.5	150+00	E	18.3
3+30	E	44.3	45+00	E	22.4	71+00	E	22.3	98+00	E	14.8	125+00	C	-17.8	151+00	E	29.3
3+40	E	44.3	46+00	E	22.4	72+00	E	22.3	99+00	E	14.8	126+00	C	-17.8	152+00	E	29.3

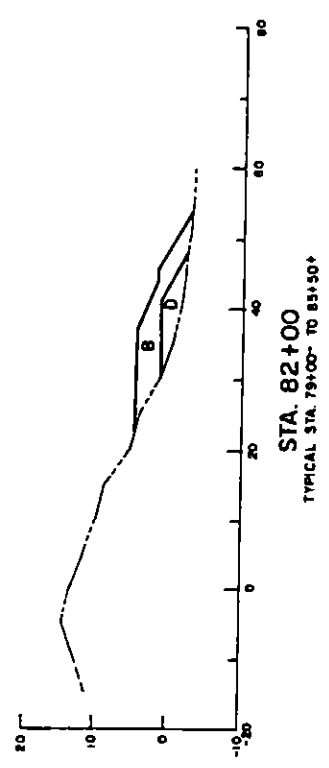
ESP EXTENDS FROM STA. 18+50 TO 21+00



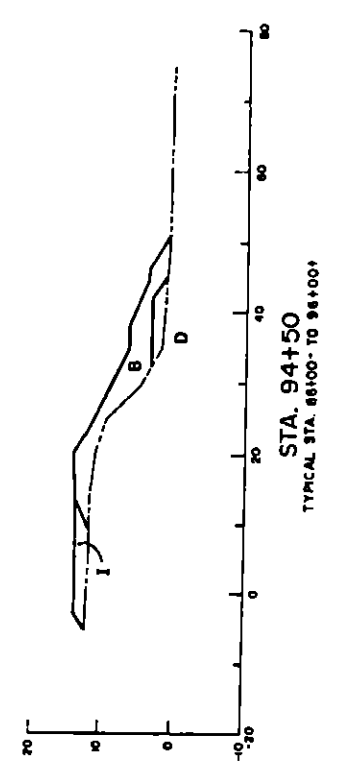
STA. 48+50  
TYPICAL STA. 43+00- TO 63+15+



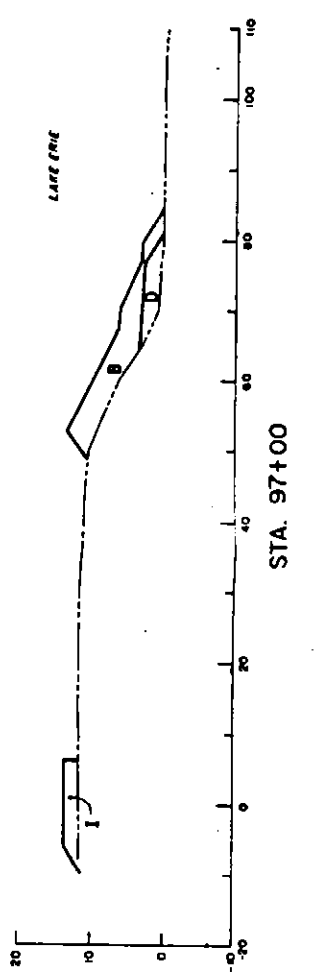
STA. 69+00  
TYPICAL STA. 64+00- TO 78+50+



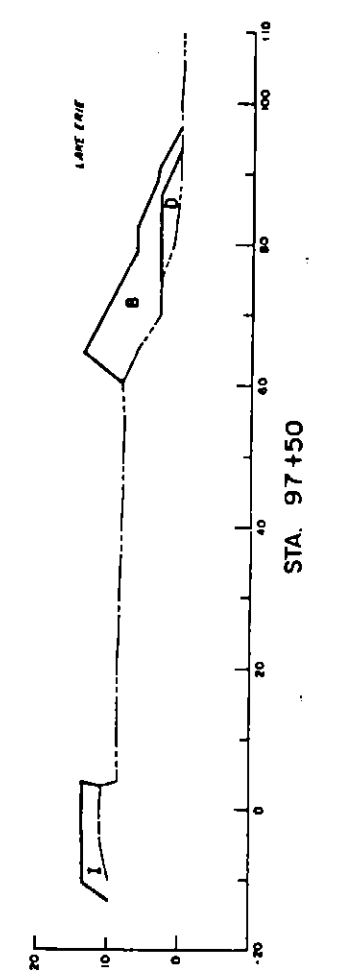
STA. 82+00  
TYPICAL STA. 79+00- TO 85+50+



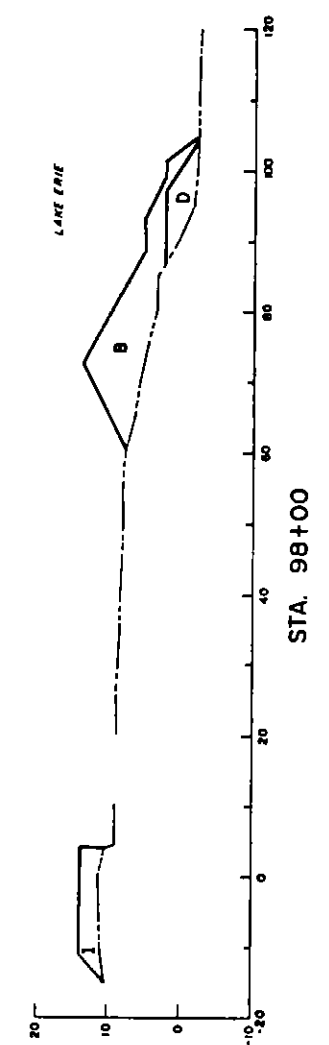
STA. 94+50  
TYPICAL STA. 88+00- TO 96+00+



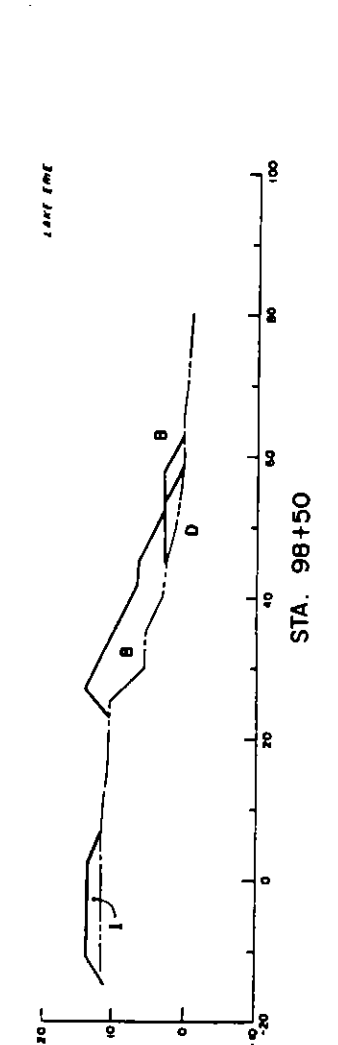
STA. 97+00



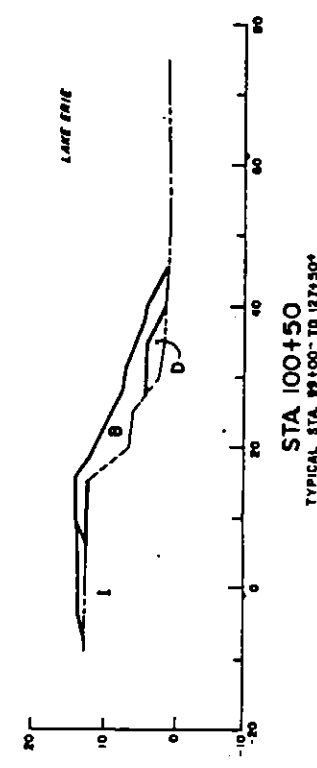
STA. 97+50



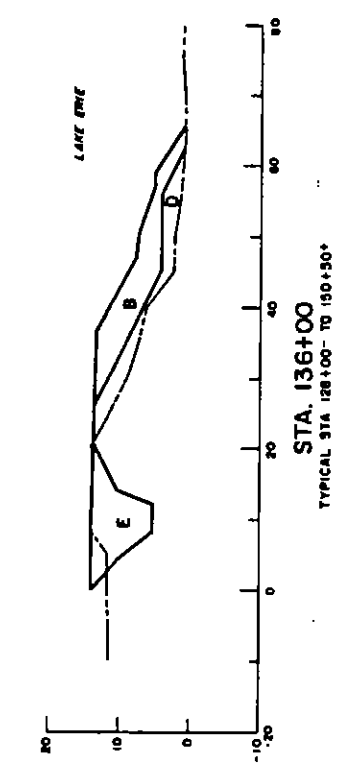
STA. 98+00



STA. 98+50



STA. 100+50  
TYPICAL STA. 89+00- TO 127+50+



STA. 136+00  
TYPICAL STA. 128+00- TO 190+50+

**NOTES:**

1. ELEVATIONS ARE IN FEET AND ARE REFERRED TO LOW WATER DATUM, ELEVATION 568.9 FEET ABOVE MEAN WATER LEVEL AT FATHER POINT, QUEBEC, INTERNATIONAL GREAT LAKES DATUM (182.0 1928).
2. HORIZONTAL DISTANCES ARE IN FEET.
3. CROSS SECTIONS SHOWN ON THE DRAWINGS CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS AT THE TIME AND LOCATION THE ELEVATIONS AND SOUNDINGS WERE OBTAINED.
4. FOR TYPICAL CROSS SECTIONS, SEE SHEET 17.
5. AREAS EXCAVATED TO PERMIT CONSTRUCTION OF THE DAMS WERE BACKFILLED TO THE EXISTING GROUND SURFACE.
6. PRIOR ARMOR STONE WAS REMOVED TO EXTENT NECESSARY TO ALLOW SAFE RECONSTRUCTION OF THE LAKE SHORE DIKE.

