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London Avenue Canal Floodwalls and Levees

General Design Memorandum

DRAFT

prepared for the

Board of Levee Commissioners of the Orleans Levee District

Orleans Levee Board Contract No. 2049-0269

by

Burk & Associates, Inc.
Engineers • Planners • Environmental Scientists

April 1986

London Avenue Canal Floodwalls and Levees

General Design Memorandum

LIST OF SECTIONS

Section I	Introduction
Section II	Existing Conditions
Section III	Proposed Improvements
Section IV	Construction Priorities
Section V	Cost Estimates
Appendix A	Plan-Profile Plates
Appendix B	Hydraulic Study
Appendix C	Geotechnical Investigation (under separate cover)

London Avenue Canal Floodwalls and Levees

General Design Memorandum

INDEX TO SECTIONS

SECTION I - INTRODUCTION

Paragraph Number	Title	Page Number
	GENERAL	
1.	Executive Summary	1-2
2.	Alternative Plans	1-3
3.	Costs	1-4
	TABLES	
Table Number	**Title**	**Page Number**
1-1	Summary of Construction Costs Recommended Plan of Interim Floodwalls and Levees - Phase I	1-5
1-2	Summary of Construction Costs Recommended Plan of Interim Floodwalls - Phase II	1-7
1-3	Summary of Construction Costs Recommended Plan for Future Permanent Floodwalls and Levees - Phase III	1-8

INDEX TO SECTIONS
(continued)

SECTION II - EXISTING CONDITIONS

Paragraph Number	Title	Page Number
	GENERAL	
1.	Scope	2-2
2.	Existing Levees	2-2
3.	Pumping Station No. 3	2-3
4.	Pumping Station No. 4	2-3
5.	Bridges	2-3
6.	Real Estate	2-4

PLATES

Plate Number	Title
2-1	Existing Conditions

SECTION III - PROPOSED IMPROVEMENTS

Paragraph Number	Title	Page Number
	GENERAL	
1.	Scope	3-4
	BRIDGES AND GATES	
2.	Southern Railroad Bridge	3-5
3.	Benefit Street Bridge	3-6
4.	Gentilly Boulevard Bridge	3-7
5.	Mirabeau Avenue Bridge	3-8
6.	Filmore Avenue Bridge	3-10
7.	Robert E. Lee Boulevard Bridge	3-11
8.	Leon C. Simon Boulevard Bridge	3-12

INDEX TO SECTIONS
(continued)

LEVEES AND FLOODWALLS

9.	Description	3-14
10.	Alternate Study	3-14
11.	Reach I	3-15
12.	Reach II	3-15
13.	Reach III	3-16
14.	Reach IV	3-17
15.	Reach V	3-18
16.	Levee Construction	3-19

DRAINAGE PUMPING STATIONS

17.	New Orleans Sewerage and Water Board Drainage Pumping Station No. 3 (Station 0+00)	3-20
18.	New Orleans Sewerage and Water Board Drainage Pumping Station No. 4 (Station 101+00)	3-20

RIGHT-OF-WAY CONSIDERATIONS AND OTHER CONSTRUCTION REQUIREMENTS

19.	Right-of-way Considerations	3-22
20.	Utility Relocations	3-23

TABLES

Table Number	Title	Page Number
3-1	Recommendations - Reach I	3-25
3-2	Recommendations - Reach III	3-26
3-3	Utility Relocation Schedule	3-27

PLATES

Plate Number	Title
3-1	Recommended Improvements
3-2	Existing Bridges - Typical Sections
3-3	Alternate 1 - Plan & Elevation
3-4	Gentilly Blvd. & Robert E. Lee Blvd. Alternate 1 - Typical Sections

INDEX TO SECTIONS
(continued)

PLATES (continued)

Plate Number	Title
3-5	Mirabeau Ave. Alternate 2 - Plan & Elevation
3-6	Mirabeau Ave. Alternate 3 - Flood Roller Gate Gate Monolith
3-7	Mirabeau Ave. Alternate 3 - Flood Roller Gate Storage Monolith
3-8	Mirabeau Ave. Alternate 3 - Flood Roller Gate Gate Details
3-9	Mirabeau Ave. Alternate 3 - Flood Roller Gate Gate Sections
3-10	Railroad Crossing - Swing Gate Gate Monolith
3-11	Railroad Crossing - Swing Gate Gate Details
3-12	Railroad Crossing - Swing Gate Railroad Falsework Details
3-13	Recommended Plan for Levees and Floodwalls - Typical Sections
3-14	Recommended Plan for Levees and Floodwalls - Typical Sections
3-15	Recommended Plan for Levees and Floodwalls - Typical Sections
3-16	Recommended Plan for Levees and Floodwalls - Typical Sections
3-17	Concrete Floodwalls - Typical Sections
3-18	Drainage Pumping Station No. 3 - Site Plan
3-19	Drainage Pumping Station No. 3 - Typical Sections
3-20	Drainage Pumping Station No. 4 - Site Plan
3-21	Drainage Pumping Station No. 4 - Typical Sections

INDEX TO SECTIONS
(continued)

SECTION IV - CONSTRUCTION PRIORITIES

Paragraph Number	Title	Page Number
	GENERAL	
1.	Scope	4-2
	FIRST PRIORITY	
2.	Bridges	4-3
3.	Levees	4-3
4.	Remaining Flood Protection	4-3
	SECOND PRIORITY	
5.	Levees	4-4
6.	Pumping Stations	4-4
7.	Conclusion	4-4
8.	Construction Schedule	4-5

TABLES

Table Number	Title	Page Number
4-1	Priority Schedule for Bridge Openings	4-6
4-2	Priority Schedule for Levees and Floodwalls	4-7
4-3	Construction Schedule	4-8

PLATES

Plate Number	Title
4-1	Construction Priorities

SECTION V - COST ESTIMATES

Paragraph Number	Title	Page Number
	GENERAL	
1.	Scope	5-2

INDEX TO SECTIONS
(continued)

TABLES

Table Number	Title	Page Number
5-1	Cost Estimate for Recommended Plan of Interim Floodwalls and Levees - Phase I	5-3
5-2	Cost Estimate for Recommended Plan of Interim Floodwalls and Levees - Phase II	5-7
5-3	Cost Estimate for Alternate Floodwalls and Levees	5-10
5-4	Cost Estimate for Alternate Bridge Modifications	5-13
5-5	Cost Estimate for Recommended Plan for Future Permanent Floodwalls and Levees - Phase III	5-16

APPENDIX A - PLAN-PROFILE PLATES

WESTSIDE

Plates A-1 through A-7

EASTSIDE

Plates A-8 through A-13

APPENDIX B - HYDRAULIC STUDY

APPENDIX C - GEOTECHNICAL INVESTIGATION

(under seperate cover)

SECTION I
INTRODUCTION

INDEX

Paragraph Number	Title	Page Number
	GENERAL	
1.	Executive Summary	1-2
2.	Alternative Plans	1-3
3.	Costs	1-4

TABLES

Table Number	Title	Page Number
1-1	Summary of Construction Costs Recommended Plan of Interim Floodwalls and Levees - Phase I	1-5
1-2	Summary of Construction Costs Recommended Plan of Interim Floodwalls - Phase II	1-7
1-3	Summary of Construction Costs Recommended Plan for Future Permanent Floodwalls and Levees - Phase III	1-8

London Avenue Canal Floodwalls and Levees

General Design Memorandum

SECTION I
INTRODUCTION

SECTION I
INTRODUCTION

GENERAL

1. Executive Summary. In February of 1985, the U.S. Army Corps of Engineers officially decided to abandon the proposed Barrier Plan for hurricane protection in favor of the High Level Plan for hurricane protection to Lake Pontchartrain and vicinity. This change in methods of protecting the City of New Orleans from hurricane driven storm tides requires the Orleans Levee Board to improve the existing levee system adjacent to the London Avenue Outfall Canal.

To upgrade the present level of flood protection, the most cost effective method of construction is to construct earthen levees where adequate right-of-way is available. However, within the project limits of the London Avenue Canal most of the present levee and floodwall system is located immediately adjacent to developed residential property and no additional right-of-way is available for raising earthen levees. Therefore, most of the proposed flood protection improvements within this project will consist of providing cantilever steel sheet pile I-wall floodwalls constructed in the existing earthen levees.

The recommended plan includes approximately 4,300 linear feet of levee improvements consisting of raising the existing earthen levee to the new flood protection elevation with no floodwall construction. These earthen levees are all located north of Robert E. Lee Boulevard between station 120+00 and 146+50 on the west levee and between station 127+20 and 144+50 on the east levee. Also included in the recommended plan is 380 linear feet of concrete inverted T-floodwall along the east levee between station 2+80 and 6+60, where stability criteria dictated that an I-wall floodwall would be unstable without creating displacements to adjacent residential property. In addition to raising earthen levees and constructing new floodwalls, there are seven bridge crossings through the present levee system which will have to be modified to maintain continuity to the levee system.

The sequencing of the flood protection improvements included in the recommended plan will be established on a priority basis. The first phase is to increase the level of flood protection offered at the seven bridge crossings as well as raising the levees and floodwalls north of Robert E. Lee Boulevard (Station 120+00) to Lake Pontchartrain (Station 160+00). Included in the first phase of this project are the following items: construction of floodgates at two

bridge crossings, full reconstruction of one existing bridge to upgrade flood protection, partial reconstruction of four existing bridges to increase flood protection, construction of approximately 3,600 linear feet of new floodwalls along with raising the elevation of approximately 4,300 linear feet of earthen levees. Project cost for Phase I improvements is $5,589,331 and is summarized in Table 1-1.

The second phase is to construct new floodwalls south of Robert E. Lee Boulevard (Station 120+00) to the southern limit of the London Avenue Outfall Canal at Station 0+00. This second phase interim flood protection consists of approximately 24,000 linear feet of new floodwalls. In addition to constructing new floodwalls, the flood protection system at two existing Sewerage and Water Board Drainage Pumping Stations are required to be upgraded to conform to this new level of flood protection. Project cost for Phase II improvements is $21,901,300 and is summarized in Table 1-2. Upon completion of the second phase of construction, interim flood protection will be provided to the entire area adjacent to the London Avenue Outfall Canal for a storm tide with a still water level of 11.5 Mean Sea Level (MSL) in Lake Pontchartrain.

The third phase is to eventually construct concrete caps over the steel sheet pile I-walls to provide permanent protection to the steel sheet piles. Project cost for Phase III improvements is $8,813,000 and is summarized in Table 1-3. The third phase is not intended to be constructed until some future time when additional funds are available.

2. Alternative Plans. The Corps of Engineers is presently studying an alternative plan for hurricane flood protection which consists of constructing a floodgate closure structure across the London Avenue Outfall Canal in the vicinity of Lake Pontchartrain. This proposed structure would consist of a series of vertically pinned steel floodgates designed to be self closing during hurricane tide conditions. Since London Avenue Canal is an outfall drainage canal for two major storm drainage pumping stations operated by the New Orleans Sewerage and Water Board, it is necessary to maintain an outfall channel for discharge from these pumping stations during hurricane conditions. For this reason, the Corps proposes to use the self actuated floodgate closure. As the drainage pumping stations pump their discharge into the London Avenue Canal, it is likely that the water level on the protected side of the floodgate structure would exceed the still water level in Lake Pontchartrain. As this occurs the floodgates are designed to automatically open and allow the excess water in the canal to discharge into Lake Pontchartrain. However, this entire concept does not relieve the Orleans Levee Board from having to upgrade the level of flood protection along the London Avenue Canal levees. The design still

water level in Lake Pontchartrain is elevation 11.5 MSL as established by the Corps of Engineers. This elevation is above most of the existing levee and floodwall elevations at the present time and without increasing the height of the existing levees, the city would still be subjected to potential flooding when the discharge canal is pumped full of storm drainage runoff from the two drainage pumping stations. Therefore, it is obvious that additional improvements are necessary to the levee system adjacent to the London Avenue Canal and the Orleans Levee Board intends to pursue interim improvements to provide the necessary flood protection.

The Orleans Levee Board has decided to base the design for these levee improvements on design criteria obtained from the Corps of Engineers. By using the same design criteria, the proposed levee and floodwall improvements can be compared to the proposed closure structure alternative on the lakefront presently being studied by the Corps of Engineers.

3. Costs. Cost estimates provided within this study are presented in three increments. The Estimated Construction Cost (E.C.C.) includes the total estimated cost for construction of the proposed improvements with no contingencies or other added costs. The Construction Cost (C.C.) is defined as the estimated construction cost with contingencies and engineering design fees added to this cost. Contingencies used in this study are approximately 15% of the estimated construction cost and include costs for mobilization, bonds, insurance and other potential added construction costs which could develop when more specific design details are developed. The design fees are estimated at approximately 5.75% of the estimated construction cost including contingencies. The Project Cost (P.C.) is defined as the total cost for construction, including the construction costs along with surveying, design memorandums, geotechnical investigations, testing laboratory and resident inspection costs. Resident inspection fees were estimated at approximately 1.4% of the estimated construction cost including contingencies.

The cost summaries for the three phases of improvements to the London Avenue Canal levee system are shown in Tables 1-1 through 1-3.

TABLE 1-1

SUMMARY OF CONSTRUCTION COSTS
RECOMMENDED PLAN OF INTERIM
FLOODWALLS AND LEVEES
PHASE I

Description of Work	Total Cost
Reach I - Station 0+00 to 21+00	
Steel Swing Gates at Southern Railroad	$216,000.00
Steel Roller Gates at Benefit Street	75,000.00
Construction of new bridge with floodwalls at Gentilly Boulevard Bridge	445,400.00
Subtotal Reach I	**$736,400.00**
Reach III - Station 37+00 to 120+00	
Floodproofing of Mirabeau Ave. Bridge	$305,000.00
Floodproofing of Filmore Ave. Bridge	264,000.00
Subtotal Reach III	**$569,000.00**
Reach IV - Station 120+00 to 127+00	
Floodwalls and Levees	$485,200.00
Floodproofing of Robert E. Lee Blvd. Bridge	335,900.00
Subtotal Reach IV	**$821,100.00**
Reach V - Station 127+00 to 160+00	
Floodwalls and Levees	$1,939,400.00
Floodproofing of Leon C. Simon Blvd. Bridge	158,500.00
Subtotal Reach V	**$2,097,900.00**

TABLE 1-1 (continued)

SUMMARY OF CONSTRUCTION COSTS
RECOMMENDED PLAN OF INTERIM
FLOODWALLS AND LEVEES
PHASE I

Description of Work	Total Cost
Estimated Construction Cost (E.C.C.)	$4,224,400.00
Contingencies 15% ±	633,600.00
Design Fees 5.75%	279,300.00
Construction Cost (C.C.) Phase I Interim Floodwalls and Levees	**$5,137,300.00**
Surveys	$95,089.00
Design Memorandum	168,942.00
Geotechnical Investigation	95,000.00
Testing Laboratory	25,000.00
Resident Inspection 1.4%	68,000.00
Project Cost (P.C.) Phase I	**$5,589,331.00**

TABLE 1-2

SUMMARY OF CONSTRUCTION COSTS
RECOMMENDED PLAN OF INTERIM
FLOODWALLS AND LEVEES
PHASE II

Description of Work	Total Cost
Reach I - Station 0+00 to 21+00	
Floodwalls and Levees	$4,467,000.00
Floodwalls at Drainage Pump Station No. 3 (Station 0+00)	96,500.00
Subtotal Reach I	**$4,563,500.00**
Reach II - Station 21+00 to 37+00	
Floodwalls and Levees	$1,569,100.00
Subtotal Reach II	**$1,569,100.00**
Reach III - Station 37+00 to 120+00	
Floodwalls and Levees	$11,505,400.00
Floodwalls at Drainage Pump Station No. 4 (Station 101+00)	75,000.00
Subtotal Reach III	**$11,580,400.00**
Estimated Construction Cost (E.C.C.)	$17,713,000.00
Contingencies 15% ±	2,657,000.00
Design Fees 5.75%	1,171,300.00
Construction Cost (C.C.) Phase II Interim Floodwalls and Levees	**$21,541,300.00**
Testing Laboratory	$75,000.00
Resident Inspection 1.4%	285,000.00
Project Cost (P.C.) Phase II	**$21,901,300.00**

TABLE 1-3

SUMMARY OF CONSTRUCTION COSTS RECOMMENDED PLAN FOR FUTURE PERMANENT FLOODWALLS AND LEVEES PHASE III

Description of Work	**Total Cost**
Reach I - Concrete Cap Over I-wall	$1,016,000.00
Reach II - Concrete Cap Over I-wall	836,000.00
Reach III - Concrete Cap Over I-wall	4,569,000.00
Reach IV - Concrete Cap Over I-wall	186,600.00
Reach V - Concrete Cap Over I-wall	483,600.00
Estimated Construction Costs (E.C.C.)	$7,091,200.00
Contingencies 15% ±	1,063,800.00
Design Fees 5.75%	468,900.00
Construction Cost (C.C.) Phase III Future Permanent Floodwalls	**$8,623,900.00**
Testing Laboratory	$75,000.00
Resident Inspection 1.4%	114,100.00
Project Cost (P.C.) Phase III	**$8,813,000.00**

London Avenue Canal Floodwalls and Levees

General Design Memorandum

SECTION II
EXISTING CONDITIONS

SECTION II
EXISTING CONDITIONS

INDEX

Paragraph Number	Title	Page Number
	GENERAL	
1.	Scope	2-2
2.	Existing Levees	2-2
3.	Pumping Station No. 3	2-3
4.	Pumping Station No. 4	2-3
5.	Bridges	2-3
6.	Real Estate	2-4

PLATES

Plate Number	Title
2-1	Existing Conditions

SECTION II
EXISTING CONDITIONS

GENERAL

1. Scope. This section describes the existing flood protection system in place along the London Avenue Outfall Canal. Present flood protection levees and floodwalls along this canal vary between elevation 9.0 msl and 12.5 msl. All of these levees are below the required flood protection height as established by the design criteria being used for this study. A detailed account of the present flood protection system is presented in this section.

2. Existing Levees. The existing levees along the London Avenue Outfall Canal consist mainly of earthen levees with steel sheet pile I walls. Most of these sheet piles have concrete caps to increase the floodwall height and to protect the steel sheets. The following describes the existing conditions along the present levee system:

a. The area from Sewerage and Water Board Drainage Pumping Station No. 3 (Station 0+00) to just north of Gentilly Boulevard (Station 21+00) has PZ-27 steel sheet piles 20 feet long with a 7.5 foot exposed height above the earthen levee with a continuous concrete cap over the steel sheets.

b. On the west side from north of Gentilly Boulevard (Station 21+00) to Robert E. Lee Boulevard (Station 120+00) there exists a steel sheet pile wall, an M-115 section 20 feet long with a 4.5 foot exposed height above the earthen levee.

c. On the east side of the canal from north of Gentilly Blvd. (Station 21+00) to Prentiss Avenue (Station 101+00) and from Robert E. Lee Boulevard (Station 120+00) to Leon C. Simon Boulevard (Station 127+00) the same M-115 steel sheet pile section is provided. The M-115 sheet pile is a narrow corrugation, low section modulus sheet pile. These sheets are also badly rusted in many places. It would be unfeasible to increase the height of the existing levees using these steel sheet piles as they are neither long enough nor stiff enough to take the additional lateral load.

d. The area between Prentiss Avenue (Station 103+00) and Robert E. Lee Boulevard (Station 120+00), on the east side of the canal, has uncapped PZ-27 steel sheet piles 32 feet long with an 8 foot exposed height above the earthen

levee. These sheet piles were provided as a replacement to the original M-115 sheet pile I-wall by the Orleans Levee Board in 1982 prior to the adoption of the present design criteria for this project.

e. The levees north of Robert E. Lee Boulevard (Station 120+00) on the west and north of Leon C. Simon Boulevard (Station 127+00) on the east, up to Lake Pontchartrain (Station 160+00) are full earthen levees. The existing height ranges from elevation 9.0 msl to elevation 11.0 msl with most of this levee system at or below elevation 10.0 msl at the present time.

For a detailed map summarizing the existing conditions of the levees adjacent to London Avenue Canal, see Plate 2-1.

3. Drainage Pumping Station No. 3. The Sewerage and Water Board's Drainage Pumping Station No. 3 is located on North Broad Avenue at the beginning of the London Avenue Canal (Station 0+00). It is a masonry brick structure with the existing floodwalls tying into the walls of the building. The discharge tubes (from the pumps inside the building) extend directly out of the brick wall on the north side of the station and are turned downward into the canal. There also exists a series of floodgates which allow the pumping station to divert some of the storm water to the Florida Avenue Canal. Present level of flood protection offered by the floodwalls at Drainage Pumping Station No. 3 is elevation 12.5 msl.

4. Drainage Pumping Station No. 4. Drainage Pumping Station No. 4 is located on Prentiss Avenue on the east side of the London Avenue Canal (Station 101+00). The original pump house structure presently houses two centrifugal pumps. In addition to the two centrifugal pumps three horizontal pumps are located outdoors adjacent to the pump house structure. Present floodwalls across this outdoor portion of the station consists of concrete floodwalls constructed between the discharge tubes of these horizontal pumps. There is also a 10 foot diameter siphon tube crossing the canal that drains the area west of the canal. The water is siphoned across the canal into the pump sump of the station and then pumped into the canal with its three horizontal pumps and two centrifugal pumps. Present level of flood protection offered by the floodwalls at Drainage Pumping Station No. 4 is elevation 10.73 msl.

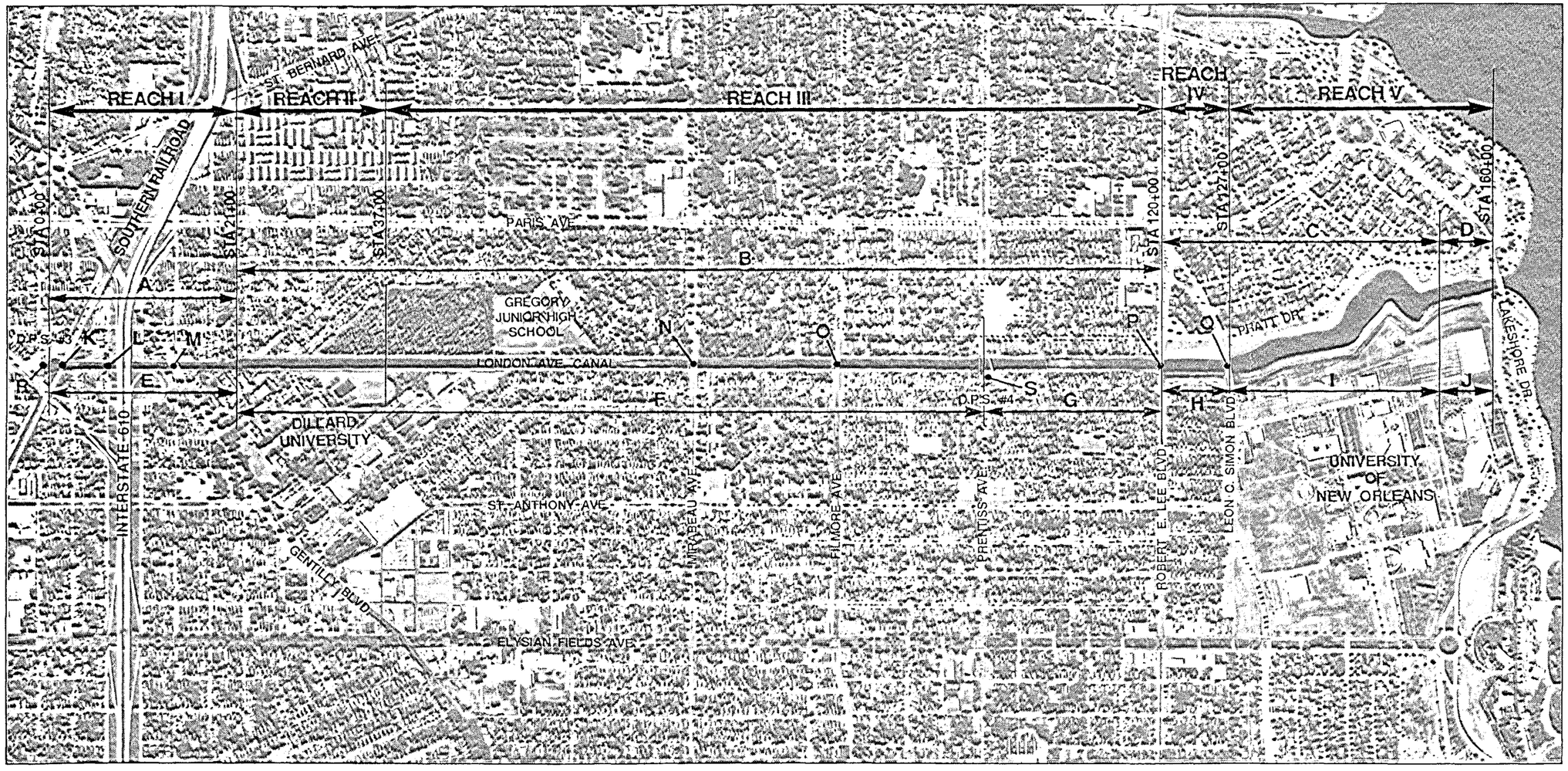
5. Bridges. There are 9 bridges crossing the London Avenue Canal. Seven of these bridges are below the required floodwall elevation. The elevation of the lowest level of flood protection at these bridges, which is

defined as the critical elevation, varies between elevation 4.19 msl and 10.03 msl, which means there are gaps in the floodwall which must be closed. The alternatives for closing these gaps are: 1) constructing flood gates at each bridge approach; 2) modifying the bridge deck and building parapet walls; or 3) rebuilding the bridges higher than the proposed floodwall elevation. More details about the bridges are discussed in Section III. The critical bridge elevations are also shown on Plate 2-1.

In addition to the 7 bridges requiring additional floodproofing, the two elevated structures carrying Interstate 610 also cross the London Avenue Canal. However, the elevation of these two structures is such that they provide adequate vertical clearance above the proposed floodwall height needed for flood protection. The lowest elevation of the bottom of the steel girders carrying I-610 is elevation 15.0 msl. Construction of new floodwalls under these existing structures will pose some problems but modification to the bridge structure will not be necessary.

6. Real Estate. Along most of the present levee system the existing property lines of the adjoining property are located at the toe of the existing levee. Most of these adjoining properties are rear yards of residential property and frequently garages or tool sheds are constructed adjacent to the property line. Alternates were considered for a full earthen levee and a 7.0 msl levee with steel sheet piling. The full earthen levee would result in approximately 90 acres of property acquisition and residential displacements, while the 7.0 msl levee with steel sheet piling would result in approximately 10 acres of property acquisition and residential displacements.

The cost for land acquisition using a full earthen levee would be approximately $32 million. The cost involved with the 7.0 msl levee with steel sheet pile for land acquisition is estimated at $4.1 million. These costs and potential time delays dictate that the improved levees are to be designed to avoid acquiring land or displacing any residents. The recommended plan requires the use of structural floodwalls where there exists a lack of right-of-way. This includes using earthen levees with structural steel sheet piling as well as structural T-walls, if needed. Full earthen levees were used only where adequate right-of-way exists to allow construction within the existing right-of-way. The recommended plan does not result in any residential displacements and only temporary servitudes will be required for access during construction under this plan.



DESIGNATION	ELEVATION (MSL)	SHEET PILE / EARTHEN LEVEE	SHEET PILE CANTILEVER
A	12.5	Z-27 L=20	7.5'
B	10.5	M-115 L=20'	4.5
C	9.0-10.0	EARTHEN LEVEE	-
D	10.0-11.0	EARTHEN LEVEE	-
E	12.5	Z-27 L=20'	7.5
F	10.5	M-115 L=20'	4.5
G	11.5	PZ-27 L=32'	8.0'
H	10.0	M-115 L=20'	4.5
I	10.0	EARTHEN LEVEE	-
J	10.0-11.0	EARTHEN LEVEE	-

CRITICAL BRIDGE ELEVATIONS

DESIGNATION	LOCATION	ELEVATION
K	SOUTHERN RAILROAD	9.33 MSL
L	BENEFIT STREET BRIDGE	8.37 MSL
M	GENTILLY BOULEVARD BRIDGE	4.19 MSL
N	MIRABEAU AVENUE BRIDGE	9.27 MSL
O	FILMORE AVENUE BRIDGE	9.15 MSL
P	ROBERT E. LEE BOULEVARD BRIDGE	8.64 MSL
Q	LEON C. SIMON BOULEVARD BRIDGE	10.03 MSL
R	DRAINAGE PUMPING STATION NO. 3	12.50 MSL
S	DRAINAGE PUMPING STATION NO. 4	10.73 MSL

PLATE 2-1

N

Burk & Associates, Inc.
Engineers • Planners • Environmental Scientists
New Orleans, Louisiana

LONDON AVENUE CANAL FLOODWALLS AND LEVEES

EXISTING CONDITIONS

ASSOCIATE	JOB NO	DESIGNED	SCALE 1"=1,250'	SHEET NO
REVIEWER	8407	DETAILED	DATE	
PLAN IN HAND		CHECKED	FILE NO	OF

LONDON AVENUE CANAL FLOODWALLS AND LEVEES
GENERAL DESIGN MEMORANDUM

BOARD OF COMMISSIONERS
ORLEANS LEVEE BOARD

ORLEANS LEVEE BOARD CONTRACT NO. 2049-0269

London Avenue Canal Floodwalls and Levees

General Design Memorandum

SECTION III
PROPOSED IMPROVEMENTS

SECTION III
PROPOSED IMPROVEMENTS

INDEX

Paragraph Number	Title	Page Number
	GENERAL	
1.	Scope	3-4
	BRIDGES AND GATES	
2.	Southern Railroad Bridge	3-5
3.	Benefit Street Bridge	3-6
4.	Gentilly Boulevard Bridge	3-7
5.	Mirabeau Avenue Bridge	3-8
6.	Filmore Avenue Bridge	3-10
7.	Robert E. Lee Boulevard Bridge	3-11
8.	Leon C. Simon Boulevard Bridge	3-12
	LEVEES AND FLOODWALLS	
9.	Description	3-14
10.	Alternate Study	3-14
11.	Reach I	3-15
12.	Reach II	3-15
13.	Reach III	3-16
14.	Reach IV	3-17
15.	Reach V	3-18
16.	Levee Construction	3-19
	DRAINAGE PUMPING STATIONS	
17.	New Orleans Sewerage and Water Board Drainage Pumping Station No. 3 (Station 0+00)	3-20
18.	New Orleans Sewerage and Water Board Drainage Pumping Station No. 4 (Station 101+00)	3-20
	RIGHT-OF-WAY CONSIDERATIONS AND OTHER CONSTRUCTION REQUIREMENTS	
19.	Right-of-way Considerations	3-22
20.	Utility Relocations	3-23

SECTION III
PROPOSED IMPROVEMENTS

INDEX (continued)

TABLES

Table Number	Title	Page Number
3-1	Recommendations - Reach I	3-25
3-2	Recommendations - Reach III	3-26
3-3	Utility Relocation Schedule	3-27

PLATES

Plate Number	Title
3-1	Recommended Improvements
3-2	Existing Bridges - Typical Sections
3-3	Alternate 1 - Plan & Elevation
3-4	Gentilly Blvd. & Robert E. Lee Blvd. Alternate 1 - Typical Sections
3-5	Mirabeau Ave. Alternate 2 - Plan & Elevation
3-6	Mirabeau Ave. Alternate 3 - Flood Roller Gate Gate Monolith
3-7	Mirabeau Ave. Alternate 3 - Flood Roller Gate Storage Monolith
3-8	Mirabeau Ave. Alternate 3 - Flood Roller Gate Gate Details
3-9	Mirabeau Ave. Alternate 3 - Flood Roller Gate Gate Sections
3-10	Railroad Crossing - Swing Gate Gate Monolith
3-11	Railroad Crossing - Swing Gate Gate Details
3-12	Railroad Crossing - Swing Gate Railroad Falsework Details
3-13	Recommended Plan for Levees and Floodwalls - Typical Sections
3-14	Recommended Plan for Levees and Floodwalls - Typical Sections
3-15	Recommended Plan for Levees and Floodwalls - Typical Sections

SECTION III
PROPOSED IMPROVEMENTS

INDEX (continued)

Plate Number	Title
3-16	Recommended Plan for Levees and Floodwalls - Typical Sections
3-17	Concrete Floodwalls - Typical Sections
3-18	Drainage Pumping Station No. 3 - Site Plan
3-19	Drainage Pumping Station No. 3 - Typical Sections
3-20	Drainage Pumping Station No. 4 - Site Plan
3-21	Drainage Pumping Station No. 4 - Typical Sections

SECTION III
PROPOSED IMPROVEMENTS

GENERAL

1. Scope. This section addresses the different alternates for improving flood protection along the London Avenue Outfall Canal. Included in the alternates studied were consideration of bridges, flood gates, levees, floodwalls, pumping stations and property acquisition and relocations of residences. A comparative analysis is done, cost estimates are provided, and recommendations of a plan of improvements are provided. For a map summarizing the proposed improvements for the recommended plan of interim flood protection, see Plate 3-1.

SECTION III
PROPOSED IMPROVEMENTS

BRIDGES AND GATES

2. Southern Railroad Bridge

a. Existing Conditions. The Southern Railroad Company owns two sets of tracks which cross the London Avenue Canal between Drainage Pumping Station No. 3 and Benefit Street at approximately station 2+00. The structure is approximately 160 feet long and 28 feet wide. The bridge consists of a sub-structure composed of eight concrete caps supported by eight steel pipe piles and one larger concrete cap with ten steel pipe piles. The superstructure consists of a solid concrete deck supporting the creosoted cross ties and two sets of rails. The concrete deck has weep holes and open joints at every bent. For a typical section of the existing bridge, see Plate 3-2.

b. Alternate Study. The structure is an open deck type railroad bridge with a top elevation of approximately 9.33 msl. This elevation is below the required floodwall elevation of 13.9 msl. The bridge cannot be modified to provide a watertight structure since a solid watertight deck and raised parapet walls would not allow storm drainage to run off this type of structure. Therefore, two alternates for providing necessary flood protection are suggested and described as follows:

1) Alternate 1: New Bridge. This alternate proposed constructing a new bridge to provide vertical clearance above the design high water level of 11.85 msl. Included in the cost of this solution is the demolition of the existing structure and the cost of the new railroad trestle to clear the proposed floodwalls.

The preliminary design of the proposed new bridge would increase the bridge length to 4,200 linear feet. This bridge will be a steel girder span structure. The estimated construction cost (E.C.C.) of the new bridge is $4,432,000 (see Table 5-4).

2) Alternate 2: Swing Gate Flood Gates. This alternate proposes constructing steel swing gates at both bridge approaches where the railroad crosses the floodwalls. A steel sheet pile cutoff will be provided for under seepage protection at each gate monolith. The opening size of the flood gates will be 30'-0" wide by 8'-6" high and will cost approximately $216,000 for

both gates (see Table 5-1). For typical details and sections see Plates 3-10 through 3-12.

c. Recommendations. Due to the extreme cost for constructing a new bridge, and the amount of time which the railroad would be out of service during construction of the bridge, this alternate is unfeasible. Therefore, the recommendation is to provide steel swing gates at each bridge approach as proposed in Alternate 2. The estimated construction cost (E.C.C.) for the recommended alternate is $216,000.

3. Benefit Street Bridge

a. Existing Conditions. This two lane bridge is located on Benefit Street at London Avenue Canal at approximately Station 6+60. The bridge is approximately 121 feet long and approximately 27 feet wide and was built in 1960. The bridge consists of a substructure composed of a concrete cap supported by four timber piles and a superstructure composed of a concrete deck supported by eleven steel girders. For a typical section of the existing structure, see Plate 3-2.

b. Alternate Study. The critical elevation of the bridge is 8.37 msl at the existing roadway deck. The deck elevation is below the required floodwall elevation of 13.9 msl. Three alternates for providing necessary flood protection are suggested and described as follows:

1) Alternate 1: Modify Existing Bridge. This alternate considered the installation of a new deck and parapet wall. The modifications include: 1) removal of the existing deck; 2) installing tension connections to the steel girders; and 3) installing a new concrete watertight deck and parapet wall. For a typical section and details similar to this type structure, see Plate 3-3. The estimated construction cost (E.C.C.) for this alternate is $149,700 (see Table 5-4).

2) Alternate 2: New Bridge. This solution considered the construction of a new bridge above the top of new floodwalls. Incorporated into the cost of this solution will be the demolition of the existing structure, the cost of the new bridge itself and the cost to raise the roadways, so that the bottom of the bridge deck elevation will be maintained above the floodwater elevation of 11.85 msl. The estimated construction cost (E.C.C.) for this alternate is $394,800 (see Table 5-4).

The preliminary design of the proposed new bridge would increase the bridge length to 550 feet. This bridge will be a concrete slab span structure. For a typical section similar to this type structure, see Plate 3-5.

3) Alternate 3: Bottom Roller Flood Gates. This solution proposes the installation of bottom roller flood gates at both bridge approaches. The opening size of the roller gate will be 31'-0" wide and 7'-0" high. A steel sheet pile cutoff will be provided for under seepage protection at each gate monolith. The estimated construction cost (E.C.C.) for this alternate is $75,000 (see Table 5-1). For typical details and sections, see Plates 3-6 through 3-9.

c. Recommendations. Benefit Street handles only localized traffic, and is in close proximity to the Gentilly Boulevard Bridge which has been recommended for modification. For these reasons and the fact that bottom roller flood gates are less expensive than floodproofing or rebuilding the entire bridge, the recommendation is to construct bottom roller flood gates as proposed in Alternate 3. The estimated construction cost (E.C.C.) for the recommended alternate is $75,000.

4. Gentilly Boulevard Bridge

a. Existing Conditions. This bridge is located on Gentilly Boulevard and London Avenue Canal at approximately station 14+00. It is approximately 108 feet long and approximately 86 feet wide, and was built in 1934 and expanded in 1950. The structure carries six lanes - three lanes in each direction. The bridge consists of a substructure composed of concrete footings supported by timber piles, concrete columns and concrete caps. The superstructure consists of a concrete slab span deck, with steel girders encased in the slab, supported by steel channels at the column bents. For a typical section of the existing bridge, see Plate 3-2.

b. Alternate Study. The lowest elevation of the bridge is 4.19 msl at top of slab and 7.53 msl at top of the parapet wall. The parapet wall elevation is below the required floodwall elevation of 13.9 msl. After evaluating the uplift forces to be resisted by the existing bridge foundation, it was determined this structure cannot safely resist the maximum uplift force which could develop during high water level to the top of floodwall elevation. The timber piles are capable of developing the tension capacity needed, however, the embedment into the existing concrete pile footings is not adequate to develop the tension forces necessary. There is no way of upgrading the pile to footing connection for this bridge since the bottom of footing elevation is several feet below the bottom of the concrete slope paving in the bottom of the canal. Therefore, two alternates

for providing the necessary flood protection are suggested and described as follows:

1) Alternate 1: New Low Level Bridge and Floodwalls. This alternate proposes the construction of a new bridge, keeping the existing deck elevation the same. The modifications include: 1) removal of the existing bridge (except footings and piles); 2) installing precast prestressed concrete (P.P.C.) pile bents; and 3) installing a new concrete watertight deck and parapet walls. The existing bridge has adequate seepage cutoff sheet piling at the end abutments. The estimated construction cost (E.C.C.) for this alternate is $445,400 (see Table 5-1). For a typical section of the new bridge, see Plate 3-4.

2) Alternate 2: New High Level Bridge. This solution proposes the construction of a new high level bridge. Incorporated into the cost of this solution will be the demolition of the existing structure, the cost of the new bridge itself and the cost to raise the roadways, so that the bottom of the bridge deck elevation will be maintained above the floodwater elevation of 11.85 msl.

The preliminary design of the proposed new bridge would increase the bridge length to 550 feet. This bridge will be a concrete slab span. The estimated construction cost (E.C.C.) for this alternate is $1,216,000 (see Table 5-4). For a typical section, see Plate 3-5.

c. Recommendations. Gentilly Boulevard is a major arterial roadway serving this area. During the approach of a hurricane this roadway functions as a primary hurricane evacuation route for residents in this area. For this reason it is necessary to keep this roadway open to traffic during the approach of a major storm. Therefore, flood gates are not considered a feasible alternate. The cost for Alternate 2 is not justified when compared with Alternate1. As a result the recommendation is to build a new bridge, keeping the new deck elevation the same as the existing deck, as proposed in Alternate 1. The estimated construction cost (E.C.C.) for the recommended alternate is $445,500.

5. Mirabeau Avenue Bridge

a. Existing Conditions. This bridge is located on Mirabeau Avenue at London Avenue Canal at station 70+00. The bridge is approximately 125 feet long and approximately 70.4 feet wide, and was built in 1960. The structure carries four travel lanes - two lanes in each direction. The bridge consists of a substructure composed of a concrete cap supported by twelve steel piles and a

superstructure composed of a concrete deck supported by twelve steel girders (see Plate 3-2). Adjacent to the bridge is a timber pedestrian bridge.

b. Alternate Study. The lowest elevation of the bridge is 7.70 msl at the top of the slab and 9.27 msl at the top of the parapet wall. The parapet wall elevation is below the required floodwall elevation of 13.9 msl. Three alternates for providing necessary flood protection are suggested and described as follows:

1) Alternate 1: Modify Existing Bridge. This alternate considered the installation of a new deck and parapet walls. The modifications include: 1) removal of the existing deck; 2) installing new steel girders along the exterior faces of the existing bridge; 3) installing tension connectors to the steel girders, piles and caps; and d) installing a new concrete watertight deck, parapet walls and pedestrian sidewalks. The existing bridge has adequate seepage cutoff sheet piling at the end abutments. Additionally, the adjacent pedestrian bridge will be removed. The estimated construction cost (E.C.C.) for this alternate is $305,000 (see Table 5-1). For typical sections and details, see Plate 3-3.

2) Alternate 2: New Bridge. This solution proposes the construction of a new high level bridge. Incorporated into the cost of this solution will be the demolition of the existing structure, the cost of the new bridge itself and the cost to raise the roadways so the bottom of the bridge deck elevation will be maintained above the floodwater elevation of 11.85 msl.

The preliminary design of the proposed new bridge would increase the bridge length to 700 feet. This bridge will be a concrete slab span. The estimated construction cost (E.C.C.) for this alternate is $1,095,600 (see Table 5-4). For typical section and details, see Plate 3-5.

3) Alternate 3: Bottom Roller Flood Gates. This alternate suggests the installation of bottom roller flood gates at both bridge approaches. The opening size of the roller gate will be 75 feet wide and 7 feet 3 inches high. The estimated construction cost (E.C.C.) for this alternate is $141,000 (see Table 5-4). For details see Plates 3-6 through 3-9.

c. Recommendations. It is not a practical solution to close the bridge during the flood period as suggested in Alternate 3. In addition, the cost differential between Alternate 3 and Alternate 1 is relatively small. The cost of Alternate 2 is $1,095,600 which is substantially more than Alternate 1. Since the benefits derived from Alternate 2 do not justify this additional expense we, therefore, recommend Alternate 1. The estimated construction cost (E.C.C.) for the recommended alternate is $305,000.

