

LAKE WORTH DRAINAGE DISTRICT

INTERBASIN STUDY

**April 1992
Revised October 1992
Revised May 1996**

Original Prepared by:

**Mock, Roos & Associates, Inc.
5720 Corporate Way
West Palm Beach, Florida 33407**

TABLE OF CONTENTS

	<u>PAGE</u>
I. INTRODUCTION	1
A. Authorization	1
B. Purpose of Study	1
C. Scope of Report	2
II. LWDD BACKGROUND	2
A. General	2
B. Permit Program	3
C. Operation and Maintenance	3
III. MAJOR DRAINAGE BASINS	10
A. C-51 Basin	10
B. C-16 Basin	13
C. C-15 Basin	15
D. Hillsboro Basin	18
IV. STUDY METHODOLOGY	22
A. Data Acquisition and Field Survey	22
B. Hydrologic Analysis	22
C. Hydraulic Analysis	24
V. STUDY RESULTS	25
A. C-51 Basin	25
B. C-16 Basin	38
C. C-15 Basin	51
D. Hillsboro Basin	63
VI. RECOMMENDATIONS	74
A. C-51 Basin	74
B. C-16 Basin	75
C. C-15 Basin	76
D. Hillsboro Basin	76
VII. SUMMARY AND CONCLUSIONS	77

LIST OF FIGURES

<u>FIGURE</u>		<u>PAGE</u>
1	Location Map	4
2	District Boundary	5
3	Major Drainage Basin Boundaries	7
4	Canal Network: C-51 Basin	11
5	Canal Network: C-16 Basin	14
6	Canal Network: C-15 Basin	16
7	Canal Network: Hillsboro Basin	19
8	Design Discharges and Stages: C-51 Basin	32 - 37
9	Design Discharges and Stages: C-16 Basin	46 - 50
10	Design Discharges and Stages: C-15 Basin	58 - 62
11	Design Discharges and Stages: Hillsboro Basin	68 - 73

LIST OF TABLES

<u>TABLE</u>		<u>PAGE</u>
1	Major Control Structures	8 - 9
2	Design Discharges and Stages: C-51 Basin	27 - 31
3	Design Discharges and Stages: C-16 Basin	39 - 45
4	Design Discharges and Stages: C-15 Basin	52 - 57
5	Design Discharges and Stages: Hillsboro Basin	64 - 67

LAKE WORTH DRAINAGE DISTRICT
INTERBASIN STUDY

I. INTRODUCTION:

A. Authorization:

The authorization for the preparation of this report was provided by the Board of Supervisors of the Lake Worth Drainage District (LWDD/District) in their regular meeting on the 17th day of October, 1990.

B. Purpose:

There are four (4) major drainage basins within LWDD. They are the West Palm Beach or C-51 Basin, the C-16 and C-15 Basins and the Hillsboro Basin. Outfalls for the four LWDD drainage basins are the C-51 Canal, the Boynton Canal, the L-38 Canal and the Hillsboro Canal respectively. The C-51 and Hillsboro Canals and the eastern extensions of the Boynton Canal and the L-38 Canal are South Florida Water Management District (SFWMD) Canals.

The hydrologic and hydraulic capacities of each of the four (4) drainage basins were evaluated individually in previous studies between 1982 and 1990. The purpose of this study is to:

1. Update the hydrologic and hydraulic computer models of all four (4) major drainage basins due to additional permitted projects for which data was not obtained during previous investigations of the individual basins.

2. Update the hydrologic and hydraulic computer models of the C-51 Basin due to the channel improvements made to the C-51 Canal from Kirk Road to Florida's Turnpike.
3. Extend computer models to overlap basin boundaries and evaluate the hydrologic and hydraulic response of the LWDD canal system during a District-wide storm event.

C. Scope:

This report includes the following:

1. Results obtained from updating the hydrologic and hydraulic computer models of the four (4) major drainage basins and evaluating the capacity of the LWDD canal system, assuming a District-wide storm event with interbasin flows between the major drainage basins.
2. Recommendations made as a result of this study and evaluation.

II. LWDD BACKGROUND:

A. General:

The LWDD was originally created on June 15, 1915 under Chapter 6458 of the Laws of the State of Florida. Subsequently, the LWDD has been abolished and recreated several times, and currently operates under Chapter 61-147 and amendments thereto. The LWDD was created for the purpose of reclaiming the lands within its boundaries for agriculture and other types of developments, and for the

further purpose of water control and water supply through the construction and maintenance of canals, ditches, water control structures and pumping stations. The LWDD is located in the southeastern section of Palm Beach County and its boundaries extend south to the Hillsboro Canal, east to the coastal ridge, the E-4 Canal and a chain of lakes, including Lake Ida and Lake Osborne, west to Water Conservation Area No. 1, and north to Okeechobee Boulevard. A location map and the boundaries of the LWDD can be seen in Figures 1 and 2, respectively.

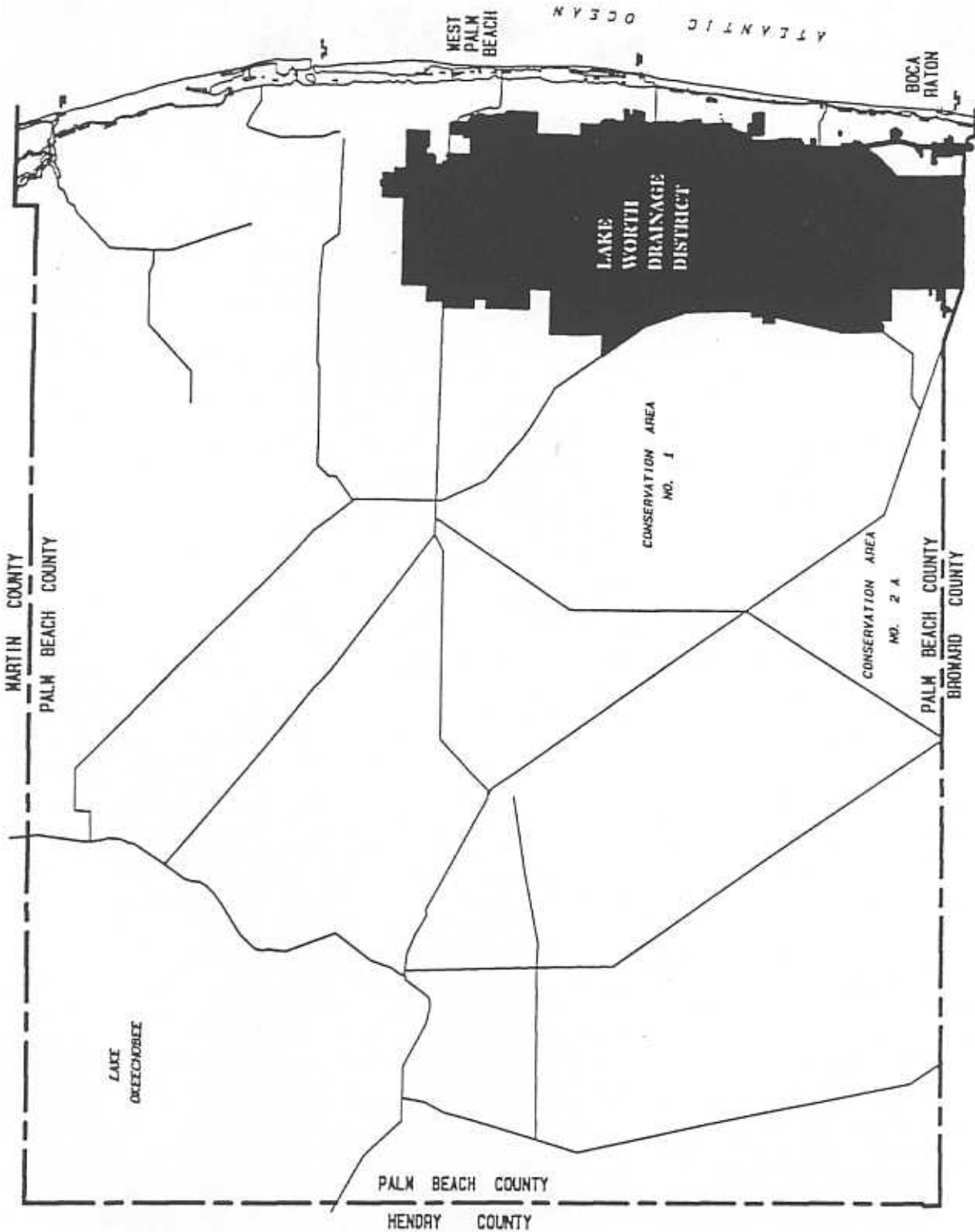
B. Permit Program:

All projects within the LWDD boundaries which alter District facilities or discharge water into the District's canal system, regardless of size or location, require review and permitting by the District. All new developments are restricted to an allowable discharge based on the location of the new development and the proposed outfall canal. Allowable discharge rates are: 35 cubic feet per second per square mile (csm) for the eastern portion of the C-51 Basin; 27 csm for the western portion of the C-51 Basin; 62.6 csm for the C-16 Basin; 70 csm for the C-15 Basin; and 35 csm for the Hillsboro Basin.

C. Operation and Maintenance:

Operation and maintenance responsibilities of the LWDD include the following:

1. Maintenance of approximately 511 miles of LWDD canals in

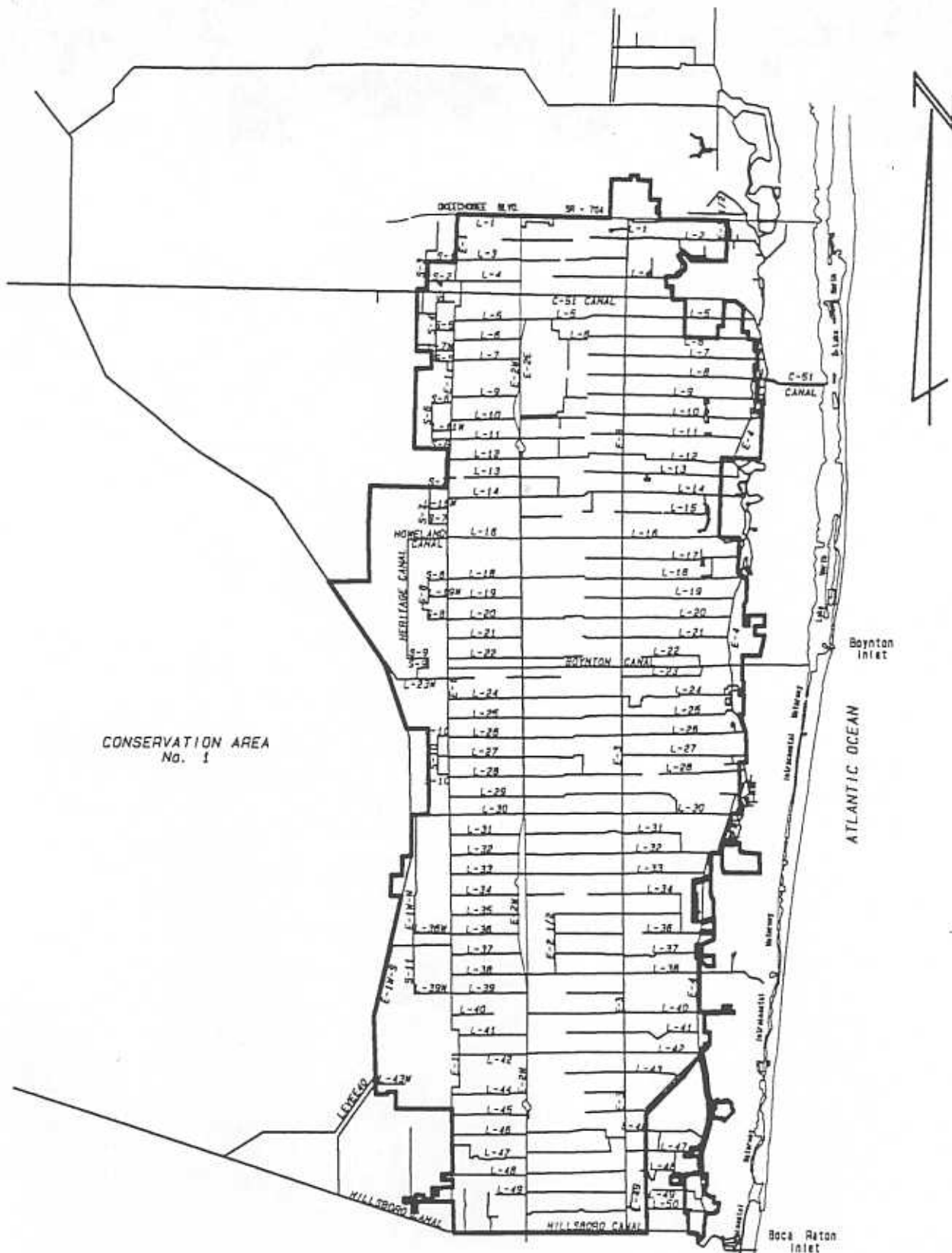


MOCK, ROOS & ASSOCIATES, INC.
ENGINEERS • SURVEYORS • PLANNERS
5720 CORPORATE WAY
WEST PALM BEACH, FLORIDA 33407
Phone: 407 683-3113 Fax: 407 478-7248



LAKE WORTH DRAINAGE DISTRICT LOCATION MAP

FIGURE No. 1



MOCK, ROOS & ASSOCIATES, INC.
 ENGINEERS • SURVEYORS • PLANNERS
 5720 CORPORATE WAY
 WEST PALM BEACH, FLORIDA 33407
 Phone: 407 683-3113 Fax: 407 478-7248