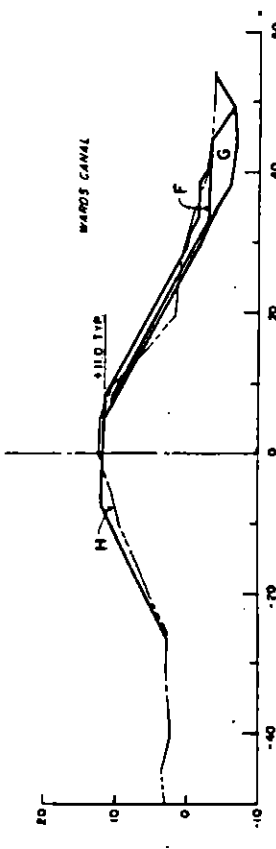
AS CONSTRUCTED

SUBMITTED BY <i>[Signature]</i>		REVISIONS	
DATE	BY	NO.	BY
U.S. ARMY ENGINEER DISTRICT, BUFFALO CORPS OF ENGINEERS BUFFALO, NEW YORK 14207			
PROJECT RENO BEACH - HOWARD FARMS, OHIO LAKESHORE DIKE		DRAWING NUMBER 86 - RBP - 1/19	
CROSS SECTIONS STA. 85+00 TO STA. 150+50		DATE JULY 98	
SCALE 1" = 10'-0"		SHEET NUMBER 19 OF 20	

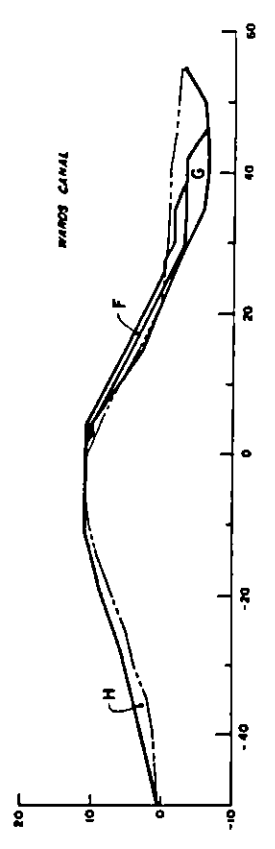


**LEGEND:**

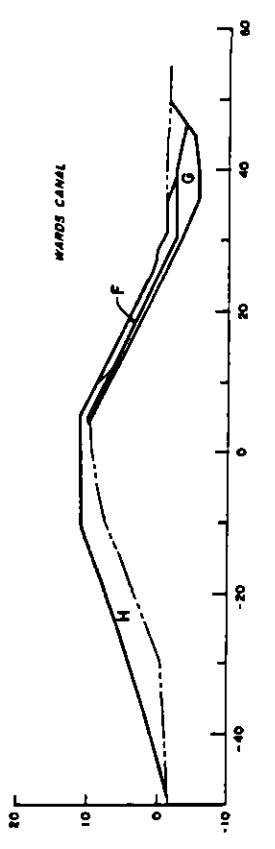
- A TIDE STONE 2-8 TON
- B ARMOR STONE 1-3 TON
- D UNDERLAYER 100-400 LBS
- E IMPERVIOUS CORE
- G SKIDGING STONE #200-4" SIEVE
- J GEOTEXTILE
- K TOPSOIL AND SEED
- H RANDOM FILL
- I STONE REMOVED FROM TRENCH



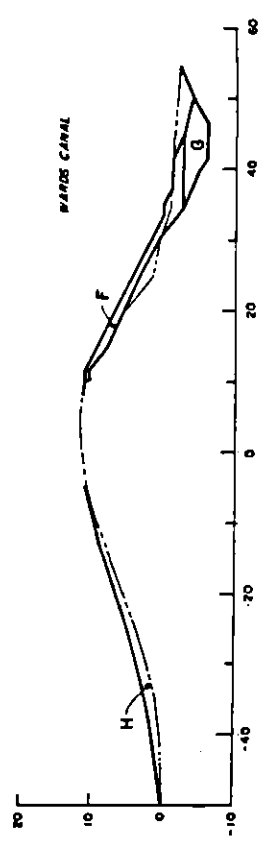
STA. -10+83



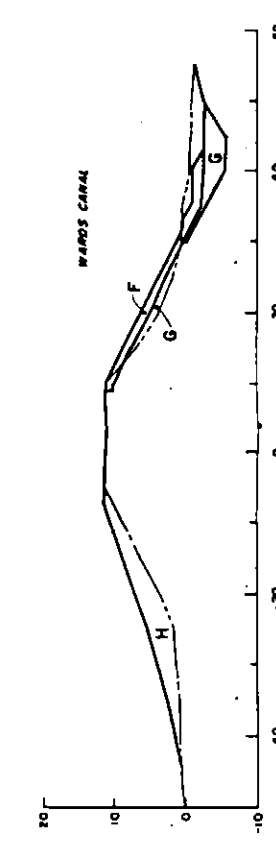
STA. -15+00



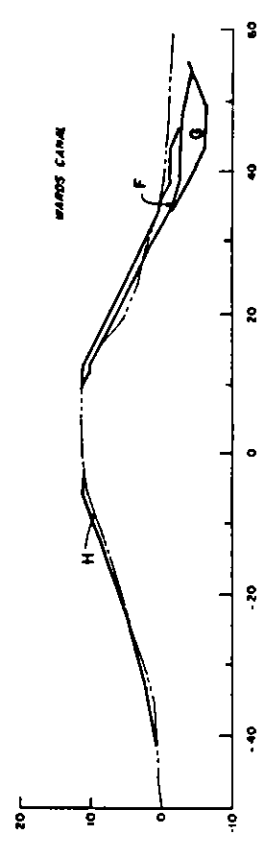
STA. -19+00



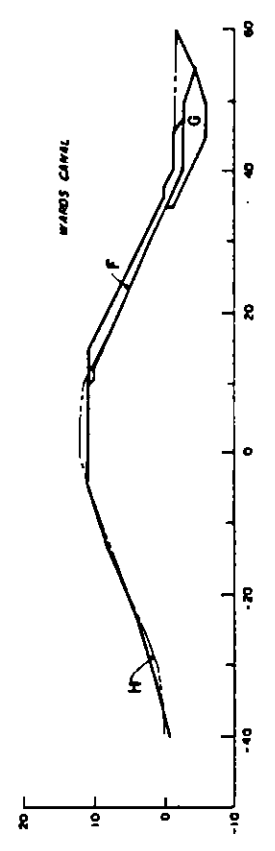
STA. -22+50



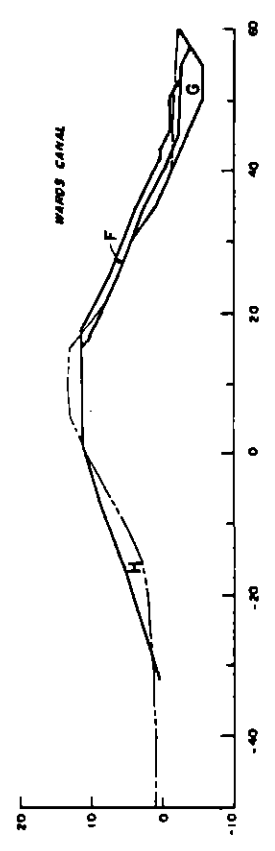
STA. -25+00



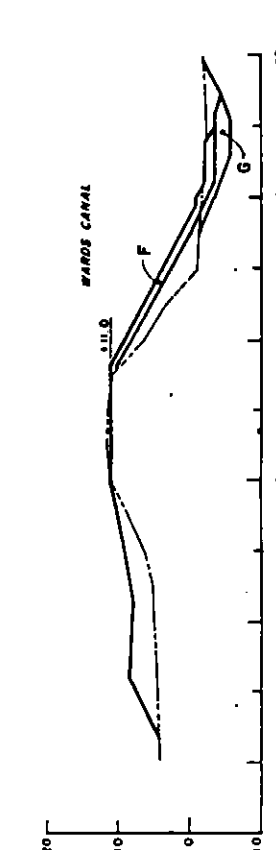
STA. -27+50



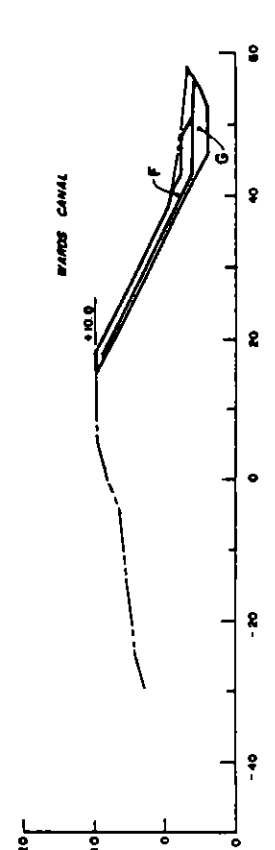
STA. -30+00



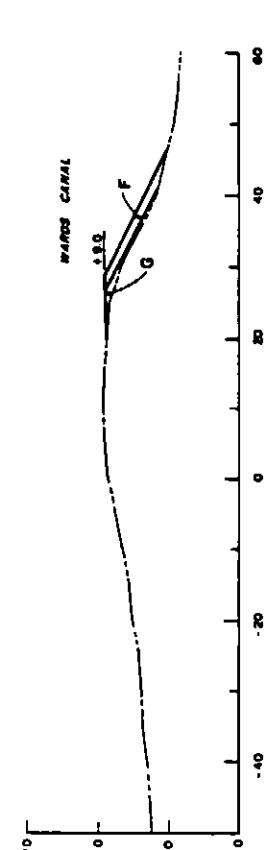
STA. -35+00



STA. -46+50



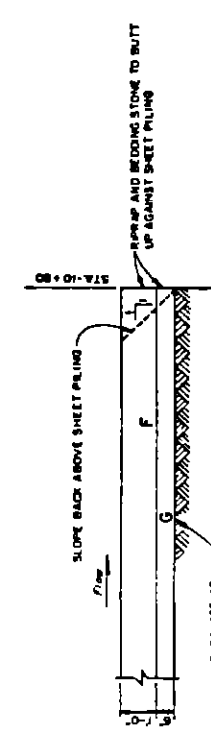
STA. -48+00



STA. -49+15 (END)

NO WORK BETWEEN 48+10 TO 48+94 DUE TO PUMP OUTLET.  
NO WORK AT 47+80± DUE TO DRAINAGE TILE THROUGH LEVEL.