6. Filmore Avenue Bridge

a. Existing Conditions. This bridge is located on Filmore Avenue at London Avenue Canal at station 85+50. The bridge is approximately 140.4 feet long and approximately 38 feet wide, and carries two travel lanes - one lane in each direction. The bridge consists of a substructure composed of a concrete cap supported by seven steel piles and a superstructure composed of a concrete deck supported by eight steel girders. It was built in 1959. For a typical section of the existing bridge, see Plate 3-2. Adjacent to the bridge is a timber pedestrian bridge.

b. Alternate Study. The lowest elevation of the bridge is 6.48 msl at the top of the slab and 9.15 msl at the top of the parapet wall. The parapet wall elevation is below the required floodwall elevation of 13.9 msl. Three alternates for providing necessary flood protection are suggested and described as follows:

1) Alternate 1: Modify Existing Bridge. This alternate considered the installation of a new deck and parapet wall. The modifications include : a) removal of the existing deck; b) installing new steel girders along the exterior faces of the existing bridge; c) installing tension connectors to the steel girders, piles and caps; d) installing a new concrete watertight deck, parapet wall and pedestrian sidewalks. The existing bridge has adequate seepage cutoff sheet piling at the end abutments. The adjacent pedestrian bridge will be removed. The estimated construction cost (E.C.C.) for this alternate is $264,000 (see Table 5-1). For a typical section similar to this type structure, see Plate 3-3.

2) Alternate 2: New Bridge. This solution proposes the construction of a new high level bridge. Incorporated into the cost of this solution will be the demolition of the existing strucuture, the cost of the new bridge itself, and the cost to raise the roadways, so the bottom of the bridge deck elevation will be maintained above the floodwater elevation of 11.85 msl.

The preliminary design of the proposed new bridge would increase the bridge length to 550 feet. This bridge will be a concrete slab span. The estimated construction cost (E.C.C.) for this alternate is $518,000 (see Table 5-4). For a typical section similar to this bridge, see Plate 3-5.

3) Alternate 3: Bottom Roller Flood Gates. This solution suggests the installation of bottom roller flood gates at both bridge approaches. The opening size of the roller gate will be 42 feet wide and 8 feet 6 inches high.

The estimated construction cost (E.C.C.) for this alternate is $80,000 (see Table 5-4). For similar details, but different dimensions, see Plates 3-6 through 3-9.

c. Recommendations. It is not a practical solution to close the bridge during the flood period as suggested in Alternate 3. In addition, the cost differential between Alternate 3 and Alternate 1 is relatively small. The cost for Alternate 2 is $518,000 which is substantially more than Alternate 1. Since the benefits derived from Alternate 2 do not justify this additional expense we, therefore, recommend Alternate 1. The estimated construction cost (E.C.C.) for the recommended alternate is $264,000.

7. Robert E. Lee Boulevard Bridge

a. Existing Conditions. This bridge is located on Robert E. Lee Boulevard at London Avenue Canal at station 120+25. The bridge is approximately 180.6 feet long and approximately 35 feet wide, and it was built in 1960. The structure carries two lanes - one lane in each direction. The bridge consists of a substructure composed of a concrete cap supported by piles and a superstructure composed of a concrete deck supported by twelve steel girders. For a typical section of the existing bridge, see Plate 3-2. Adjacent to the bridge is a timber pedestrian bridge.

b. Alternate Study. The lowest elevation of the bridge is 5.39 msl at the top of the slab and 8.64 msl at the top of the parapet wall. The parapet wall elevation is below the required floodwall elevation of 13.9 msl. Two alternates for providing necessary flood protection are suggested and described as follows:

1) Alternate 1: Modify Existing Bridge. This alternate considered the installation of a new deck and parapet wall. The modifications include: 1) removal of the existing deck; 2) installing new steel girders along the exterior faces of the existing bridge; 3) installing new tension piles at each bent to resist uplift during high water; 4) installing tension connectors to the steel girders, caps and piles; and 5) installing a new concrete watertight deck, parapet wall and pedestrian sidewalks. The existing bridge has adequate seepage cutoff sheet piling at the end abutments. The adjacent pedestrian bridge will be removed. The estimated construction cost (E.C.C.) for this alternate is $335,900 (see Table 5-1). For a typical section, see Plate 3-4.

2) Alternate 2: New Bridge. This solution proposed the construction of a new high level bridge. Incorporated into the cost of this solution will be the demolition of the existing structure, the cost of the new

bridge itself and the cost to raise the roadways, so the bottom of the bridge deck elevation will be maintained above the floodwater elevation of 11.85 msl.

The preliminary design of the proposed new bridge would increase the bridge length to 550 feet. This would be a concrete slab span. The estimated construction cost (E.C.C.) for this alternate is $488,300 (see Table 5-4). For a typical section similar to this type structure, see Plate 3-5.

c. Recommendations. Robert E. Lee Boulevard is a major arterial roadway serving this area. During the approach of a hurricane this roadway functions as a primary hurricane evacuation route for residents in this area. For this reason it is necessary to keep this roadway open to traffic during the approach of a major storm. Therefore, flood gates are not considered a feasible alternate. The cost for Alternate 2 is too high. As a result, the recommendation is to replace the deck and parapet walls as suggested in Alternate 1. The estimated construction cost (E.C.C.) for the recommended alternate is $335,900.

8. Leon C. Simon Boulevard Bridge

a. Existing Conditions. This bridge is located on Leon C. Simon Boulevard at London Avenue Canal at approximately station 127+50. The bridge is approximately 184 feet long and approximately 71 feet wide, and it was built in 1967. The structure carries four travel lanes - two lanes in each direction. The bridge consists of a substructure composed of concrete caps each supported by nineteen steel piles and a superstructure composed of a concrete deck supported by twelve steel girders. For a typical section of the existing bridge, see Plate 3-2.

b. Alternate Study. The lowest elevation of the bridge is 6.52 msl at the top of the slab and 10.03 msl at the top of the parapet wall. The parapet wall elevation is below the required floodwall elevation of 13.60 msl. Three alternates for providing necessary flood protection are suggested and described as follows:

1) Alternate 1: Modify Existing Bridge. This alternate considered the installation of tension connectors to the steel girders, caps and piles, and construction of new parapet walls parallel to the centerline of the bridge along each face of the bridge deck. This existing bridge has a watertight deck and therefore replacement of the existing deck is not necessary. The existing bridge has adequate seepage cutoff sheet piling at the end abutments.

The estimated construction cost (E.C.C.) for this alternate is $158,500 (see Table 5-1). For a typical section similar to this type structure, see Plate 3-3.

2) Alternate 2: New Bridge. This solution proposed the construction of a new high level bridge. Incorporated into the cost of this solution will be the demolition of the existing structure, the cost of the new bridge itself and the cost to raise the roadways, so that the bottom of the bridge deck elevation will be maintained above the floodwater elevation of 11.60 msl.

The preliminary design of the proposed new bridge would increase the bridge length to 700 feet. This bridge will be a concrete slab span. The estimated construction cost (E.C.C.) of this alternate is $1,134,000 (see Table 5-4). For a typical section and similar details, see Plate 3-5.

3) Alternate 3: Bottom Roller Flood Gates. This solution suggests the installation of bottom roller flood gates at both bridge approaches. The opening size of each roller gate will be 75 feet wide and 8 feet 6 inches high. The estimated construction cost (E.C.C.) for this alternate if $141,000 (see Table 5-4). For typical details and sections, see Plates 3-6 through 3-9.

c. Recommendations. It is not feasible to reconstruct this entire bridge as suggested in Alternate 2 due to the extreme cost involved. It is also not practical to recommend installing flood gates, which involve ongoing operation and maintenance costs, when modifications to the existing structure can adequately provide the necessary flood protection. Also, the costs for modifying this structure as recommended in Alternate 1 are approximately equal in cost to installing flood gates as discussed in Alternate 3. Therefore, the recommendation is to replace the parapet walls and secure the steel girders and piles to resist the uplift forces as discussed in Alternate 1. The estimated construction cost (E.C.C.) of the recommended alternate is $158,500.

SECTION III
PROPOSED IMPROVEMENTS

LEVEES AND FLOODWALLS

9. Description. The levees adjacent to the London Avenue Canal require upgrading to conform to the design criteria obtained from the U.S. Army Corps of Engineers, which is the adopted design criteria for this project. This design calls for a still water surface elevation in the canal at Lake Pontchartrain of 11.5 msl. The design criteria also requires a two foot freeboard in the canal, raising the levees to elevation 13.5 msl in the vicinity of the Lake. Due to the hydraulic gradient in the canal (see Appendix B - Hydraulic Study), the levee will be raised to 13.9 msl at Sewerage and Water Board's DPS #4 (Station 101+00) and be maintained at this elevation down to DPS #3 (Station 0+00). Along the perimeter of the Lake, the Corps of Engineers is raising the levees to elevation 17.5 msl. This elevation includes wave action and three feet of freeboard. The project design criteria allows two feet of freeboard for levee design within the confines of the canal. There will be an area of transition of the levee from elevation 13.5 to 17.5 near the Lake to tie into the lakefront levee system.

10. Alternate Study. The basis of the design and analysis of the levee/floodwall combinations are from a stability analysis, performed by Eustis Engineering Company (see Appendix C - Geotechnical Investigation), using the hydrostatic pressure with the water at the top of the wall. This analysis is conservative because the design allows for two feet of freeboard above the design water surface profile. The design of the sheet pile section was based on a deflection analysis due to lateral loading with the hydrostatic loading to the top of the wall.

The criteria for selecting the recommended alternate was established by selecting a levee system which satisfies the stability criteria, has the lowest net cost, and which does not require any additional right-of-way. Where right-of-way is not a problem, a full earthen levee section is recommended. Where right-of-way becomes restricted, an elevation 7.0 msl levee or an elevation 5.0 msl levee with cantilever steel sheet piling ranging from PZ-27 to PZ-40 is recommended. In areas where these alternates are not feasible, a poured in place concrete T-wall floodwall is recommended.

If an earthen levee was selected for the entire project, it would require that 90 acres of real estate be acquired at a cost of approximately $32 million in

addition to the levee construction cost. Similarly, if an elevation 7.0 msl levee with steel sheet piles were used throughout this project, approximately 10 acres of real estate would need to be acquired at a cost of $4.1 million. For these reasons, as well as potential time delays in acquiring the land, it was established that the Recommended Plan would be developed such that no relocations would be required.

In some reaches, a number of different alternates are recommended within a particular reach. This is due to the varying right-of-way limits and the least expensive alternate is recommended. For typical sections of the levee/floodwall improvements for the recommended plan, see Plates 3-13 through 3-17.

11. Reach I. The section of canal, located between stations 0+00 and 21+00, is defined as Reach I. Within Reach I, the present right-of-way is very narrow and construction of an earthen levee is not feasible within the existing right-of-way. The landside toe of an earthen levee would be located approximatley 160 feet landside of the existing floodwall resulting in a major amount of residential relocations. The alternate for constructing an earthen levee to elevation 7.0 msl was also considered but due to stability criteria, a setback distance of approximately 46 feet from the existing floodwall to the landside toe of the new levee is required. This setback also results in a significant amount of residential displacement and consequently is unfeasible. Therefore, the recommendation is to upgrade the existing earthen levees within Reach I to elevation 5.0 msl and to provide PZ-40 steel sheet pile I-walls cut off at elevation 13.9 msl. Along the east levee between stations 2+80 and 6+60 where construction of a levee to elevation 5.0 msl would require right-of-way acquisition and would result in residential displacements, a concrete inverted 'T' floodwall is recommended. There are many variations for sheet pile placements for the recommended plan within the levee along Reach I. The locations and type of sheet piles along with the length and setback distances are summarized in Table 3-1.

The estimated construction cost (E.C.C.) for the levee improvements in Reach I is estimated at $4,467,000 as summarized in Table 5-2. Plan and profiles are shown in Appendix A, Plates A-1 and A-2 on the west side and Plate A-8 on the east side, and typical sections are shown on Plates 3-13 and 3-17.

12. Reach II. The section of canal located between stations 21+00 and 37+00 is defined as Reach II. Within Reach II the existing right-of-way is not as restricted as Reach I, but still does not allow enough room for construction of an earthen levee to the required grade. An all earthen levee would have a landside

toe located approximately 140 feet landside of the existing floodwall and would displace many residences along with many facilities within the Dillard University campus. On the other hand, construction of a concrete inverted 'T' floodwall is too costly and not necessary for maintaining the construction limits within the existing right-of-way. Therefore, the recommendation for this reach is to construct an earthen levee to elevation 7.0 msl with a PZ-27 cantilever sheet pile I-wall cut off at elevation 13.9 msl. The length of the sheet pile is 34'-6" and is setback 3 feet from the existing I-wall. This recommendation is for both the east and west levees of the canal. The estimated construction cost (E.C.C.) for the levees in Reach II is estimated at $1,569,100 as summarized in Table 5-2. Plan and profiles are found in Appendix A, Plate A-2 on the west side and Plates A-8 and A-9 on the east side, and typical sections of the recommended plan are shown on Plate 3-13.

13. Reach III. The section of canal located between stations37+00 and 120+00 is defined as Reach III. Within this reach the right-of-way restrictions vary but are not adequate for construction of an earthen levee to the required grade. An earthen levee would have a landside toe setback approximately 170 feet from the existing floodwall. This would result in a major amount of residential displacements along both sides of the London Avenue Canal within this reach and is therefore unfeasible. A combination levee and cantilever sheet pile floodwall system is feasible so it is not necessary to construct concrete inverted 'T' floodwalls within this reach. Therefore,the recommendations for Reach III improvements are generally to build up the earthen levee slightly and place steel sheet piles cut off at elevation 13.9 msl. From station 37+00 to station 58+00 on the east levee and from station 37+00 to station 120+10 on the west levee an earthen levee can be constructed to elevation 7.0 msl with a PZ-27 steel sheet pile I-wall cut off at elevation 13.9 msl. Due to a more restricted right-of-way from station 58+00 to station 120+10 on the east levee, an earthen levee can only be constructed up to elevation 5.0 msl with a PZ-40 steel sheet pile I-wall cut off at elevation13.9 msl is required. The other alternative to this more costly PZ-40 I-wall would be to acquire an additional strip of right-of-way from the rear yards of the residential properties along Warrington Drive between station 58+00 and 120+10 (approximately 1000 feet south of Mirabeau Boulevard to Robert E. Lee Boulevard). This required right-of-way would result in displacing numerous garages and tool sheds and several large oak trees for construction of the required levee. Additionally, this alternate was almost as costly as the recommended plan when the right-of-way and relocations costs are included in the estimate. Therefore, to minimize this negative impact and potential time delays from having to acquire this large scale right-of-way acquisition, the recommended plan is to develop the earthen levee only to elevation 5.0 msl in this portion of Reach III, and provide the 8.9 foot high

cantilever I-wall floodwall within the existing right-of-way. The detailed summary of sheet pile type, length, setback distances from the existing I-wall and the required levee elevations are shown in Table 3-2.

The estimated construction cost (E.C.C.) for the levee improvements in Reach III is estimated at $11,505,400 and is summarized in Table 5-2. Plan and profiles are shown in Appendix A, Plates A-2 through A-5 on the west side and Plates A-9 through A-12 on the east side, and typical sections for the recommended plan are shown on Plates 3-13 and 3-14.

14. Reach IV. The section of canal located between stations 120+00 and 127+00 is defined as Reach IV. The east levee within Reach IV is similar to Reaches II and III. An earthen levee constructed in this reach would have a landside levee toe approximately 140 feet setback from the existing I-wall. This would again result in a significant number of residential displacements along this section of levee between Robert E. Lee and Leon C. Simon Boulevard and is considered unfeasible. A concrete inverted 'T' floodwall is not necessary since adequate right-of-way is available for construction of a combination earthen levee and cantilever I-wall. Therefore, the recommendation for the levee on the east side of the canal is to upgrade the earthen levee to elevation 6.5 msl and place PZ-27 cantilevered steel sheet piles cut off at elevation 13.6 msl. The sheet piles will be 34'-6" long and they will be setback 3' from the existing I-wall.

The west levee within Reach IV can be improved up to the required elevation of 13.6 msl without creating any displacements or acquiring any additional right-of-way. Since earthen levees are more economical than combination levees with cantilevered I-walls or concrete T floodwalls, the recommendation for this west levee is to construct the entire levee as an earthen levee. The location of this levee section, as established by the geotechnical investigation performed by Eustis Engineers, requires the centerline of the upgraded levee to be setback 100 feet from the -5.0 msl contour in the London Avenue Canal. This places the centerline of the improved levee approximately 25 feet landside of the existing levee centerline.

The estimated construction cost (E.C.C.) for the levee improvements in Reach IV is estimated at $485,200, as summarized in Table 5-1. Plan and profiles are shown in Appendix A, Plates A-5 and A-6 on the west side and Plate A-12 on the east side, and typical sections of the recommended plan are shown on Plates 3-14 and 3-15.

15. Reach V. The section of canal located between stations 127+00 and 160+00 is defined as Reach V. This reach consists of three separate required levee heights. In the south end of this reach, the design levee height is 13.5 msl. There is an area on each side of the canal where the elevation will transition from 13.5 to 17.5 msl. The north end of this reach has a design height of 17.5 msl where the levee is subjected to wave runup from Lake Pontchartrain..

a. East Side Station 127+20 to 144+50. The recommendation for this section is to construct a new earthen levee with a crown elevation of 13.5 msl. The centerline of the new proposed levee will match the centerline of the existing levee and all construction shall remain within the existing right-of-way limits. Since this alternate is the most economical solution, no other alternates were considered.

b. East Side Station 144+50 to 147+50. This section is the transition area where the earthen levee crown elevation will vary from 13.5 to 11.0 msl. PZ-27 steel sheet pile I-walls will be placed starting at a cut off elevation at 13.5 and extending to elevation 17.5 msl. The lengths of the sheet pile will also change from 14'-6" to 33'-6".

c. East Side Station 147+50 to 159+90. Due to stability criteria, an earthen levee constructed to elevation 17.5 msl would require a setback distance of approximately 160 feet from the existing levee centerline to the new landside levee toe. This setback would require additional right-of-way acquisition from the University of New Orleans and also conflicts with proposed roadway improvements which UNO is scheduling in the near future. Therefore, this last section on the east side will continue with the crown of the earthen levee at elevation 11.0 msl. It will have a PZ-27 steel sheet pile I-wall cut off at elevation 17.5 msl. The sheet pile will be 33'-6" long and the centerline of the new levee crown will match the centerline of the existing levee.

d. West Side Station 127+55 to 146+50. The first section on the west side of the canal will have a new earthen levee constructed at elevation 13.5 msl similar to the east side. The centerline of this new levee will match the centerline of the existing levee and all construction shall remain within the existing right-of-way limits.

e. West Side Station 146+50 to 149+50. The transitional section on the west side is the same as for the east side. The earthen levee's crown elevation will vary from 13.5 to 11.0 msl. A PZ-27 steel sheet pile cut off between elevation 13.5 and 17.5 msl will be placed in the levee, and the lengths of the sheet piles will vary from 14'-6" to 33'-6".

f. West Side Station 149+50 to 159+70. This last section on the west side will be similar to the east side. Due to stability criteria, an earthen levee constructed to elevation 17.5 msl on this west levee would require a setback distance of approximately 190 feet from the existing levee centerline to the new landside levee toe. This setback would require additional right-of-way and also result in substantial residential displacements adjacent to this levee. Therefore, under the recommended plan, the earthen levee crown elevation will continue at elevation 11.0 msl. It will have a PZ-27 steel sheet pile I-wall cut off at elevation 17.5 msl. The length of the sheet piling will be 33'-6" and the setback distance will be approximately 20 feet landside from the existing levee centerline.

The estimated construction cost (E.C.C.) for the levee improvements in Reach V is estimated at $1,939,400, as summarized in Table 5-1. Plan and profiles are shown in Appendix A, Plate A-6 and A-7 on the west side and A-12 and A-13 on the east side, and typical sections for the recommended plan are shown on Plates 3-15 and 3-16.

16. Levee Construction. When the new steel sheet pile I-walls are constructed from Reach I through Reach IV, the existing concrete floodwall will be obsolete above the new earthen levee elevation. Therefore, the upper portion of the existing floodwall is to be removed and disposed of by placing the concrete cap along the canal bank of the London Avenue Canal. This concrete will serve as rip rap for scour protection along the face of the new floodwall. Removal of this upper portion of the old floodwall will also assist the Orleans Levee Board in maintenance of the new levee since the area between the old and new I-walls would be inaccessible if it remained intact.

During construction of the new levees and floodwalls, interim flood protection will have to be maintained to elevation 8.0 msl at all times. Where construction activity requires removal of the existing I-wall for driving the new steel sheet piles, minimal gaps will be permitted during the construction phase on a daily basis only. All openings in levee protection required for construction access will have to be closed at the end of each working day.

SECTION III
PROPOSED IMPROVEMENTS

DRAINAGE PUMPING STATIONS

17. New Orleans Sewerage and Water Board Drainage Pumping Station No. 3 (Station 0+00). This pumping station is located just north of the intersection of N. Broad Avenue and London Avenue and marks the beginning of the London Avenue Outfall Canal. Being situated across the south end of the canal, the current level of flood protection is provided by the structure of the station itself. The walls of the discharge basin are then integrated with the earthen levee and floodwall system of the canal on the east and west sides to complete the continuity of flood protection.

Proposed improvements to the existing level of flood protection at Pump Station No. 3 involves upgrading of the existing system. On the west side, enough space is available to raise the elevation of the existing earth levee to elevation 13.9 msl. This will require that a portion of the existing concrete discharge basin wall be raised also. On the east side, the entire length of the existing discharge basin wall, from the pumping station to the junction with the proposed swing gate at the railroad crossing, will be raised to the required elevation of 13.9 msl. This portion of new work includes proposed replacement of an existing flow diversion flood gate which permits certain pumps within the station to pump either directly to Lake Pontchartrain or to divert discharge to N.O.S.&W.B. Pump Station No. 5. Since major modifications to the pump station structure are not economically feasible at this time, improved flood protection across the front of the station will be provided by constructing a new concrete wall immediately in front of the existing structure. This new wall shall extend laterally between the discharge basin walls on either side and will be supported vertically by the existing foundation slab. Plates 3-18 and 3-19 present pictorially the proposed improvements to Pump Station No. 3.

18. New Orleans Sewerage and Water Board Pumping Station No. 4 (Station 101+00). This pumping station is located on the east bank of London Avenue Outfall Canal at Prentiss Avenue. Being situated parallel with the flow of the canal, existing flood protection is provided by the earthen levee and floodwall system of the canal being linked with the foundation and building structure of the station.

Consistent with the existing scheme, improvements to the levee and floodwall system of the canal will extend completely to the structural limits of pumping station. Therefore, proposed upgrading of flood protection for the station will be confined to modifications of the structure only. The level of flood protection for the original pumping station was upgraded in 1973 and proposed new improvements are predicated upon the system used. These interim modifications to the pump station are proposed to be replaced with new components constructed to the higher elevation of 13.9 msl as required and founded upon the original structure of the station. In addition, the centrifugal pump discharge bay on the south end of the structure is to receive a new concrete wall facing against the existing building. This wall is to extend laterally between the walls of the discharge basin and vertically from the top of the existing discharge tubes up to the required elevation of 13.9 msl. Plates 3-20 and 3-21 present pictorially the proposed improvements to Pump Station No. 4.

SECTION III
PROPOSED IMPROVEMENTS

RIGHT-OF-WAY CONSIDERATIONS AND OTHER CONSTRUCTION REQUIREMENTS

19. Right-of-Way Considerations. The recommended plan of improvements to the London Avenue Canal floodwalls does not require any significant right-of-way acquisitions. Under the recommended plan, only temporary construction access servitudes will be necessary during the construction phase of this project. Several alternate plans were looked at which involved any where from a minor right-of-way acquisition to massive acquisitions and relocations. In order to be able to expedite the implementation of the interim floodwalls and levees, it was a high priority to develop the levee sections to remain within the existing right-of-way.

a. Reach I. In Reach I, due to the weaker subsoils, this resulted in maintaining a levee embankment at elevation 5.0 msl with an 8.9 foot high cantilever I-wall since a levee constructed to elevation 7.0 msl in this reach would require a setback distance of approximately 17 feet from the existing floodwall to the new floodwall. This setback would have resulted in a large number of residential displacements and was therefore considered unfeasible.

b. Reach II. Right-of-way was not a problem in Reach II since the earthen levee can safely be constructed to elevation 7.0 msl with an economical steel sheet pile I-wall to provide the full flood protection with no additional right-of-way required.

c. Reach III. The southern portion of Reach III as well as the western half of this reach can safely be constructed similar to Reach II within the existing right-of-way. However, along the eastern levee of Reach III between station 58+00 and 120+00 (1000' south of Mirabeau Ave. to Robert E. Lee Blvd.) the earthen levee crown has to be lowered to elevation 5.0 msl to avoid levee construction crossing the existing right-of-way limits. This results in a substantially heavier steel sheet pile I-wall due to the reduction in levee crown elevation. The other two choices were to maintain the levee crown at elevation 7.0 msl and either construct a retaining wall 3 to 5 feet high at the property line or acquire 10 to 15 feet of additional right-of-way within this reach. In addition to the real estate purchase, a substantial number of garages and tool sheds would be displaced as well as approximately 160 trees would be displaced by this acquisition. The costs for this real estate and relocations, as well as the potential

time delays for these acquisitions, resulted in selecting the lower levee height with a heavier I-wall in this area for the recommended plan.

d. Reach IV. In Reach IV the east levee can be constructed to elevation 6.5 msl with an economical steel sheet pile I-wall to provide full flood protection safely within the existing right-of-way. However, the option of omitting the I-wall and developing an earthen levee to elevation 13.6 msl results in major relocation of adjacent residential property. The west levee in Reach IV can safely be developed as an earthen levee to elevation 13.6 msl within existing right-of-way. There are no displacements within this existing right-of-way.

e. Reach V. In Reach V between Leon C. Simon Blvd. and the point where the levee must be raised due to wave runup from Lake Pontchartrain, an earthen levee can safely be constructed on both the east and west levee within existing right-of-way. The only displacements are 26 trees within this right-of-way. At the north end of Reach V when the levee crown must be raised to elevation 17.5 msl, an earthen levee on the west side would result in a large scale residential relocation and was ruled unfeasible. On the east levee, the earthen levee to elevation 17.5 msl would require a significant amount of right-of-way acquisition from the University of New Orleans. The 5 year plan of improvements of UNO plans to construct a new campus perimeter roadway within the area where this levee would be located. Therefore, it is more feasible to maintain an elevation 11.0 msl earthen levee with a 6.5 foot high sheet pile I-wall within the present right-of-way for this portion of Reach V.

20. Utility Relocations. Included in the plan for the floodwall improvements is the relocation work at certain existing utility crossings along the existing floodwall. Where new steel sheet piling is to be driven at these utility crossings, the normal procedure is to build a temporary bypass line to maintain the necessary services. After installation of the temporary bypass, the new steel sheet piling is driven at the proper location and a steel sleeve is installed to allow the permanent utility line to pass through the floodwall. Once the permanent utility pipe is passed through the floodwall, a water tight seal is placed around the pipe and then the temporary bypass pipe line can be disassembled. At less critical utility crossings,the bypass line can be deleted if the existing utility line can be disconnected long enough to allow construction of the new sheet pile floodwall and reconnection of the utility pipe line. Besides water mains, sewer force mains and gas transmission trunklines crossing this floodwall, the Sewerage & Water Board's primary electric power transmission cable will require relocation at certain areas. This power cable provides the S&WB electric power to D.P.S. No. 3 and No. 4 and must be maintained operable at all times to allow the drainage pump stations to operate. Therefore,

before construction involving floodwalls which support the present transmission cable proceed, a relocated power cable must be installed.

Another major utility line which may be affected is the 10 foot diameter siphon pipe line from Prentiss Ave. west of London Avenue Canal to D.P.S. No. 4 on the east side of the canal. Constructing the new levee will have to be coordinated closely with New Orleans Sewerage and Water Board so the siphon tube can be disconnected while the steel sheet piles are driven. Then the tube must be replaced immediately, keeping the shut down time to a minimum. The construction must also take place at a time of the year when weather conditions will permit. This type of construction will save thousands of dollars by not having to build a bypass tube. A summary of the existing utilities requiring relocation is shown in Table 3-3.

TABLE 3-1
INTERIM FLOODWALL AND LEVEE
RECOMMENDATIONS - REACH I

Station	Canal Side	Elevation of Levee (msl)	Sheet Pile Section	Cutoff Elevation (msl)	Length of Sheet Pile	Setback from Existing I-wall
0+00 to 1+40	E	5.0	Inverted T	13.9	-	-
1+78 to 2+80	E	5.0	PZ-40	13.9	58'-0"	3'
2+80 to 6+60	E	2.0	Concrete Inverted T	13.9	-	0
6+90 to 13+70	E	5.0	PZ-40	13.9	58'-0"	3'
14+70 to 21+00	E	5.0	PZ-40	13.9	58'-0"	0-3'
0+00 to 2+10	W	13.9	-	-	-	-
2+38 to 6+60	W	5.0	PZ-40	1.39	58'-0"	3'
6+90 to 13+10	W	5.0	PZ-40	13.9	58'-0"	0-3'
14+10 to 18+00	W	5.0	PZ-40	13.9	58'-0"	0
18+00 to 21+00	W	5.0	PZ-40	13.9	58'-0"	3'

TABLE 3-2
INTERIM FLOODWALL AND LEVEE RECOMMENDATIONS - REACH III

Station	Canal Side	Elevation of Levee (msl)	Sheet Pile Section	Cutoff Elevation (msl)	Length of Sheet Pile	Setback from Existing I-wall
37+00 to 52+00	E	7.0	PZ-27	13.9	34'-0"	3'
52+00 to 58+00	E	7.0	PZ-27	13.9	34'-0"	0
58+00 to 69+60	E	5.0	PZ-40	13.9	49'-0"	3'
70+30 to 85+35	E	5.0	PZ-40	13.9	49'-0"	0
85+70 to 100+80	E	5.0	PZ-40	13.9	49'-0"	-2'
102+20 to 120+10	E	5.0	PZ-40	13.9	49'-0"	-2'
37+00 to 69+60	W	7.0	PZ-27	13.9	34'-0"	3'
70+30 to 80+00	W	7.0	PZ-27	13.9	34'-0"	-2'-(-3')
80+00 to 85+35	W	7.0	PZ-27	13.9	34'-0"	2'
85+70 to 94+00	W	7.0	PZ-27	13.9	34'-0"	2'
94+00 to 120+10	W	7.0	PZ-27	13.9	34'-0"	-2'-(-4')

TABLE 3-3

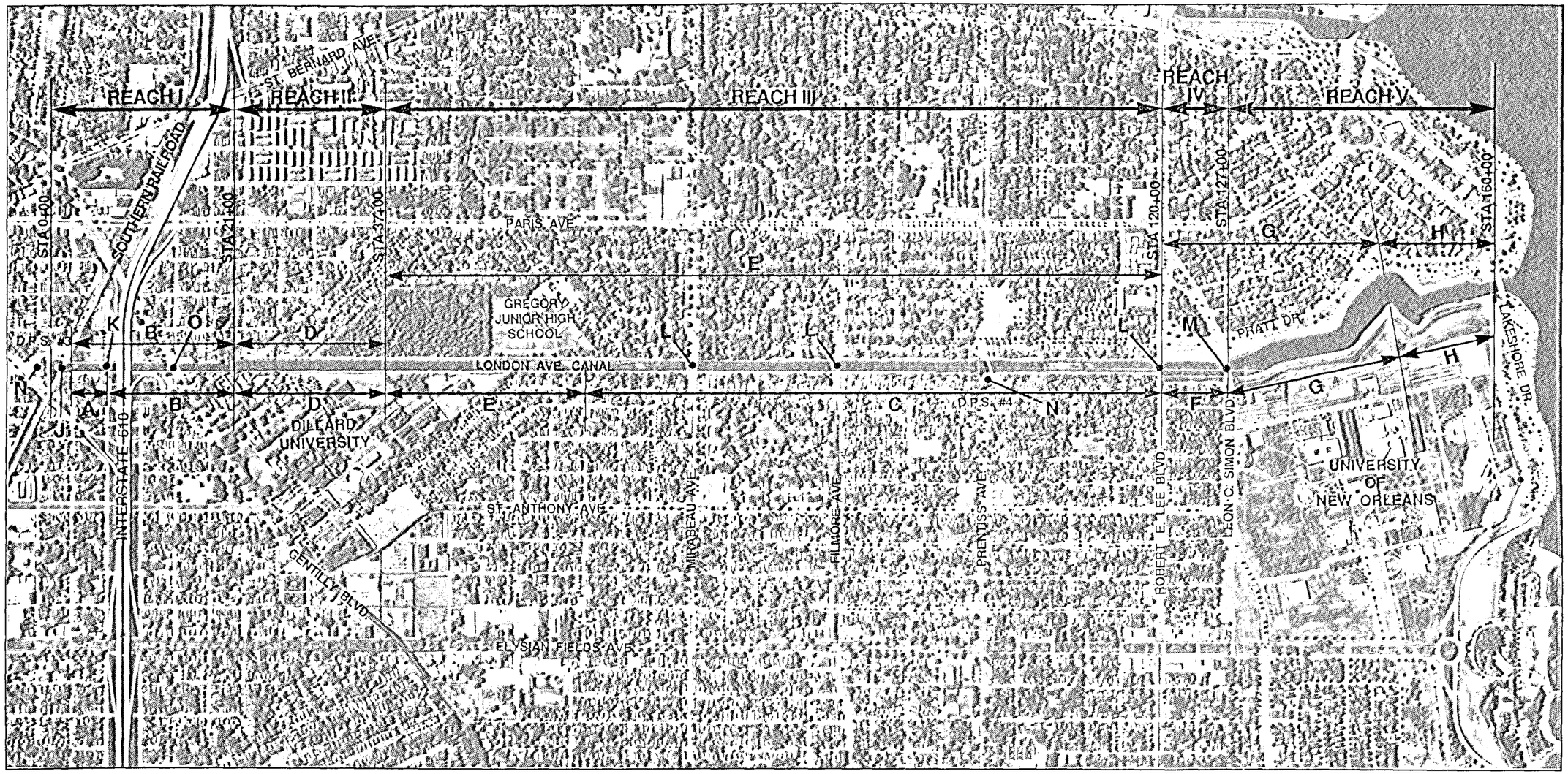
UTILITY RELOCATION SCHEDULE

Station	Description	Disposition
1+23	48"Ø Drainage Force Main	Remains - Adjust Floodwall around existing pipe
6+55	Overhead Power Lines	Remains
10+59	Overhead Power Lines	Remains
13+08	12"Ø Gas Main	Remains - Install Temporary Bypass
14+18	12"Ø Water Main	Remains - Install Temporary Bypass
49+88	Pedestrian Foot Bridge	Remains - Install new conc. step
69+35	Pedestrian Foot Bridge	To Be Removed, Replaced with Sidewalk on Bridge
69+44	10"Ø Gas Main	Remains - Install Temporary Bypass
69+46	6"Ø Gas Main	Remains - Install Temporary Bypass
70+40	12"Ø Water Main	Remains - Install Temporary Bypass
84+91	5"Ø Gas Main	Remains - Install Temporary Bypass
85+00	50"Ø Water Main	Remains - Install Temporary Bypass
85+13	Pedestrian Foot Bridge	To Be Removed, Replaced with Sidewalk on Bridge

TABLE 3-3 (continued)

UTILITY RELOCATION SCHEDULE

Station	Description	Disposition
100+60	Overhead Power Lines	Remain
100+66	18-5"Ø Telephone Conduits	Remains - Provide Split Sleeve Casing through Steel Sheet Pile
101+55	10'Ø Steel Siphon Tube	Remains - Temporary Removal during Sheet Pile Driving Only
101+64	52"Ø Steel Discharge Tube	Remains - Temporary Removal during Sheet Pile Driving Only
119+87	Pedestrian Foot Bridge	To Be Removed, Replaced with Sidewalk on Bridge
120+49	12"Ø Water Main	Remains - Install Temporary Bypass
121+10	Overhead Power Lines	Remains
0+00 to 100+00	S&WB Primary 25 Cycle Power Cable	To Remain - Relocate where necessary



LEVEE / FLOODWALL IMPROVEMENTS

DESIGNATION	LEVEE HEIGHT	TOP OF WALL HEIGHT	SHEET PILE SECTION & LENGTH
A	2.0	13.9	INVERTED T WALL
B	5.0	13.9	PZ-40, 58' LONG
C	5.0	13.9	PZ-40, 49' LONG
D	7.0	13.9	PZ-27, 34.5' LONG
E	7.0	13.9	PZ-27, 34' LONG
F	6.5	13.9	PZ-27, 34.5' LONG
G	13.6	-	-
H	11.0	17.5	PZ-27, 33.5' LONG

BRIDGES AND PUMP STATIONS

DESIGNATION	DESCRIPTION
J	STEEL SWING GATES
K	STEEL ROLLER GATES
L	FLOODPROOF BRIDGE DECK & RAISE PARAPET WALLS
M	RAISE BRIDGE PARAPET WALLS
N	RAISE CONCRETE FLOODWALLS AT DRAINAGE PUMP STATION
O	RECONSTRUCT BRIDGE WITH PARAPET WALLS

PLATE 3-1

N

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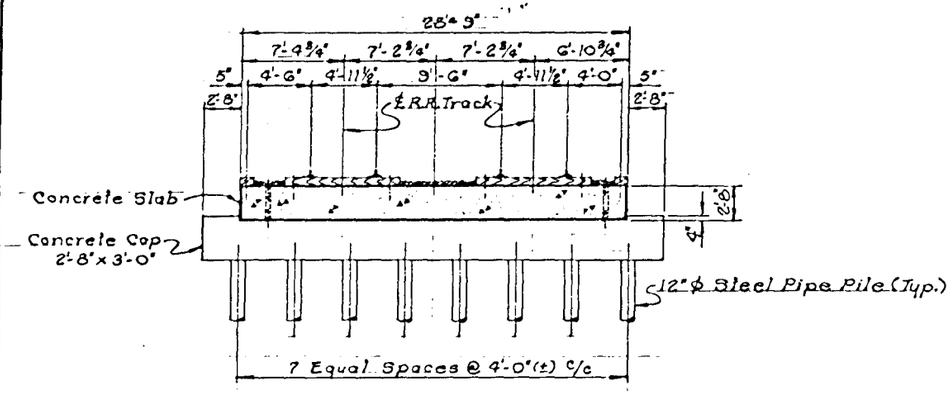
New Orleans, Louisiana

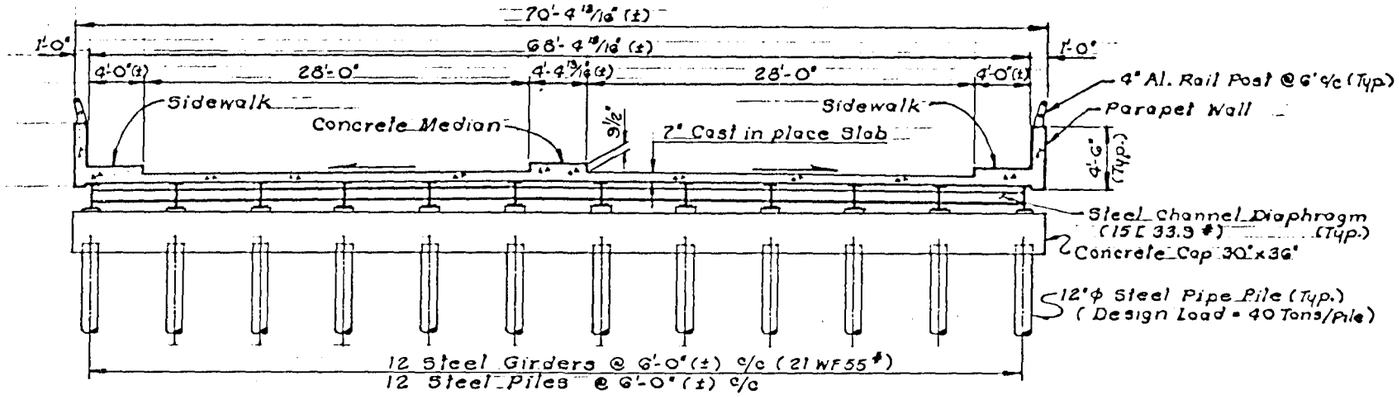
LONDON AVENUE CANAL FLOODWALLS AND LEVEES

RECOMMENDED IMPROVEMENTS

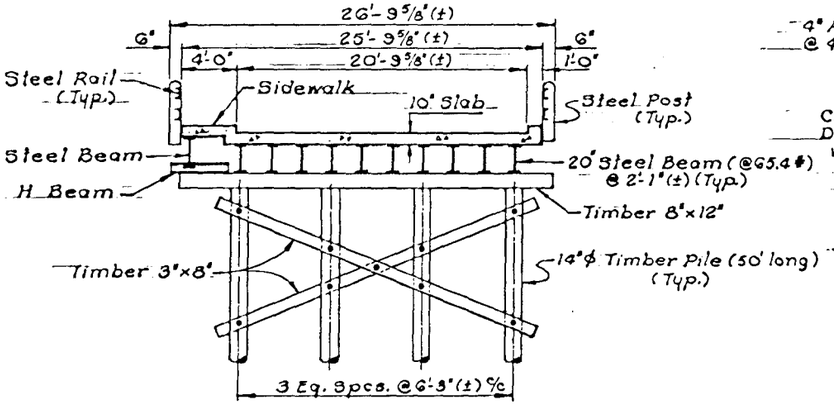
ASSOCIATE	JOB NO	DESIGNED	SCALE 1"=1,250'	SHEET NO
REVIEWER	8407	DETAILED	DATE	
PLAN IN HAND		CHECKED	FILE NO	OF



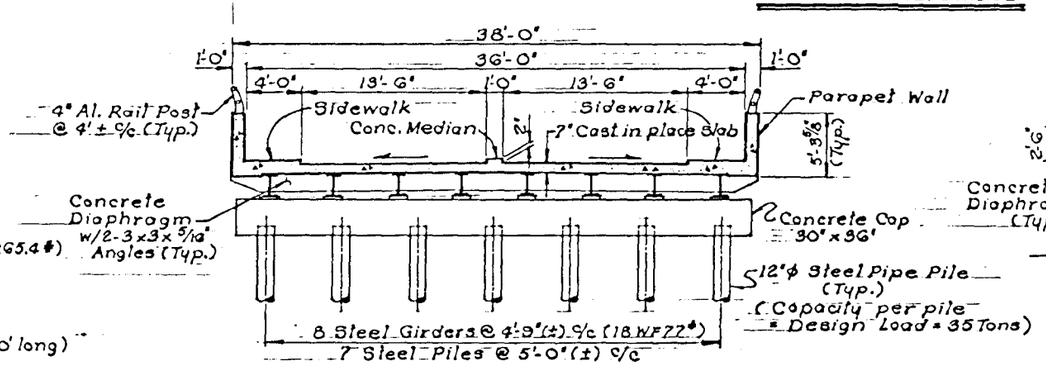
SOUTHERN RAILROAD BRIDGE



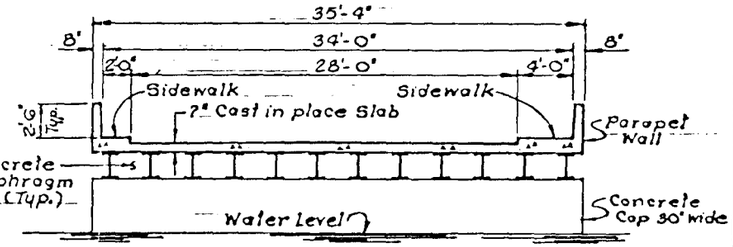
MIRABEAU AVE. BRIDGE



BENEFIT ST. BRIDGE

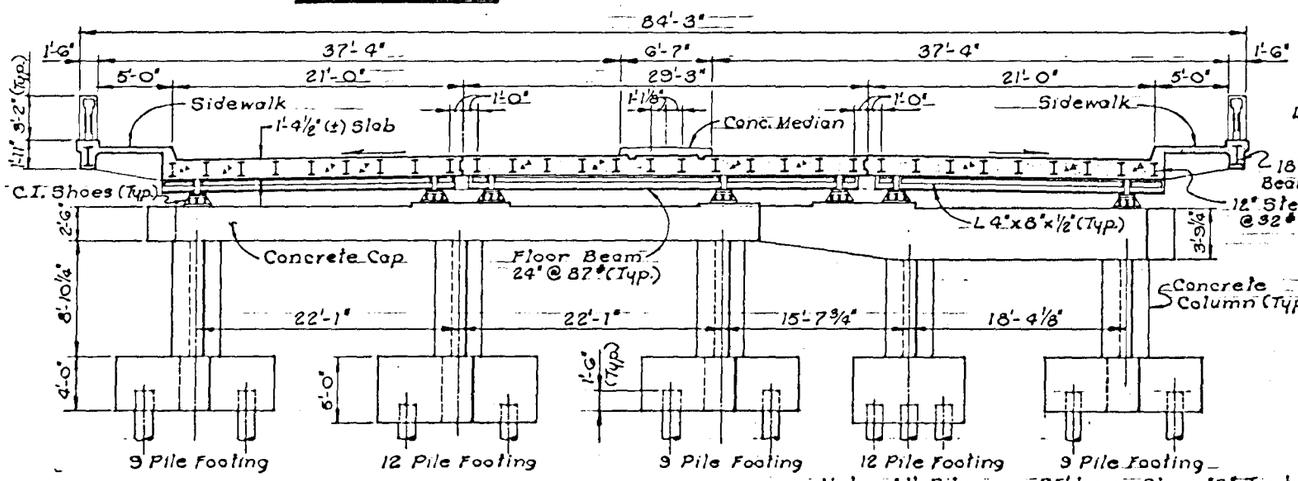


FILMORE AVE. BRIDGE

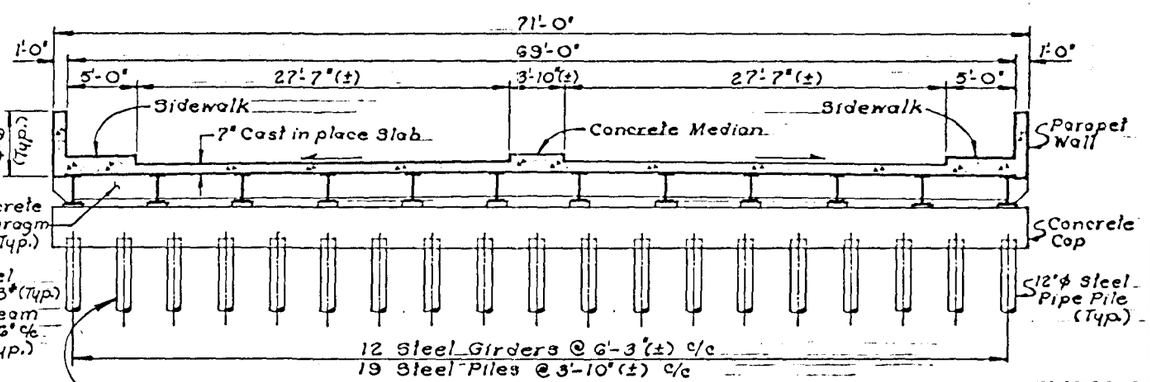


Piles can not be seen.