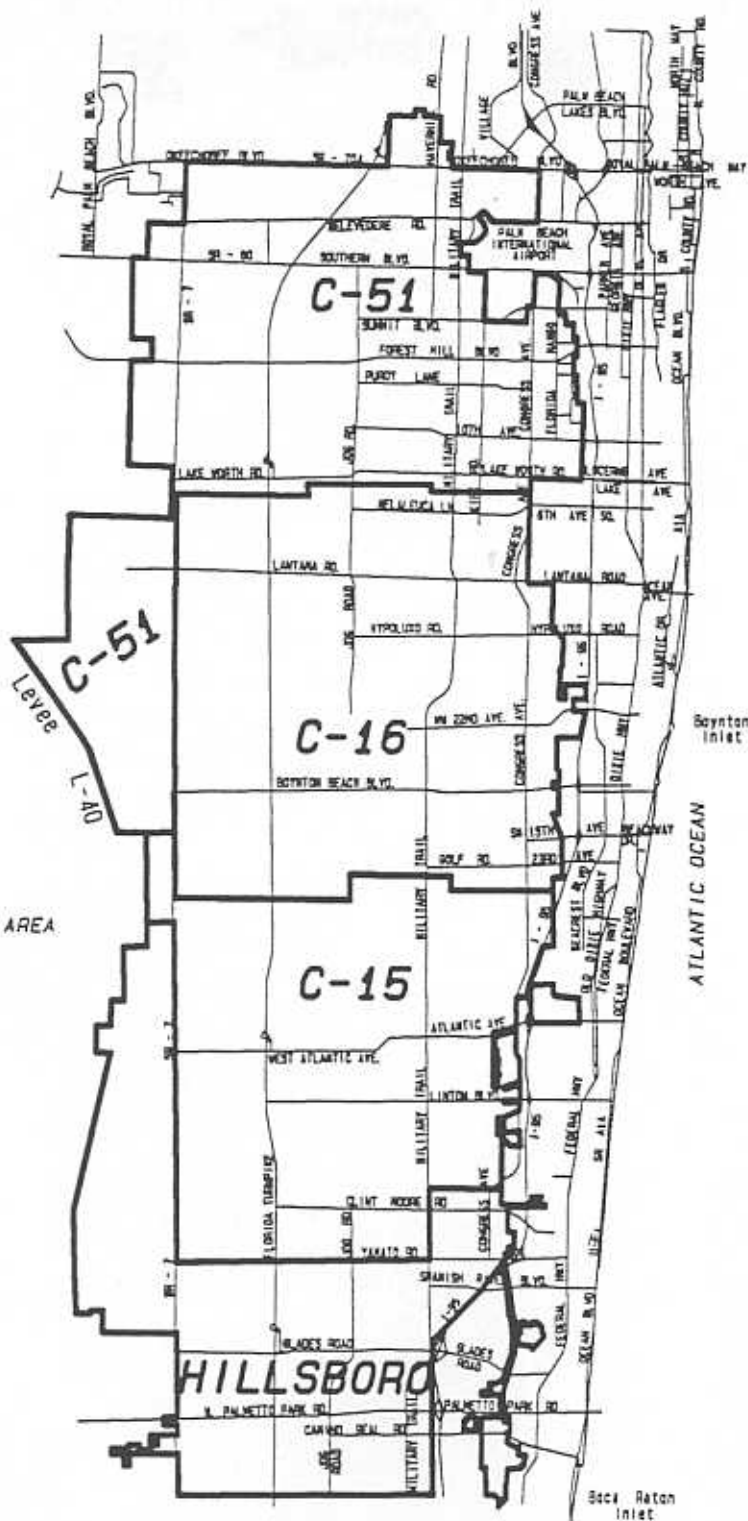
LAKE WORTH DRAINAGE DISTRICT
 DISTRICT BOUNDARY

FIGURE No. 2

order to provide water control and water supply throughout the District. The LWDD boundaries and canal system can be seen on Figure 2. Figure 3 shows the boundaries of the four (4) major drainage basins within the District.

2. An aquatic weed control program using Environmental Protection Agency approved herbicides and mechanical harvesting. This service is provided to minimize frictional losses in the canal channels.
3. Maintenance and operation of the 17 major water control structures listed in Table 1 and numerous minor water control structures as needs dictate.
4. Records of daily rainfall events at 12 different gauges and canal surface water elevations at 31 stations. These records are maintained at the LWDD office which is located at 13081 Military Trail, Delray Beach, Florida 33484.
5. A water quality monitoring program (9 stations are monitored) to establish a data base and protect LWDD interests.

CONSERVATION AREA
No. 1



MOCK, ROOS & ASSOCIATES, INC.
ENGINEERS • SURVEYORS • PLANNERS
5720 CORPORATE WAY
WEST PALM BEACH, FLORIDA 33407
Phone: 407 683-3113 Fax: 407 478-7248



LAKE WORTH DRAINAGE DISTRICT
MAJOR DRAINAGE BASIN BOUNDARIES

FIGURE No. 3

TABLE 1
LAKE WORTH DRAINAGE DISTRICT
MAJOR CONTROL STRUCTURES

Control Struct. No.	LWDD Basin	Location	Year Constructed	Description of Discharge Facility	Description of Water Supply Facility
1	Hillsboro	L-30W, W. of SR 7	1988	2-6 ft. wide by 7 ft. high, manually operated sluice gates, invert El. 10.0 ft. NGVD	2-30,000 GPM Pumps
2	C-51	E-1, S. of C-51	1989	2-12 ft. wide by 7.3 ft. high automated radial gates, invert El. 8.0 ft. NGVD	1-42,000 GPM Pumps
3	Hillsboro	L-36 1/2 W. of SR 7	1982	2-5 ft. wide by 7 ft. high, manually operated slide gates	2-20,000 GPM Pumps
4	C-51	E-2, S. of C-51	1991	2-12 ft. wide by 7.5 ft. high automatically operated radial gates, invert El. 8.5 NGVD	
5	C-16	E-2E, S. of L-16	1995	1-4 1/2 ft. wide gate, invert El. 13.0 NGVD	
6	C-51	E-3, S. of C-51	1994	3-12 ft. wide by 6.5 ft. high radial gates automated, invert El. 6.5 NGVD	
8	C-16	L-14, E. of Military	1993	2-12 ft. wide by 5.7 high automatic radial gates, invert El. 7.5 NGVD	
9	C-16	Boynton Canal @ Lawrence Road	1980	2-12 ft. wide by 11.5 ft. high automated radial gates, invert El. 4.5 NGVD	1-20,000 GPM Pump
11	C-15	L-30, E. of E-3	1987	3-12 ft. wide by 7.9 ft. high radial gates (2 automated, 1 manually), invert El. 8.0 ft. NGVD	

TABLE 1 (Cont'd)

Control Struct. No.	LWDD Basin	Location	Year Constructed	Description of Discharge Facility	Description of Water Supply Facility
12	C-15	L-38, E. of E-3	1987	3-12 ft. wide by 9 ft. high, radial gates (2 automated, 1 manually) invert El. 6.5 NGVD	1-45,000 GPM Pumps
14	Hillsboro	E-1, N. of Hillsboro	1988	1-111.75 ft. long weir crest E. 13.0 ft. NGVD, 1-6 ft. wide by 7ft. high manually operated radial gate at invert El. 6.0 ft. NGVD	
15	C-15	E-4 @ Congress	1970*	1-72 in. diameter corrugated metal pipe with manual vertical gate. Top of gate El. 8.0± NGVD	
16	Hillsboro	E-3, N. of Hillsboro	1985	3-9 ft. wide by 6 ft. high gates, 1-manual radial gate, 2 amil gates, invert El. 3.39 ft.	
17E	Hillsboro	E-2E, N. of Hillsboro	1990	2-6 ft. wide by 11.6 ft. high manually operated slide gates, invert E. 4.0 ft. NGVD	1-35,000 GPM Pump (City of Boca Raton's)
17N	Hillsboro	E-2E, S. of Glades N. of L-46	1996	2-4 ft. wide by 3.7 ft. high manually operated slide gates, invert E. 13.0 ft. NGVD	
17W	Hillsboro	E-2W, N. of Hillsboro	1992	2-12 ft. wide by 8.5 ft. high automated radial gates, invert E. 7.5 ft. NGVD	1-36,000 GPM Pump 1-30,000 GPM Pump
19	Hillsboro	E-1, S. of L-45	1989	2-14 ft. wide by 5.5 ft. high automated radial gates, invert El. 10.0 ft. NGVD	
20	Hillsboro	E-1WS, N. of L-43W	1987	3-5 ft. wide by 5 ft. high manually operated slide gates, invert El. 8.0 ft. NGVD	

* Approximate Construction Date

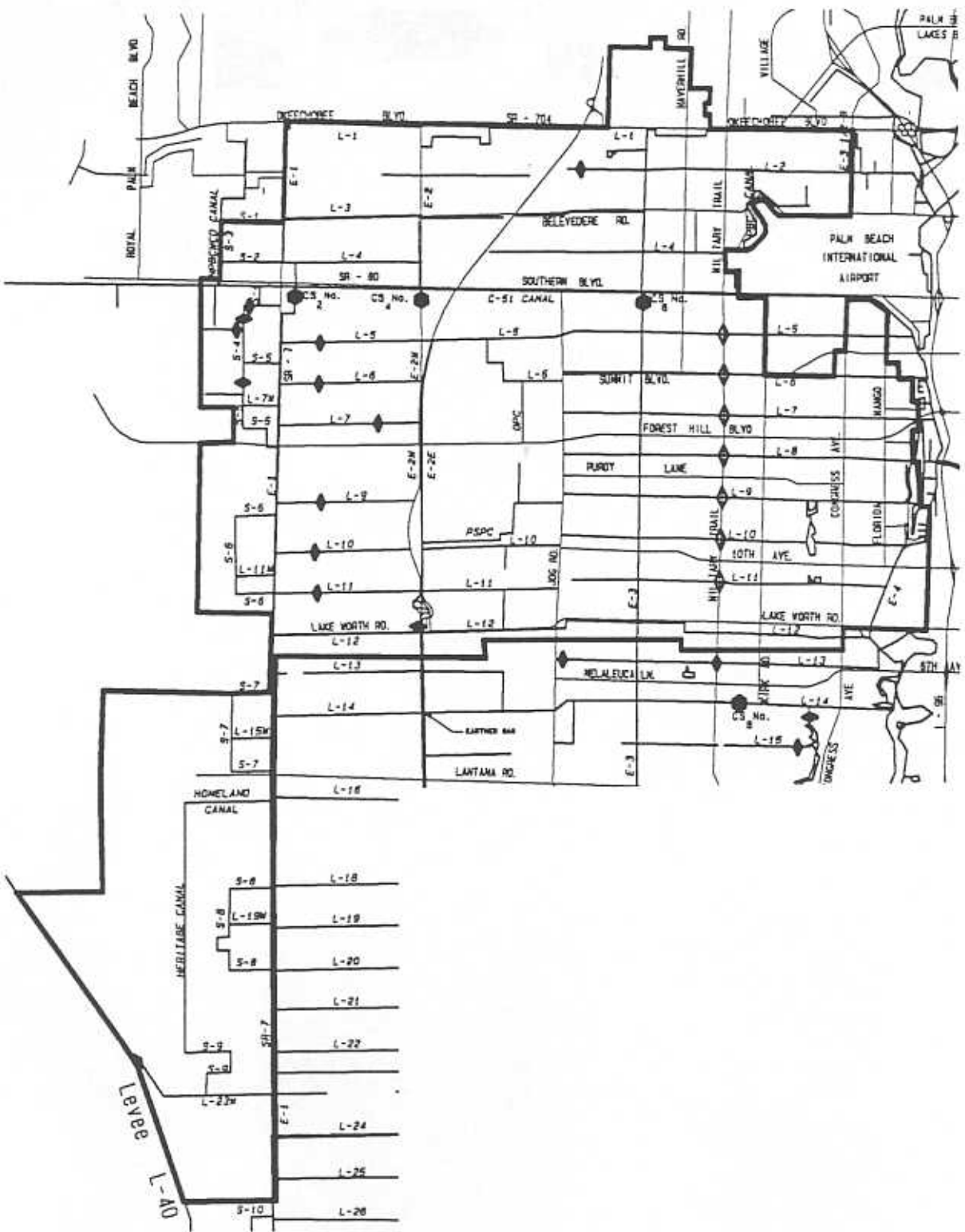
III. MAJOR DRAINAGE BASINS:

A. C-51 Basin:

The LWDD C-51 Basin is depicted on Figure 4 and consists generally of the area south of Okeechobee Boulevard to Lake Worth Road and west of I-95 to State Road No. 7. The LWDD C-51 Basin also includes an area west of State Road No. 7 from Okeechobee Boulevard to south of Boynton Beach Boulevard. The total drainage area within the LWDD C-51 Basin is approximately 65 square miles.

The Surface Water Management Plan for the LWDD C-51 Basin was completed in 1986. Drainage of the LWDD C-51 Basin is generally accomplished by a system of east-west canals referred to as laterals (L-1 to L-12) and by five main north-south canals referred to as equalizing canals (E-1, E-2W, E-2E, E-3 and E-4). This system of canals is shown on Figure 4. The C-51 Canal serves as the major collector of flow for this basin. Runoff is conveyed from the interior network of laterals to the equalizing canals. The equalizing canals discharge from the north and south into the C-51 Canal, which flows east to the Intracoastal Waterway.

