

London Avenue Canal Interim Floodwalls and Levees

Revised General Design Memorandum

prepared for the

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

by

Burk and Associates, Inc.
Engineers • Architects • Planners • Environmental Scientists

May 1990

**London Avenue Canal
Floodwalls and
Levees**

General Design Memorandum

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London
Inter

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SECTION I INTRODUCTION

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. With this change in mind, the Orleans Levee Board, under its own initiative, implemented an interim flood protection plan which would be consistent with the U. S. Army Corps of Engineers plan.

In April 1986, a general design memorandum was prepared for this flood protection (protection for a 300 year storm plus two feet of free board with the Corps' current geotechnical design standards) which indicated a cost of 44 million dollars. At the time, the available budget for London Avenue Canal was considerably less than this amount. Therefore, the Board decided to upgrade the existing system for interim flood protection to a level within the budgetary limits. Also, with the Corps standards being too stringent, the Board decided to follow the ASCE's state of the art geotechnical criteria and standards for structural design.

As a result, this flood protection system was designed for a 100 year storm water elevation plus two feet of freeboard and with geotechnical standards established for this project. The hydraulic curves and design were prepared by the C.O.E. using their stage water elevations for different storms and pump discharge capacities derived from Sewerage and Water Board's pump curves.

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 without relocating residences. 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 adjacent to the existing sheet piling.

The recommended plan also includes approximately 7,300 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 from Robert E. Lee Boulevard to Lake Pontchartrain on

the west levee and from Leon C. Simon Boulevard to the Lake on the east levee.

In addition to raising earthen levees and constructing new floodwalls four roadway bridge crossings will be modified and floodgates will be placed at a railroad and two roadway bridge approaches to maintain continuity to the levee system. The floodwalls of the Drainage Pumping Stations No. 3 and No. 4 will also be raised.

Construction Phasing

The sequencing of the flood protection improvements included in the recommended plan will be established on a priority basis in three phases as shown on Plate I-1. The first phase (Phase I) is to increase the level of flood protection offered at the seven bridge crossings as well as raising the earthen levees, the flood walls north of Filmore Avenue (including DPS No. 4), 300 feet of floodwalls north of Mirabeau Avenue, east side, and floodwalls between Sere Street and 1,600 feet north of Sere Street, at a cost of 11.9 million dollars (Table I-1). At the present time, funds in the amount of 12 million dollars are available for these interim improvements.

Since the 300 feet of existing floodwalls north of Mirabeau Avenue on the east side consists of a weak pile section and is good for only a 10 year storm, the improvement of this portion is included in the first phase. The 1,600 feet reach north of Sere Street is proposed to be reconstructed in Phase I for economic reasons. About 1,100 feet of existing sheet piles taken from south of Robert E. Lee Boulevard can be used for this reach.

The second phase consists of construction of the remaining floodwalls (from ~~Drainage Pumping Station No. 3 at Broad Street to Sere Street and from 1,600 feet north of Sere Street to Filmore Avenue~~) and improvements to the existing floodwalls at Drainage Pumping Station No. 3. Total cost at the second phase (Phase II) is estimated to be 12.3 million dollars as shown in Table I-2.

The level of protection of the existing system within the Phase II construction site is only good for a 25 year storm with no free board. Therefore, it is recommended that the construction of the second phase start immediately after completion of Phase I.

Upon completion of the second phase of construction, interim flood protection will be provided to the entire area adjacent to the London Avenue Canal for a 100 year storm tide with a still water level of 10.3 National Geodetic Vertical Datum (NGVD) in Lake Pontchartrain, and 13.0 NGVD at Drainage Pumping Station No. 3 plus 2 feet of freeboard.

The third phase (Phase III) is to eventually construct concrete caps over the steel sheet pile I-walls to complete the project. The estimated cost for Phase III improvements is 9.2 million dollars as summarized in Table I-3 . The third phase is not intended to be constructed until some future time when additional funds are available to improve the aesthetics of the floodwalls.

The Corps of Engineers Plan

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 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 a 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. The Corps' design still water level in Lake Pontchartrain is elevation 11.5 NGVD which is a 300 year stage elevation.

Their hydraulic profiles for London Avenue Canal indicate that water surface elevations of a 300-year storm is approximately a foot higher than those of a 100-year storm.

Cost Determination

Cost estimates provided within this study are presented as estimated construction cost for structures and estimated total cost for phases. The construction cost includes only the cost of installation of the structures and the total cost is the summation of construction cost and contingencies, engineering and other related costs as described below.

Contingencies used in this study are estimated at 15% of the estimated construction cost and include costs for mobilization, bonds, insurance and other potential added construction costs which could evolve when more specific design details are developed. The design fees are estimated at approximately 5.75% of the estimated construction cost including contingencies. Other costs are surveys, 1%, design memorandum, 0.5%, geotechnical investigations, 1%, testing laboratory, 1%, resident inspection, 2.5% of the estimated construction cost including contingencies.

TABLE I-1
SUMMARY OF PROPOSED IMPROVEMENTS
PHASE I

Description	Estimated Construction Cost
Floodproofing of Gentilly Boulevard Bridge	\$ 500,000.00
Floodproofing of Mirabeau Avenue Bridge	457,000.00
Floodproofing of Filmore Avenue Bridge	361,000.00
Floodproofing of Leon C. Simon Boulevard Bridge	153,000.00
Floodgates at Southern Railroad Bridge	265,000.00
Floodgates at Benefit Street Bridge	275,000.00
Floodgates at Robert E. Lee Boulevard Bridge	325,000.00
Drainage Pumping Station No. 4 Floodwalls	86,000.00
Raising of Earthen Levees (R.E. Lee to Lake on West Side and L.C. Simon to Lake on East Side)	1,086,000.00
Steel Sheet Pile I-Walls (Filmore to R.E. Lee on West Side and Filmore to L.C. Simon on East Side)	4,661,320.00
Steel Sheet Pile I-Walls (Mirabeau to 300 feet North of Mirabeau, East Side)	196,800.00
Steel Sheet Pile I-Walls (Sere to 1,600 North of Sere, West Side and East Side)	<u>869,500.00</u>
Estimated Construction Cost	\$ 9,235,620.00
Contingencies, Engineering, Etc. (28.5%)	<u>2,632,151.70</u>
Estimated Total Cost-Phase I	\$11,867,771.70

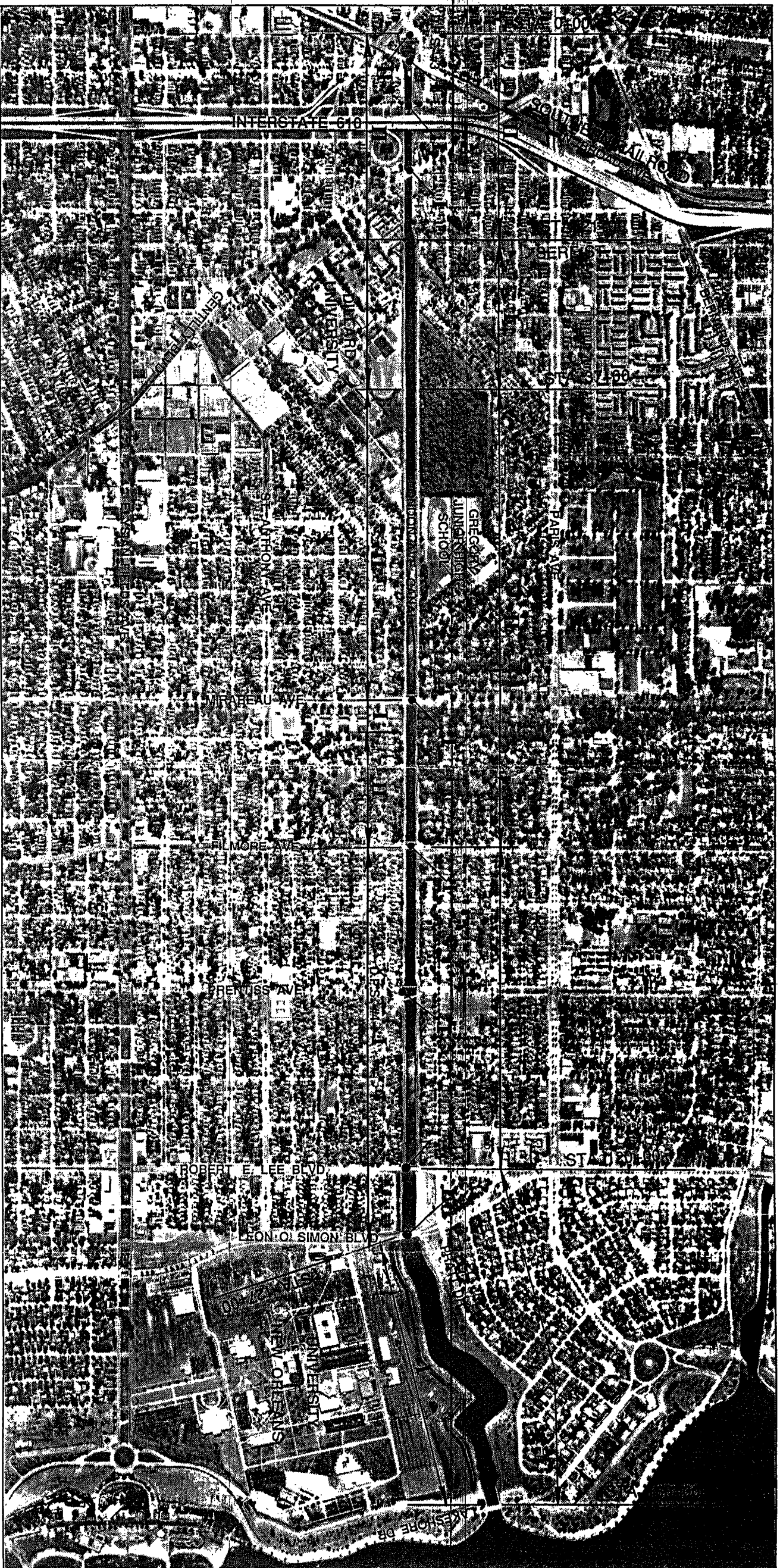
Bridge
closed

TABLE I-2
SUMMARY OF PROPOSED IMPROVEMENTS
PHASE II

<u>Description</u>	<u>Estimated Construction Cost</u>
Steel Sheet Pile I-Walls (1,600 North of Sere to Filmore, West Side and East Side)	6,559,880.00
Drainage Pumping Station No. 3 Floodwalls	111,000.00
Steel Sheet Pile I-Walls (DPS No. 3 to Sere, West Side and East Side)	<u>2,933,028.00</u>
Estimated Construction Cost	\$9,603,908.00
Contingencies, Engineering, etc. (28.5%)	<u>2,737,113.78</u>
Estimated Total Cost - Phase II	\$12,341,021.78

TABLE I-3
SUMMARY OF PROPOSED IMPROVEMENTS
PHASE III

<u>Description</u>	<u>Estimated Construction Cost</u>
Concrete Cap over I-Walls (DPS No. 3 to R.E. Lee on West Side and DPS No. 3 to L.C. Simon on East Side)	\$ 6,705,200.00
Demolition and Removal of Old Sheet Piles and Concrete Caps	148,200.00
Regrading and Seeding	<u>296,400.00</u>
Estimated Construction Cost	\$ 7,149,800.00
Contingencies, Engineering, etc. (28.5%)	<u>2,037,693.00</u>
Estimated Total Cost - Phase III	\$ 9,187,493.00



PHASE I

1. FLOODPROOFING ALL SEVEN CROSSINGS
2. RAISING EARTHEN LEVEES
3. CONSTRUCTING FLOODWALLS (FILMORE AVE. TO LEVEES & 300' N. OF MIR EAST)
4. RAISING DPS #4 FLOODWALLS
5. CONSTRUCTING FLOODWALLS (SERE ST. TO STA. 37+00)

PHASE II

1. CONSTRUCTING FLOODWALLS (STA. 37+00 TO FILMORE AVE.)
2. CONSTRUCTING FLOODWALLS (DPS #3 TO SERE ST.)
3. RAISING DPS #3 FLOODWALLS

PHASE III

1. CAPPING ALL SHEET PILES

PLATE I-1

LONDON AVE. CANAL FLOODWALLS AND LEVEES

GENERAL DESIGN MEMORANDUM

BOARD OF LEVEE COMMISSIONERS
ORLEANS LEVEE BOARD

ORLEANS LEVEE BOARD CONTRACT NO. 2049-0269

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

**LONDON AVENUE CANAL
FLOODWALLS AND LEVEES**

CONSTRUCTION PHASING

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

SECTION II HYDRAULICS

General

The hydraulic criteria and data used for evaluation and analysis of the existing floodwalls and levees and design of the proposed structures were to be compatible with the Corps' criteria used in their projects. Therefore, the Corps was requested to provide a set of hydraulic profiles for London Avenue Canal, given discharge flows from the pumping stations for several frequencies. The Sewerage and Water Board's pump curves were used to determine the discharge flows.

Procedures and Data

The following computations and tasks were performed to provide necessary data for COE's use in their computations and preparation of hydraulic data:

1. Stage-Frequency curves for Lake Pontchartrain as prepared by the Corps (COE's Plates A-17 and A-18, November 1984) were used to determine the Lake water stage elevations for occurrence probabilities of 5-, 10-, 15-, 25-, 50-, 100-, 200- and 300- year. These curves (copies of COE's Plate A-17 and Plate A-18) are shown on Plate II-1 and the results are tabulated on Plate II-2.
2. The Pump Characteristic Curves furnished by the N.O.S. & W.B. were used for computations and the intake water elevations were set at -2.4 NGVD for Pump Station #3 and -4.8 NGVD for Pump Station #4 to have reasonable flood elevation in the vicinity.

The total capacity of the Pump Stations were calculated for several discharge water elevations using the intake water elevations and Pump Characteristic Curves described above. The results are shown by two curves on Plate II-4.

3. The results of the previous backwater profile computer runs were studied and analyzed to approximate backwater profiles for several stages. The approximated profiles were necessary to estimate the differential heads at the pump stations. These profiles were created by establishing relationships between the losses in canal and pump stations capacity (discharge) and by interpolating all losses. See Backwater Profile 1 on Plate II-3.

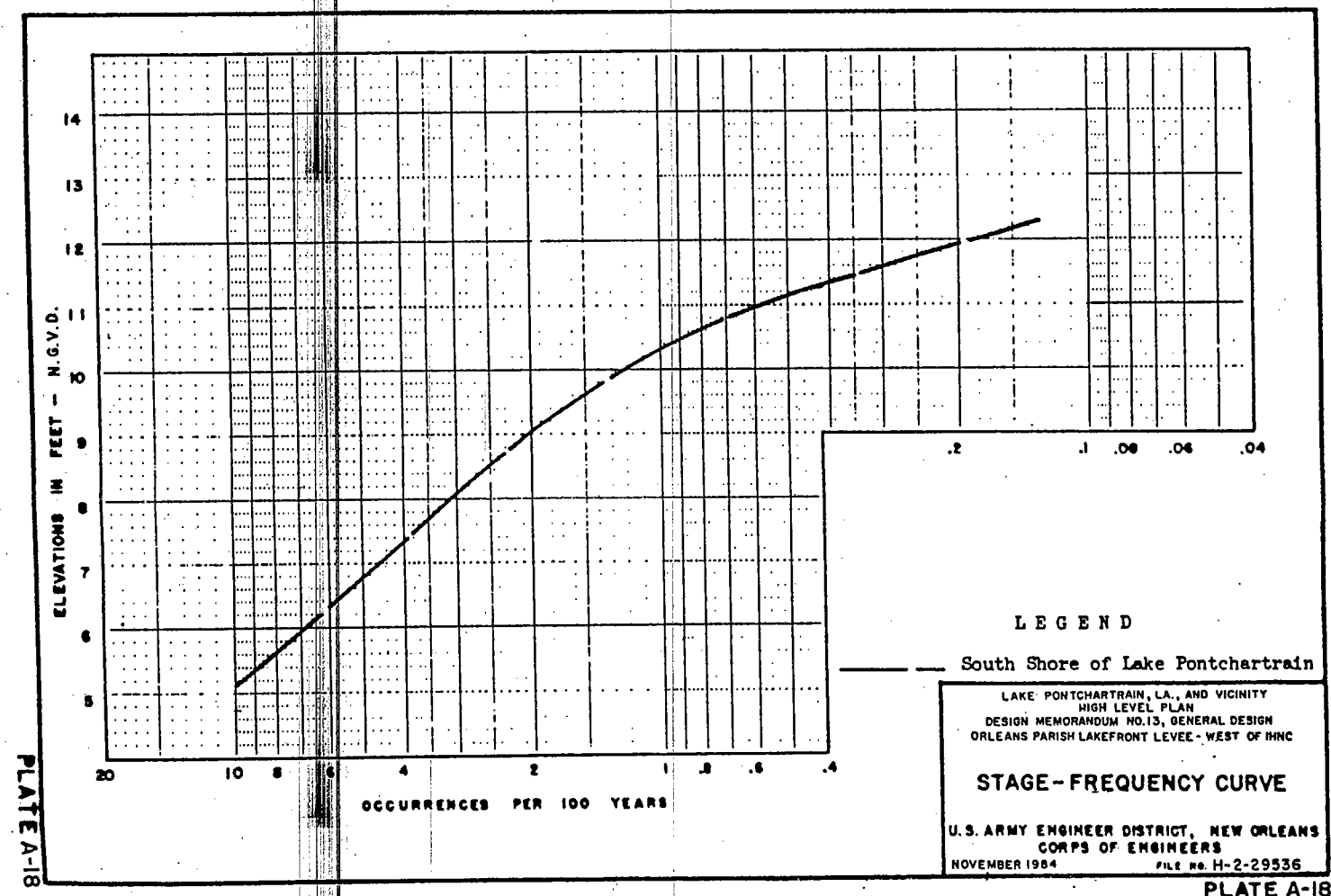
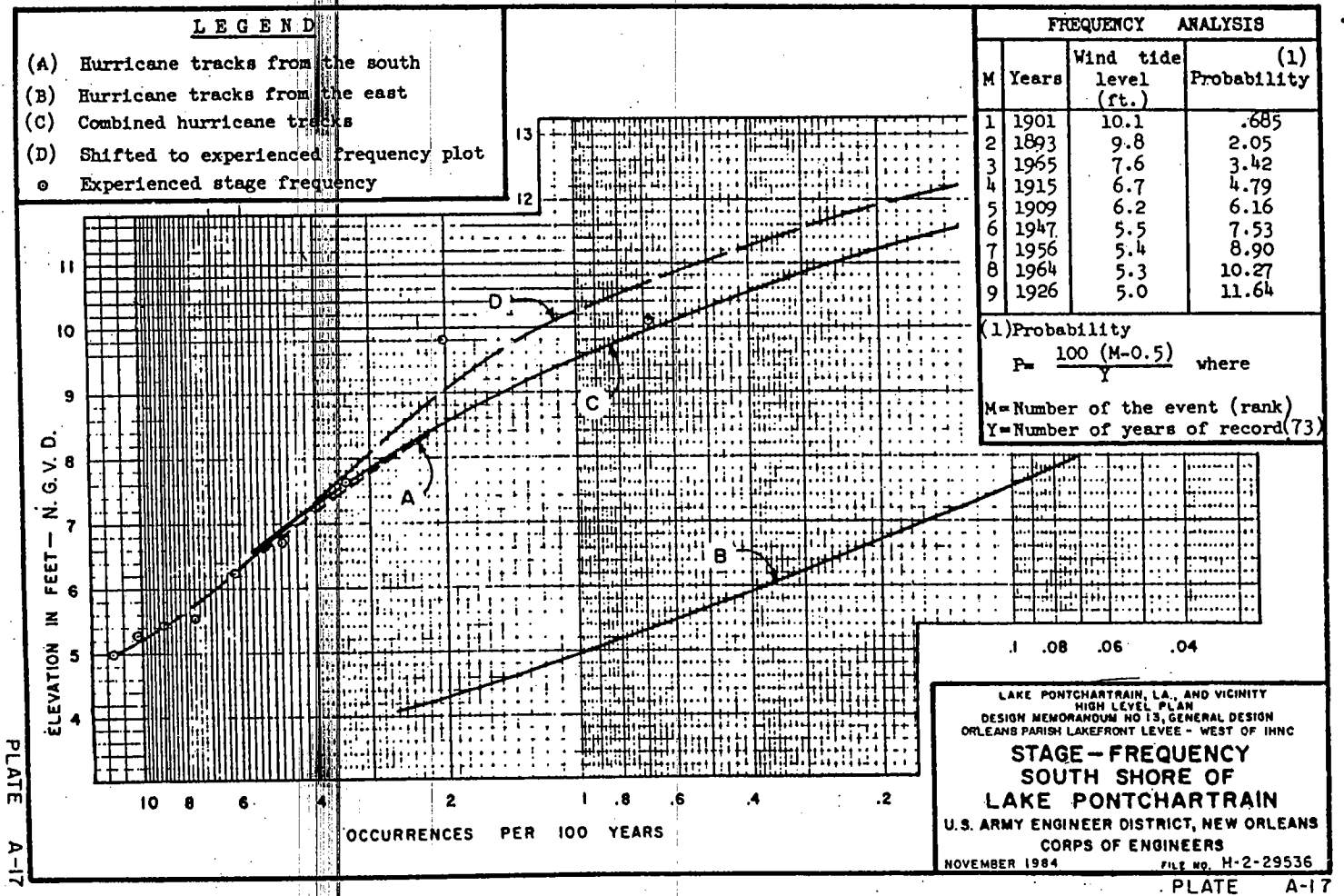
4. Discharge basin water elevations at pump station were read for each profile in "Backwater Profile 1" and corresponding total pump station capacities were determined from curves shown on Plate II-4. These values were plotted against the lake water elevations taken from the profiles mentioned above. See "Lake Elev. - Pump Station Capacity Curves" on Plate II-4.
5. The "Lake Elev. - Pump Station Capacity Curves" were used to determine the discharge values for each Lake stage as tabulated on Plate II-4. These figures were given to the Corps.
6. The approximated profiles for the Lake Stages were calculated and plotted ("Backwater Profile 2", Plate II-3) for comparison with the project's profile as would be prepared by the Corps to determine the accuracy of the approximation.
7. The project's backwater profiles were prepared by the Corps using the furnished data. The elevations are tabulated on Plate II-5 and the profiles are shown on Plate II-6.

Results and Conclusions

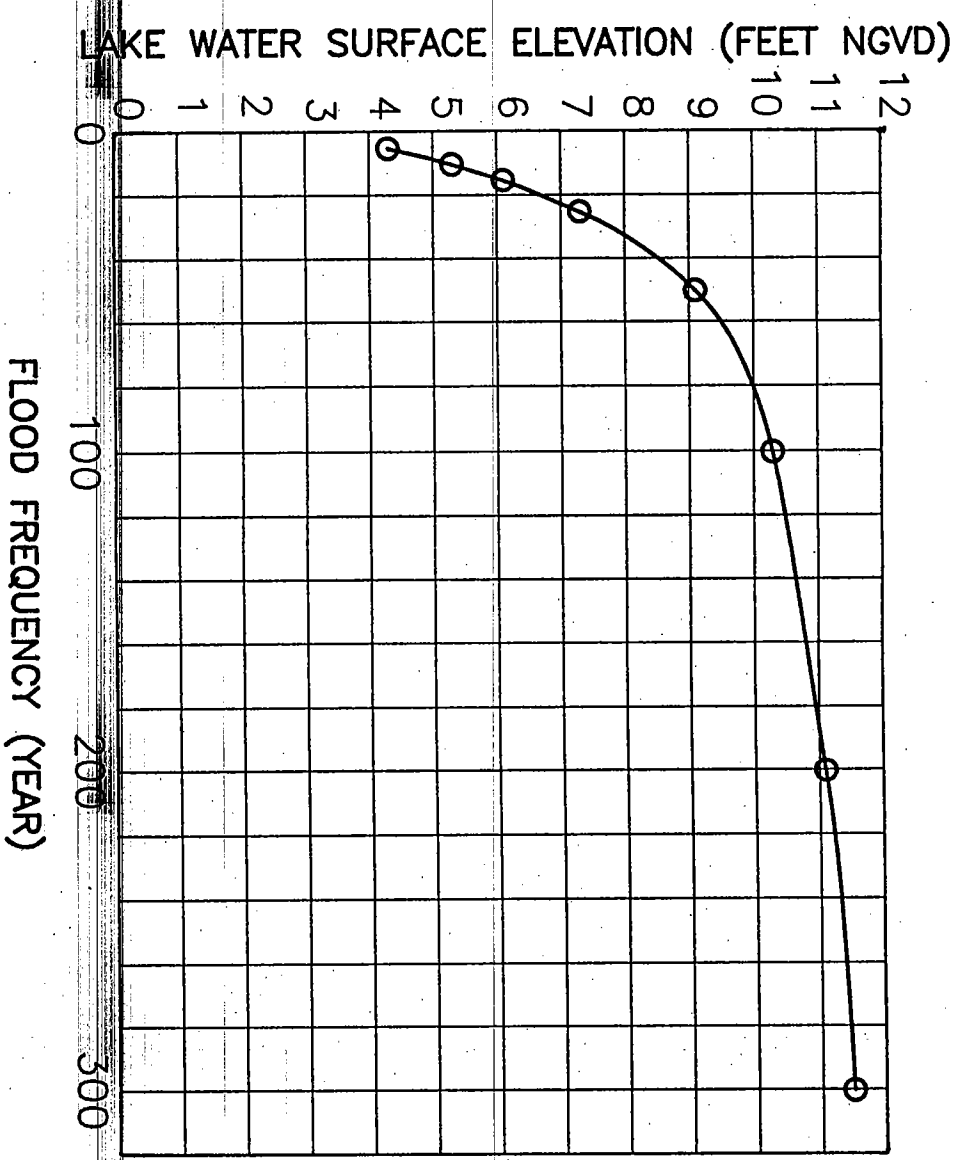
C.O.E.'s Plate A-17 shows the stage-frequency curve for south shore of Lake Pontchartrain as developed by the Corps using recorded data and a probability formula. This curve is taken as the empirical curve for this project and the curve on their Plate A-18 as the theoretical. Comparing these two curves indicates minor differences in elevations for different frequencies. This comparison is shown in the table "Frequency-Stage Elevations " on Plate II-2.

A study of Plate II-5 shows that difference between elevations of a 300 year frequency back water profile (11.5-14.0) and those of a 100 year (10.3-13.0) varies from 1.0 to 1.2 feet. This indicates that the project's hydraulic criteria, providing a flood protection for a 100 year storm plus two feet of freeboard, will accommodate a 300 year storm plus one foot of freeboard.

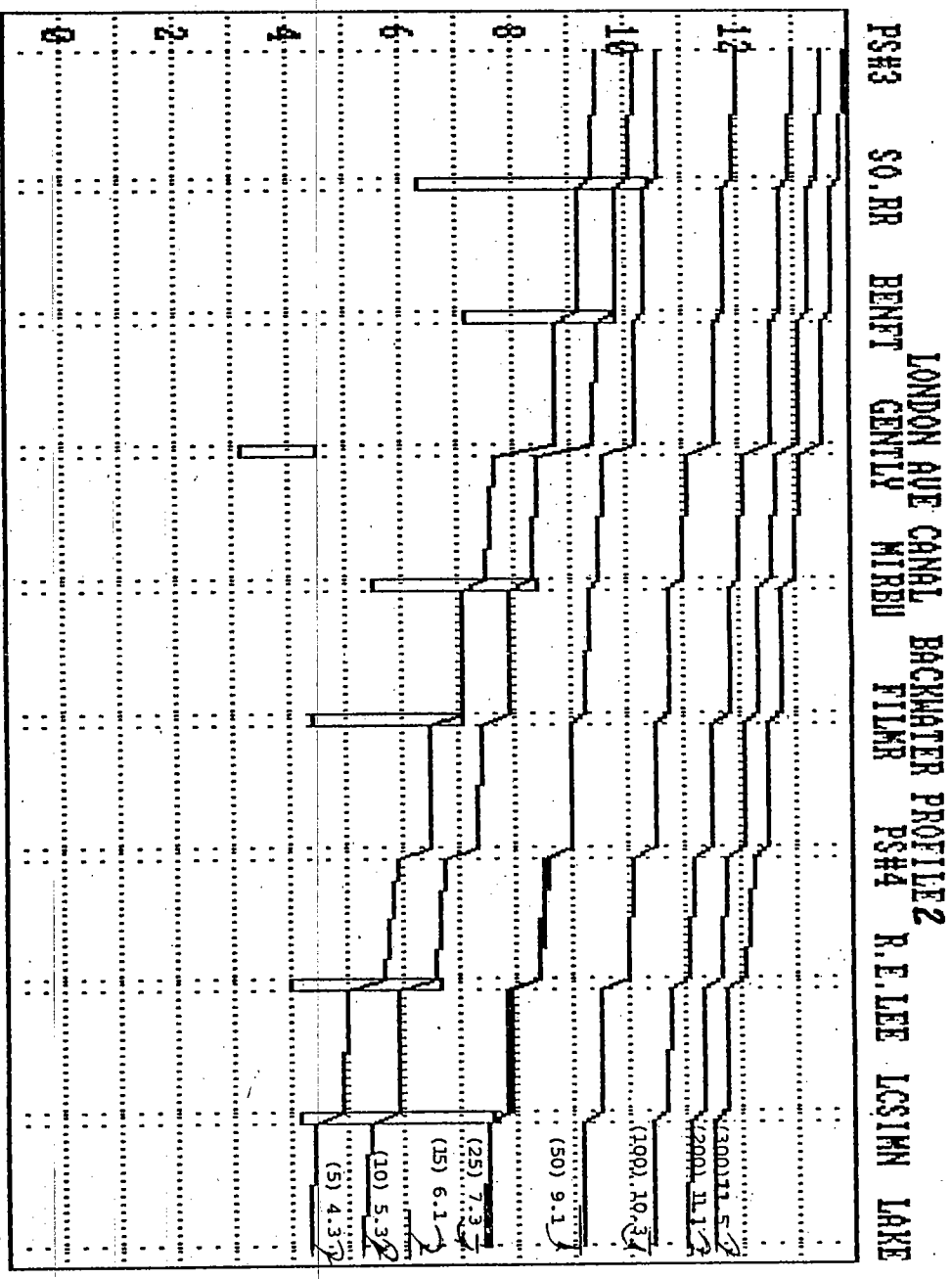
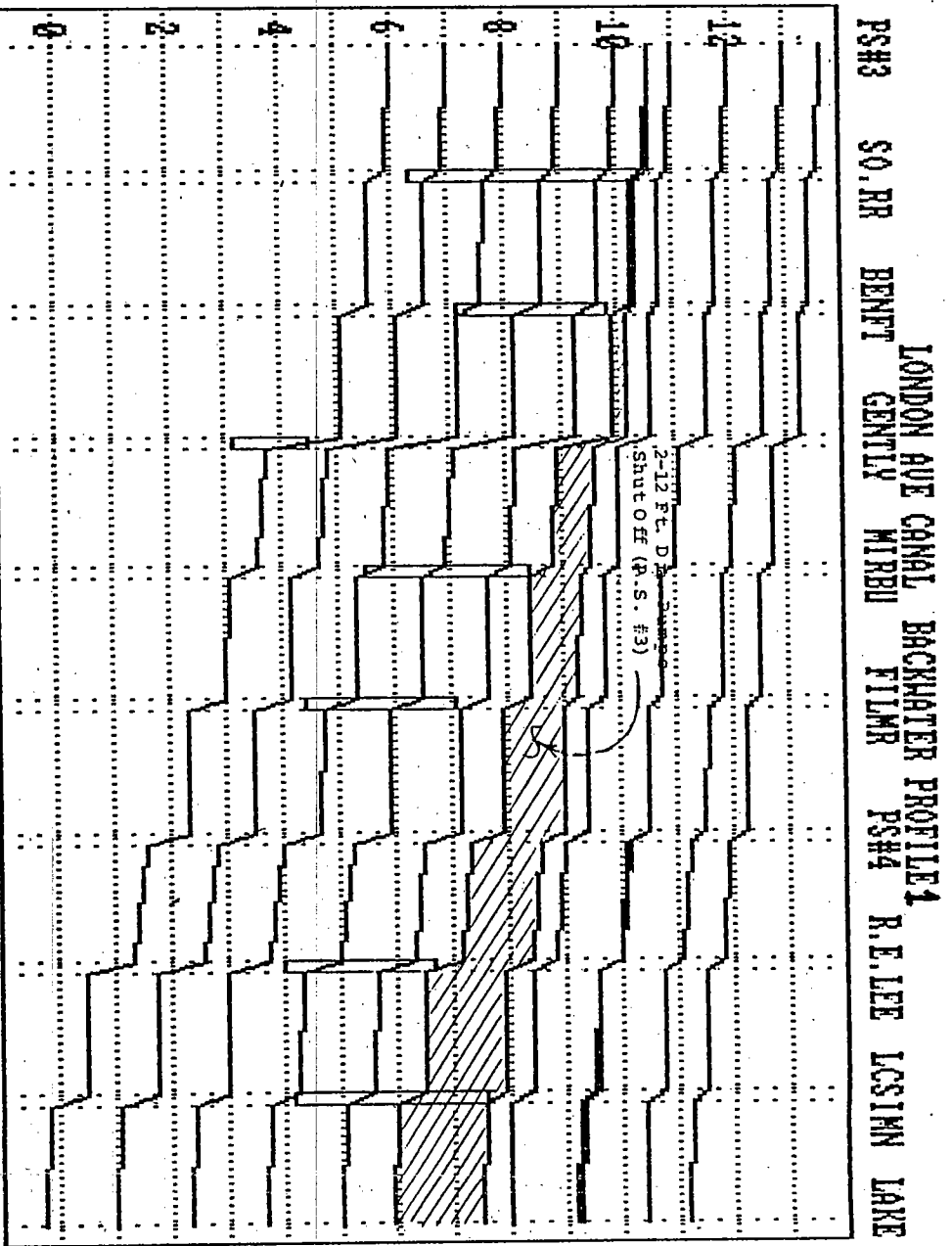
The hydraulic profiles approximated for estimating pump stations discharge were compared with the project's profiles as developed by the Corps. The differences between upstream elevations of the curves were very small which indicated that the estimated discharge values were valid and accurate.