ROBERT E. LEE BLVD. BRIDGE



GENTILLY BLVD. BRIDGE



LEON C. SIMON BLVD. BRIDGE

Note: All Piles are 65' long, Class "B" Timber Piles.
Pile capacity = 15 Tons

PLATE 3-2

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EXISTING BRIDGES

TYPICAL SECTIONS

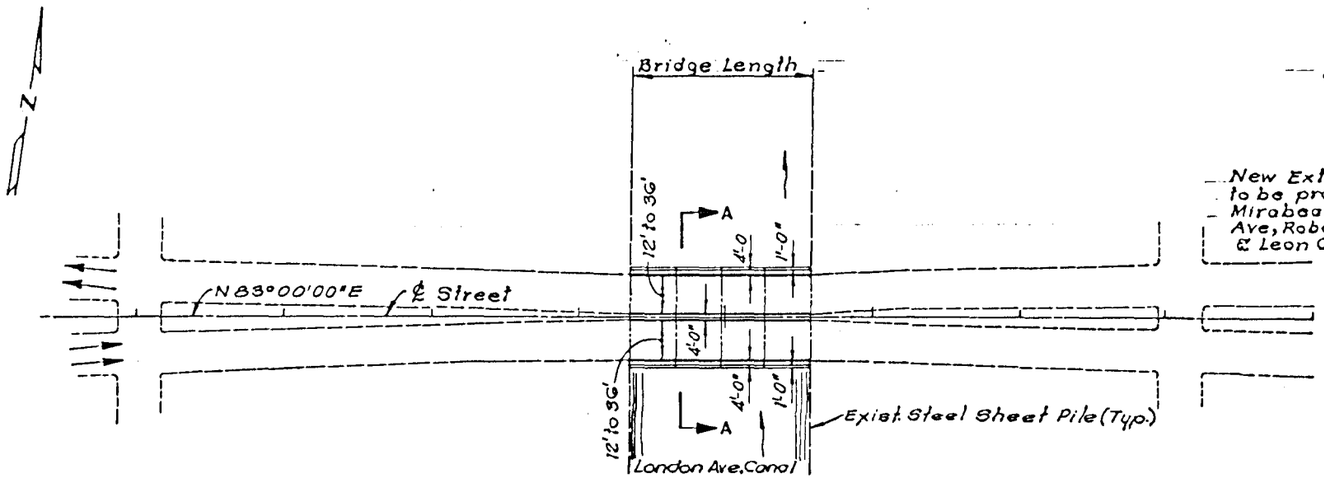
ASSOCIATE	JOB NO 8407	DESIGNED S.I.S.	SCALE 3/16"=1'-0"	SHEET NO
REVIEWED		DETAILED L.V.B.	DATE	
PLANS BY NAME		CHECKED M.O.J.	FILE NO	OF

LONDON AVE. CANAL FLOODWALLS AND LEVEES

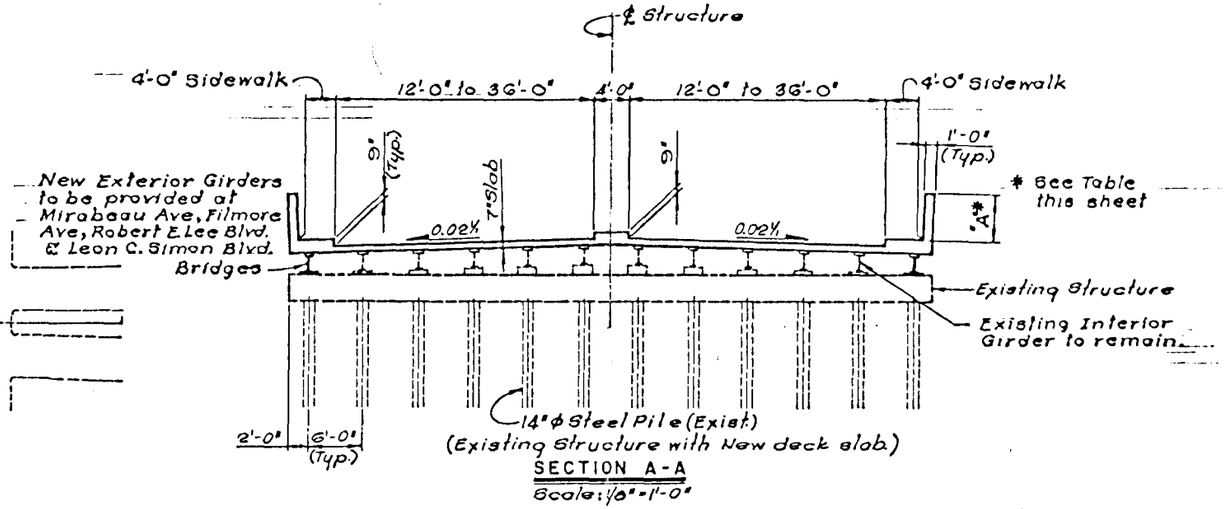
GENERAL DESIGN MEMORANDUM

BOARD OF LEVEE COMMISSIONERS
ORLEANS LEVEE BOARD

ORLEANS LEVEE BOARD CONTRACT NO. 2049-0269

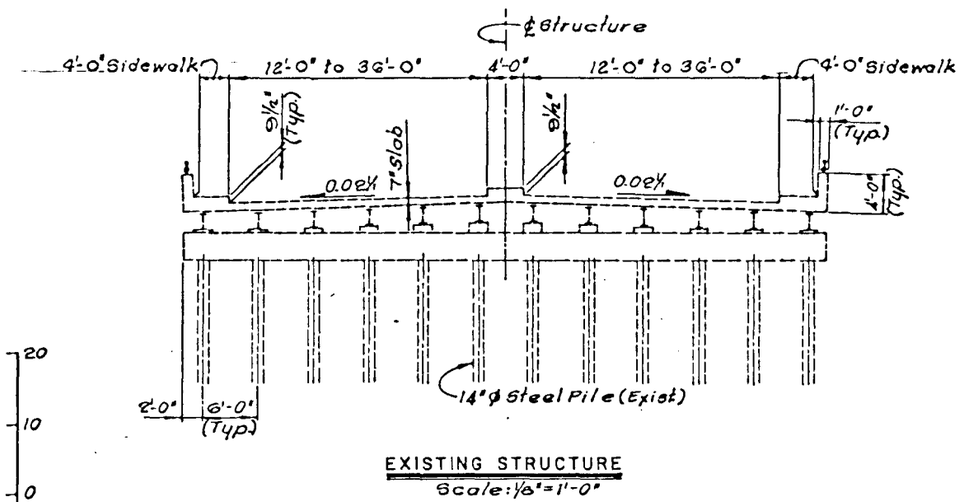


PLAN
Scale: 1" = 50'

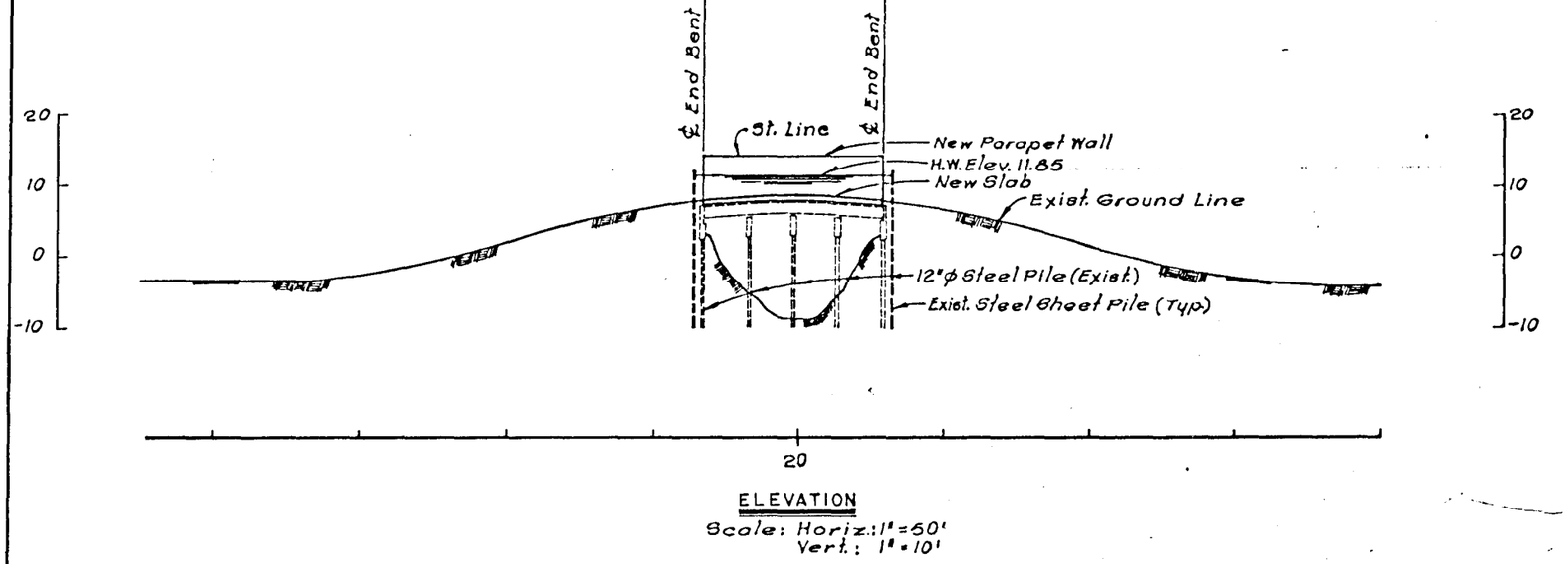


SECTION A-A
Scale: 1/8" = 1'-0"

BRIDGE NAME	DIMENSION "A" (MINIMUM)	TOP ELEVATION OF PARAPET WALL
Gentilly Blvd. Bridge	7'-8"	13.85
Mirabeau Ave. Bridge	5'-10"	13.85
Filmore Ave. Bridge	6'-3"	13.85
Robert E. Lee Blvd. Bridge	6'-9"	13.85
Leon C. Simon Blvd. Bridge	5'-10"	13.60



EXISTING STRUCTURE
Scale: 1/8" = 1'-0"



ELEVATION
Scale: Horiz.: 1" = 50'
Vert.: 1" = 10'

PLATE 3-3

Burk & Associates, Inc.
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New Orleans, Louisiana

ALTERNATE I

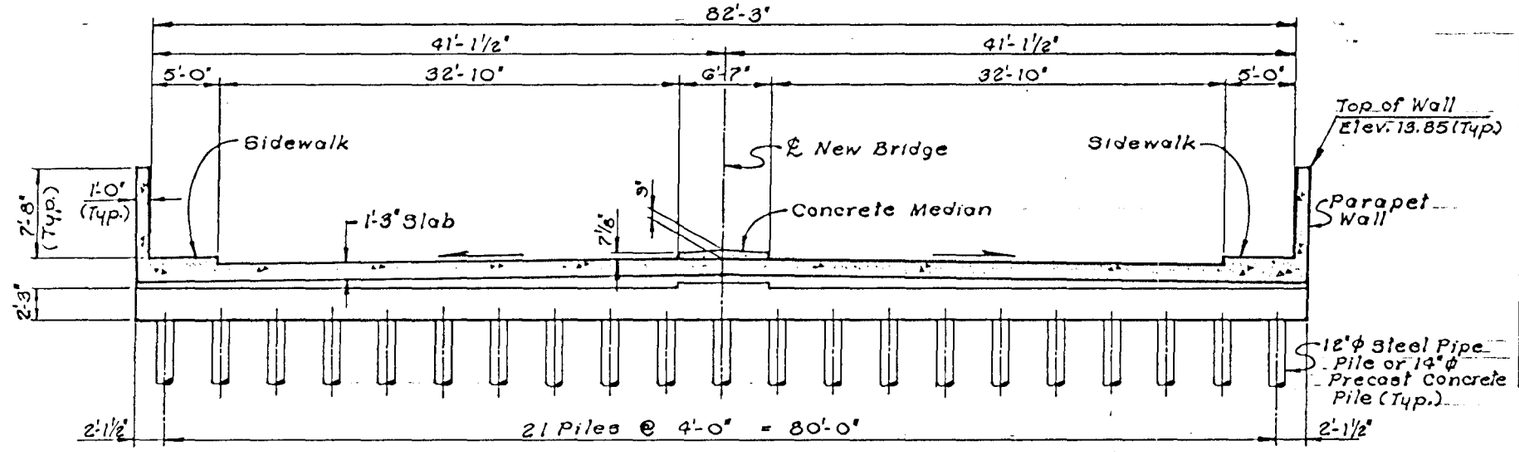
PLAN AND ELEVATION

LONDON AVE. CANAL FLOODWALLS AND LEVEES
GENERAL DESIGN MEMORANDUM

ORLEANS LEVEE BOARD CONTRACT NO. 2049-0269

BOARD OF LEVEE COMMISSIONERS
ORLEANS LEVEE BOARD

ASSOCIATE	JOB NO 8407	DESIGNED K.W.K.	SCALE AS SHOWN	SHEET NO 1 of 3
REVIEWER		DETAILED O.P.	DATE JAN. 1966	
PLANE OF HAND		CHECKED M.C.J.	FILE NO	

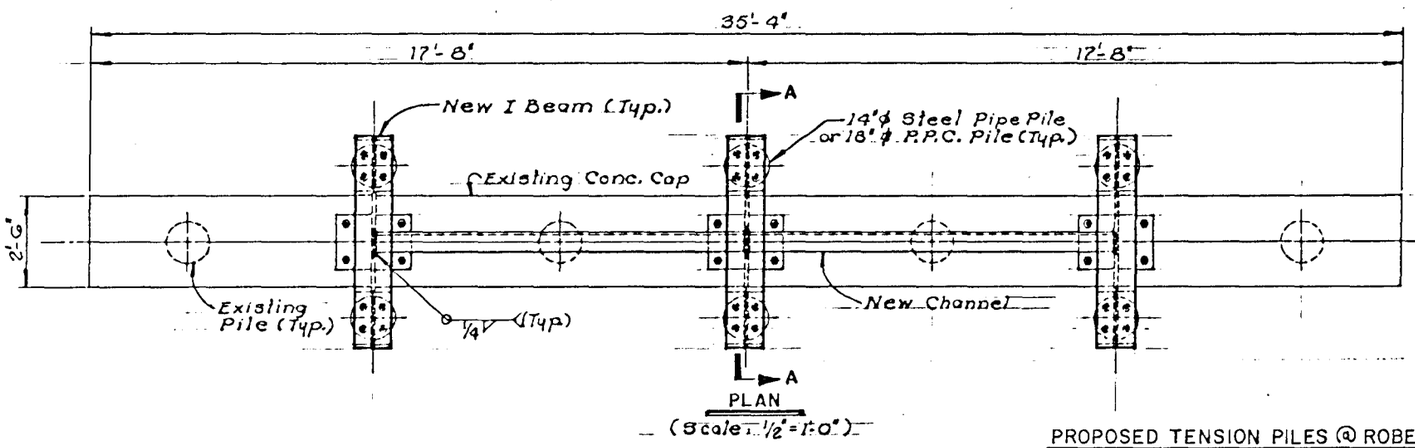


SECTION
(Scale: 3/16" = 1'-0")

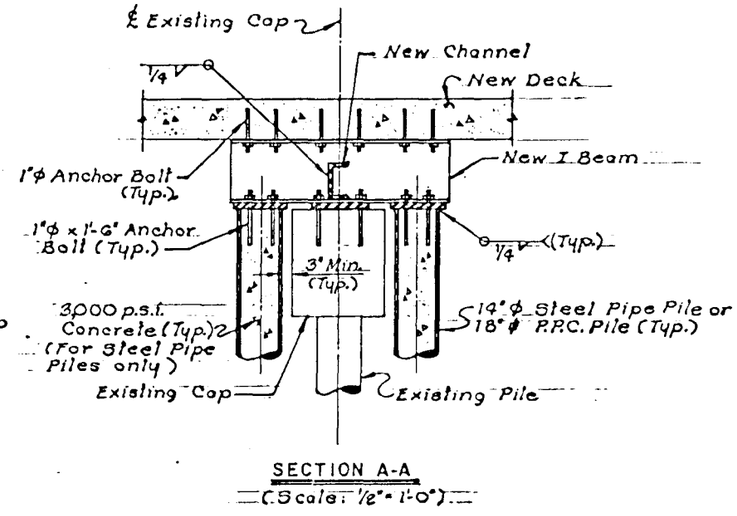
PROPOSED NEW BRIDGE @ GENTILLY BLVD.

BRIDGE NAME	TOTAL UPLIFT FORCE ACTING ON BRIDGE (TONS)	TOTAL UPLIFT FORCE PER PILE (TONS)	RECOMMENDATION
1. Southern Railroad Bridge	—	—	Floodgates
2. Benefit Street Bridge	562	16.20	Floodgates
3. Gentilly Blvd. Bridge	3,152	10.17/22.80*	New Bridge @ Existing Deck Elevation
4. Mirabeau Ave. Bridge	1,749	19.63	Tension Connections to all Structural Members
5. Filmore Ave. Bridge	1,262	18.70	Tension Connections to all Structural Members
6. Robert E. Lee Blvd. Bridge	1,656	25.42*	Drive New Steel Piles & Provide Tension Connections to Cap & Deck
7. Leon C. Simon Blvd. Bridge	3,001	25.57	Tension Connections to all Structural Members

*For New Piles.



PLAN
(Scale: ½" = 1'-0")



SECTION A-A
(Scale: ½" = 1'-0")

PROPOSED TENSION PILES @ ROBERT E. LEE BLVD. BRIDGE

PLATE 3-4

NO.	DATE	DESCRIPTION	BY

Burk & Associates, Inc.
Engineers • Planners • Environmental Scientists
New Orleans, Louisiana

GENTILLY BLVD. & ROBERT E. LEE BLVD.
ALTERNATE I

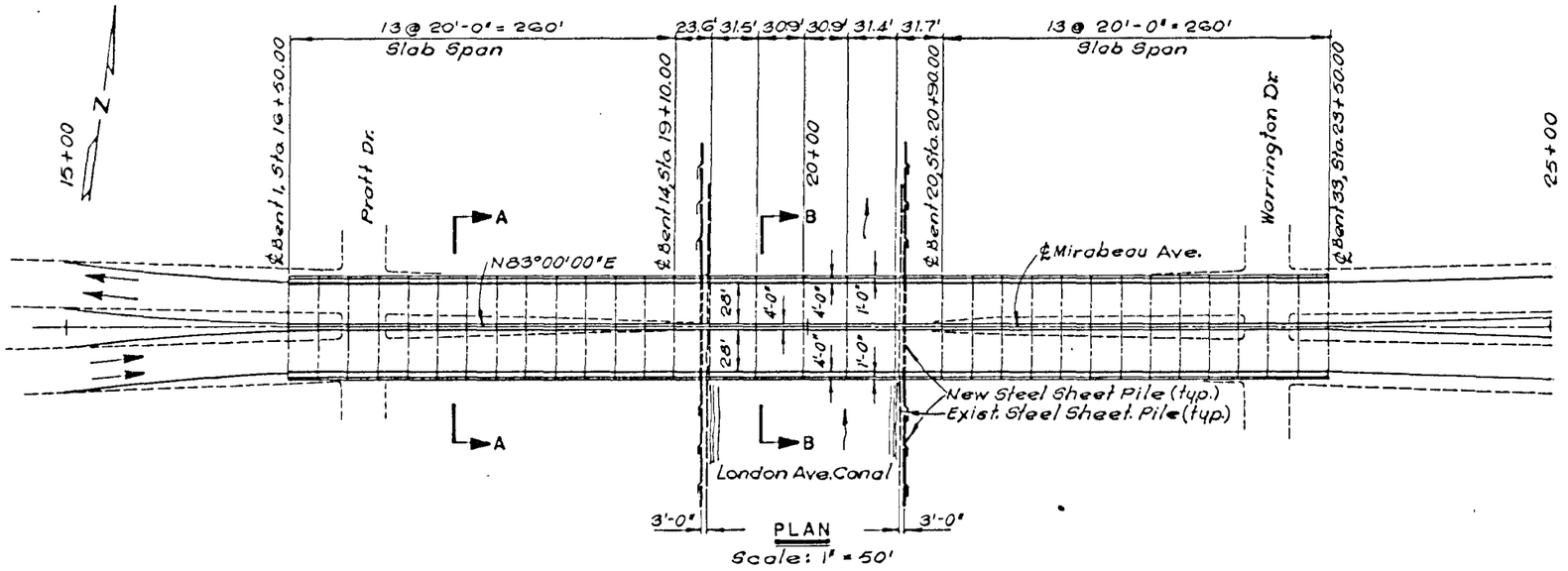
TYPICAL SECTIONS

ASSOCIATE	JOB NO. 8407	DESIGNED S.I.B.	SCALE AS NOTED	SHEET NO.
REVIEWER		DETAILED L.V.B.	DATE	
PLANE IN HAND		CHECKED H.G.J.	FILE NO.	OF

LONDON AVE. CANAL FLOODWALLS AND LEVEES
GENERAL DESIGN MEMORANDUM

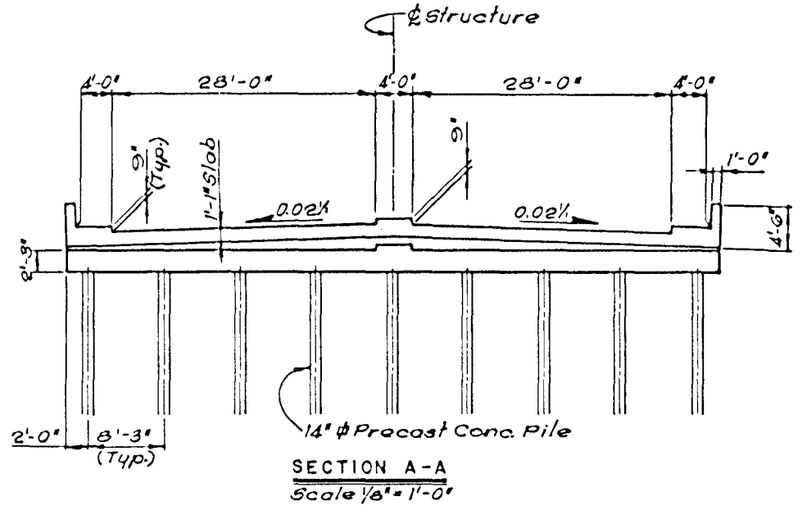
ORLEANS LEVEE BOARD CONTRACT NO. 2049-0269

BOARD OF LEVEE COMMISSIONERS
ORLEANS LEVEE BOARD



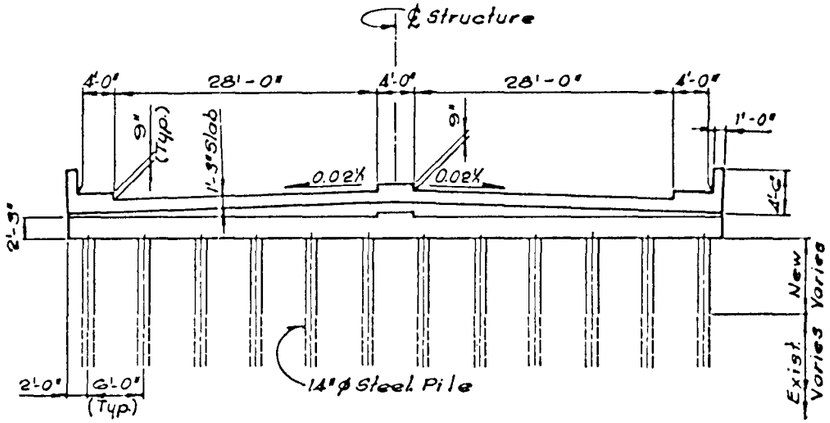
PLAN

Scale: 1" = 50'



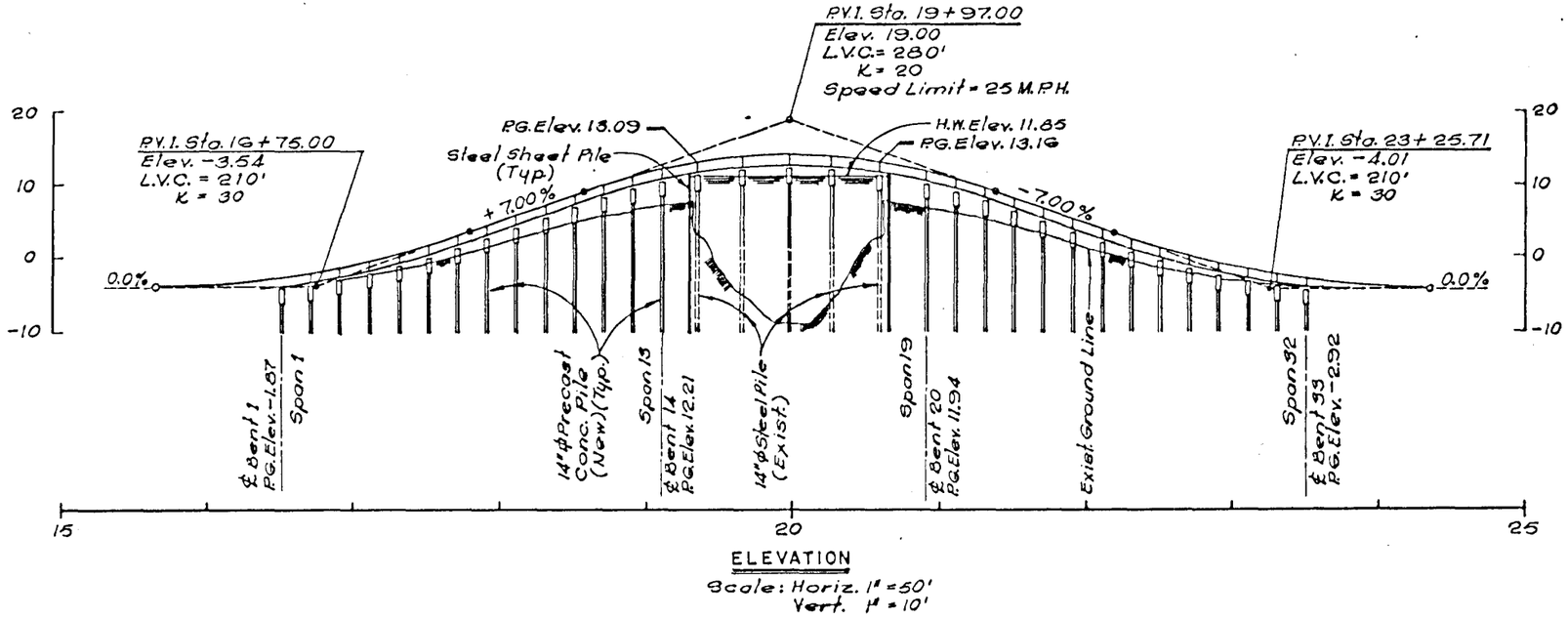
SECTION A-A

Scale 1/8" = 1'-0"



SECTION B-B

Scale: 1/8" = 1'-0"



ELEVATION

Scale: Horiz. 1" = 50'
Vert. 1" = 10'

PLATE 3-5

REV	DATE	DESCRIPTION	BY

Burk & Associates, Inc.
Engineers • Planners • Environmental Scientists
New Orleans, Louisiana

MIRABEAU AVENUE
OVER LONDON AVE. CANAL

ALTERNATE-2
PLAN & ELEVATION

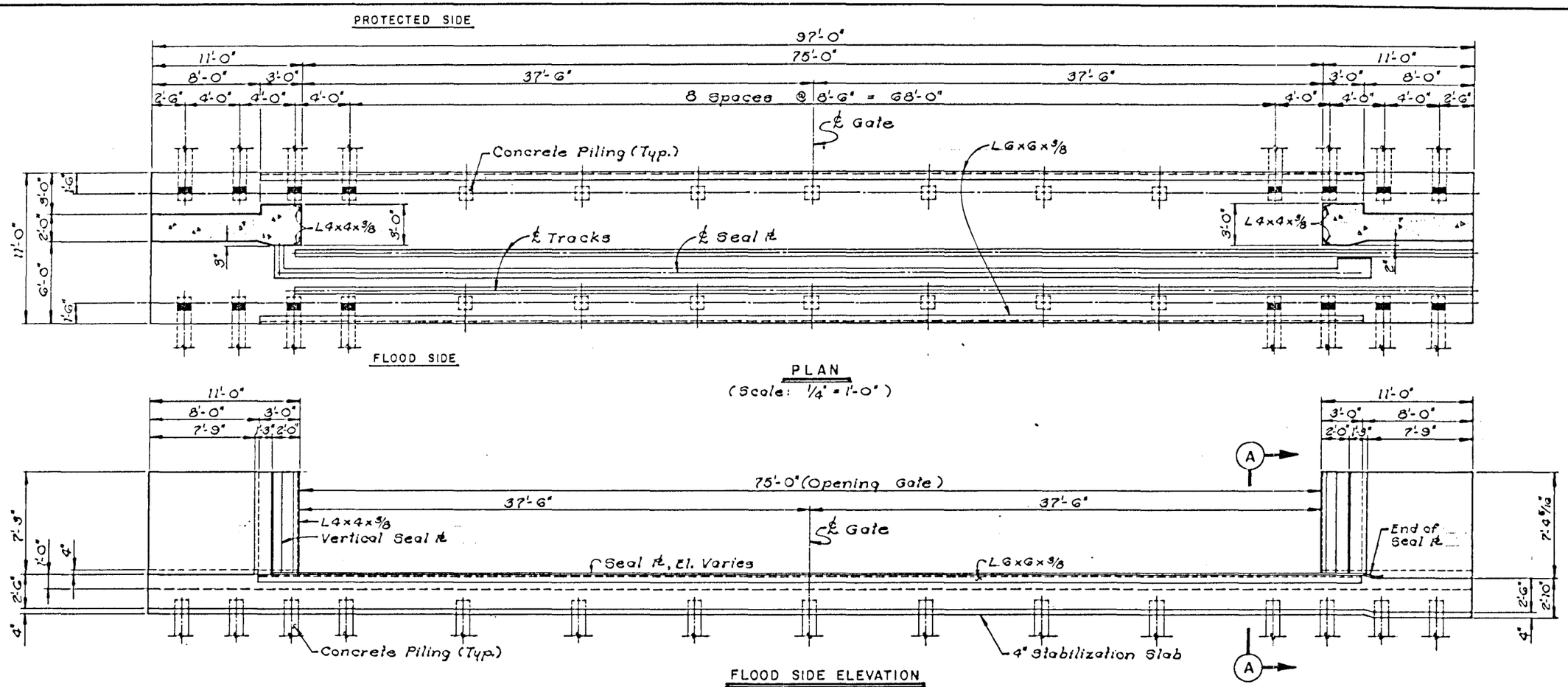
ASSOCIATE	JOB NO	DESIGNED K.W.K.	SCALE AS SHOWN	SHEET NO
REVIEWER	8407	DETAILED O.F	DATE JA. 1986	2 of 9
PLAN BY NAME		CHECKED M.G.J.	FILE NO	

LONDON AVE. CANAL FLOODWALLS AND LEVEES

GENERAL DESIGN MEMORANDUM

BOARD OF LEVEE COMMISSIONERS
ORLEANS LEVEE BOARD

ORLEANS LEVEE BOARD CONTRACT NO. 2049-0269



LONDON AVE. CANAL FLOODWALLS AND LEVEES

GENERAL DESIGN MEMORANDUM

ORLEANS LEVEE BOARD CONTRACT NO. 2049-0269

BOARD OF LEVEE COMMISSIONERS
ORLEANS LEVEE BOARD

PLATE 3-6

REV	DATE	DESCRIPTION	BY

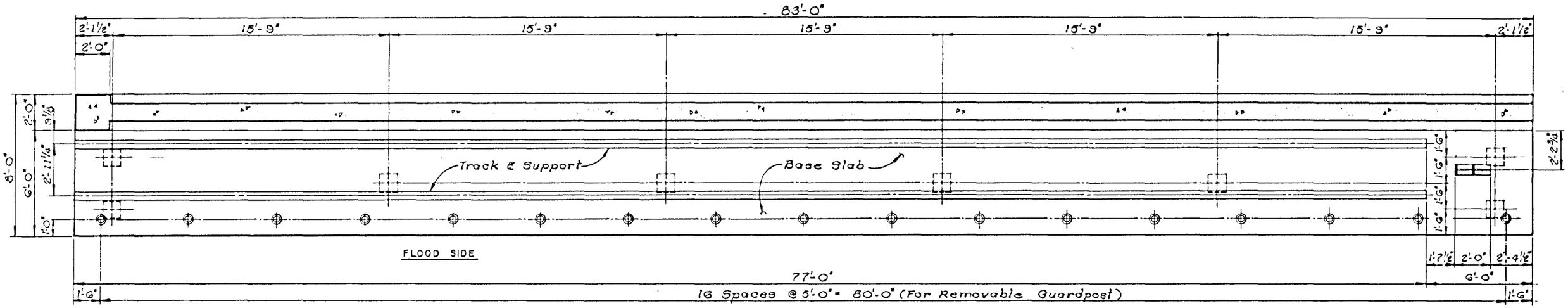
Burk & Associates, Inc.
Engineers • Planners • Environmental Scientists
New Orleans, Louisiana

MIRABEAU AVENUE
OVER LONDON AVE. CANAL

ALTERNATE-3
FLOOD ROLLER GATE
GATE MONOLITH

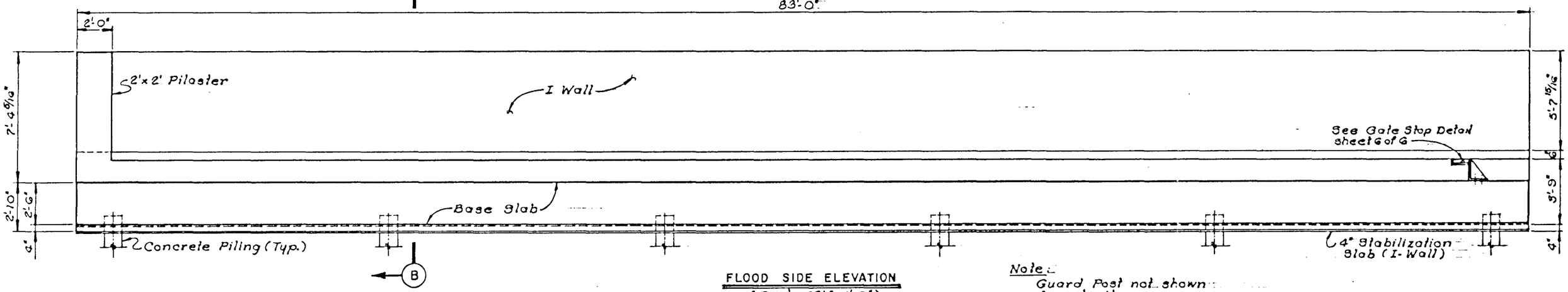
ASSOCIATE	JOB NO.	DESIGNED K.W.K.	SCALE AS NOTED	SHEET NO.
REVIEWER	8407	DETAILED L.V.B.	DATE 02/63	3 of 9
PLAN IN HAND		CHECKED M.G.J.	FILE NO.	

PROTECTED SIDE



PLAN
(Scale: 3/8" = 1'-0")

B



FLOOD SIDE ELEVATION
(Scale: 3/8" = 1'-0")

Note:
Guard Post not shown for clarity.

PLATE 3-7

REV	DATE	DESCRIPTION	BY

Burk & Associates, Inc.
Engineers • Planners • Environmental Scientists
New Orleans, Louisiana

MIRABEAU AVENUE
OVER LONDON AVE. CANAL

ALTERNATE-3
FLOOD ROLLER GATE
STORAGE MONOLITH

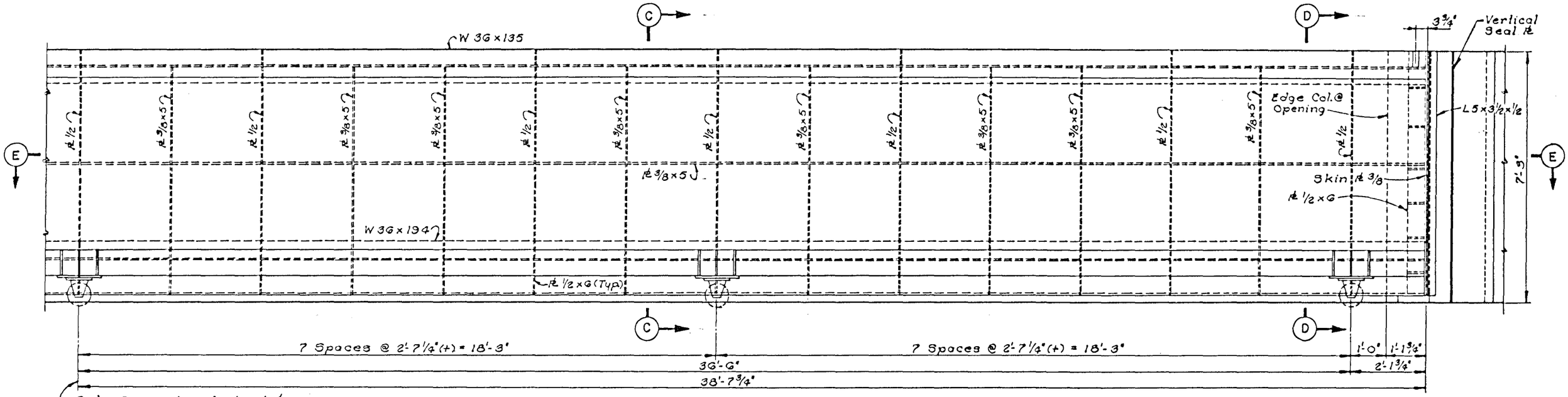
ASSOCIATE	JOB NO. 8407	DESIGNED K.W.K.	SCALE AS NOTED
REVIEWER		DETAILED L.V.B.	DATE 02/86
PLAN IN HAND		CHECKED M.G.J.	FILE NO.