Within the C-51 Basin, the LWDD maintains and operates several water control structures to control discharge and maintain optimum water levels. Major control structures are located on the E-1, E-2 and E-3 Canals south of the C-51 Canal. LWDD Control Structure No. 2 on the E-1 Canal was relocated in 1989 and replaced with two automatically controlled radial gates to maintain water levels south of the structure at approximately 16.0 feet NGVD. LWDD Control Structure No. 4 on the E-2 Canal was replaced in 1991 and consists of two automatically controlled radial



● - MAJOR LMOO CONTROL STRUCTURE; ◆ - MINOR LMOO CONTROL STRUCTURE; ◊ - PROPOSED LMOO CONTROL STRUCTURE; - - - - - BASIN BOUNDARY

MOCK, ROOS & ASSOCIATES, INC.
 ENGINEERS • SURVEYORS • PLANNERS
 5720 CORPORATE WAY
 WEST PALM BEACH, FLORIDA 33407
 Phone: 407 683-3113 Fax: 407 478-7248



LAKE WORTH DRAINAGE DISTRICT
 CANAL NETWORK: C-51 BASIN

FIGURE No. 4

gates (equipped with water level sensors to monitor upstream and downstream stages) to regulate and maintain water levels south of the structure at approximately 13.0 feet NGVD. If stages within the C-51 Canal are higher than stages within the E-2 Canal, the gates close until stages within the E-2 Canal are higher. LWDD Control Structure No. 6 on the E-3 Canal was constructed in 1978 and consists of four aml gates to control upstream stages at elevation 13.0 feet NGVD. The SFWMD permit allows only three of the four aml gates to be used at one time.

Stages within the C-51 Canal are regulated by SFWMD. To improve the hydraulic capacity of the C-51 Canal, SFWMD has recently completed channel improvements to the C-51 Canal between Kirk Road and Florida's Turnpike. The SFWMD Salinity Control Structure S-155 is located on the C-51 Canal east of Dixie Highway. This structure is a reinforced concrete spillway with discharges controlled by three 25 feet wide x 7.5 feet high vertical lift gates. The operation of the gates is automatically controlled, but with manual backup. Automatic gate controls were designed to maintain an optimum headwater elevation of 8.5 feet NGVD.

The capacity of the LWDD C-51 Basin canal system, as evaluated in 1986, was determined to be approximately 5.8 inches of rainfall within a 24 hour period. This corresponds to a design frequency of one in three years, or on the average, a 33.3 percent chance of occurring in any given year. Since 1986, SFWMD has constructed canal improvements within the C-51 Canal between Forest Hill Boulevard and Summit Boulevard, and from Kirk Road to Florida's Turnpike. These improvements have resulted in the lowering of stages within the C-51 Canal, thereby reducing

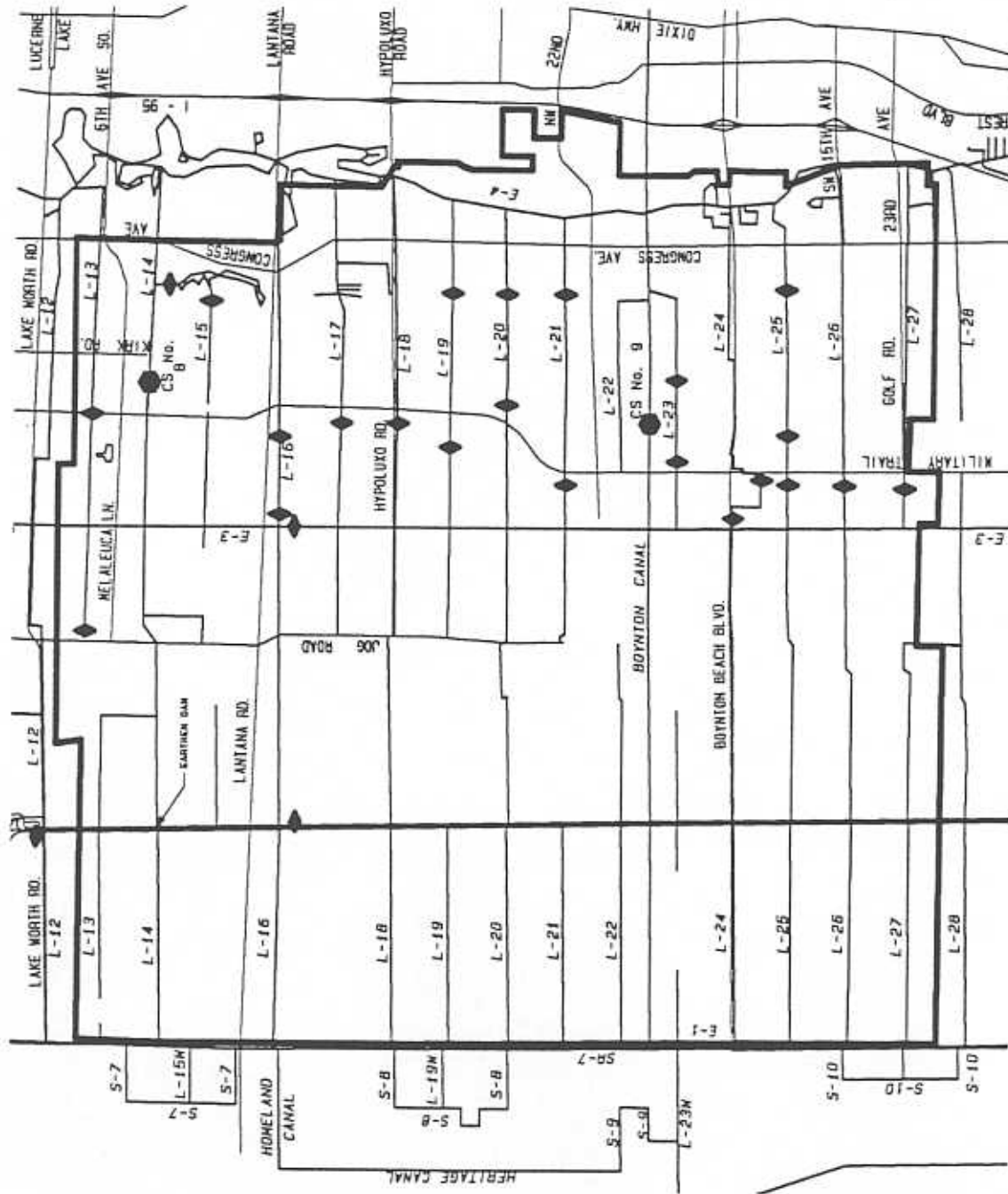
tailwater conditions for LWDD canals. As a result, the LWDD canal system was re-evaluated to determine the effect of lowering stages within the C-51 Canal on the capacity of the District's canal system.

B. C-16 Basin:

The LWDD C-16 Basin is depicted on Figure 5 and consists generally of the area south of Lake Worth Road to Golf Road and west of I-95 to State Road No. 7. The total drainage area within the LWDD C-16 Basin is approximately 65 square miles.

The Surface Water Management Plan for the LWDD C-16 Basin was completed in 1991. Drainage of the LWDD C-16 Basin is accomplished by a system of east-west canals referred to as laterals (L-13 to L-27) and by four main north-south canals referred to as equalizing canals (E-2W, E-2E, E-3 and E-4). This system of canals is shown on Figure 5 and includes the Boynton Canal and the L-14 Canal which, along with the E-4 Canal serve as the major collectors of flow for this basin. Runoff is conveyed from the interior network of canals and laterals to either the Boynton Canal or the L-14 Canal. Flow from the L-14 Canal is to the E-4 Canal, which is partially a natural channel and runs through Lake Osborne. The Boynton Canal and the E-4 Canal discharge into the Intracoastal Waterway via the C-16 Canal, which is an eastern extension of the Boynton Canal.

Within the C-16 Basin, the LWDD maintains and operates several water control structures to control discharge and maintain optimum water levels. The two



● - MAJOR LWD CONTROL STRUCTURE; ◆ - MINOR LWD CONTROL STRUCTURE; — - BASIN BOUNDARY

MOCK, ROOS & ASSOCIATES, INC.
 ENGINEERS • SURVEYORS • PLANNERS
 5720 CORPORATE WAY
 WEST PALM BEACH, FLORIDA 33407
 Phone: 407 683-3113 Fax: 407 478-7248



LAKE WORTH DRAINAGE DISTRICT
 CANAL NETWORK: C-16 BASIN

FIGURE No. 5

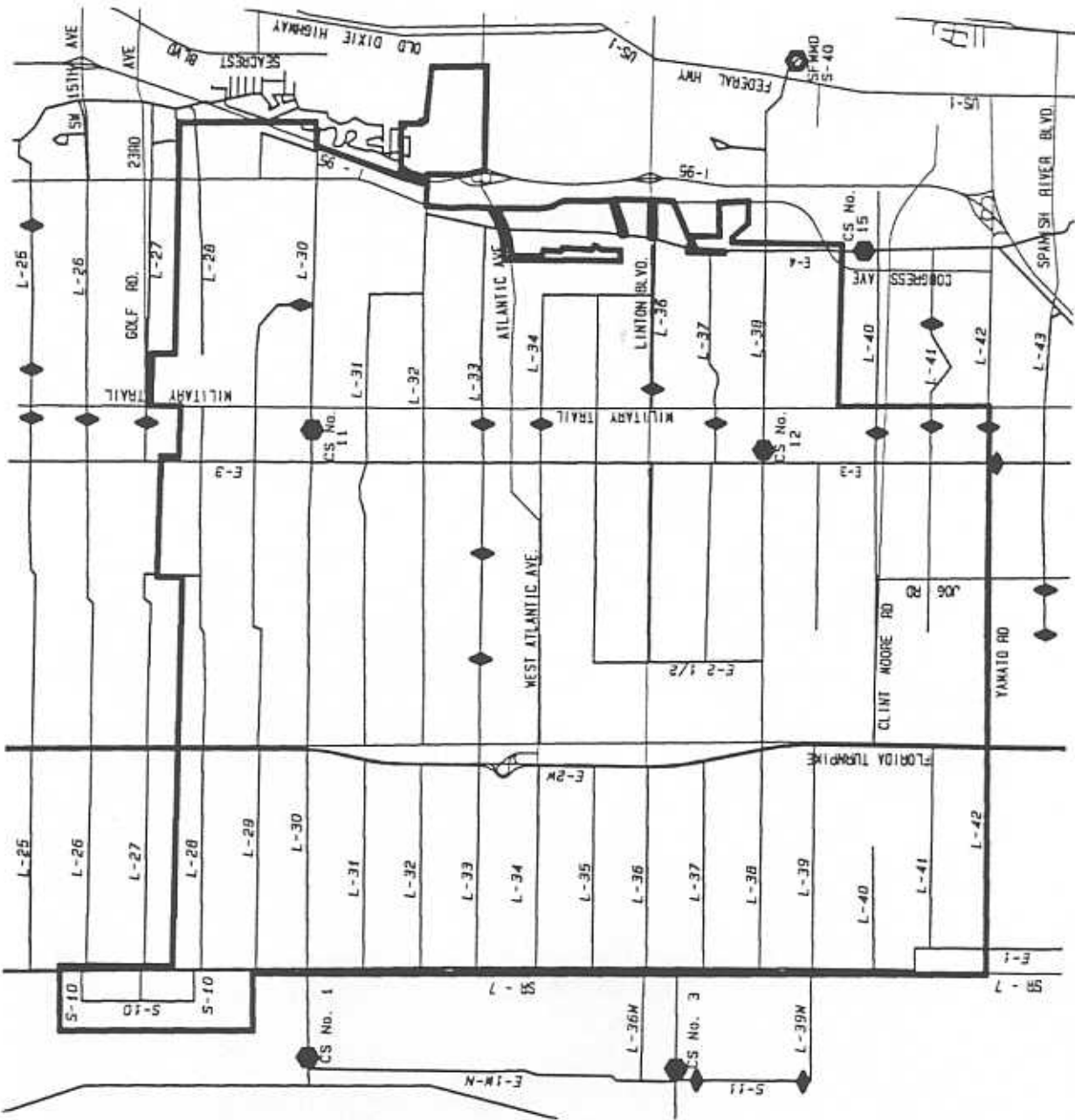
major water control structures are located on the L-14 Canal and the Boynton Canal. LWDD Control Structure No. 8 is located along the L-14 Canal between Military Trail and Congress Avenue. The existing structure consists of five manually controlled slide gates (a new structure consisting of two radial gates is proposed for construction in 1993) to maintain water levels west of the structure at approximately 13.0 feet NGVD. LWDD Control Structure No. 9 is located along the Boynton Canal on the west side of Lawrence Road and consists of two manually controlled radial gates to maintain water levels west of the structure at approximately 16.0 feet NGVD. Downstream of this structure, east of Dixie Highway, is the SFWMD Salinity Control Structure S-41. This structure consists of two automatically controlled 25 feet wide x 8.4 feet high gates to maintain water levels between 7.8 and 8.5 feet NGVD upstream of the structure to the LWDD structures.

The capacity of the LWDD C-16 Basin canal system as evaluated in 1991, was determined to be approximately 9.5 inches of rainfall within a 24 hour period. This corresponds to a design frequency of one in ten years, or on the average, a 10 percent chance of occurring in any given year.