FREQUENCY (YEARS)	FREQUENCY-STAGE ELEVATIONS			
	LAKE W.S. ELEVATION (NGVD)			
	EMPIRICAL	THEORETICAL	EXPERIENCED	PROJECT
5	4.3	4.3	--	4.3
10	5.25	5.15	5.3	5.3
15	6.05	6.05	--	6.1
25	7.3	7.35	--	7.3
50	9.05	9.05	9.8	9.1
100	10.25	10.35	--	10.3
200	11.05	11.15	--	11.1
300	11.45	11.5	--	11.5



LONDON AVENUE CANAL FLOODWALLS AND LEVEES GENERAL DESIGN MEMORANDUM		PROJECT STAGE-FREQUENCY CURVE		BOARD OF COMMISSIONERS ORLEANS LEVEE BOARD		Burk & Associates, Inc. <small>Engineers • Planners • Environmental Scientists New Orleans, Louisiana</small>	
				OLB CONTRACT NO. 2049-0269		JOB NO. 8407	
						PLATE II-2	



BACKWATER PROFILE 1
(UP STREAM ELEVS. ORBITRARILY SET)

BACKWATER PROFILE 2
(UP STREAM ELEVS. ESTIMATED FOR LAKE STAGES)

PUMP STATION	NOMINAL CAPACITY (CFS)
PS#3	4,300
PS#4	3,900
PROPOSED PS	1,000

LEGEND
(FREQUENCY) LAKE W.S. ELEV.
 (25) 7.3
 CROSSING STRUCTURE

LONDON AVENUE CANAL FLOODWALLS AND LEVEES
GENERAL DESIGN MEMORANDUM

APPROXIMATED
BACKWATER
PROFILES

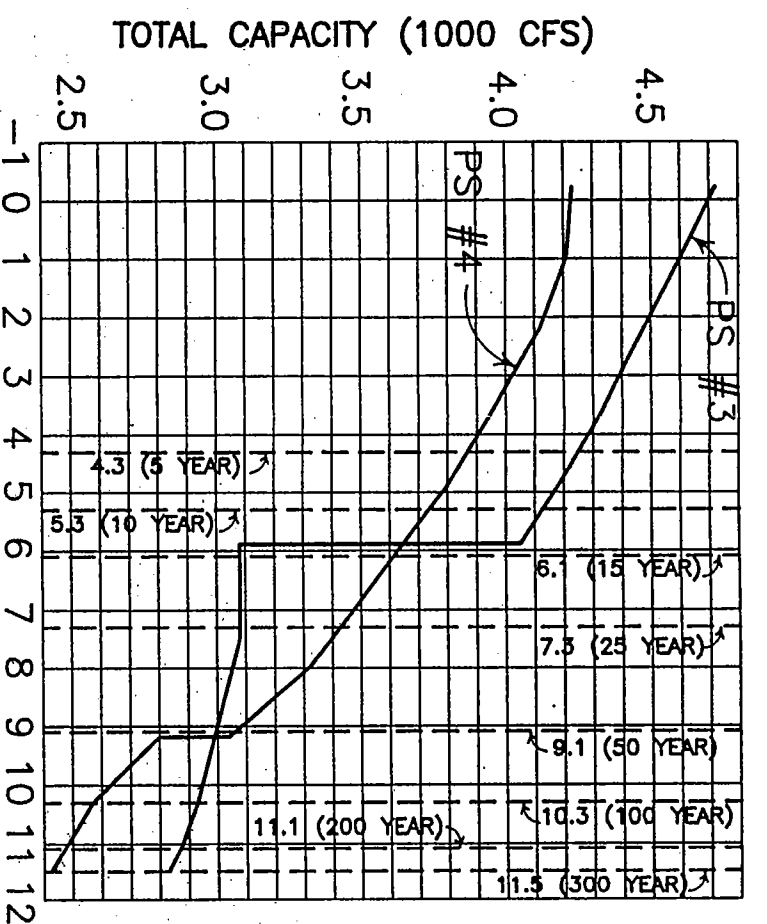
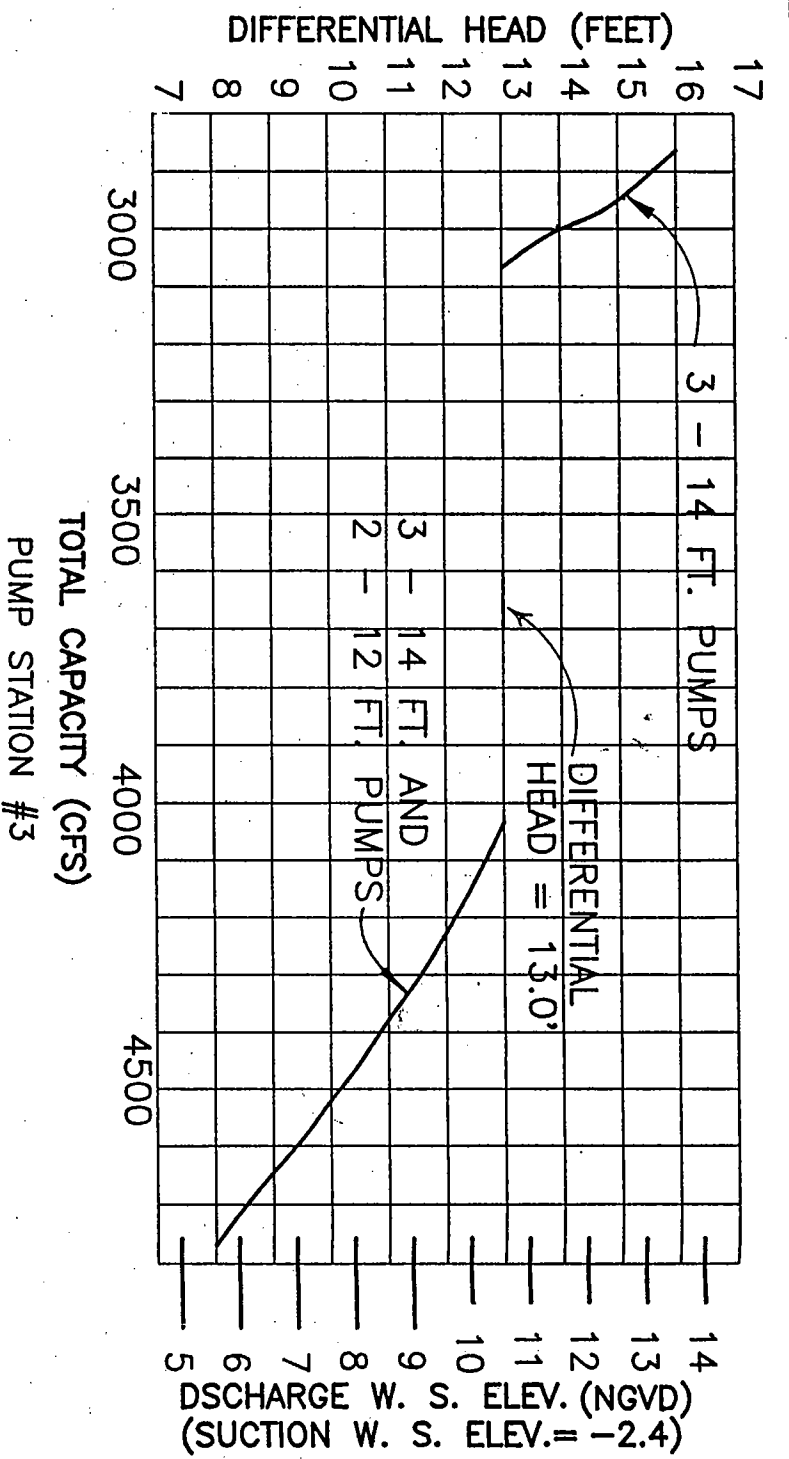
BOARD OF COMMISSIONERS
ORLEANS LEVEE BOARD

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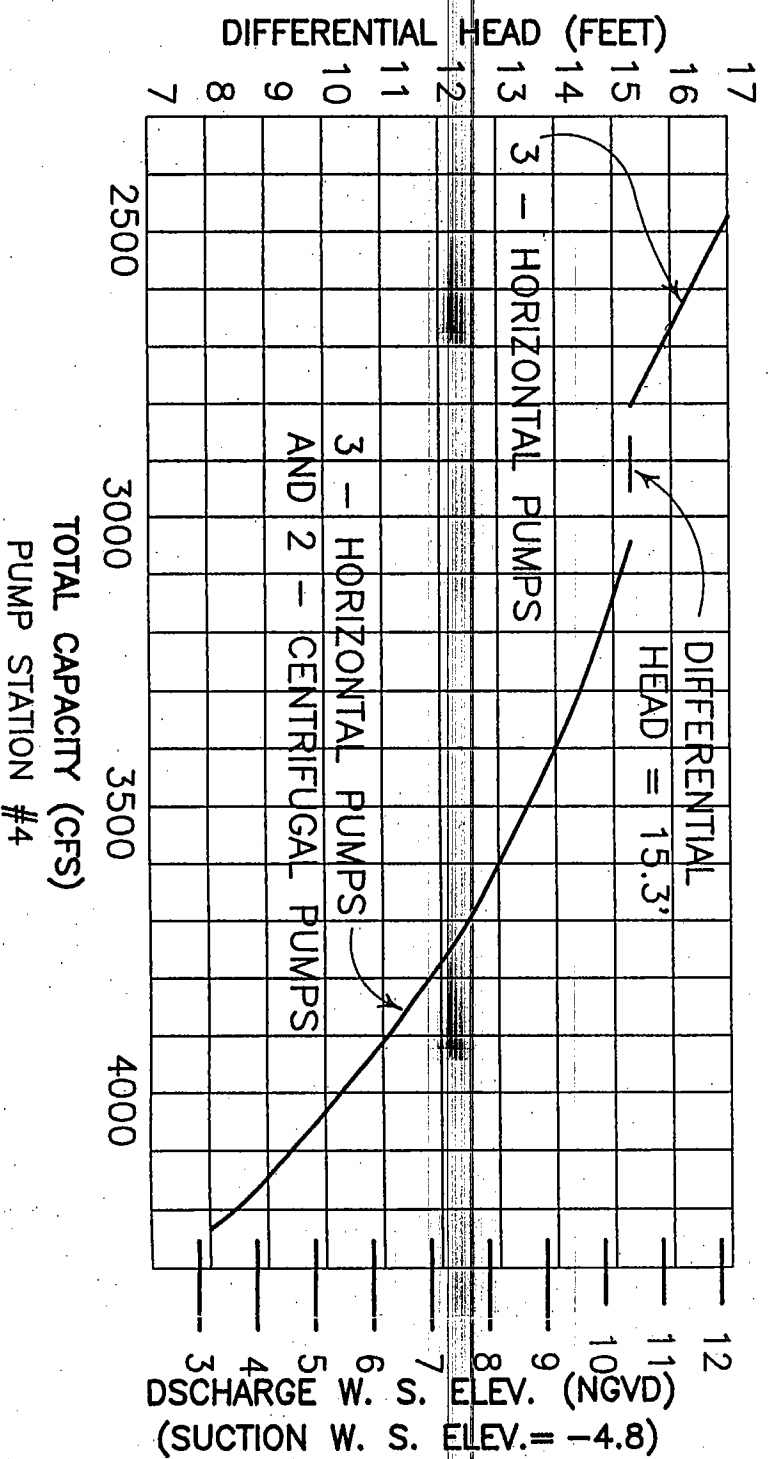
OLB CONTRACT NO. 2049-0269

JOB NO. 8407

PLATE II-3



LAKE WATER SURFACE ELEVATION (NGVD)
PUMP STATION CAPACITY VS. LAKE W. S. ELEVATION



SUMMARY

FREQUENCY (YEARS)	LAKE W. S. ELEVATION (NGVD)	PS #3 CAPACITY (CFS)	PS #4 CAPACITY (CFS)	FUTURE CAPACITY (CFS)	PS TOTAL CAPACITY (CFS)
300	11.5	2830	2425	1000	6255
200	11.1	2870	2490	1000	6360
100	10.3	2930	2640	1000	6570
50	9.1	2980	3100	1000	7080
25	7.3	3075	3490	1000	7565
15	6.1	3075	3640	1000	7715
10	5.3	4130	3740	1000	8870
5	4.3	4250	3860	1000	9110

LONDON AVENUE CANAL FLOODWALLS AND LEVEES
GENERAL DESIGN MEMORANDUM

PUMP STATION
CAPACITY CURVES

BOARD OF COMMISSIONERS
ORLEANS LEVEE BOARD

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New Orleans, Louisiana

OLB CONTRACT NO. 2049-0269

JOB NO. 8407

PLATE II-4

UPSTREAM-DOWNSTREAM
CANAL WATER SURFACE ELEVATIONS IN NGVD, HEADLOSS & (CANAL FLOW IN CFS)

FREQUENCY	ELEV. AT DPS #3 STA. 0+00	BENEFIT STREET 6+70-WEIR *	GENTILLY BOULEVARD 14+00-PRESSURE*	MIRABEAU AVENUE 70+00-PRESSURE*	FILMORE AVENUE 85+50-PRESSURE*	D.P.S. #4 101+ 80-OPEN*	ROBERT E. LEE BLVD. 120+25-WEIR*	LEON C. SIMON BLVD. 127+30-PRESSURE*	ELEV. AT LAKE PONTCHARTRAIN STA. 160+00
300 YEAR	14.0	13.7-13.6 0.1' (2.830)	13.6-13.1 0.5' (2.830)	12.9-12.8 0.1' (2.830)	12.7-12.6 0.1' (2.830)	12.5-12.3 0.2' (2.830)	12.1-11.8 0.3' (6.255)	11.8-11.6 0.2' (6.255)	11.5
200 YEAR	13.7	13.4-13.2 0.2' (2.870)	13.2-12.7 0.5' (2.870)	12.6-12.5 0.1' (2.870)	12.3-12.2 0.1' (2.870)	12.1-11.9 0.2' (2.870)	11.8-11.4 0.4' (6.360)	11.4-11.2 0.2' (6.360)	11.1
100 YEAR	13.0	12.7-12.5 0.2' (2.930)	12.5-12.0 0.5' (2.930)	11.9-11.8 0.1' (2.930)	11.6-11.5 0.1' (2.930)	11.4-11.2 0.2' (2.930)	11.0-10.6 0.4' (6.570)	10.6-10.4 0.2' (6.570)	10.3
50 YEAR	12.1	11.8-11.6 0.2' (2.980)	11.6-11.1 0.5' (2.980)	10.9-10.8 0.1' (2.980)	10.7-10.5 0.2' (2.980)	10.4-10.2 0.2' (2.980)	9.9-9.5 0.4' (7.080)	9.5-9.2 0.3' (7.080)	9.1
25 YEAR	10.7	10.3-10.1 0.2' (3.075)	10.1-9.6 0.5' (3.075)	9.4-9.3 0.1' (3.075)	9.1-9.0 0.1' (3.075)	8.8-8.6 0.2' (3.075)	8.2-7.8 0.4' (7.565)	7.8-7.5 0.3' (7.565)	7.3
15 YEAR	10.5	9.8-9.5 0.3' (3.075)	9.5-9.0 0.5' (3.075)	8.2-8.1 0.1' (3.075)	8.1-7.9 0.2' (3.075)	7.7-7.5 0.2' (3.075)	7.1-6.7 0.4' (7.715)	6.6-6.4 0.2' (7.715)	6.1
10-YEAR	10.2	9.5-9.2 0.3' (4.130)	9.2-8.3 0.9' (4.130)	7.9-7.8 0.1' (4.130)	7.6-7.4 0.2' (4.130)	7.1-7.0 0.1' (4.130)	6.6-6.1 0.5' (8.870)	6.1-5.8 0.3' (8.870)	5.3
5 YEAR	9.4	8.7-8.4 0.3' (4.250)	8.4-7.4 1.0' (4.250)	7.2-7.1 0.1' (4.250)	6.9-6.7 0.2' (4.2450)	6.3-6.3 0' (4.250)	5.8-5.3 0.5' (9.110)	5.2-4.9 0.3' (9.110)	4.3

*STA-FLOW TYPE
THE FLOW AT RAILROAD BRIDGE IS WEIR TYPE.
ALL ELEVATIONS ARE NGVD.

LONDON AVENUE CANAL FLOODWALLS AND LEVEES
GENERAL DESIGN MEMORANDUM

HYDRAULIC
PROFILE ELEVATIONS

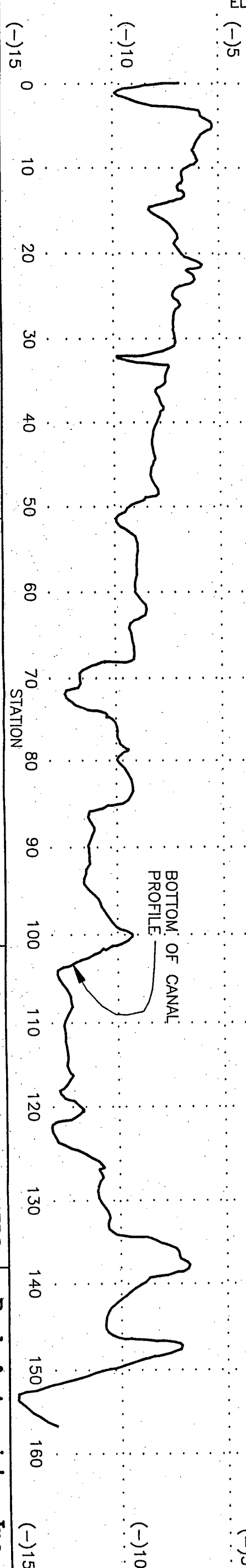
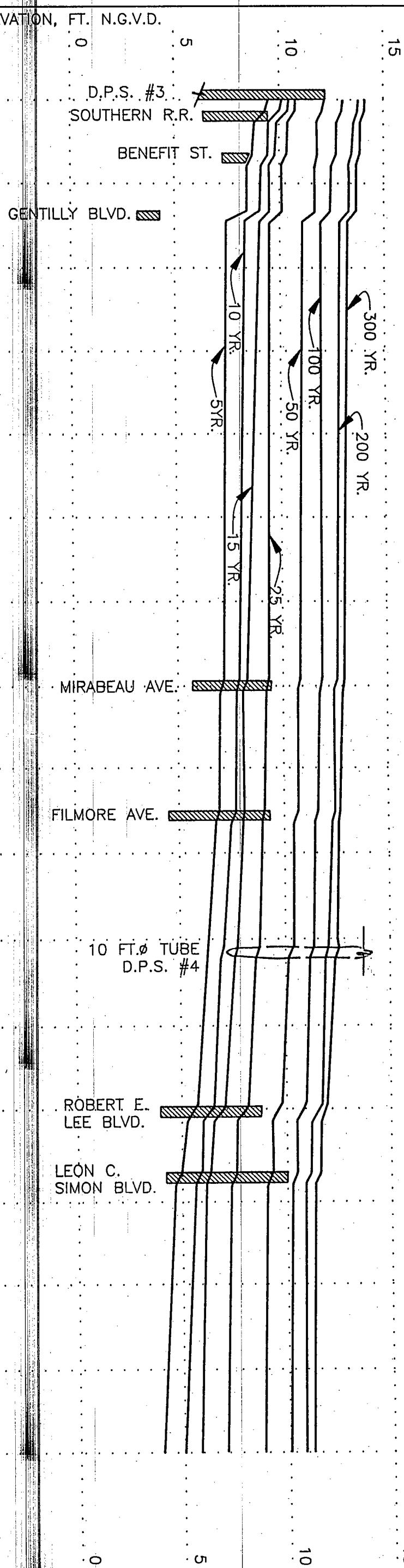
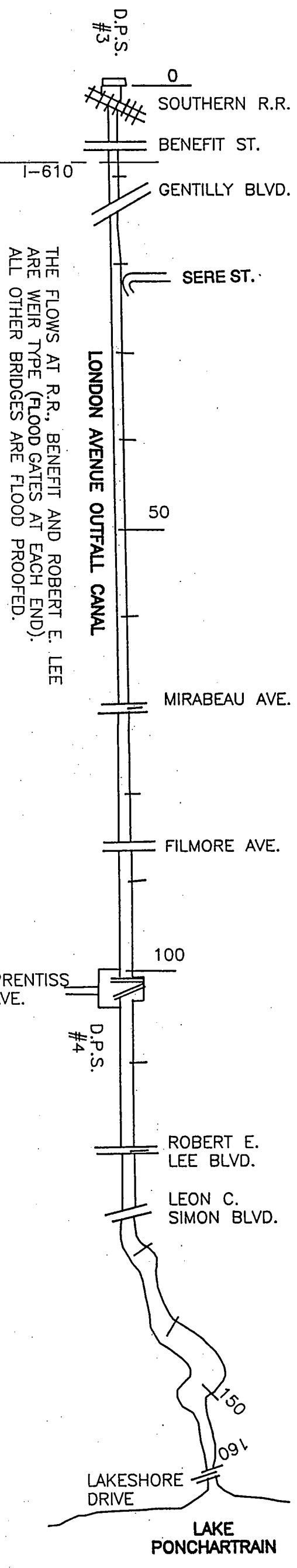
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OLB CONTRACT NO. 2049-0269

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New Orleans, Louisiana

JOB NO. 8407

PLATE II-5



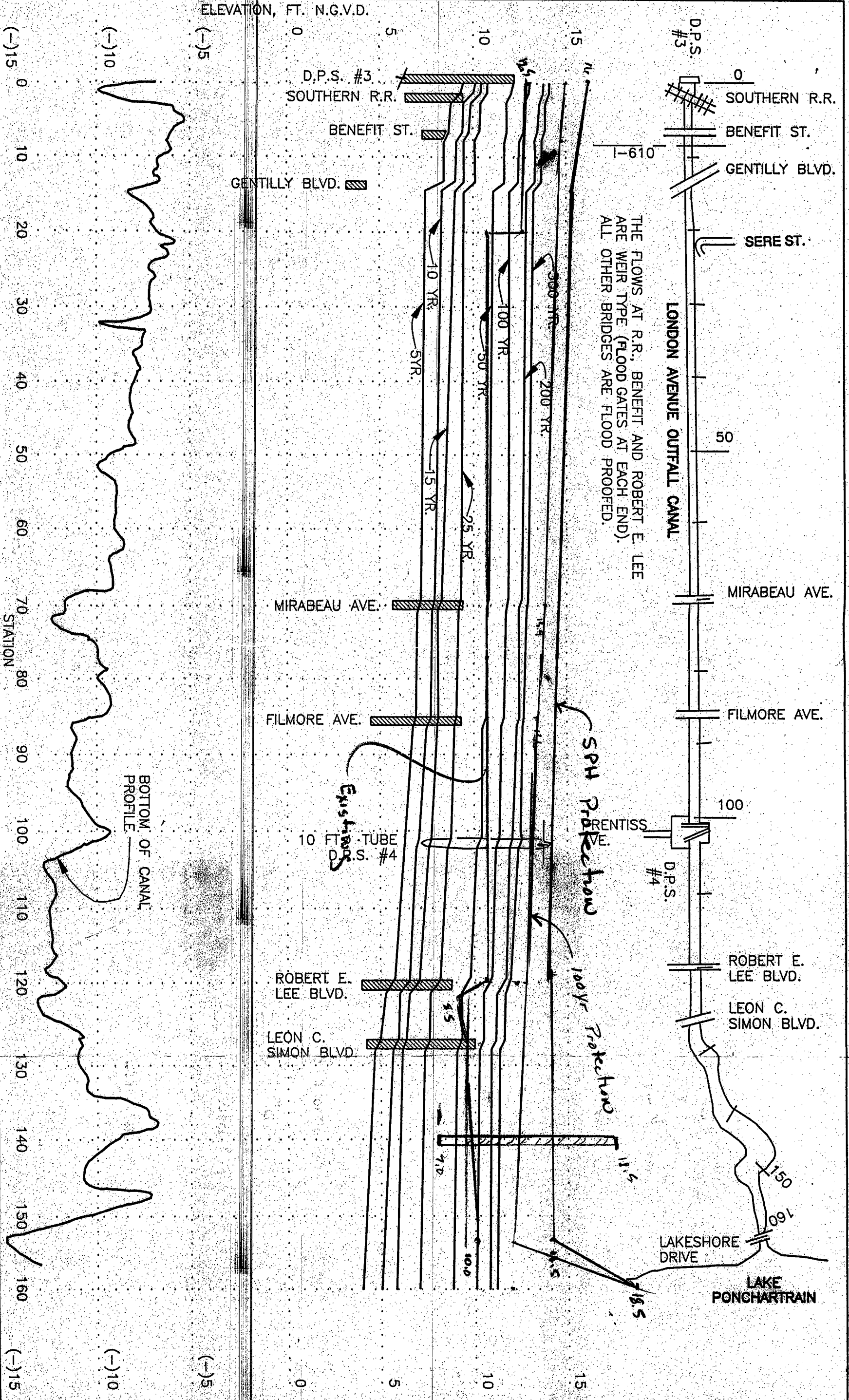
LONDON AVENUE CANAL FLOODWALLS AND LEVEES
GENERAL DESIGN MEMORANDUM

PROJECT
HYDRAULIC PROFILES

BOARD OF COMMISSIONERS
ORLEANS LEVEL BOARD

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New Orleans, Louisiana

OLB CONTRACT NO. 2049-0269
JOB NO. 8407
PLATE II-6



LONDON AVENUE CANAL FLOODWALLS AND LEVEES
GENERAL DESIGN MEMORANDUM

PROJECT
HYDRAULIC PROFILES

BOARD OF COMMISSIONERS
ORLEANS LEVEE BOARD

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JOB NO. 8407

PLATE II-6

SECTION III EXISTING CONDITIONS

General

In addition to proposing an adequate flood protection plan, the scope of this GDM includes analysis and evaluation of the existing floodwalls and levees based on the Corps of Engineers' recorded Lake water stage elevations and hydraulic criteria. A geotechnical study was also performed for this analysis. The purpose of this evaluation was to determine the levels of protections the existing system provides.

Procedures

The Corps of Engineers' water elevations and other data, as described in Section II, were utilized for all hydraulic criteria of this project.

To evaluate the existing conditions the available drawings, field survey and visual inspection were used in combination to determine the existing sheet piling length, shape, cantilever, etc. and to prepare a listing for several reaches. The shape and type of piles or levees determined the breakdown of the reaches. See Plates III-1 and III-2. These reaches were further subdivided by the geotechnical engineers for their analyses.

Slope stability analyses were performed and factors of safety, moments and deflections were calculated for several water levels for each reach by Eustis Engineering. These geotechnical and structural data showed the still water surface elevations each reach can handle based on a factor of safety of 1.5. See Plate III-3. Using these elevations and the hydraulic profiles shown on Plate II-6, Section II, the levels of protection (protection against storm frequencies) were determined. Table III-1 and Plate III-4 show the result of this study.

Existing Levees and Floodwalls

The existing levees along the London Avenue 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 sheet piling from the weather elements.

The present flood protection levees and floodwalls along this canal vary between elevation 8.5 NGVD and 12.5 NGVD. All of the present flood protection systems are lower in elevation than the flood protection proposed in this GDM.

The sheet piles are made of standard, special and non-standard sections in various sizes and lengths and the levees have an 8 foot crown and side slopes varying from 5:1 to 3:1. Plates III-2 and III-4 show the existing features and conditions.

Drainage Pumping Stations

The New Orleans 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 structure with the existing floodwalls tying into the walls of the building. The horizontal 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 provided by the floodwalls at Drainage Pumping Station No. 3 is elevation 12.5 NGVD. (see Plates IV-14 and IV-15 in Section IV).

Drainage Pumping Station No. 4 is located at the intersection of Prentiss Avenue and the east levee of the London Avenue Canal (Station 101+00). The pump structure presently houses two centrifugal pumps (see Plates IV-16 and IV-17 in Section IV). In addition to the two centrifugal pumps three horizontal pumps are located north of the centrifugal pump 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 NGVD.

Bridges

There are nine bridges crossing the London Avenue Canal within the project limits. Two of these crossings (I-610 twin bridges) are above the required elevation and the other seven bridges are below. The overtopping elevations of these seven bridges vary between elevation 4.19 NGVD and 10.03 NGVD,

which are below the design elevations, (100 year water surface profile plus two feet of freeboard).

The following schedule is a summary of existing bridge superstructure elevations (NGVD).

Crossing Location	Approximate Station	Bridge Deck Elevation	Overtopping Elevation	Bottom Chord Elevation
Southern Railroad	2+20	9.33	9.33	6.3
Benefit Street	6+70	8.37	8.37	7.2
Gentilly Boulevard	14+00	4.19	4.19	3.2
Mirabeau Avenue	70+00	7.70	9.27	5.5
Filmore Avenue	85+50	6.48	9.15	4.4
Robert E. Lee Boulevard	120+25	5.39	8.64	4.0
Leon C. Simon Boulevard	127+30	6.52	10.03	4.2

Typical sections of the existing bridges are shown on Plate IV-9 in Section IV.

The two elevated structures of Interstate 610 crossing the London Avenue Canal provide adequate vertical clearance above the proposed floodwall height. The lowest elevation of the bottom of the steel girders is 15.0 NGVD.

Results of Evaluation

As shown on Table III-1 and Plate III-4, the existing system and soil conditions with a factor of safety of 1.5 will accommodate still water elevations at or above a 25-year storm (with no freeboard) except for Reaches Ex-VIII-R (good for a 10-year storm) and Ex-X-R (good for a 15-year storm) which have weak pile sections. The allowable bending stress for sheet pile sections is assumed to be 18 ksi.

The slope stability analysis for the earthen levees at low water elevations resulted in the following factors of safety:

Reach	Factor of Safety		
	W.E. - 1.0	W.E. - 3.0	W.E. - 5.0
Ex-IV-L	1.5	1.4	1.3
Ex-V-L	1.4	1.3	1.2
Ex-XIII-R	1.8	1.65	1.55
Ex-XIV-R	1.6	1.5	1.4

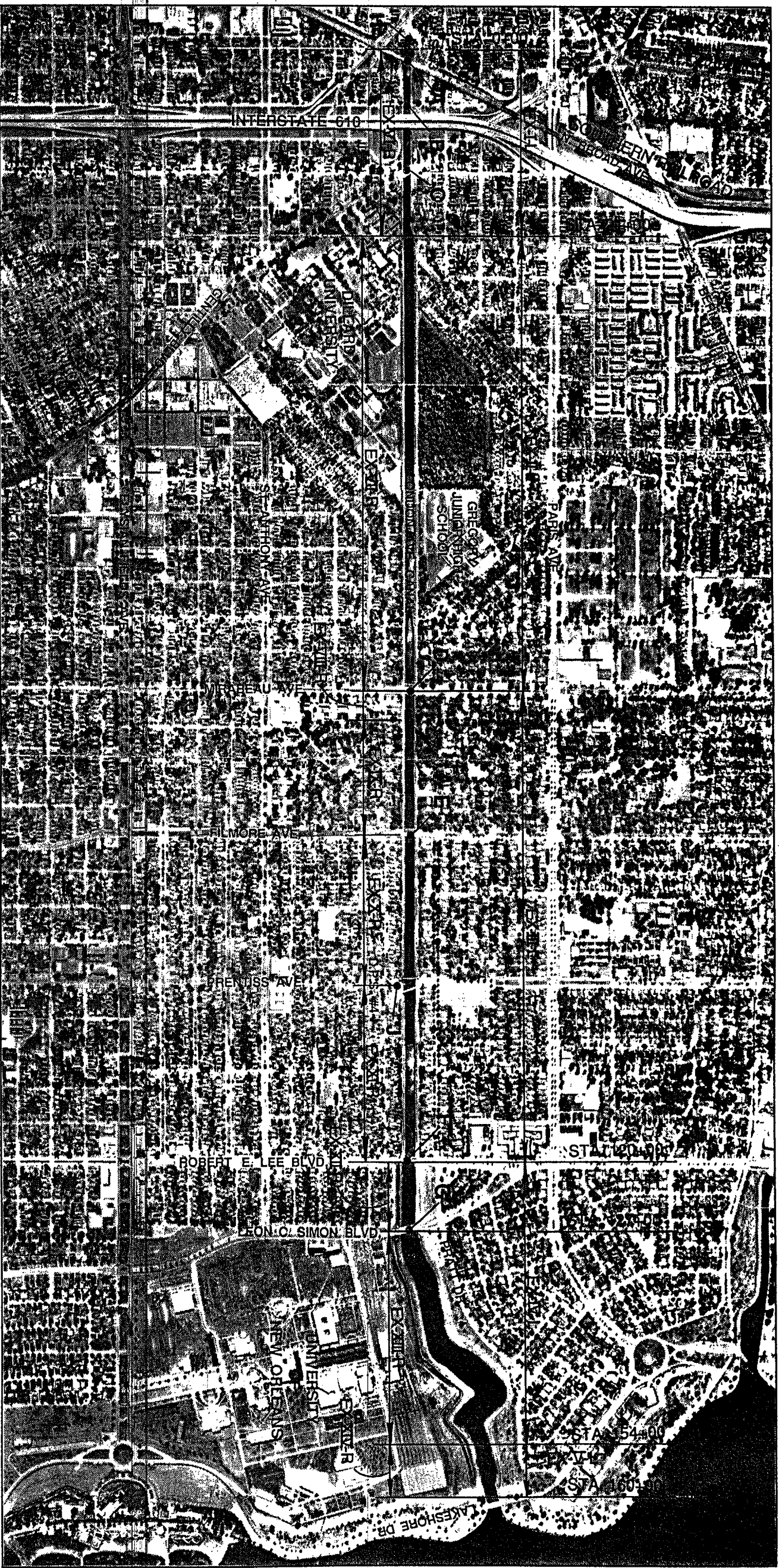
The lowest recorded water elevation is - 1.0 and the lowest probable water elevation as established by the Corps is - 5.0.

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.