SHEET NO. 4 of 9

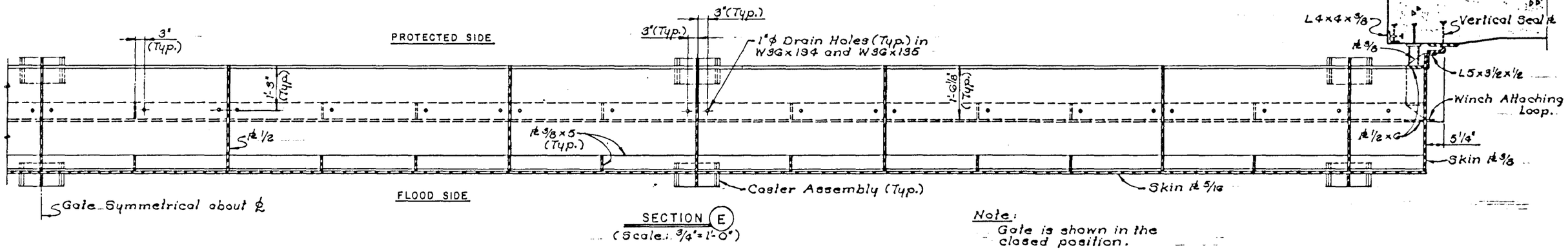
LONDON AVE. CANAL FLOODWALLS AND LEVEES
GENERAL DESIGN MEMORANDUM

ORLEANS LEVEE BOARD CONTRACT NO. 2049-0269

BOARD OF LEVEE COMMISSIONERS
ORLEANS LEVEE BOARD



FLOOD SIDE ELEVATION
(Scale: ¾"=1'-0")



SECTION (E)
(Scale: ¾"=1'-0")

Note:
Gate is shown in the closed position.

PLATE 3-8

REV	DATE	DESCRIPTION	BY

Burk & Associates, Inc.
Engineers • Planners • Environmental Scientists
New Orleans, Louisiana

MIRABEAU AVENUE
OVER LONDON AVE. CANAL

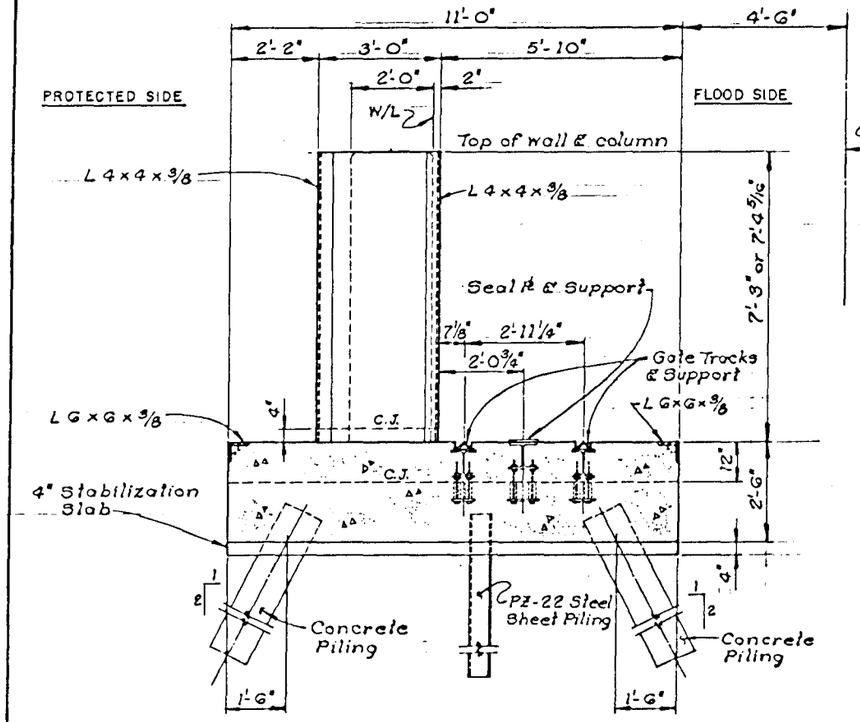
ALTERNATE-3
FLOOD ROLLER GATE
GATE DETAILS

ASSOCIATE	JOB NO.	DESIGNED K.W.K.	SCALE AS NOTED	SHEET NO.
REVIEWER	8407	DETAILED L.V.B.	DATE 02/83	5 of 9
PLAN IN HAND		CHECKED M.G.J.	FILE NO.	

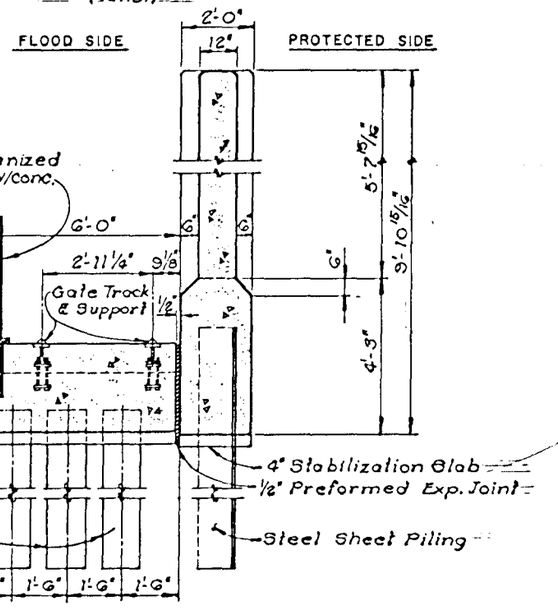
LONDON AVE. CANAL FLOODWALLS AND LEVEES
GENERAL DESIGN MEMORANDUM

ORLEANS LEVEE BOARD CONTRACT NO. 2049-0269

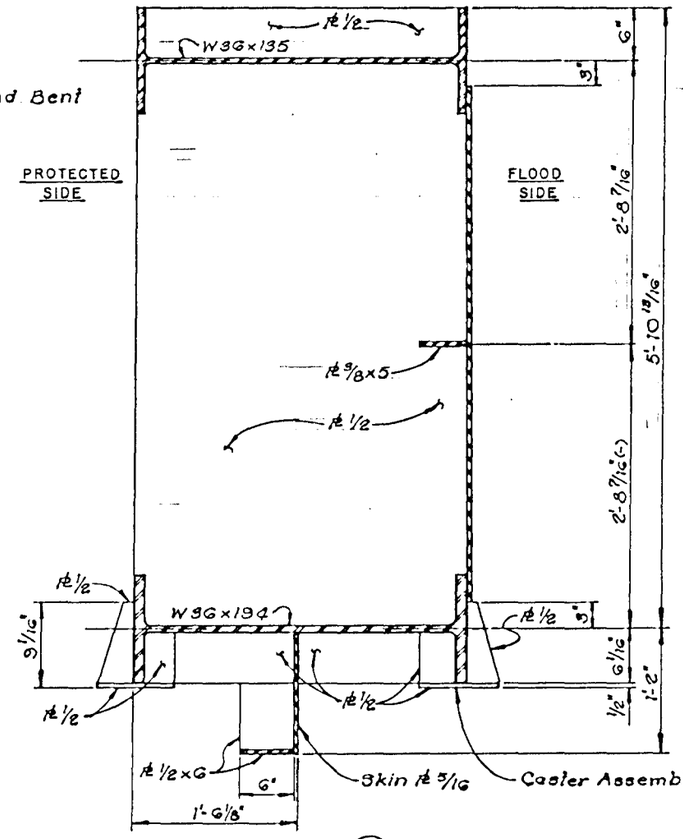
BOARD OF LEVEE COMMISSIONERS
ORLEANS LEVEE BOARD



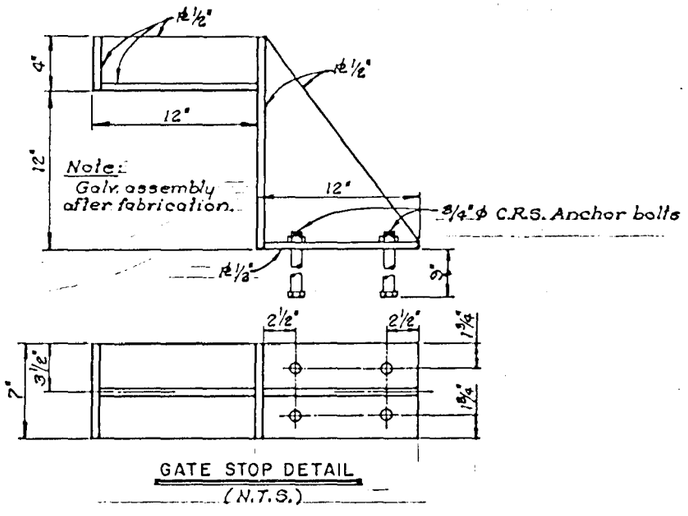
SECTION (A)
(N.T.S.)



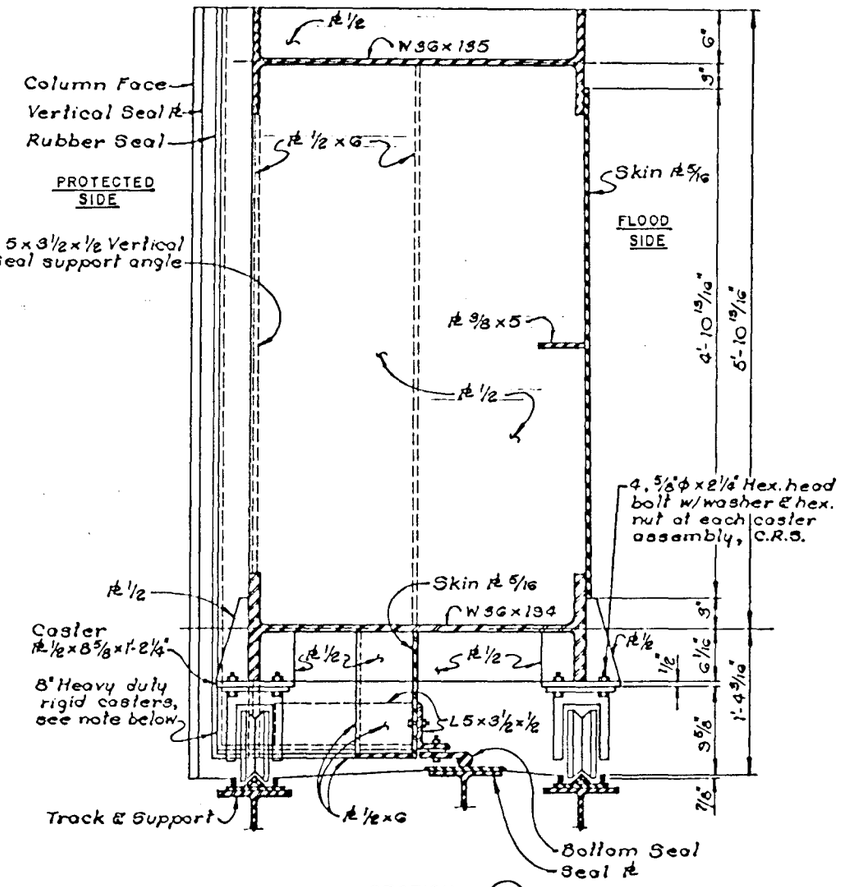
SECTION (B)
(Scale: 1/2"=1'-0")



SECTION (C)
(Scale: 1 1/2"=1'-0")



GATE STOP DETAIL
(N.T.S.)



SECTION (D)
(Scale: 1 1/2"=1'-0")

Note:
Particular attention shall be given to field adjustment of bottom seal in order to obtain a perfect seal with seal ℄.

PLATE 3-9

REV	DATE	DESCRIPTION	BY

Burk & Associates, Inc.
Engineers • Planners • Environmental Scientists
New Orleans, Louisiana

MIRABEAU AVENUE
OVER LONDON AVE. CANAL

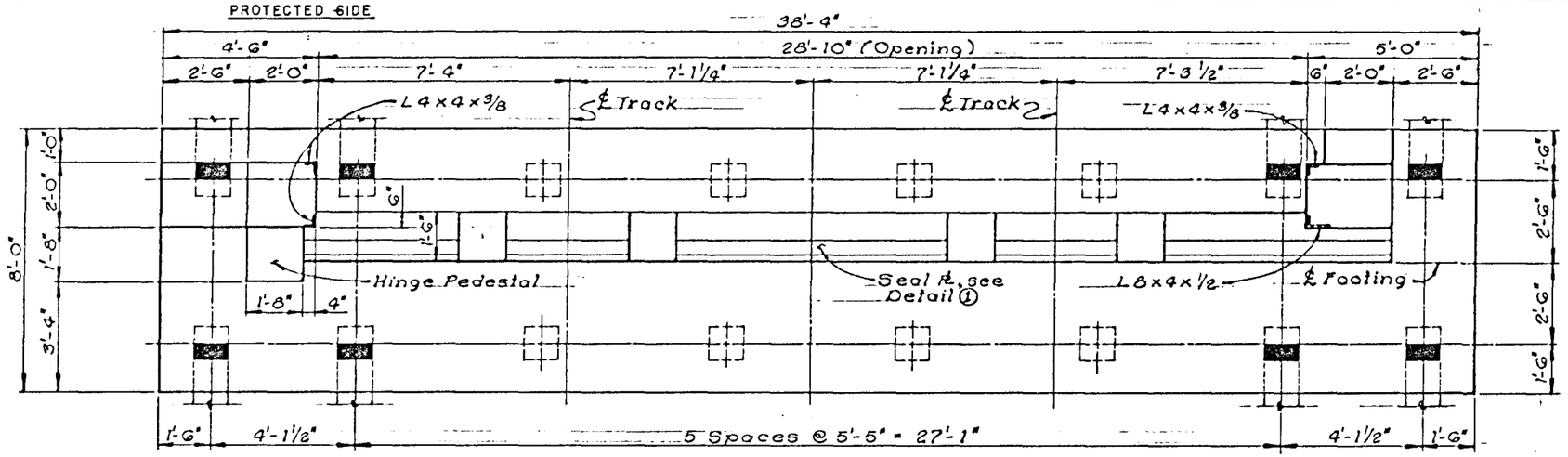
ALTERNATE-3
FLOOD ROLLER GATE
GATE SECTIONS

ASSOCIATE	JOB NO	DESIGNED K.W.K.	SCALE AS NOTED	SHEET NO
REVIEWER	8407	DETAILED L.V.B.	DATE 02/66	6 of 9
PLANE SURVEY		CHECKED M.G.J.	FILE NO	

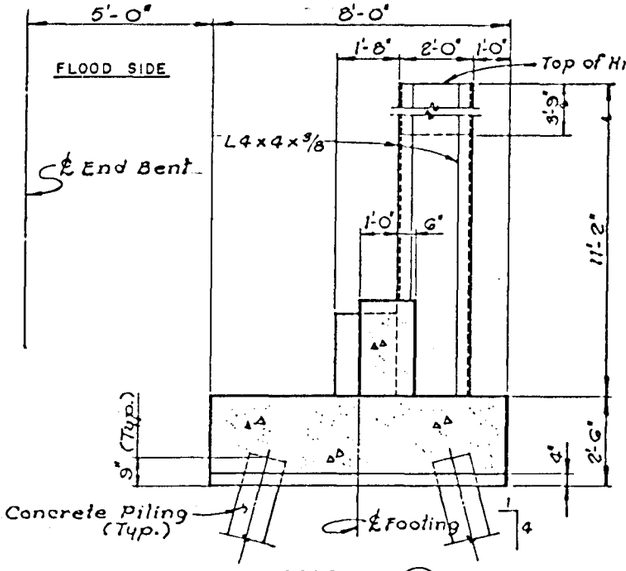
LONDON AVE. CANAL FLOODWALLS AND LEVEES
GENERAL DESIGN MEMORANDUM

BOARD OF LEVEE COMMISSIONERS
ORLEANS LEVEE BOARD

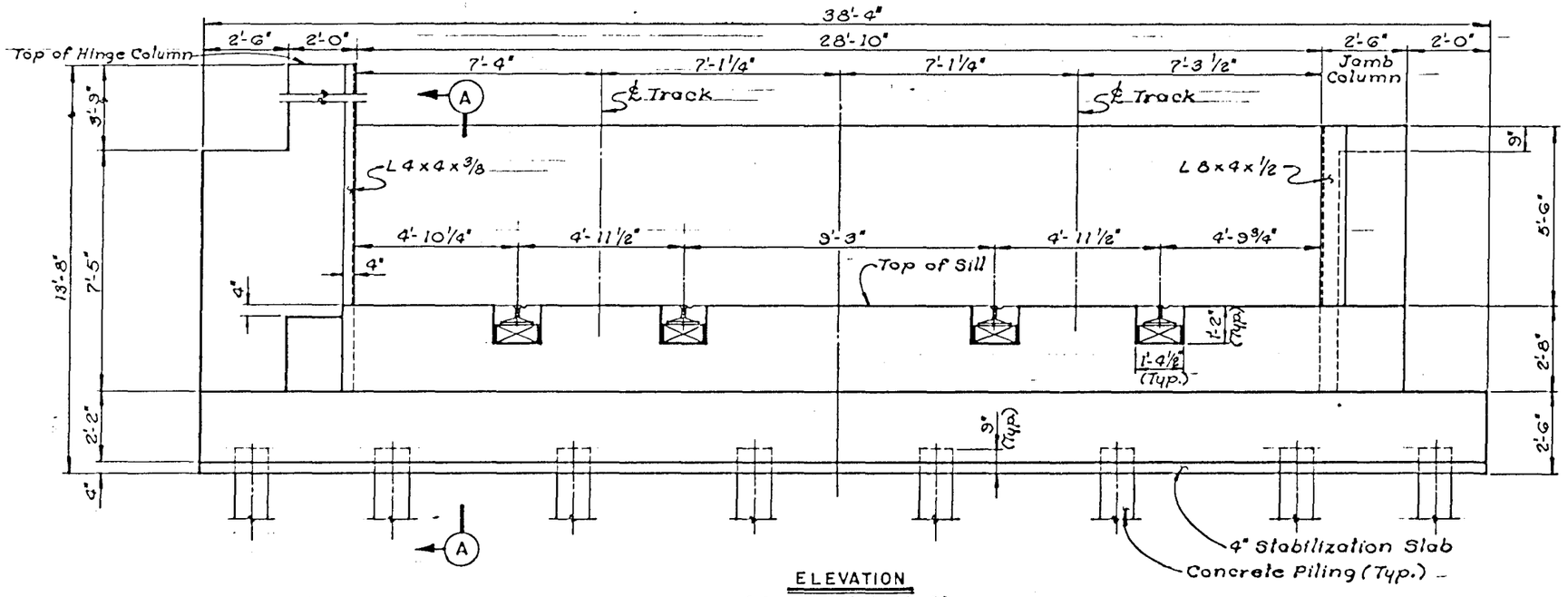
ORLEANS LEVEE BOARD CONTRACT NO. 2049-0269



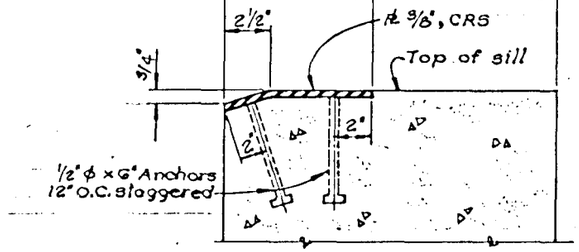
PLAN
(Scale: ½"=1'-0")



SECTION (A)
(Scale: ½"=1'-0")



ELEVATION
(Scale: ½" = 1'-0")



SEAL PLATE - DETAIL ①
(Scale: 3" = 1'-0")

PLATE 3-10

REV	DATE	DESCRIPTION	BY

Burk & Associates, Inc.
Engineers • Planners • Environmental Scientists
New Orleans, Louisiana

RAILROAD CROSSING
OVER LONDON AVE. CANAL

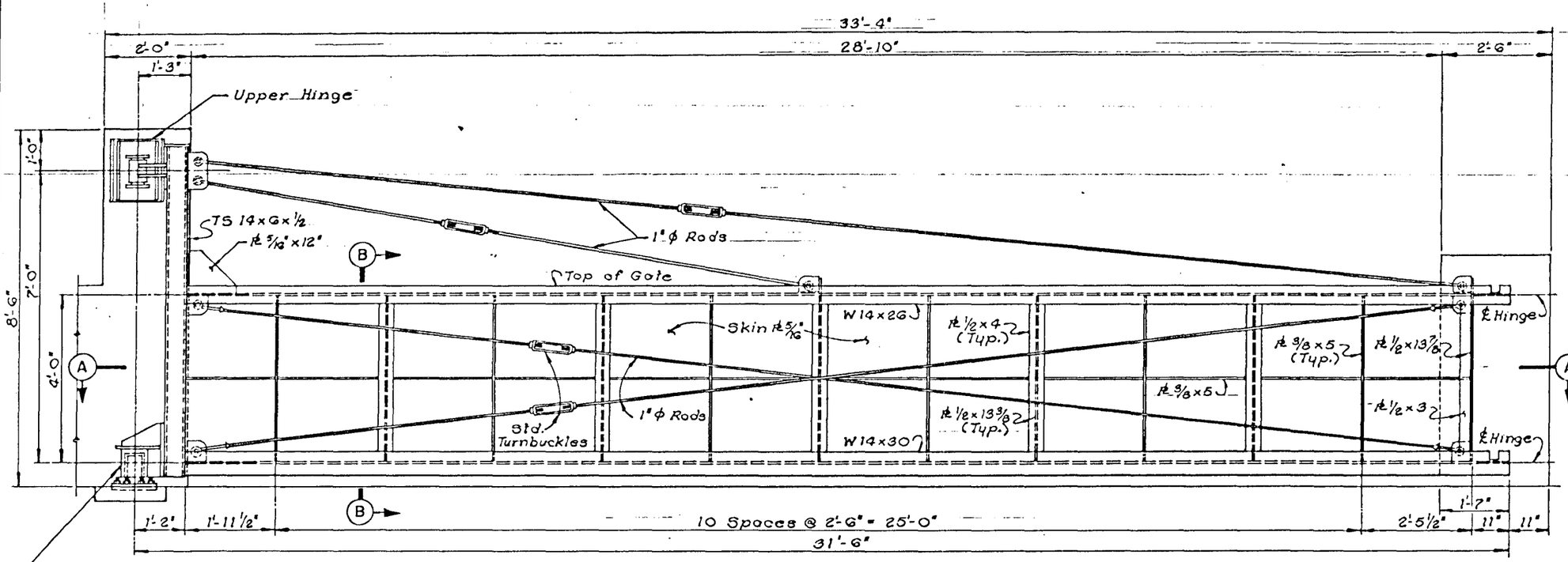
SWING GATE
GATE MONOLITH

ASSOCIATE	JOB NO	DESIGNED K.W.K.	SCALE AS NOTED	SHEET NO
REVIEWER	8407	DETAILED L.V.B.	DATE 02/86	7 of 9
PLAN IN HAND		CHECKED M.G.J.	FILE NO	

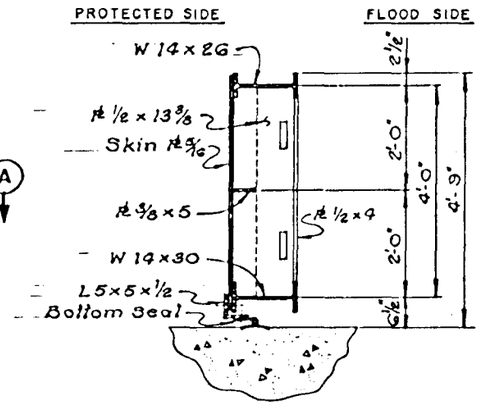
LONDON AVE. CANAL FLOODWALLS AND LEVEES
GENERAL DESIGN MEMORANDUM

BOARD OF LEVEE COMMISSIONERS
ORLEANS LEVEE BOARD

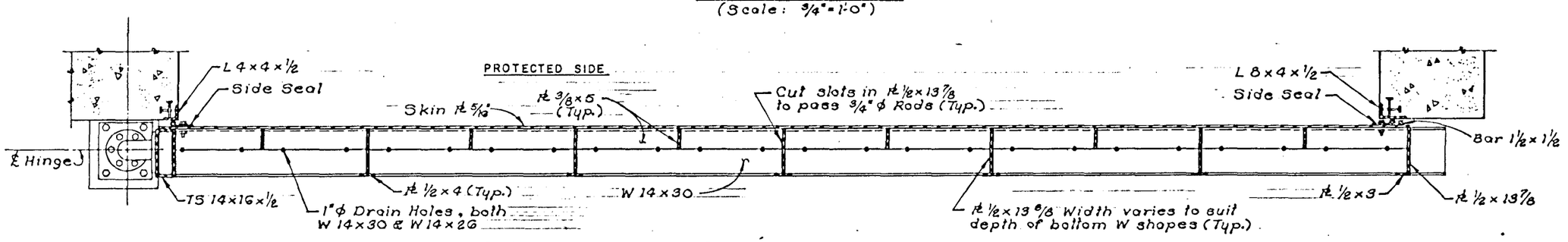
ORLEANS LEVEE BOARD CONTRACT NO. 2049-0269



FLOOD SIDE ELEVATION
(Scale: 3/4"=1'-0")



SECTION (B)
(Scale: 3/4"=1'-0")



SECTION (A)
(Scale: 3/4"=1'-0")

PLATE 3-11

REV	DATE	DESCRIPTION	BY

Burk & Associates, Inc.
Engineers • Planners • Environmental Scientists
New Orleans, Louisiana

RAILROAD CROSSING OVER LONDON AVE. CANAL

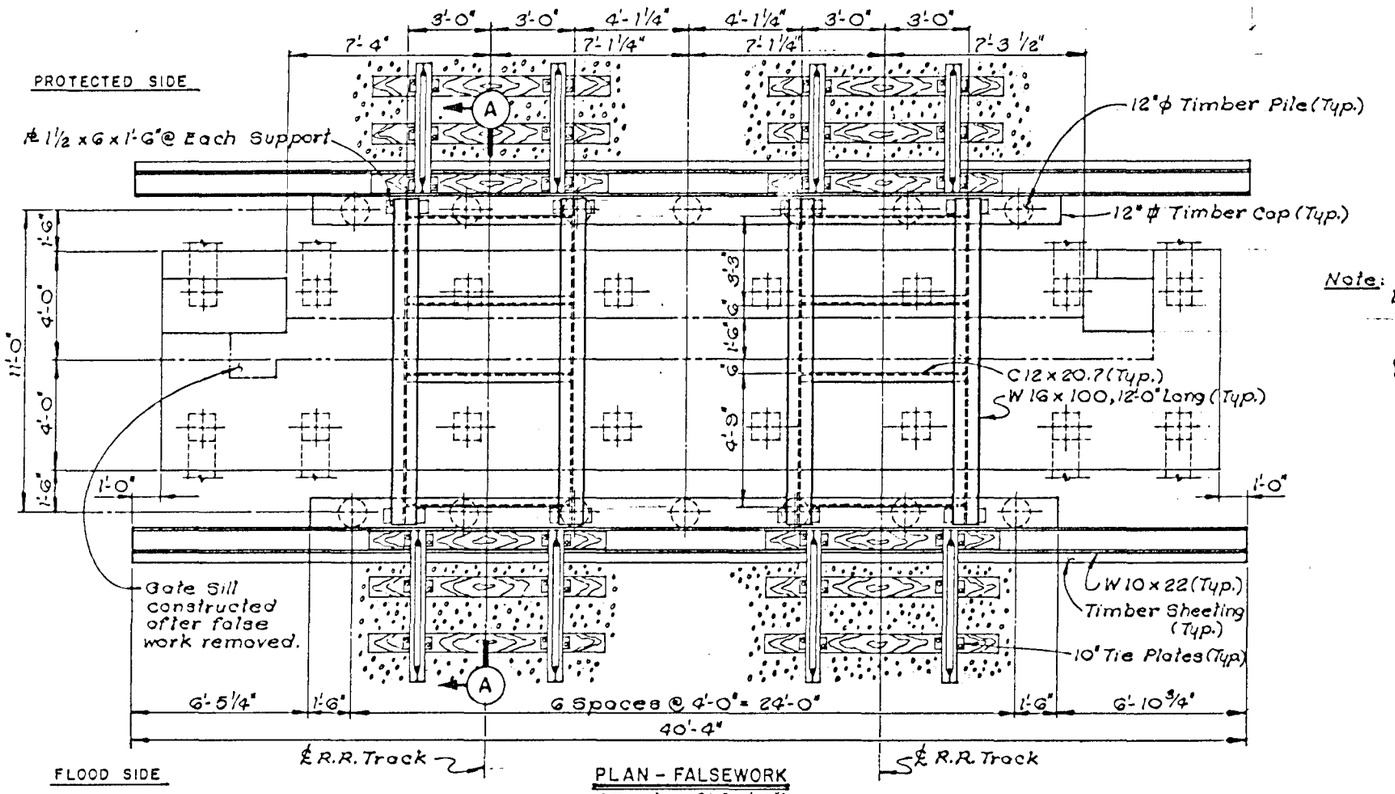
SWING GATE GATE DETAILS

LONDON AVE. CANAL FLOODWALLS AND LEVEES.
GENERAL DESIGN MEMORANDUM.

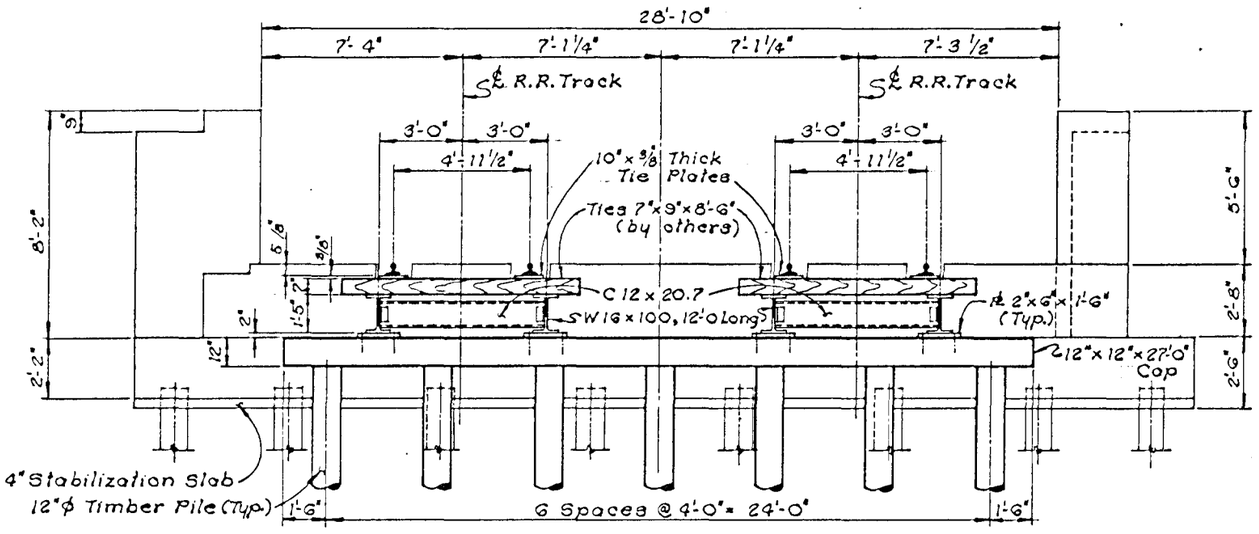
BOARD OF LEVEE COMMISSIONERS
ORLEANS LEVEE BOARD

ORLEANS LEVEE BOARD CONTRACT NO. 2049-0269

ASSOCIATE	JOB NO	DESIGNED S.I.S.	SCALE AS NOTED	SHEET NO
REVIEWED	8407	DETAILED L.V.B.	DATE 02/86	8 OF 9
PLAN IS BOARD		CHECKED M.G.J.	FILE NO	

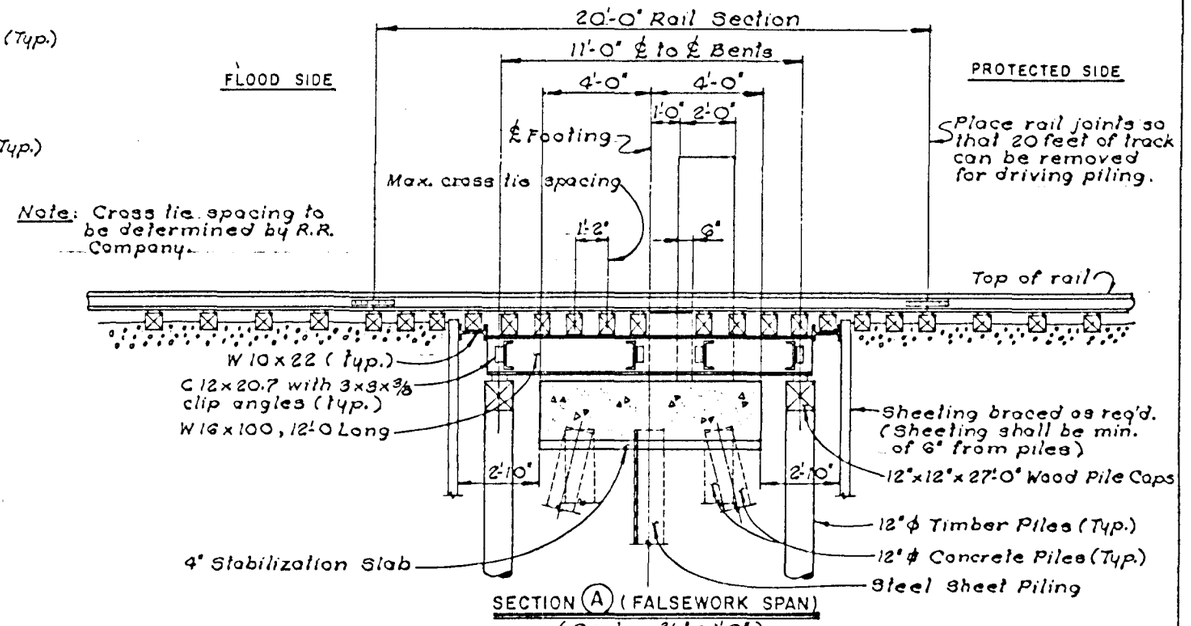


PLAN – FALSEWORK
(Scale: 3/8" = 1'-0")

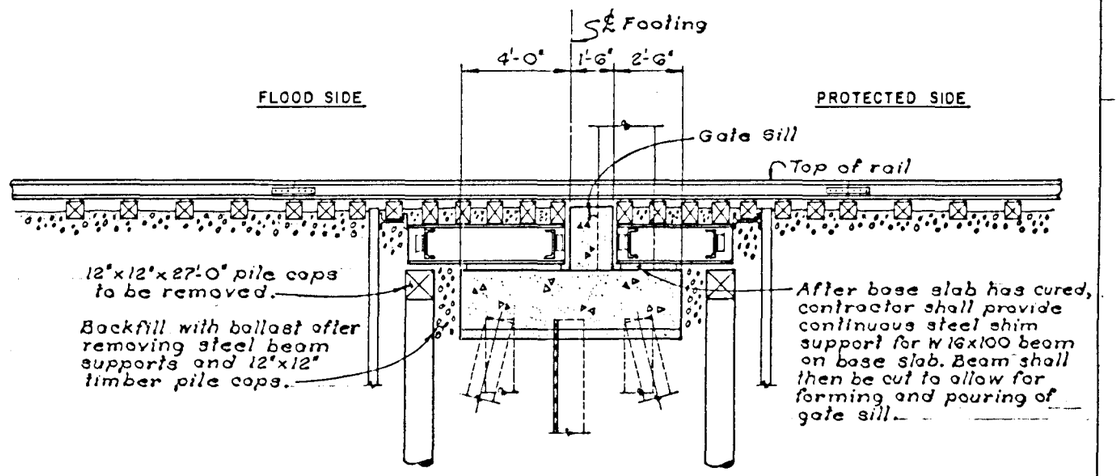


FLOOD SIDE ELEVATION – FALSEWORK BENTS
(Scale: 3/8" = 1'-0")

Note: Falsework bents on Protected Side are similar to those on Flood Side.



SECTION (A) (FALSEWORK SPAN)
(Scale: 3/8" = 1'-0")



SECTION (A) (FALSEWORK REMOVED)
(Scale: 3/8" = 1'-0")

PLATE 3-12

REV	DATE	DESCRIPTION	BY

Burk & Associates, Inc.
Engineers • Planners • Environmental Scientists
New Orleans, Louisiana

LONDON AVE. CANAL FLOODWALLS AND LEVEES
GENERAL DESIGN MEMORANDUM

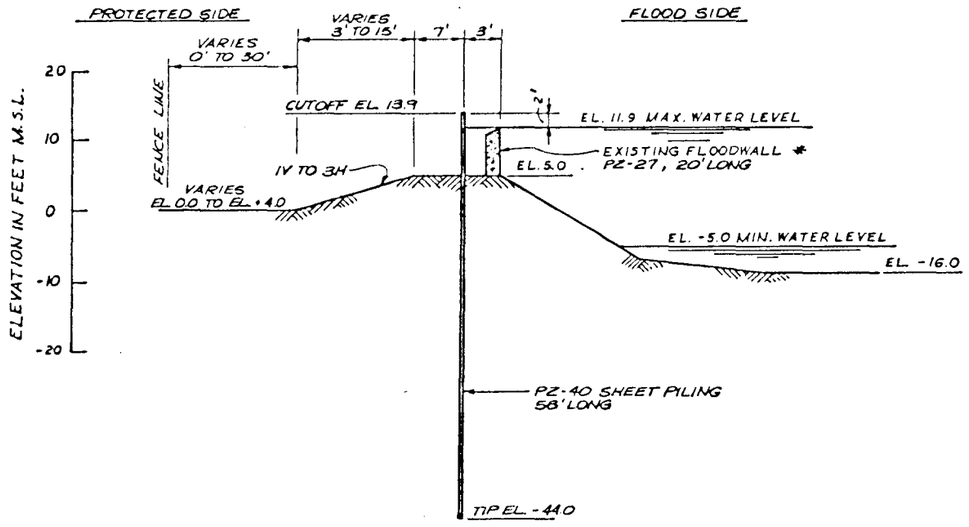
ORLEANS LEVEE BOARD CONTRACT NO. 2049-0269

BOARD OF LEVEE COMMISSIONERS
ORLEANS LEVEE BOARD

RAILROAD CROSSING OVER LONDON AVE. CANAL

SWING GATE RAILROAD FALSEWORK DETAILS

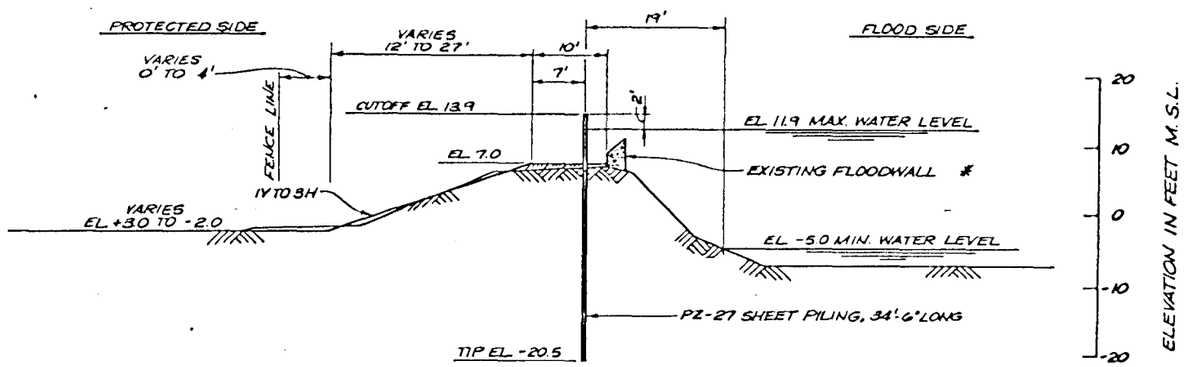
ASSOCIATE	JOB NO	DESIGNED K.W.K.	SCALE AS NOTED	SHEET NO
REVIEWER	8407	DETAILED L.V.B.	DATE 02/86	9 of 9
PLAN IN HAND		CHECKED M.G.J.	FILE NO	



REACH I

STA. 0+00 TO STA. 21+00 WEST SIDE
STA. 1+80 TO STA. 2+80 EAST SIDE
STA. 6+60 TO STA. 21+00 EAST SIDE

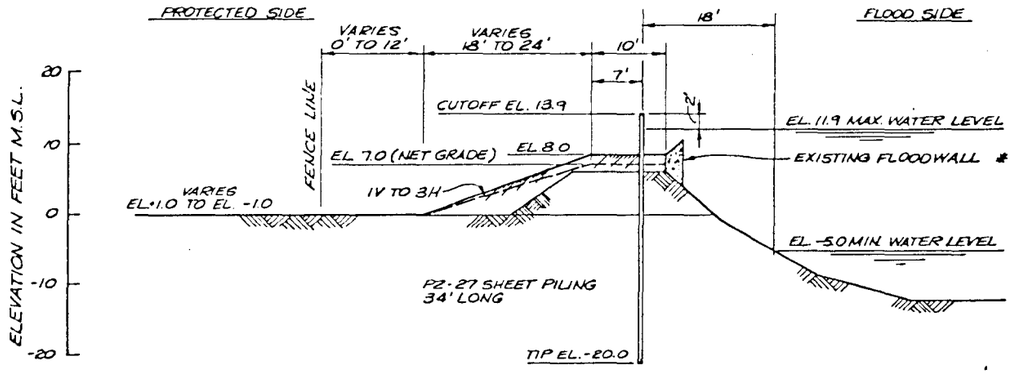
*: EXISTING FLOODWALL TO BE REMOVED DOWN TO ELEVATION OF EARTHEN LEVEE AFTER COMPLETION OF NEW FLOODWALL.



REACH II

STA. 21+00 TO STA. 37+00 EAST SIDE AND WEST SIDE

*: EXISTING FLOODWALL TO BE REMOVED DOWN TO ELEVATION EARTHEN LEVEE AFTER COMPLETION OF NEW FLOODWALL.



REACH III

STA. 37+00 TO STA. 59+00 EAST SIDE
STA. 37+00 TO STA. 70+00 WEST SIDE

NOTE: GROSS GRADE NOT TO EXCEED 1V ON 2.7 H

*: EXISTING FLOODWALL TO BE REMOVED DOWN TO ELEVATION OF EARTHEN LEVEE AFTER COMPLETION OF NEW FLOODWALL.

PLATE 3 - 13

REV	DATE	DESCRIPTION	BY

Burk & Associates, Inc.
Engineers • Planners • Environmental Scientists
New Orleans, Louisiana

RECOMMENDED PLAN FOR LEVEES AND FLOODWALLS

TYPICAL SECTIONS

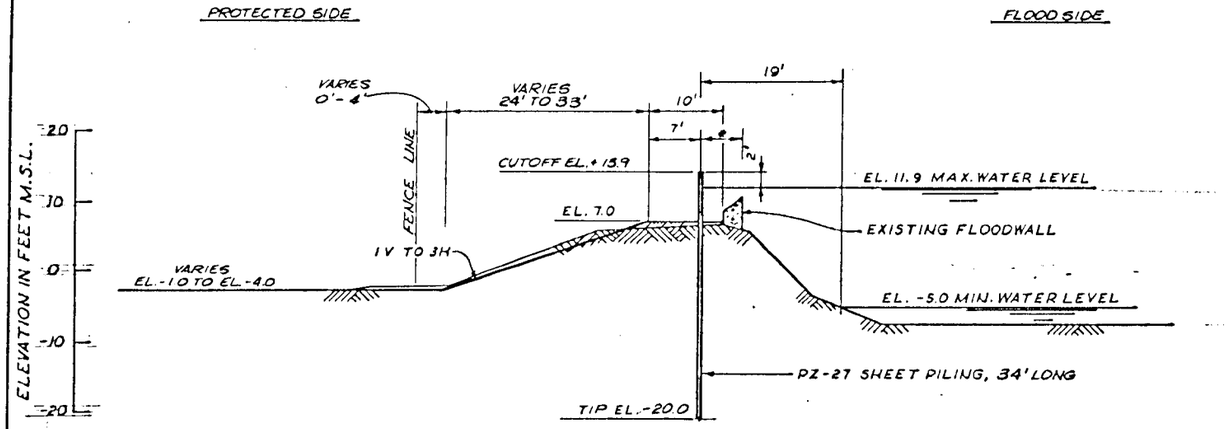
ASSOCIATE	JOB NO.	DESIGNED	SCALE	SHEET NO.
REVIEWER		DETAILED	DATE	1 of 4
PLAN BY NAME		CHECKED	FILE NO.	