C. C-15 Basin:

The LWDD C-15 Basin is depicted on Figure 6 and consists generally of the area south of Golf Road to Yamato Road and west of I-95 to State Road No. 7. The total drainage area within the LWDD C-15 Basin is approximately 55 square miles.

The Surface Water Management Plan for the LWDD C-15 Basin was



◆ - MAJOR LMO CONTROL STRUCTURE; ● - MINOR LMO CONTROL STRUCTURE; ○ - SFMO CONTROL STRUCTURE; ——— - BASIN BOUNDARY

MOCK, ROOS & ASSOCIATES, INC.
 ENGINEERS • SURVEYORS • PLANNERS
 5720 CORPORATE WAY
 WEST PALM BEACH, FLORIDA 33407
 Phone: 407 683-3113 Fax: 407 478-7248

LAKE WORTH DRAINAGE DISTRICT
 CANAL NETWORK: C-15 BASIN

FIGURE No. 6

completed in 1989. Drainage of the District's C-15 Basin is accomplished by a system of east-west canals referred to as laterals (L-28 to L-42) and by five main north-south canals referred to as equalizing canals (E-1, E-2W, E-2E, E-3 and E-4). This system of canals is shown on Figure 6. Laterals L-30 and L-38 and the equalizing canal E-4 serve as the major collectors of flow for this basin. Runoff is conveyed from the interior network of canals to either the L-30 or L-38 Canal. Flow from the L-30 Canal is to the E-4 Canal, which is partially a natural channel and runs through Lake Ida. The E-4 and L-38 Canals discharge into the Intracoastal Waterway via the C-15 Canal, which is an eastern extension of the L-38 Canal.

Within the C-15 Basin, the LWDD maintains and operates several water control structures to control discharge and maintain optimum water levels. The two major water control structures are located on the L-30 and L-38 Canals. LWDD Control Structure No. 12 is located along the L-38 Canal west of Military Trail. This structure consists of two automatically controlled radial gates and one manually controlled gate to maintain water levels west of the structure at approximately 16.0 feet NGVD. Downstream of this structure, east of Dixie Highway, is the SFWMD Salinity Control Structure S-40. This structure consists of two automatically controlled gates to maintain water levels between 7.8 and 8.5 feet NGVD upstream of the structure to the LWDD structures. LWDD Control Structure No. 11 is located along the L-30 Canal east of the E-3 Canal and, like LWDD Control Structure No. 12, consists of two automatically controlled radial gates and one manually controlled gate to maintain water levels west of the structure at approximately 16.0 feet NGVD.

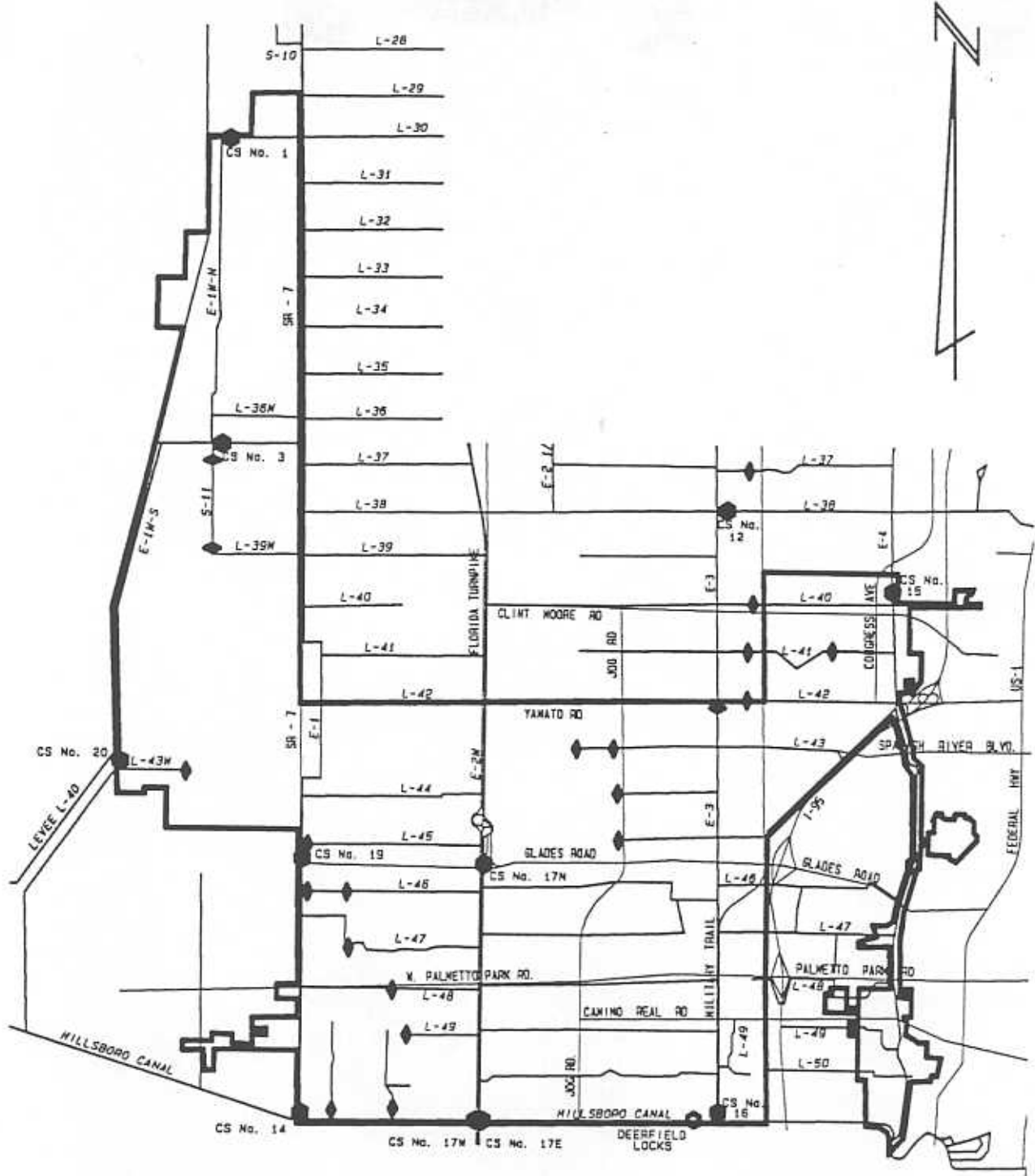
The capacity of the LWDD C-15 Basin canal system, as evaluated in 1989, was determined to be approximately 10.5 inches of rainfall within a 24 hour period. This corresponds to a design frequency of one in ten years, or on the average, a 10 percent chance of occurring in any given year.

D. Hillsboro Basin:

The LWDD Hillsboro Basin is depicted on Figure 7 and consists generally of the area south of Yamato Road to the Hillsboro Canal and west of Federal Highway to State Road No. 7. The LWDD Hillsboro Basin also includes an area west of State Road No. 7 from south of the L-29 Canal to the Hillsboro Canal. The total drainage area within the LWDD Hillsboro Basin is approximately 60 square miles.

The Surface Water Management Plan for the LWDD Hillsboro Basin was completed in 1984. Drainage of the LWDD Hillsboro Basin is generally accomplished by a system of east-west canals referred to as laterals (L-42 to L-50) and by six north-south canals referred to as equalizing canals (E-1W, E-1, E-2W, E-2E, E-3 and E-4). This system of canals is shown on Figure 7. The equalizing canals serve as the major collectors of flow for this basin. Runoff is conveyed from the interior network of laterals to the equalizing canals. The equalizing canals convey discharge to the Hillsboro Canal which discharges to the Intracoastal Waterway.

Within the Hillsboro Basin, the LWDD maintains and operates several water control structures to control discharge and maintain optimum water levels. Major control structures are located on the E-1, E-2W, E-2E and E-3 Canals north of the



● - MAJOR LMOO CONTROL STRUCTURE; ◆ - MINOR LMOO CONTROL STRUCTURE; ○ - SFMOO CONTROL STRUCTURE; ——— - BASIN BOUNDARY

MOCK, ROOS & ASSOCIATES, INC.
 ENGINEERS • SURVEYORS • PLANNERS
 5720 CORPORATE WAY
 WEST PALM BEACH, FLORIDA 33407
 Phone: 407 683-3113 Fax: 407 478-7248



LAKE WORTH DRAINAGE DISTRICT
 CANAL NETWORK: HILLSBORO BASIN

FIGURE No. 7

Hillsboro Canal. LWDD Control Structure No. 19 is located along the E-1 Canal north of Glades Road. This structure consists of two automated radial gates to maintain water levels north of the structure at approximately 16.0 feet NGVD. LWDD Control Structure No. 14 is also located along the E-1 Canal downstream of LWDD Control Structure No. 19, immediately north of the Hillsboro Canal, and consists of a weir and manually operated radial gate to maintain water levels north of the structure (to LWDD Control Structure No. 19) at approximately 13.0 feet NGVD. LWDD Control Structure No. 17W is located along the E-2W Canal immediately north of the Hillsboro Canal and consists of two automated radial gates to maintain stages north of the structure at approximately 16.0 feet NGVD. LWDD Control Structures No. 17E and No. 17N are located along the E-2E Canal immediately north of the Hillsboro Canal and south of Glades Road, respectively. LWDD Control Structure No. 17E consists of two manually operated slide gates to maintain water levels north of the structure (to LWDD Control Structure No. 17N) at approximately 9.3 feet NGVD. LWDD Control Structure No. 17N consists of four manually operated slide gates to maintain water levels north of the structure at approximately 16.0 feet NGVD. LWDD Control Structure No. 16 is located along the E-3 Canal immediately north of the Hillsboro Canal and consists of one manually operated radial gate and two amil gates to maintain water levels north of the structure (to Yamato Road) at approximately 9.3 feet NGVD. LWDD Control Structures No. 1, No. 3 and No. 20 are located west of State Road No. 7 along the L-30W, L-36½W and E-1W-S Canals respectively. These structures consist of manually operated sluice

gates or slide gates to maintain water levels within the E-1W-S and E-1W-N Canals north of LWDD Control Structure No. 20 to LWDD Control Structure No. 1 at approximately 13.0 feet NGVD.

Stages within the Hillsboro Canal are regulated by the Deerfield Lock, a SFWMD Salinity Control Structure located approximately 0.75 miles west of I-95. The Deerfield Lock is a lift gate structure which maintains water levels west of the structure at approximately 7.7 feet NGVD. A LWDD/Boca Raton Salinity Control Structure exists along the E-4 Canal north of Glades Road to maintain water levels north of the structure at approximately 4.3 feet NGVD.

The capacity of the LWDD Hillsboro Basin canal system, as evaluated in 1984, was determined to be approximately 10.5 inches of rainfall within a 24 hour period. This corresponds to a design frequency of one in ten years, or on the average, a 10 percent chance of occurring in any given year.

IV. STUDY METHODOLOGY:

A. Data Acquisition and Field Survey:

All of the data used to develop the Surface Water Management Plans for each of the four (4) major drainage basins was used for this study. The data used consisted primarily of field surveys for each basin (beginning in 1982 with the Hillsboro Basin) and inventories of SFWMD and LWDD permit files.

The field surveys were conducted during the individual basin studies (between 1982 and 1990) to determine the locations, elevations and dimensions of all structures which cross the LWDD canals or discharge into them. Canal cross-sections were taken at approximately one-half mile intervals and upstream or downstream of canal crossings. None of the field surveys were updated with the exception of several minor water control structures which were thought to have a major impact on study results. Any canal excavation or other structures (i.e. canal connections or canal crossings) constructed after the field surveys were not evaluated or used to develop the results of this study.

A current inventory of SFWMD's permit files was made as part of this study to obtain data on additional permitted projects for which data was not available during previous investigations. Most of the data obtained was for projects within the C-51 Basin which were permitted after the individual basin study.

B. Hydrologic Analysis:

The hydrologic analysis was performed using the U.S. Department of

Agriculture's Soil Conservation Service (SCS) revised TR-20 computer program which uses the Modified ATT-Kin coefficient method for stream flood routing. This computer program provides for hydrologic analyses of a watershed using single event storm rainfall-frequency data. Sub-area surface runoff hydrographs were developed, routed through a reservoir (using the storage indication method) and combined with hydrographs from other sub-areas. The resulting hydrograph was then routed through a reach of canal using the Modified Att-Kin coefficient method. Uniform rain depth and distribution were assumed over the entire District with the exception of minor variations in rain depth due to the large area covered by the District. The routing procedures used by the TR-20 program are described in the SCS National Engineering Handbook, Section 4, Hydrology (NEH-4).

In establishing a hydrologic model for the LWDD canal system, the District was first divided into the four (4) major drainage basins shown on Figure 3. Each of the major drainage basins was then divided into sub-basins based on LWDD and SFWMD permit information and input from LWDD regarding District operations. Each sub-basin was divided into sub-areas based on individual stormwater management systems identified by permits, plats or field investigations. An average sub-area was approximately 100 acres in size. Estimates of the hydrologic parameters for each of the stormwater management systems, such as the time of concentration and runoff curve number, were based on SFWMD procedures. The design rainfall for a District-wide storm was determined to be approximately 8.5 to 10.5 inches. This is the average amount of rainfall for the District as shown on SFWMD's rainfall maps

for the 10-year, 24-hour event.

Design discharges for developed and/or permitted areas were based on the results of the TR-20 modeling. For those sub-areas (e.g. undeveloped or agricultural areas) whose current land use could change in accordance with the Palm Beach County Land Use Plan, runoff was based on LWDD's allowable discharge criteria for each of the four (4) major drainage basins. The allowable runoff calculated for these sub-areas was then added to the TR-20 discharges. The final design discharges were adjusted in certain areas due to flow from one basin to another to balance design stages at basin boundaries.