**TABLE NO. III-1
LONDON AVE. CANAL FLOODWALLS AND LEVEES
SUMMARY OF EXISTING FLOOD PROTECTION LEVELS**

REACH DESIGNATION	STA TO STA	SIDE OF CANAL	LOCATION	MAX. SAFE DESIGN WATER LEVEL	RETURN FREQ. STORM	EXIST TOP OF WALL OR LEVEE ELEV.	FREE BOARD
EX-I-L	2+00 TO 21+00	West	Southern RR to Sere St.	10.5	25 yr.	12.5	2.0
EX-II-L	21+00 TO 70+00	West	Sere St. to Mirabeau Ave	10.5	25 yr.	10.5	0.0
EX-III-L	70+00 TO 120+00	West	Mirabeau to Robert E. Lee	10.0	25 yr.	10.5	0.5
EX-IV-L	120+00 TO 154+00	West	R.E. Lee to 600' S of Lakeshore	9.5	25 yr.	9.5	0.0
EX-V-L	154+00 TO 160+00	West	600' S. of L to Lakeshore Dr.	10.5	50 yr.	10.5	0.0
EX-VI-R	2+00 TO 21+00	East	Southern RR to Sere St.	10.5	25 yr.	12.5	2.0
EX-VII-R	21+00 TO 70+00	East	Sere St. to Mirabeau	10.5	25 yr.	10.5	0.0
EX-VIII-R	70+00 TO 73+00	East	Mirabeau to 300' N. of Mirabeau	8.0	10 yr.	10.0	2.0
EX-IX-R	73+00 TO 85+50	East	300' N. or Mirabeau to Filmore	10.5	25 yr.	10.5	0.0
EX-X-R	85+50 TO 101+00	East	Filmore to Prentiss (DPS#4)	8.8	15 yr.	10.5	1.7
EX-XI-R	101+00 TO 120+00	East	Prentiss (DPS#4) to Rbt. E.Lee	10.5	25 yr.	11.5	1.0
EX-XII-R	120+00 TO 127+00	East	Rbt. E.Lee to Leon C. Simon	10.0	50 yr.	10.0	0.0
EX-XIII-R	127+00 TO 154+00	East	L.C.Simon to 600'S of Lakeshore	8.5	25 yr.	8.5	0.0
EX-XIV-R	154+00 TO 160+00	East	600' S of L to Lakeshore Drive	10.0	25 yr.	10.0	0.0



OVERTOPPING DESIGNATION	BRIDGE ELEVATIONS LOCATION	ELEVATION
A	SOUTHERN RAILROAD	9.33 NGVD
B	BENEFIT STREET BRIDGE	8.37 NGVD
C	GENTILLY BOULEVARD BRIDGE	4.19 NGVD
D	MIRABEAU AVENUE BRIDGE	9.27 NGVD
E	FILMORE AVENUE BRIDGE	9.15 NGVD
F	ROBERT E. LEE BOULEVARD BRIDGE	8.64 NGVD
G	LEON C. SIMON BOULEVARD BRIDGE	10.03 NGVD
H	DRAINAGE PUMPING STATION NO.3	12.50 NGVD
J	DRAINAGE PUMPING STATION NO.4	10.73 NGVD

FOR DESCRIPTION OF EXISTING SHEET PILES AND LEVEES, SEE PLATES III-2 AND III-4

PLATE III - 1

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

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**LONDON AVENUE CANAL
FLOODWALLS AND LEVEES**

EXISTING CONDITIONS

REACH DESIGNATION	STATION TO STATION	SIDE OF CANAL	LOCATION	TYPE OF STRUCTURE	TOP OF WALL EL	GROUND EL	CANTILEVER	TOP OF SHEET PILE EL	BOTTOM OF SHEET PILE EL	LENGTH	SH. PILE SECTION	CROWN EL	CROWN WIDTH	CROSS SLOPE
EX-I-L	2+00 TO 21+00	WEST	SOUTHERN RR TO SERE ST.	SHEET PILE W/CAP	12.5	4.5	8.0'	9.5	-10.5	20'	PZ-27	-	-	-
EX-II-L	21+00 TO 70+00	WEST	SERE ST. TO MIRABEAU AVE.	SHEET PILE W/CAP	10.5	5.5	5.0'	7.3	-12.7	20'	SP SEC 1A*	-	-	-
EX-III-L	70+00 TO 120+00	WEST	MIRABEAU TO ROBT. E. LEE	SHEET PILE W/CAP	10.5	4.5	6.0'	7.3	-12.7	20'	M-115	-	-	-
EX-IV-L	120+00 TO 154+00	WEST	ROBT. E. LEE TO 600'S OF LAKESHORE	EARTHEN LEVEE	-	-	-	-	-	-	-	9.5	8	4:1
EX-V-L	154+00 TO 160+00	WEST	600' S. OF LAKE TO LAKESHORE DRIVE	EARTHEN LEVEE	-	-	-	-	-	-	-	10.5-11.5	8	3:1
EX-VI-R	2+00 TO 21+00	EAST	SOUTHERN RR TO SERE ST.	SHEET PILE W/CAP	12.5	4.5	8.0'	9.5	-10.5	20'	PZ-27	-	-	-
EX-VII-R	21+00 TO 70+00	EAST	SERE ST. TO MIRABEAU AVE.	SHEET PILE W/CAP	10.5	5.0	5.5'	7.3	-12.7	20'	SP SEC 1A*	-	-	-
EX-VIII-R	70+00 TO 73+00	EAST	MIRABEAU TO 300' N. OF MIRABEAU	SHEET PILE W/CAP	10.0	4.0	6.0'	6.8	-13.2	20'	MP-112	-	-	-
EX-IX-R	73+00 TO 85+50	EAST	300' N. OF MIRABEAU TO FILMORE	SHEET PILE W/CAP	10.5	4.5	6.0'	7.3	-12.7	20'	MP-115	-	-	-
EX-X-R	85+50 TO 101+00	EAST	FILMORE TO PRENTISS (DPS #4)	SHEET PILE W/CAP	10.5	4.5	6.0'	7.3	-12.7	20'	*ZIGZAG***	-	-	-
EX-XI-R	101+00 TO 120+00	EAST	PRENTISS (DPS #4) TO ROBT. E. LEE	SHEET PILE (NO CAPS)	11.5	3.5	8.0'	11.5	-20.5	20'	PZ-22	-	-	-
EX-XII-R	120+00 TO 127+00	EAST	ROBT. E. LEE TO LEON C. SIMON	SHEET PILE W/CAP	9.5-	5.5	5.0'	7.5	-12.5	20'	PZ-27	-	-	-
EX-XIII-R	127+00 TO 154+00	EAST	L. C. SIMON TO 600' S. OF LAKESHORE	EARTHEN LEVEE	10.5	-	-	-	-	-	-	8.5-10.0	8	5:1
EX-XIV-R	154+00 TO 160+00	EAST	600' S. OF LAKE TO LAKESHORE DR.	EARTHEN LEVEE	-	-	-	-	-	-	-	10.0-11.0	8(+/-)	5:1

* This pile section "SP SEC 1A", is a 1/4" thick Z section, 5-3/4" deep. This pile section "ZIG ZAG", is in a shape of corrugated steel sheet, 1/4" (+/-), thick. The corrugations are folded (not wrinkled) 90 degree angles. Each section is 15-3/4" and the section modulus per linear foot of wall is 9.5 in.3, as per Foster Frodingham Catalog, Special Section 1A-RD3. Each section has 5 corrugations.

All elevations are NGVD.

LONDON AVENUE CANAL FLOODWALLS AND LEVEES
GENERAL DESIGN MEMORANDUM

TABULATED
EXISTING CONDITIONS

BOARD OF COMMISSIONERS
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OLB CONTRACT NO. 2049-0269 JOB NO. 8407

PLATE III-2

REACH DESIG- NATION	STATION TO STATION	SIDE OF CANAL	LOCATION	SHEET PILE SECTION	TYPE OF STRUCTURE	TOP OF WALL EL MODULUS	SEC. IN3	MOM OF INERTIA IN4	SOIL F.S. > 1.5			PILE fb = 18KSI		
									MAX SAFE WSL	MOM FT.-K	fb KSI	DEFL IN.	DEFL IN.	MAX SAFE WSL
EX-I-L	2+00 TO 21+00	WEST	SOUTHERN RR TO SERE ST.	PZ-27	SHEET PILE W/CAP	12.5	30.2	181.2	10.5	7.0	28	0.2	-	-
EX-II-L	21+00 TO 70+00	WEST	SERE ST. TO MIRABEAU AVE.	SP. SEC. 1A	SHEET PILE W/CAP	10.5	9.5	27.3	10.5	8.1	10.2	1.35	-	-
EX-III-L	70+00 TO 120+00	WEST	MIRABEAU TO ROBT. E. LEE	M-115	SHEET PILE W/CAP	10.5	5.4	8.8	10.3	9.9	22.0	5.2	3.8	10.0
EX-IV-L	120+00 TO 154+00	WEST	ROBT E. LEE TO 600'S OF LAKESHORE	-	EARTHEN LEVEE	-	-	-	-	-	-	-	-	-
EX-V-L	154+00 TO 160+00	WEST	600'S OF LAKE TO LAKESHORE DRIVE	-	EARTHEN LEVEE	-	-	-	-	-	-	-	-	-
EX-VI-R	2+00 TO 21+00	EAST	SOUTHERN RR TO SERE ST.	PZ-27	SHEET PILE W/CAP	12.5	30.2	181.2	10.5	8.0	3.2	0.2	-	-
EX-VII-R	21+00 TO 70+00	EAST	SERE ST. TO MIRABEAU AVE.	SP. SEC. 1A	SHEET PILE W/CAP	10.5	9.5	27.3	10.5	10.5	13.3	1.9	-	-
EX-VIII-R	70+00 TO 73+00	EAST	MIRABEAU TO 300' N. OF MIRABEAU	MP-112	SHEET PILE W/CAP	10.0	2.4	1.6	10.0	9.8	49.0	30.0	5.6	8.0
EX-IX-R	73+00 TO 85+50	EAST	300' N. OF MIRABEAU TO FILMORE	MP-115	SHEET PILE W/CAP	10.5	5.4	8.8	10.5	8.0	17.8	4.2	-	-
EX-X-R	85+50 TO 101+00	EAST	FILMORE TO PRENTISS (DPS #4)	*ZIG ZAG*	SHEET PILE W/CAP	10.5	2.0*	2.8*	10.5	8.6	51.6	15.0	2.9	8.8
EX-XI-R	101+00 TO 120+00	EAST	PRENTISS (DPS #4) TO ROBT. E. LEE	PZ-32	SHEET PILE (NO CAPS)	11.5	38.3	220.2	10.5	13.0	4.1	0.4	-	-
EX-XII-R	120+00 TO 127+00	EAST	ROBT. E. LEE TO LEON C. SIMON	PZ-27	SHEET PILE W/CAP	9.5- 10.5	30.2	181.2	10.0	3.5	1.4	0.06	-	-
EX-XIII-R	127+00 TO 154+00	EAST	L. C. SIMON TO 600' S. OF LAKESHORE	-	EARTHEN LEVEE	-	-	-	-	-	-	-	-	-
EX-XIV-R	154+00 TO 160+00	EAST	600' S. OF LAKE TO LAKESHORE DR.	-	EARTHEN LEVEE	-	-	-	-	-	-	-	-	-

* Assumed 1/4" Thickness

LONDON AVENUE CANAL FLOODWALLS AND LEVEES
GENERAL DESIGN MEMORANDUM

EXISTING
SHEET PILE DATA

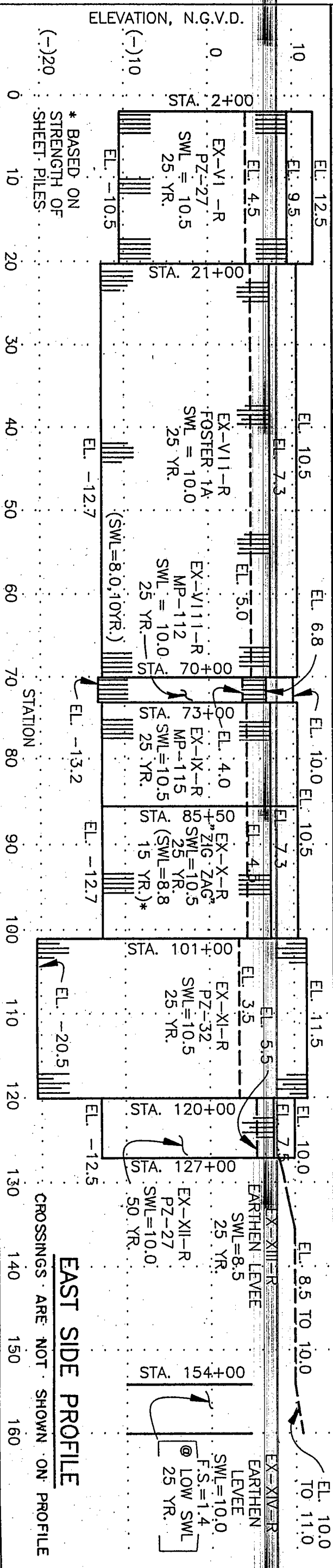
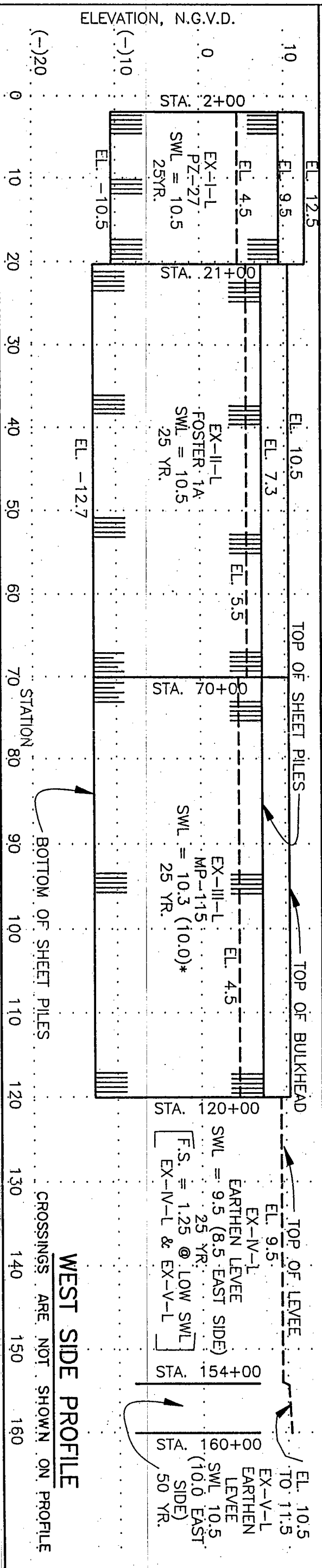
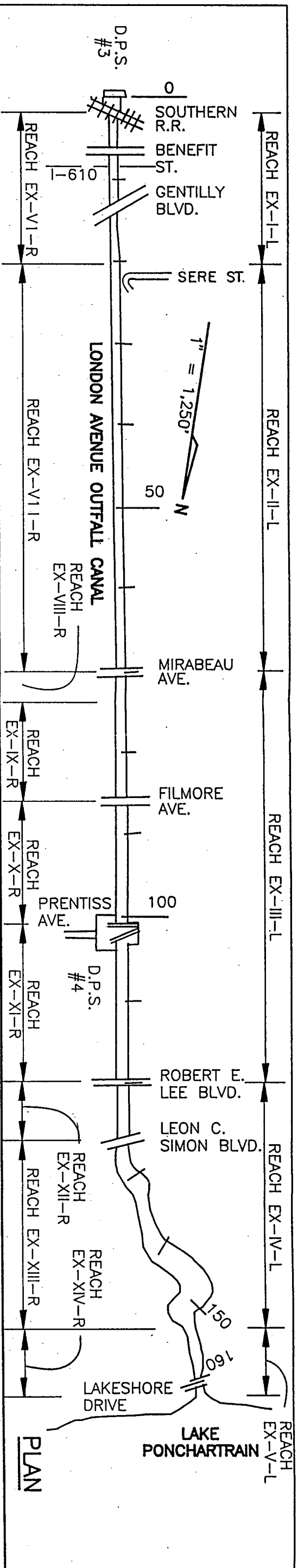
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JOB NO. 8407

PLATE III-3



LONDON AVENUE CANAL FLOODWALLS AND LEVEES

GENERAL DESIGN MEMORANDUM

EXISTING STRUCTURES AND LEVELS OF PROTECTION

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PLATE III-4

* BASED ON STRENGTH OF SHEET PILES.

SECTION IV PROPOSED IMPROVEMENTS

General

The existing floodwalls, levees and crossings, as discussed in Section II, provide a flood protection for 25 years storm and less without freeboard. The proposed system, when completed, will protect against a flood with elevations 12.3 NGVD at the Lake and 15.0 NGVD at the upstream end, DPS No. 3. This is 4.3 to 5.0 feet above a 25 year storm and is established as a 100 year storm plus 2 feet of freeboard. Due to limited available funds, these improvements are proposed to be made in three phases.

Phase I.

Upgrading the crossings at Southern Railroad, Benefit Street, Gentilly Boulevard, Mirabeau Avenue, Filmore Avenue, Robert E. Lee Boulevard and Leon C. Simon Boulevard.

Raising the earthen levees from Robert E. Lee Boulevard on the west and Leon C. Simon Boulevard on the east to Lake Pontchartrain.

Construction of new I-walls from Filmore Avenue to the earthen levees from Mirabeau Avenue to 300 feet north of Mirabeau Avenue, east side, and from Sere Street to 1600 feet north of Sere Street.

Raising the floodwalls of DPS No. 4.

Phase II.

Construction of I-walls from 1600 feet north of Sere Street to Filmore Avenue and from DPS No. 3 to Sere Street.

Raising the floodwalls of DPS No. 3.

Phase III.

Installation of concrete cap over the new sheet piles and removal of the old sheet piles.

The total cost of Phase I is estimated at 11.6 million dollars which is within the available budget and Phase II is estimated to cost 12.6 million dollars. Since the construction of Phase III will not upgrade the overall flood protection, it is recommended to be performed when additional fund becomes available.

The proposed improvements are shown and summarized in Plates IV-1, IV-2, IV-3 and IV-4.

Earthen Levees

The levees adjacent to the London Avenue Canal require upgrading to conform to the design water elevations obtained from the U.S. Army Corps of Engineers, which is required by Orleans Levee Board for this project. This design calls for a 100 year flood still water surface elevation in the canal at Lake Pontchartrain of 10.3 NGVD. The design criteria also requires a two foot freeboard in the canal, raising the required levee elevation to 12.3 NGVD at the Lake. Along the perimeter of the Lake, the Corps of Engineers is raising the levees to elevation 17.5 NGVD east of the London Ave. Canal and 18.0 NGVD west of the canal. These elevations include 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 12.5± to 17.5, west levee and 18.0, east levee near the Lake to tie into the lakefront levee system. These transitions are about 750' long each.

The location of these levees, as established by the geotechnical investigation performed by Eustis Engineers, requires the centerline of the upgraded levee to be setback from the existing.

These setbacks vary from a few feet to approximately 100 feet landside of the existing levee and require no additional right of way. The typical levee sections are shown on Plates IV-5, IV-6 and IV-7.

Steel Sheet Pile I-Walls

Due to right of way restriction, none of the existing sheet piles can be replaced with only earthen levees. The proposed system calls for higher and stronger sheet pile I-walls than the existing with the same concept, steel sheet piles in low levees. Some of these levees are proposed to be improved (graded or raised) within the existing right of way. The pile sections were selected for different locations based on soil and loading conditions. Plates IV-1, IV-2, IV-3 and IV-4 show the breakdown and summary of the proposed floodwalls. See Plate IV-8 for typical sections of sheet piles in levees.

Floodproofing of Crossings

Except I-610 twin bridges, all crossings within the project site have an overtopping elevation lower than the design flood and will be floodproofed as part of this project. The Leon C. Simon Bridge has the highest top elevation, 10.03 NGVD, and will be improved last. However, all bridges are proposed to be floodproofed in Phase I. Table IV-I summarizes openings and improvement of the bridges and Plate IV-9 shows the existing typical sections. Alternate studies were made to determine the most economical and feasible concept for each crossing's improvement. For typical details and sections of these alternates (flood gate, bridge modification and new bridge) see Plates IV-10 through IV-13. Each bridge is discussed individually, as follows:

Southern Railroad Bridge

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 each 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 IV-9.

The structure, including the rails, has a top elevation of approximately 9.33 NGVD and a bottom chord elevation of 6.3 NGVD. The top elevation is below the required floodwall elevation of 15.0 NGVD at this location. The bridge cannot be easily modified without a major cost increase 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 were considered - a new bridge and floodgates.

Constructing a new bridge to provide vertical clearance above the design high water level of 13.0 NGVD would be very costly (estimated over 5 million dollars) and would put the tracks out of service for a long time. Therefore, this GDM proposes constructing steel swing gates at both bridge approaches where the railroad crosses the floodwalls. PZ-22 steel sheetpiles driven 15 feet below the base of the structure will be provided for seepage protection at each gate monolith. The opening size of the floodgates will be 28'-10" wide by 5'-9" high and will cost approximately \$265,000 for both gates. For details see Plate IV-10.

Benefit Street Bridge

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 27 feet wide and was built in 1960. It consists of a substructure composed of a concrete cap supported by four timber piles per bent and a superstructure composed of a concrete deck supported by eleven steel girders per span. For a typical section of the existing structure, see Plate IV-9.

The lowest overtopping elevation of the bridge is 8.37 NGVD at the existing roadway deck. The deck elevation is below the required floodwall elevation of 14.7 NGVD. Three alternates for providing necessary flood protection were studied and described as follows:

Alternate 1: Modify Existing Bridge. This alternate considers modifying the existing bridge by the installation of a new deck and parapet wall. The modifications include removal of the existing deck; installing new steel girders along the exterior faces of the existing bridge; installing tension connections to the steel girders; installing a new concrete watertight deck and parapet wall; and providing seepage cutoff at each bridge abutment with 15' long PZ-22 steel sheet piles. The estimated construction cost for this alternate is \$309,000.

Alternate 2: New Bridge. This solution considers the construction of a new bridge above the top of the new floodwalls. Incorporated into the cost of this solution is 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 12.7 NGVD. The estimated construction cost for this alternate is \$600,000.

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. PZ-22 steel sheetpiles driven 15 feet below the base of the structure will be provided for seepage protection at each gate monolith. The estimated construction cost for this alternate is \$275,000 for two gates.

Benefit Street handles only a low volume local traffic and is in close proximity to the Gentilly Boulevard Bridge which has been recommended for modification and can be used as an access to Benefit Street when closed. For these reasons and the fact that bottom roller flood gates are less expensive than modifying or rebuilding the entire bridge, the recommendation is to construct bottom roller flood gates as proposed in Alternate 3 at the estimated construction cost of \$275,000. For gate details see Plate IV-13.

Gentilly Boulevard Bridge

This bridge is located on Gentilly Boulevard and London Avenue Canal at approximately station 14+00. It is approximately 108 feet long and 84 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 IV-9.

The lowest elevation of the bridge is 4.19 NGVD at top of slab and 7.53 NGVD at top of the parapet wall. The parapet wall elevation is below the required floodwall elevation of 14.5 NGVD. 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 necessary tension forces. There is no practical 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 - a new high level bridge to clear the flood elevation of 12.5 NGVD at an estimated construction cost of \$1,956,000 and a low level bridge with parapet walls at \$500,000. Being more economical, the latter is proposed.

This alternate proposes the construction of a new bridge, keeping the existing deck elevation the same. The modifications include: removal of the existing bridge (except footings and piles which are below canal bottom and would be abandoned); installing precast prestressed concrete pile bents; installing a new concrete watertight deck and parapet walls; and providing new seepage protection at bridge abutments using PZ-22 steel sheetpiles driven 15 feet below the base of the structure. For bridge modification details see Plate IV-11.

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.

Mirabeau Avenue Bridge

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 per bent and a superstructure composed of a concrete deck supported by twelve steel girders (see Plate IV-9. Adjacent to the bridge is a timber pedestrian bridge.

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

Alternate 1: Modify Existing Bridge. This alternate considered the installation of a new deck and parapet walls. The modifications include: removal of the existing deck; installing new steel girders along the exterior faces of the existing bridge; installing tension connectors to the existing steel girders, piles and caps; installing a new concrete watertight deck, parapet walls and pedestrian sidewalks; and provide new seepage protection at bridge abutments using PZ-22 steel sheetpiles driven 15 feet below the base of the structure. Additionally, the adjacent pedestrian bridge will be removed. The estimated construction cost for this alternate is \$457,000.

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 11.9 NGVD.

The preliminary design of the proposed new bridge would increase the bridge length to 700 feet. The proposed bridge is a concrete slab span structure. The estimated construction cost for this alternate is \$1,849,000.

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 for this alternate is \$408,000.

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 substantially more than Alternate 1. Therefore, Alternate 1, bridge modification at a cost of

\$457,000 is recommended for upgrading of this crossing. For bridge modification details see Plate IV-11.

Filmore Avenue Bridge

This bridge is located on Filmore Avenue at London Avenue Canal at station 85+50. It is approximately 140.4 feet long and 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 per bent and a superstructure composed of a concrete deck supported by eight steel girders per span. It was built in 1959. For a typical section of the existing bridge, see Plate IV-9. Adjacent to the bridge is a timber pedestrian bridge.

The lowest elevation of the bridge is 6.48 NGVD at the top of the slab and 9.15 NGVD at the top of the parapet wall. The parapet wall elevation is below the required floodwall elevation of 13.6 NGVD. Three alternates for providing necessary flood protection are suggested and described as follows:

Alternate 1: Modify Existing Bridge. This alternate considers the installation of a new deck and parapet wall. The modifications include: removal of the existing deck; installing new steel girders along the exterior faces of the existing bridge; installing tension connectors to the steel girders, piles and caps; installing a new concrete watertight deck, parapet wall and pedestrian sidewalks; and providing new seepage protection at bridge abutments using PZ-22 steel sheetpiles driven 15 feet below the base of the structure. The adjacent pedestrian bridge will be removed. The estimated construction cost for this alternate is \$361,000.

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 11.6 NGVD.~~

The preliminary design of the proposed new bridge would increase the bridge length to 550 feet. The proposed bridge is a concrete slab span structure. The estimated construction cost for this alternate is \$834,000.

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 for this alternate is \$243,000.

It is not a practical solution to close the bridge during the flood period as suggested in Alternate 3. Since the cost for Alternate 2 is substantially more than Alternate 1, the modification of existing bridge, Alternate 1, at a cost of \$361,000 is proposed for this bridge. For details see Plate IV-11.

Robert E. Lee Boulevard Bridge

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 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 pile supported cap and a superstructure composed of a concrete deck supported by twelve steel girders per span. For a typical section of the existing bridge, see Plate IV-9. Adjacent to the bridge is a timber pedestrian bridge.

The lowest elevation of the bridge is 5.39 NGVD at the top of the slab and 8.64 NGVD at the top of the parapet wall. The parapet wall elevation is below the required floodwall elevation of 13.0 NGVD. Three alternates for providing necessary flood protection are suggested and described as follows:

Alternate 1: Modify Existing Bridge. This alternate considers the installation of a new deck and parapet wall. The modifications include: removal of the existing deck; installing new steel girders along the exterior faces of the existing bridge; installing new tension piles at each bent to resist uplift during high water; installing tension connectors to the steel girders, caps and piles; installing a new concrete watertight deck, parapet wall and pedestrian sidewalks; and provide new seepage protection at bridge abutments using PZ-22 steel sheetpiles driven 15 feet below the base of the structure. The adjacent pedestrian bridge will be removed. The estimated construction cost for this alternate is \$415,000.

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 11.0 NGVD.

The preliminary design of the proposed new bridge would increase the bridge length to 550 feet. The proposed bridge is a concrete slab span structure. The estimated construction cost for this alternate is \$793,000.

Alternate 3: Bottom Roller Flood Gates. This solution proposes the installation of bottom roller flood gates at both bridge approaches. The opening size of each roller gate will be 40'-0" wide and 9'-6" high. The estimated construction cost for this alternate is \$325,000.

Robert E. Lee Boulevard is an arterial roadway serving this area but is in close proximity to the Leon C. Simon Blvd. bridge which has been recommended for modification and can be used instead of this crossing during a flood. 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 the bottom roller flood gates (estimated cost \$325,000) as proposed in Alternate 3. For gate details see Plate IV-13.

Leon C. Simon Boulevard Bridge

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 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 per bent and a superstructure composed of a concrete deck supported by twelve steel girders per span. For a typical section of the existing bridge, see Plate IV-9.

The lowest elevation of the bridge is 6.52 NGVD at the top of the slab and 10.03 NGVD at the top of the parapet wall. The parapet wall elevation is below the required floodwall elevation of 12.6 NGVD. Three alternates for providing necessary flood protection are suggested and described as follows:

Alternate 1: Modify Existing Bridge. This alternate considers the installation of tension connectors to the existing steel girders, caps and piles, and construction of new parapet walls parallel to the centerline of the bridge along each edge of the bridge deck. Additionally new seepage protection at bridge abutments using PZ-22 steel sheetpiles driven 15 feet below the base of the structure will be provided. This existing bridge has a watertight deck and therefore, for interim protection, replacement of the existing deck is not necessary. The estimated construction cost for this alternate is \$176,000.

Alternate 2: New Bridge. This solution proposes the construction of a new high level bridge. Incorporated into the cost of this solution is 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 10.6 NGVD.

The preliminary design of the proposed new bridge would increase the bridge length to 700 feet. The proposed bridge is a concrete slab span structure. The estimated construction cost of this alternate is \$1,907,000.

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 for this alternate is \$424,000.

For this crossing, the obvious choice is the modification of existing bridge with estimated cost of \$176,000 which is the most economical and the roadway will be open to traffic during a flood. This bridge will also be used for Robert E. Lee Boulevard traffic. See Plate IV-11 for bridge modification details.

Drainage Pumping Stations

1. **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 Canal. Since the station is 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 connected 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 floodwall and levee system. On the west side, enough space is available to raise the elevation of the existing earthen levee to elevation 15.0 NGVD. 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 15.0 NGVD. This portion of new work includes proposed replacement of an existing flow diversion flood gate which permits two 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 will extend laterally between the discharge basin walls on either side and will be supported vertically by the existing foundation slab. Present backflow preventers on each horizontal pump within DPS No. 3 will remain intact for

interim flood protection. The estimated construction cost for improvements at DPS No. 3 is \$111,000.

Plates IV-14 and IV-15 present pictorially the proposed improvements at this pumping station.

2. 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 Canal at Prentiss Avenue. Since the station is situated parallel with the flow of the canal, the 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 previous interim modifications to the pump station are proposed to be replaced with new interim components constructed to the higher elevation of 13.4 NGVD 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 13.4 NGVD. The present backflow preventers on each horizontal and centrifugal pump within DPS No. 4 shall remain intact for interim flood protection.

The estimated construction cost for interim floodwalls at DPS No. 4 is estimated at \$86,000.

Plates IV-16 and IV-17 present pictorially the proposed improvements to Pump Station No. 4.

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 anywhere 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 with the existing right-of-way.

Between Leon C. Simon Boulevard and Lake Pontchartrain, an earthen levee can safely be constructed to the required elevation of 12.5 ± on both the east and west levee within existing right-of-way. The only displacements are several shrubs and less than eight trees within this right-of-way. On the east levee, the transition of earthen levee to elevation 17.5 NGVD will require some right-of-way acquisition from the University of New Orleans. The 5 year plan of improvements of UNO includes the construction of a new campus perimeter roadway within the area where this levee would be located. However, the landside berm for the new levee could be used for this proposed roadway and therefore both UNO and the Orleans Levee Board could possibly work together to accomplish all objectives.

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 utility 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 N.O.S.&W.B. 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 new bypass tube. A summary of the existing utilities requiring relocation is shown in Table IV-2.

Construction Priority

The first priority for raising the level of flood protection along London Avenue Canal is to floodproof the existing openings at seven bridges along the canal. These seven bridges listed in their order of stationing are shown in Table IV-1. As seen in this table, the present level of flood protection varies between elevation 4.19 NGVD and elevation 10.03 NGVD. The additional height necessary for required flood protection is as much as 10.31 feet at the Gentilly Boulevard Bridge, making this the top priority item for construction. The other bridges require between 6.33 feet and 2.57 feet of additional height to meet the required flood protection levels necessary under this project.

After the bridges have been modified as discussed above, the levees represent the highest priority for required flood protection. Present levee heights vary between elevation 8.5 and 11.5 NGVD 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 12.6 and transition to elevation 18.0 NGVD in the vicinity of Lake Pontchartrain due to wave runup. Therefore, as much as 6.5 feet is required to be filled by these levees making them a top priority item.

After construction of the levees the sheet piles are to be driven from the levees towards upstream end to achieve a continuous protection along the completed portion. The floodwalls at DPS No. 4 are also raised at this time.

The existing sheet piles from Mirabeau Avenue to 300 feet north of Mirabeau Avenue, on the east side (Reach Ex-VIII-R), are weak (MP-112) and good for a 10 year storm. Therefore, this section is proposed to be improved in Phase I.

The improvement of the segment between Sere Street and 1,600 feet north of Sere Street has been included in Phase I of the project to utilize 1,110 feet of existing 1,790 feet PZ-32 sheet piles removed from the east floodwall between DPS No. 4 and Robert E. Lee Boulevard. The other 680 feet of these piles are used on the east side of the Canal between Robert E. Lee Boulevard and Leon C. Simon Boulevard.

Phase II construction is suggested to begin at Filmore Avenue, continue towards DPS No. 3 and end by raising the wall and levee at DPS No. 3.

Phase III, installation of concrete cap over new sheet piles, may begin and be completed when additional funds are available for this phase. However, it is preferred that capping begin at the north end.