LONDON AVE. CANAL FLOODWALLS AND LEVEES

GENERAL DESIGN MEMORANDUM

BOARD OF LEVEE COMMISSIONERS
ORLEANS LEVEE BOARD

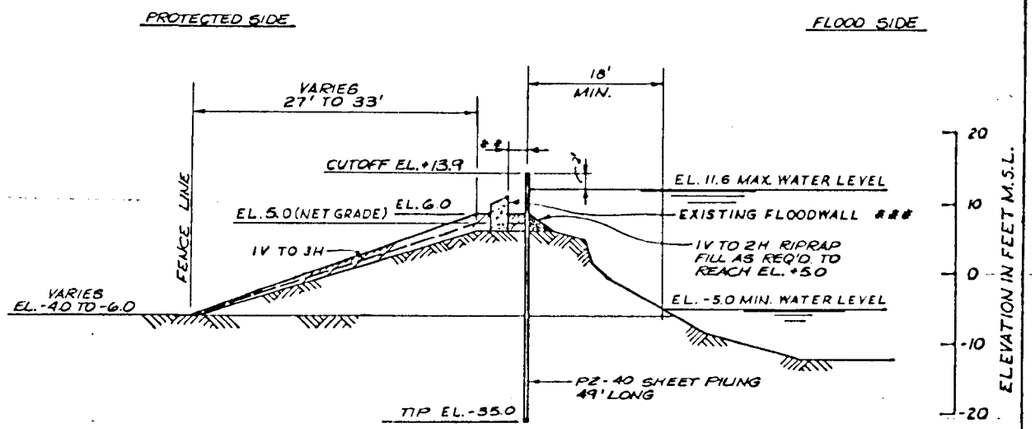
ORLEANS LEVEE BOARD CONTRACT NO. 2049-0269



REACH III

STA. 70+30 TO STA. 120+10 WEST SIDE

* SETBACK DISTANCE BETWEEN EXISTING FLOODWALL AND NEW CANTILEVER I-WALL VARIES BETWEEN 2' SETBACK TOWARDS PROTECTED SIDE OF EXISTING FLOODWALL AND 4' OFFSET TOWARDS FLOOD SIDE OF EXISTING FLOODWALL.



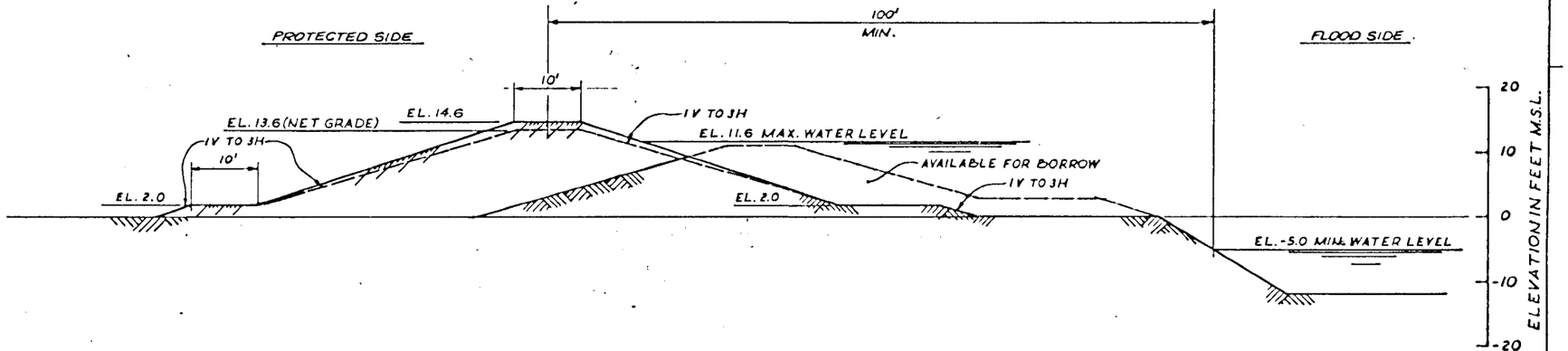
REACH III

STA. 59+00 TO STA. 120+10 EAST SIDE

** SETBACK DISTANCE BETWEEN EXISTING FLOODWALL AND NEW CANTILEVER I-WALL VARIES BETWEEN 3' SETBACK TOWARDS PROTECTED SIDE OF EXISTING FLOODWALL AND 2' OFFSET TOWARDS FLOOD SIDE OF EXISTING FLOODWALL.

NOTE: GROSS GRADE NOT TO EXCEED 1V ON 2.7 H

*** EXISTING FLOODWALL TO BE REMOVED DOWN TO ELEVATION OF EARTHEN LEVEE AFTER COMPLETION OF NEW FLOODWALL.



REACH IV WEST

STA. 120+00 TO STA. 127+00

NOTE: GROSS GRADE NOT TO EXCEED 1V ON 2.7 H

PLATE 3-14

REV	DATE	DESCRIPTION	BY

Burk & Associates, Inc.
Engineers • Planners • Environmental Scientists
New Orleans, Louisiana

RECOMMENDED PLAN FOR LEVEES AND FLOODWALLS

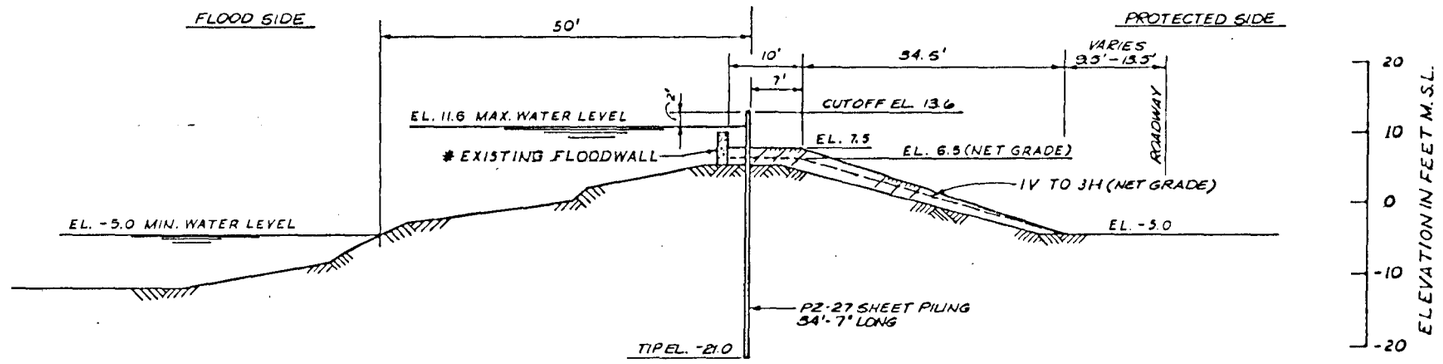
TYPICAL SECTIONS

ASSOCIATE	JOB NO.	DESIGNED	SCALE	SHEET NO.
REVIEWER		DETAILED	DATE	2 OF 4
PLAN IN HAND		CHECKED	FILE NO.	

LONDON AVE. CANAL FLOODWALLS AND LEVEES
GENERAL DESIGN MEMORANDUM

ORLEANS LEVEE BOARD CONTRACT NO. 2049-0269

BOARD OF LEVEE COMMISSIONERS
ORLEANS LEVEE BOARD

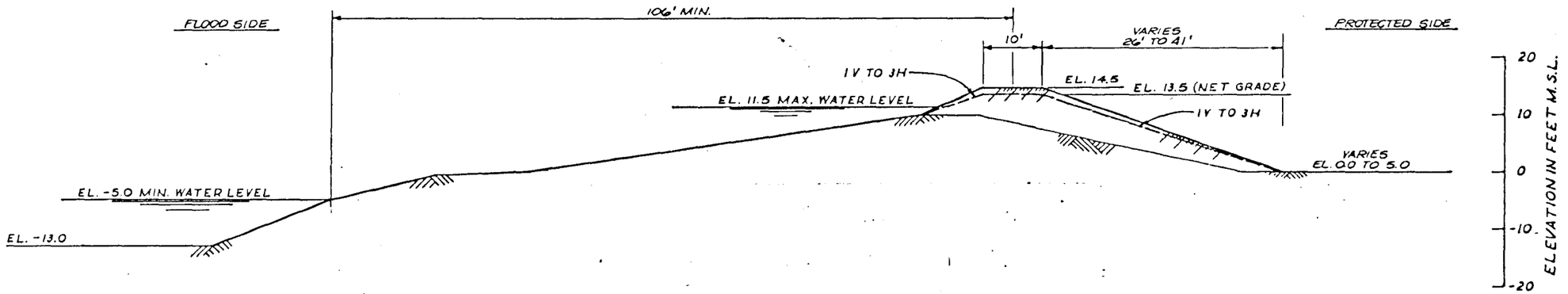


REACH IV EAST

STA. 120+40 TO STA. 127+20

NOTE : GROSS GRADE NOT TO EXCEED IV ON 2.7H

#: EXISTING FLOODWALL TO BE REMOVED DOWN TO ELEVATION OF EARTHEN LEVEE AFTER COMPLETION OF NEW FLOODWALL.



REACH V

STA. 127+95 TO STA. 144+50 EAST SIDE
STA. 127+55 TO STA. 146+50 WEST SIDE

NOTE : GROSS GRADE NOT TO EXCEED IV ON 2.7H

PLATE 3-15

REV	DATE	DESCRIPTION	BY

Burk & Associates, Inc.
Engineers • Planners • Environmental Scientists
New Orleans, Louisiana

RECOMMENDED PLAN FOR LEVEES AND FLOODWALLS

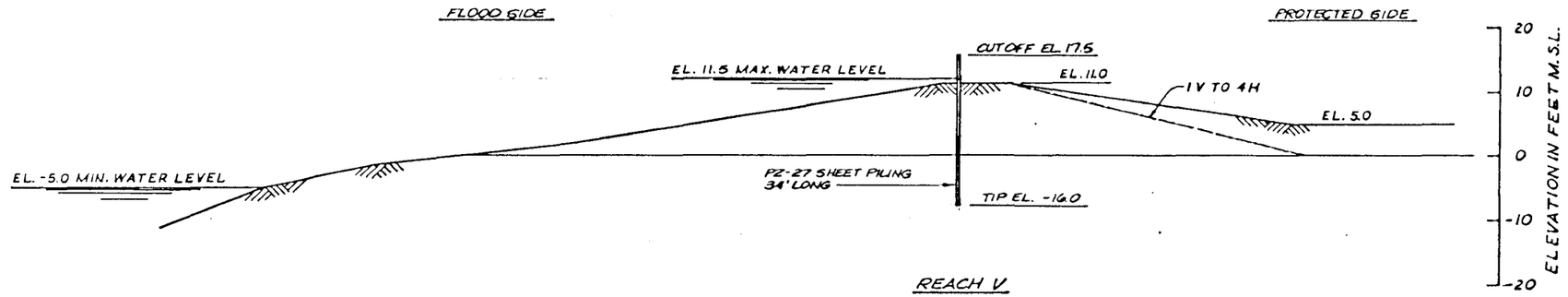
TYPICAL SECTIONS

ASSOCIATE	JOB NO.	DESIGNED	SCALE	SHEET NO.
REVIEWER		DETAILED	DATE	3 of 4
PLAN BY HWB		CHECKED	FILE NO.	

LONDON AVE. CANAL FLOODWALLS AND LEVEES
GENERAL DESIGN MEMORANDUM

BOARD OF LEVEE COMMISSIONERS
ORLEANS LEVEE BOARD

ORLEANS LEVEE BOARD CONTRACT NO. 2049-0269



REACH V

STA. 149+50 TO STA. 159+70 WEST SIDE *
STA. 147+50 TO STA. 159+90 EAST SIDE **

* NOTE: BETWEEN STA. 146+50 AND 149+50 CUTOFF ELEV. FOR STEEL SHEET PILING TRANSITIONS FROM EL. 13.5 TO EL. 17.5

** NOTE: BETWEEN STA. 144+50 AND 147+50 CUTOFF ELEV. FOR STEEL SHEET PILING TRANSITIONS FROM EL. 13.5 TO EL. 17.5

PLATE 3-16

REV	DATE	DESCRIPTION	BY

Burk & Associates, Inc.
Engineers • Planners • Environmental Scientists
New Orleans, Louisiana

RECOMMENDED PLAN FOR LEVEES AND FLOODWALLS

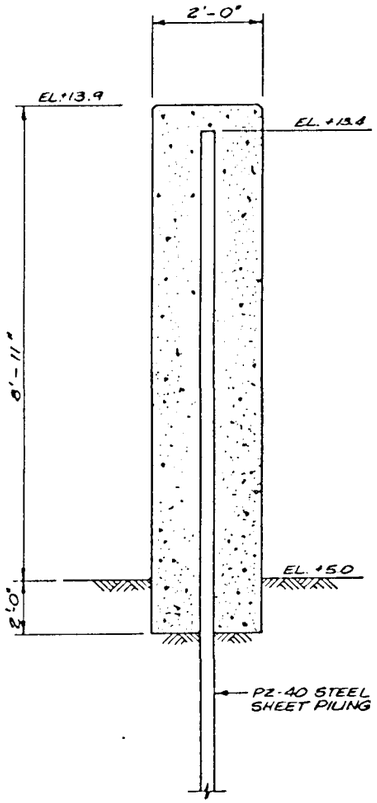
TYPICAL SECTIONS

ASSOCIATE	JOB NO	DESIGNED	SCALE	SHEET NO
REVIEWED		DETAILED	DATE	4 of 4
PLAN IS SIGNED		CHECKED	FILE NO	

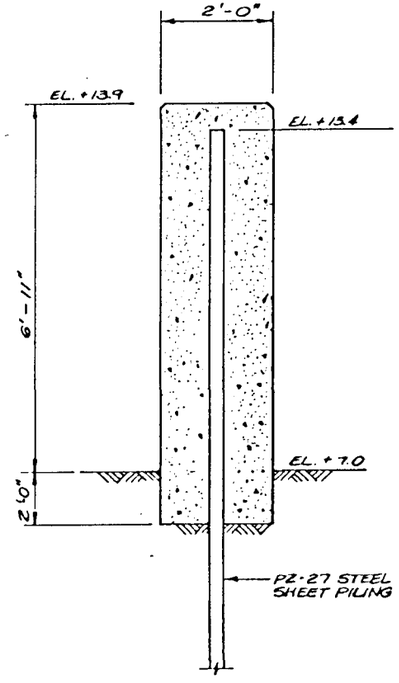
LONDON AVE. CANAL FLOODWALLS AND LEVEES
GENERAL DESIGN MEMORANDUM

BOARD OF LEVEE COMMISSIONERS
ORLEANS LEVEE BOARD

ORLEANS LEVEE BOARD CONTRACT NO. 2049-0269



REACH I - III
PERMANENT CONCRETE CAP OVER CANTILEVER SHEET PILE WITH EARTH LEVEE AT EL. +5.0



REACH II - IV
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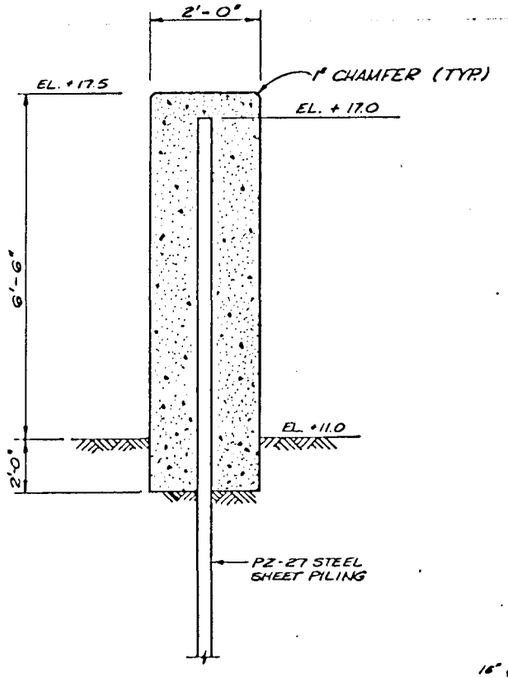
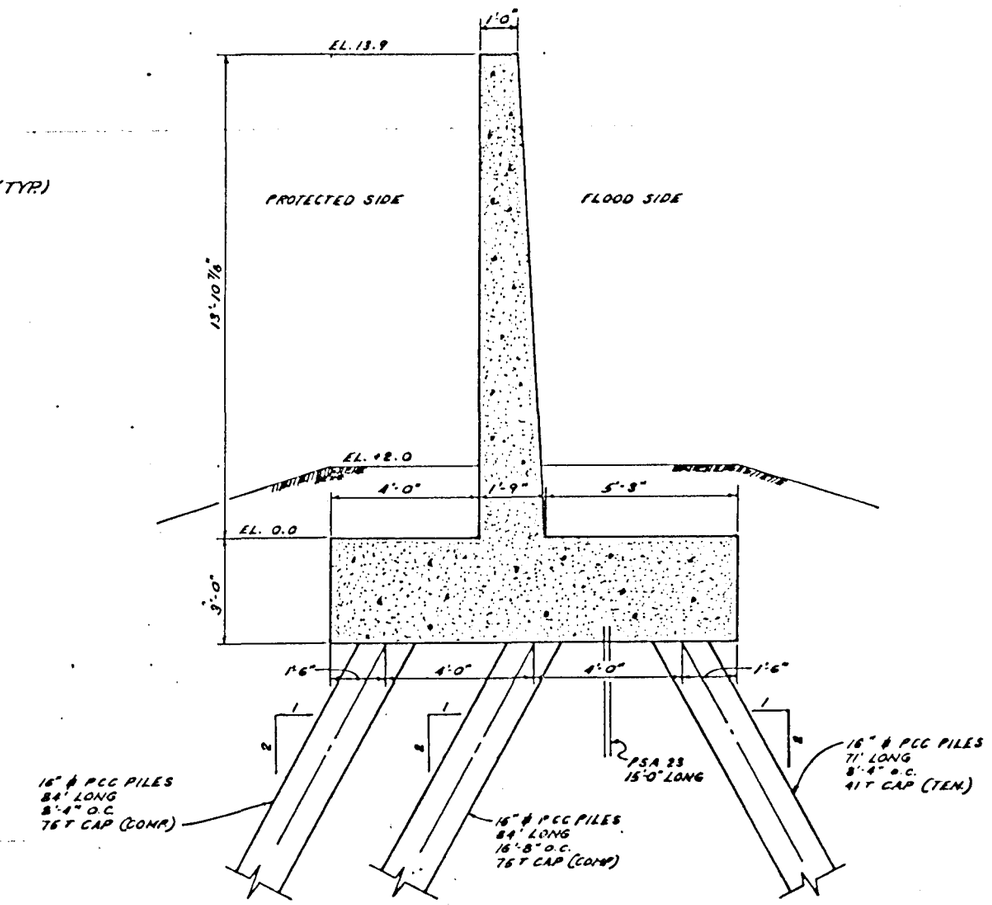


REACH V
PERMANENT CONCRETE CAP OVER CANTILEVER SHEET PILE WITH EARTH LEVEE AT EL. +11.0



REACH I
INVERTED 'T' WALL
STA. 2+80 TO STA. 6+80 EAST SIDE

Note:
For Construction Purposes, Existing Steel Sheet Pile Will Be Cut Off 6".

PLATE 3-17

REV	DATE	DESCRIPTION	BY

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New Orleans, Louisiana

CONCRETE FLOODWALLS

TYPICAL SECTIONS

ASSOCIATE	JOB NO	DESIGNED M. G. J.	SCALE	SHEET NO
REVIEWER		DETAILED A. C. R.	DATE	1 of 1
PLATE IN BOOK		CHECKED	FILE NO	

LONDON AVE. CANAL FLOODWALLS AND LEVEES
GENERAL DESIGN MEMORANDUM

ORLEANS LEVEE BOARD CONTRACT NO. 2049-0269

BOARD OF LEVEE COMMISSIONERS
ORLEANS LEVEE BOARD

E. MARIGNY CANAL

LONDON AVE. CANAL FLOW

SOUTHERN R.R.

2+00

1+00

0+00

3:1 (typ.)

NEW LEVEE CROWN

SLOPE TO TOP OF WALL

LONDON AVE.

B&A WEST SURVEY LINE

WALL "A"

WALL "B"

WALL "C"

WALL "D"

WALL "E"

WALL "F"

EXIST. M.H.

48" ϕ D.F.M.

EXIST. GATE TO BE REPLACED

TO STATION #5

TO STATION #5

B&A EAST SURVEY LINE

EXISTING BUILDING - N.O. S.&W.B. DRAINAGE PUMPING STATION No. 3

BYPASS CANAL

N

SITE PLAN

16 0 16 32

SCALE IN FEET

PLATE 3-18

REV	DATE	DESCRIPTION	BY

Burk & Associates, Inc.
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New Orleans, Louisiana

DRAINAGE PUMPING STATION Nº 3

SITE PLAN

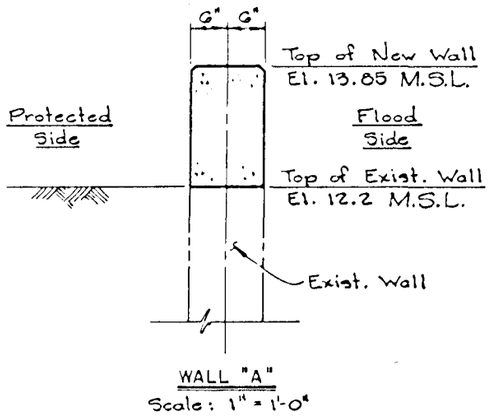
ASSOCIATE	JOB NO. 8407	DESIGNED J.M.C.	SCALE AS SHOWN	SHEET NO. 1 of 2
REVIEWER		DETAILED W.K./C.K.S.	DATE 4/69	
PLAN IN HAND		CHECKED M.G.J.	FILE NO.	

LONDON AVE. CANAL FLOODWALLS AND LEVEES

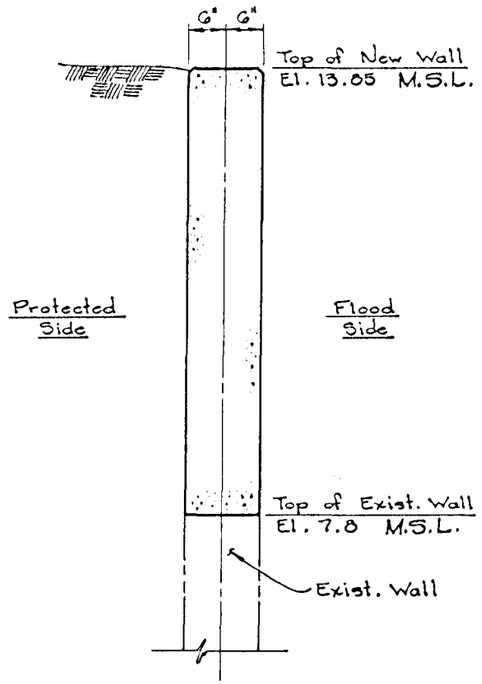
GENERAL DESIGN MEMORANDUM

BOARD OF LEVEE COMMISSIONERS
ORLEANS LEVEE BOARD

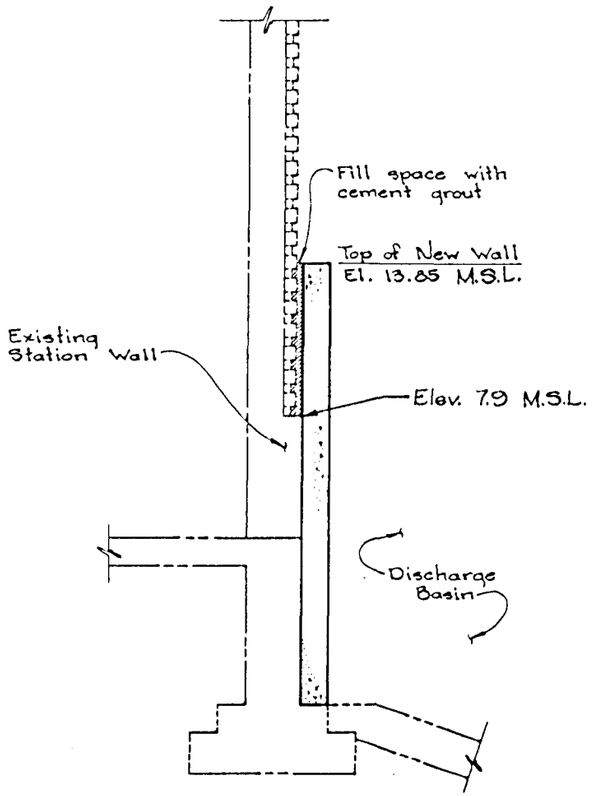
ORLEANS LEVEE BOARD CONTRACT NO. 2049-0269



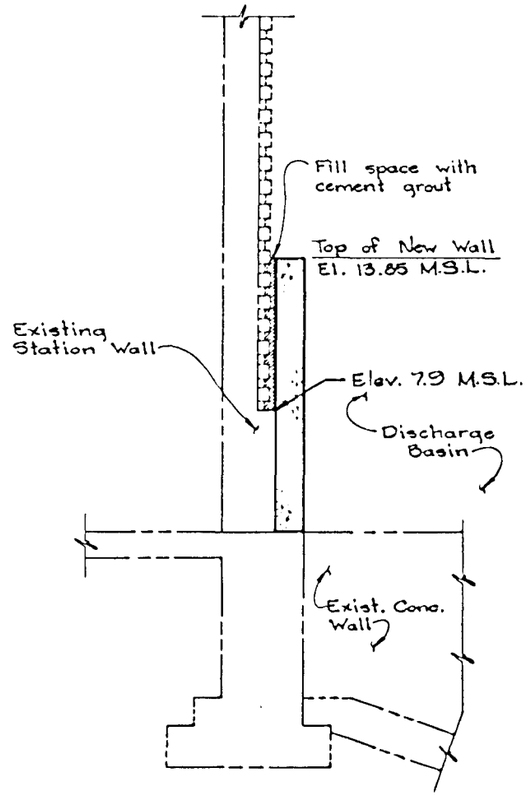
WALL "A"
Scale: 1" = 1'-0"



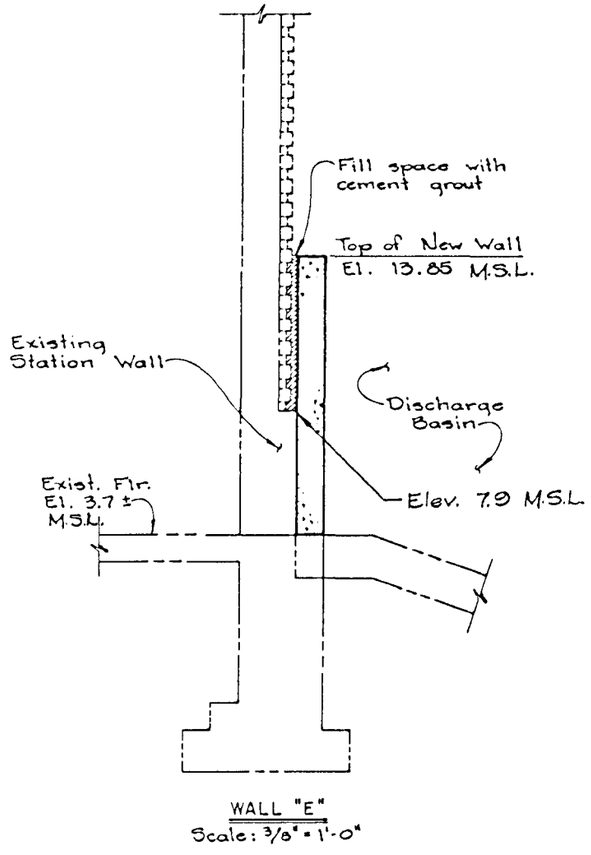
WALL "B"
Scale: 1" = 1'-0"



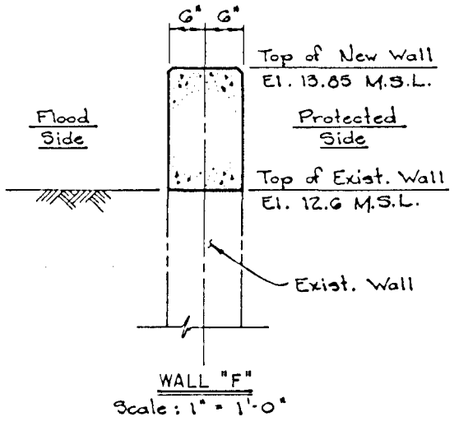
WALL "C"
Scale: 3/8"-1'-0"



WALL "D"
Scale: 3/8"-1'-0"



WALL "E"
Scale: 3/8"-1'-0"



WALL "F"
Scale: 1" = 1'-0"

PLATE 3-19

NO	DATE	DESCRIPTION	BY

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New Orleans, Louisiana

DRAINAGE PUMPING STATION Nº 3

TYPICAL SECTIONS

ASSOCIATE	JOB NO	DESIGNED J.M.C.	SCALE AS SHOWN	SHEET NO
REVIEWER	8407	DETAILED C.H.S.	DATE 4/66	2 of 2
PLAN IN HAND		CHECKED M.G.J.	FILE NO	

LONDON AVE. CANAL FLOODWALLS AND LEVEES

GENERAL DESIGN MEMORANDUM

ORLEANS LEVEE BOARD CONTRACT NO. 2049-0269

BOARD OF LEVEE COMMISSIONERS
ORLEANS LEVEE BOARD

N

STA. 103+00

LONDON AVE. CANAL
FLOW

EXISTING 50"Φ STEEL SIPHON TUBE

EXISTING 10'Φ STEEL SIPHON TUBE

NEW 12" WALL "G," EL. 13.85

STA. 102+00

NEW 18" WALL "H"
NEW 12" WALL "F," EL. 13.85

NEW 12" WALL "E," EL. 13.85

EXIST. EL. 14.61

NEW 12" WALL "D," EL. 13.85

NEW 12" WALL "C," EL. 13.85
NEW 18" WALL "H"

NEW 10" WALL "B," EL. 13.85

STA. 101+00

NEW 8'/14" WALL "J"
NEW 10" WALL "A," EL. 13.85

EXISTING BLDG. N.O.S.&W.B. DRAINAGE PUMPING STATION # 4

B&A WEST SURVEY LINE

B&A MAIN SURVEY LINE

EXISTING CONCRETE-LINED CANAL AREA

B&A EAST SURVEY LINE

EXISTING 18-6'Φ PIPES (3-TIER)

STA. 100+00

WARRINGTON DRIVE

PRENTISS AVE.

WARRINGTON DRIVE

SITE PLAN

16 0 16 32
SCALE IN FEET

PLATE 3-20

REV	DATE	DESCRIPTION	BY

Burk & Associates, Inc.
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New Orleans, Louisiana

DRAINAGE PUMPING STATION Nº 4

SITE PLAN

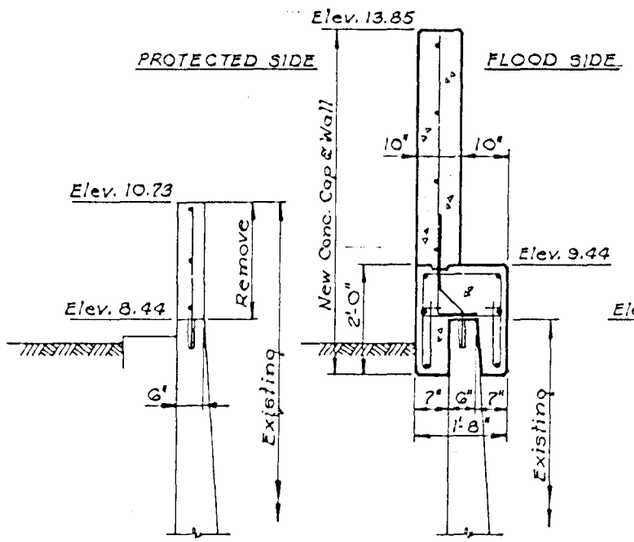
ASSOCIATE	JOB NO.	DESIGNED J.M.C.	SCALE AS SHOWN	SHEET NO.
REVIEWED	8407	DETAILED W.K.	DATE 4/66	1 of 2
PLAN BY MAB		CHECKED M.G.J.	FILE NO.	

LONDON AVE. CANAL FLOODWALLS AND LEVEES

GENERAL DESIGN MEMORANDUM

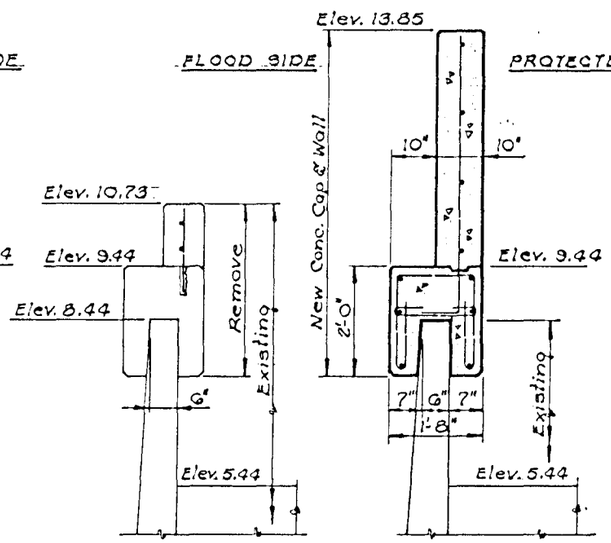
ORLEANS LEVEE BOARD CONTRACT NO. 2049-0269

BOARD OF LEVEE COMMISSIONERS
ORLEANS LEVEE BOARD



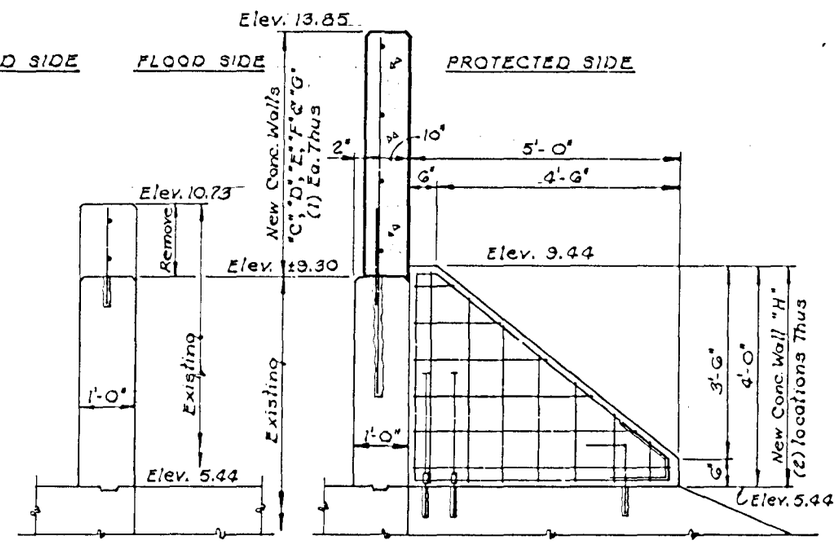
EXISTING WALL "A" PROPOSED

SECTION



EXISTING WALL "B" PROPOSED

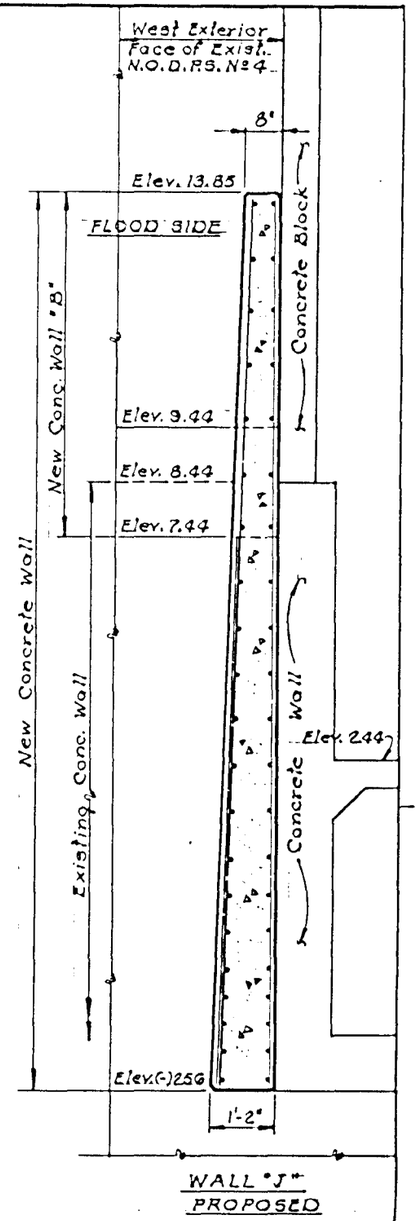
SECTION



WALLS "C", "D", "E", "F", "G" & "H"

EXISTING PROPOSED

SECTION



WALL "J"

PROPOSED

PLATE 3-21

REV	DATE	DESCRIPTION	BY

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New Orleans, Louisiana

DRAINAGE PUMPING STATION № 4

TYPICAL SECTION

ASSOCIATE	JOB NO.	DESIGNED O.B.L.	SCALE AS NOTED	SHEET NO.
REVIEWER	8407	DETAILED L.V.B.	DATE 4/86	2 of 2
PLAN IN HAND		CHECKED H.G.J.	FILE NO.	

LONDON AVE. CANAL FLOODWALLS AND LEVEES
GENERAL DESIGN MEMORANDUM

ORLEANS LEVEE BOARD CONTRACT NO. 2049-0269

BOARD OF LEVEE COMMISSIONERS
ORLEANS LEVEE BOARD

London Avenue Canal Floodwalls and Levees

General Design Memorandum

SECTION IV
CONSTRUCTION PRIORITIES

SECTION IV
CONSTRUCTION PRIORITIES

INDEX

Paragraph Number	Title	Page Number
	GENERAL	
1.	Scope	4-2
	FIRST PRIORITY	
2.	Bridges	4-3
3.	Levees	4-3
4.	Remaining Flood Protection	4-3
	SECOND PRIORITY	
5.	Levees	4-4
6.	Pumping Stations	4-4
7.	Conclusion	4-4
8.	Construction Schedule	4-5

TABLES

Table Number	Title	Page Number
4-1	Priority Schedule for Bridge Openings	4-6
4-2	Priority Schedule for Levees and Floodwalls	4-7
4-3	Construction Schedule	4-8

PLATES

Plate Number	Title
4-1	Construction Priorities

SECTION IV
CONSTRUCTION PRIORITIES

GENERAL

1. Scope. This section addresses the sequence of constructing flood improvements along the London Avenue Outfall Canal to resolve the most critical areas in present flood protection as a top priority item. After completion of the first phase, then a continuation of construction will upgrade the remaining parallel levees to result in accomplishing the completion of the interim flood proofing in accordance with the design criteria obtained from the Corps of Engineers. Eventually, permanent flood proofing will be scheduled to complete the entire project.

SECTION IV
CONSTRUCTION PRIORITIES

FIRST PRIORITY

2. Bridges. The first priority for eliminating present gaps in the flood protection along London Avenue Outfall Canal is to floodproof the existing openings at seven bridges along the canal. These seven bridges listed in their order of priority order are shown in Table 4-1. As seen in Table 4-1, the present bridge elevations vary between elevation 4.19 msl and elevation 10.03 msl. The additional height necessary for required flood protection is as much as 9.66 feet of additional protection at the Gentilly Boulevard Bridge, making this the top priority item for construction. The other bridges require between 5.48 feet and 3.57 feet of additional height to meet the required flood protection levels necessary under this project.

3. Levees. The top priority levees to reduce potential flooding within this project are the earthen levees between Robert E. Lee Boulevard and Lakeshore Drive Station 120+50 to 160+00, See Table 4-2. After the bridges have been modified as discussed above, this reach of levees represents the highest priority for required flood protection. Present levee heights vary between elevation 9.0 and 10.0 msl on the earthen levees between Robert E. Lee and Lakeshore Drive, adjacent to the London Avenue Canal. These levees must be as high as elevation 17.5 msl in the vicinity of Lake Pontchartrain due to wave runup. Therefore, as much as 7.5 feet is required to be filled by these levees making them a top priority item.

4. Remaining Flood Protection. Upon completion of the Phase I construction items, the most critical flood protection level along London Avenue Outfall Canal will be elevation 10.50 msl. The remaining construction will fall under the Phase II of construction to eliminate this difference between elevation 10.5 and 13.9 msl as required protection.

SECTION IV
CONSTRUCTION PRIORITIES

SECOND PRIORITY

5. Levees. The second priority for providing flood protection to the area adjacent to the London Avenue Outfall Canal will be to raise the remaining levees south of Robert E. Lee Boulevard to achieve the required level of flood protection. As seen in Table 4-2, these levees are prioritized beginning with priority number II-1 through number II-4. The east levee between Dillard University (Station 21+00) and Prentiss Avenue (Station 101+00) is the first item under the second priority due to the present I-wall configuration. The present I-wall consists of a 20.0 foot length of M-115 sheetpile section supporting a 4.5 foot cantilever I-wall. Also natural ground elevations in this particular reach are as low as -4.0 msl adding to the critical stability of this I-wall. The next priority is the west levee between Dillard University (Station 21+00) and Robert E. Lee Blvd. (Station 120+00). This present floodwall is similar to the east floodwall with only slightly higher natural ground elevations adding to the stability of this floodwall. After completion of these two reaches of floodwall the existing floodwalls between Drainage Pump Station No. 3, Station 0+00 to Dillard University Station 21+00, east and west of London Avenue Canal, need to be upgraded. These present floodwalls in this reach consist of a 20-foot length of PZ-27 sheetpile with approximately a 7.5 foot cantilever I-wall. The last reach of floodwall requiring improving is the east floodwall between Prentiss Avenue and Robert E. Lee Boulevard, Station 102+60 to 120+00. The present floodwall in this reach is a 32-foot length of PZ-27 sheet pile with an 8.0 foot cantilever I-wall. This section of wall was constructed in 1982 and is the most recent improvement to the floodwalls within this project.