- NOTES:**
1. ELEVATIONS ARE IN FEET AND ARE REFERRED TO LOW WATER DATUM, ELEVATION 548.8 FEET ABOVE MEAN WATER LEVEL AT RASHER POINT, QUEBEC, INTERNATIONAL GREAT LAKES DATUM (IGLD) 1955.
  2. HORIZONTAL DISTANCES ARE IN FEET.
  3. CROSS SECTIONS SHOWN ON THE DRAWINGS CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS AT THE TIME THE ELEVATIONS AND SOUNDINGS WERE OBTAINED.
  4. FOR LEGEND OF STONE SIZES, SEE SHEET 17.
  5. AREAS EXCAVATED TO ALLOW PLACEMENT OF THE TOP STONE AND UNDERLYING BEDDING STONE WERE BACKFILLED TO THE EXISTING GROUND SURFACE.
  6. WARDS CANAL LEVEE, EXCEPT RIPRAP FACE, WAS TOP-SOILED AND SEEDS IN ALL AREAS AFFECTED BY THE CONTRACTOR'S OPERATIONS.



SECTION I-I  
RIPRAP END PROTECTION  
SCALE: 1" = 2'-0"



- LEGEND:**
- F 12" RIPRAP 5-60 LBS
  - G BEDDING STONE #200-4"
  - H RANDOM FILL

**AS CONSTRUCTED** APPROVED

U.S. ARMY ENGINEER DISTRICT, BUFFALO  
CORPS OF ENGINEERS  
BUFFALO, NEW YORK 14223

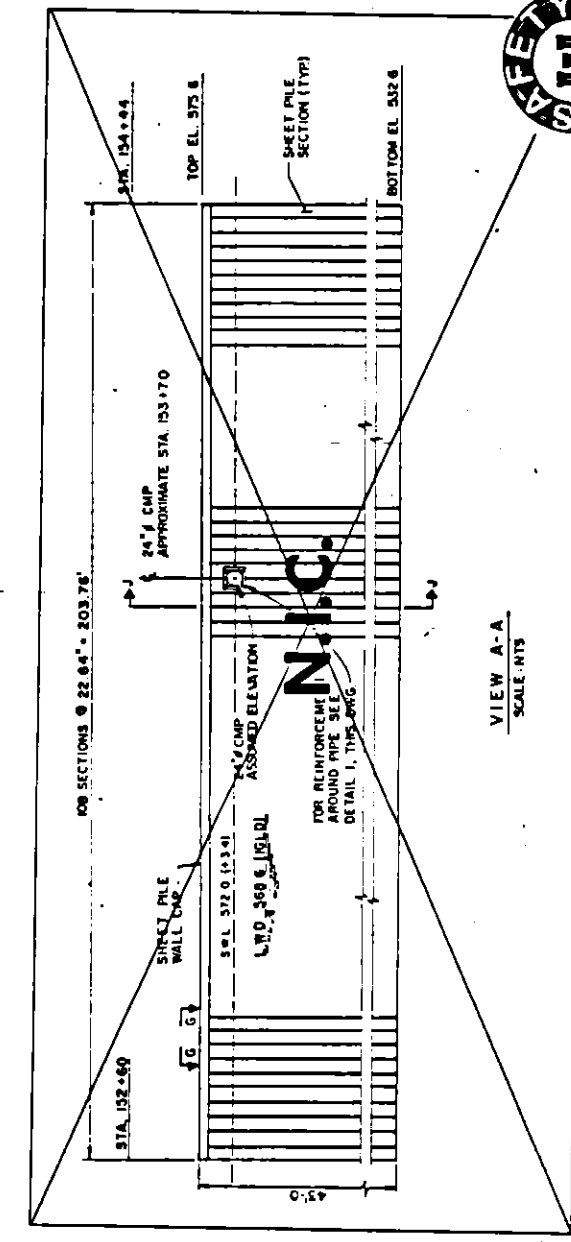
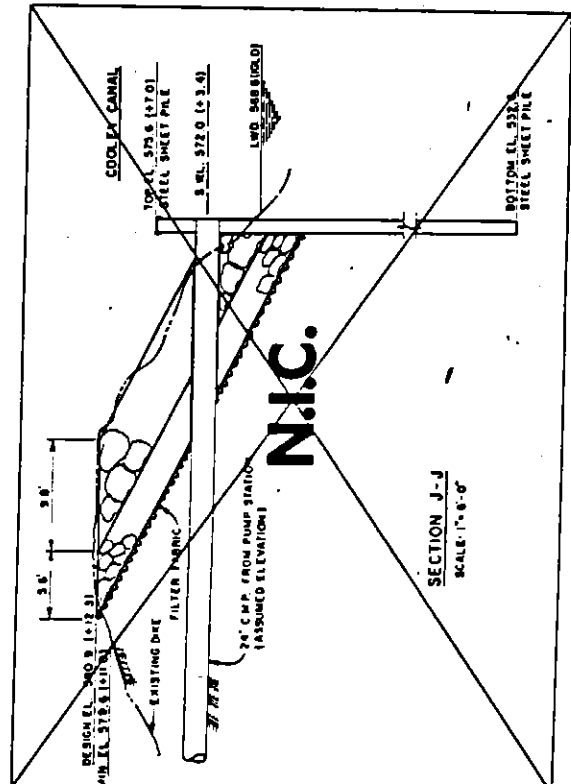
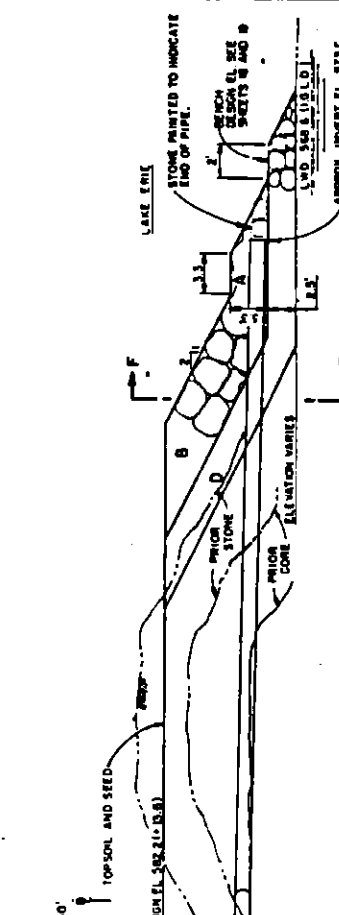
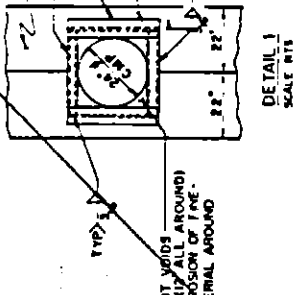
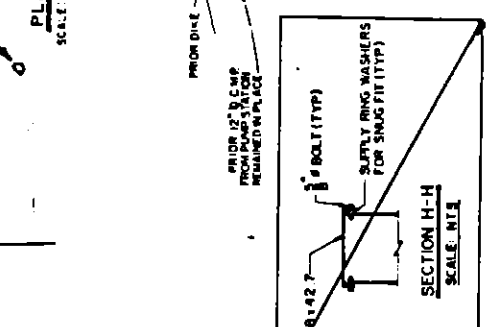
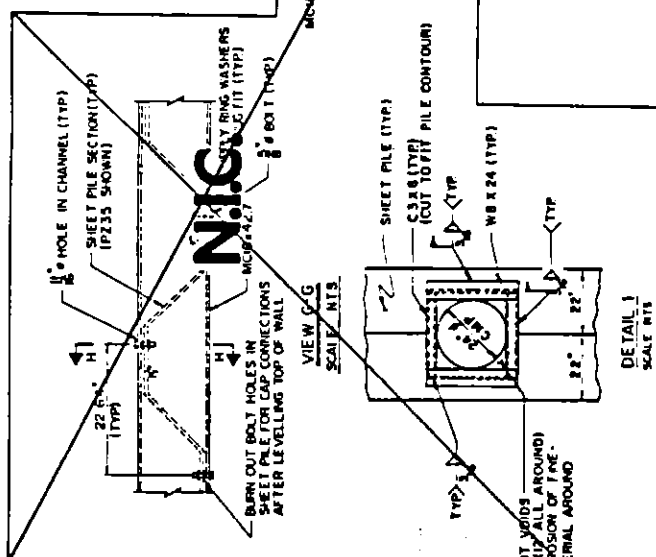
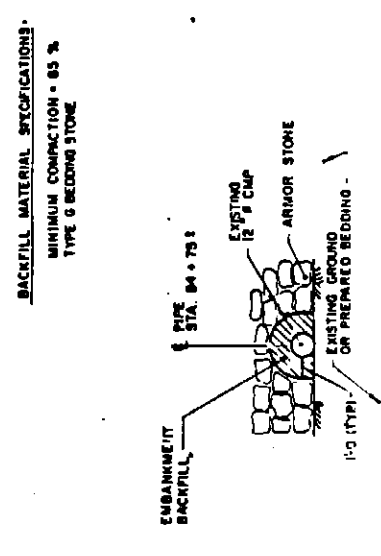
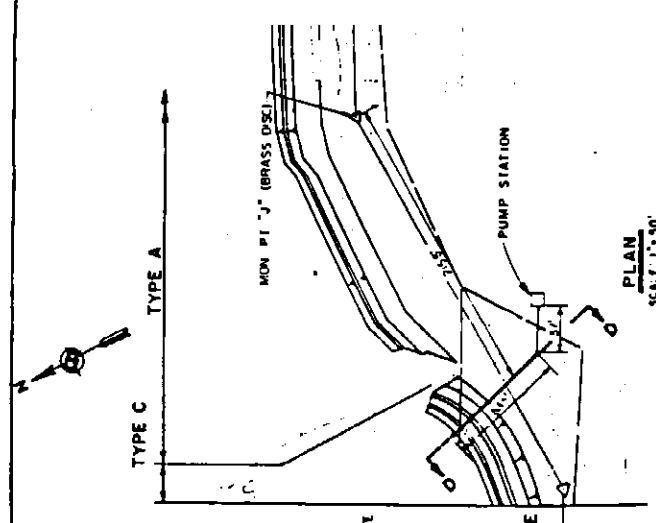
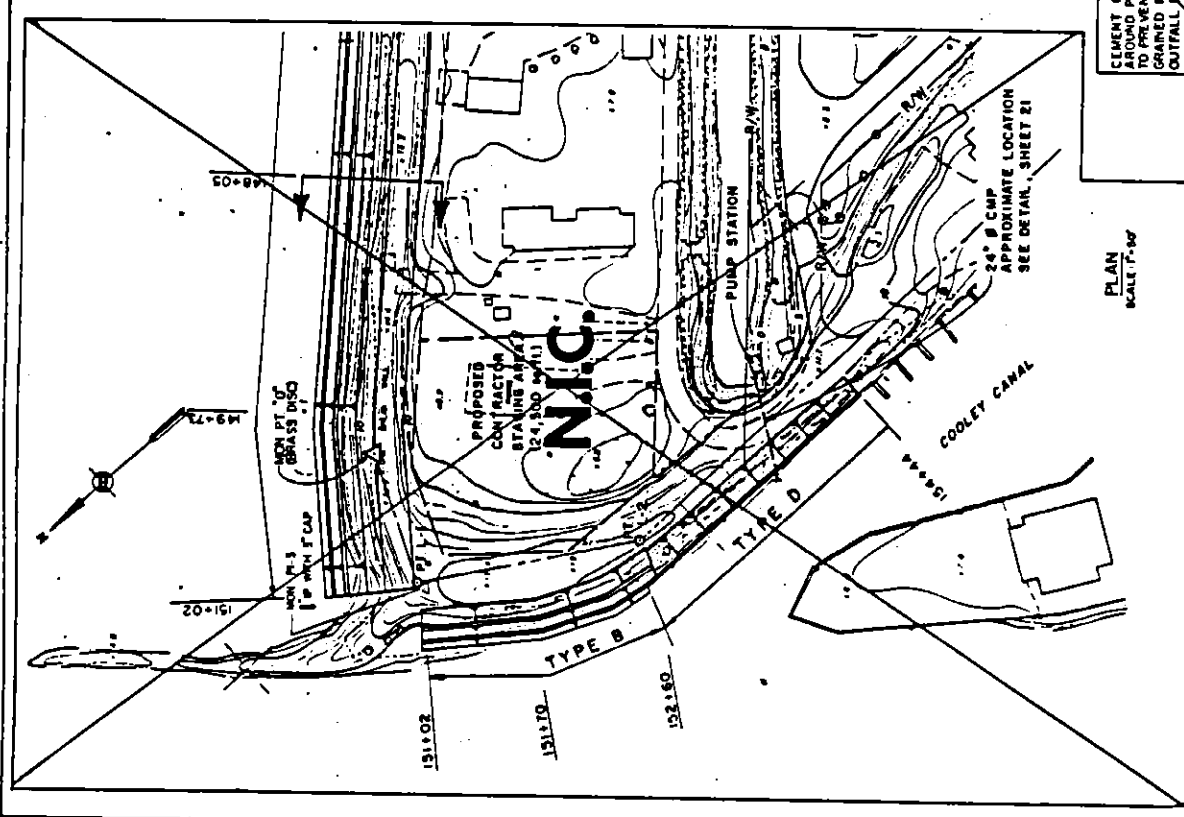
REMO BEACH - HOWARD FARMS, OHIO  
WARDS CANAL LEVEE