C. Hydraulic Analysis:

Analysis of the hydraulic characteristics of the District's canals was performed using the U.S. Department of Agriculture's Soil Conservation Service (SCS) WSP-2 computer program. This model uses a standard step backwater procedure for calculating water surface profiles. The effects of channel configuration, and hydraulic structures such as bridges, culverts, weirs and control structures were considered in the analysis. For the purpose of this study, the canals were assumed to be well maintained and, as such, a channel roughness coefficient of 0.03 was used. The analysis also assumed that all major outfall structures, with the exception of LWDD Control Structure No. 19, were operating at maximum capacity. Stages at basin boundaries were reviewed and, since a District-wide storm event was assumed, discharges from one basin to another were allowed in order to balance stages. The

design capacity of the LWDD canals was determined by analyzing the stages within the equalizing canals for different storm events and selecting the maximum runoff amount which is contained within the canal banks. Where overtopping of the canal banks of laterals was indicated, improvements were recommended. The impact of design stages on existing development adjacent to LWDD canals was not investigated.

V. STUDY RESULTS:

A. C-51 Basin:

Due to the canal improvements made to the C-51 Canal, stages within the canal were lowered, thereby reducing the tailwater conditions for the LWDD canal system. As a result of the C-51 Canal improvements along with an exchange of discharge between the LWDD C-51 and C-16 Basins, it was determined that the capacity of the LWDD C-51 Basin (with the exception of the L-2 and E-3½-8 Canals east of Military Trail and north of the C-51 Canal) is equivalent to a 10-year, 24-hour storm event. Due to the low top of bank elevations and restricted canal right-of-way of the outfall canal, it was determined that the capacity of the L-2 and E-3½-8 Canals east of Military Trail and north of the C-51 Canal is equivalent to a 5-year, 24-hour storm event with 7.5 inches of rainfall. The resulting design discharges and stages are given in Table 2 and can be seen on Figures 8-A through 8-E.

The 10-year, 24-hour design stages were based on a 10-year, 24-hour storm event with approximately 8.5 inches of rainfall. Minor control structures (10 foot wide weirs with weir crest elevations of 13 feet NGVD) were assumed at Military Trail with

some flow (30 - 100 cfs) from west to east for laterals L-5 to L-11.

Results of this study indicated that an exchange of discharge would occur at the basin boundary between the C-51 and C-16 Basins. Approximately 242 cfs from the C-51 Basin flows south from the C-51 Basin along the E-3 Canal to the L-14 Canal. At the E-4 Canal approximately 178 cfs flows from the C-16 Basin north to the C-51 Basin.

Earlier studies indicated that the C-51 Basin included the E-1 Canal and all interconnecting canals west of the E-1 Canal from the S-1 Canal south to the L-23W Canal. Results of this study indicated that during a District-wide 10-year, 24-hour storm event some of this discharge (approximately 200 cfs) would flow south along the E-1 Canal to the C-16 Basin.

This exchange of discharges between basins resulted in lowering design stages within the C-51 Basin along the E-1 and E-3 Canals south of the C-51 Canal.

TABLE 2

DESIGN DISCHARGES AND STAGES: C-51 CANAL

LWDD CANAL	STATION	LOCATION	DESIGN DISCHARGE (CFS)	DESIGN STAGE (FT. NGVD)
E-1	117+41	OKEECHOBEE BLVD.	10	16.1
E-1	53+46	BELVEDERE ROAD	51	16.1
E-1	1+02	SOUTHERN BLVD.	74	16.0
E-1	1+85	CONTROL STRUCTURE NO. 2	361	16.2/16.0
E-1	79+50	L-7W	260	16.6
E-1	106+45	FOREST HILL BLVD.	222	16.7
E-1	202+10	L-11	150	17.1
E-1	256+00	L-13	120	17.2
E-1	283+10	L-14	95	17.3
E-1	446+20	L-20	235	17.0
E-1	526+90	L-23W	135	16.7
E-2	93+50	L-1	107	15.7
E-2	75+00	L-2	155	15.7
E-2	19+50	L-4	318	15.5
E-2	3+22	CONTROL STRUCTURE NO. 4	675	16.0/15.3
E-2W	62+10	L-6	169	16.3
E-2W	102+52	FOREST HILL BLVD.	156	16.3
E-2W	171+50	L-10	131	16.4
E-2E	0+00	SOUTH OF L-5	318	16.3
E-2E	67+74	FOREST HILL BLVD.	318	16.3
E-2E	136+00	L-10	295	16.4
E-2E	192+29	LAKE WORTH ROAD	80	16.5
E-3	93+50	L-1	305	15.7
E-3	53+27	BELVEDERE ROAD	682	15.4
E-3	1+33	SOUTHERN BLVD.	1165	14.4
E-3	1+97	CONTROL STRUCTURE NO. 6	813	15.0/14.4

TABLE 2

DESIGN DISCHARGES AND STAGES: C-51 CANAL

LWDD CANAL	STATION	LOCATION	DESIGN DISCHARGE (CFS)	DESIGN STAGE (FT. NGVD)
E-3	53+40	SUMMIT BLVD.	729	15.5
E-3	93+47	FOREST HILL BLVD.	479	15.9
E-3	213+40	LAKE WORTH ROAD	189	16.2
E-4	78+25	10TH AVENUE NORTH	783	12.1
E-4	114+10	2ND AVENUE NORTH	371	12.1
L-1	22+50	POWELL ROAD	8	16.1
L-1	83+30	WEST OF E-2	22	15.7
L-1	95+35	EAST OF E-2	78	15.7
L-1	128+19	GOLDEN LAKES BLVD.	54	16.4
L-1	265+00	WEST OF E-3	55	15.7
L-1	279+00	EAST OF E-3	156	15.7
L-1	308+45	HAVERHILL ROAD	55	18.2
L-2	53+32	GOLDEN LAKES BLVD.	33	15.9/15.8
L-2	80+18	SKEES ROAD	6	16.5
L-2	150+51	DREXEL ROAD	63	15.9/15.8
L-2	205+55	HAVERHILL ROAD	89	17.7/17.3
L-2	267+47	WABASSO DRIVE	178	13.9
L-3	0+00	E-1	43	16.1
L-3	88+00	WEST OF E-2	20	15.7
L-3	90+00	EAST OF E-2	34	15.7
L-3	140+68	SKEES ROAD	3	15.9
L-3	214+15	DREXEL ROAD	68	15.5
L-3	238+00	WEST OF E-3	96	15.4
L-4	0+00	E-1	37	16.0
L-4	80+85	BENOIST FARMS ROAD	94	15.8/15.5

TABLE 2

DESIGN DISCHARGES AND STAGES: C-51 CANAL

LWDD CANAL	STATION	LOCATION	DESIGN DISCHARGE (CFS)	DESIGN STAGE (FT. NGVD)
L-4	120+00	EAST OF FLORIDA'S TURNPIKE	5	16.8
L-4	188+30	FIRST STREET	125	16.7
L-4	230+00	WEST OF E-3	209	15.0
L-4	232+00	EAST OF E-3	186	15.0
L-4	280+00	WEST OF MILITARY TRAIL	44	16.1
L-5	0+00	E-1	26	16.4
L-5	97+03	FLORIDA'S TURNPIKE	513	16.3
L-5	132+00	OKEEHHEELER PARK CANAL	185	16.3
L-5	186+00	WEST OF JOG ROAD	66	16.5
L-5	242+00	WEST OF E-3	56	15.1
L-5	293+00	WEST OF MILITARY TRAIL	30	14.7
L-5	321+41	KIRK ROAD	98	13.9/13.5
L-5	374+29	CONGRESS AVENUE	114	12.9/12.8
L-5	416+00	C-51	194	12.5
L-6	0+00	E-1	45	16.5
L-6	91+00	E-2W	21	16.3
L-6	162+00	OKEEHHEELER PARK CANAL	9	16.3
L-6	247+00	WEST OF E-3	69	15.6
L-6	248+00	EAST OF E-3	65	15.6
L-6	297+85	WEST OF MILITARY TRAIL	45	17.7
L-6	377+48	CONGRESS AVENUE	187	12.8
L-6	417+10	PATRICK DRIVE	285	12.2/12.1
L-7	0+00	E-1	26	16.6
L-7	92+00	E-2W	3	16.3
L-7	190+00	EAST OF JOG ROAD	13	16.2
L-7	243+00	WEST OF E-3	63	15.8

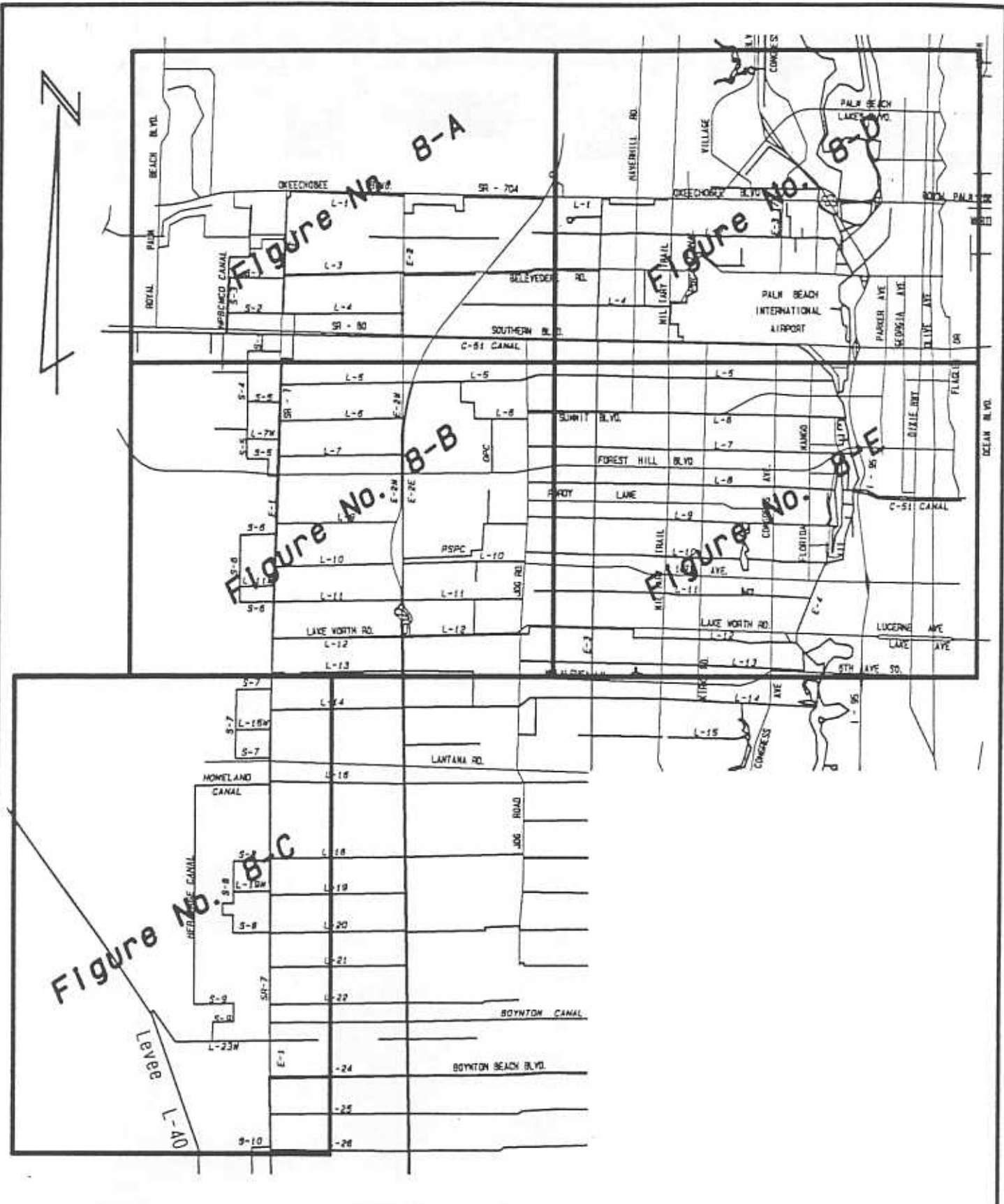
TABLE 2
DESIGN DISCHARGES AND STAGES: C-51 CANAL

LWDD CANAL	STATION	LOCATION	DESIGN DISCHARGE (CFS)	DESIGN STAGE (FT. NGVD)
L-7	244+00	EAST OF E-3	67	15.7
L-7	298+17	WEST OF MILITARY TRAIL	30	16.0
L-7	348+60	DAVIS ROAD	143	14.3
L-7	418+92	FOREST HILL BLVD.	228	12.6/11.8
L-8	190+00	EAST OF JOG ROAD	6	16.2
L-8	242+00	WEST OF E-3	110	16.1
L-8	244+00	EAST OF E-3	22	16.1
L-8	296+13	WEST OF MILITARY TRAIL	100	16.1
L-8	362+65	ANGEL ROAD	202	13.2/12.9
L-8	417+24	WEST LAKE ROAD	315	11.6
L-9	0+00	E-1	11	16.8
L-9	91+80	E-2W	17	16.4
L-9	190+00	EAST OF JOG ROAD	7	17.0
L-9	243+00	WEST OF E-3	99	16.2
L-9	245+00	EAST OF E-3	34	16.2
L-9	296+76	WEST OF MILITARY TRAIL	50	16.2
L-9	349+57	DAVIS ROAD	219	12.8
L-9	417+74	WEST LAKE DRIVE	321	11.8
L-10	0+00	E-1	3	17.0
L-10	91+60	E-2W	57	16.4
L-10	100+40	E-2E	106	16.4
L-10	151+35	PINEHURST DRIVE	62	17.7/17.5
L-10	192+00	EAST OF JOG ROAD	10	16.3
L-10	243+00	WEST OF E-3	82	16.3
L-10	244+00	EAST OF E-3	138	16.3