6. Pumping Stations. Also within Phase II of construction is the need to raise existing floodwalls within Drainage Pumping Station No. 3 at Station 0+00 and at Drainage Pumping Station No. 4 at Station 101+00. The existing concrete floodwalls adjacent to each pump station need to be raised to elevation 13.9 msl as well as construction of new concrete floodwalls across the masonry pump station structures to provide the necessary flood protection.

7. Conclusion. The construction of the necessary flood improvements along the London Avenue Outfall Canal will require several years to be

completed. Therefore, it is necessary to address the most critical gaps in the present levee system as the first priority of construction. Upon completion of the Phase I, a similar schedule of construction is necessary for levees and floodwalls within the Phase II. For a map summarizing the proposed construction priority schedule, see Plate 4-1.

8. Construction Schedule. A proposed schedule of construction for both the Phase I and Phase II interim floodwalls and levees is presented in Table 4-3. Total estimated time of completion from the initial start of the design phase is 3 years and 3 months until completion of the interim floodwalls and levee construction.

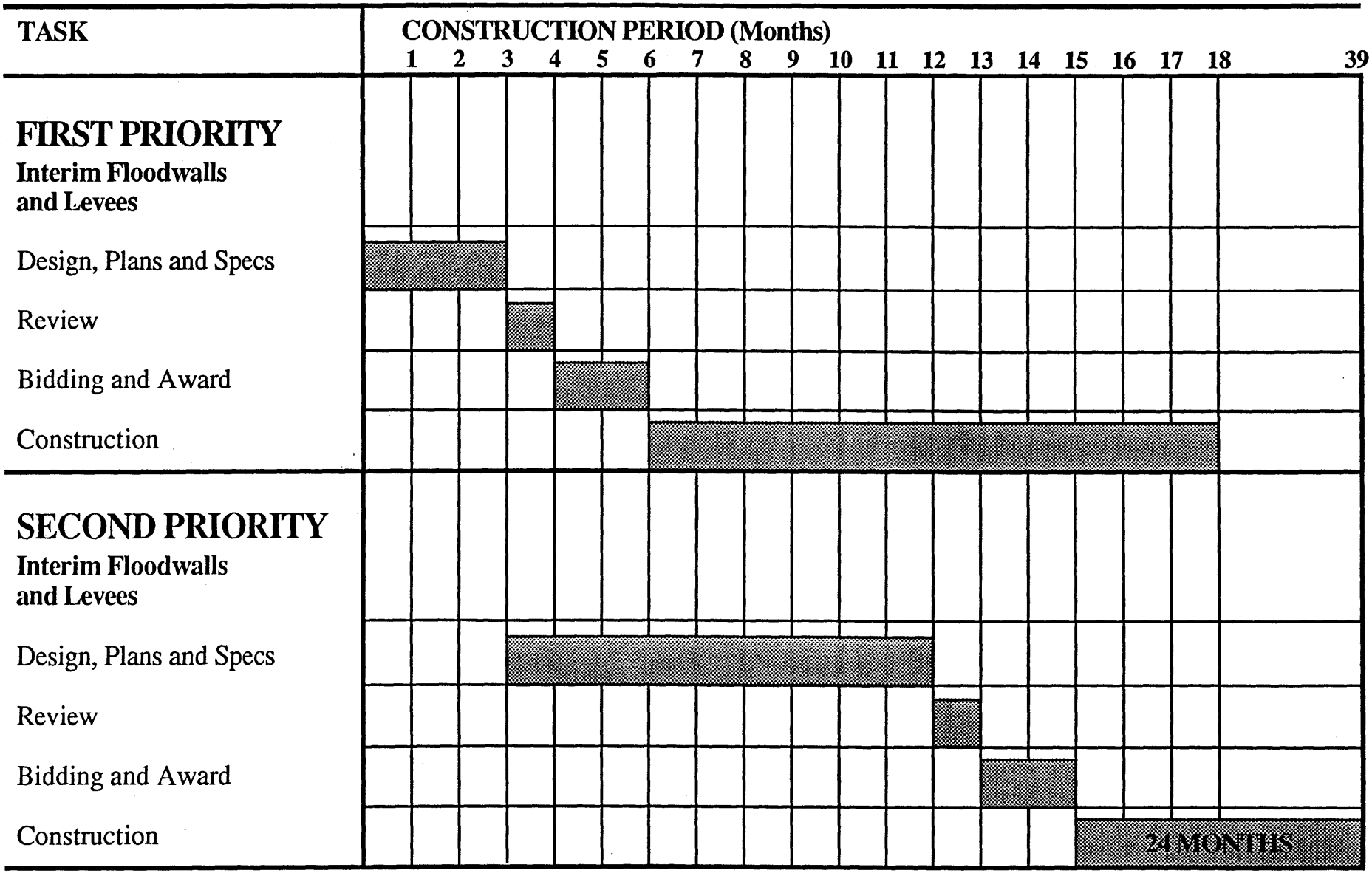
TABLE 4-1
PRIORITY SCHEDULE FOR BRIDGE OPENINGS

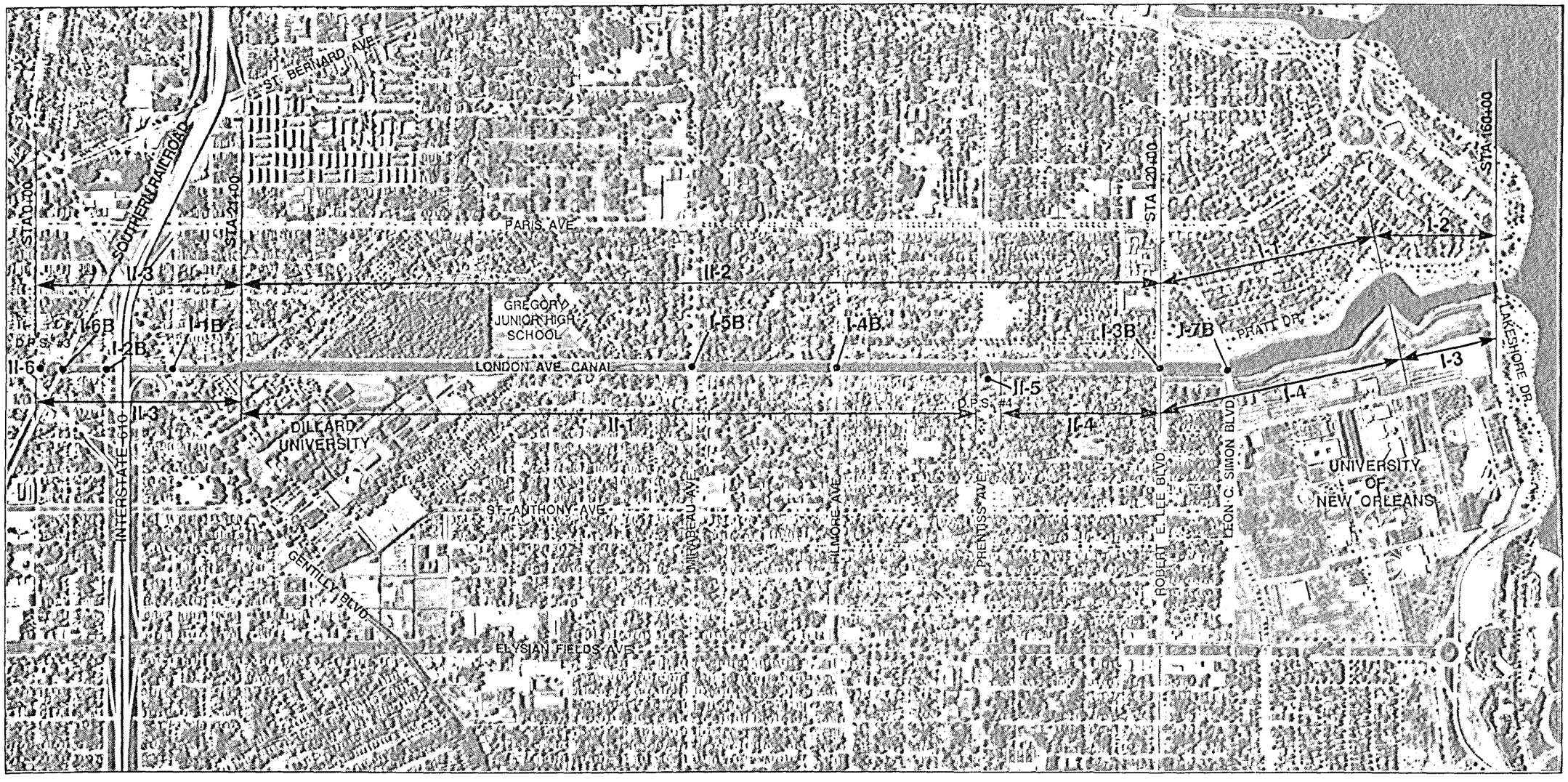
Flood Priority Number	Location	Station	Present Critical Elevation	Required Protection Elevation
I-1B	Gentilly Boulevard Bridge	13+50	4.19	13.9
I-2B	Benefit Street Bridge Rollergates	6+70	8.37	13.9
I-3B	Robert E. Lee Boulevard Bridge	120+25	8.64	13.9
I-4B	Filmore Avenue Bridge	85+50	9.15	13.9
I-5B	Mirabeau Avenue Bridge	70+00	9.27	13.9
I-6B	Southern Railroad Trestle Swing Gates	2+20	9.33	13.9
I-7B	Leon C. Simon Boulevard Bridge	127+60	10.03	13.60

TABLE 4-2
PRIORITY SCHEDULE FOR LEVEES AND FLOODWALLS

Priority Number	Location	Station Limits	Present Critical Elevation	Required Flood Protection Elevation
I-1	Robert E. Lee Boulevard North to Transition Area, West	120+50 to 142+00	9.0	13.6
I-2	Transition Area to Lakeshore Drive, West	142+00 to 160+00	10.0	17.5
I-3	Transition Area to Lakeshore Drive, East	144+50 to 160+00	10.0	17.5
I-4	Robert E. Lee Boulevard North to Transition Area, East	120+50 to 144+50	10.0	13.6
II-1	Dillard University to Prentiss Avenue,East	21+00 to 100+80	10.5	13.9
II-2	Dillard University to Robert E. Lee Boulevard, West	21+00 to 120+00	10.5	13.9
II-3	Drainage Pumping Station No. 3 to Dillard University, East & West	0+00 to 21+00	12.5	13.9
II-4	Prentiss Avenue to Robert E. Lee Boulevard, East	102+60 to 120+00	11.5	13.9
II-5	Drainage Pumping Station No. 4	100+80 to 102+60	10.5	13.9
II-6	Drainage Pumping Station No. 3	0+00	12.5	13.9

TABLE 4-3
CONSTRUCTION SCHEDULE





PRIORITY SCHEDULE FOR LEVEES AND FLOODWALLS

I-1	ROBERT E. LEE BOULEVARD NORTH TO TRANSITION AREA, WEST
I-2	TRANSITION AREA TO LAKESHORE DRIVE, WEST
I-3	TRANSITION AREA TO LAKESHORE DRIVE, EAST
I-4	ROBERT E. LEE BOULEVARD NORTH TO TRANSITION AREA, EAST
II-1	DILLARD UNIVERSITY TO PRENTISS AVENUE, EAST
II-2	DILLARDUNIVERSITY TO ROBERT E. LEE BOULEVARD, WEST
II-3	DRAINAGE PUMPING STATION NO. 3 TO DILLARD UNIVERSITY, EAST & WEST
II-4	PRENTISS AVENUE TO ROBERT E. LEE BOULEVARD, EAST
II-5	DRAINAGE PUMPING STATION NO. 4
II-6	DRAINAGE PUMPING STATION NO. 3

PRIORITY SCHEDULE FOR BRIDGES

I-1B	GENTILLY BOULEVARD BRIDGE
I-2B	BENEFIT STREET BRIDGE
I-3B	ROBERT E. LEE BOULEVARD BRIDGE
I-4B	FILMORE AVENUE BRIDGE
I-5B	MIRABEAU AVENUE BRIDGE
I-6B	SOUTHERN RAILROAD TRESTLE SWING GATES
I-7B	LEON C. SIMON BOULEVARD BRIDGE

PLATE 4-1

N

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New Orleans, Louisiana

LONDON AVENUE CANAL FLOODWALLS AND LEVEES

CONSTRUCTION PRIORITIES

ASSOCIATE	JOB NO.	DESIGNED	SCALE 1"=1,250'	SHEET NO.
REVIEWER	8407	DETAILED	DATE	
PLAN IN HAND		CHECKED	FILE NO.	OF

LONDON AVENUE CANAL FLOODWALLS AND LEVEES

GENERAL DESIGN MEMORANDUM

ORLEANS LEVEE BOARD CONTRACT NO. 2049-0269

BOARD OF COMMISSIONERS
ORLEANS LEVEE BOARD

London Avenue Canal Floodwalls and Levees

General Design Memorandum

SECTION V
COST ESTIMATES

SECTION V
COST ESTIMATES

INDEX

Paragraph Number	Title	Page Number
	GENERAL	
1.	Scope	5-2
	TABLES	
Table Number	**Title**	**Page Number**
5-1	Cost Estimate for Recommended Plan of Interim Floodwalls and Levees - Phase I	5-3
5-2	Cost Estimate for Recommended Plan of Interim Floodwalls and Levees - Phase II	5-7
5-3	Cost Estimate for Alternate Floodwalls and Levees	5-10
5-4	Cost Estimate for Alternate Bridge Modifications	5-13
5-5	Cost Estimate for Recommended Plan for Future Permanent Floodwalls and Levees - Phase III	5-16

SECTION V
COST ESTIMATES

GENERAL

1. Scope. This section addresses the estimated costs for constructing the interim and permanent flood protection improvements along the London Avenue Outfall Canal. Also alternate plans are presented for comparison with the recommended plan cost estimate.The cost estimate for the floodwalls and levee improvements included in the recommended plan are shown in Table 5-1 and Table 5-2. Included in these tables are all costs including levees and floodwalls, modifications to existing bridge crossings and flood protection measures at the two drainage pump stations. The costs for alternate levee and floodwall improvements are summarized in Table 5-3. The costs for alternate bridge modifications are summarized in Table 5-4. The future costs for the permanent concrete cap construction on the I-wall floodwalls is summarized in Table 5-5. Typical sections of the new permanent concrete cap can be found on Plate 3-15.

TABLE 5-1

COST ESTIMATE FOR RECOMMENDED PLAN OF INTERIM FLOODWALLS AND LEVEES PHASE I

Description of Work	Quantity	Unit	Unit Cost	Total Cost
Reach I - Steel Swing Gates at Southern Railroad				
Demolition		Lump Sum		$2,500.00
Falsework	2	Each	40,750.00	81,500.00
Gate Monolith	2	Each	42,000.00	84,000.00
Steel Swing Gate (28' opening)	2	Each	24,000.00	48,000.00
			Subtotal	**$216,000.00**
Steel Roller Gates at Benefit Street				
Storage Monolith	2	Each	4,750.00	$9,500.00
Gate Monolith	2	Each	8,750.00	17,500.00
Steel Roller Gate (31' opening)	2	Each	24,000.00	48,000.00
			Subtotal	**$75,000.00**
New Low Level Bridge at Gentilly Blvd.				
Demolition (except ftg. & piles)		Lump Sum		$120,000.00
New bridge	9,180	S.F.	30.00	275,400.00
Approach Roadway Modifications		Lump Sum		30,000.00
Concrete parapet walls	72.73	C.Y.	275.00	20,000.00
			Subtotal	**$445,400.00**

TABLE 5-1 (continued)

COST ESTIMATE FOR RECOMMENDED PLAN OF INTERIM FLOODWALLS AND LEVEES PHASE I

Description of Work	Quantity	Unit	Unit Cost	Total Cost
Reach III - Floodproofing of Mirabeau Ave. Bridge				
Demolition		Lump Sum		$50,000.00
New Steel Girders and Tension Connections between Slab and Girders	247.19	L.F.	445.00	110,000.00
New Concrete Deck and Parapet Walls	327.27	C.Y.	275.00	90,000.00
Tension Connections between Cap and Girders		Lump Sum		25,000.00
Tension Connections between Cap and Piles	60	Each	500.00	30,000.00
			Subtotal	**$305,000.00**
Floodproofing of Filmore Ave. Bridge				
Demolition		Lump Sum		$35,000.00
New Steel Girders and Tension Connections between Slab and Girders	263.16	L.F.	380.00	100,000.00
New Concrete Deck and Parapet Walls	261.82	C.Y.	275.00	72,000.00
Tension Connections between Cap and Girders		Lump Sum		25,000.00
Tension Connections between Cap and Piles	64	Each	500.00	32,000.00
			Subtotal	**$264,000.00**

TABLE 5-1 (continued)

COST ESTIMATE FOR RECOMMENDED PLAN OF INTERIM FLOODWALLS AND LEVEES PHASE I

Description of Work	Quantity	Unit	Unit Cost	Total Cost
Reach IV - Floodwalls and Levees - Station 120+00 to 127+00				
Levee embankment fill	15,500	C.Y.	10.00	$155,000.00
PZ-27 steel sheet pile	23,460	S.F.	14.00	328,000.00
Seeding and Fertilizer	2.2	Acre	1,000.00	2,200.00
			Subtotal	**$485,200.00**
Floodproofing Robert E. Lee Blvd. Bridge				
Demolition		Lump Sum		$40,000.00
New Steel Girders & Tension Connections between Slab and Girders	360.36	L.F.	333.00	120,000.00
New Concrete Deck and Parapet Walls	327.27	C.Y.	275.00	90,000.00
Tension Connections between Girders and Cap		Lump Sum		25,000.00
New Steel Pipe Piles (for uplift resistance)	30	Each	1,530.00	45,900.00
New I-beams to Connect Piles to Caps, including all Connections		Lump Sum		15,000.00
			Subtotal	**$335,900.00**
Reach V - Floodwalls and Levees - Station 127+00 to Station 160+00				
Levee embankment fill	67,000	C.Y.	10.00	$670,000.00
PZ-27 steel sheet pile	90,110	S.F.	14.00	1,261,600.00
Seeding and Fertilizer	7.8	Acre	1,000.00	7,800.00
			Subtotal	**$1,939,400.00**

TABLE 5-1 (continued)

COST ESTIMATE FOR RECOMMENDED PLAN OF INTERIM FLOODWALLS AND LEVEES PHASE I

Description of Work	Quantity	Unit	Unit Cost	Total Cost
Floodproofing of Leon C. Simon Blvd. Bridge				
Demolition		Lump Sum		$10,000.00
New Concrete Parapet walls	185.45	C.Y.	275.00	51,000.00
Tension Connectors between Steel Girders and Deck		Lump Sum		20,000.00
Tension Connections between Cap and Girders		Lump Sum		30,000.00
Tension Connections between Cap and Piles	95	Each	500.00	47,500.00
			Subtotal	**$158,500.00**

Summary of Estimated Construction Costs
Recommended Plan - Interim Floodwalls and Levees - Phase I

Reach I	$ 736,400.00
Reach III	$ 569,000.00
Reach IV	$ 821,100.00
Reach V	$ 2,097,900.00

Estimated Construction Cost (E.C.C.)	$4,224,400.00
Contingencies (15% ±)	633,600.00
Design Fees (5.75%)	279,300.00
Construction Cost (C.C.)	**$5,137,300.00**
Surveys	95,089.00
Design Memorandum	168,942.00
Geotechnical Investigation	95,000.00
Testing Laboratory	25,000.00
Resident Inspection (1.4%)	68,000.00
Project Cost (P.C.) - Phase I	**$5,589,331.00**

TABLE 5-2

COST ESTIMATE FOR RECOMMENDED PLAN OF INTERIM FLOODWALLS AND LEVEES PHASE II

Description of Work	Quantity	Unit	Unit Cost	Total Cost
Reach I - Floodwalls and Levees - Station 0+00 to Station 21+00				
Demolition		Lump Sum		$11,000.00
Levee embankment fill	1,500	C.Y.	10.00	15,000.00
PZ-40 steel sheet pile	182,352	S.F.	20.00	3,647,000.00
Concrete Inverted T Floodwall	380	L.F.	1,900.00	722,000.00
Utility Adjustments		Lump Sum		70,000.00
Seeding and Fertilizer	2.0	Acre	1,000.00	2,000.00
			Subtotal	**$4,467,000.00**
Floodwalls at Drainage Pump Station No. 3				
Construction Dewatering		Lump Sum		$50,000.00
Reinforced Concrete Floodwalls	69	C.Y.	500.00	34,500.00
New Fabricated Steel Sluice Gates	1	Each	12,000.00	12,000.00
			Subtotal	**$96,500.00**
Reach II - Floodwalls and Levees - Station 21+00 to Station 37+00				
Levee embankment fill	2,100	C.Y.	10.00	$21,000.00
PZ-27 steel sheet pile	110,400	S.F.	14.00	1,545,600.00
Seeding and Fertilizer	2.5	Acre	1,000.00	2,500.00
			Subtotal	**$1,569,100.00**

TABLE 5-2 (continued)

COST ESTIMATE FOR RECOMMENDED PLAN OF INTERIM FLOODWALLS AND LEVEES PHASE II

Description of Work	Quantity	Unit	Unit Cost	Total Cost
Reach III - Floodwalls and Levees - Station 37+00 to Station 120+00				
Demolition		Lump Sum		$21,000.00
Levee embankment fill	32,000	C.Y.	10.00	320,000.00
Riprap fill	1,000	C.Y.	14.00	14,000.00
PZ-27 steel sheet pile	350,370	S.F.	14.00	4,905,200.00
PZ-40 steel sheet pile	292,285	S.F.	20.00	5,845,700.00
Utility Adjustments		Lump Sum		387,000.00
Seeding and Fertilizer	12.5	Acre	1,000.00	12,500.00
			Subtotal	**$11,505,400.00**
Floodwalls at Drainage Pump Station No. 4				
Construction Dewatering		Lump Sum		$50,000.00
Demolition		Lump Sum		10,000.00
Reinforced Concrete Floodwall	30	C.Y.	500.00	15,000.00
			Subtotal	**$75,000.00**

Summary of Estimated Construction Costs
Recommended Plan - Interim Floodwalls and Levees - Phase II

Reach I	$ 4,563,500.00
Reach II	$ 1,569,100.00
Reach III	$11,580,400.00

TABLE 5-2 (continued)

COST ESTIMATE FOR RECOMMENDED PLAN OF INTERIM FLOODWALLS AND LEVEES PHASE II

Description of Work	Quantity	Unit	Unit Cost	Total Cost
Estimated Construction Cost (E.C.C.)				$17,713,000.00
Contingencies (15% ±)				$2,657,000.00
Design Fees (5.75%)				$1,171,300.00
Construction Cost (C.C.)				**$21,541,300.00**
Testing Laboratory				75,000.00
Resident Inspection (1.4%)				285,000.00
Project Cost (P.C.) - Phase II				**$21,901,300.00**

TABLE 5-3

COST ESTIMATE FOR ALTERNATE FLOODWALLS AND LEVEES

Description of Work	Quantity	Unit	Unit Cost	Total Cost
Reach I - Earth Levee Crown Elevation 7.0 msl, Cantilever I-wall				
Levee embankment fill	10,000	C.Y.	10.00	$100,000.00
PZ-27 steel sheet pile	119,816	S.F.	14.00	1,677,400.00
Utility Adjustments		Lump Sum		70,000.00
Seeding and Fertilizer	4.0	Acre	1,000.00	4,000.00
Demolition		Lump Sum		140,000.00
Right-of-Way Acquisition		Lump Sum		1,570,000.00
Relocations Costs		Lump Sum		168,000.00
			Subtotal	**$3,729,400.00**
Reach I - Earth Levee Crown Elevation 13.9 msl				
Levee embankment fill	97,000	C.Y.	10.00	$970,000.00
Seeding and Fertilizer	16.5	Acre	1,000.00	16,500.00
Demolition		Lump Sum		380,000.00
Right-of-Way Acquisition		Lump Sum		4,039,000.00
Relocations Costs		Lump Sum		456,000.00
			Subtotal	**$5,861,500.00**
Reach II - Earth Levee Crown Elevation 13.9 msl				
Levee embankment fill	103,000	C.Y.	10.00	$1,030,000.00
Seeding and Fertilizer	11.6	Acre	1,000.00	11,600.00
Demolition		Lump Sum		100,000.00
Right-of-Way Acquisition		Lump Sum		1,686,000.00
Relocations Costs		Lump Sum		120,000.00
			Subtotal	**$2,947,600.00**

TABLE 5-3 (continued)

COST ESTIMATE FOR ALTERNATE FLOODWALLS AND LEVEES

Description of Work	Quantity	Unit	Unit Cost	Total Cost
Reach III - Earth Levee Crown Elevation 7.0 msl, Cantilever I-wall				
Levee embankment fill	58,000	C.Y.	10.00	$580,000.00
PZ-27 steel sheet pile	553,180	S.F.	14.00	7,744,500.00
Utility Adjustments		Lump Sum		387,000.00
Seeding and Fertilizer	16.2	Acre	1,000.00	16,200.00
Demolition		Lump Sum		111,000.00
Right-of-Way Acquisition		Lump Sum		2,515,000.00
			Subtotal	**$11,353,700.00**
Reach III - Earth Levee Crown Elevation 13.9 msl				
Levee embankment fill	730,000	C.Y.	10.00	$7,300,000.00
Seeding and Fertilizer	71.4	Acre	1,000.00	71,400.00
Demolition		Lump Sum		2,010,000.00
Right-of-Way Acquisition		Lump Sum		21,494,000.00
Relocations Costs				2,412,000.00
			Subtotal	**$33,287,400.00**
Reach IV - Earth Levee Crown Elevation 13.6 msl				
Levee embankment fill	42,000	C.Y.	10.00	$420,000.00
Seeding and Fertilizer	4.5	Acre	1,000.00	4,500.00
Demolition		Lump Sum		110,000.00
Right-of-Way Acquisition		Lump Sum		1,233,000.00
Relocations Costs		Lump Sum		132,000.00
			Subtotal	**$1,899,500.00**

TABLE 5-3 (continued)

COST ESTIMATE FOR ALTERNATE FLOODWALLS AND LEVEES

Description of Work	Quantity	Unit	Unit Cost	Total Cost
Reach V - Earth Levee Crown Elevation 13.5 to 17.5 msl				
Levee embankment fill	130,000	C.Y.	10.00	$1,300,000.00
Seeding and Fertilizer	22.4	Acre	1,000.00	22,400.00
Demolition		Lump Sum		20,000.00
Right-of-Way Acquisition		Lump Sum		3,465,000.00
Relocations Costs		Lump Sum		24,000.00
			Subtotal	**$4,831,400.00**

TABLE 5-4

COST ESTIMATE FOR ALTERNATE BRIDGE MODIFICATIONS

Description of Work	Quantity	Unit	Unit Cost	Total Cost
Southern Railroad - New Elevated Bridge				
Demolition		Lump Sum		$70,000.00
New Bridge Structure	61,600	S.F.	70.00	4,312,000.00
Approach Railroad Modifications		Lump Sum		50,000.00
			Subtotal	**$4,432,000.00**
Benefit Street Bridge Floodproofing				
Demolition		Lump Sum		$30,000.00
New Concrete Deck and Parapets	127.27	C.Y.	275.00	35,000.00
New Steel Girders & Tension Con.	242	L.F.	350.00	84,700.00
			Subtotal	**$149,700.00**
Benefit Street - New Elevated Bridge				
Demolition		Lump Sum		$50,000.00
New Bridge Structure	14,740	S.F.	20.00	294,800.00
Approach Roadway Modifications		Lump Sum		50,000.00
			Subtotal	**$394,800.00**
Gentilly Blvd. - New Elevated Bridge				
Demolition		Lump Sum		$70,000.00
New Bridge Structure	47,300	S.F.	20.00	946,000.00
Approach Roadway Modification		Lump Sum		200,000.00
			Subtotal	**$1,216,000.00**

TABLE 5-4 (continued)

COST ESTIMATE FOR ALTERNATE BRIDGE MODIFICATIONS

Description of Work	Quantity	Unit	Unit Cost	Total Cost
Mirabeau Ave. Bridge - Floodgates				
Storage Monolith	2	Each	7,500.00	$15,000.00
Gate Monolith	2	Each	18,000.00	36,000.00
Steel Roller Gate (75' opening)	2	Each	45,000.00	90,000.00
			Subtotal	**$141,000.00**
Mirabeau Ave. Bridge - New Elevated Bridge				
Demolition		Lump Sum		$60,000.00
New Bridge Structure	49,280	S.F.	20.00	985,600.00
Approach Roadway Modifications		Lump Sum		50,000.00
			Subtotal	**$1,095,600.00**
Filmore Ave. Bridge - Floodgates				
Storage Monolith	2	Each	4,900.00	$9,800.00
Gate Monolith	2	Each	9,100.00	18,200.00
Steel Roller Gate (42' opening)	2	Each	26,000.00	52,000.00
			Subtotal	**$80,000.00**
Filmore Ave. Bridge New Elevated Bridge				
Demolition		Lump Sum		$50,000.00
New Bridge Structure	20,900	S.F.	20.00	418,000.00
Approach Roadway Modifications		Lump Sum		50,000.00
			Subtotal	**$518,000.00**

TABLE 5-4 (continued)

COST ESTIMATE FOR ALTERNATE BRIDGE MODIFICATIONS

Description of Work	Quantity	Unit	Unit Cost	Total Cost
Robert E. Lee Blvd. - New Elevated Bridge				
Demolition		Lump Sum		$50,000.00
New Bridge Structure	19,415	S.F.	20.00	388,300.00
Approach Roadway Modification		Lump Sum		50,000.00
			Subtotal	**$488,300.00**
Leon C. Simon Blvd. - Floodgates				
Storage Monolith	2	Each	7,500.00	$15,000.00
Gate Monolith	2	Each	18,000.00	36,000.00
Steel Roller Gate (75' opening)	2	Each	45,000.00	90,000.00
			Subtotal	**$141,000.00**
Leon C. Simon Blvd. - New Elevated Bridge				
Demolition		Lump Sum		$90,000.00
New Bridge Structure	49,700	S.F.	20.00	994,000.00
Approach Roadway Modification		Lump Sum		50,000.00
			Subtotal	**$1,134,000.00**

TABLE 5-5

COST ESTIMATE FOR RECOMMENDED PLAN FOR FUTURE PERMANENT FLOODWALLS AND LEVEES PHASE III

Description of Work	Quantity	Unit	Unit Cost	Total Cost
Reach I - Concrete Cap				
Demolition		Lump Sum		$84,000.00
Concrete Cap over I-wall	2542.86	C.Y.	350.00	890,000.00
Regrade and Seed Levee		Lump Sum		42,000.00
			Subtotal	**$1,016,000.00**
Reach II - Concrete Cap				
Demolition		Lump Sum		$64,000.00
Concrete Cap over I-wall	2114.29	C.Y.	350.00	740,000.00
Regrade and Seed Levee		Lump Sum		32,000.00
			Subtotal	**$836,000.00**
Reach III - Concrete Cap				
Demolition		Lump Sum		$332,000.00
Concrete Cap over I-wall	11631.43	C.Y.	350.00	4,071,000.00
Regrade and Seed Levee		Lump Sum		166,000.00
			Subtotal	**$4,569,000.00**
Reach IV - Concrete Cap				
Demolition		Lump Sum		$13,600.00
Concrete Cap over I-wall	474.29	C.Y.	350.00	166,000.00
Regrade and Seed Levee		Lump Sum		7,000.00
			Subtotal	**$186,600.00**

TABLE 5-5 (continued)

COST ESTIMATE FOR RECOMMENDED PLAN FOR FUTURE PERMANENT FLOODWALLS AND LEVEES PHASE III

Description of Work	Quantity	Unit	Unit Cost	Total Cost
Reach V - Concrete Cap				
Demolition		Lump Sum		$58,000.00
Concrete Cap over I-wall	1134.29	C.Y.	350.00	397,000.00
Regrade and Seed Levee		Lump Sum		28,600.00
			Subtotal	**$483,600.00**

Summary of Estimated Construction Costs
Recommended Plan - Future Permanent Floodwalls and Levees - Phase III

Reach I	$1,016,000.00
Reach II	$ 836,000.00
Reach III	$4,569,000.00
Reach IV	$ 186,600.00
Reach V	$ 483,600.00

Estimated Construction Cost (E.C.C.)	$7,091,200.00
Contingencies (15% ±)	1,063,800.00
Design Fees (5.75%)	468,900.00
Construction Cost (C.C.)	**$8,623,900.00**
Testing Laboratory	$75,000.00
Resident Inspection (1.4%)	114,100.00
Project Cost (P.C.) - Phase III	**$8,813,000.00**

London Avenue Canal Floodwalls and Levees

General Design Memorandum

APPENDIX A
PLAN-PROFILE PLATES

APPENDIX A
PLAN-PROFILE PLATES

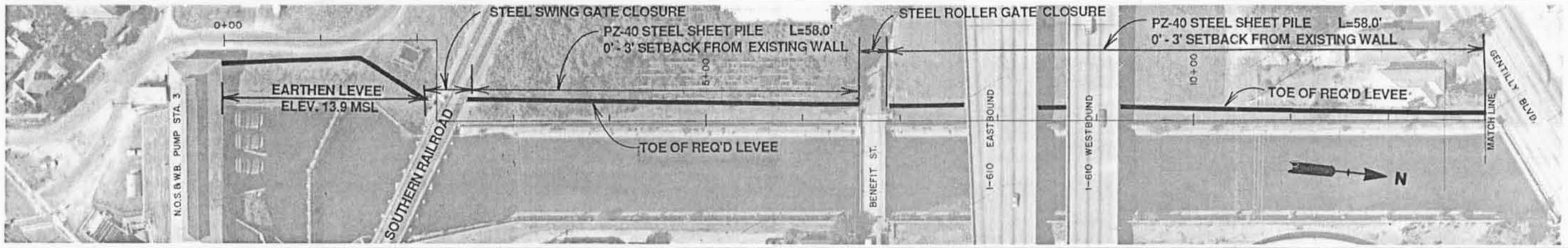
INDEX

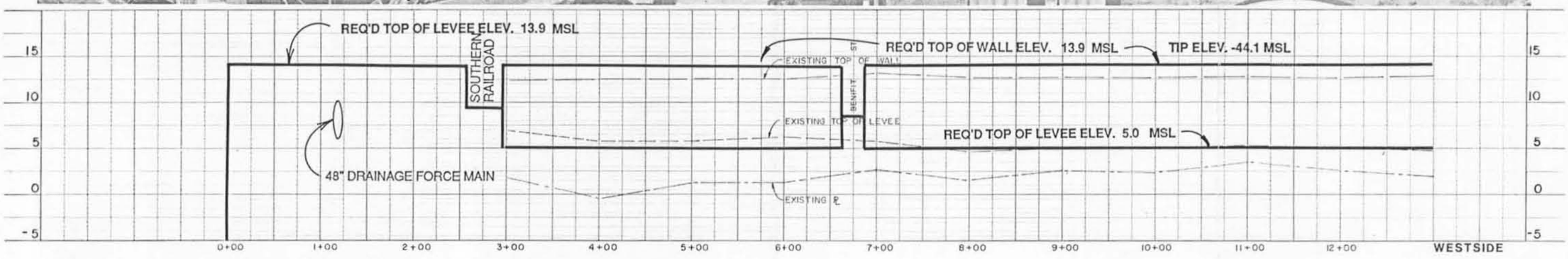
WESTSIDE

Plates A-1 through A-7

EASTSIDE

Plates A-8 through A-13





LONDON AVENUE CANAL FLOODWALLS AND LEVEES

GENERAL DESIGN MEMORANDUM

ORLEANS LEVEE BOARD CONTRACT NO. 2049-0269

BOARD OF COMMISSIONERS
ORLEANS LEVEE BOARD

JOB NO. 8407

PLATE NO. A-1

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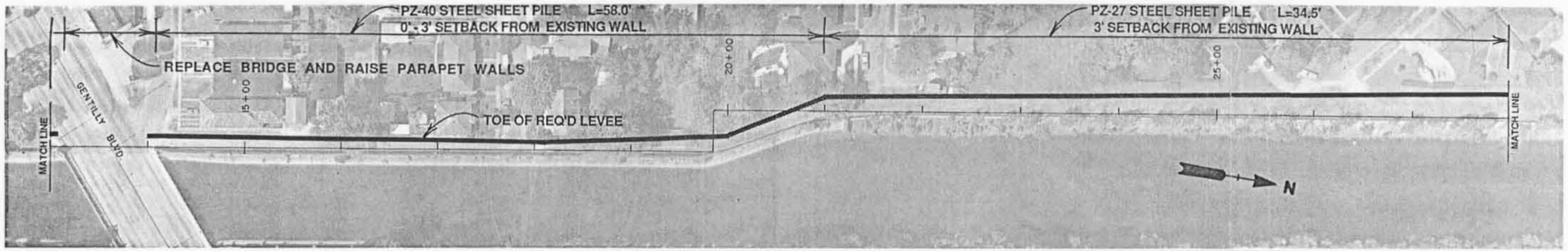

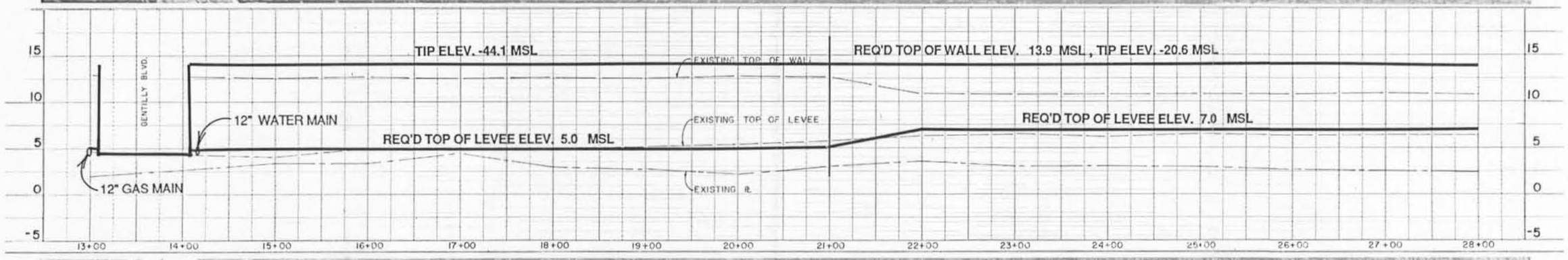

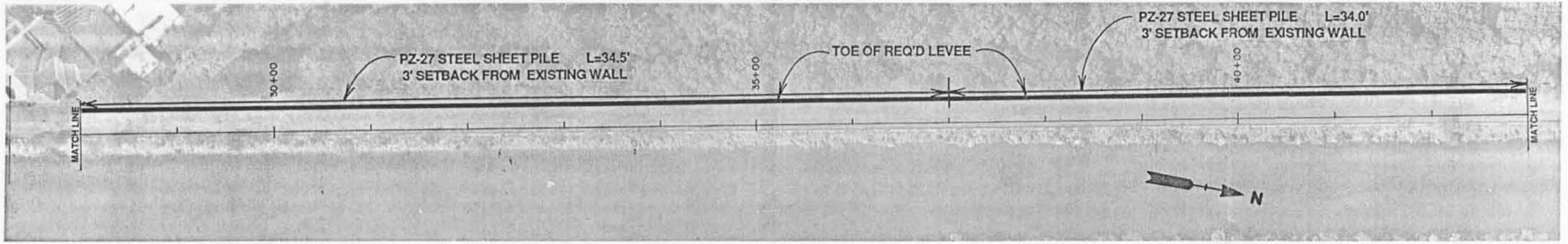

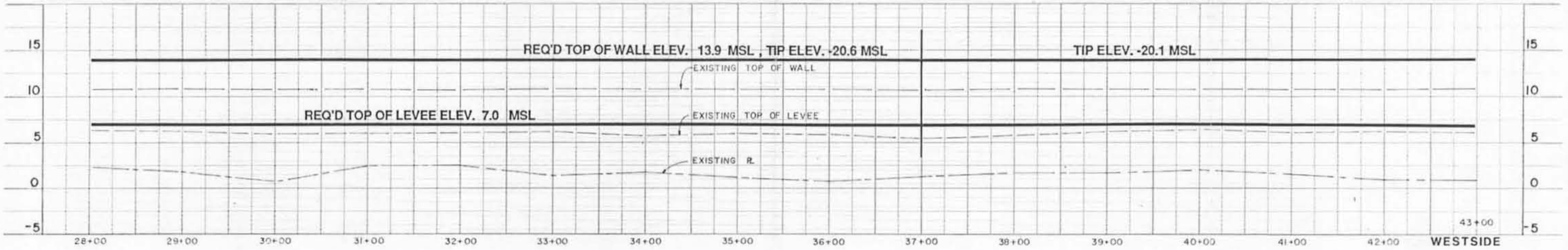

LONDON AVENUE CANAL FLOODWALLS AND LEVEES

GENERAL DESIGN MEMORANDUM

ORLEANS LEVEE BOARD CONTRACT NO. 2049-0269

BOARD OF COMMISSIONERS
ORLEANS LEVEE BOARD

JOB NO. 8407

PLATE NO. A-2

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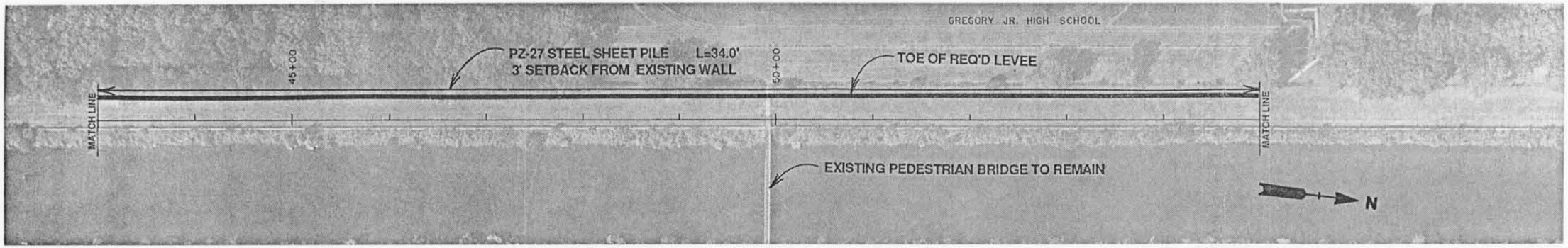