EXISTING CROSS SECTIONS  
STA. -10+83 TO STA. -49+15

DATE: 11/24/92

SCALE: 1" = 10'

DRAWING NUMBER: 66-RBP-1/20  
SHEET NO. 01 OF 28



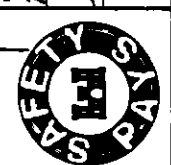
NOTES:  
 1. WITHIN LIMITS OF EXISTING SHEET PILING AT THE DISCHARGE FLUME FROM PUMP STATION ON WARDS CANAL (SHEET M-3), THE FORESLOPE OF THE WARDS CANAL LEVÉE SHALL BE REWORKED AS SHOWN ON THE TYPICAL SECTION.  
 2. FOR TYPICAL SECTION TYPES AND STONE SIZE TYPES AND RANGES SEE SHEET 17

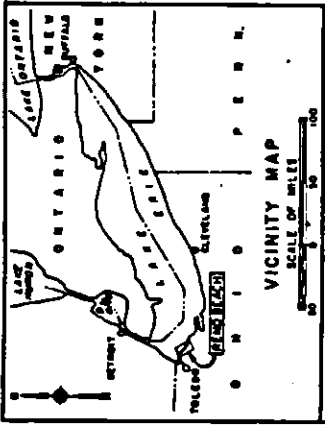
**AS CONSTRUCTED**

APPROVED: *[Signature]*  
 U.S. ARMY ENGINEER DISTRICT BUFFALO  
 CORPS OF ENGINEERS  
 BUFFALO, NEW YORK 14207

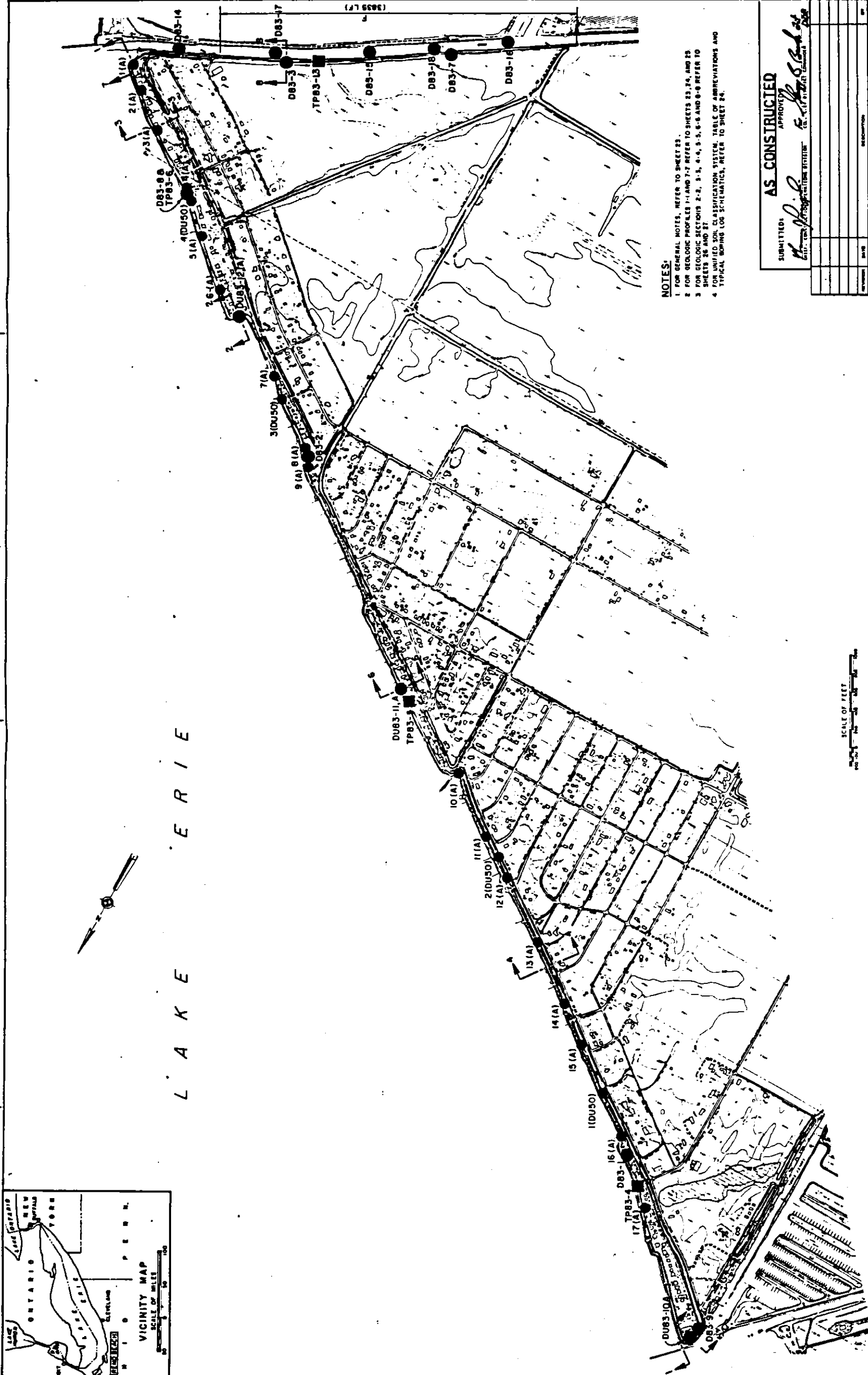
RENO BEACH - HOWARD FARMS, OHIO  
 FLOOD PROTECTION  
 MISCELLANEOUS DETAILS

DATE AS SHOWN: 11.04.59  
 DRAWING NUMBER: 86-RBP-1/21  
 SHEET 21 OF 28





L A K E E R I E



NOTES:  
 1 FOR GENERAL NOTES, REFER TO SHEETS 23.  
 2 FOR GEOLOGIC PROFILES 1-11 AND 7-7 REFER TO SHEETS 23, 24, AND 25.  
 3 FOR GEOLOGIC SECTIONS 2-2, 3-3, 4-4, 5-5, 6-6 AND 8-8 REFER TO SHEETS 23 AND 24.  
 4 FOR UNITED SOIL CLASSIFICATION SYSTEM, TABLE OF ABBREVIATIONS AND TYPICAL BORING LOG SCHEMATICS, REFER TO SHEET 24.