TABLE 2

DESIGN DISCHARGES AND STAGES: C-51 CANAL

LWDD CANAL	STATION	LOCATION	DESIGN DISCHARGE (CFS)	DESIGN STAGE (FT. NGVD)
L-10	297+26	WEST OF MILITARY TRAIL	50	16.6
L-10	376+38	CONGRESS AVENUE	174	12.3/12.1
L-10	403+38	FLORIDA MANGO ROAD	242	12.1
L-11	0+00	E-1	2	17.0
L-11	97+60	E-2W	49	16.4
L-11	101+40	E-2E	133	16.4
L-11	152+39	PINEHURST DRIVE	81	18.5/18.3
L-11	242+00	WEST OF E-3	146	16.3
L-11	244+00	EAST OF E-3	43	16.3
L-11	297+19	WEST OF MILITARY TRAIL	70	17.1
L-11	376+97	CONGRESS AVENUE	344	13.1/12.4
L-11	402+00	E-4	383	12.1
L-12	0+00	E-1	18	17.1
L-12	200+00	E-2E	80	16.5
L-12	422+71	KIRK ROAD	79	16.6/16.2
L-12	498+00	E-4	154	12.1
OKEEHHEEL PARK CANAL	0+00	L-5	60	16.3
OKEEHHEEL PARK CANAL	53+00	L-6	42	16.3
PINE STATE PARK CANAL	3+00	E-2E	57	16.4
PINE STATE PARK CANAL	56+20	PINEHURST DRIVE	57	16.6/16.5

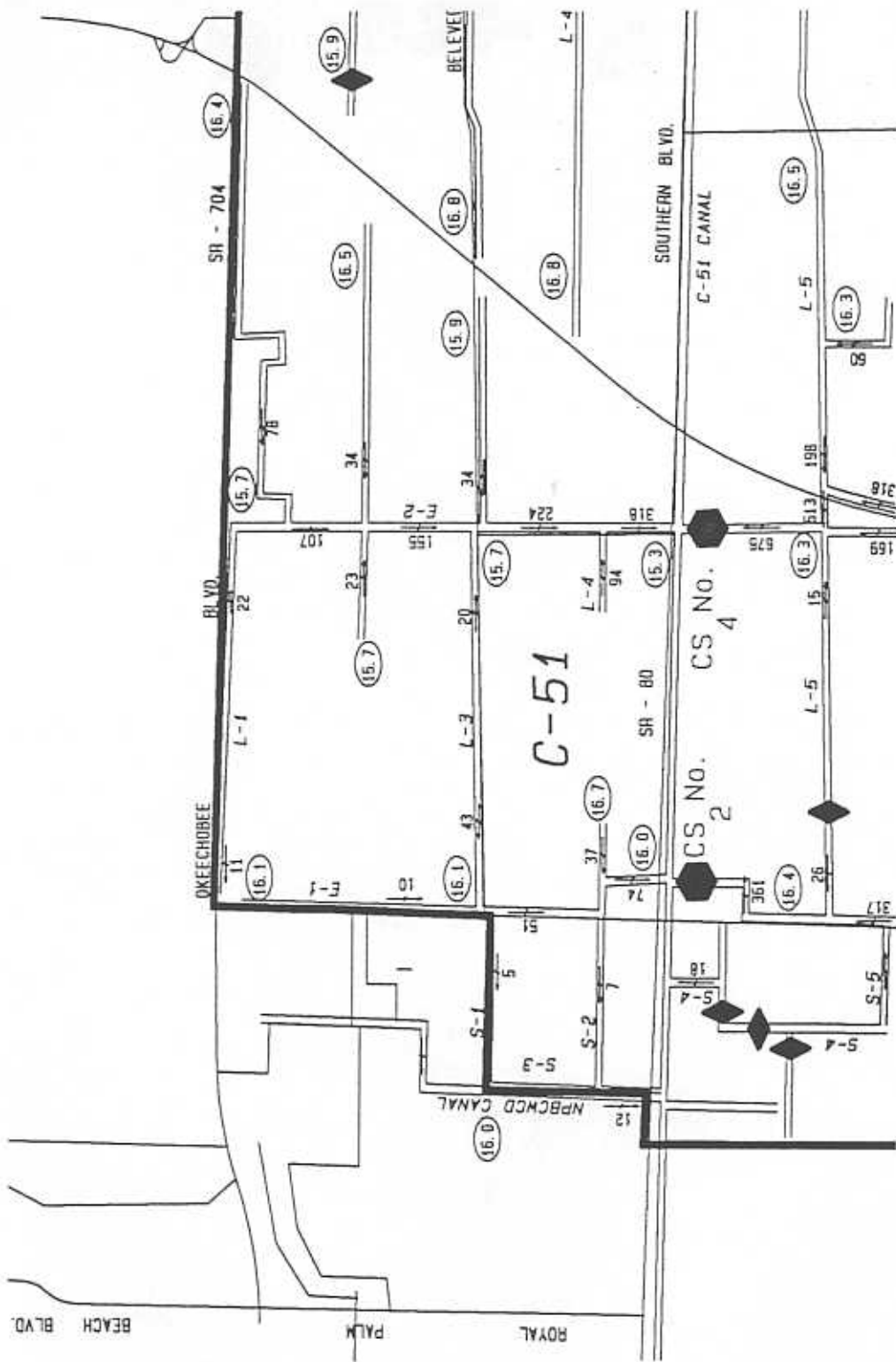
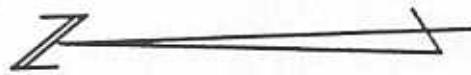


MOCK, ROOS & ASSOCIATES, INC.
 ENGINEERS • SURVEYORS • PLANNERS
 5720 CORPORATE WAY
 WEST PALM BEACH, FLORIDA 33407
 Phone: 407 683-3113 Fax: 407 478-7248



LWDD C-51 BASIN
 DESIGN DISCHARGES AND STAGES
 INDEX MAP

FIGURE No. B

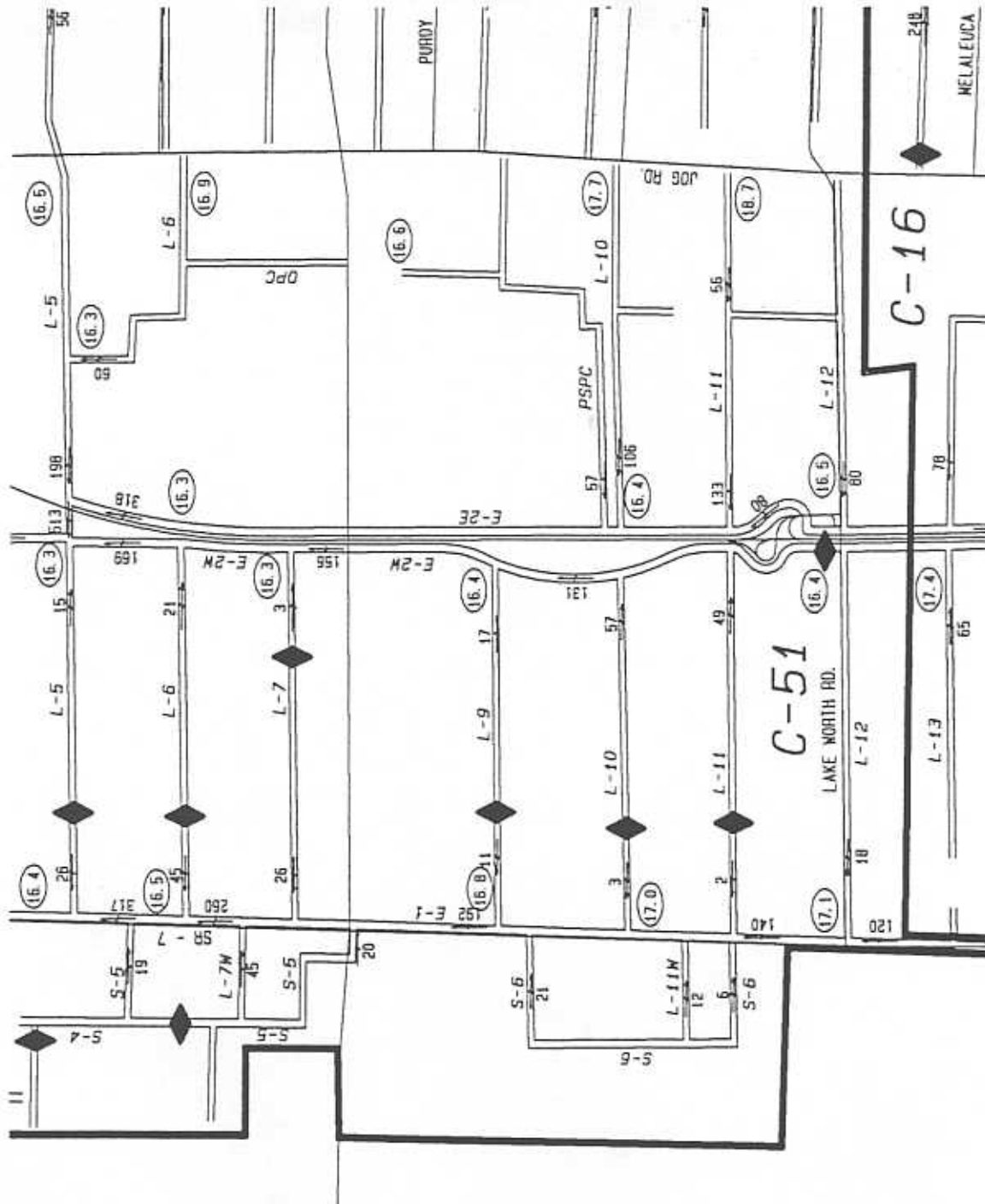


16.1 = DESIGN STAGE; 50 = DESIGN DISCHARGE AND FLOW DIRECTION

MOCK, ROOS & ASSOCIATES, INC.
 ENGINEERS • SURVEYORS • PLANNERS
 5720 CORPORATE WAY
 WEST PALM BEACH, FLORIDA 33407
 Phone: 407 583-3113 Fax: 407 478-7248

LAKE WORTH DRAINAGE DISTRICT
 C-51 BASIN
 DESIGN DISCHARGES AND STAGES

FIGURE No. B-A

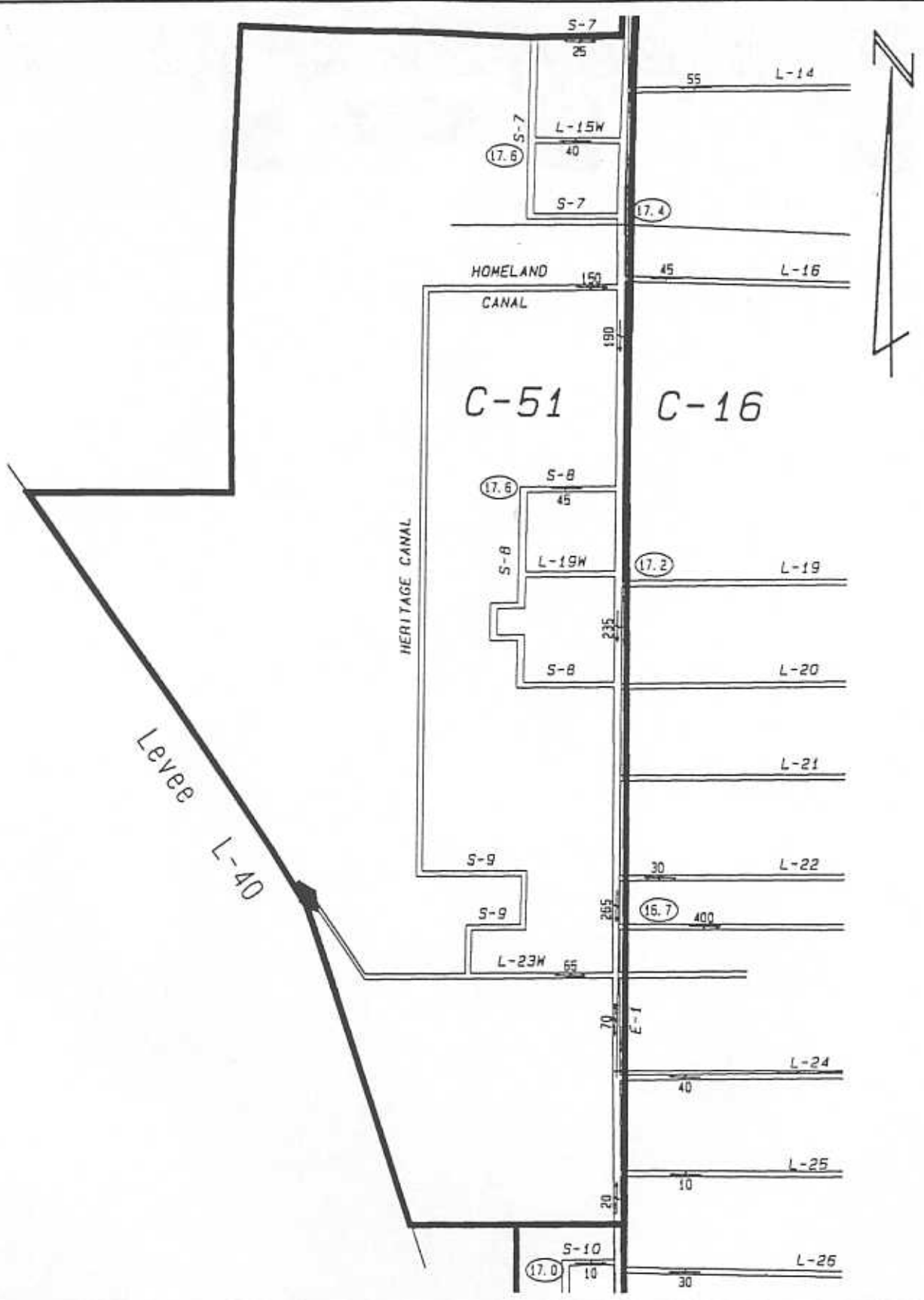


(16.1) = DESIGN STAGE; 50 = DESIGN DISCHARGE AND FLOW DIRECTION

MOCK, ROOS & ASSOCIATES, INC.
ENGINEERS • SURVEYORS • PLANNERS
5720 CORPORATE WAY
WEST PALM BEACH, FLORIDA 33407
Phone: 407 683-3113 Fax: 407 478-7248