**TABLE IV-1
BRIDGE OPENING AND IMPROVEMENTS**

LOCATION, STRUCTURE DESCRIPTION	STATION	PRESENT OVERTOPPING ELEVATION (NGVD)	REQUIRED PROTECTION ELEVATION (NGVD)	REQUIRED ADDITIONAL HEIGHT (FEET)	ORDER OF PRIORITY
Southern Railroad, Swing Gates	2+20	9.33	15	5.67	3
Benefit Street, Roller Gates	6+70	8.37	14.7	6.33	2
Gentilly Boulevard, Bridge Modification	14+00	4.19	14.5	10.31	1
Mirabeau Avenue, Bridge Modification	70+00	9.27	13.9	4.63	4
Filmore Avenue, Bridge Modification	85+50	9.15	13.6	4.45	5
Robert E. Lee Boulevard, Roller Gate	120+25	8.64	13	4.36	6
Leon C. Simon Boulevard, Bridge Modification	127+30	10.03	12.6	2.57	7

TABLE IV-2

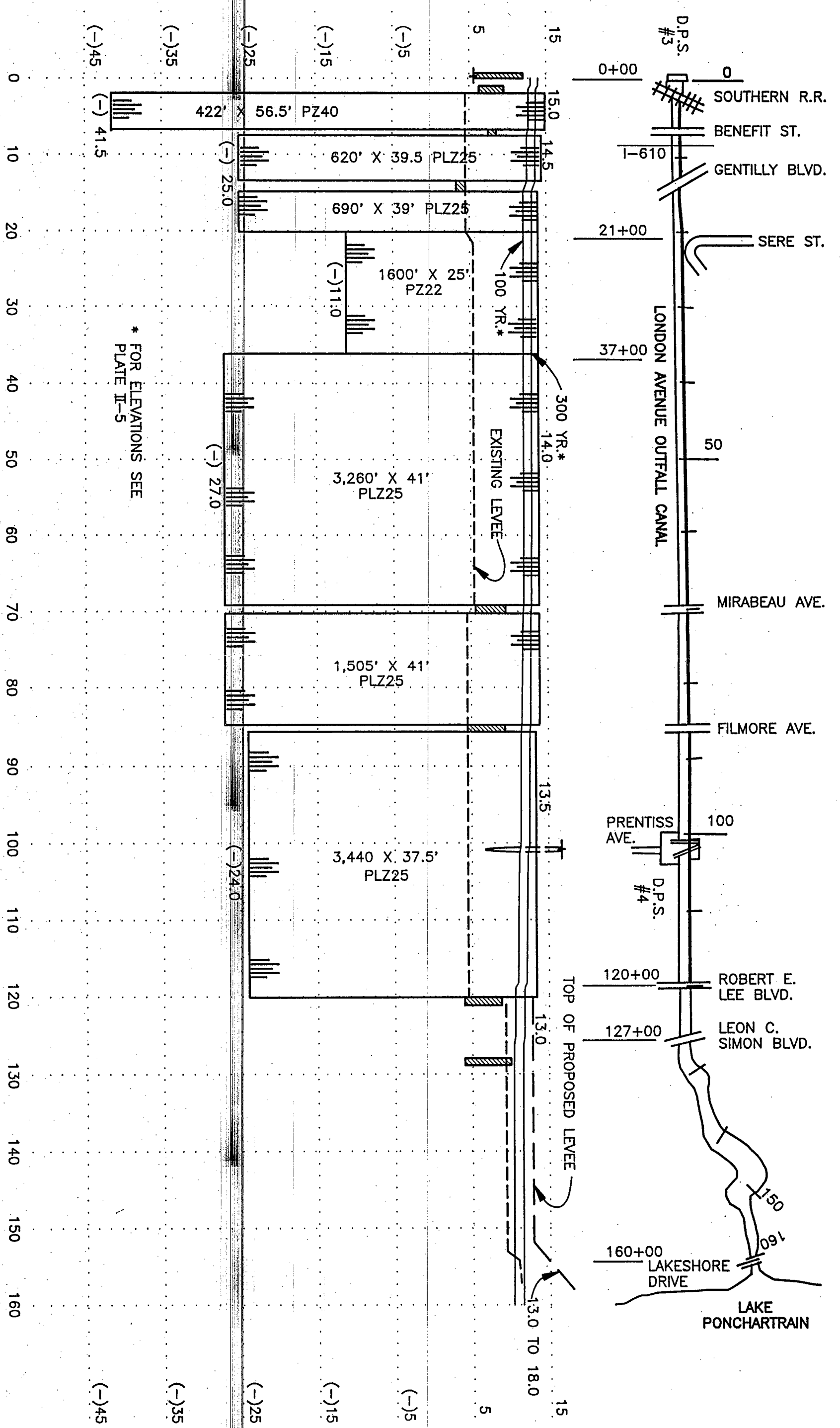
UTILITY RELOCATION SCHEDULE

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 IV-2 (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	N.O.S.& W.B. Primary 25 Cycle Power Cable	To Remain - Relocate where necessary



LONDON AVENUE CANAL FLOODWALLS AND LEVEES
GENERAL DESIGN MEMORANDUM

PROPOSED FLOODWALLS
AND LEVEES
WEST SIDE

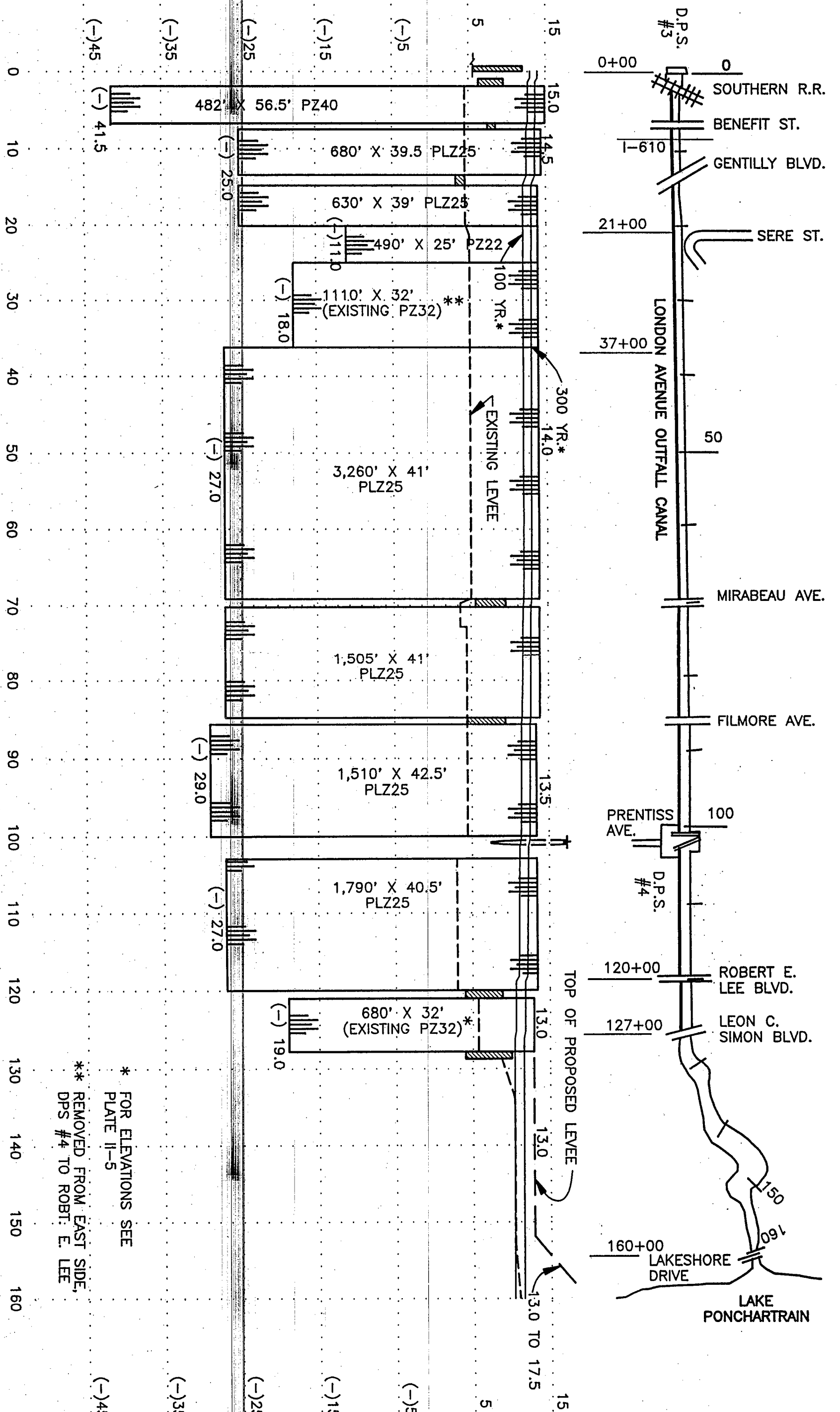
BOARD OF COMMISSIONERS
ORLEANS LEVEL BOARD

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Engineers • Planners • Environmental Scientists
New Orleans, Louisiana

OLB CONTRACT NO. 2049-0269

JOB NO. 8407

PLATE IV-1



* FOR ELEVATIONS SEE PLATE II-5
 ** REMOVED FROM EAST SIDE, DPS #4 TO ROBT. E. LEE

LONDON AVENUE CANAL FLOODWALLS AND LEVEES
 GENERAL DESIGN MEMORANDUM

PROPOSED FLOODWALLS AND LEVEES
 EAST SIDE

BOARD OF COMMISSIONERS
 ORLEANS LEVEE BOARD

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 Engineers • Planners • Environmental Scientists
 New Orleans, Louisiana

OLB CONTRACT NO. 2049-0269

JOB NO. 8407

PLATE IV-2

STATION TO STATION	LOCATION	IMPROVEMENT OR STRUCTURE	LENGTH OF STRUCTURE	PILE CUT OFF ELEVATION	PILE TIP ELEVATION	VERTICAL PILE LENGTH	QUANTITY	UNIT	UNIT COST (\$)	CONSTRUCTION COST (\$)	PHASE
0+00 - 2+10	DPS #3	FLOODWALL	--	--	--	--	LUMP SUM	--	--	111,000.00	II
2+10 - 2+38	SOUTHERN R.R.	FLOOD GATE	--	--	--	--	LUMP SUM	--	--	265,000.00	I
2+38 - 6+60	WEST	PZ 40	422'	15.0	-41.5	56.5'	23,843	SQ. FT.	23.00	548,389.00	II
6+60 - 6+90	BENEFIT ST.	FLOOD GATE	--	--	--	--	LUMP SUM	--	--	275,000.00	I
6+90 - 13+10	WEST	PLZ 25	620'	14.5	-25.0	39.5'	24,490	SQ. FT.	16.00	391,840.00	II
13+10 - 14+10	GENTILLY BLVD.	MODIFY BRIDGE	--	--	--	--	LUMP SUM	--	--	500,000.00	I
14+10 - 21+00	WEST	PLZ 25	690'	14.0	-25.0	39.0'	26,910	SQ. FT.	16.00	430,560.00	II
0+00 - 21+00	EAST & WEST	MISCELLANEOUS	--	--	--	--	LUMP SUM	--	--	113,000.00	II
21+00 - 37+00	WEST	PZ 22	1,600'	14.0	-11.0	25.0'	40,000	SQ. FT.	14.00	560,000.00	I
21+00 - 37+00	EAST & WEST	MISCELLANEOUS	--	--	--	--	LUMP SUM	--	--	27,000.00	I
37+00 - 69+60	WEST	PLZ 25	3,260'	14.0	-27.0	41.0'	133,660	SQ. FT.	16.00	2,138,560.00	II
69+60 - 70+30	MIRABEAU AVE.	MODIFY BRIDGE	--	--	--	--	LUMP SUM	--	--	457,000.00	I
70+30 - 85+35	WEST	PLZ 25	1,505'	14.0	-27.0	41.0'	61,705	SQ. FT.	16.00	987,280.00	II
37+00 - 85+35	EAST & WEST	MISCELLANEOUS	--	--	--	--	LUMP SUM	--	--	505,000.00	II
85+35 - 85+70	FILMORE AVE.	MODIFY BRIDGE	--	--	--	--	LUMP SUM	--	--	361,000.00	I
85+70 - 120+10	WEST	PLZ 25	3,440	13.5	-24.0	37.5'	129,090	SQ. FT.	16.00	2,064,990.00	I
85+35 - 120+10	EAST & WEST	MISCELLANEOUS	--	--	--	--	LUMP SUM	--	--	363,000.00	I
120+10 - 120+40	ROBT. E. LEE BLVD.	FLOOD GATE	--	--	--	--	LUMP SUM	--	--	325,000.00	I
120+40 - 127+20	WEST	LEVEE EMBANK.	680'	--	--	--	15,500	CU. YD.	12.00	186,000.00	I
127+20 - 127+40	L. C. SIMON BLVD.	MODIFY BRIDGE	--	--	--	--	LUMP SUM	--	--	153,000.00	I
127+40 - 160+00	EAST & WEST	LEVEE EMBANK.	3,260'	--	--	--	75,000	CU. YD.	12.00	900,000.00	I

ALL ELEVATIONS ARE NGVD

LONDON AVENUE CANAL FLOODWALLS AND LEVEES
GENERAL DESIGN MEMORANDUM

SUMMARY OF PROPOSED
IMPROVEMENTS
(WEST SIDE AND CROSSINGS)

BOARD OF COMMISSIONERS
ORLEANS LEVEE BOARD

OLB CONTRACT NO. 2049-0269

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

JOB NO. 8407

PLATE IV-3

STATION TO STATION	LOCATION	IMPROVEMENT OR STRUCTURE	LENGTH OF STRUCTURE	PILE CUT OFF ELEVATION	PILE TIP ELEVATION	VERTICAL PILE LENGTH	QUANTITY	UNIT	UNIT COST (\$)	CONSTRUCTION COST (\$)	PHASE
0+00 - 1+40	DPS #3	*	--	--	--	--	--	--	--	*	*
1+40 - 1+78	SOUTHERN R.R.	*	--	--	--	--	--	--	--	*	*
1+78 - 6+60	EAST	PZ 40	482'	15.0	-41.5	56.5'	27,233	SQ. FT.	23.00	626,359.00	II
6+60 - 6+90	BENEFIT ST.	*	--	--	--	--	--	--	--	*	*
6+90 - 13+70	EAST	PLZ 25	680'	14.5	-25.0	39.5'	26,860	SQ. FT.	16.00	429,760.00	II
13+70 - 14+70	GENTILLY BLVD.	*	--	--	--	--	--	--	--	*	*
14+70 - 21+00	EAST	PLZ 25	630'	14.0	-25.0	39.0'	24,570	SQ. FT.	16.00	393,120.00	I
21+00 - 25+90	EAST	PZ 22	490'	14.0	-11.0	25.0'	12,250	SQ. FT.	14.00	171,500.00	I
25+90 - 37+00	EAST	PZ 32 **	1,110'	14.0	-18.0	32.0'	1,110	LN. FT.	100.00	111,000.00	I
37+00 - 69+60	EAST	PLZ 25	3,260'	14.0	-27.0	41.0'	133,660	SQ. FT.	16.00	2,138,560.00	II
69+60 - 70+30	MIRABEAU AVE.	*	--	--	--	--	--	--	--	*	*
70+30 - 73+30	EAST	PLZ 25	300'	14.0	-27.0	41.0'	12,300	SQ. FT.	16.00	196,800.00	I
73+30 - 85+35	EAST	PLZ 25	1,205'	14.0	-27.0	41.0'	49,405	SQ. FT.	16.00	790,480.00	II
85+35 - 85+70	FILMORE AVE.	*	--	--	--	--	--	--	--	*	*
85+70 - 100+80	EAST	PLZ 25	1,510	13.5	-29.0	42.5'	64,175	SQ. FT.	16.00	1,026,800.00	I
100+80 - 102+20	DPS #4	FLOODWALL	--	--	--	--	LUMP SUM	--	--	86,000.00	I
102+20 - 120+10	EAST	PLZ 25	1,790	13.5	-27.0	40.5'	72,495	SQ. FT.	16.00	1,159,920.00	I
120+10 - 120+40	ROBT. E. LEE BLVD.	*	--	--	--	--	--	--	--	*	*
120+40 - 127+20	EAST	PZ 32 **	680'	13.0	-19.0	32.0'	680	LN. FT.	70.00	47,600.00	I
127+20 - 127+40	L. C. SIMON BLVD.	*	--	--	--	--	--	--	--	*	*
127+40 - 160+00	EAST & WEST	*	--	--	--	--	--	--	--	*	*
0+00 - 127+20	EAST & WEST	CONCRETE CAP	24,700'	--	--	--	LUMP SUM	--	--	7,149,800.00	III

ALL ELEVATIONS ARE NGVD

* SEE PLATE IV-3

** USING EXISTING PZ 32 SHEET PILES REMOVED FROM REACH EX-XI-R (DPS #4 TO ROBT. E. LEE BLVD., EAST)

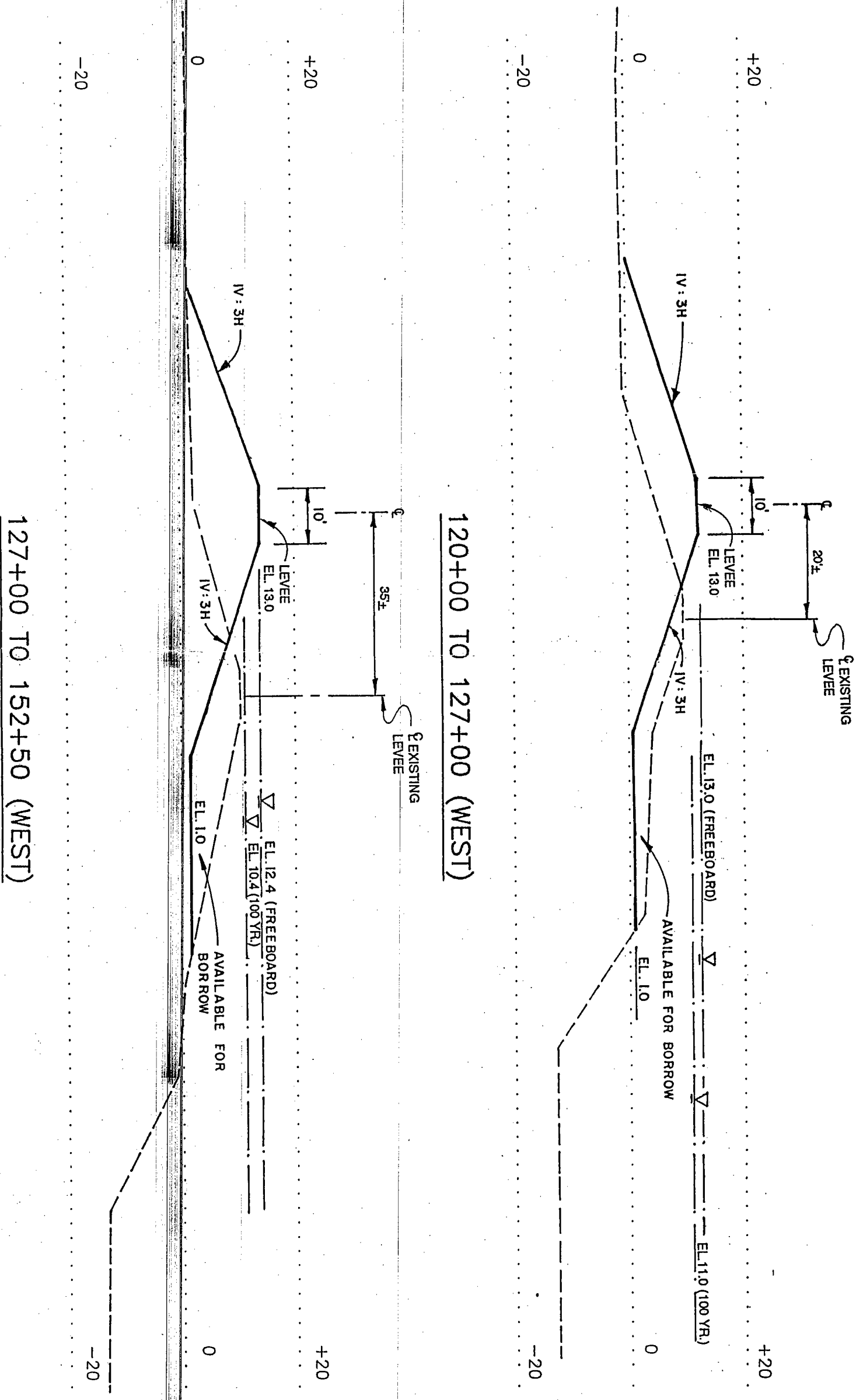
PHASE	CONSTRUCTION COST (\$)	TOTAL COST (\$)
I	9,235,620.00	11,867,771.70
II	9,603,908.00	12,341,021.78
III	7,149,800.00	9,187,493.00

TOTAL COST (\$) = CONSTRUCTION COST (\$) X 1.285

SUMMARY OF PROPOSED IMPROVEMENTS (EAST SIDE AND PHASE III)

<p>LONDON AVENUE CANAL FLOODWALLS AND LEVEES GENERAL DESIGN MEMORANDUM</p>	<p style="text-align: center;">BOARD OF COMMISSIONERS ORLEANS LEVEE BOARD</p> <p>OLB CONTRACT NO. 2049-0269</p>
	<p>Burk & Associates, Inc. Engineers • Planners • Environmental Scientists New Orleans, Louisiana</p>

JOB NO. 8407 PLATE IV-4



LONDON AVENUE CANAL FLOODWALLS AND LEVEES
GENERAL DESIGN MEMORANDUM

TYPICAL LEVEE SECTIONS
STA. 120+00 TO STA. 152+50
WEST SIDE

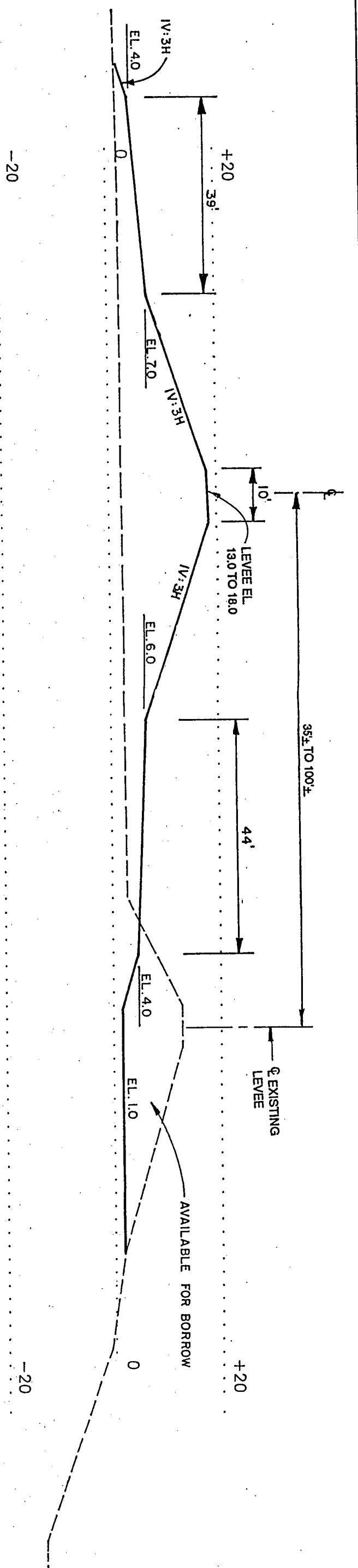
BOARD OF COMMISSIONERS
ORLEANS LEVEE BOARD

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

OLB CONTRACT NO. 2049-0269

JOB NO. 8407

PLATE IV-5



152+50 TO LAKE (WEST)
(TRANSITION)

LONDON AVENUE CANAL FLOODWALLS AND LEVEES
GENERAL DESIGN MEMORANDUM

TYPICAL LEVEE SECTIONS
STA. 152+50 TO LAKE
WEST SIDE

BOARD OF COMMISSIONERS
ORLEANS LEVEE BOARD

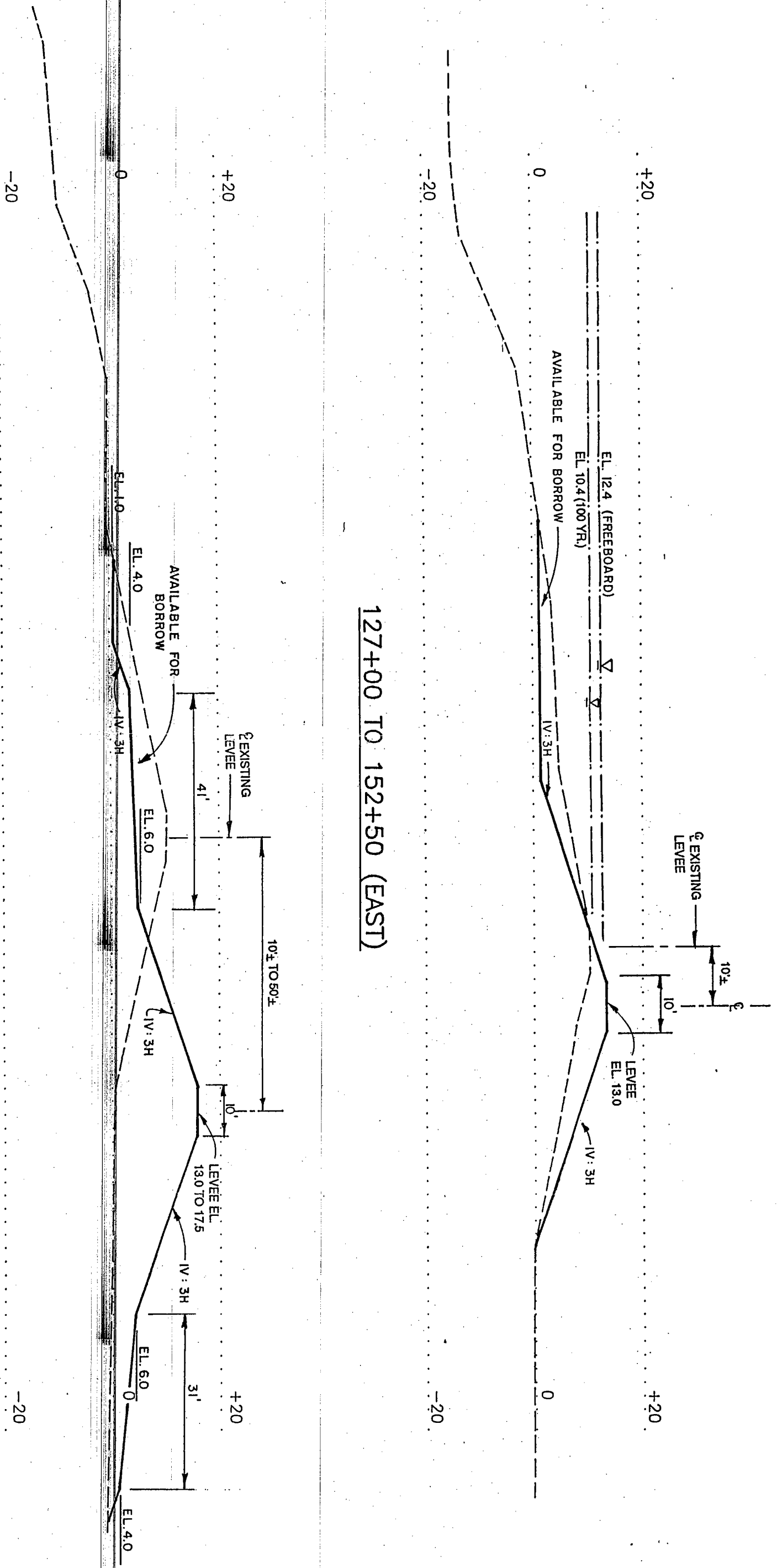
Burk & Associates, Inc.
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New Orleans, Louisiana

OLB CONTRACT NO. 2049-0269

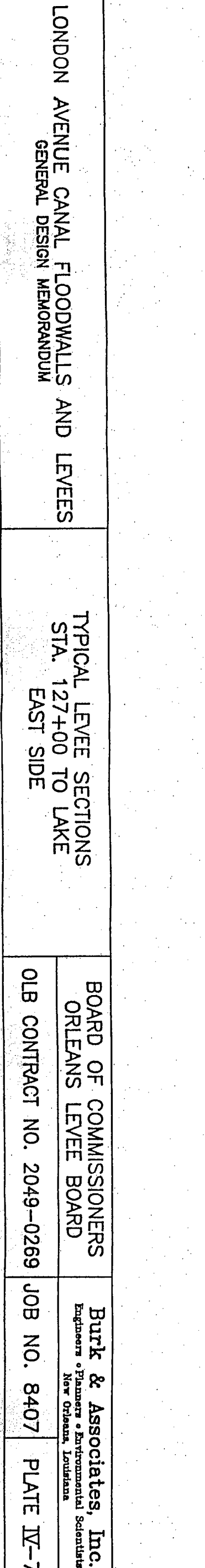
JOB NO. 8407

PLATE IV-6

127+00 TO 152+50 (EAST)



152+50 TO LAKE (EAST)
TRANSITION



LONDON AVENUE CANAL FLOODWALLS AND LEVEES
GENERAL DESIGN MEMORANDUM

TYPICAL LEVEE SECTIONS
STA. 127+00 TO LAKE
EAST SIDE

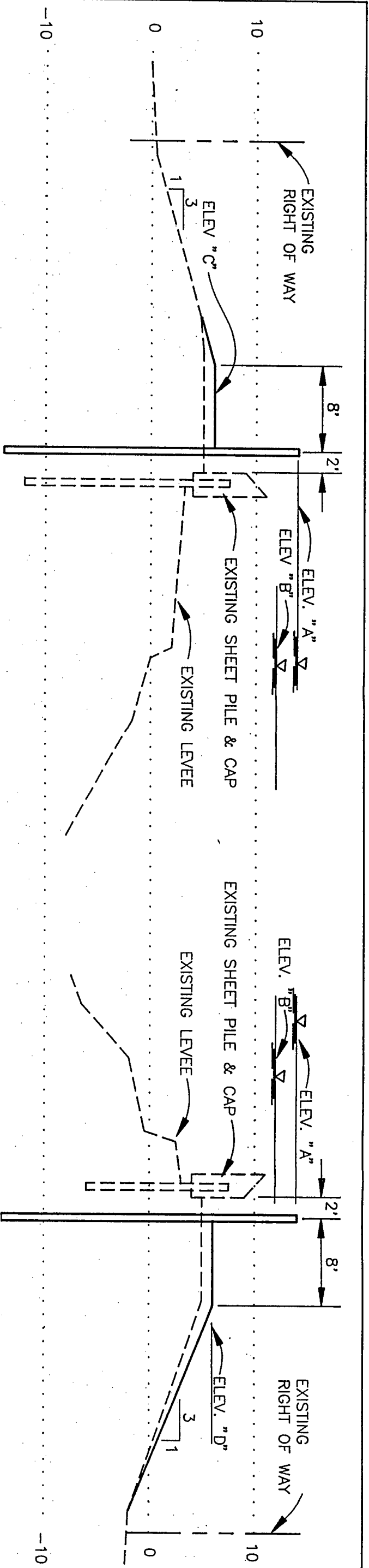
BOARD OF COMMISSIONERS
ORLEANS LEVEE BOARD

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New Orleans, Louisiana

OLB CONTRACT NO. 2049-0269

JOB NO. 8407

PLATE IV-7

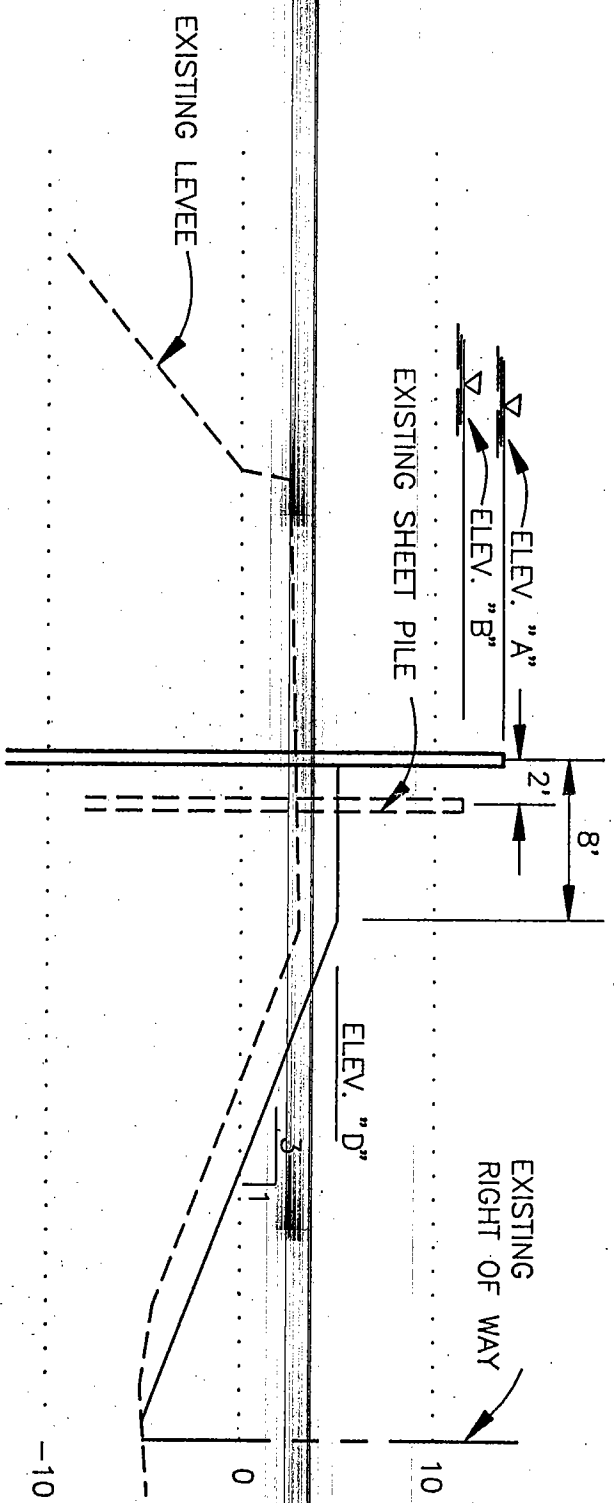


TYPICAL SECTION
SOUTHERN R.R. TO ROBERT E. LEE BLVD.
(WEST SIDE)