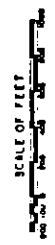
**AS CONSTRUCTED**  
 APPROVED  
 SUBMITTED BY: *[Signature]*  
 TITLE: SUBSURFACE EXPLORATION SYSTEM

U. S. ARMY ENGINEER DISTRICT, BUFFALO  
 CORPS OF ENGINEERING  
 BUFFALO, NEW YORK 14207

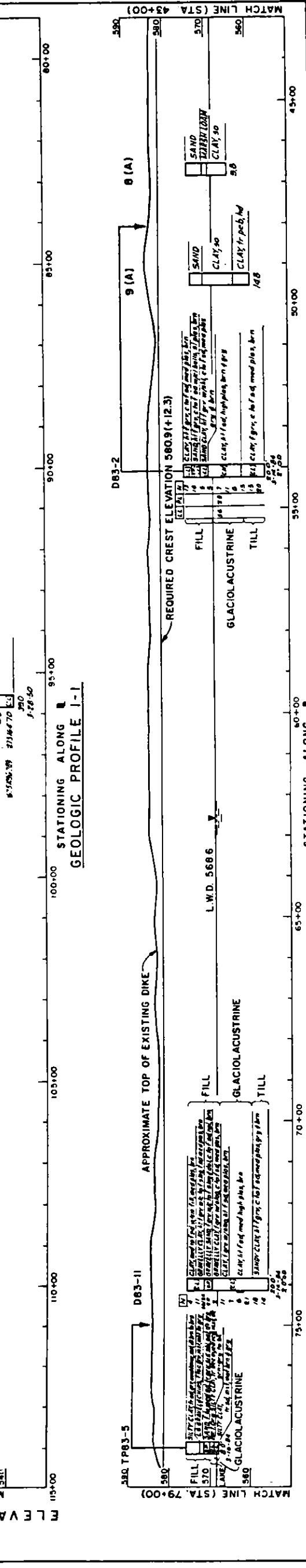
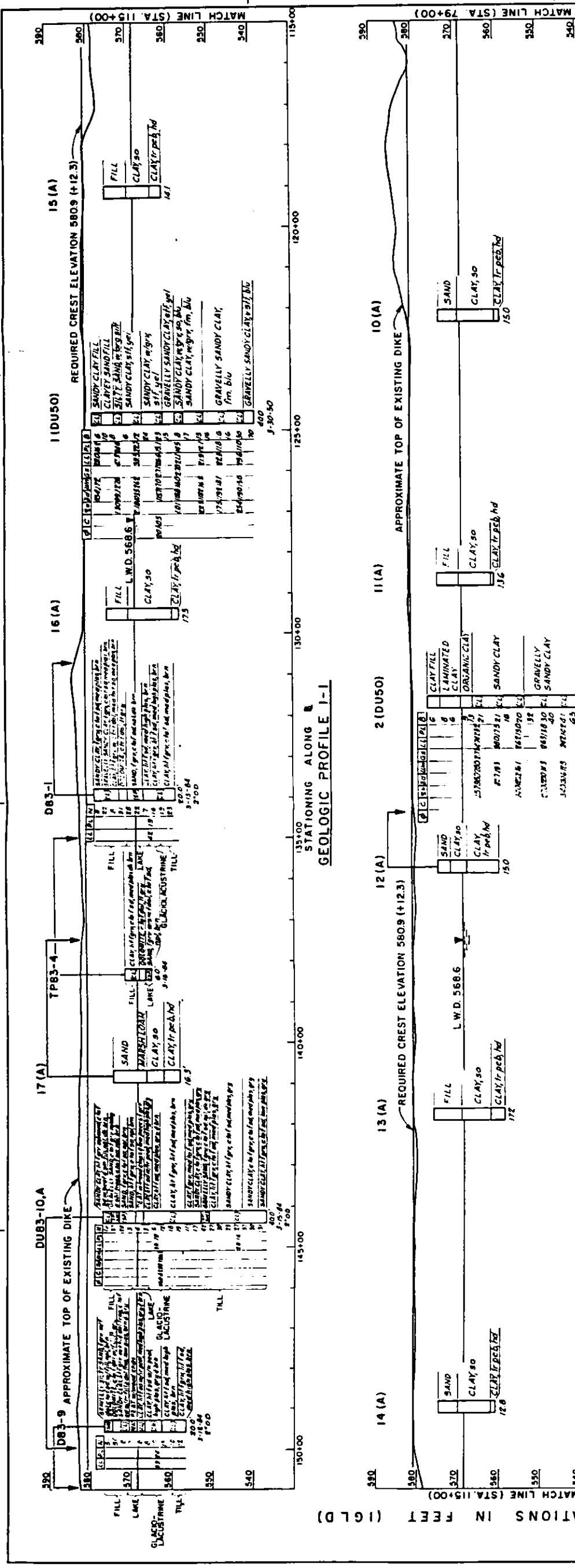
REMO BEACH - HOWARD FARMS, OHIO  
 FLOOD PROTECTION

PLAN OF  
 SUBSURFACE EXPLORATION

DATE: 11 July 51  
 DRAWING NUMBER: 66-RBP-1/22  
 SHEET 22 OF 28



- LEGEND:
- 1(A) PRE-1946 AUGER BORING BY DETROIT DISTRICT
  - 1(DU50) 1950 DRIVE - UNDISTURBED BORING BY DETROIT DISTRICT
  - INDICATES LOCATION OF A GEOLOGIC PROFILE OR CROSS SECTION
  - D83-1 1983 DRIVE BORING LOCATION
  - DU83-10A, 1983 DRIVE - UNDISTURBED SAMPLE BORING LOCATION
  - TP83-4 1983 TEST PIT LOCATION



U. S. ARMY ENGINEER DISTRICT, BUFFALO  
 CORPS OF ENGINEERS  
 BUFFALO, NEW YORK 14207

RENO BEACH - HOWARD FARMS, OHIO  
 LAKESHORE DIKE

**GEOLOGIC PROFILE I-1**

DRAWN BY: [Signature]  
 CHECKED BY: [Signature]  
 DATE: 11, 1954

U. S. ARMY ENGINEER DISTRICT, BUFFALO  
 CORPS OF ENGINEERS  
 BUFFALO, NEW YORK 14207

DRAWING NUMBER: 86-RBP-1/23  
 SHEET 23 OF 28

**AS CONSTRUCTED**

APPROVED BY: [Signature]

**NOTES:**

- The 17 auger borings shown on this plate were advanced for the U.S. Army Engineer District, Detroit, Michigan. The borings were performed prior to January, 1946 and were incorporated into that District's survey report for Reno Beach, Lucas County, Ohio, dated 21 January, 1946.
- The four drive undisturbed borings shown on this plate were advanced in 1950 for the U.S. Army Engineer District, Detroit, Michigan. They were advanced by driving an un-specified sampler with a 200 pound hammer. Undisturbed soil samples recovered from these borings were tested for various strength tests as well as triaxial (Q) compressive strength tests. The borings are shown in the accompanying diagram.
- All elevations are referred to low water datum (L.W.D.) International Great Lakes Datum, 1955. (IGLD, 1955). These elevations were converted from the original, datum elevations used for the boring program, mean Sea Level (M.S.L.).

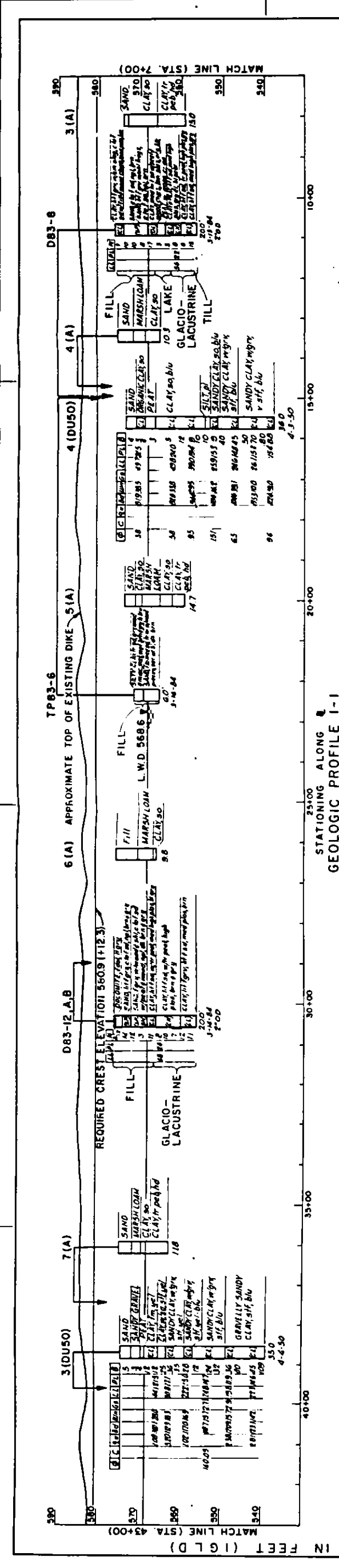
by subtracting the correction factor (1.80 feet) from each M.S.L. value.

6. For plan of boring locations and project features, see Sheet 22.

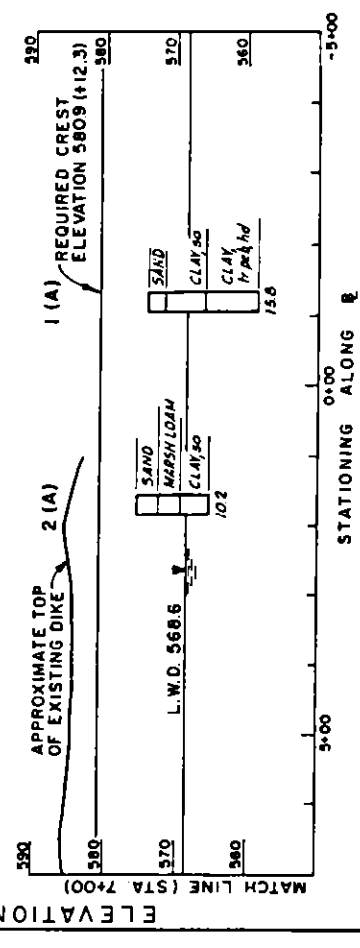
7. For Abbreviations, Typical Boring Log Schematics, Unified Soil Classifications System - Continuation of Profile I-1, see Sheet 24.