LAKE WORTH DRAINAGE DISTRICT
C-51 BASIN
DESIGN DISCHARGES AND STAGES

FIGURE No. 8-B



(16.1) = DESIGN STAGE; 50 = DESIGN DISCHARGE AND FLOW DIRECTION

MOCK, ROOS & ASSOCIATES, INC.
 ENGINEERS • SURVEYORS • PLANNERS
 5720 CORPORATE WAY
 WEST PALM BEACH, FLORIDA 33407
 Phone: 407 683-3113 Fax: 407 478-7248

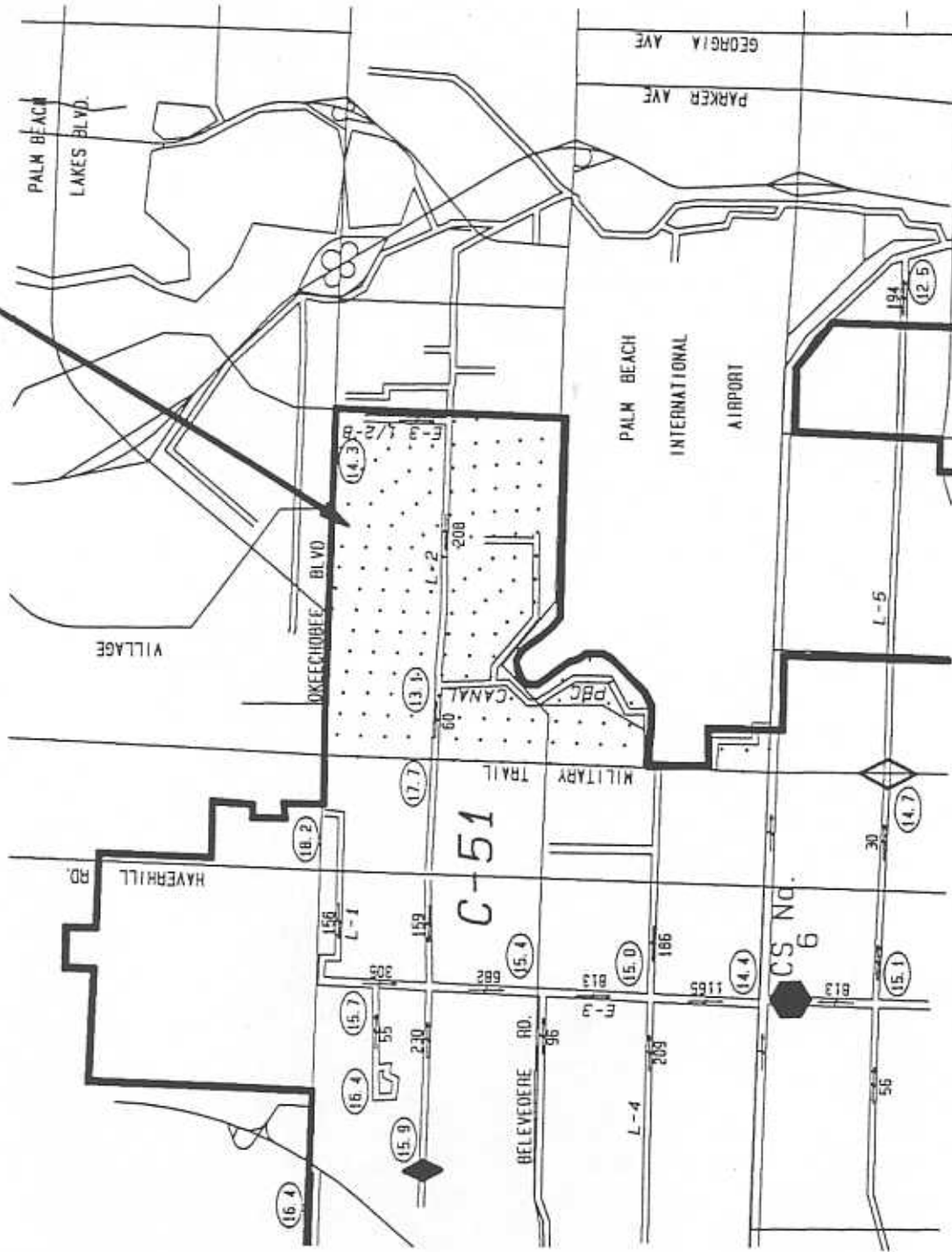


LAKE WORTH DRAINAGE DISTRICT
 C-51 BASIN
 DESIGN DISCHARGES AND STAGES

FIGURE No. B-C



NOTE: FOR THIS AREA DESIGN DISCHARGES AND STAGES ARE BASED ON A 5-YEAR, 24-HOUR STORM EVENT.



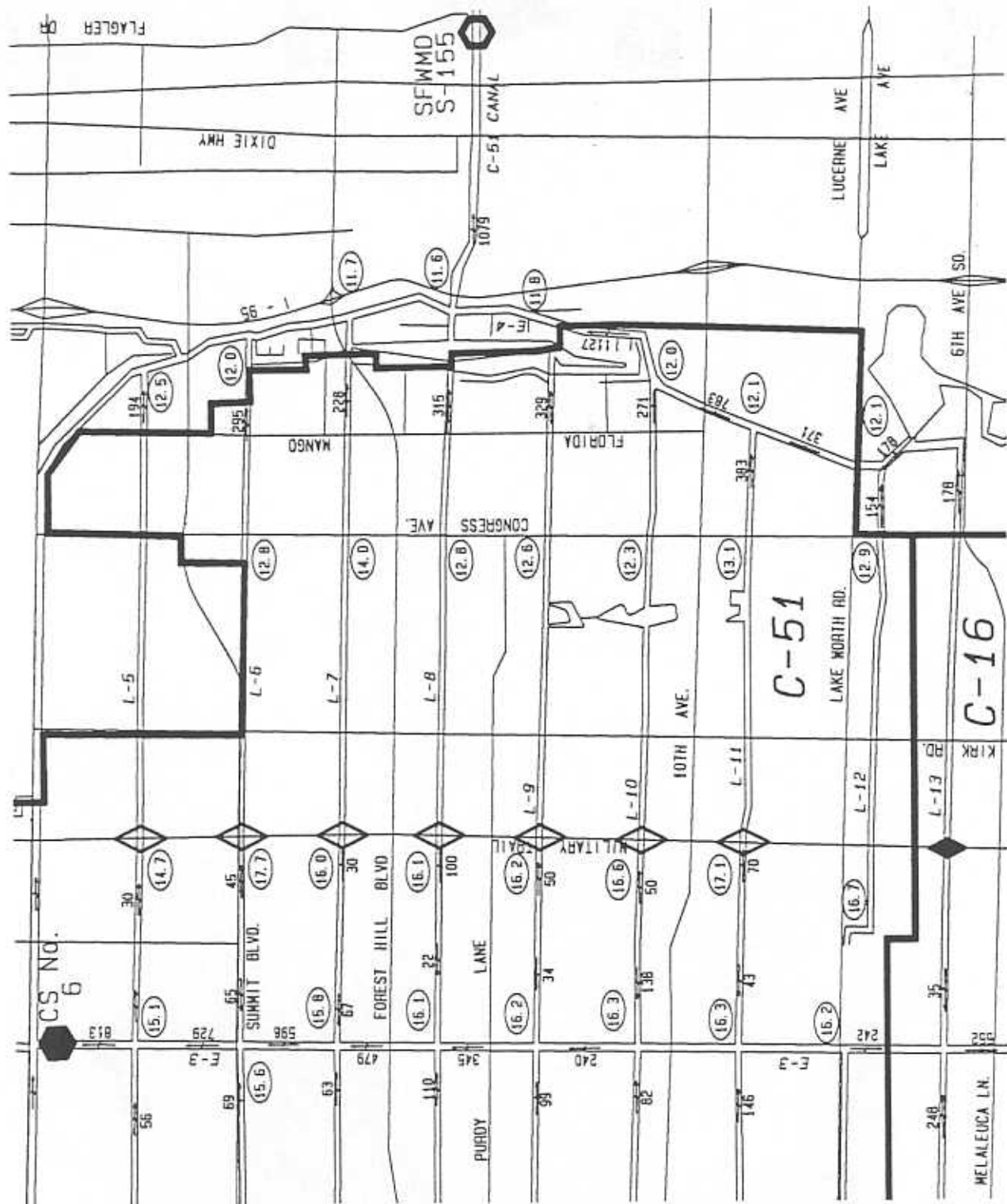
(16.1) = DESIGN STAGE; 50 = DESIGN DISCHARGE AND FLOW DIRECTION

MOCK, ROOS & ASSOCIATES, INC.
 ENGINEERS • SURVEYORS • PLANNERS
 5720 CORPORATE WAY
 WEST PALM BEACH, FLORIDA 33407
 Phone: 407 683-3113 Fax: 407 478-7248



LAKE WORTH DRAINAGE DISTRICT
 C-51 BASIN
 DESIGN DISCHARGES AND STAGES

FIGURE No. 8-D



(16.1) = DESIGN STAGE; 50 = DESIGN DISCHARGE AND FLOW DIRECTION

MOCK, ROOS & ASSOCIATES, INC.
 ENGINEERS • SURVEYORS • PLANNERS
 5720 CORPORATE WAY
 WEST PALM BEACH, FLORIDA 33407
 Phone: 407 683-3113 Fax: 407 478-7248



LAKE WORTH DRAINAGE DISTRICT
 C-51 BASIN
 DESIGN DISCHARGES AND STAGES

FIGURE No. 8-E

B. C-16 Basin:

The resulting design discharges and stages for a 10-year, 24-hour District-wide storm event are given in Table 3 and can be seen on Figures 9-A through 9-D:

Changes to the design discharges and stages given in the Surface Water Management Plan for the LWDD C-16 Basin are due to the exchange of discharges between the C-51 and C-16 Basins and between the C-15 and C-16 Basins. An exchange of discharges between basins was necessary in order to balance stages at basin boundaries.

Flow entering the C-16 Basin from other basins includes approximately 242 cfs from the C-51 Basin along the E-3 Canal, approximately 200 cfs from the C-51 Basin along the E-1 Canal and approximately 800 cfs from the C-15 Basin along the E-4 Canal. Results also indicated that approximately 178 cfs flows north from the C-16 Basin to the C-51 Basin along the E-4 Canal and approximately 50 cfs flows south from the C-16 Basin to the C-15 Basin along each of the equalizing canals E-1, E-2E, E-2W and E-3. This exchange of discharges between basins resulted in raising design stages within the C-16 Basin along the L-14 and E-4 Canals, Lake Osborne and a section of the Boynton Canal east of the LWDD Control Structure No. 9.