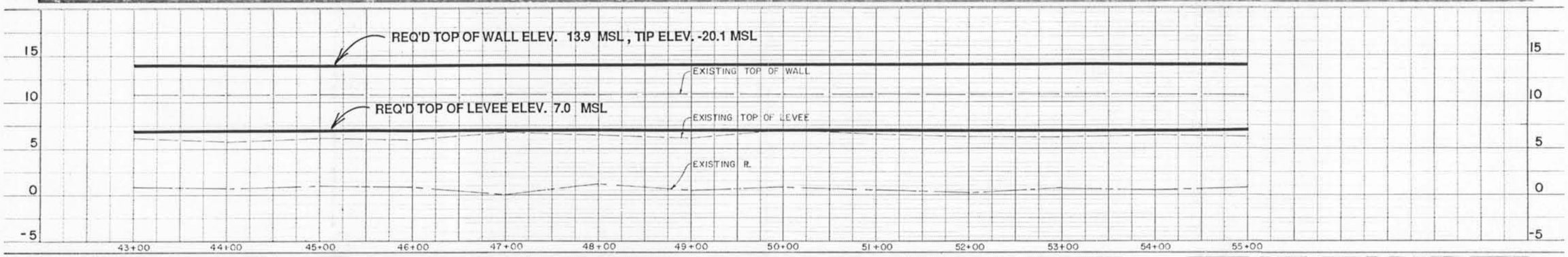

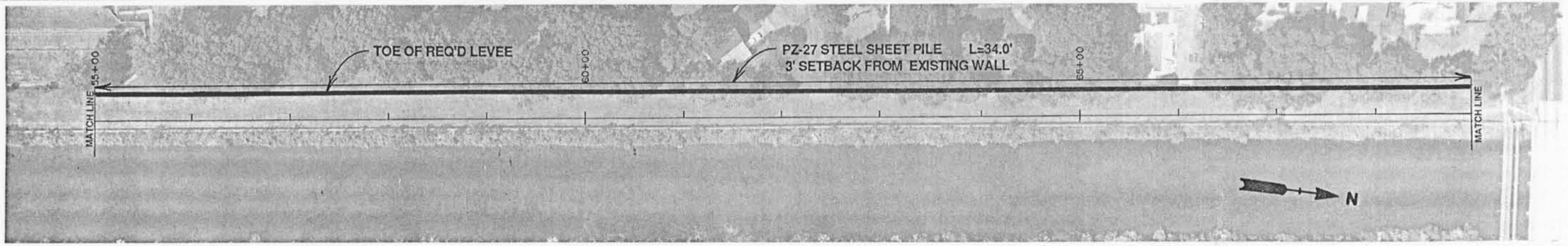

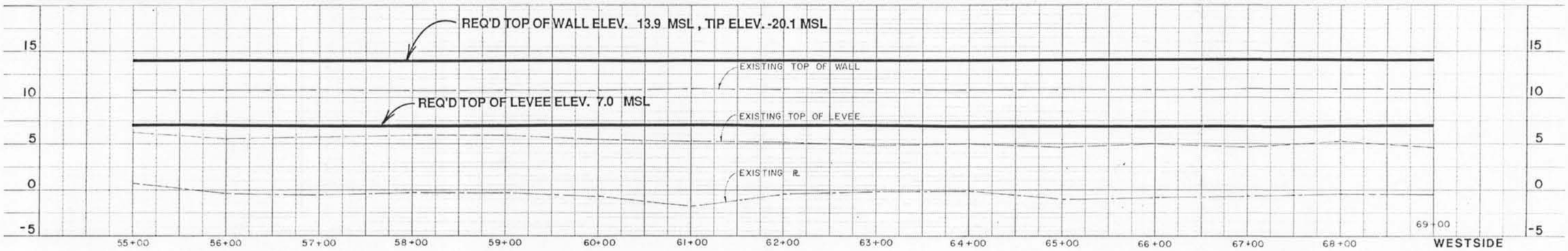

LONDON AVENUE CANAL FLOODWALLS AND LEVEES

GENERAL DESIGN MEMORANDUM

ORLEANS LEVEE BOARD CONTRACT NO. 2049-0269

BOARD OF COMMISSIONERS
ORLEANS LEVEE BOARD

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PLATE NO. A-3

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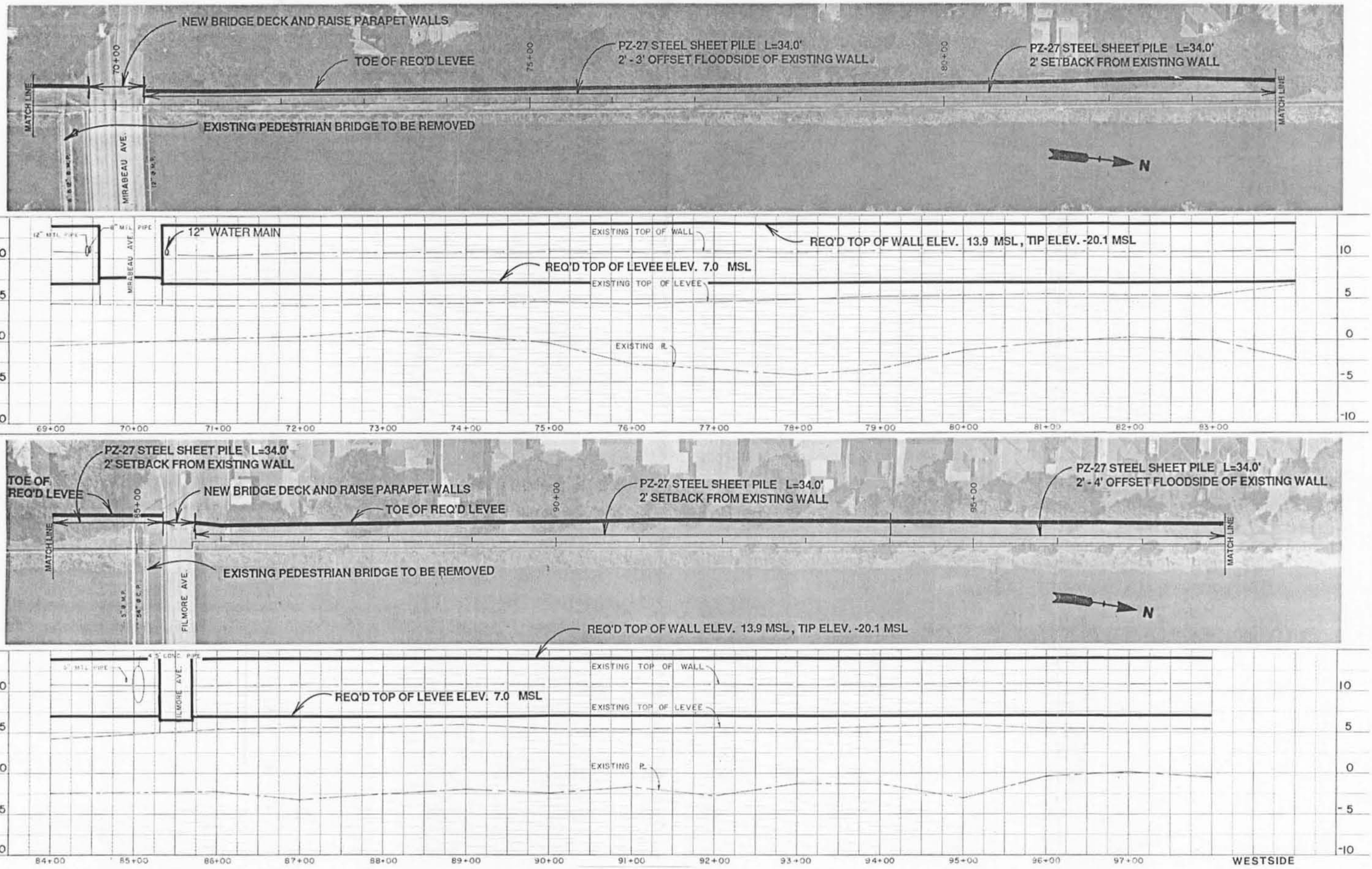

LONDON AVENUE CANAL FLOODWALLS AND LEVEES

GENERAL DESIGN MEMORANDUM

ORLEANS LEVEE BOARD CONTRACT NO. 2049-0269

BOARD OF COMMISSIONERS
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PLATE NO. A-4

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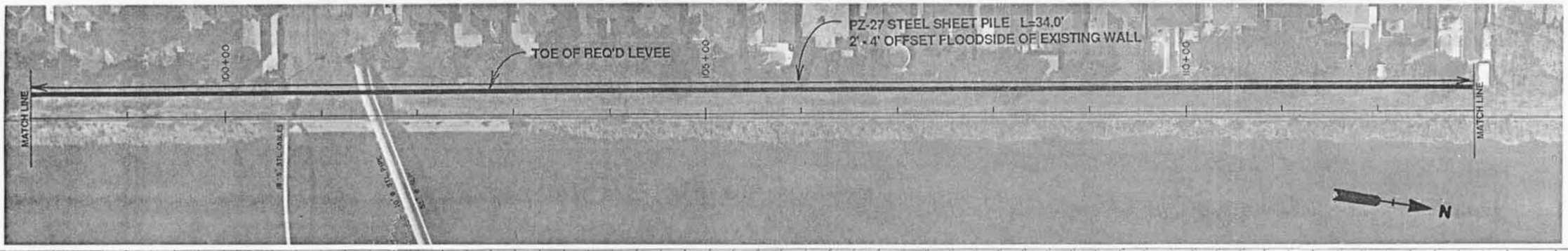

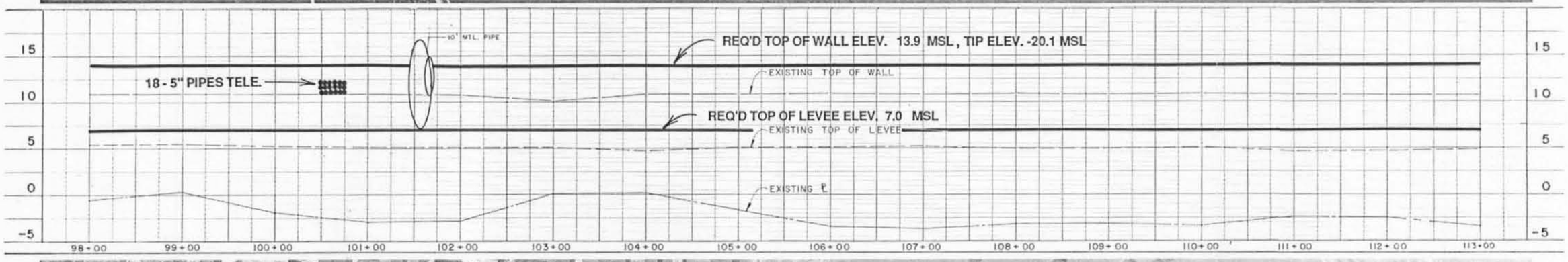

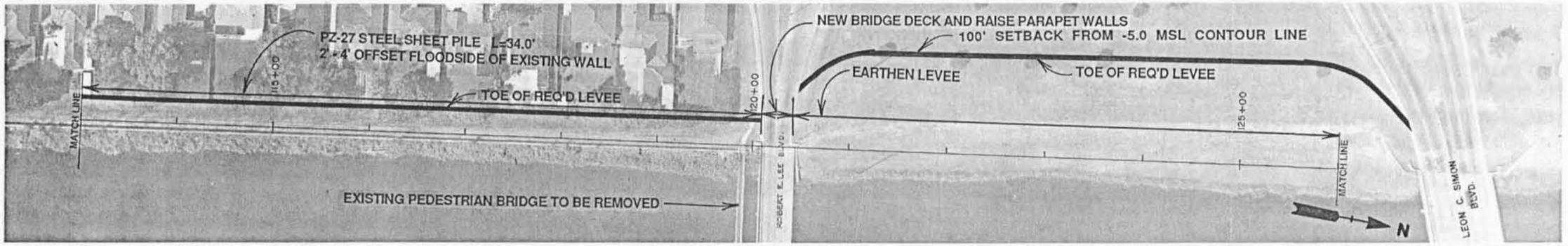

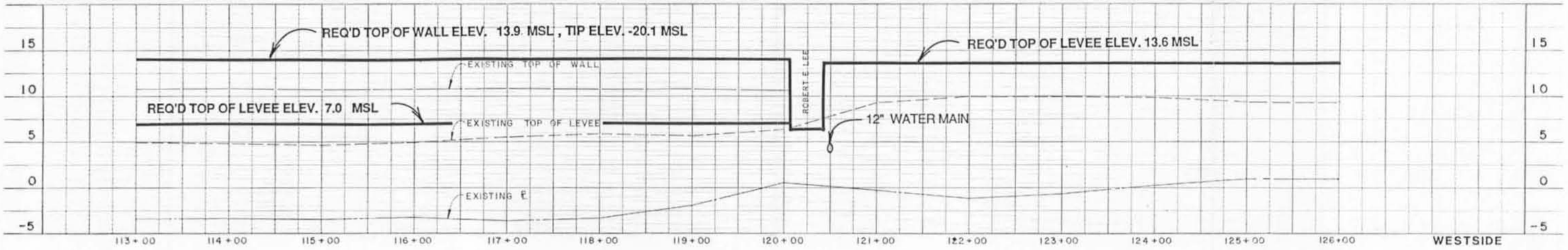

LONDON AVENUE CANAL FLOODWALLS AND LEVEES

GENERAL DESIGN MEMORANDUM

ORLEANS LEVEE BOARD CONTRACT NO. 2049-0269

BOARD OF COMMISSIONERS
ORLEANS LEVEE BOARD

JOB NO. 8407

PLATE NO. A-5

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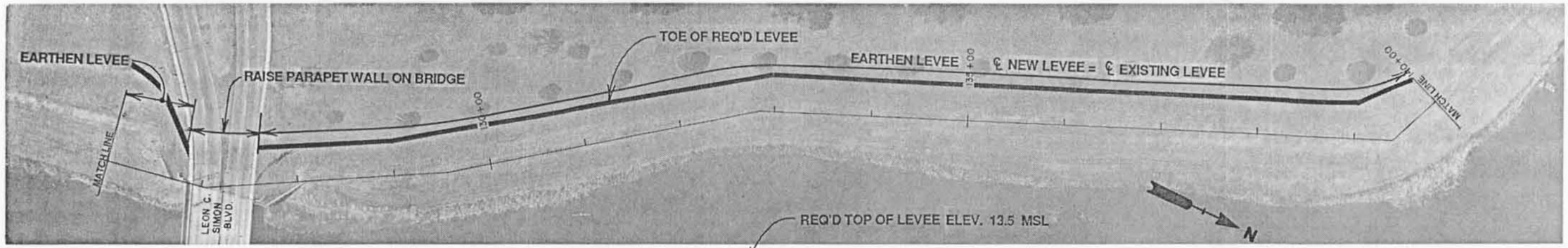

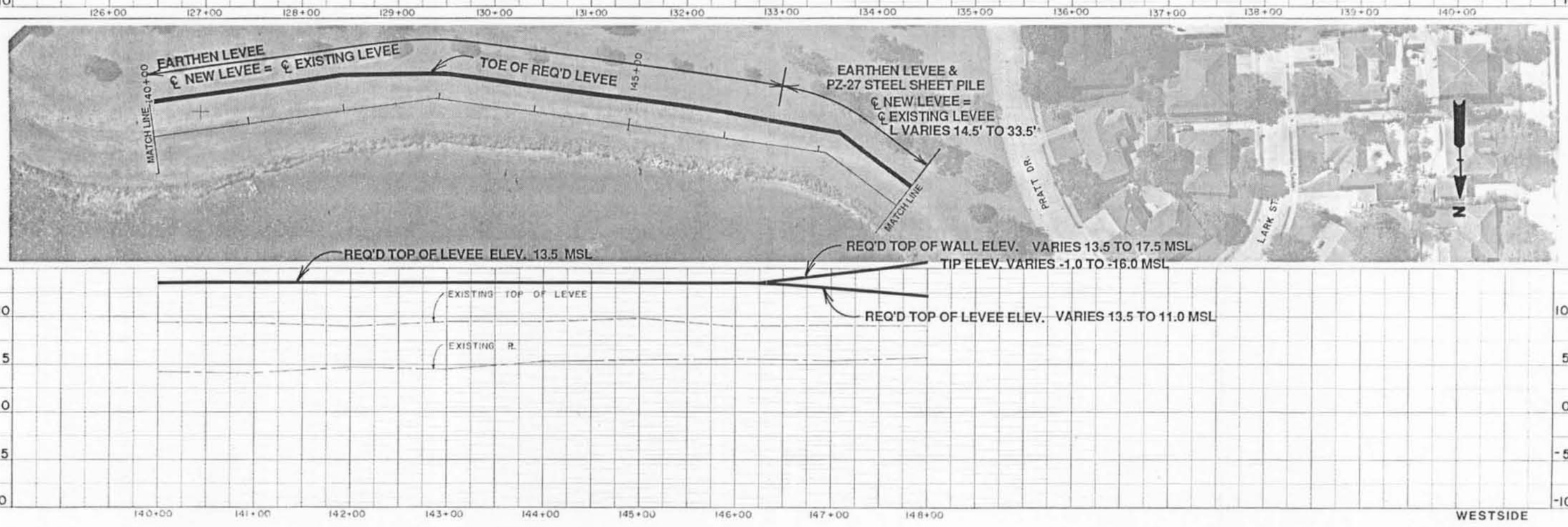

LONDON AVENUE CANAL FLOODWALLS AND LEVEES

GENERAL DESIGN MEMORANDUM

ORLEANS LEVEE BOARD CONTRACT NO. 2049-0269

BOARD OF COMMISSIONERS
ORLEANS LEVEE BOARD

JOB NO. 8407

PLATE NO. A-6

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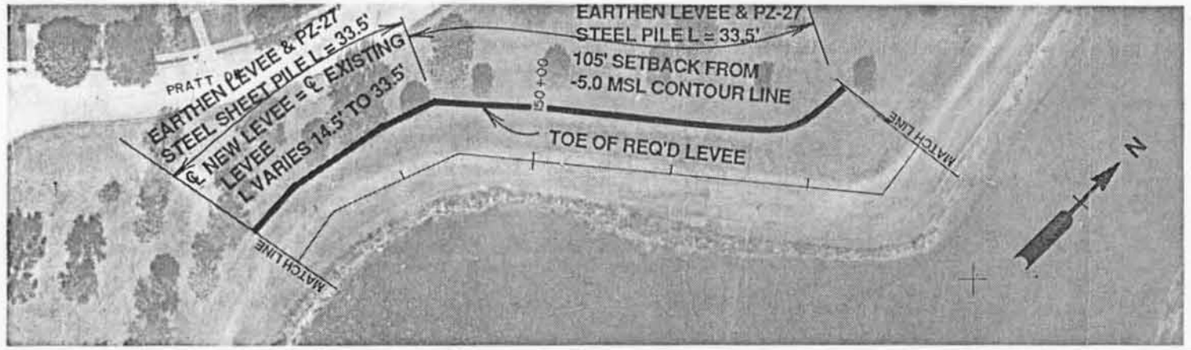

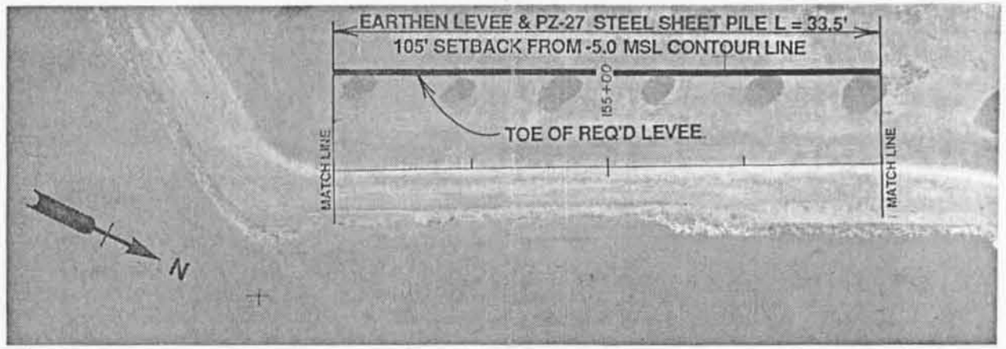

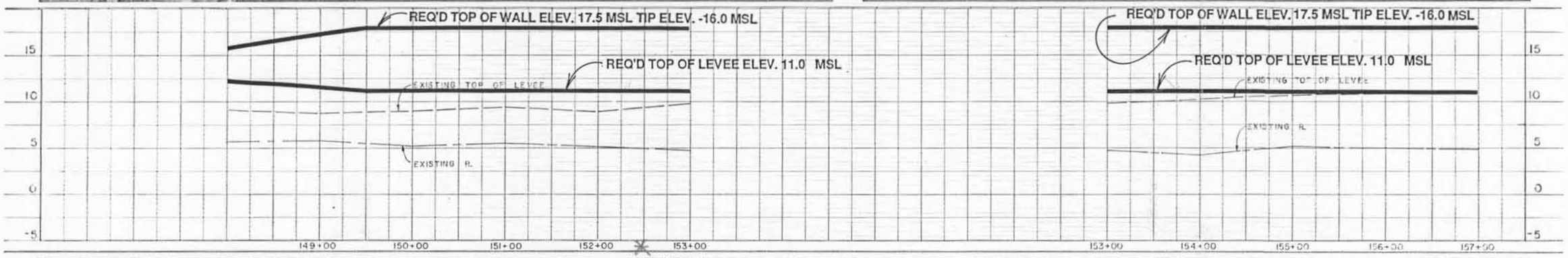

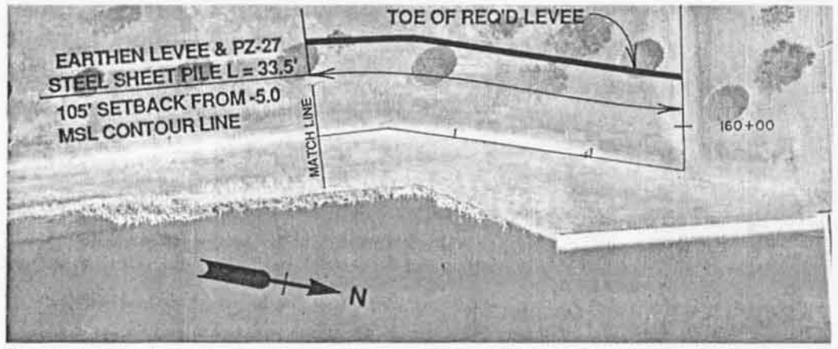

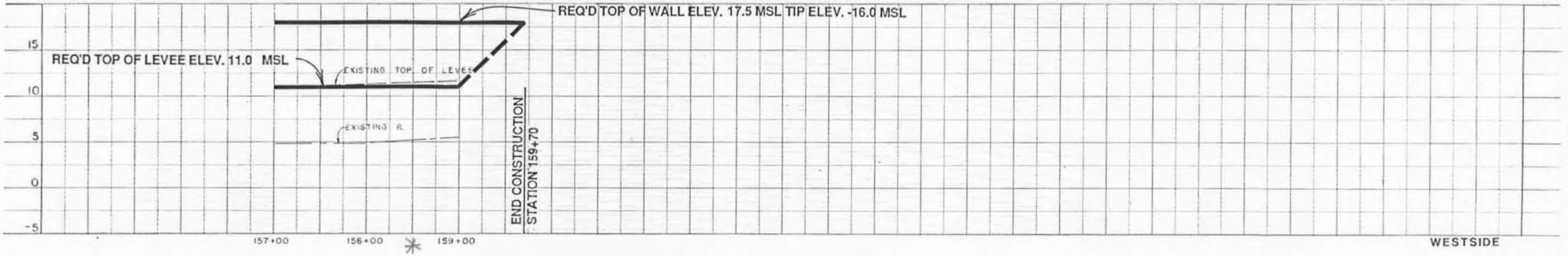

LONDON AVENUE CANAL FLOODWALLS AND LEVEES

GENERAL DESIGN MEMORANDUM

ORLEANS LEVEE BOARD CONTRACT NO. 2049-0269

BOARD OF COMMISSIONERS
ORLEANS LEVEE BOARD

JOB NO. 8407

PLATE NO. A - 7

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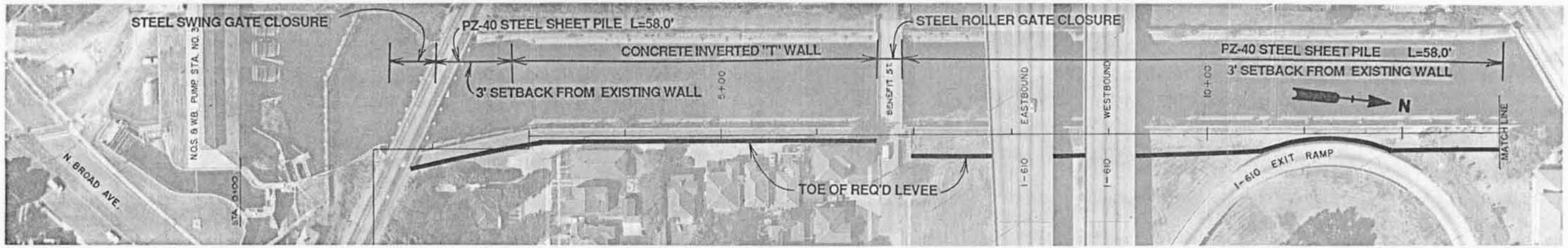

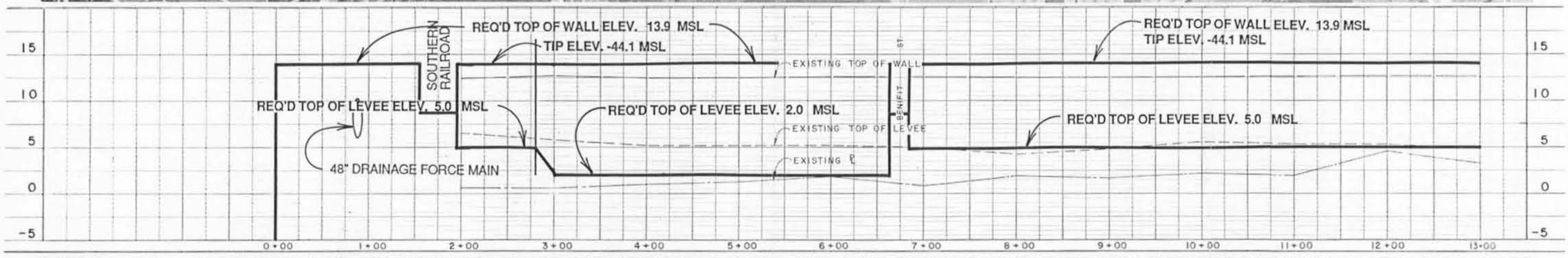

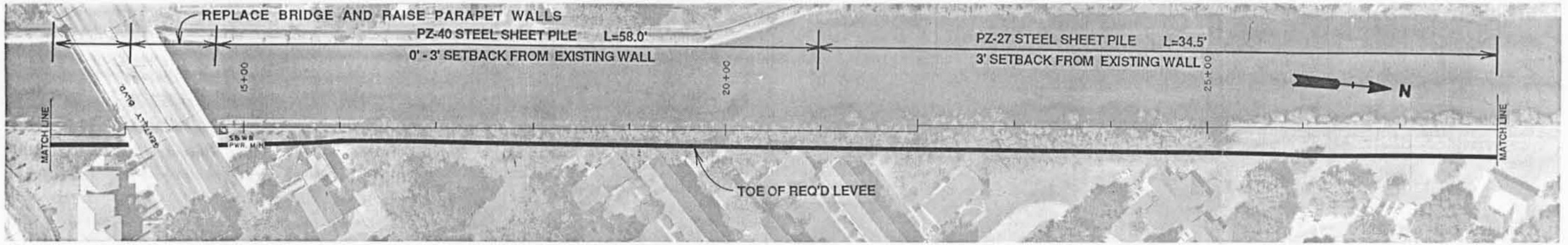

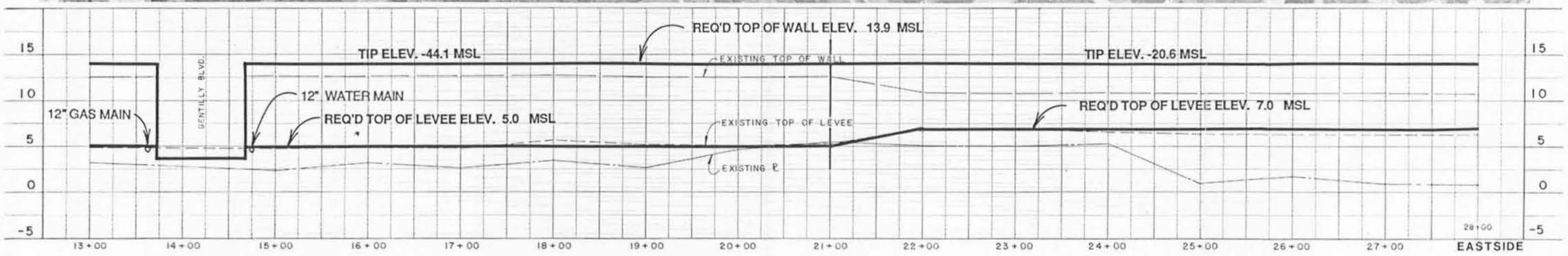

LONDON AVENUE CANAL FLOODWALLS AND LEVEES

GENERAL DESIGN MEMORANDUM

ORLEANS LEVEE BOARD CONTRACT NO. 2049-0269

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JOB NO. 8407

PLATE NO. A-8

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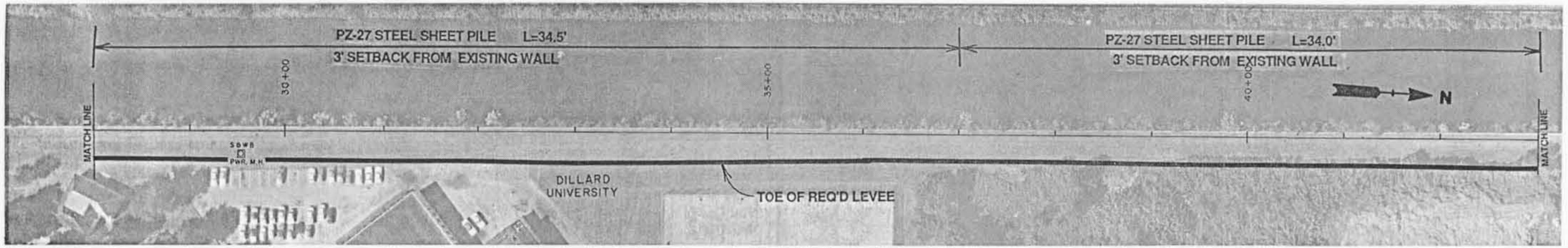

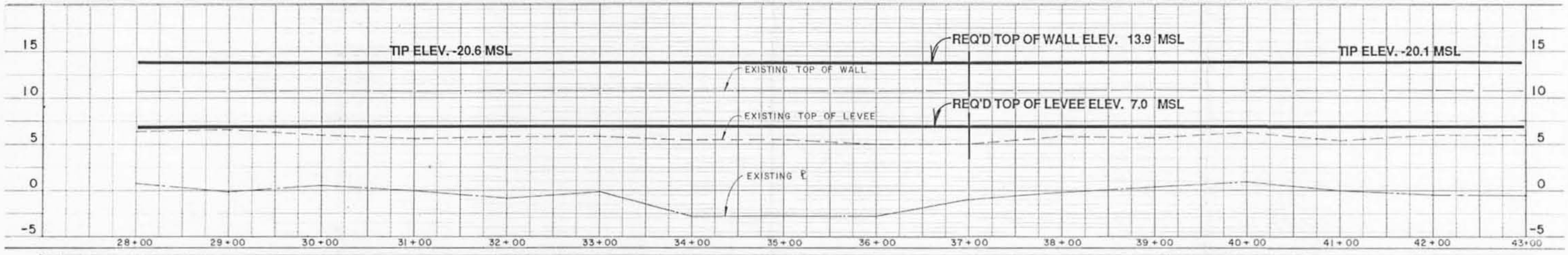

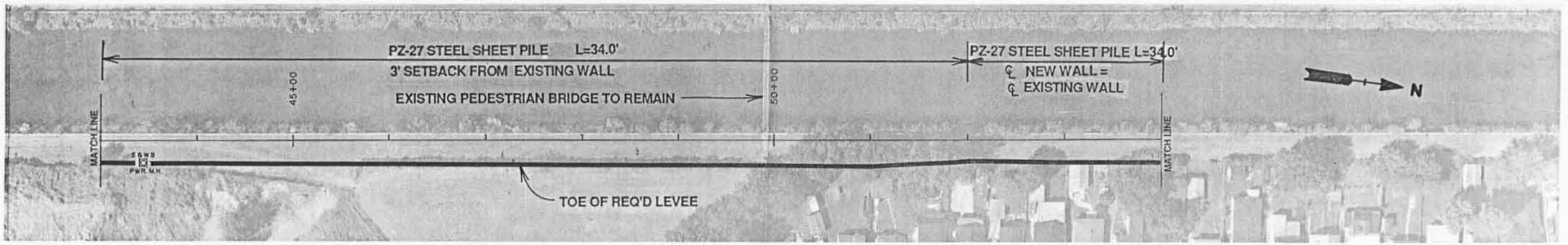

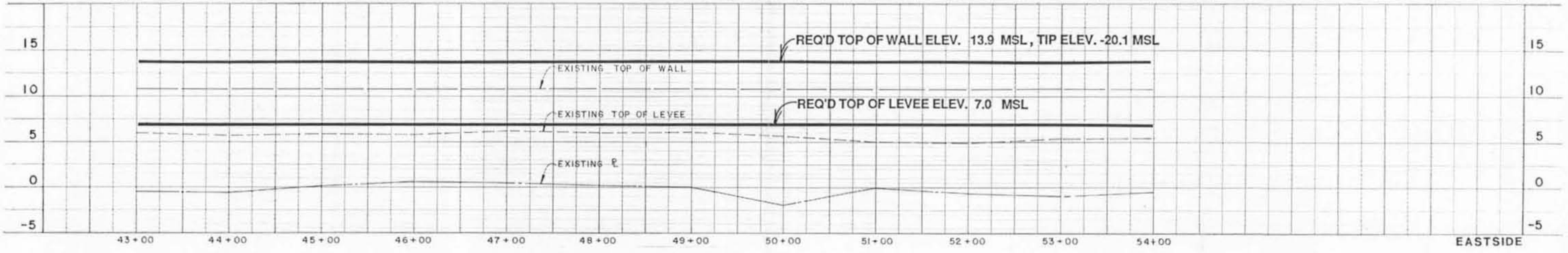

LONDON AVENUE CANAL FLOODWALLS AND LEVEES

GENERAL DESIGN MEMORANDUM

ORLEANS LEVEE BOARD CONTRACT NO. 2049-0269

BOARD OF COMMISSIONERS
ORLEANS LEVEE BOARD

JOB NO. 8407

PLATE NO. A-9

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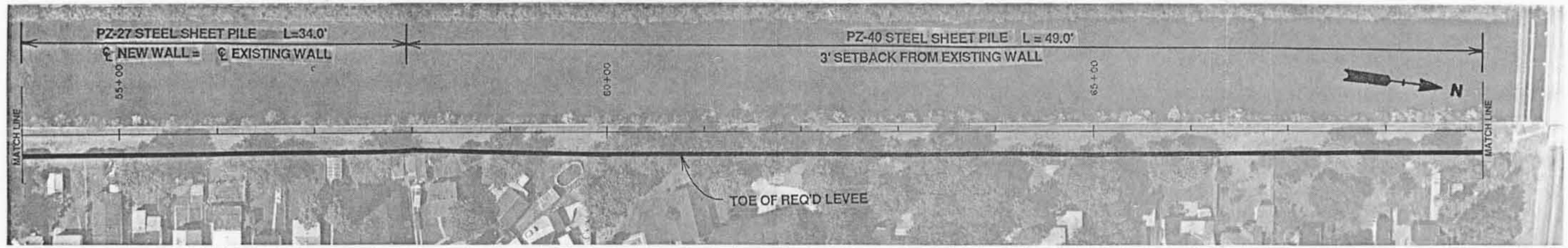

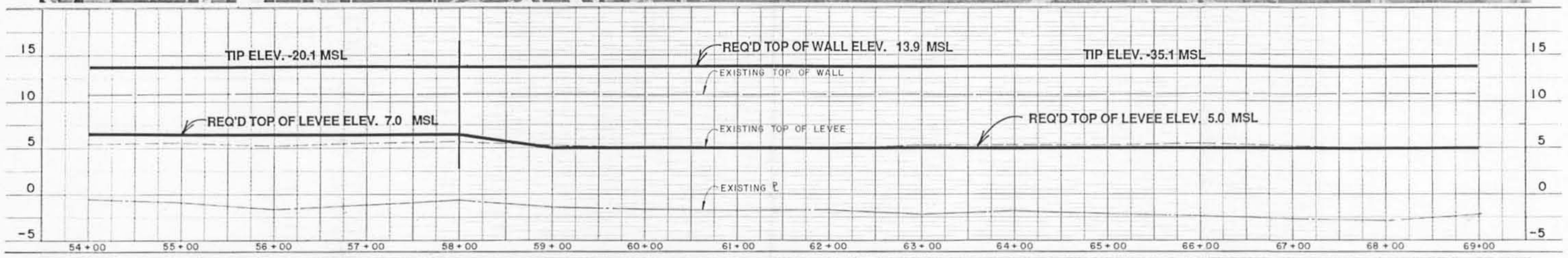

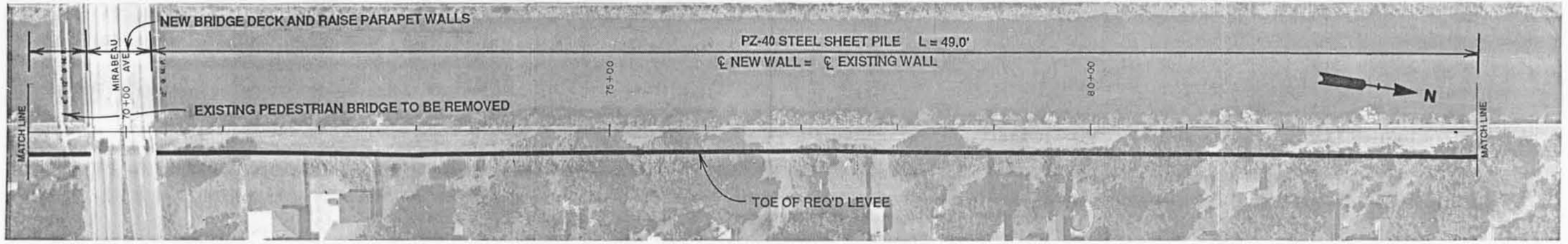

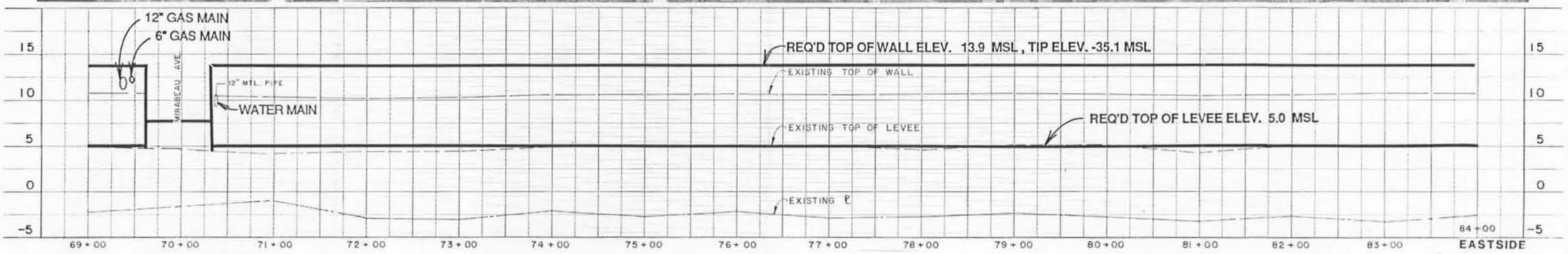

LONDON AVENUE CANAL FLOODWALLS AND LEVEES

GENERAL DESIGN MEMORANDUM

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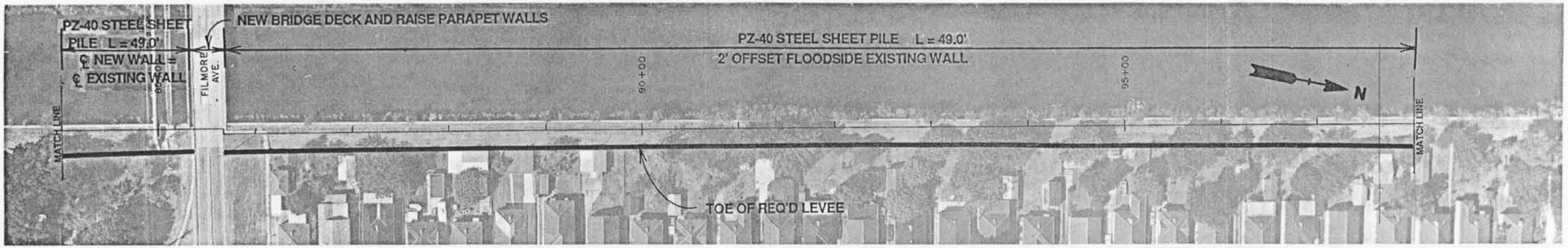