8. For Geologic Profile 7-7, see Sheet 25.

9. Refer to a 1946 drive boring Bu-19-14. Refer to a 1949 drive undisturbed sample boring TP83-4. Refer to a 1953 test pit. These explorations were conducted by Buffalo District on both land and water.



STATIONING ALONG **I**  
GEOLOGIC PROFILE I-I



STATIONING ALONG **I**  
GEOLOGIC PROFILE I-I

LEGEND (EXPLORATIONS)

- TYPICAL DRIVE-UNDISTURBED SAMPLE SCHEMATIC**  
 Hole number and designation --- 1 (DUSO)  
 Drive sample  
 Undisturbed sample  
 Year of boring (1950)
- TYPICAL AUGER BORING SCHEMATIC**  
 Hole number and designation --- 1 (A)  
 Boring number  
 Auger boring
- Material classification from visual and laboratory description as appropriate
- Field blow count (Blows/ft)  
 Plastic limit (%)  
 Liquid limit (%)  
 Specific gravity  
 Natural moisture  
 Content (%)  
 Natural dry  
 Density (pcf)  
 Unconfined compressive strength (psf)  
 Cohesion (psf)  
 Angle of internal friction (deg)  
 Unified soil classification determined in laboratory
- Material classification from visual description
- Total depth of exploration (ft) --- 600  
 Drilling completion date --- 3-30-50  
 Outside diameter of sampler --- 2.00
- \* B Refers to an unspecified sampler driven with a 200 pound hammer.  
 N Refers to a standard 2 inch O.D. sampler driven with a 140 pound hammer free falling 30 inches.

TABLE OF ABBREVIATIONS

bl	blue	hd	hard	sd	saturated
bk	black	ls	limestone	sd	sand
brn	brown	li	light	sc	beans
c	coarse	ll	light	sh	shells
cl	clay	lo	loose	sl	silt
cl	clay	med	medium	so	soft
cl	clay	mf	mass	sm	some
d	dense	mal	mass	sm	some
dol	dolomite	mat	mat	st	stiff
f	fine	mf	medium	tr	trace
fm	firm	ngl	non-plastic	vr	very
frag	fragments	org	organic	wh	with
gr	green	pl	plastic	wh	white
gr	gravel	pl	plastic	wh	white
g-y	gray	pl	plastic	yl	yellow

LEGEND (UNIFIED SOIL CLASSIFICATION SYSTEM)

- GW Well graded gravels, gravel sand mixtures, little or no fines
  - GM Poorly graded gravels or gravel sand mixtures, little or no fines
  - GC Silty gravels, gravel sand mixtures
  - GC Clayey gravels, gravel sand mixtures
  - GW Well graded sands, gravelly sand mixtures
  - GM Poorly graded sands, gravelly sand mixtures, little or no fines
  - GC Poorly graded sands or gravels, little or no fines
  - GC Silty sands, sand silt mixtures
  - GC Clayey sands, sand clay mixtures
  - GW Well graded silts and clayey fine sands
  - GM Poorly graded silts or clayey fine sands
  - GC Inorganic silts with light plasticity
  - GC Inorganic silts of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
  - GC Organic silts and organic silty clays of low plasticity
  - GM Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
  - GM Inorganic clays of high plasticity
  - GM Organic clays of medium to high plasticity, organic silts
  - GM Peat and other highly organic soils
- For details on the Unified Soil Classification System, See Waterways Experiment Station Technical Memorandum No. 3-357 dated March 1953 and revised in 1960.

- NOTES:  
 1. For general notes, see Sheet 23.  
 2. For plan of borings, see Sheet 22.  
 3. For geologic profile 1-1, see Sheet 23.  
 4. For geologic profile 2-2, see Sheet 25.

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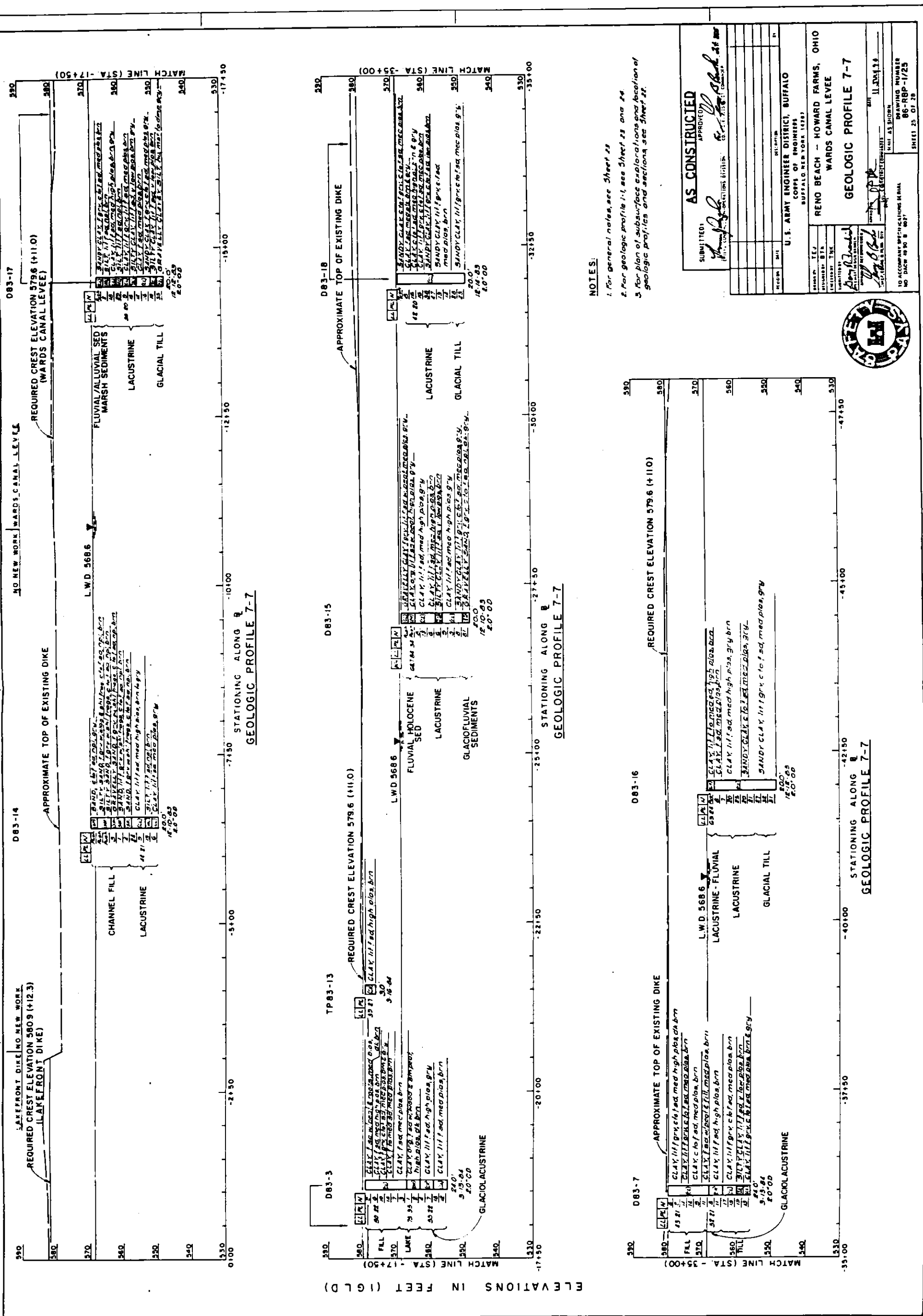
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 CORPS OF ENGINEERS  
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 LAKESHORE DIKE

GEOLOGIC PROFILE I-I

DATE: JUN 11 1950  
 DRAWING NUMBER: 86-RBP-24  
 SHEET NO. OF 28





NOTES:  
 1. For general notes, see Sheet 22  
 2. For geologic profile 1-1, see Sheet 23 and 24  
 3. For plan of subsurface explorations and location of geologic profiles and sections see Sheet 22