TYPICAL SECTION
DPS #3 TO DPS #4
ROBERT E. LEE BLVD. TO LEON C. SIMON BLVD.
(EAST SIDE)

LOCATION	ELEV. "A" * TOP OF SHEET PILE ELEV.	ELEV. "B" * 100 YEAR STORM ELEV.	ELEV. "C" WEST LEVEE ELEV.	ELEV. "D" EAST LEVEE ELEV.
DPS#3 - S. RAILROAD S. RAILROAD - BENEFIT	15.0	13.0	15.0 *	12.6
BENEFIT - GENTILLY	15.0	13.0	5.0	5.0
GENTILLY - STA. 21+00	14.5	12.5	5.0	5.0
STA. 21+00 - STA. 37+00	14.0	12.0	5.0	5.0
STA. 37+00 - STA. 58+00	14.0	12.0	7.0	7.0
STA. 58+00 - MIRABEAU	14.0	12.0	6.0	6.0
MIRABEAU - FILMORE	14.0	12.0	6.0	6.0
FILMORE - DPS#4	14.0	12.0	6.0	6.0
DPS#4 - ROBERT E. LEE	13.5	11.5	6.0	5.0
ROBERT E. LEE - L.C. SIMON	13.0	11.0	13.0 ***	5.5

* ELEV. "A" = ELEV. "B" + 2' FREEBOARD MINIMUM.
** SEE DPS #3 DETAILS
*** NO SHEET PILES ON WEST SIDE



TYPICAL SECTION
DPS #4 TO ROBERT E. LEE BLVD.
(EAST SIDE)

LONDON AVENUE CANAL FLOODWALLS AND LEVEES
GENERAL DESIGN MEMORANDUM

TYPICAL SECTIONS
SHEET PILE I-WALLS

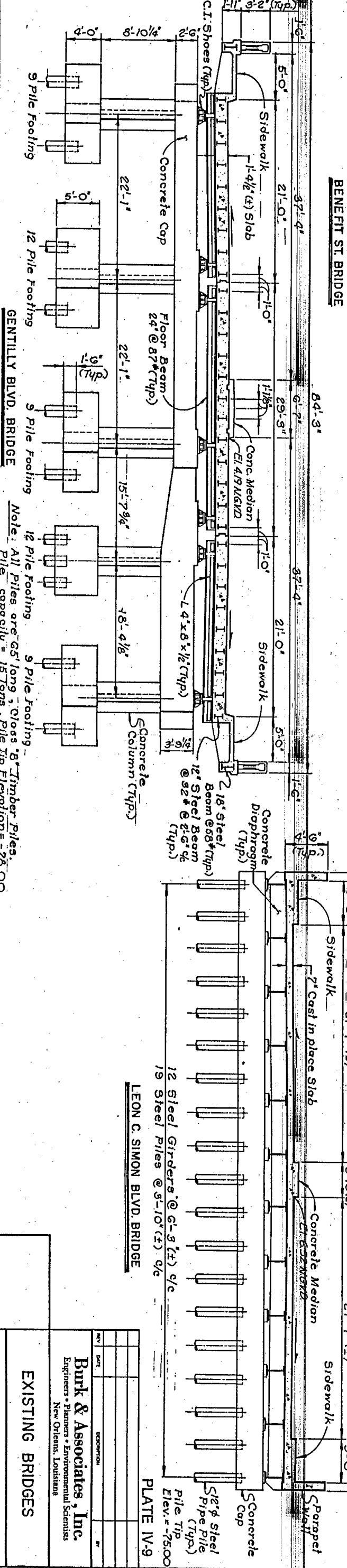
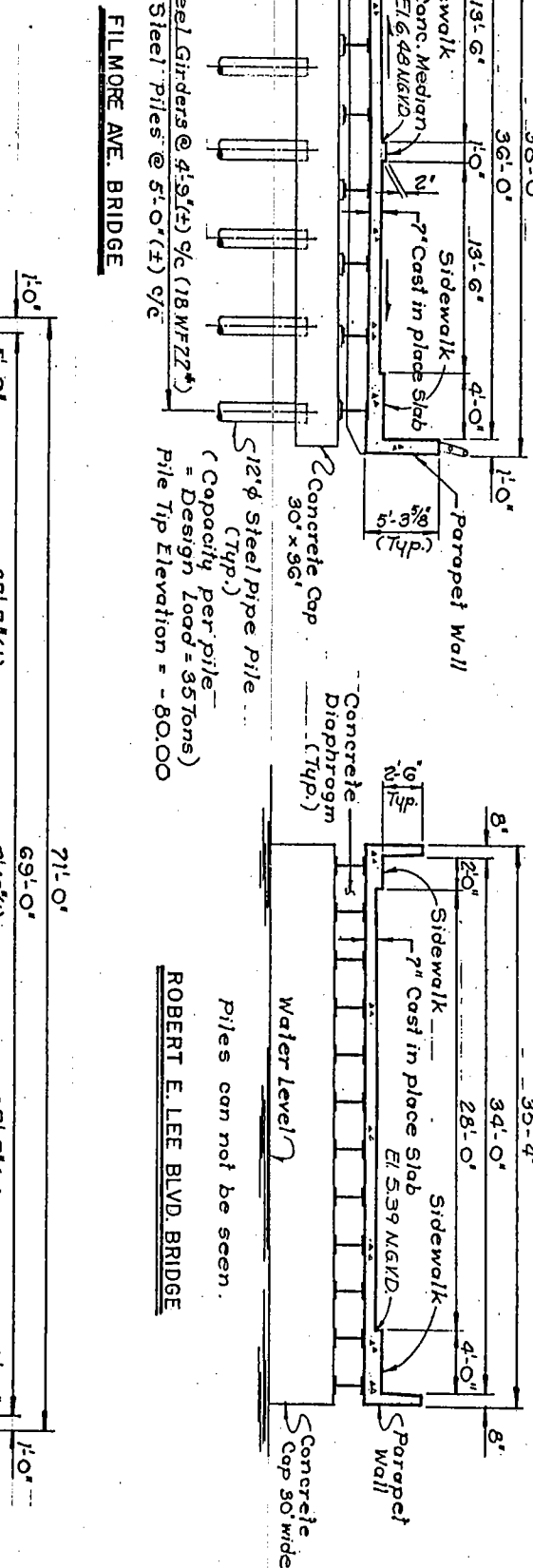
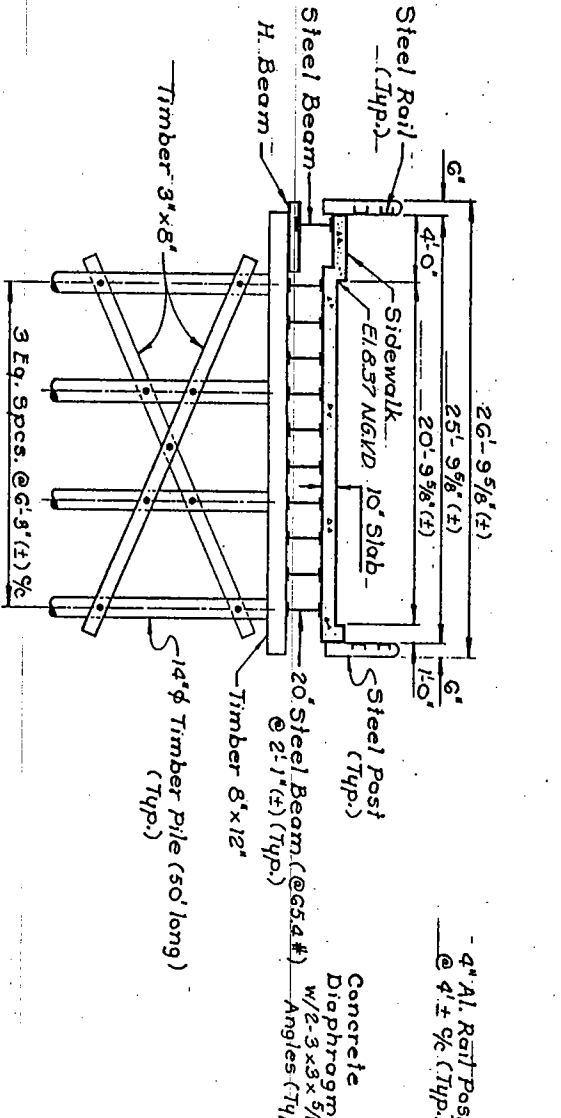
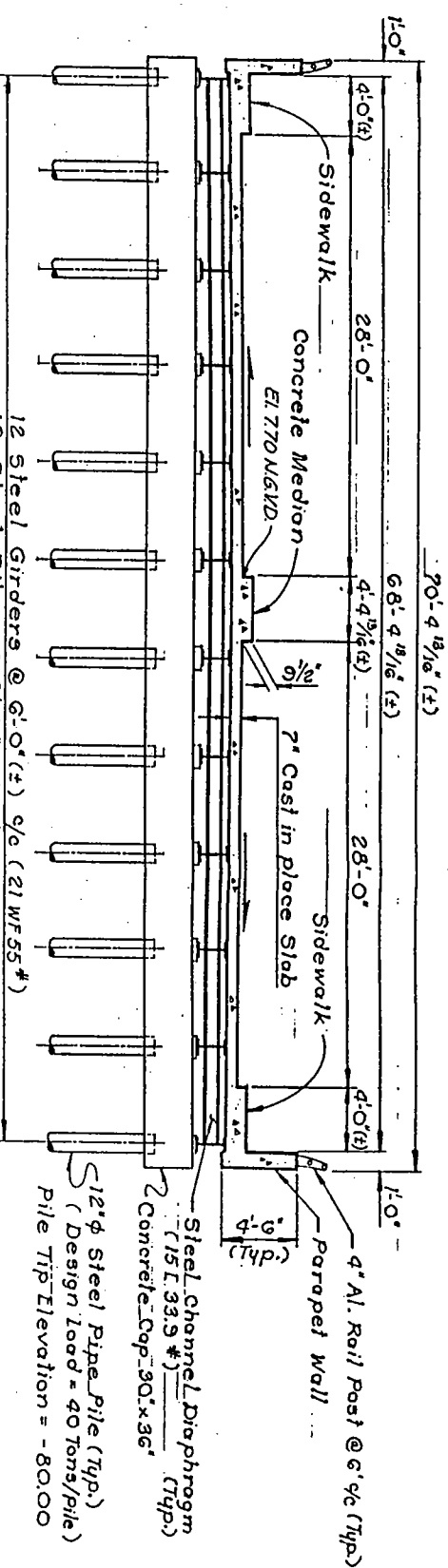
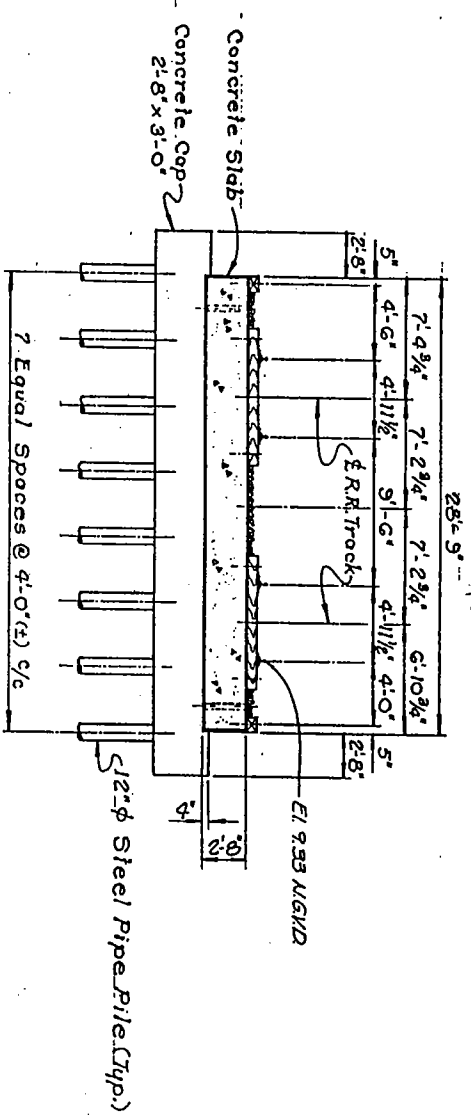
BOARD OF COMMISSIONERS
ORLEANS LEVEE BOARD

OLB CONTRACT NO. 2049-0269

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

JOB NO. 8407

PLATE IV-8



NOTE: All Piles are 65' long, Gross 8" Timber Piles. Pile Capacity = 15 tons, Pile Tip Elevation = -78.00

LONDON AVE. CANAL FLOODWALLS AND LEVEES
 GENERAL DESIGN MEMORANDUM
 ORLEANS LEVEL BOARD CONTRACT NO. 2049 - 0269

BOARD OF LEVEE COMMISSIONERS
ORLEANS LEVEE BOARD

NO.	DATE	DESCRIPTION

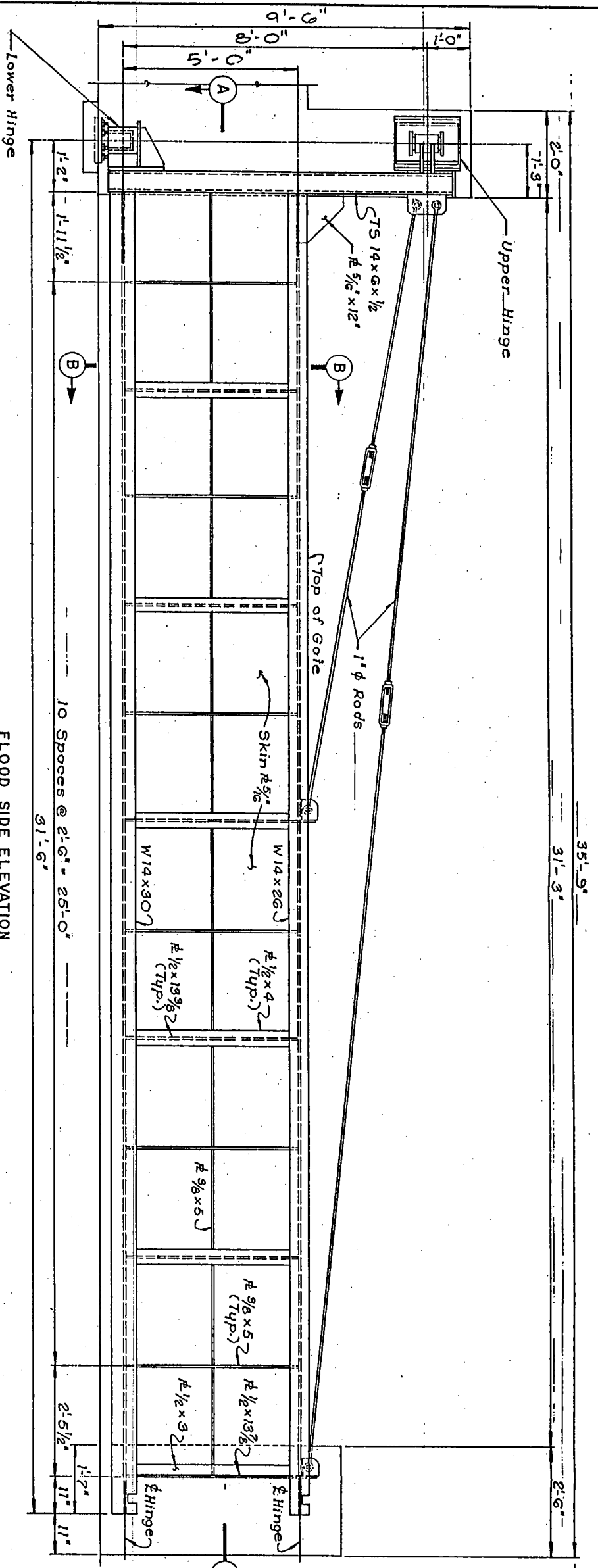
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EXISTING BRIDGES

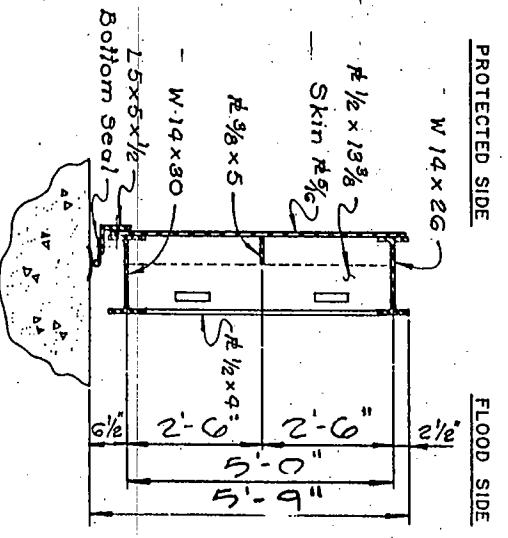
NO.	DATE	DESCRIPTION

TYPICAL SECTIONS

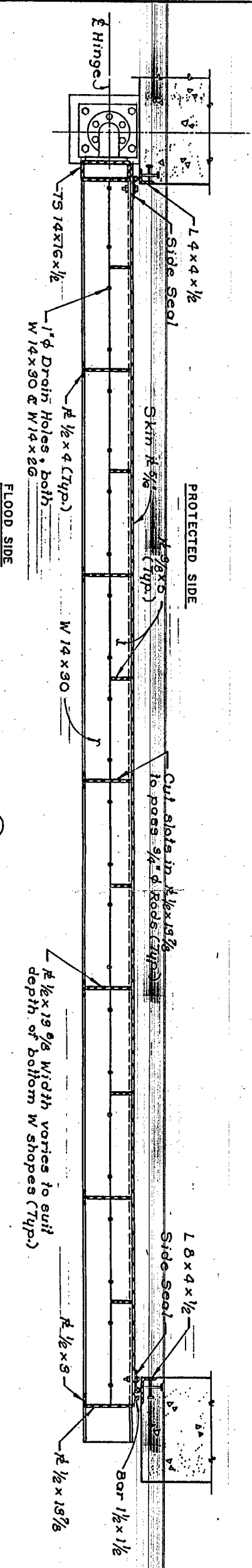
APPROXIMATE	SCALE	DATE
8407	3/16" = 1'-0"	



FLOOD SIDE ELEVATION



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



SECTION (A)

PLATE IV-10

LONDON AVE. CANAL FLOODWALLS AND LEVEES

GENERAL DESIGN MEMORANDUM

ORLEANS LEVEE BOARD CONTRACT NO. 2049-0269

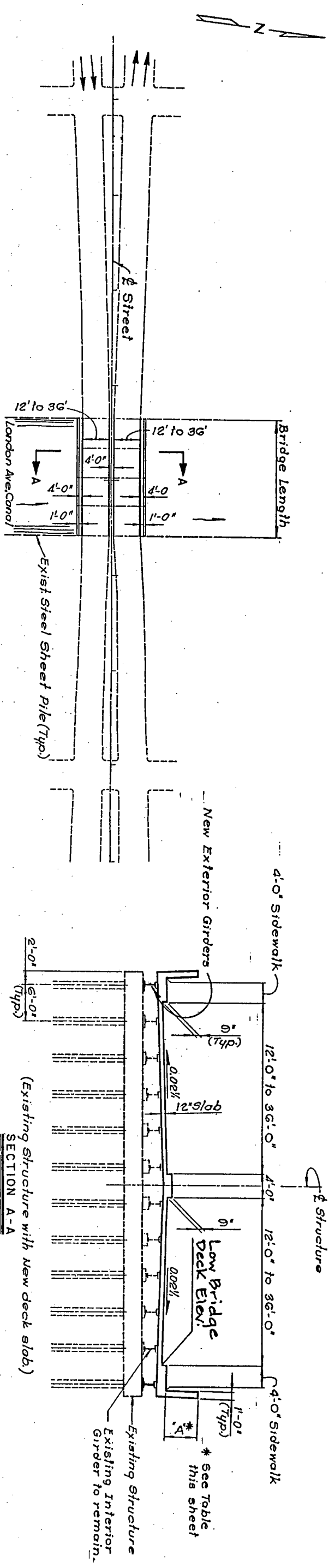
BOARD OF LEVEE COMMISSIONERS
ORLEANS LEVEE BOARD

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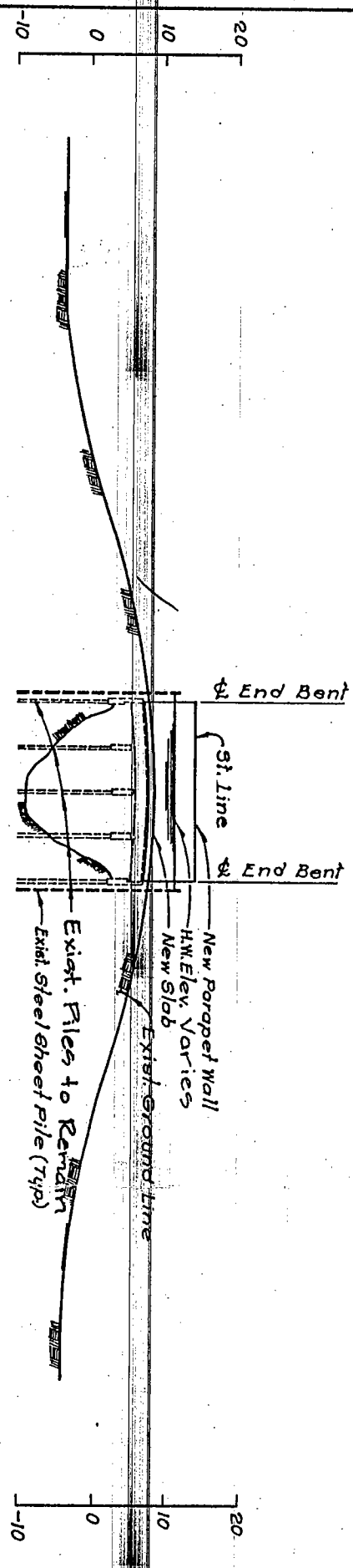
RAILROAD CROSSING
OVER LONDON AVE. CANAL
SWING GATE
GATE DETAILS

DATE	REVISION	BY

DESIGNED BY	DATE	SCALE
8407	02/86	1" = 1'
CHECKED BY	DATE	SCALE



BRIDGE	LOW BRIDGE DECK ELEV.	PARAPHET WALL ELEV.	DIMENSION "A" (MINIMUM)
GENTILLY BLVD. BRIDGE	4.19	14.5	9'-7"
MIRABEAU AVE. BRIDGE	7.70	13.9	5'-6"
FILMORE AVE. BRIDGE	6.48	13.6	6'-5"
LEON C. SIMON BLVD. BRIDGE	6.52	12.6	5'-4"



For Existing Sections 2, see Plate IV-2.

PLATE IV-11

ELEVATION

REV	DATE	DESCRIPTION	BY

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New Orleans, Louisiana

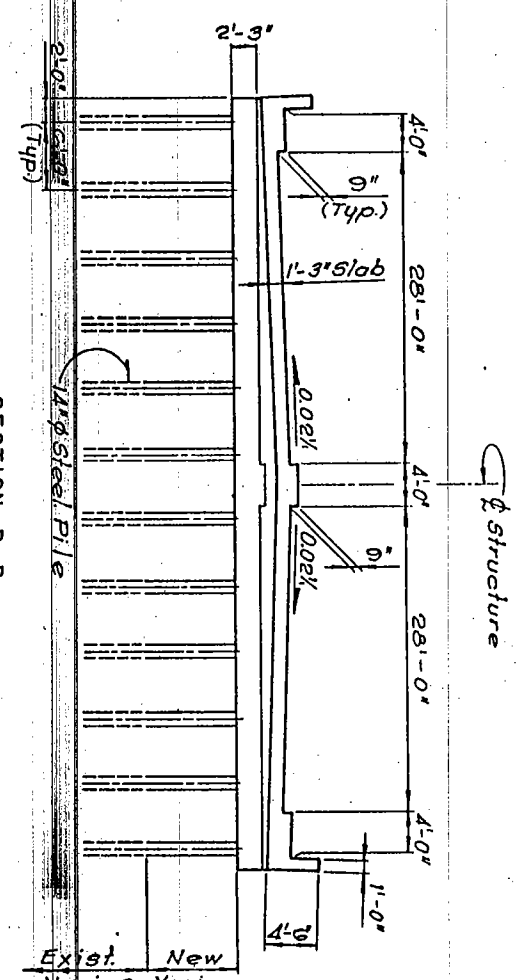
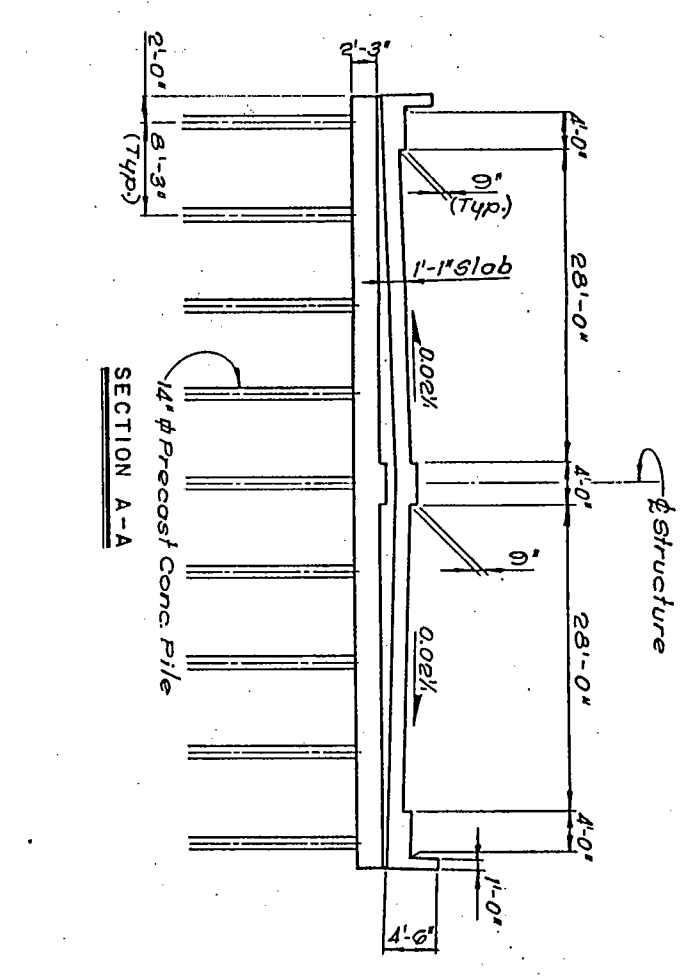
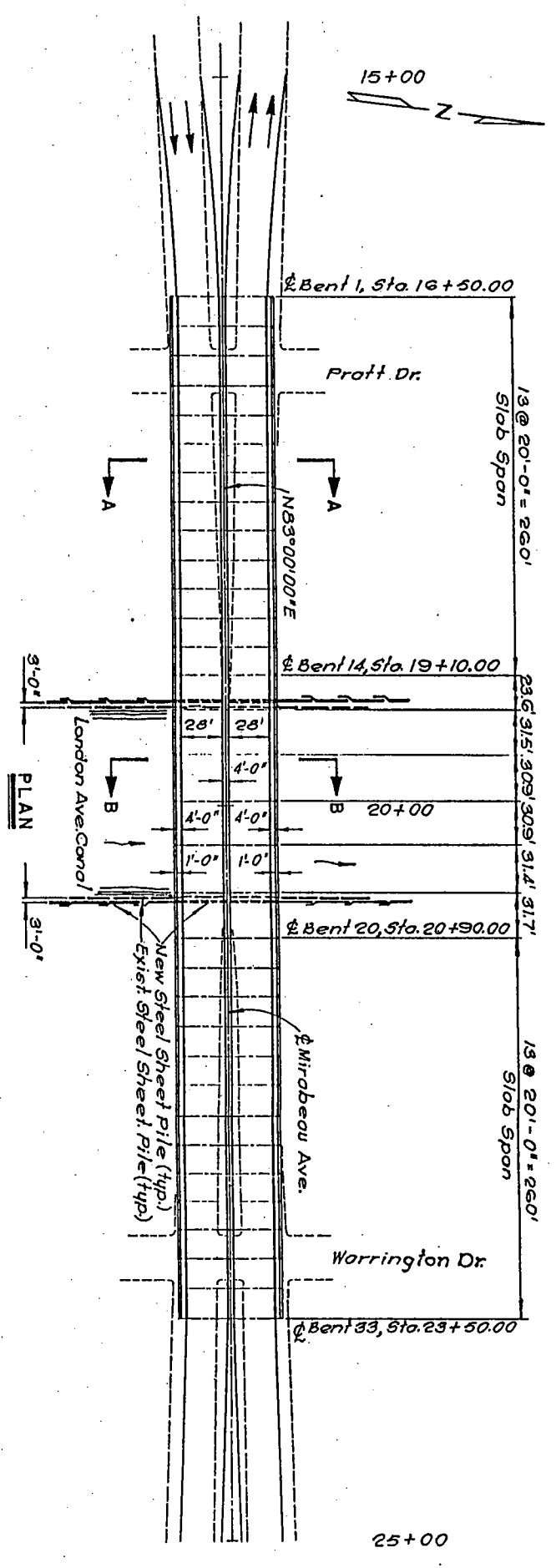
BRIDGE MODIFICATIONS (ALTERNATE 1)

TYPICAL DETAILS

PROJECT	8407	DATE	JAN 17, 63	SHEET NO.	1 of 1
DESIGNED BY	D.W.K.	CHECKED BY	A.S.B.	DATE	JAN 17, 63
DRAWN BY	O.P.	DATE	JAN 17, 63	PROJECT NO.	8407
SCALE	AS SHOWN	DATE	JAN 17, 63	PROJECT NO.	8407

LONDON AVE. CANAL FLOODWALLS AND LEVEES
GENERAL DESIGN MEMORANDUM

BOARD OF LEVEE COMMISSIONERS
ORLEANS LEVEE BOARD
ORLEANS LEVEE BOARD CONTRACT NO. 2049-0269



This Alternate is not Proposed for Any Crossings. Details shown are for Mirabeau Ave. Others are similar.

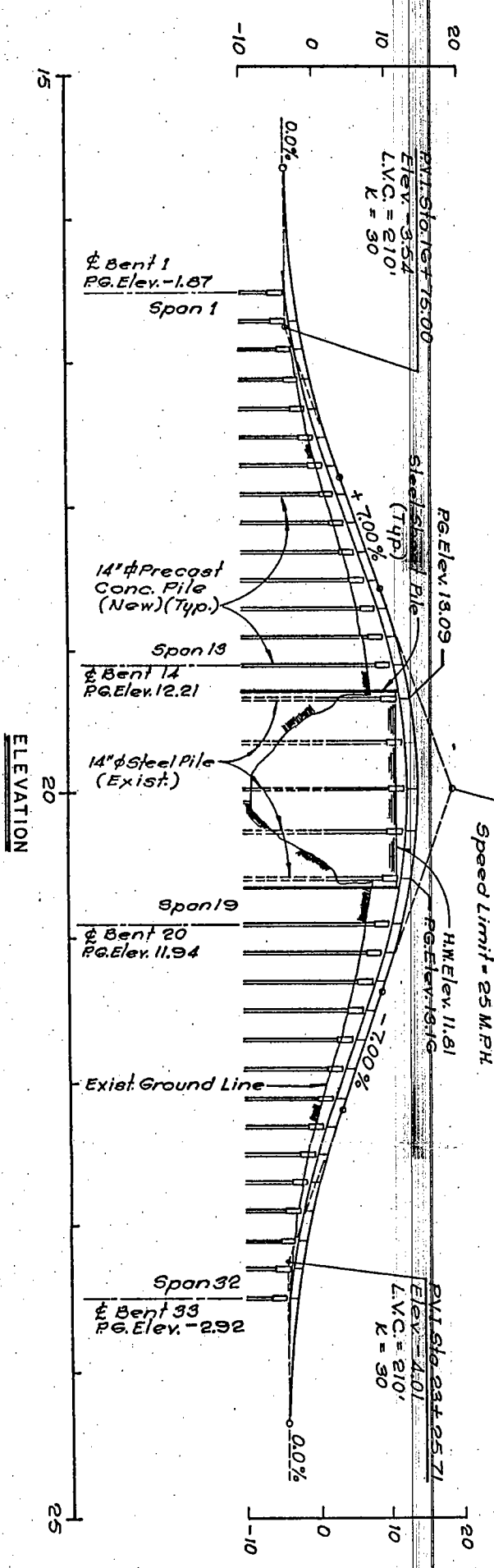


PLATE IV-12

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 New Orleans, Louisiana

**NEW BRIDGE
 (ALTERNATE 2)**

TYPICAL DETAILS

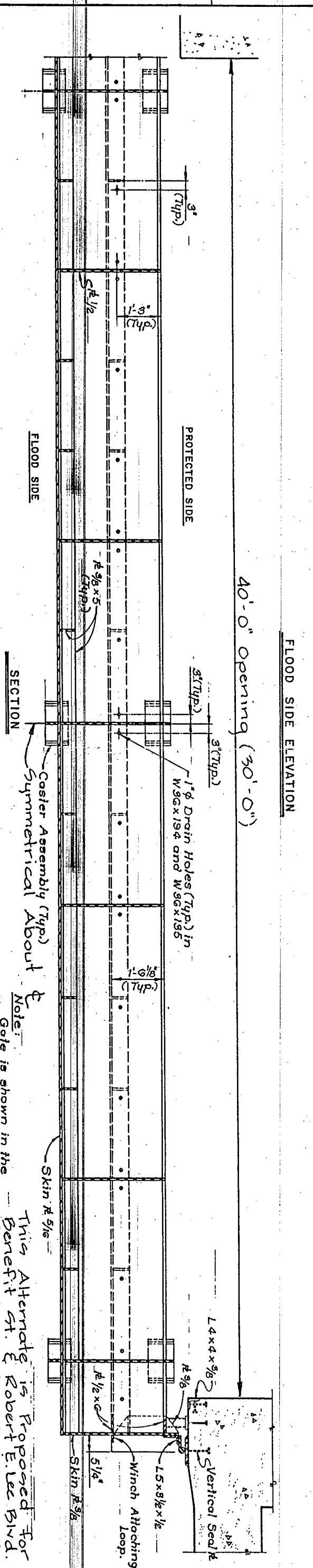
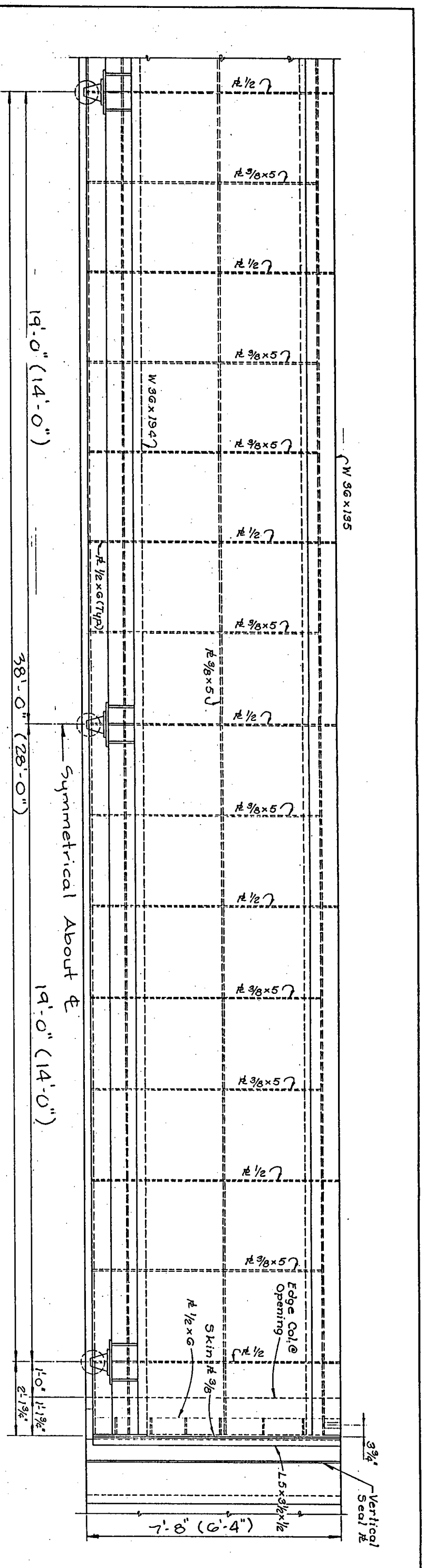
DESIGNED BY	DR. J. W. K.	CHECKED BY	J. S. J.
DATE	NOV. 1968	DATE	JAN. 1969
PROJECT NO.	8407	SCALE	1" = 1'
APPROVED BY			
REVISION			

LONDON AVE. CANAL FLOODWALLS AND LEVEES

GENERAL DESIGN MEMORANDUM

ORLEANS LEVEE BOARD CONTRACT NO. 2049-0269

BOARD OF LEVEE COMMISSIONERS
 ORLEANS LEVEE BOARD



Note:
Gate is shown in the closed position.