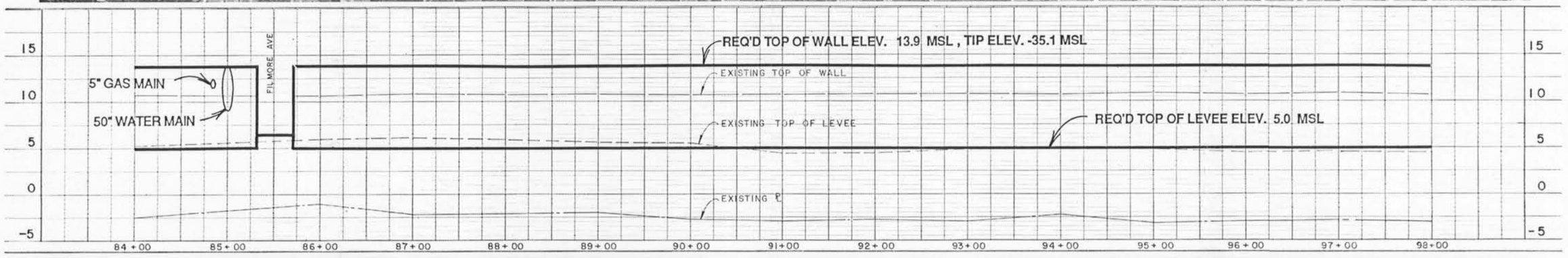

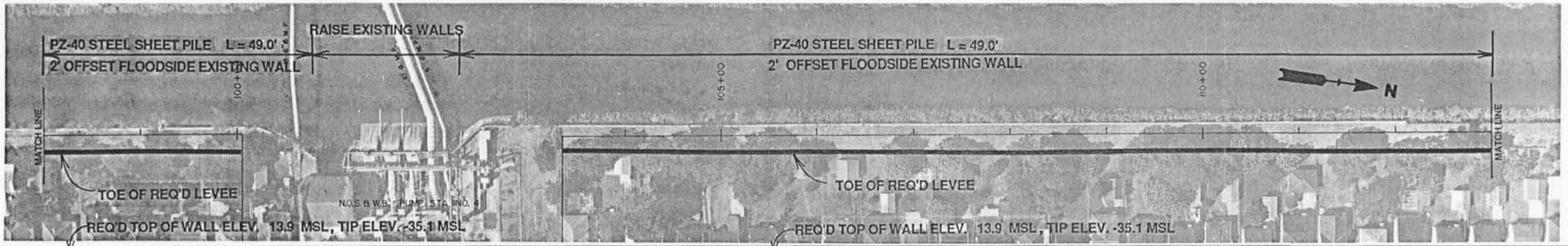

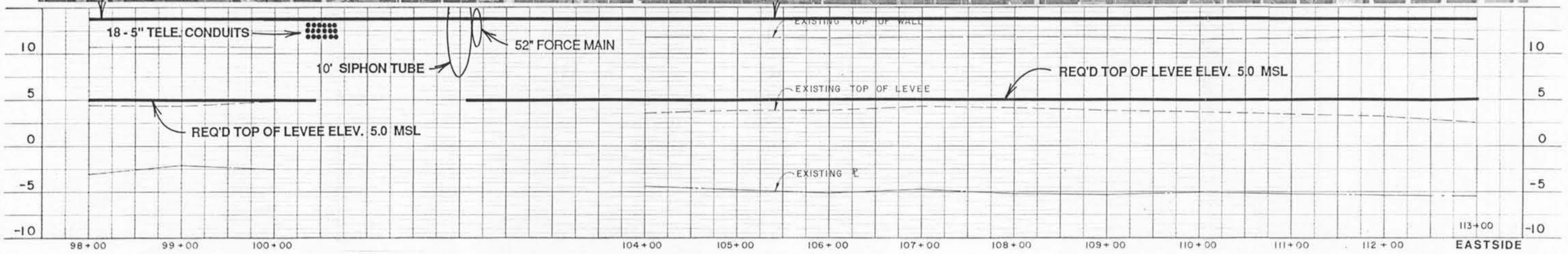

LONDON AVENUE CANAL FLOODWALLS AND LEVEES

GENERAL DESIGN MEMORANDUM

ORLEANS LEVEE BOARD CONTRACT NO. 2049-0269

BOARD OF COMMISSIONERS
ORLEANS LEVEE BOARD

JOB NO. 8407

PLATE NO. A-11

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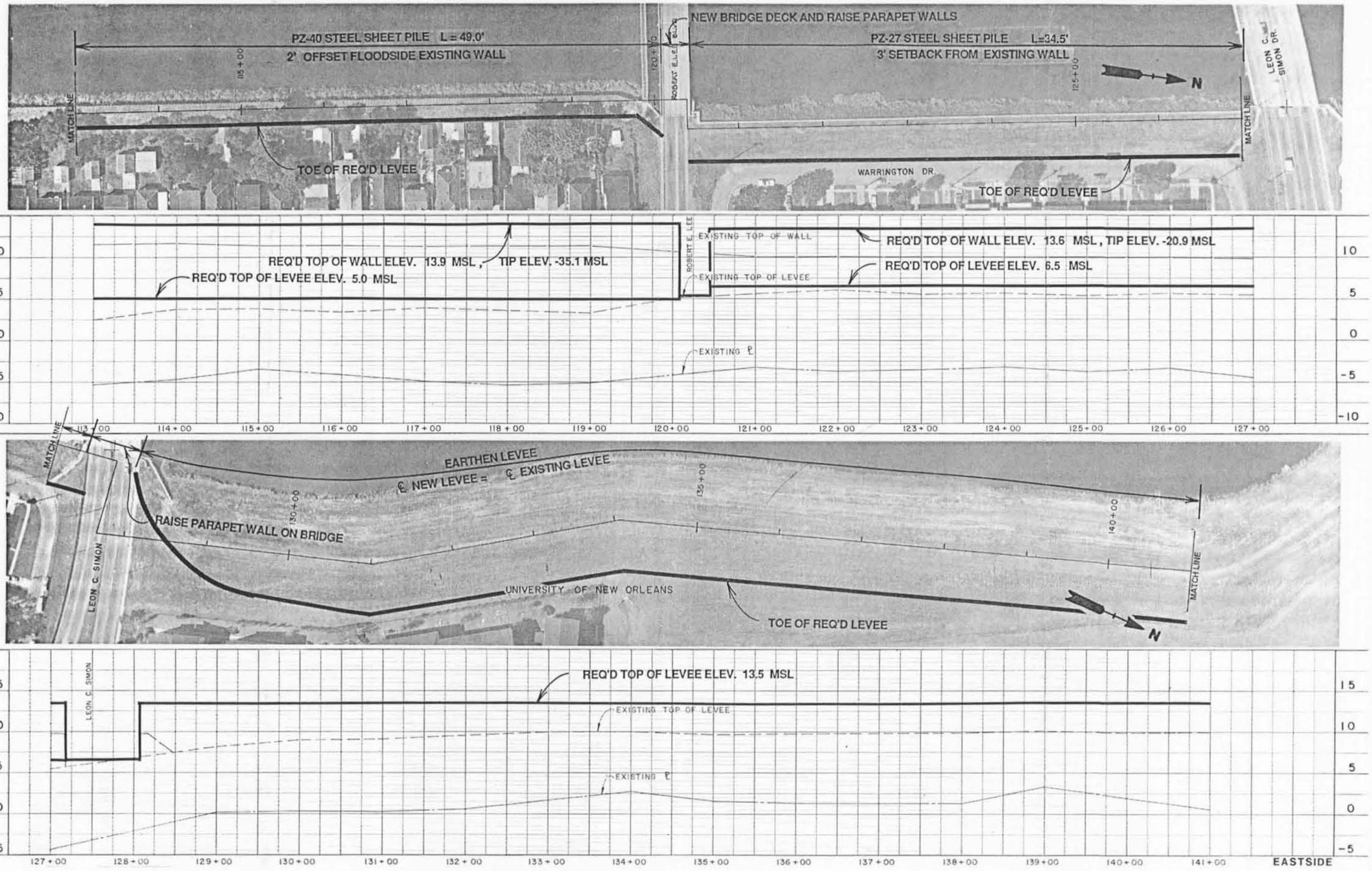

LONDON AVENUE CANAL FLOODWALLS AND LEVEES

GENERAL DESIGN MEMORANDUM

ORLEANS LEVEE BOARD CONTRACT NO. 2049-0269

BOARD OF COMMISSIONERS
ORLEANS LEVEE BOARD

JOB NO. 8407

PLATE NO. A-12

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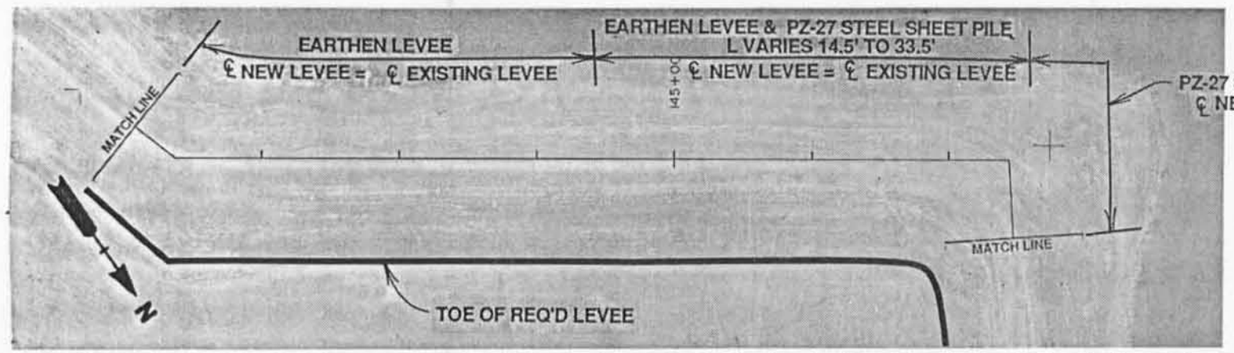

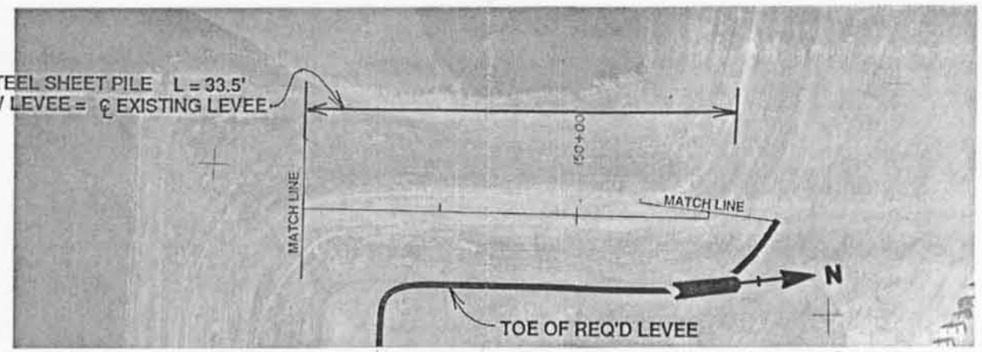

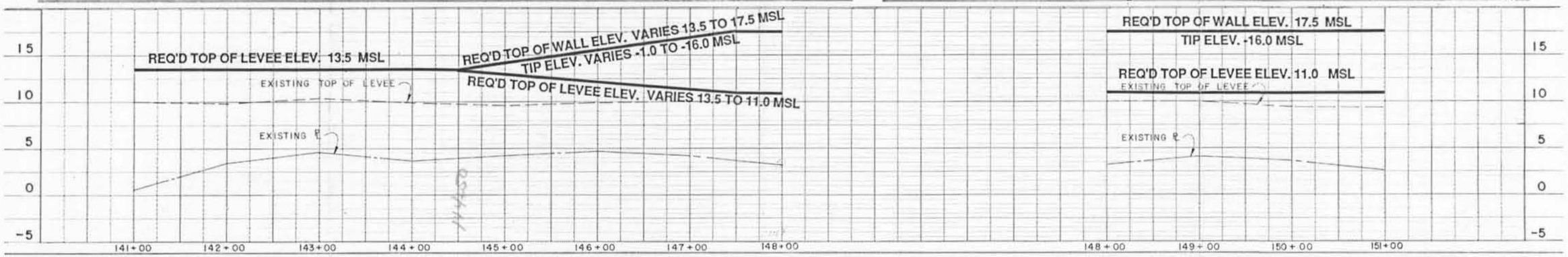

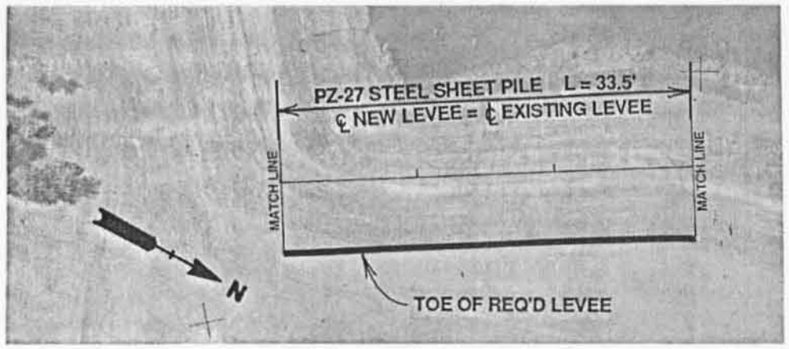

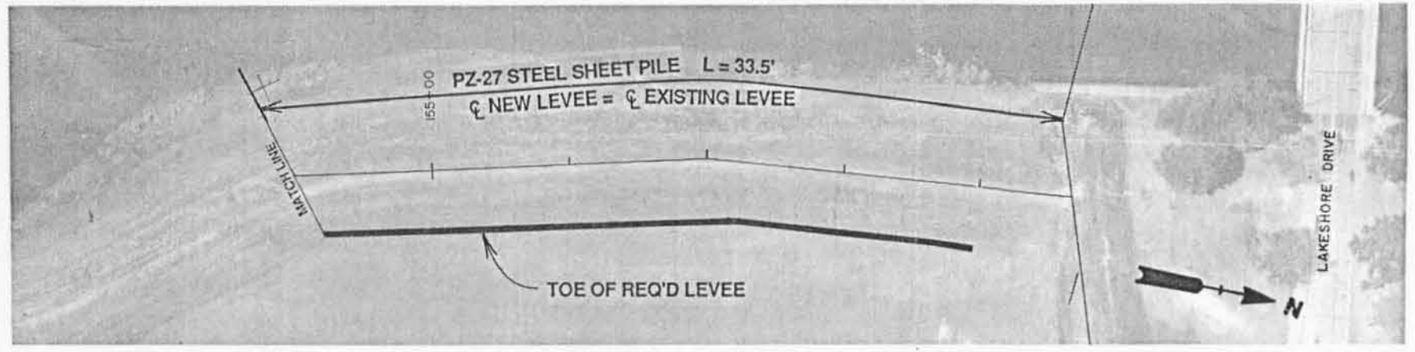

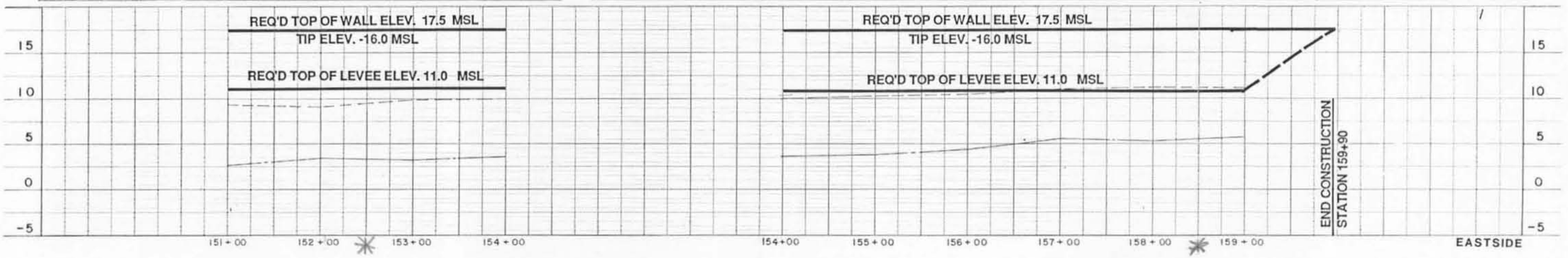

LONDON AVENUE CANAL FLOODWALLS AND LEVEES

GENERAL DESIGN MEMORANDUM

ORLEANS LEVEE BOARD CONTRACT NO. 2049-0269

BOARD OF COMMISSIONERS
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JOB NO. 8407

PLATE NO. A-13

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London Avenue Canal Floodwalls and Levees

General Design Memorandum

APPENDIX B
HYDRAULIC STUDY

London Avenue Canal Floodwalls and Levees

General Design Memorandum

APPENDIX B
HYDRAULIC STUDY

prepared for the

Board of Levee Commissioners
of the Orleans Levee District
Orleans Levee Board Contract No. 2049-0269

by

Burk & Associates, Inc.
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April 1986

APPENDIX B
HYDRAULIC STUDY

Title	Page Number
Introduction	B-2
Hydraulic Computer Model	B-3
Pumping Capacities	B-5
Computer Runs	B-6
Modification No. 1	B-12
Modification No. 2	B-13
Modification No. 3	B-15
Modification No. 4	B-15
Modification No. 5	B-17
Recommendation	B-18

APPENDIX B
HYDRAULIC STUDY

INTRODUCTION

A hydraulic analysis was performed for the London Avenue Outfall Canal to determine the required floodwall height for hurricane protection. The hydraulic gradient in the canal between Lake Pontchartrain and Sewerage & Water Board Drainage Pumping Station No. 3 was calculated for various lake water surface elevations, pumping capacities, and canal configurations. Still water level in Lake Pontchartrain under hurricane conditions is 11.5 msl as established by the New Orleans District Corps of Engineers. The proposed floodwalls along London Avenue Canal need to to be raised to protect the city from flooding during this hurricane condition, as well as the additional backwater build-up created by running the pumps at Sewerage & Water Board Drainage Pump Stations No. 3 and No. 4. The results of this hydraulic analysis, as well as justification for the recommended floodwall height are summarized in this report.

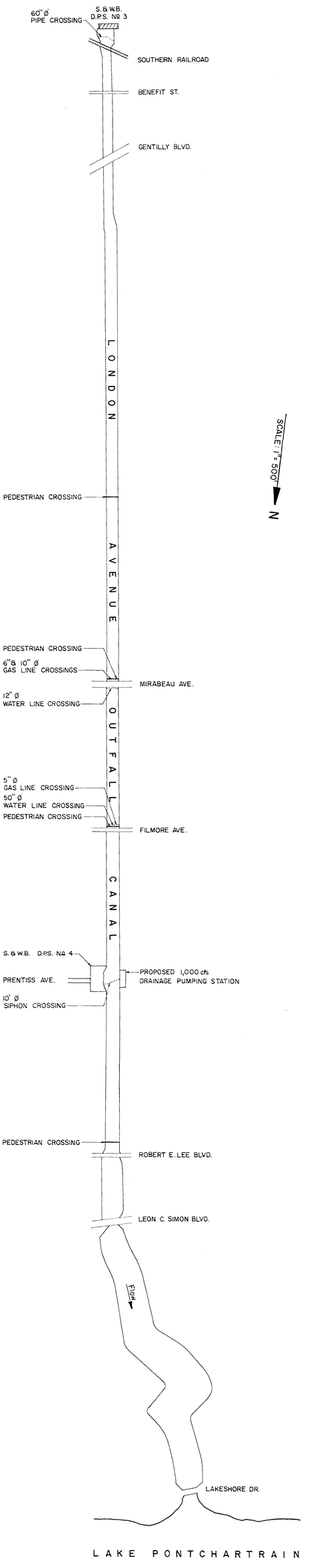
APPENDIX B
HYDRAULIC STUDY

HYDRAULIC COMPUTER MODEL

Calculations were performed on an IBM PC/XT microcomputer using the HEC-2 Water Surface Profiles computer program developed by the U. S. Army Corps of Engineers Hydrologic Engineering Center. The HEC-2 program is capable of computing friction and transition losses along the canal, as well as analyzing the effect of structures crossing the canal. Headloss calculated through bridges account for transition losses and the flow condition or combination of flow conditions - low flow, weir flow, or pressure flow.

The hydraulic computer model consisted of surveyed cross sections for the 3-mile canal stretch, with reach lengths not exceeding 500 feet, and additional data at all structures crossing London Avenue Outfall Canal. A general layout of the canal and structures crossing the canal is shown on Plate B-1. The model was calibrated using Sewerage & Water Board rain load records for the May 3, 1978 rainstorm. The recorded high lake water surface elevations for this storm at the Westend and Seabrook Bridge gauges were obtained from the U. S. Army Corps of Engineers, and the average of these two elevations, 2.9 msl, was used as the starting downstream water surface elevation for the calibration. Canal flows were determined using suction basin and discharge basin water surface elevations from the rain load records and the Sewerage & Water Board pump curves for the existing pumping equipment operating during that storm. The data showed pumping capacities of 3190 cfs and 3500 cfs at D.P.S. Nos. 3 and 4, respectively during the highest recorded discharge basin water surface elevation (W.S.E.) for the May 3, 1978 storm.

The results of the calibration run are summarized on Table B-1 as run CAL. The HEC-2 model gave a W.S.E. of 4.04 msl in the discharge basin of D.P.S. No. 4, which was very close to the actual recorded W.S.E. of 4.1 msl. At D.P.S. No. 3, the calibration run calculated a W.S.E. of 5.65 msl, as compared to an actual recorded elevation near 5.5 msl for this storm.



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HYDRAULIC STUDY OF
LONDON AVENUE OUTFALL CANAL
NEW ORLEANS LOUISIANA

PLATE B-1: GENERAL CANAL LAYOUT

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APPENDIX B
HYDRAULIC STUDY

PUMPING CAPACITIES

The existing nominal capacity for Sewerage & Water Board D.P.S. No. 3 and D.P.S. No. 4 used in these computations was 4300 cfs and 3900 cfs respectively. The pumping equipment at D.P.S. No. 3, excluding constant duty pumps, consists of 3-14 ft. diameter horizontal pumps, each with a nominal capacity of 1100 cfs, and 2-12 ft. diameter horizontal pumps, each with 500 cfs nominal pumping capacity. Pumping capacity at D.P.S. No. 4 consists of 3-1100 cfs horizontal pumps and 2-300 cfs centrifugal pumps. Nominal pumping capacities are based on an approximate 11 ft. pool to pool differential head.

A new 1000 cfs pumping station is proposed to be constructed on London Avenue Outfall Canal opposite D.P.S. No. 4. This new pumping station would increase the existing 8200 cfs nominal pumping capacity to 9200 cfs., as required by the Sewerage & Water Board Master Drainage Plan.

APPENDIX B
HYDRAULIC STUDY

COMPUTER RUNS

Hydraulic gradients for the London Avenue Outfall Canal were computed for various lake and canal conditions. The starting downstream water surface elevation at the lake was either assumed to be high lake level under a hurricane condition at elevation 11.5 msl as required by the Corps of Engineers or normal lake level of 0.0 msl. Five modifications to the canal or bridge crossings were analyzed separately, all in conjunction with raising the floodwalls parallel to the canal:

1. Construct floodwalls parallel to the bridges on either side of the existing structures for flood protection, which will prevent weir flow at all roadway crossings.

2. Construct roller gates in the existing floodwall openings and allow weir flow over all bridges and pipe crossings, except Robert E. Lee Blvd. and Gentilly Blvd., which will have to be kept open to traffic.

3. Reconstruct all roadway bridges above the anticipated high water elevation in the canal, with only the pile foundations interfering with flow in the canal.

4. Reconstruct all roadway bridges and the Sewerage & Water Board siphon crossing at D.P.S. No. 4 above the anticipated high water elevation in the canal. Remove all foot bridges and pipe crossings with the exception of the 60" diameter pipe crossing and the Southern Railroad trestle just north of D.P.S. No. 3.

5. Excavate the London Avenue Outfall Canal north of Robert E. Lee to Lake Pontchartrain, where necessary to maintain a minimum invert elevation of -11 msl in the canal.

The results of calculated water surface profiles for the above modifications and various pumping capacities are summarized in Table B-1. A discussion of these results follows.

TABLE B-1
HYDRAULIC STUDY OF LONDON AVENUE OUTFALL CANAL
RESULTS OF HYDRAULIC ANALYSIS

Computer Run	Special Conditions	Canal Flow (cfs) DPS #3 To DPS #4	Canal Flow (cfs) DPS #4 TO LAKE PONT.	Canal Water Surface Elevation (msl) LAKE PONT.	LEON C. SIMON	PRENTISS AVE(S&WB DPS #4)	MIRABEAU AVE.	GENTILLY BLVD.	S&WB DPS #3
	Existing Canal Configuration								
CAL	Calibration Run for the May 3,1978 Storm	3190	6690	2.9	3.42	4.04	4.50	4.75	5.65
	Modification #1: Floodwalls Built Across Roadway Bridges								
	High Lake Level (11.5 msl)								
1A	Existing Pumping Capacity at High Head	0	2475	11.5	11.5	11.66	11.68	11.68	11.68
1B	Existing Pumping Capacity at High Head and Proposed 1000 cfs P.S.	0	3475	11.5	11.51	11.85	11.85	11.85	11.85

TABLE B-1
HYDRAULIC STUDY OF LONDON AVENUE OUTFALL CANAL
RESULTS OF HYDRAULIC ANALYSIS
(Continued)

Computer Run	Special Conditions	Canal Flow (cfs) DPS #3 To DPS #4	Canal Flow (cfs) DPS #4 TO LAKE PONT.	Canal Water Surface Elevation (msl) LAKE PONT.	LEON C. SIMON	PRENTISS AVE(S&WB DPS #4)	MIRABEAU AVE.	GENTILLY BLVD.	S&WB DPS #3
1C	Existing Nominal Pumping Capacity	4300	8200	11.5	11.58	13.17	13.92	14.42	16.33
1D	Future Nominal Pumping Capacity	4300	9200	11.5	11.60	13.60	14.38	14.88	16.79
1E	Existing Pumping Capacity at Highest Head Condition Before Shut Down	2850	5325	11.5	11.53	12.22	12.56	12.80	13.66
	Normal Lake Level (0.0 msl)								
1F	Existing Nominal Pumping Capacity	4300	8200	0.0	2.16	3.53	4.33	4.80	6.40
1G	Future Nominal Pumping Capacity	4300	9200	0.0	2.49	4.06	5.04	5.42	7.23

TABLE B-1
HYDRAULIC STUDY OF LONDON AVENUE OUTFALL CANAL
RESULTS OF HYDRAULIC ANALYSIS
(Continued)

Computer Run	Special Conditions	Canal Flow (cfs) DPS #3 To DPS #4	Canal Flow (cfs) DPS #4 TO LAKE PONT.	Canal Water Surface Elevation (msl) LAKE PONT.	LEON C. SIMON	PRENTISS AVE(S&WB DPS #4)	MIRABEAU AVE.	GENTILLY BLVD.	S&WB DPS #3
	Modification #2: Install Roller Gates & Allow Flow Over All Roadways Except Gentilly & Robert E. Lee								
2A	High Lake Level - Future Nominal Pumping Capacity	4300	9200	11.5	11.60	13.52	14.15	14.56	16.23
	Modification #3: Raise All Roadways Above W.S.E.								
	High Lake Level - Future Nominal Pumping Capacity	4300	9200	11.5	11.60	12.37	12.88	13.19	13.65

TABLE B-1
HYDRAULIC STUDY OF LONDON AVENUE OUTFALL CANAL
RESULTS OF HYDRAULIC ANALYSIS
(Continued)

Computer Run	Special Conditions	Canal Flow (cfs) DPS #3 To DPS #4	Canal Flow (cfs) DPS #4 TO LAKE PONT.	Canal Water Surface Elevation (msl) LAKE PONT.	LEON C. SIMON	PRENTISS AVE(S&WB DPS #4)	MIRABEAU AVE.	GENTILLY BLVD.	S&WB DPS #3
	Modification #4: Raise All Roadways and Siphon Above W.S.E., And Remove All Foot Bridges And Pipe Crossings Except 60" Diameter Pipe Crossing Just North of D.P.S. No. 3								
4A	High Lake Level - Future Nominal Pumping Capacity	4300	9200	11.5	11.60	11.78	11.99	12.04	12.58

TABLE B-1
HYDRAULIC STUDY OF LONDON AVENUE OUTFALL CANAL
RESULTS OF HYDRAULIC ANALYSIS
(Continued)

Computer Run	Special Conditions	Canal Flow (cfs) DPS #3 To DPS #4	Canal Flow (cfs) DPS #4 TO LAKE PONT.	Canal Water Surface Elevation (msl) LAKE PONT.	LEON C. SIMON	PRENTISS AVE(S&WB DPS #4)	MIRABEAU AVE.	GENTILLY BLVD.	S&WB DPS #3
	Modification #5: Excavate London Avenue Outfall Canal North of Robert E. Lee Blvd.								
5A	Normal Lake Level - Existing Nominal Pumping Capacity	4300	8200	0.0	1.39	3.06	3.96	4.50	6.13

Modification No. 1: Floodwalls Constructed at All Roadway Crossings

Floodwalls would be constructed across the London Avenue Outfall Canal on either side of the roadway crossings extending from the bridge deck to 2 feet above the anticipated high water elevation in the canal. This modification would prevent stormwater from overflowing bridge guardrails and keep roadway crossings open to traffic during hurricane lake conditions.

This canal configuration was analyzed with several lake levels and canal flows, as shown in Table B-1. Computer run 1A calculated the hydraulic profile for the existing pumping capacity at high lake level. Pump curves for existing pumping equipment showed that the 2 centrifugal pumps at D.P.S. No. 4 could not operate at head conditions greater than approximately 16 feet, pool to pool. The 3-1000 cfs horizontal pumps at D.P.S. No. 4 have a total pumping capacity of 2475 cfs at the maximum head differential near 17 feet, pool to pool. Pumping during hurricane lake conditions with the water surface elevation in London Avenue Canal near 12 msl, would require a minimum intake sump elevation of -5 msl to allow the 3-1000 cfs pumps at this station to be operable. Therefore, assuming elevation -5 msl is the maximum allowable intake sump elevation at D.P.S. No. 4 and the discharge basin elevation is near elevation 12 msl, D.P.S. No. 4 would have an existing pumping capacity of 2475 cfs.

Pump curves for the 2-12 ft. diameter pumps at D.P.S. No. 3 showed shut off head level for these pumps to be near 13 feet, pool to pool. The 3-14 ft. diameter pumps at this station can operate up to approximately 16 feet differential head conditions, pool to pool, with a total pumping capacity of 2850 cfs. The hydraulic profile for the London Avenue Outfall Canal with 2475 cfs flow from D.P.S. No. 4 and 2850 cfs flow from D.P.S. No. 3 yielded a water surface elevation at the discharge side of D.P.S. No. 3 of 13.66 msl. (See computer run 1E). Therefore, in order to continue operating the 3-14 ft. diameter pumps at D.P.S. No. 3, the intake sump elevation at D.P.S. No. 3 could be no lower than -2.3 msl, thus flooding much of this pumping station's drainage basin. Consequently, it was assumed that there would be no pumping capacity at D.P.S. No. 3 when lake level is near 11.5 msl, unless the pumping equipment is replaced in the future with equipment capable of pumping against these high heads.

Run 1A, with a total flow in London Avenue Canal of 2475 cfs, exclusively from D.P.S. No. 4, and a starting W.S.E. of 11.5 msl, yielded a high W.S.E. of 11.68 msl at D.P.S. No. 3. Should the existing pumping equipment not be upgraded and the proposed 1000 cfs pumping station opposite D.P.S. No. 4 be constructed, run 1B generated a high W.S.E. of 11.85 msl at D.P.S. No. 3,

with the same conditions as run 1A and a total canal flow of 3475 cfs. The water surface profile for computer run 1B is shown in Plate B-2.

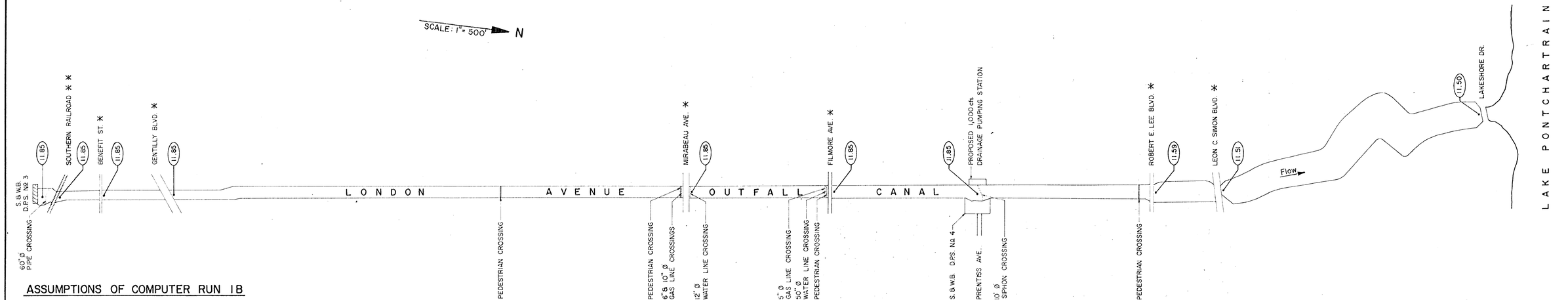
If existing pumping equipment at both D.P.S. No. 3 and D.P.S. No. 4 is improved to pump against high head conditions, lake level is 11.5 msl, and floodwalls are constructed along the canal and across roadway bridges above canal W.S.E., the hydraulic profile would yield an ultimate canal W.S.E. of 16.33 msl at D.P.S. No. 3, for the existing nominal pumping capacity of 8200 cfs, as shown by run 1C. Similarly, for the same conditions as run 1C except with canal flows totaling 9200 cfs to account for the proposed 1000 cfs pumping station at Prentiss, run 1D gave a canal water surface elevation of 16.79 msl at D.P.S. No. 3, analyzing the effects of future nominal pumping capacity.

The London Avenue Outfall Canal was also analyzed at normal lake level of 0 msl with this floodwall modification at the roadway bridges. Computer profile runs 1F and 1G for the existing and future nominal pumping capacity flows and starting W.S.E. of 0 msl, generated upstream water surface elevations of 6.40 msl and 7.23 msl respectively, as shown in Table B-1.

Modification No. 2: Flow Allowed Over All Roadway Bridges Except Robert E. Lee Blvd. And Gentilly Blvd.

In an effort to reduce the amount of head loss at roadway crossing due to the reduction of flow area at roadway bridges with the proposed floodwalls included in Modification No. 1, it was decided to analyze the effect of allowing flow over all structures crossing the canal, except the Robert E. Lee Blvd. and Gentilly Blvd. bridges. Roller gates would be constructed across the Leon C. Simon, Filmore, Mirabeau, Benefit St., and the Southern Railroad bridges, aligned with the canal banks, and stormwater would be allowed to flow over the guardrails of the bridges within the canal. Floodwalls would be constructed across the canal on either side of the Robert E. Lee Blvd. and Gentillty Blvd. bridges, as in Modification No. 1. The floodwalls would prevent stormwater from overflowing bridge guardrails and keep these two roadways open to traffic during hurricane lake conditions.

The hydraulic gradient for this modification was calculated on computer run 2A for the high lake level of 11.5 msl and the full future nominal pumping capacity of 9200 cfs. The water surface elevation at the upstream end, D.P.S. No. 3, was computed to be 15.23 msl, a 0.6 ft. reduction from Modification No. 1.



ASSUMPTIONS OF COMPUTER RUN 1B

(11.85) = CANAL WATER SURFACE ELEVATION M.S.L.

1. FLOODWALLS PARALLEL TO THE LONDON AVENUE OUTFALL CANAL ARE RAISED ABOVE THE CANAL W.S.E.

*2. FLOODWALLS ARE CONSTRUCTED ACROSS THE CANAL ON EITHER SIDE OF THE ROADWAY CROSSINGS, SOUTH OF LAKESHORE DR. TO PREVENT FLOW OVER THE ROADWAYS.

**3. ROLLER GATES ARE CONSTRUCTED ACROSS THE SOUTHERN RAILROAD ALLOWING FLOW OVER THE TRESTLE.

4. THE PROPOSED 1,000 cfs DRAINAGE PUMPING STATION AT PRENTISS AVE. HAS BEEN CONSTRUCTED.

5. DRAINAGE PUMPING STATION NO.3 HAS 0 cfs PUMPING CAPACITY. DRAINAGE PUMPING STATION NO.4 HAS 2475 cfs PUMPING CAPACITY.

6. LAKE WATER SURFACE ELEVATION IS 11.5 M.S.L. (HURRICANE CONDITIONS).

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New Orleans, Louisiana

HYDRAULIC STUDY OF
LONDON AVENUE OUTFALL CANAL
NEW ORLEANS LOUISIANA

PLATE B-2: WATER SURFACE PROFILE FOR COMPUTER RUN 1B

B & A JOB NO. 8407-3

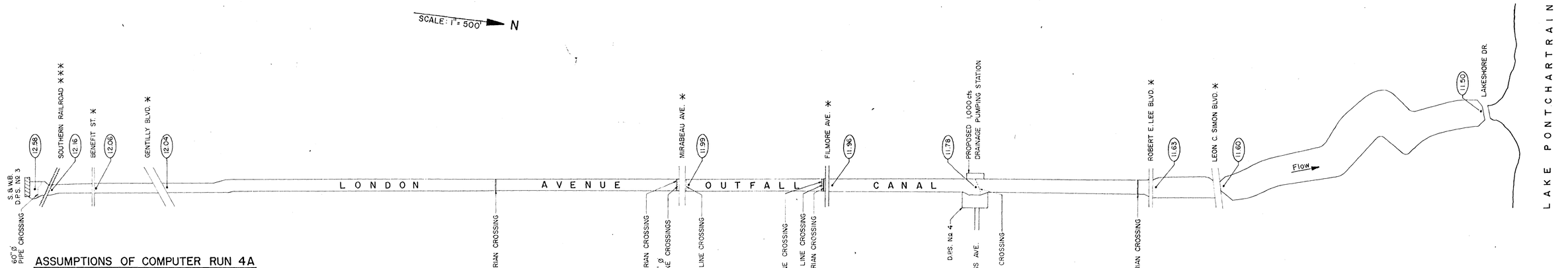
Modification No. 3: Raise All Roadway Bridges Above Canal W.S.E.

Much of the headloss computed in the London Avenue Canal for Modifications No. 1 and 2 during high lake level can be attributed to the structures crossing the canal. Modification No. 3 assumed all roadway bridges would be reconstructed with the entire bridge deck above the canal water profile, and only the bridge pilings restricting flow. Beginning with a high lake level of 11.5 msl and assuming full future nominal pumping capacity of 9200 cfs, computer run 3A computed the high water surface elevation of 13.65 msl at D.P.S. No. 3, a substantial reduction, as compared to Modifications No. 1 and 2.

Modification No. 4: Raise All Roadways And Siphon And Remove All Foot Bridges And Pipe Crossings With The Exception Of The 60" Pipe At D.P.S. No. 3 And Southern Railroad Trestle.

To further reduce the headloss caused by bridges and pipe crossings, a final modification involving these structures was tested. As with Modification No. 3, all roadways were raised above the canal W.S.E., with only the bridge pilings within the canal flow section. Additionally, all foot bridges and pipe crossings were completely removed from the hydraulic model, with the exception of the Sewerage & Water Board siphon crossing, the Southern Railroad Trestle and the 60" diameter pipe crossing just north of D.P.S. No. 3. The siphon crossing, like the roadways, was raised above the canal water surface profile with only the pilings in the canal flow section and the Southern Railroad Trestle and the 60" diameter pipe crossing remained as is. Roller gates were assumed to be constructed at the floodwall openings for the Southern Railroad Bridge allowing weir flow across the bridge. Since both the railroad bridge and the 60" diameter pipe crossing are both within 200 ft. of D.P.S. No. 3, additional modifications to these two crossings were not considered cost justified. Canal bank floodwalls from the railroad to D.P.S. No. 3 can be built slightly higher than the remainder of the canal to account for the additional headloss caused by these two structures. In reconstructing roadway crossings, roadway bridge decks can be widened to include a pedestrian crossing, to account for the loss of foot bridges removed in this modification.

Computer run 4A for this canal configuration, high lake level of 11.5 msl, and future nominal pumping capacity of 9200 cfs, calculated the W.S.E. at D.P.S. No. 3 to be 12.58 msl, and a W.S.E. of 12.16 msl just north of the Southern Railroad crossing. The water surface profile calculated for these improved conditions is shown on Plate B-3.



ASSUMPTIONS OF COMPUTER RUN 4A

(12.16) = CANAL WATER SURFACE ELEVATION M.S.L.

1. FLOODWALLS PARALLEL TO THE LONDON AVENUE OUTFALL CANAL ARE RAISED ABOVE THE CANAL W.S.E.

* 2. ALL ROADWAY CROSSINGS SOUTH OF LAKESHORE DR. AND THE S. & W.B. SIPHON ARE RECONSTRUCTED ABOVE THE CANAL W.S.E. WITH ONLY BRIDGE PILINGS INTERFERING WITH FLOW.

** 3. ALL PEDESTRIAN AND PIPE CROSSINGS HAVE BEEN REMOVED EXCEPT THE 60" DIA. PIPE CROSSING JUST NORTH OF D.P.S. NO.3.

*** 4. ROLLER GATES ARE CONSTRUCTED ACROSS THE SOUTHERN RAILROAD, ALLOWING FLOW OVER THE TRESTLE.

5. THE PROPOSED 1,000 cfs DRAINAGE PUMPING STATION HAS BEEN CONSTRUCTED.

6. FLOWS IN THE CANAL ARE BASED ON THE FUTURE NOMINAL PUMPING CAPACITY – 4300 cfs FROM D.P.S. NO.3 AND 3900 cfs FROM D.P.S. NO.4 .

7. LAKE WATER SURFACE ELEVATION IS 11.5 M.S.L. (HURRICANE CONDITION).

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HYDRAULIC STUDY OF
LONDON AVENUE OUTFALL CANAL
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PLATE B-3: WATER SURFACE PROFILE FOR COMPUTER RUN 4A

B & A JOB NO. 8407-3

Modification No. 5: Excavation Of London Avenue Outfall Canal

As mentioned earlier, most of the headloss calculated during high lake level of 11.5 msl can be attributed to existing structures crossing the canal. However, during normal lake level more substantial friction headloss accumulates, especially near Lake Pontchartrain. Therefore, the final modification considered was to excavate the London Avenue Outfall Canal from Robert E. Lee Blvd. to Lake Pontchartrain within the existing canal banks, where necessary, to maintain a minimum invert elevation of -11 msl in the canal. The bottom of the canal is irregular, especially near the canal bends where silting may have occurred. However, the hydraulic profile analysis only showed a 0.3 ft. ultimate reduction in water surface elevation between Lake Pontchartrain and D.P.S. No. 3 following 200,000 c.y. of excavation. These results, included as computer run 5A, were based on the existing nominal pumping capacity of 8200 cfs, normal lake level of 0 msl, and floodwalls built at all roadway crossings as in Modification No. 1. Therefore, the expense of excavation may not be justified.

APPENDIX B
HYDRAULIC STUDY

RECOMMENDATION

The results of the computer analysis were used to determine the required height of the proposed floodwall improvements for London Avenue Outfall Canal. Computer runs 1B and 4A were used to establish this height.

Since the existing pumping capacity is greatly reduced at high lake levels near 11.5 msl, it was assumed not to be realistic to design for full pumping capacity without reconstructing bridge crossings. If roadways are not rebuilt above the expected canal water surface profile, floodwalls must be built across roadway bridges to allow traffic flow. Assuming floodwalls are constructed on either side of the roadway bridges, roller gates are installed across the railroad crossing, the existing pumping equipment is not upgraded, and the proposed 1000 cfs pumping station is constructed, stormwater in the canal is not expected to rise above elevation 11.85 msl, under hurricane conditions (computer run 1B). Therefore, floodwalls should be built to elevation 13.85 msl, allowing 2 ft. of freeboard to protect against these conditions.

Should existing pumping equipment be improved to pump under these high head levels, additional canal modifications would be required to continue to maintain near 2 ft. freeboard. (see computer run 4A). All structures crossing the canal would have to be rebuilt or removed. These bridge modifications can be done incrementally as pumping capacity is upgraded. The floodwall for the upstream 200 feet of canal must be raised higher than 13.85 msl to eliminate the necessity of rebuilding the railroad crossing and the 60" diameter pipe crossing just north of D.P.S. No. 3. A floodwall height of 14.6 msl would be required for this 200 foot canal reach to account for additional headloss at these two crossings, and allow 2 ft. freeboard. As calculated by computer run 4A, the design water surface elevation just north of the railroad crossing is 12.15 msl. Therefore, a floodwall height from the railroad tracks to Lake Pontchartrain of 13.85 msl, would allow a freeboard of between 1.7 feet and 2 feet for this canal configuration.