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 SUBMITTED: *[Signature]*  
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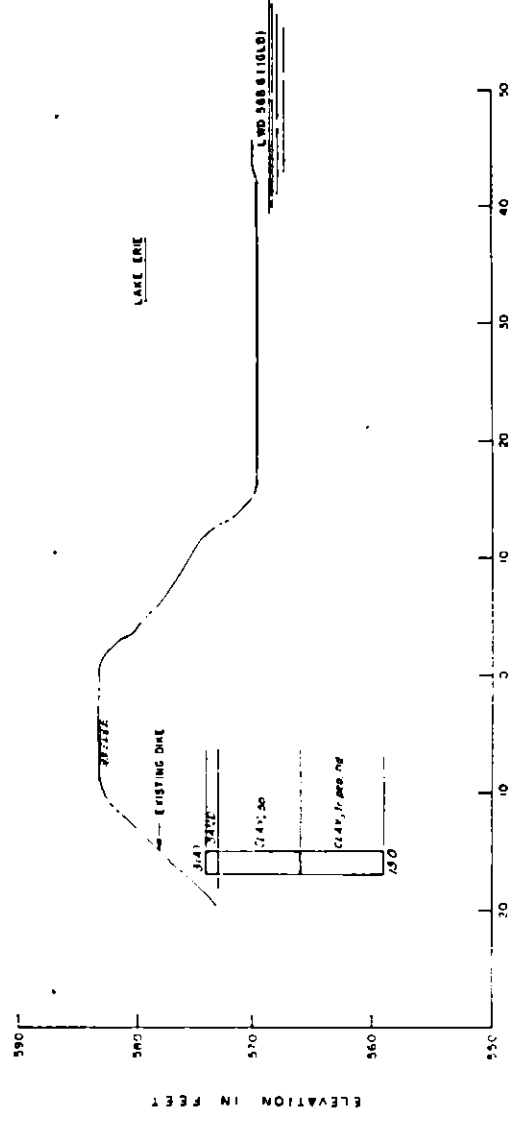
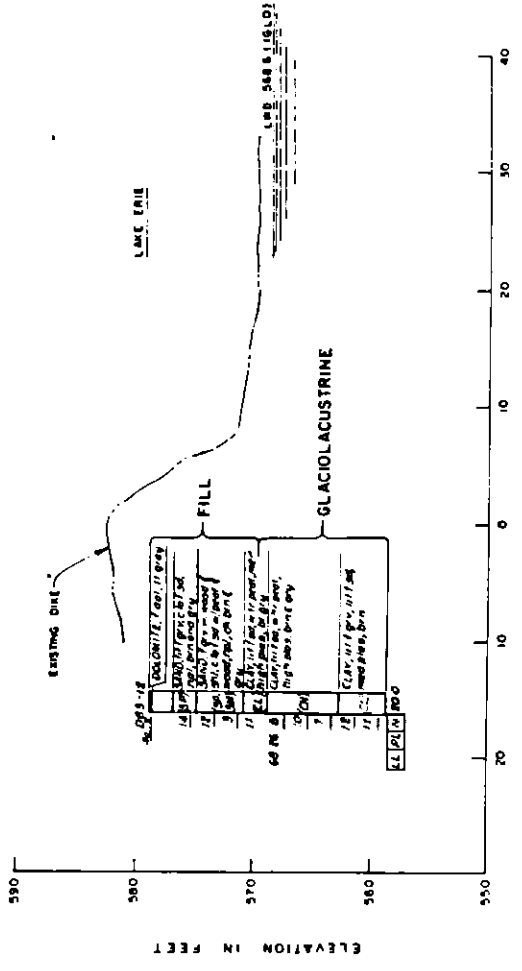
RENO BEACH - HOWARD FARMS, OHIO  
 WARDS CANAL LEVEE

**GEOLOGIC PROFILE 7-7**

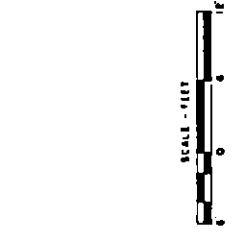
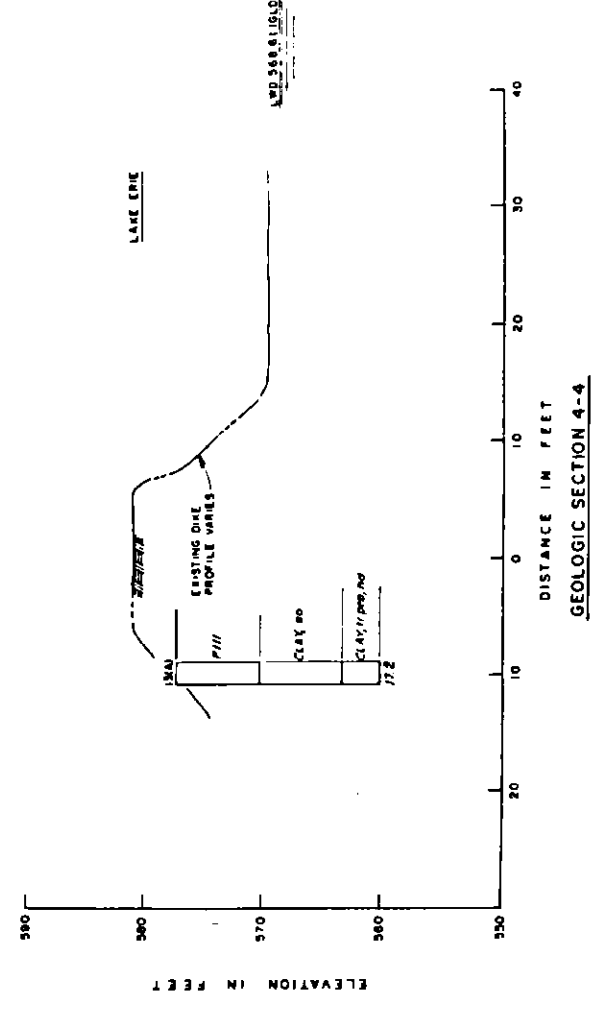
DRAWING NUMBER: 86-RBP-1/25  
 SHEET 25 OF 28







**NOTES:**  
 1 FOR GENERAL NOTES, SEE SHEET 23  
 2 FOR PLAN OF BORINGS, SEE SHEET 22  
 3 FOR GEOLOGIC PROFILES AND OTHER SECTIONS, SEE SHEETS 23, 24, 25 AND 27



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**GEOLOGIC SECTIONS**  
 2-2, 3-3, AND 4-4

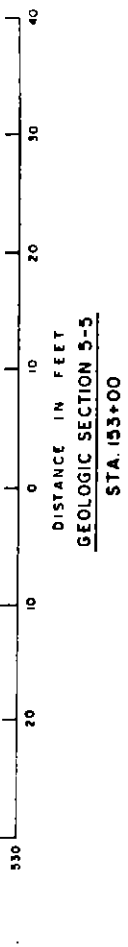
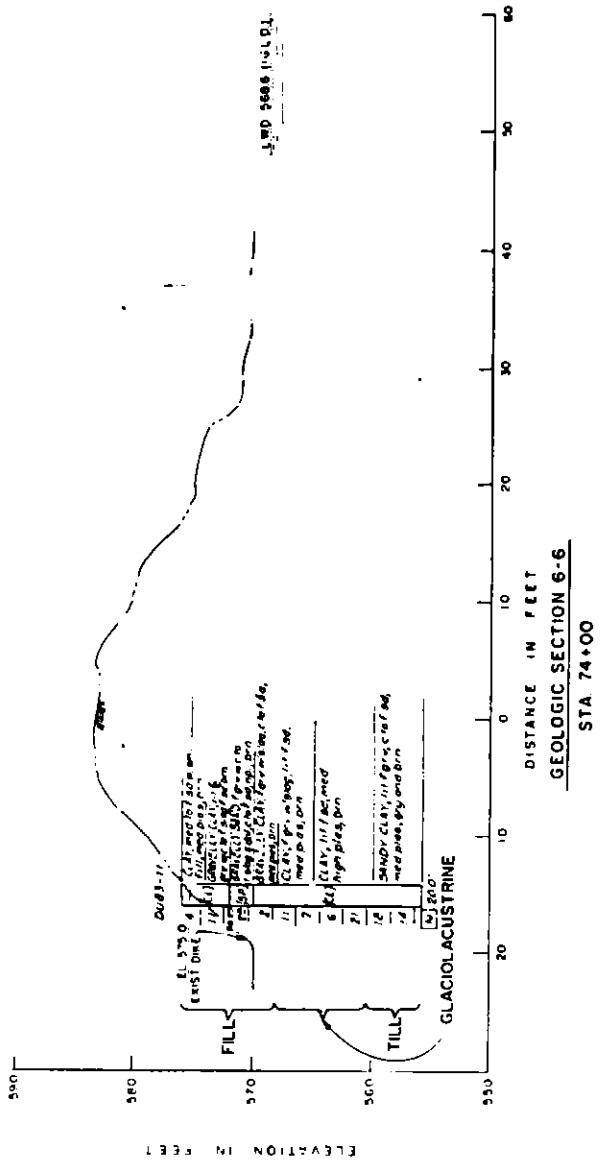
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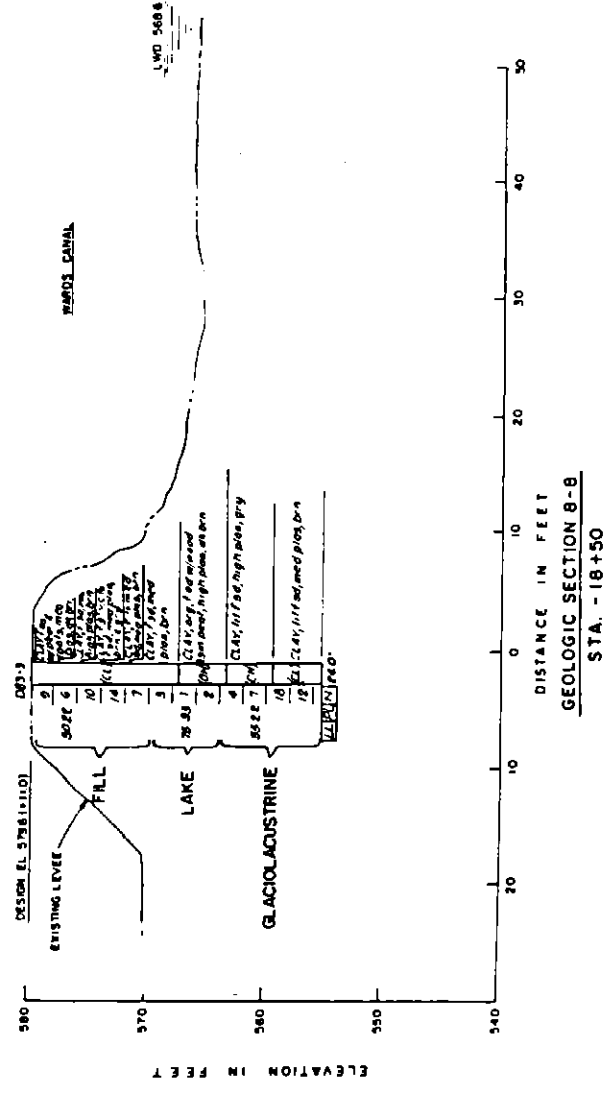
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 SHEET 25 OF 28



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TYPE F. NEW WORK  
WARDS CANAL LEVEL