This Alternate is Proposed for Benefit of Robert E. Lee Blvd. Dimensions shown in Parentheses are for Benefit of Crossing.

PLATE IV-13

REV	DATE	DESCRIPTION	BY

Burk & Associates, Inc.
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New Orleans, Louisiana

**FLOOD GATE
(ALTERNATE 3)**

**FLOOD ROLLER GATE
GATE DETAILS**

NO.	DATE	DESCRIPTION	BY

DESIGNED BY: K.M.K. DATE: 02/86
CHECKED BY: L.V.B. DATE: 02/86
DRAWN BY: M.G.J. DATE:

LONDON AVE. CANAL FLOODWALLS AND LEVEES

GENERAL DESIGN MEMORANDUM

ORLEANS LEVEE BOARD CONTRACT NO. 2049-0269

BOARD OF LEVEE COMMISSIONERS
ORLEANS LEVEE BOARD

NO.	DATE	DESCRIPTION	BY

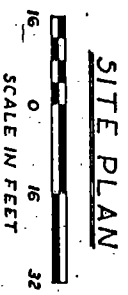
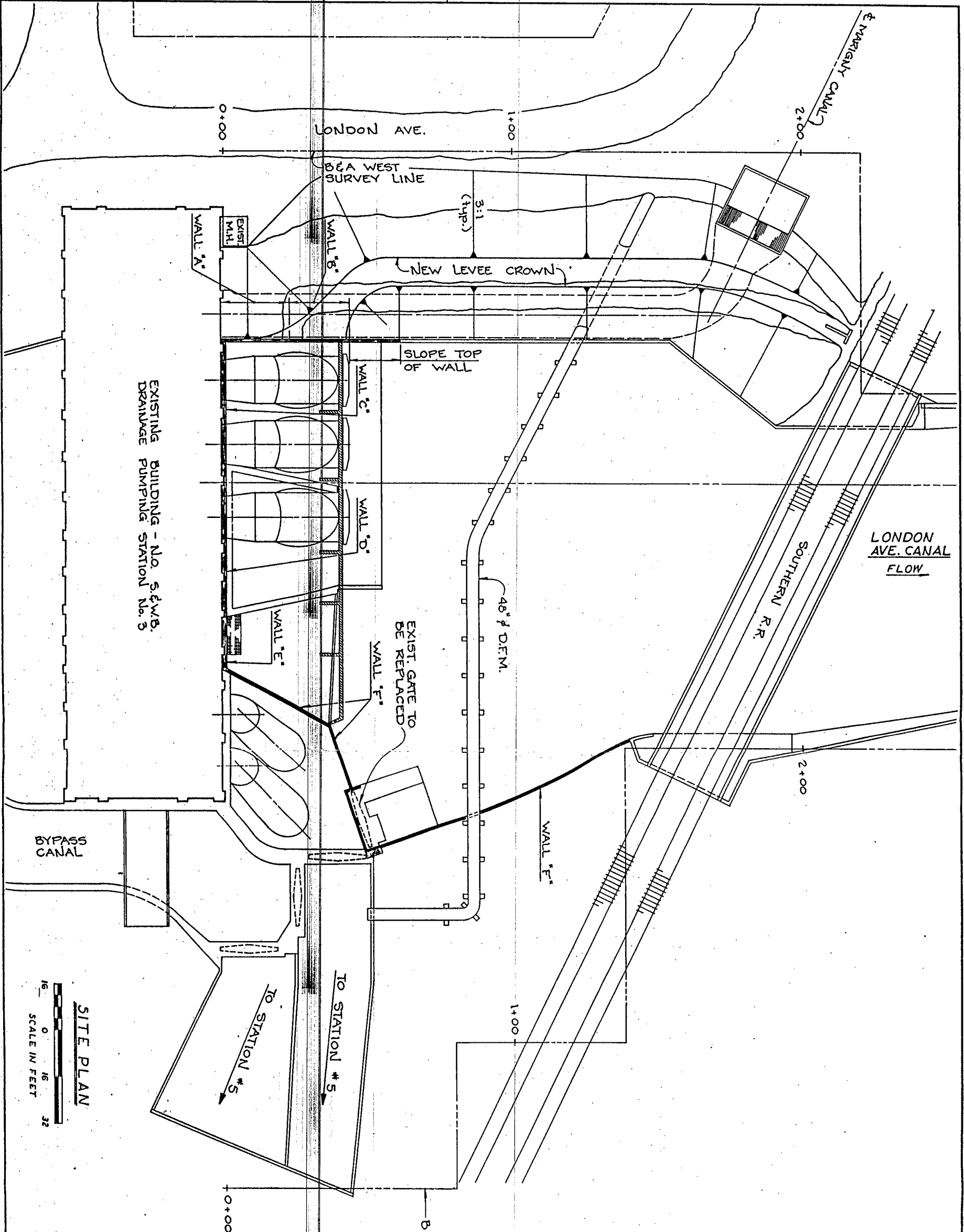
DESIGNED BY: K.M.K. DATE: 02/86
CHECKED BY: L.V.B. DATE: 02/86
DRAWN BY: M.G.J. DATE:

LONDON AVE. CANAL FLOODWALLS AND LEVEES

GENERAL DESIGN MEMORANDUM

ORLEANS LEVEE BOARD CONTRACT NO. 2049 - 0269

BOARD OF LEVEE COMMISSIONERS
ORLEANS LEVEE BOARD



LEGEND
 [Solid black bar] PHASE II INTERIM PROTECTION
 [Hatched bar] PHASE III PERMANENT PROTECTION

PLATE IV-14

Burk & Associates, Inc.
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 New Orleans, Louisiana

DRAINAGE PUMPING STATION NO. 3

SITE PLAN

NO.	DATE	DESCRIPTION	BY

DATE	04/07	DESIGNED BY	J.M.C.	SCALE	AS SHOWN	SHEET NO.	1 OF 2
REVISION		CHECKED BY	V.A.C./E.M.S.	DATE	4/05		
APPROVED		CHECKED	M.A.G./J.T.	FILE NO.			

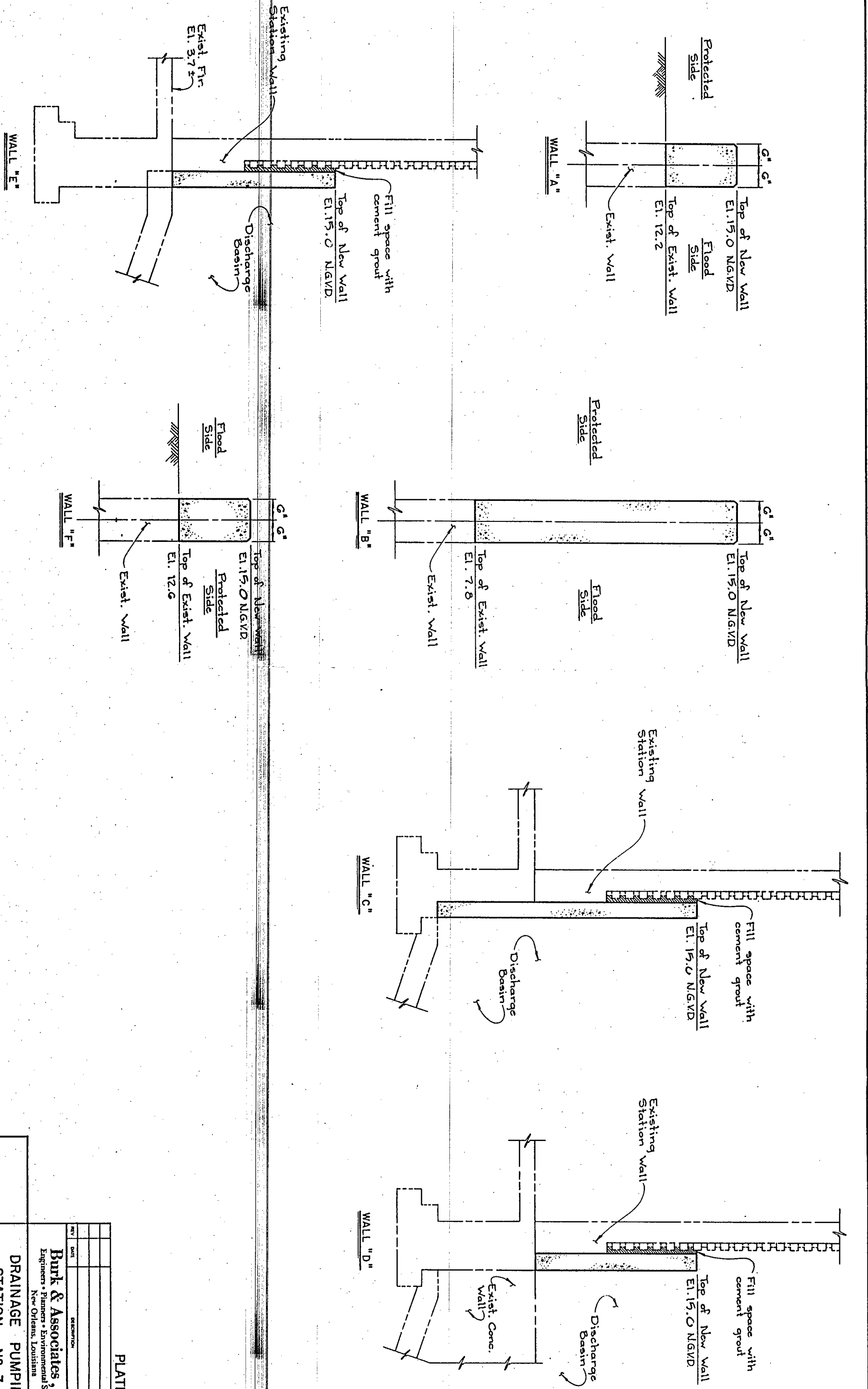


PLATE IV-15

Burk & Associates, Inc.
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 New Orleans, Louisiana

DRAINAGE PUMPING STATION NO 3

REV.	DATE	DESCRIPTION	BY

TYPICAL SECTIONS

JOB NO.	6407	DRAWN BY	J.M.C.	CHECKED BY	C.H.S.	DATE	4/80	SHEET NO.	2 of 2
APPROVED BY		PROJECT	M.O.L.	FILE NO.					

LONDON AVE. CANAL FLOODWALLS AND LEVEES

GENERAL DESIGN MEMORANDUM

ORLEANS LEVEE BOARD CONTRACT NO. 2049-0269

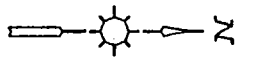
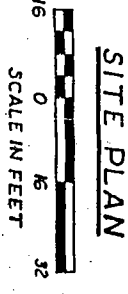
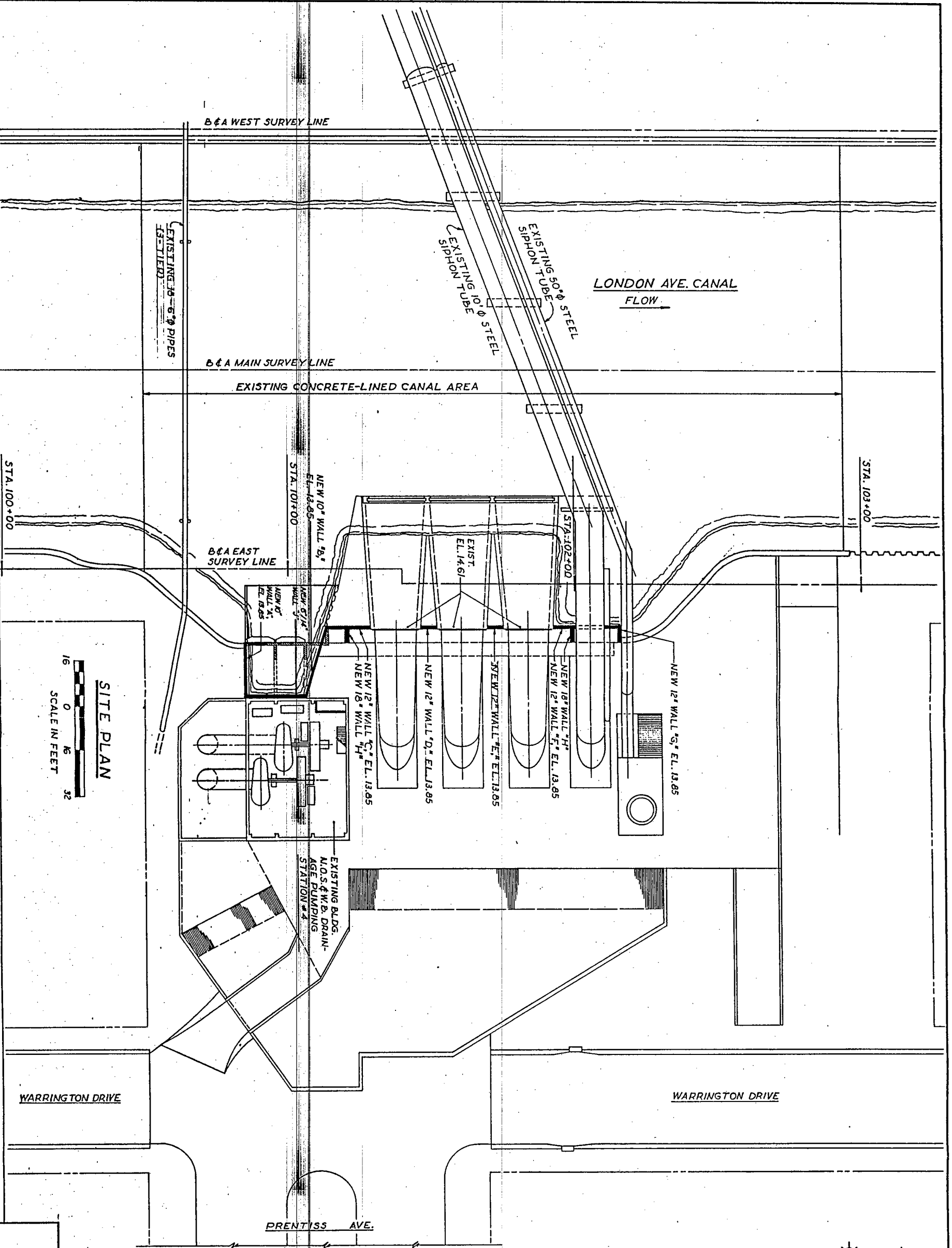
BOARD OF LEVEE COMMISSIONERS
 ORLEANS LEVEE BOARD

LONDON AVE. CANAL FLOODWALLS AND LEVEES

GENERAL DESIGN MEMORANDUM

ORLEANS LEVEL BOARD CONTRACT NO. 2049-0269

BOARD OF LEVEE COMMISSIONERS
ORLEANS LEVEL BOARD



LEGEND
 [Hatched Box] PHASE II INTERIM PROTECTION
 [Solid Box] PHASE III PERMANENT PROTECTION

PLATE IV-16

Burk & Associates, Inc.
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New Orleans, Louisiana

DRAINAGE PUMPING STATION NO 4

SITE PLAN

NO. 8407	DATE 4/86	SCALE 1/8" = 1'-0"	SHEET NO. 1 OF 2
DESIGNED BY W.K.	CHECKED BY M.D.J.	DATE 4/86	
PROJECT NO. 8407	PROJECT NAME		

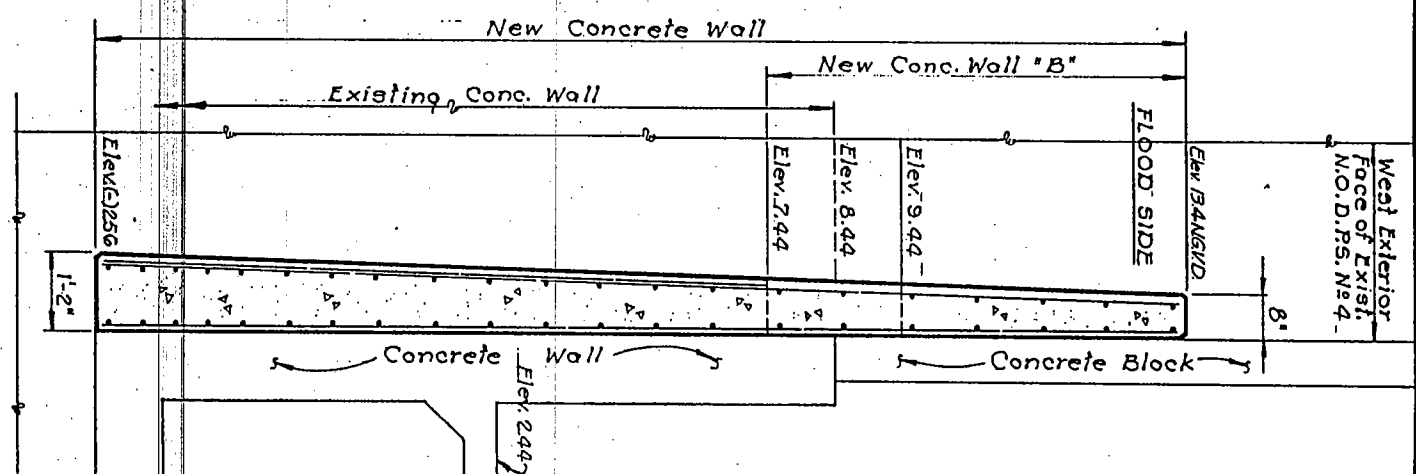
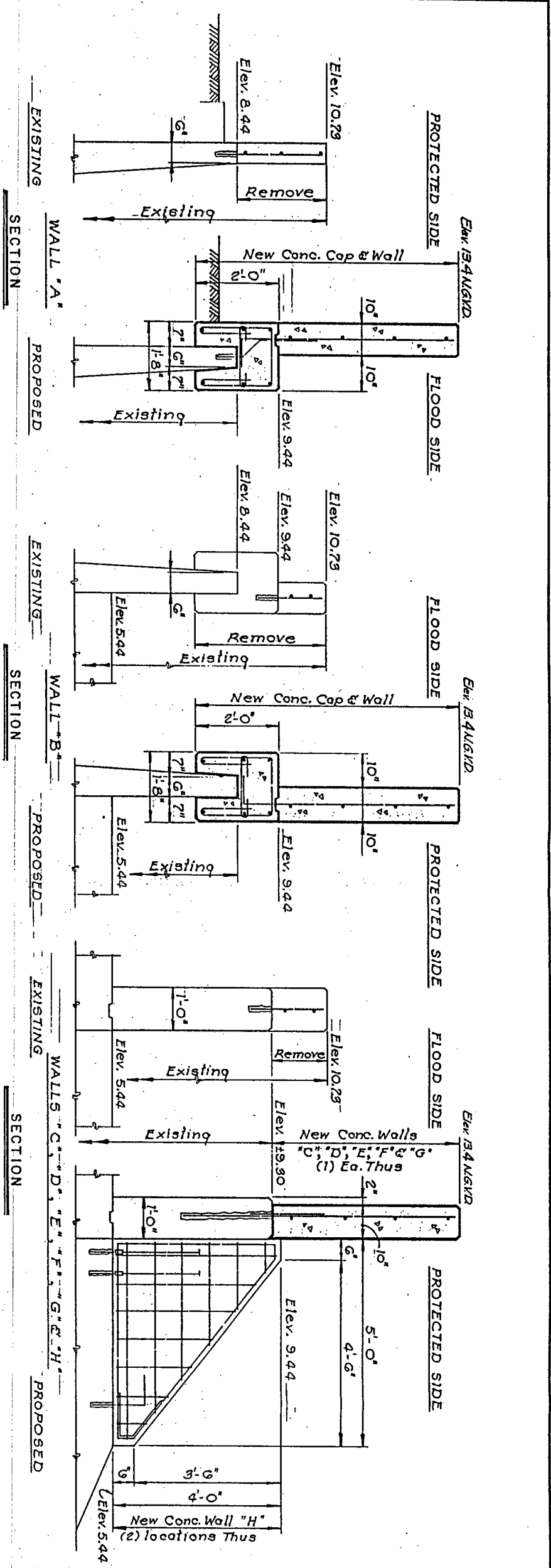


PLATE IV-17

WALL "J"
 PROPOSED

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

**DRAINAGE PUMPING
 STATION NO 4**

REV	DATE	DESCRIPTION

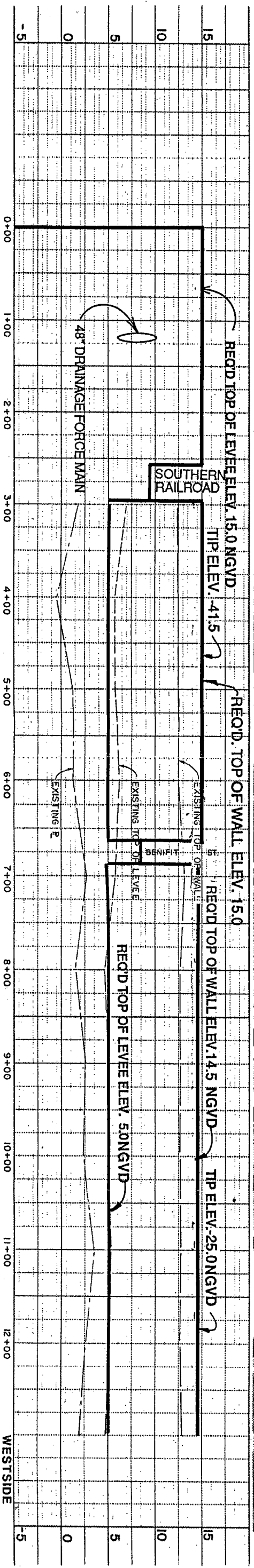
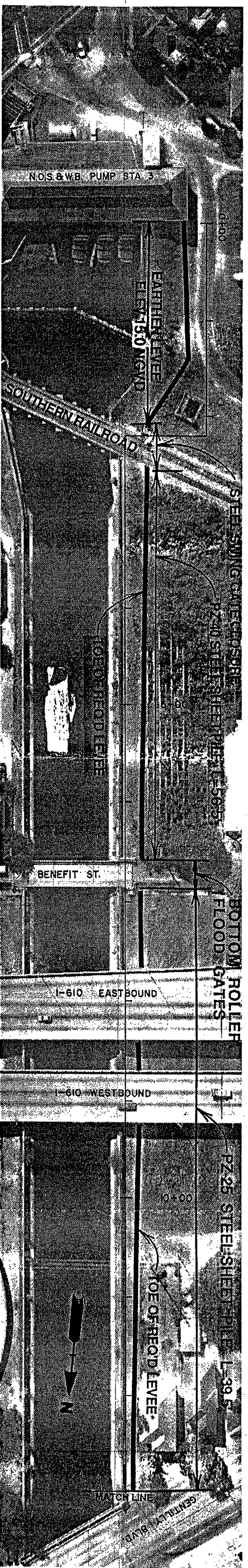
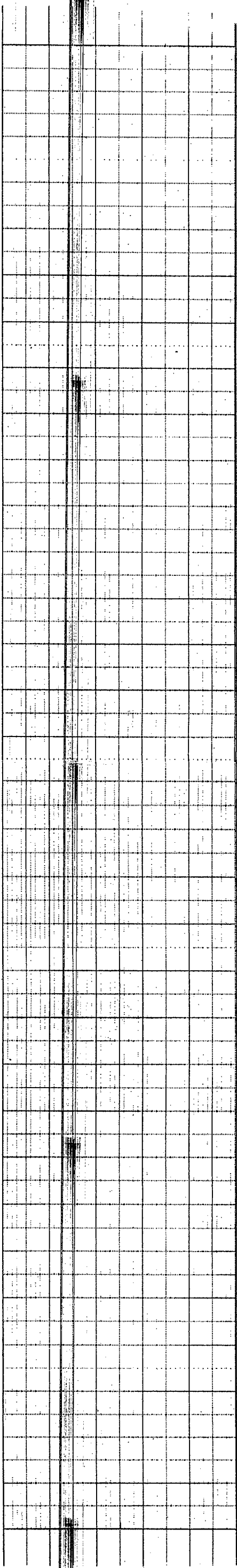
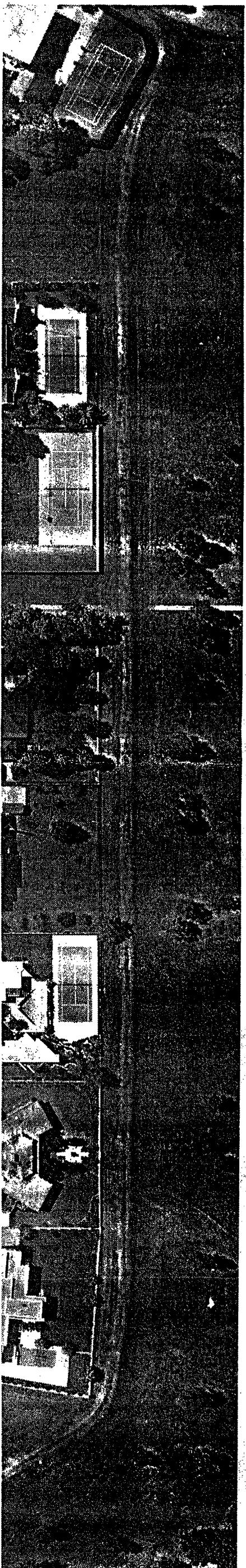
JOB NO.	8407	SCALE	AS NOTED	SHEET NO.	2 OF 2
DESIGNED	O.B.L.	CHECKED	M.G.J.	DATE	4/86
DRAWN	L.V.B.	DATE	4/86		
PROJECT					

TYPICAL SECTIONS

APPENDIX A
PLAN-PROFILE PLATES

General

This appendix contains 13 plan and profile drawings (plates) showing the type, elevation and location of the existing and proposed flood protection structures. Plates A-1 through A-7 cover the west side and Plates A-8 through A-13 cover east side of the canal.



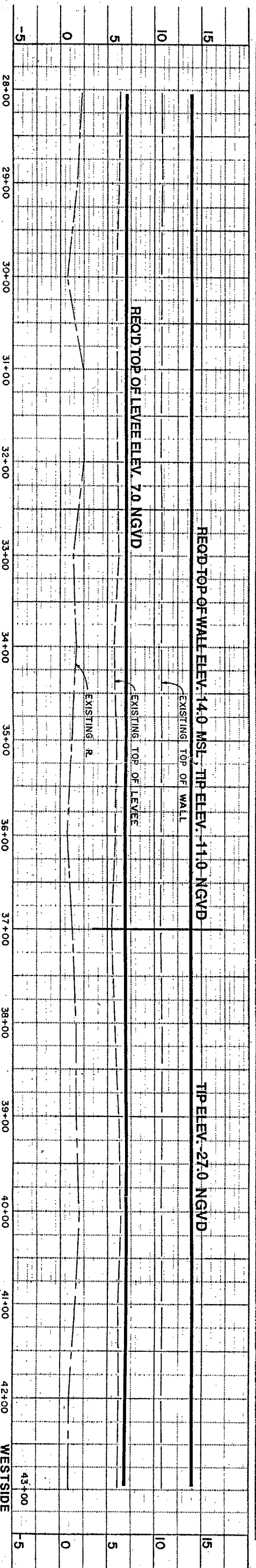
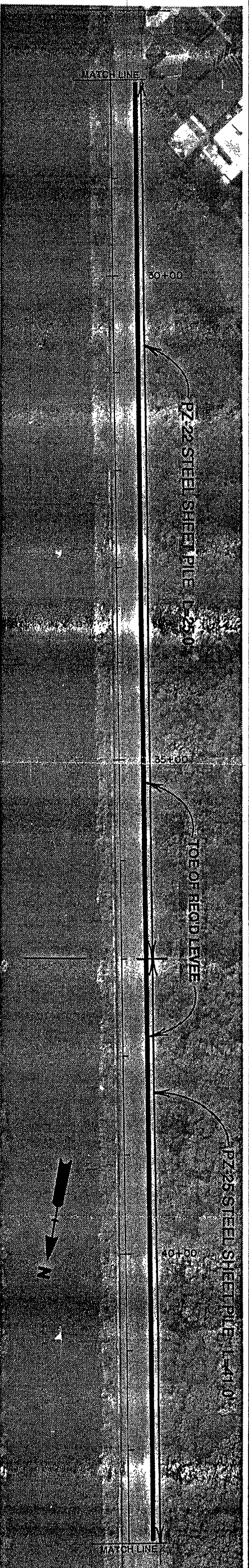
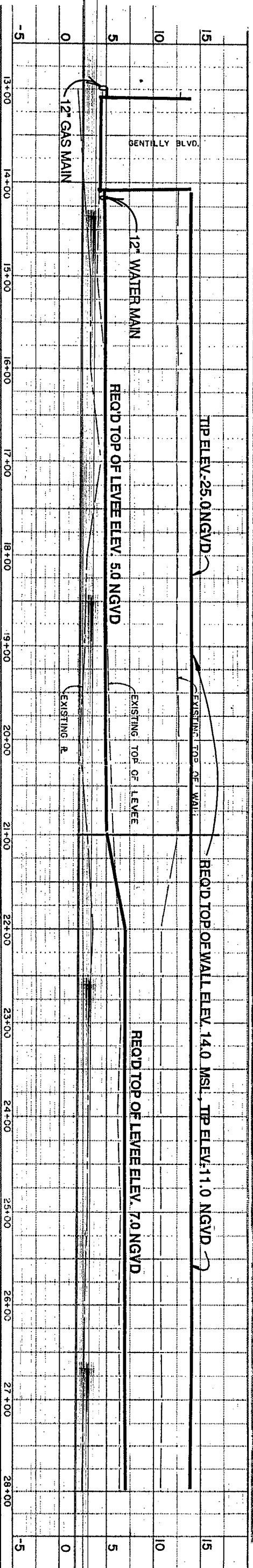
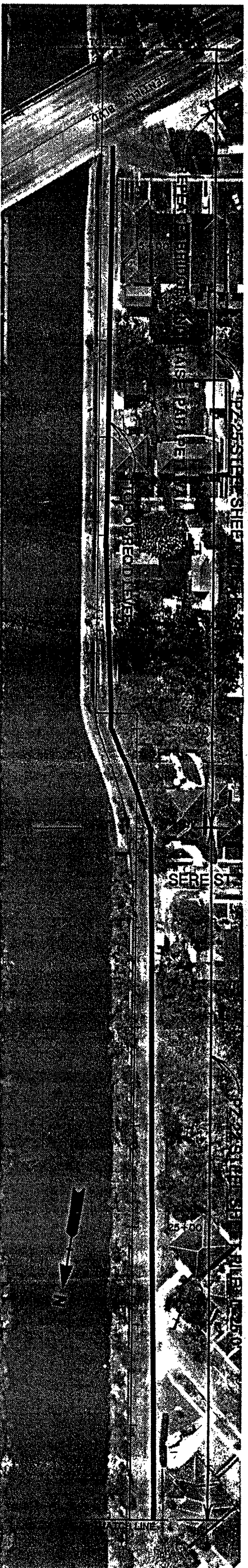
LONDON AVENUE CANAL FLOODWALLS AND LEVEES
GENERAL DESIGN MEMORANDUM