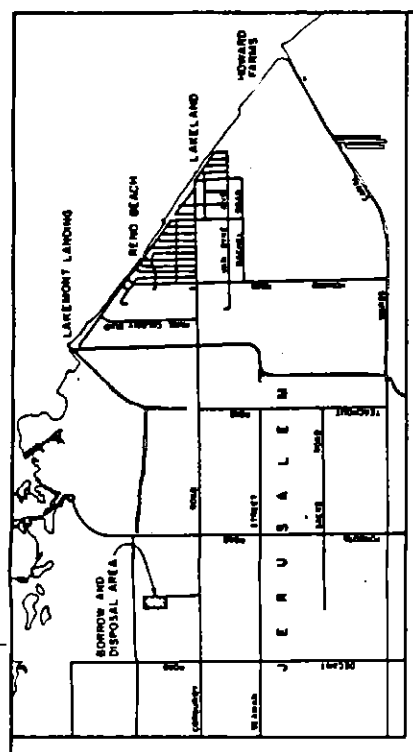
- NOTES:**
- 1 FOR GENERAL NOTES, SEE SHEET B3
  - 2 FOR PLAN OF BORINGS, SEE SHEET B2
  - 3 FOR GEOLOGIC PROFILES AND OTHER SECTIONS, SEE SHEETS B3, B4, B5, AND B6



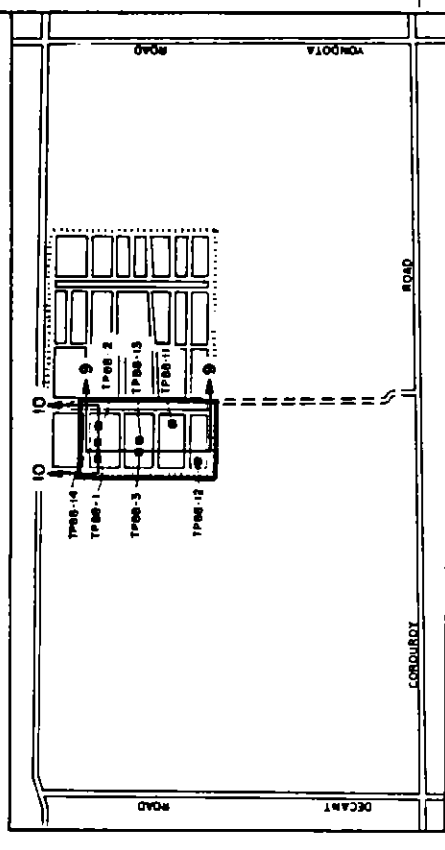
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BUFFALO, NEW YORK 14207	
DESIGNER: T.E.J.	SCALE AS SHOWN
DRAWN BY: B.T.K.	
CHECKED BY: T.M.	
APPROVED BY: [Signature]	DATE: 11/25/54
<b>GEOLOGIC SECTIONS 5-5, 6-6, AND 8-8</b>	
TO ACCOMPANY SPECIFICATIONS SERIAL NO. 6247 98 3 8 1957	
DRAWING NUMBER <b>86-RBP-1127</b>	
SHEET 27 OF 28	



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[Signature]



VICINITY MAP FOR BORROW AREA  
SCALE 1" = 3000'



LOCALITY MAP FOR BORROW AND DISPOSAL AREA  
SCALE 1" = 500'

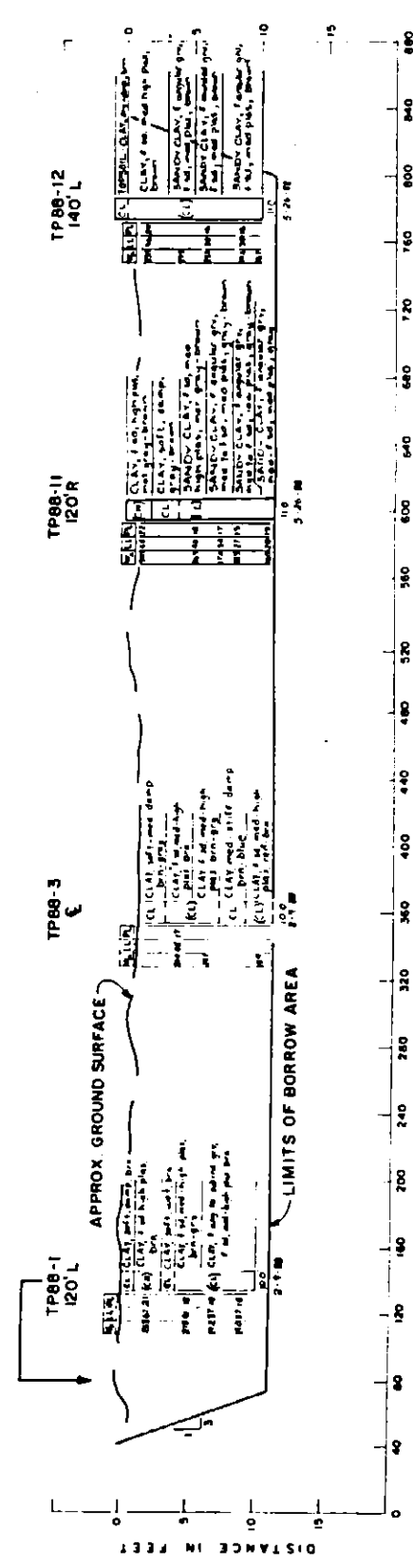
NOTES:

- 1 FOR GENERAL NOTES, SEE SHEET 25
- 2 FOR PLAN OF BORINGS, SEE SHEET 22
- 3 FOR GEOLOGIC PROFILES AND OTHER SECTIONS, SEE SHEETS 23, 24, 25, AND 27
- 4 TP88-1 THRU TP88-5 REPRESENT TEST PITS DUG 9 FEB 68
- 5 HORIZONTAL AND VERTICAL SURVEYS WERE NOT CONDUCTED FOR THIS BORROW INVESTIGATION. HORIZONTAL LOCATIONS MAY VARY BY APPROXIMATELY 25' VERTICAL ELEVATIONS MAY VARY BY APPROXIMATELY 2'
- 6 TP88-11 THRU TP88-14 REPRESENT TEST PITS DUG 26 MAY 1968
- 7 SEE SECTION 22 OF THE TECHNICAL PROVISIONS FOR FILL REQUIREMENTS

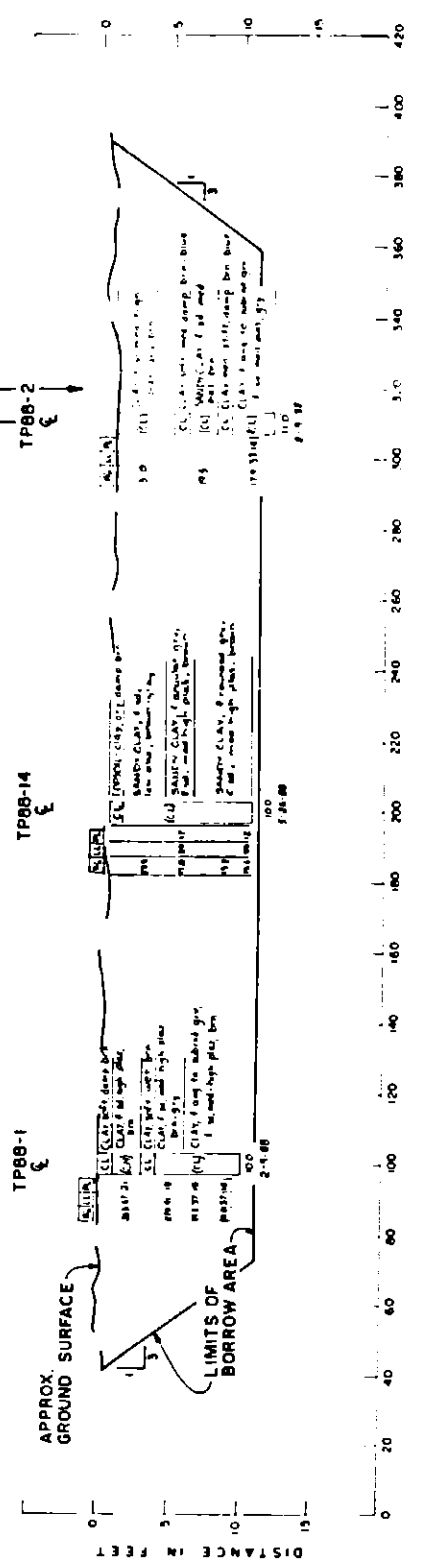
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CORPS OF ENGINEERS  
BUFFALO, NEW YORK 14217

DATE: 11/24/68	BY: [Signature]
DESIGNED: [Signature]	CHECKED: [Signature]
U.S. ARMY ENGINEER DISTRICT, BUFFALO CORPS OF ENGINEERS BUFFALO, NEW YORK 14217	
RENO BEACH - HOWARD FARMS, OHIO BORROW AREA	
GEOLOGIC PROFILE 9-9 & GEOLOGIC SECTION 10-10	
NO. OF SHEETS: 28	SHEET NO.: 28 OF 28
DRAWING NUMBER: 86-RBP-1/28	DATE: 11/24/68



GEOLOGIC PROFILE 9-9



GEOLOGIC SECTION 10-10

THIS BORROW AREA NOT USED BY CONTRACTOR

- TP88-1 - HOLE NUMBER AND DESIGNATION
  - TEST PIT NUMBER
  - YEAR OF TEST PIT
  - TEST PIT
- 100 L - OFFSET RIGHT OR LEFT
- PLASTIC LIMIT - 21-E-4
- LIQUID LIMIT - 41
- WATER CONTENT - 44
- UNIFIED SOIL CLASSIFICATION DETERMINED IN LABORATORY
- CLAY - MATERIAL CLASSIFICATION FROM FIELD VISUAL
- DIVIDING LINE BETWEEN CLASSIFICATION
- GROUPS OF CLASSIFICATION
- BASED ON TESTING (ON VISUAL)
- UNIFIED SOIL CLASSIFICATION DETERMINED IN LABORATORY
- 100 - TOTAL DEPTH OF EXPLORATION
- 2-4 M - DATE BORING COMPLETED

TYPICAL BORING SCHEMATIC