ORLEANS LEVEE BOARD CONTRACT NO. 2049-0269

BOARD OF COMMISSIONERS
ORLEANS LEVEE BOARD

JOB NO. 8407
 PLATE NO. A-1

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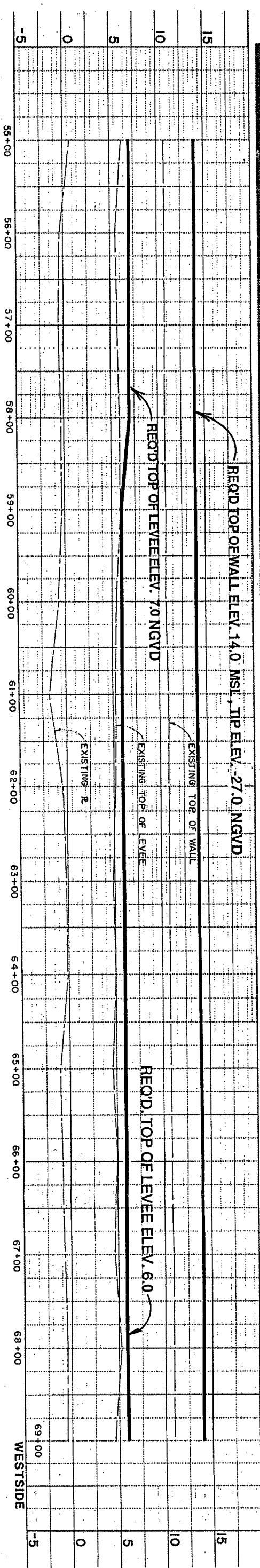
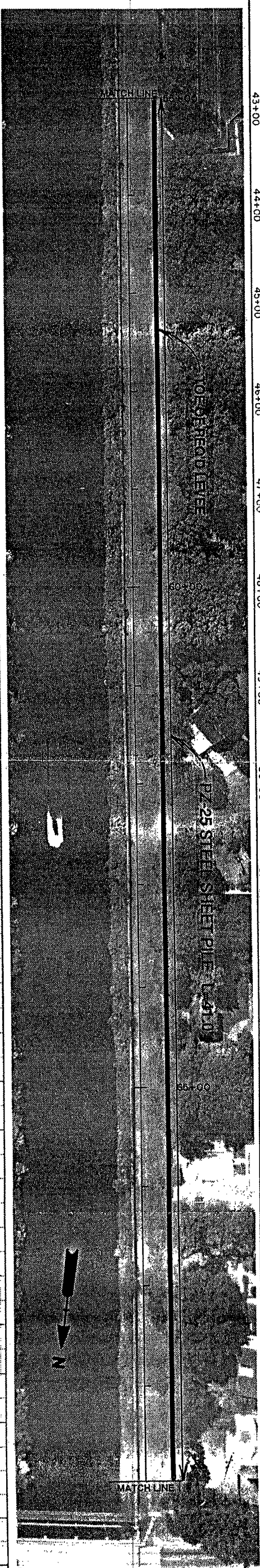
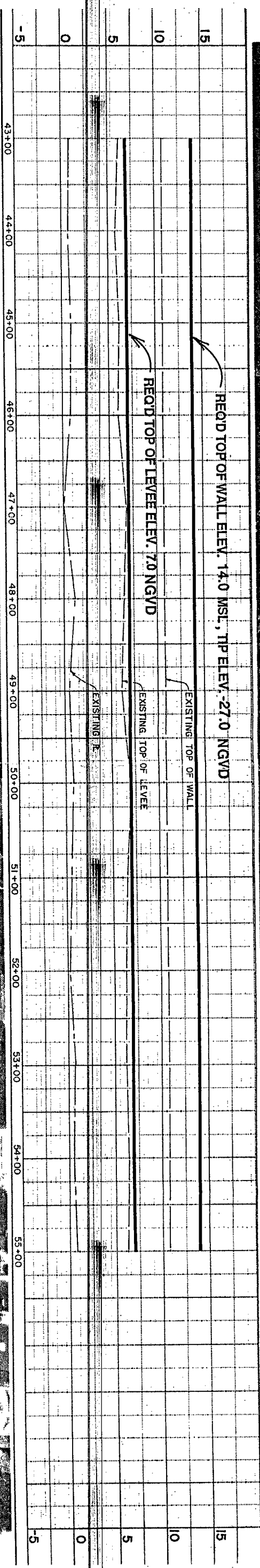
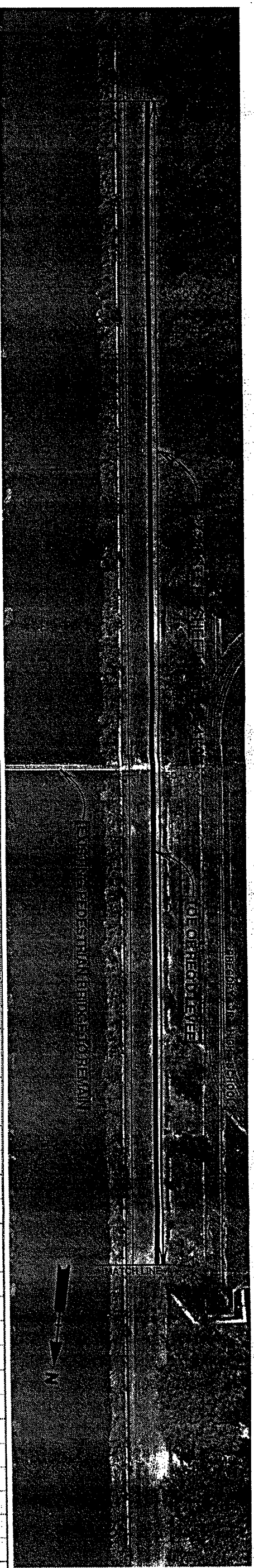
LONDON AVENUE CANAL FLOODWALLS AND LEVEES
GENERAL DESIGN MEMORANDUM

ORLEANS LEVEE BOARD CONTRACT NO. 2049-0289

BOARD OF COMMISSIONERS
ORLEANS LEVEE BOARD

JOB NO.
8407
PLATE NO.
A-2

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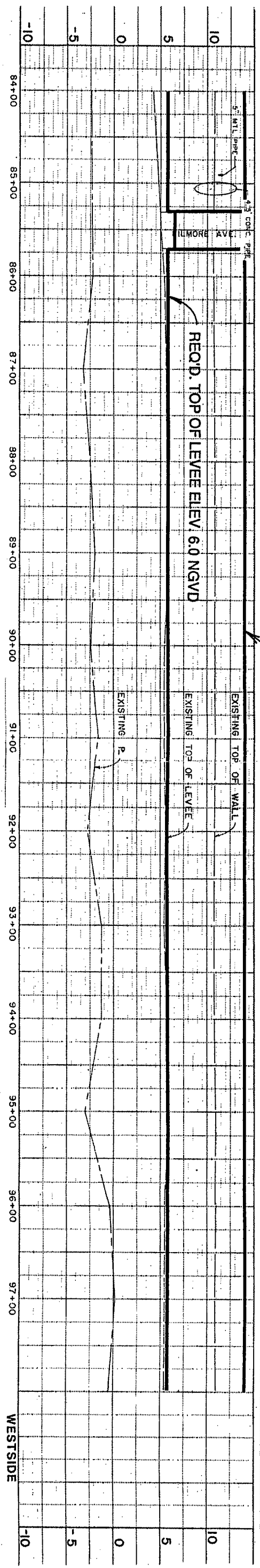
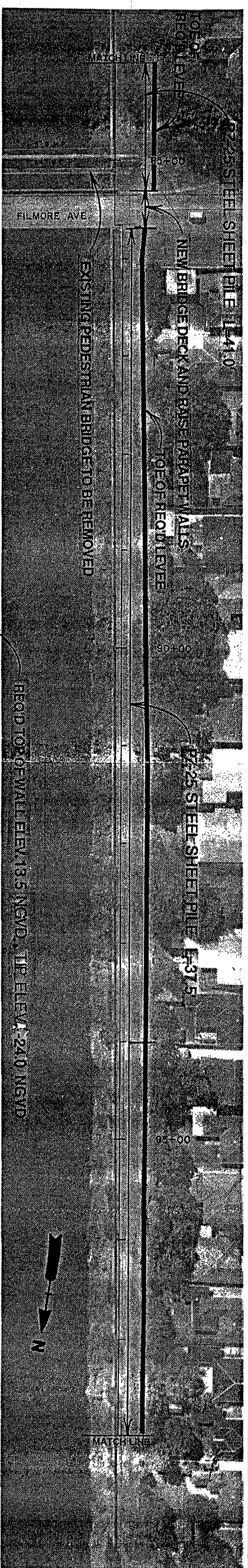
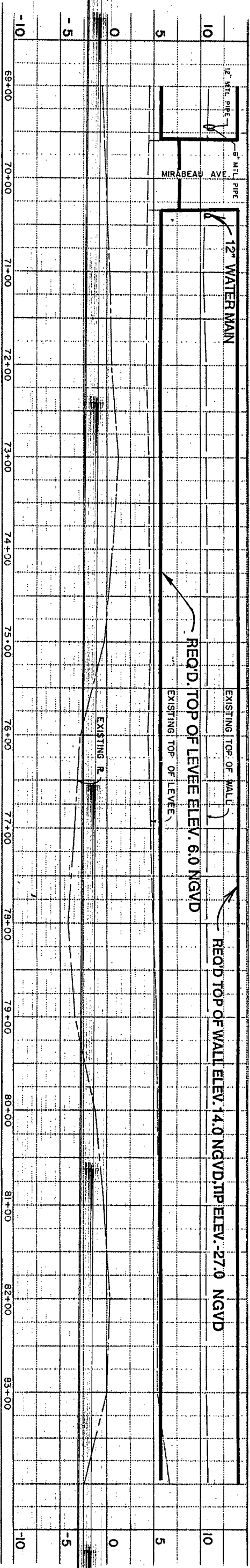
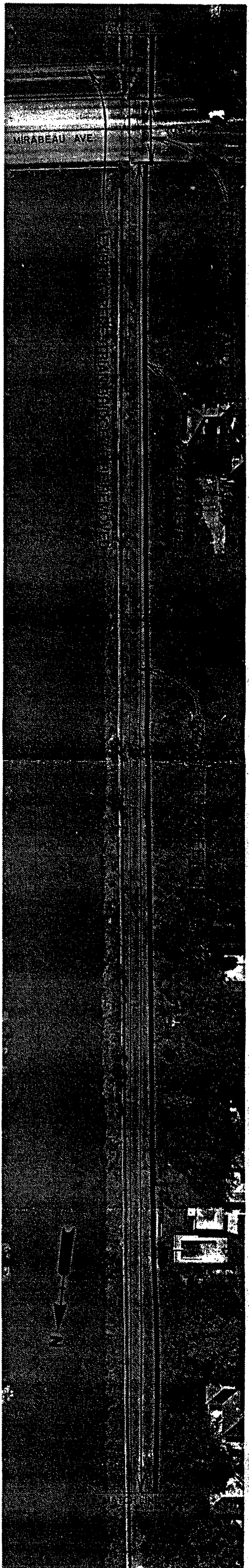
LONDON AVENUE CANAL FLOODWALLS AND LEVEES
 GENERAL DESIGN MEMORANDUM

ORLEANS LEVEE BOARD CONTRACT NO. 2049-0269

BOARD OF COMMISSIONERS
 ORLEANS LEVEE BOARD

JOB NO. 8407
 FLATE NO. A-3

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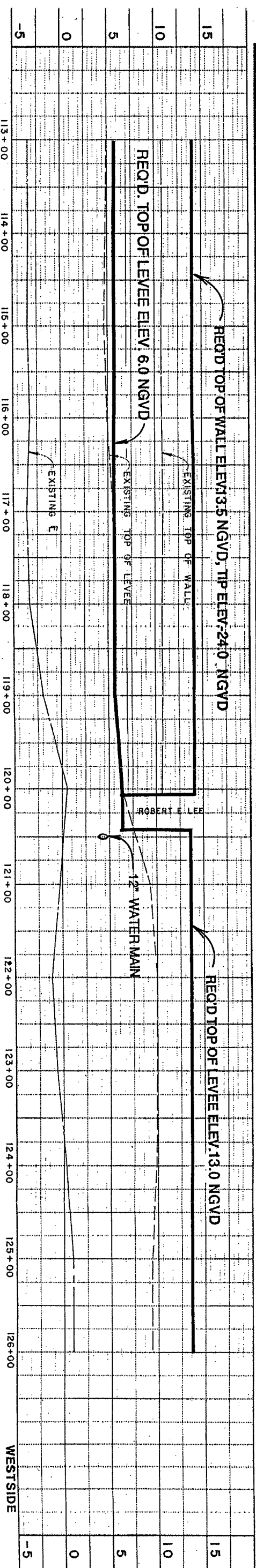
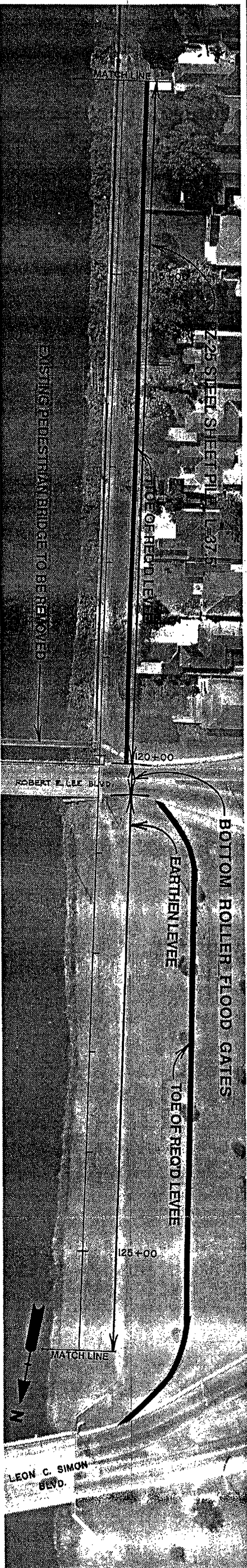
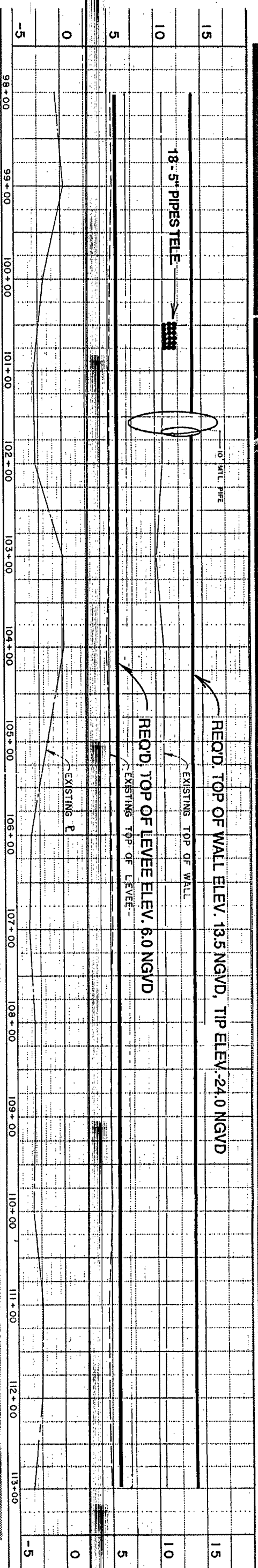
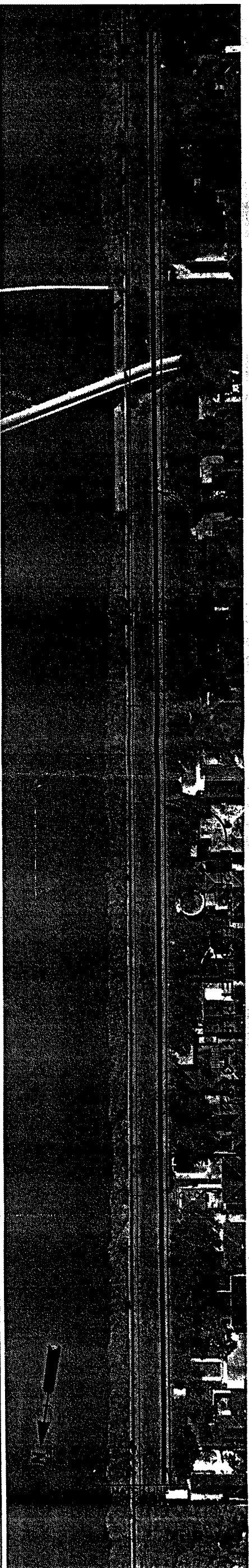
LONDON AVENUE CANAL FLOODWALLS AND LEVEES
GENERAL DESIGN MEMORANDUM

ORLEANS LEVEE BOARD CONTRACT NO. 2049-0289

BOARD OF COMMISSIONERS
ORLEANS LEVEE BOARD

JOB NO.
8407
PLATE NO.
A-4

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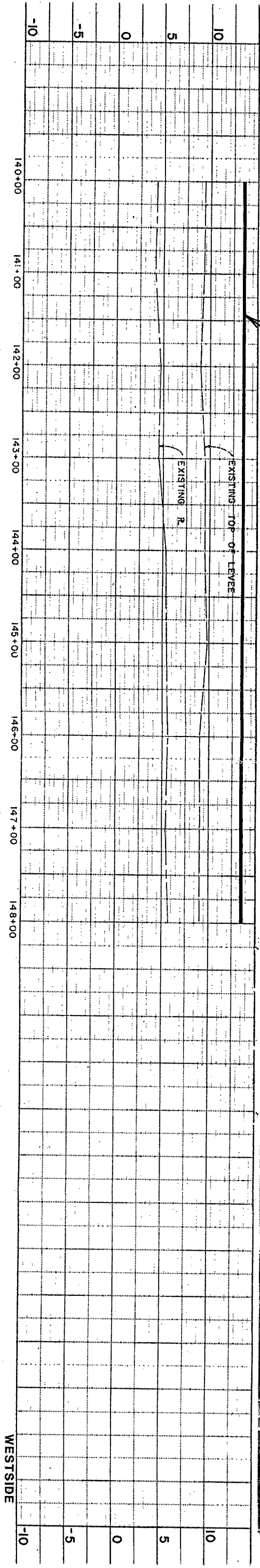
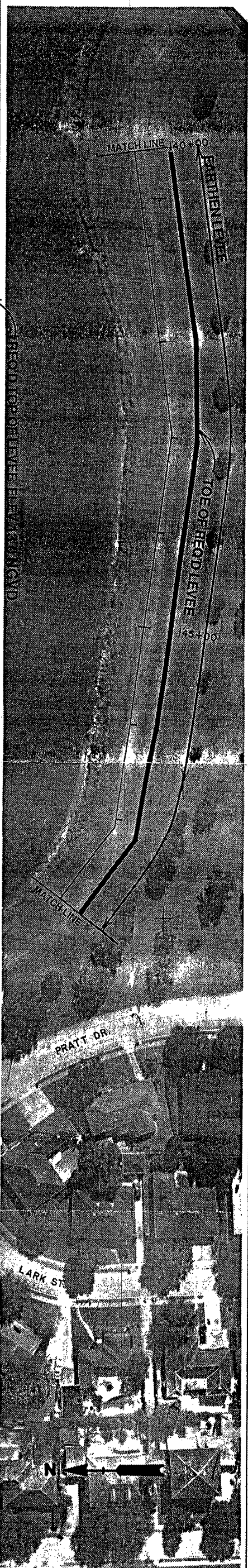
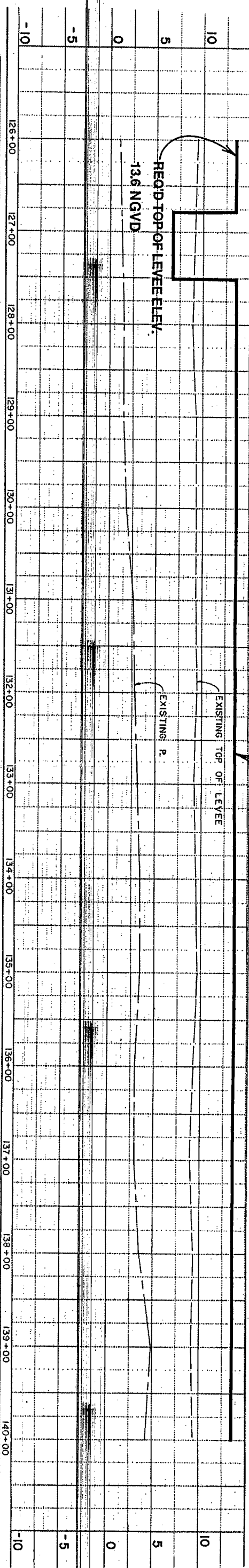
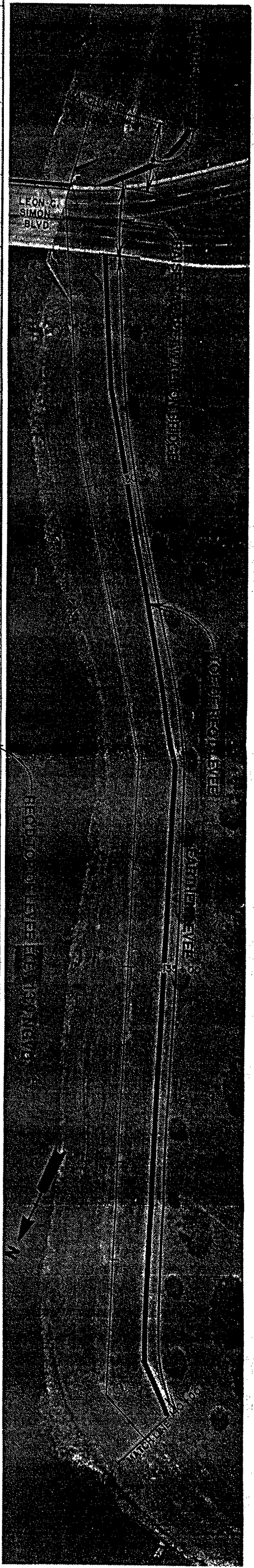
LONDON AVENUE CANAL FLOODWALLS AND LEVEES
 GENERAL DESIGN MEMORANDUM

ORLEANS LEVEE BOARD CONTRACT NO. 2049-0269

BOARD OF COMMISSIONERS
ORLEANS LEVEE BOARD

JOB NO.	8407
PLATE NO.	A-5

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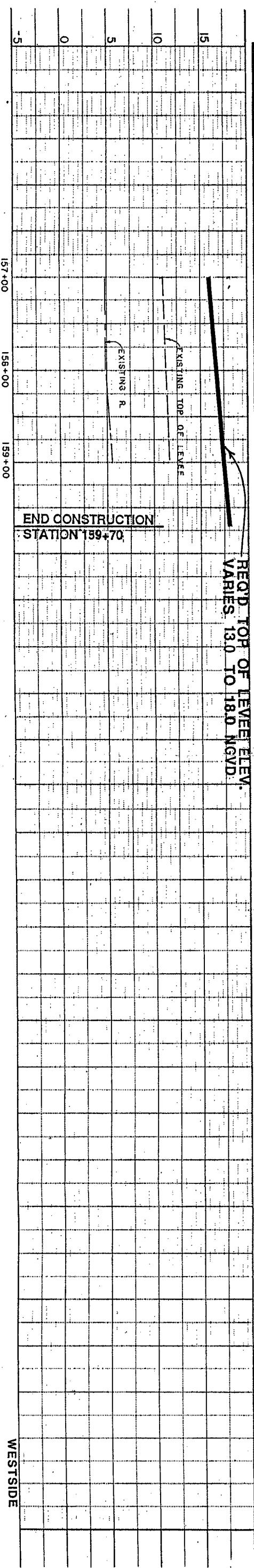
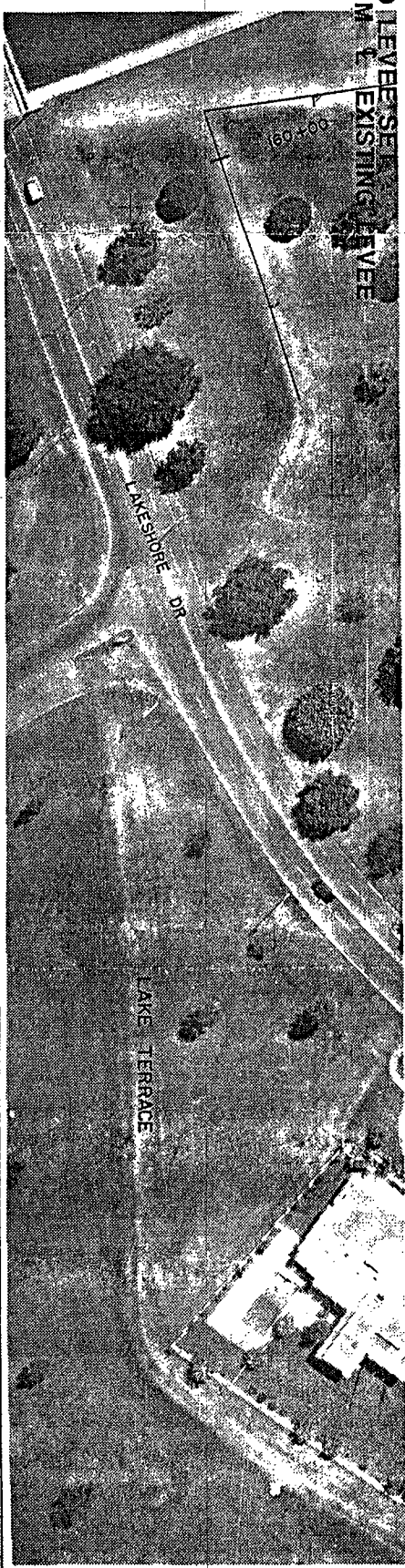
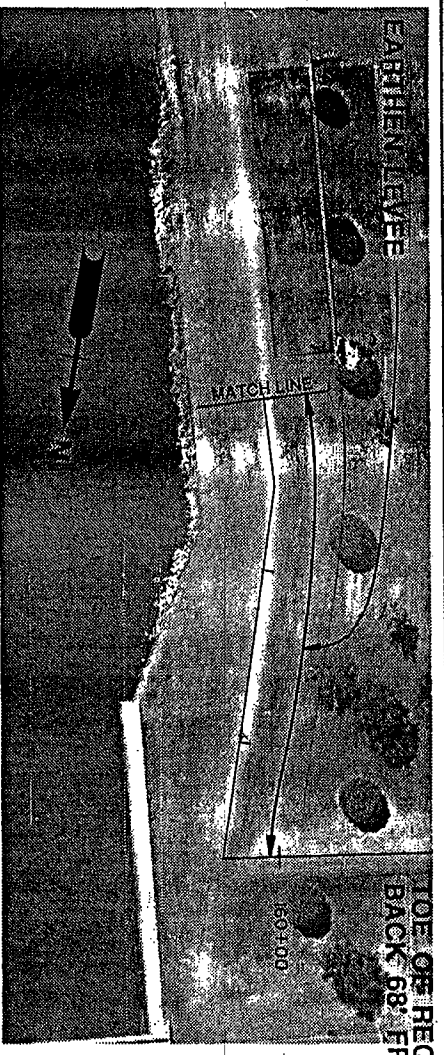
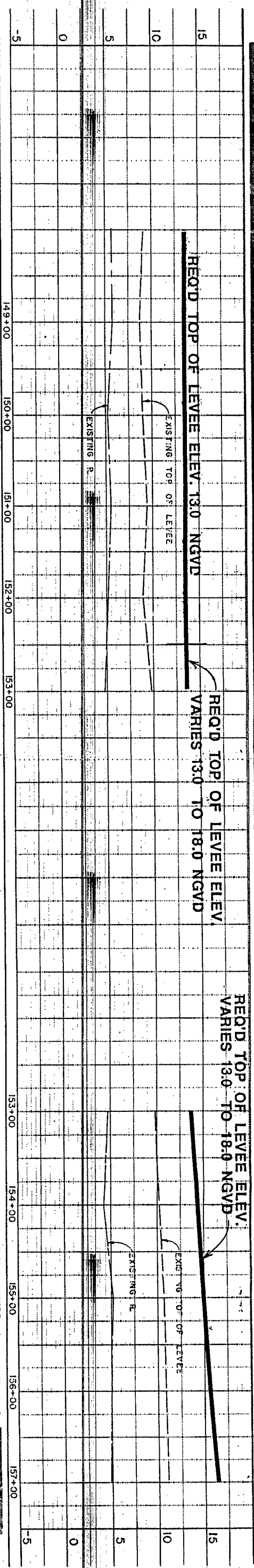
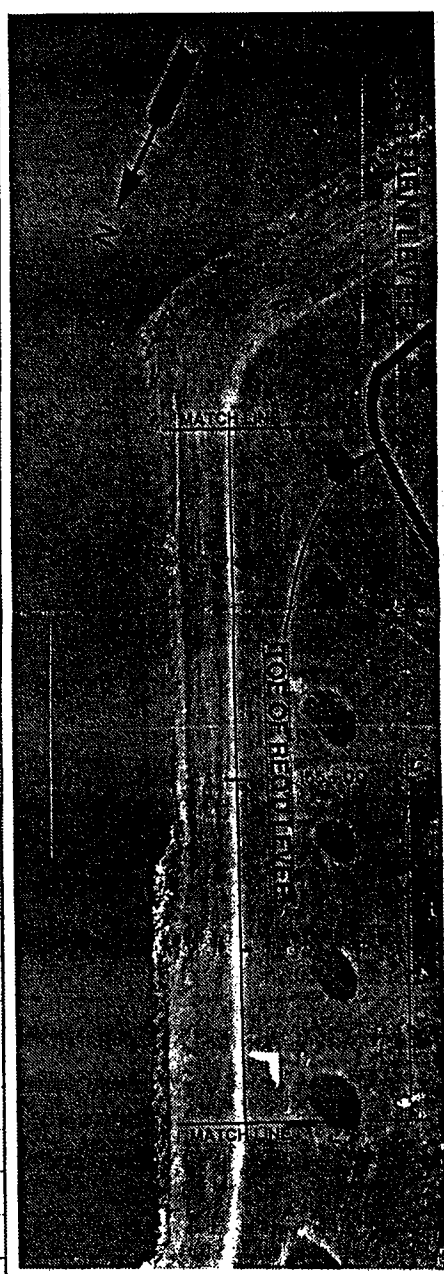
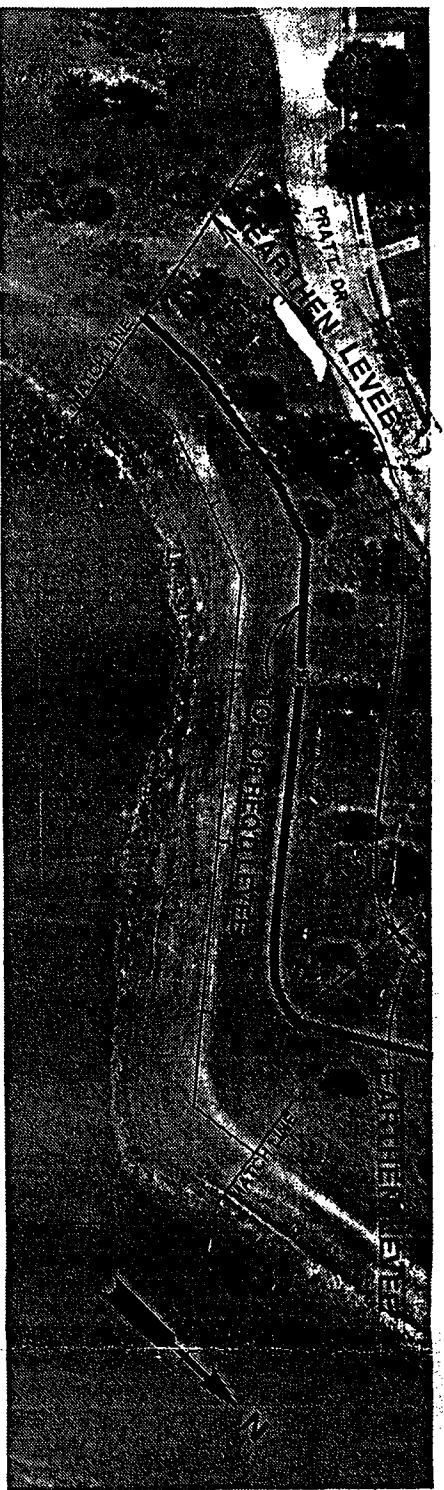
LONDON AVENUE CANAL FLOODWALLS AND LEVEES
GENERAL DESIGN MEMORANDUM

ORLEANS LEVEE BOARD CONTRACT NO. 2049-0269

BOARD OF COMMISSIONERS
ORLEANS LEVEE BOARD

JOB NO. 8407
PLATE NO. A-6

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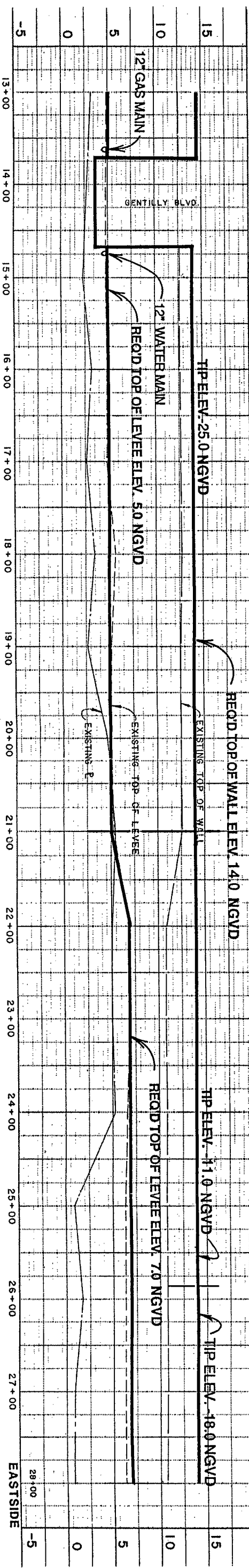
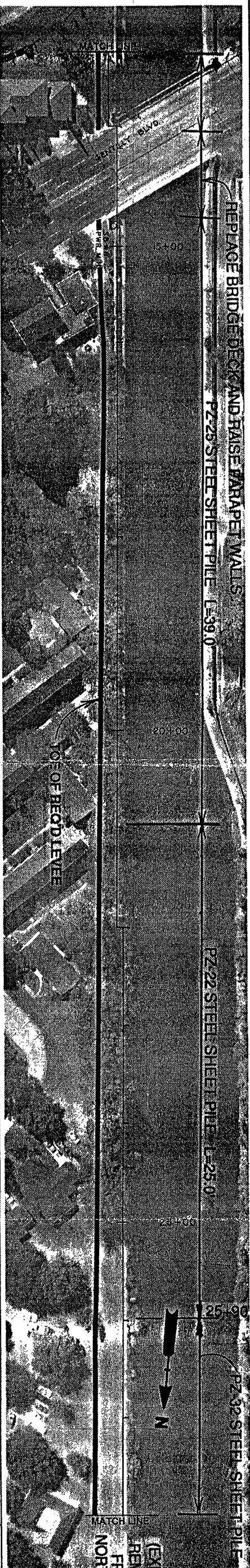
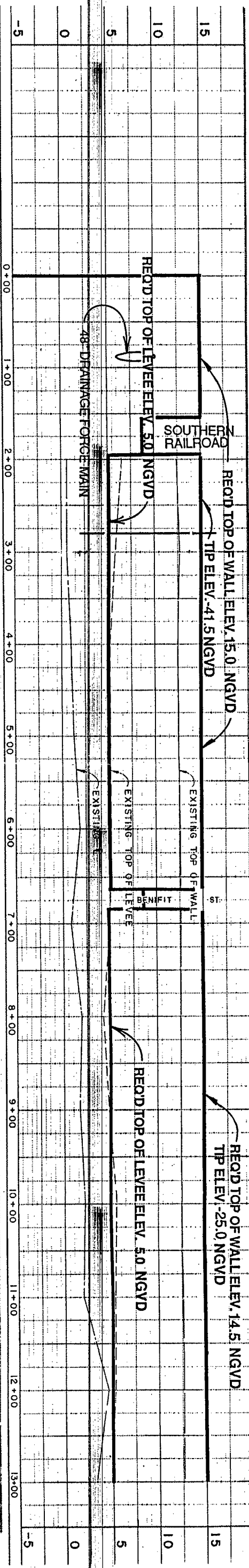
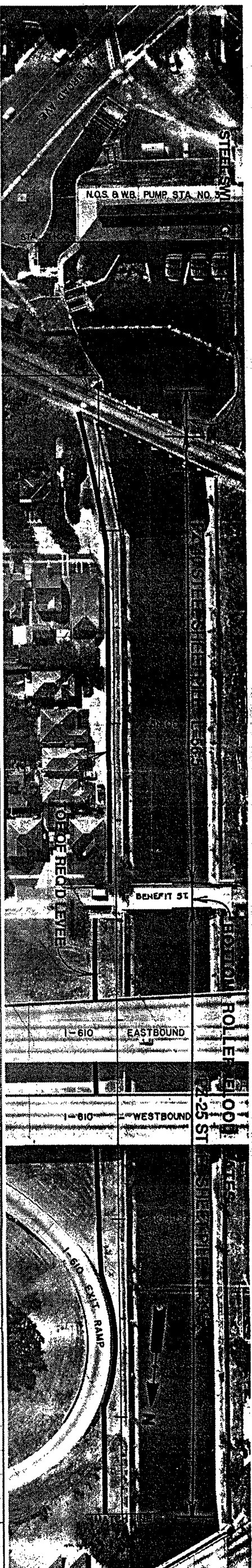
LONDON AVENUE CANAL FLOODWALLS AND LEVEES
GENERAL DESIGN MEMORANDUM

ORLEANS LEVEE BOARD CONTRACT NO. 2049-0269

BOARD OF COMMISSIONERS
ORLEANS LEVEE BOARD

JOB NO. 8407
 PLATE NO. A-7

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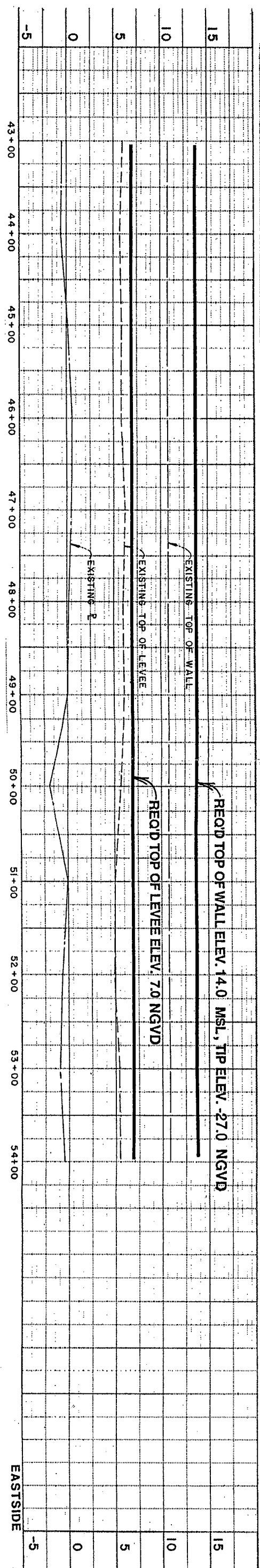
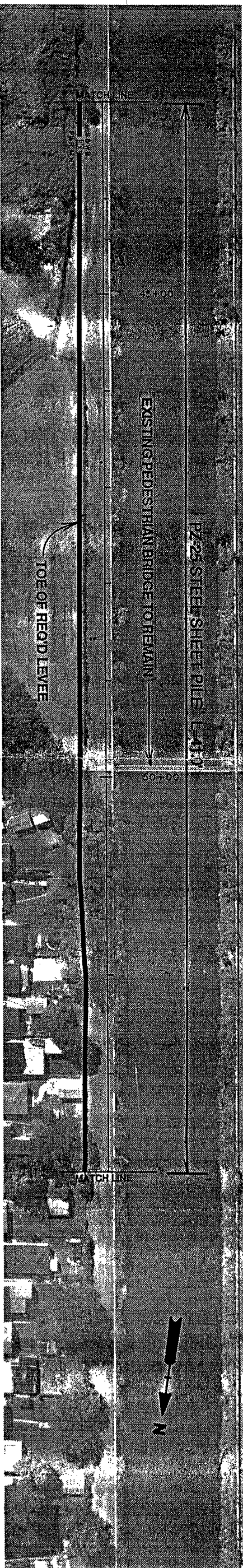
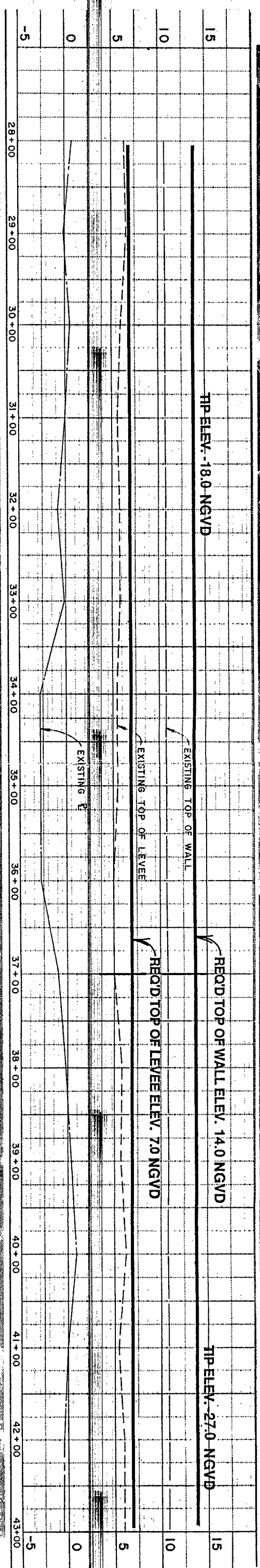
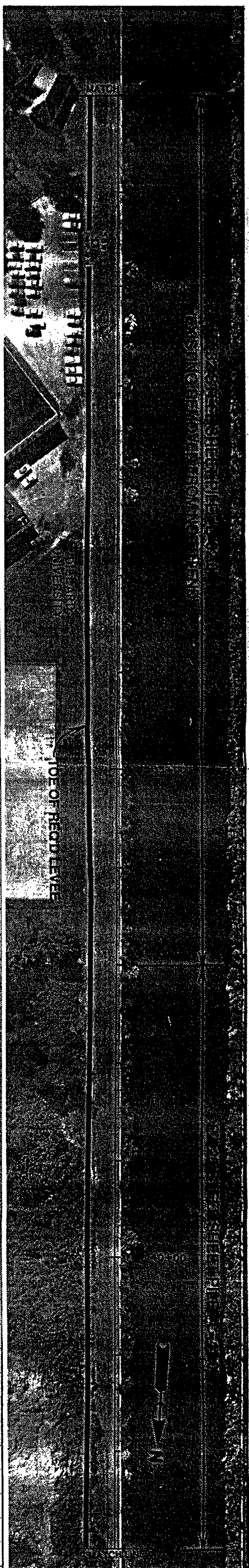
LONDON AVENUE CANAL FLOODWALLS AND LEVEES
 GENERAL DESIGN MEMORANDUM

BOARD OF COMMISSIONERS
 ORLEANS LEVEE BOARD

JOB NO. 8407
 PLATE NO. A-8

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ORLEANS LEVEE BOARD CONTRACT NO. 2049-0289



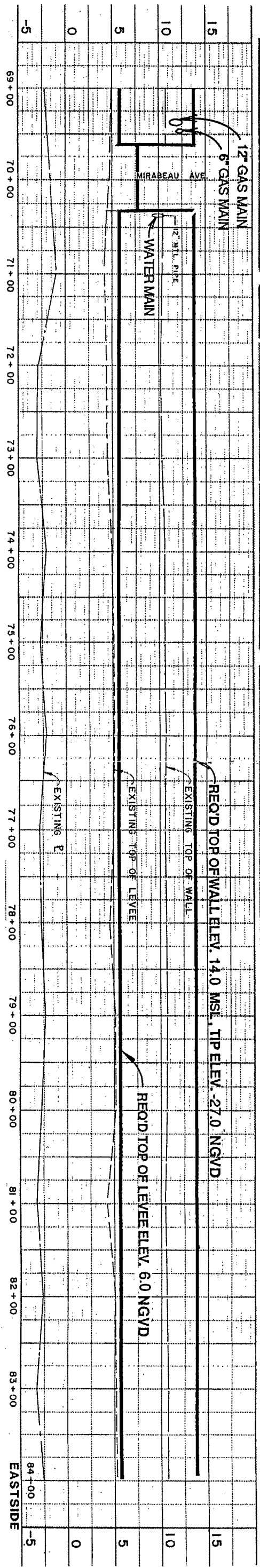
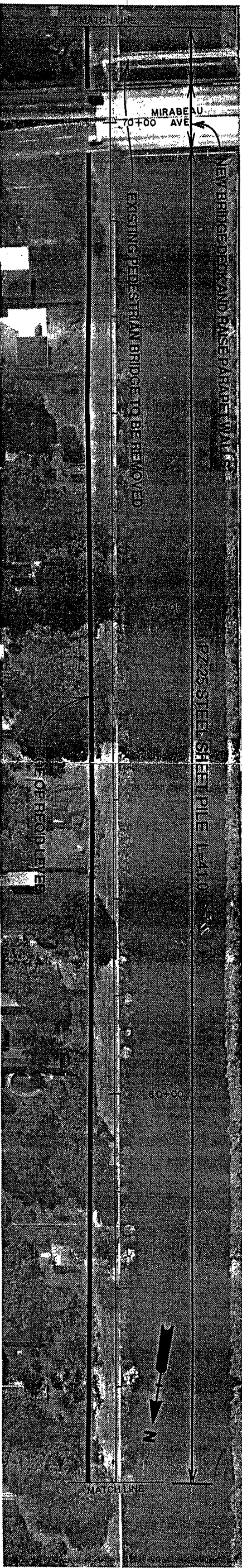
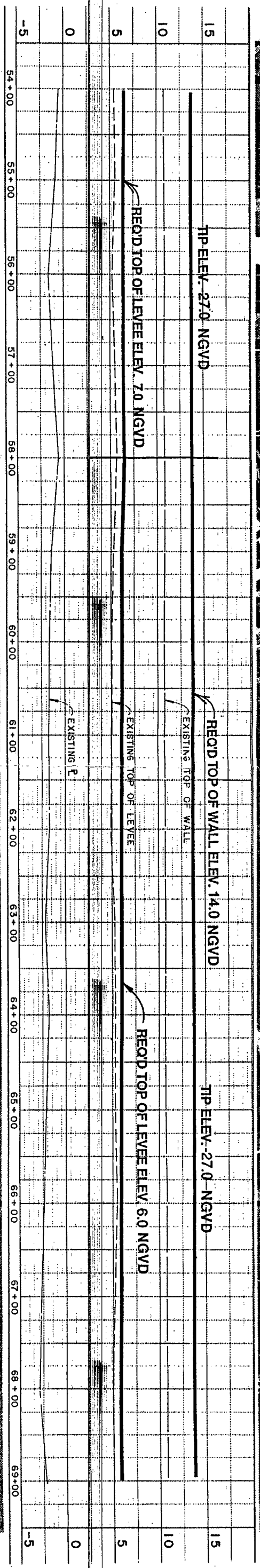
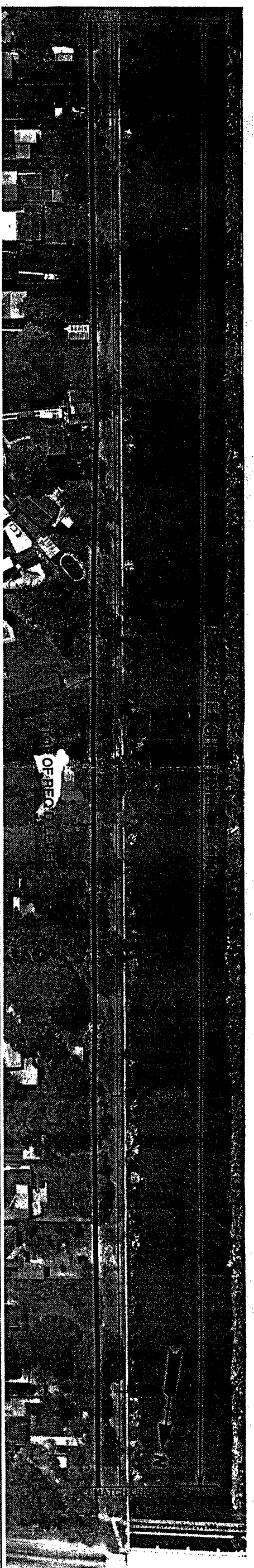
LONDON AVENUE CANAL FLOODWALLS AND LEVEES
GENERAL DESIGN MEMORANDUM

ORLEANS LEVEE BOARD CONTRACT NO. 2046-0269

BOARD OF COMMISSIONERS
ORLEANS LEVEE BOARD

JOB NO. 8407
 PLATE NO. A-9

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LONDON AVENUE CANAL FLOODWALLS AND LEVEES

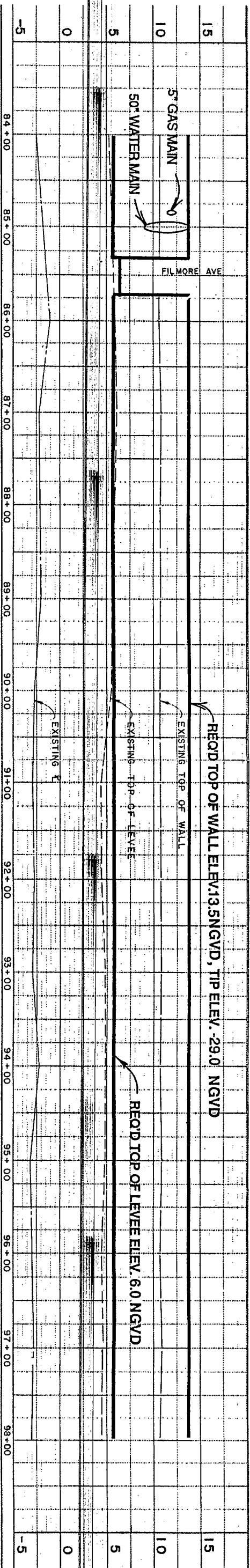
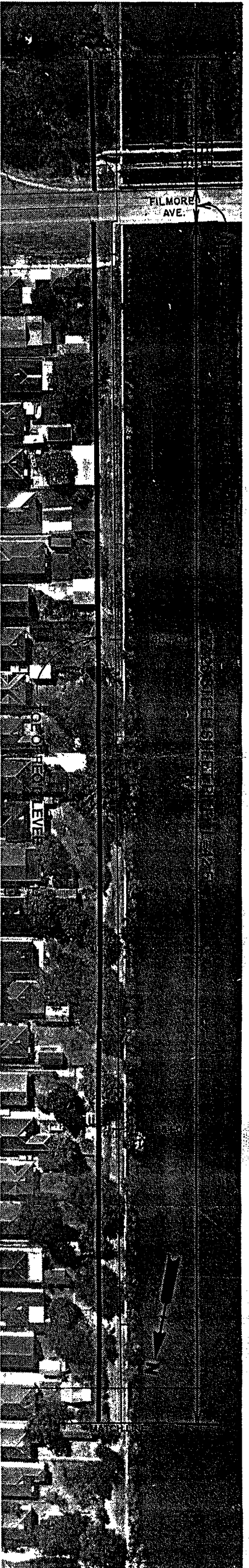
GENERAL DESIGN MEMORANDUM

ORLEANS LEVEE BOARD CONTRACT NO. 2049-0269

BOARD OF COMMISSIONERS
ORLEANS LEVEE BOARD

JOB NO.
8407
PLATE NO.
A-10

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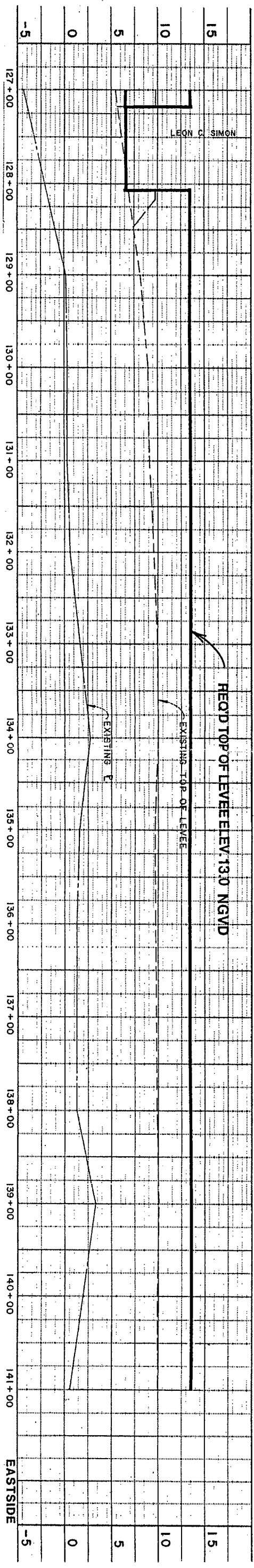
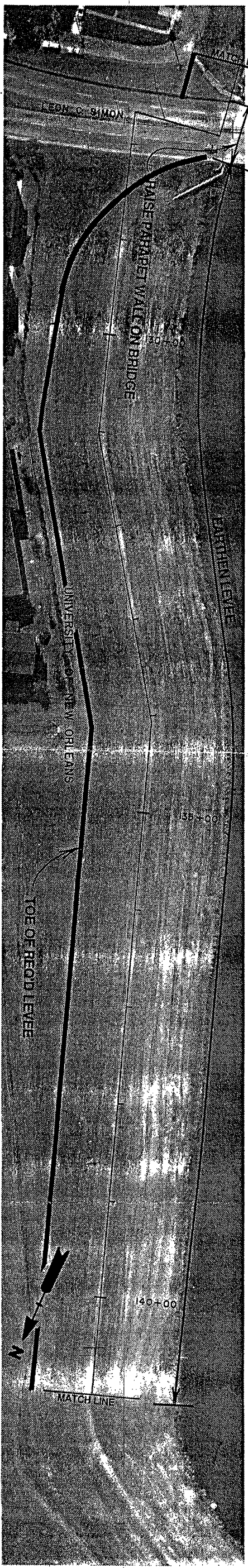
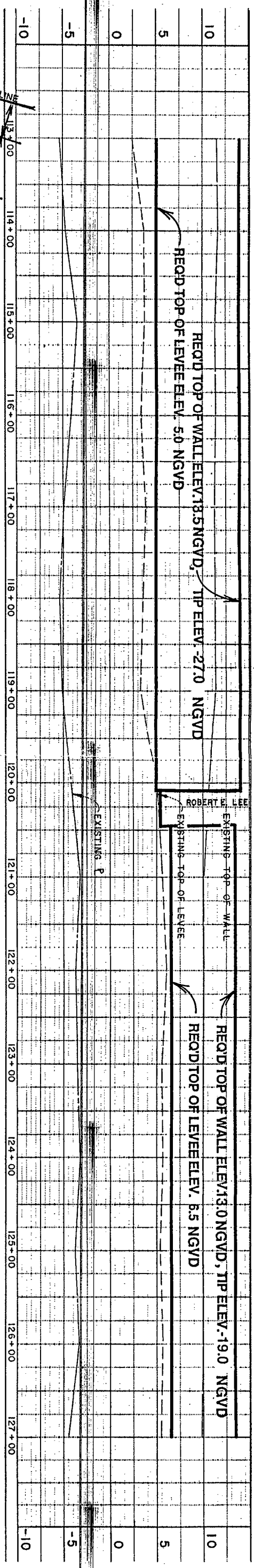
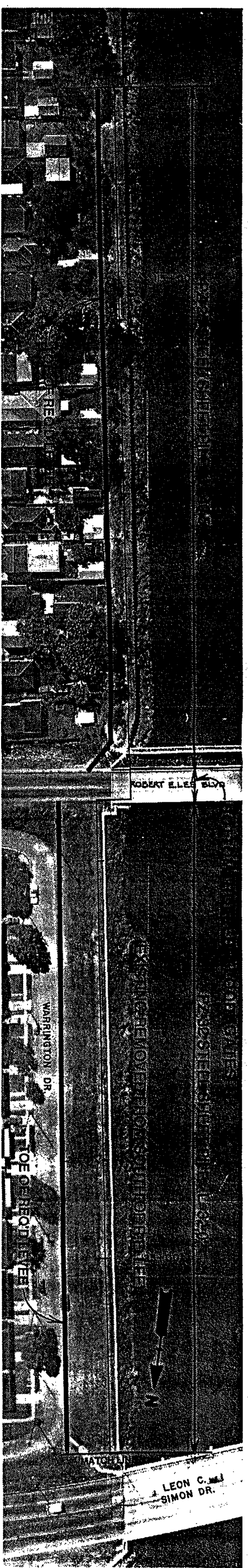
LONDON AVENUE CANAL FLOODWALLS AND LEVEES
 GENERAL DESIGN MEMORANDUM

ORLEANS LEVEE BOARD CONTRACT NO. 2049-0269

BOARD OF COMMISSIONERS
 ORLEANS LEVEE BOARD

JOB NO.
 8407
 PLATE NO.
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LONDON AVENUE CANAL FLOODWALLS AND LEVEES

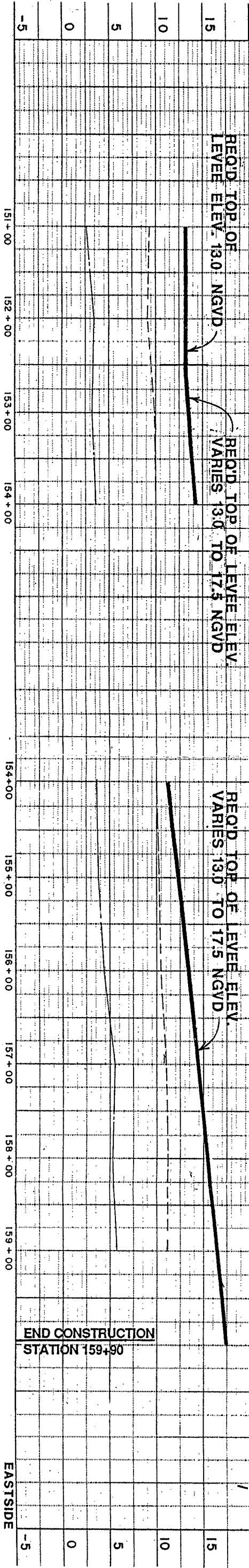
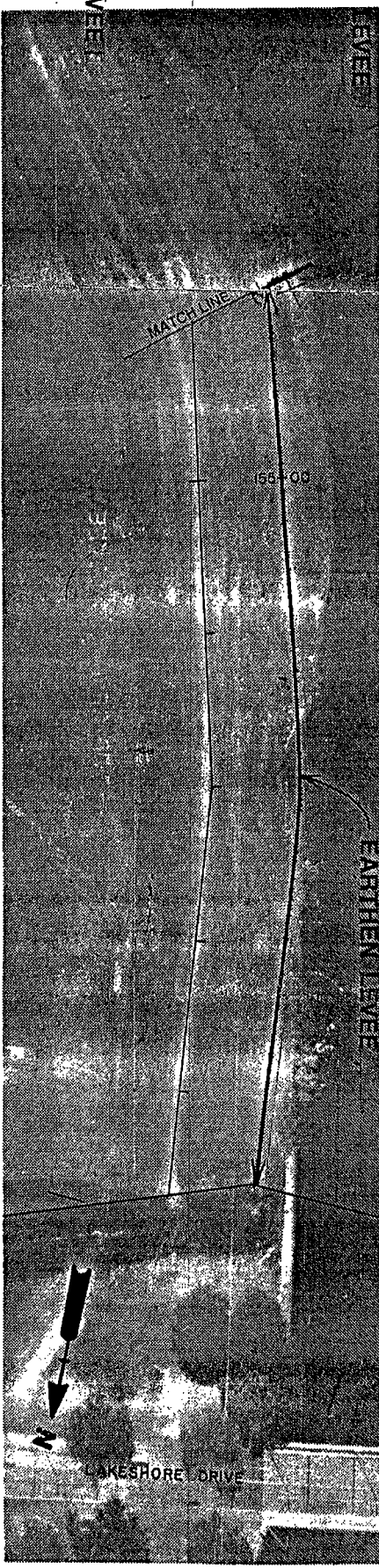
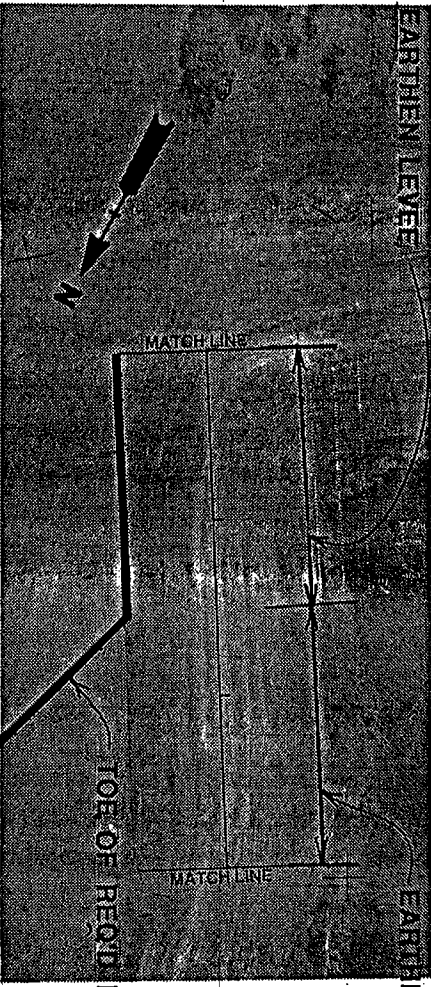
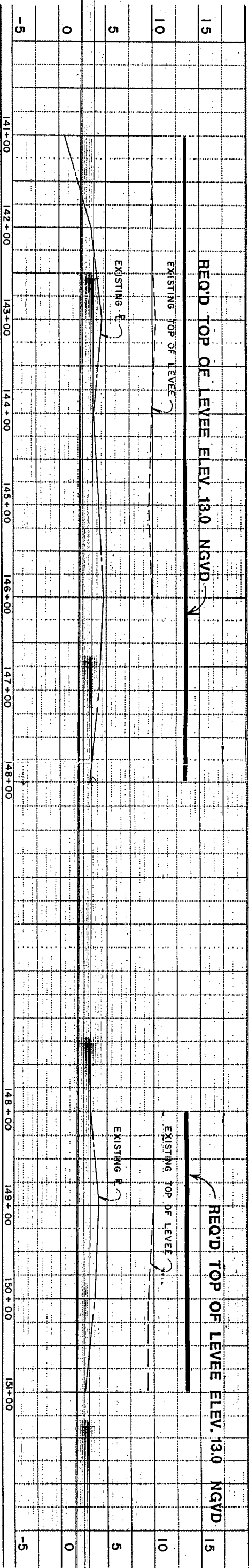
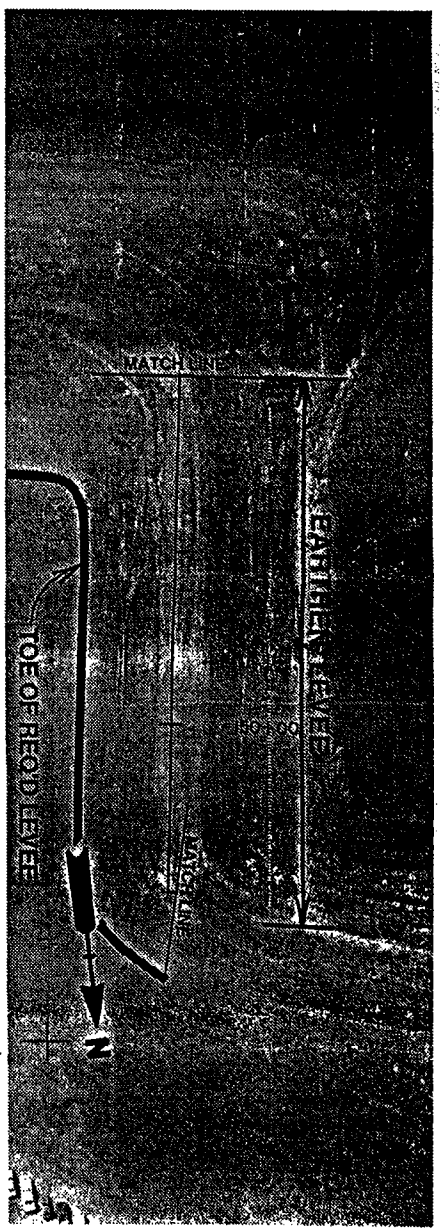
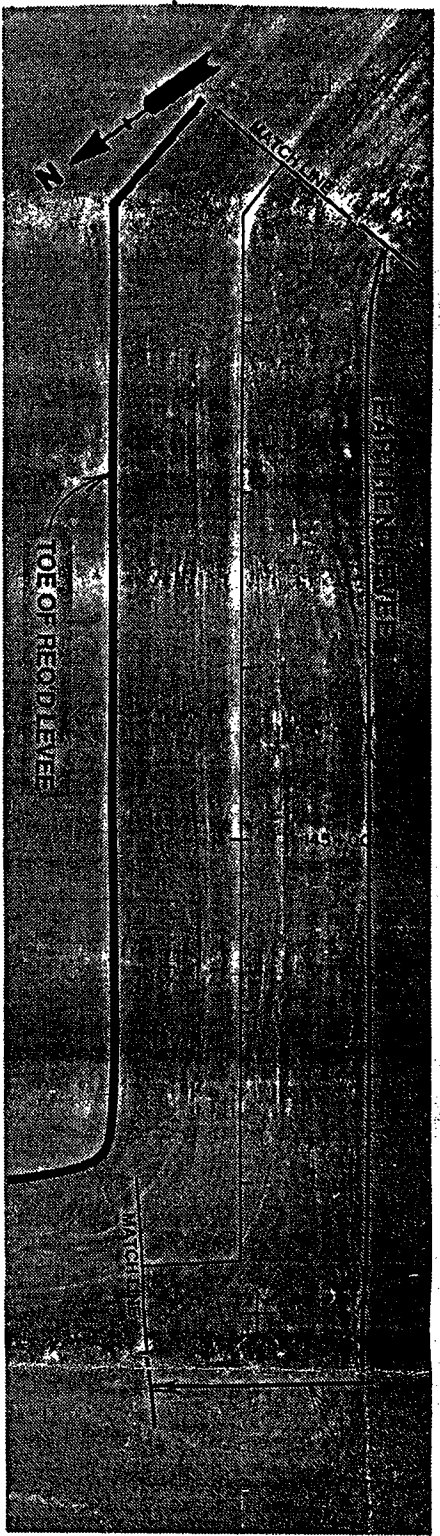
GENERAL DESIGN MEMORANDUM

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
ORLEANS LEVEE BOARD

JOB NO.	8407
PLATE NO.	A-13

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APPENDIX B

GEOTECHNICAL INVESTIGATIONS

General

All geotechnical investigations and studies were made by Eustis Engineering, Geotechnical Engineers, 3011 28th Street, Metairie, Louisiana 70002. The following soil reports were written by Eustis Engineering for London Avenue Canal:

TITLE	DATE	
SUBSOIL INVESTIGATION SLOPE STABILITY STUDY BETWEEN STATIONS 113+00 AND 119+00 EAST SIDE OF LONDON AVENUE CANAL ORLEANS, LOUISIANA	11 OCTOBER 1979	NO
SUBSOIL INVESTIGATION LONDON AVENUE CANAL LEVEE EAST SIDE RIPRAP SLOPE CONSTRUCTION FILMORE AVENUE TO PRENTISS PUMP STATION NEW ORLEANS, LOUISIANA	10 AUGUST 1981	NO
GEOTECHNICAL INVESTIGATION ORLEANS LEVEE DISTRICT LONDON AVENUE OUTFALL CANAL OLB PROJECT NO. 2049-0269 NEW ORLEANS, LOUISIANA (VOLUME I & VOLUME II)	4 MARCH 1986	YES
GEOTECHNICAL ENGINEERING ANALYSIS LONDON AVENUE OUTFALL CANAL OLB PROJECT NO. 2049-0269 NEW ORLEANS, LOUISIANA	22 NOVEMBER 1989	NO

The above documents have been submitted to the Orleans Levee District.