TABLE 3

DESIGN DISCHARGES AND STAGES: C-16 BASIN

LWDD CANAL	STATION	LOCATION	DESIGN DISCHARGE (CFS)	DESIGN STAGE (FT. NGVD)
E-2W	706+00	SOUTH OF L-25	29	16.6
E-2W	775+20	SOUTH OF BOYNTON CANAL	167	16.4
E-2W	775+90	NORTH OF BOYNTON CANAL	546	16.4
E-2W	816+43	L-21	516	16.7
E-2W	870+56	L-19	398	16.9
E-2W	947+42	L-16	220	17.3
E-2W	962+63	LANTANA ROAD	167	17.3
E-2W	1033+00	L-13	65	17.4
E-2E	650+21	L-27	16	16.7
E-2E	704+00	L-25	146	16.5
E-2E	772+10	SOUTH OF BOYNTON CANAL	212	16.4
E-2E	772+80	NORTH OF BOYNTON CANAL	175	16.4
E-2E	895+50	L-18	107	16.7
E-2E	1003+50	SOUTH OF L-14	84	16.2
E-2E	1004+00	NORTH OF L-14	108	16.2
E-2-1/2	196+70	NORTH OF L-14	81	16.1
E-3	729+50	L-25	219	16.2
E-3	795+50	SOUTH OF BOYNTON CANAL	331	15.5
E-3	796+40	NORTH OF BOYNTON CANAL	371	15.5
E-3	846+84	LE CHALET BLVD.	356	15.8
E-3	889+00	L-19	235	16.1
E-3	943+60	L-17	99	16.2
E-3	1033+20	SOUTH OF L-14	109	15.8
E-3	1033+80	NORTH OF L-14	552	15.8
E-3	1047+28	MELALEUCA LANE	552	16.0
E-4	740+33	WOOLBRIGHT ROAD	1065	10.8

TABLE 3

DESIGN DISCHARGES AND STAGES: C-16 BASIN

LWDD CANAL	STATION	LOCATION	DESIGN DISCHARGE (CFS)	DESIGN STAGE (FT. NGVD)
E-4	785+16	OCEAN DRIVE	1518	10.7
E-4	841+60	SOUTH OF BOYNTON CANAL	1754	10.1
E-4	843+00	NORTH OF BOYNTON CANAL	1876	10.1
E-4	868+79	NORTHWEST 22ND AVENUE	1854	10.7
E-4	1021+35	LANTANA ROAD	1187	12.1
L-13	59+08	JUBILEE ROAD	35	18.2/18.1
L-13	109+22	WEST OF E-2W	65	17.4
L-13	139+38	OHIO ROAD	44	16.9/16.7
L-13	231+95	SOUTH 57TH AVENUE	144	16.4
L-13	259+10	WEST OF E-3	248	16.2
L-13	259+50	EAST OF E-3	35	16.2
L-13	366+44	DAVIS ROAD	164	14.9/13.6
L-13	393+40	CONGRESS AVENUE	178	13.2/13.0
L-13	430+00	WEST OF E-4	178	12.1
L-14	60+00	JUBILEE ROAD	23	17.4
L-14	110+50	WEST OF E-2W	38	17.4
L-14	168+00	E-2-1/2	325	16.1
L-14	199+36	JOG ROAD	370	16.1
L-14	259+40	E-3	1103	15.8
L-14	332+45	WEST OF CONTROL STRUCTURE NO. 8	1120	15.2
L-14	333+25	EAST OF CONTROL STRUCTURE NO. 8	1120	12.7
L-14	373+00	L-15	1206	12.1
L-14	428+00	WEST OF E-4	1216	12.1
L-15	50+00	EAST OF E-2E	37	16.2

TABLE 3
DESIGN DISCHARGES AND STAGES: C-16 BASIN

LWDD CANAL	STATION	LOCATION	DESIGN DISCHARGE (CFS)	DESIGN STAGE (FT. NGVD)
L-15	238+75	SOUTH OF L-14	63	16.0
L-15	327+80	EAST OF E-3	50	15.9
L-15	381+12	WEST OF MILITARY TRAIL	25	16.1
L-16	67+78	LYONS ROAD	10	17.6
L-16	103+15	GRAND LACUNA BLVD.	53	17.5/17.4
L-16	139+00	EAST OF E-2E	18	16.2
L-16	200+00	WEST OF JOG ROAD	14	16.4
L-16	212+00	EAST OF JOG ROAD	14	16.2
L-16	259+60	WEST OF E-3	35	15.9
L-16	344+57	LAWRENCE ROAD	42	12.7/12.6
L-16	381+10	CONGRESS AVENUE	69	12.4
L-16	322+60	WEST OF E-4	128	12.1
L-17	208+00	EAST OF JOG ROAD	15	16.6
L-17	257+65	WEST OF E-3	30	16.2
L-17	258+40	EAST OF E-3	74	16.2
L-17	340+40	LAWRENCE ROAD	28	12.2
L-17	391+05	CONGRESS AVENUE	152	12.1
L-17	420+40	WEST OF E-4	215	12.1
L-18	120+50	EAST OF E-2E	74	16.7
L-18	206+47	WEST OF JOG ROAD	18	17.0
L-18	208+20	EAST OF JOG ROAD	16	16.5
L-18	263+29	WEST OF E-3	32	16.2
L-18	263+69	EAST OF E-3	24	16.2
L-18	385+43	MEADOWS WAY	123	14.4/14.3
L-18	422+20	WEST OF E-4	208	12.0
L-19	9+40	EAST OF E-1	15	17.2

TABLE 3
DESIGN DISCHARGES AND STAGES: C-16 BASIN

LWDD CANAL	STATION	LOCATION	DESIGN DISCHARGE (CFS)	DESIGN STAGE (FT. NGVD)
L-19	113+00	WEST OF E-2W	60	16.9
L-19	210+20	EAST OF JOG ROAD	15	16.2
L-19	263+00	WEST OF E-3	35	16.1
L-19	263+80	EAST OF E-3	48	16.1
L-19	316+22	MILITARY TRAIL	41	16.8
L-19	358+70	WEST OF CONTROL STRUCTURE NO. 191	86	16.6
L-19	404+23	BOYNTON LAKES BLVD.	133	11.8/11.6
L-20	10+40	EAST OF E-1	8	17.0
L-20	114+40	WEST OF E-2W	93	16.8
L-20	119+50	EAST OF E-2E	40	16.6
L-20	200+80	WEST OF JOG ROAD	20	16.8
L-20	200+40	EAST OF JOG ROAD	20	16.3
L-20	260+00	WEST OF E-3	56	15.9
L-20	260+50	EAST OF E-3	55	15.9
L-20	286+76	HAVERHILL ROAD	15	15.9
L-20	363+40	WEST OF CONTROL STRUCTURE NO. 201	64	15.5
L-20	363+60	EAST OF CONTROL STRUCTURE NO. 201	64	11.9
L-20	392+88	CONGRESS AVENUE	67	11.3
L-21	11+20	EAST OF E-1	8	16.9
L-21	114+74	WEST OF E-2W	30	16.8
L-21	195+00	EAST OF JOG ROAD	14	16.0
L-21	258+00	WEST OF E-3	14	15.8
L-21	260+00	EAST OF E-3	3	15.8
L-21	300+01	CATAMARAN CIRCLE	7	16.5

TABLE 3

DESIGN DISCHARGES AND STAGES: C-16 BASIN

LWDD CANAL	STATION	LOCATION	DESIGN DISCHARGE (CFS)	DESIGN STAGE (FT. NGVD)
L-21	351+72	WEST OF CONTROL STRUCTURE NO. 211	41	16.3
L-21	351+92	EAST OF CONTROL STRUCTURE NO. 211	41	11.0
L-21	404+70	WEST OF E-4	116	10.9
L-22	10+80	EAST OF E-1	30	16.8
L-22	114+40	WEST OF E-2W	30	16.4
L-22	118+50	EAST OF E-2E	28	16.4
L-22	195+00	WEST OF JOG ROAD	7	16.9
L-22	286+00	EAST OF MILITARY TRAIL	14	15.6
L-22	334+20	LAWRENCE ROAD	124	15.2
L-22	372+53	NORTH OF BOYNTON CANAL	157	10.8
BOYNTON CANAL	10+90	EAST OF E-1	400	16.7
BOYNTON CANAL	116+48	FLORIDA'S TURNPIKE	1005	16.4
BOYNTON CANAL	118+20	EAST OF E-2E	1255	16.4
BOYNTON CANAL	200+50	JOG ROAD	1271	15.9
BOYNTON CANAL	254+90	EAST OF E-3	1790	15.5
BOYNTON CANAL	333+60	WEST OF CONTROL STRUCTURE NO. 9	1790	14.6
BOYNTON CANAL	333+80	EAST OF CONTROL STRUCTURE NO. 9	1790	10.9
BOYNTON CANAL	364+37	L-23	1925	10.7
BOYNTON CANAL	403+00	EAST OF E-4	5184	10.1
L-23	11+00	EAST OF E-1	15	16.7

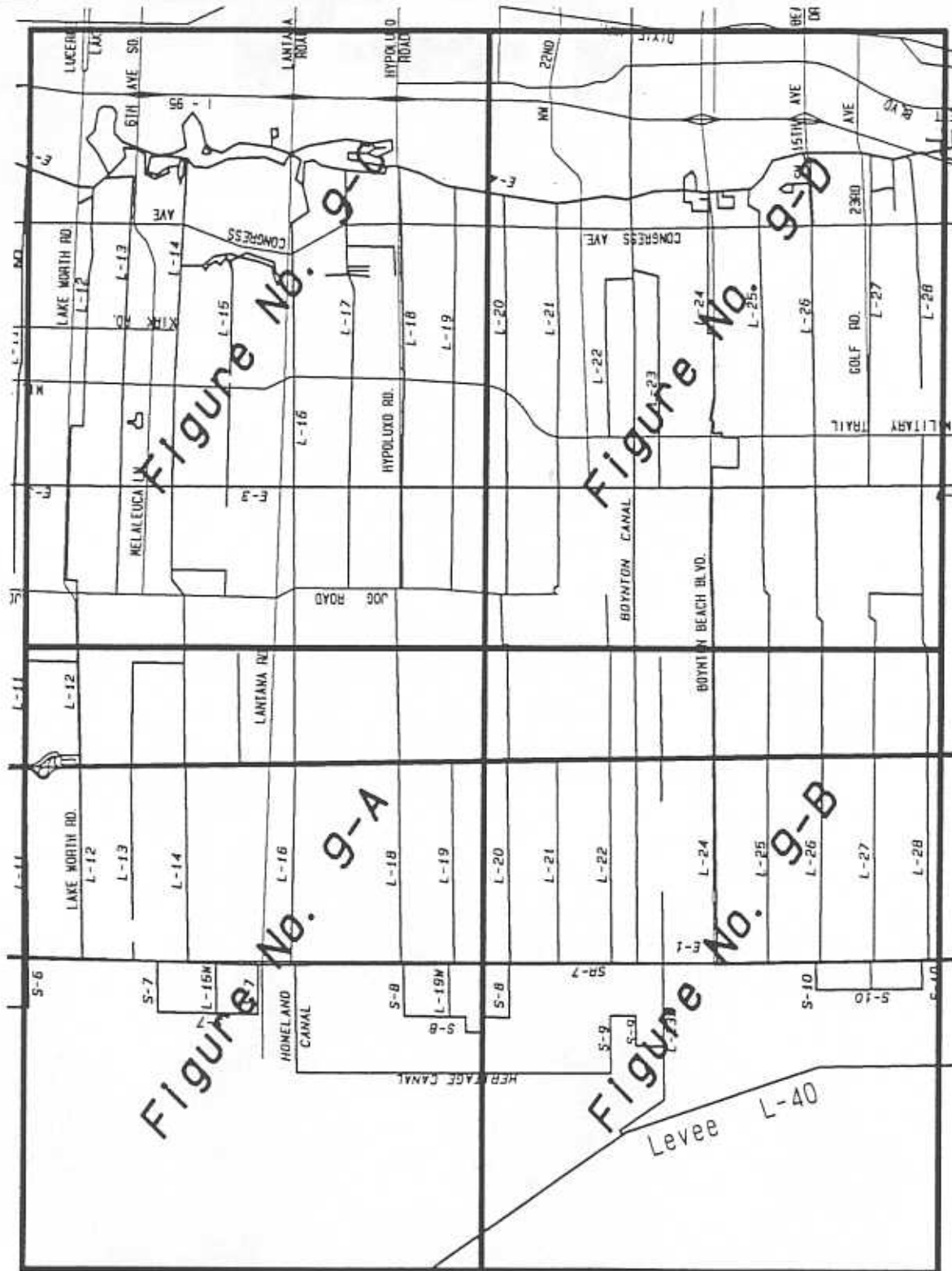
TABLE 3
DESIGN DISCHARGES AND STAGES: C-16 BASIN

LWDD CANAL	STATION	LOCATION	DESIGN DISCHARGE (CFS)	DESIGN STAGE (FT. NGVD)
L-23	114+25	WEST OF E-2W	46	16.4
L-23	118+90	EAST OF E-2E	33	16.4
L-23	253+40	EAST OF E-3	10	15.5
L-23	332+69	LAWRENCE ROAD	34	17.3/12.7
L-23	349+00	NICKELS BLVD.	34	12.7/12.0
L-23	373+80	SOUTH OF BOYNTON CANAL	76	10.7
L-24	11+10	EAST OF E-1	40	16.8
L-24	114+51	WEST OF E-2W	60	16.4
L-24	118+40	EAST OF E-2E	33	16.5
L-24	199+20	JOG ROAD	10	17.8
L-24	252+50	WEST OF E-3	23	15.9
L-24	324+68	PINEAPPLE TREE DRIVE	18	12.8
L-24	394+20	KNUTH ROAD	63	11.5/11.1
L-24	436+40	WEST OF E-4	76	10.6
L-25	10+70	EAST OF E-1	10	16.9
L-25	114+00	WEST OF E-2W	47	16.5
L-25	116+10	FLORIDA'S TURNPIKE	70	16.5
L-25	144+37	HAGEN RANCH ROAD	31	16.6
L-25	199+18	JOG ROAD	20	16.5
L-25	253+00	WEST OF E-3	39	16.4
L-25	254+00	EAST OF E-3	97	16.4
L-25	334+00	LAWRENCE ROAD	100	16.0
L-25	338+40	CONGRESS AVENUE	152	11.2
L-25	409+42	SOUTHWEST 18TH STREET	178	10.8
L-26	10+00	EAST OF E-1	30	17.0

TABLE 3

DESIGN DISCHARGES AND STAGES: C-16 BASIN

LWDD CANAL	STATION	LOCATION	DESIGN DISCHARGE (CFS)	DESIGN STAGE (FT. NGVD)
L-26	113+78	WEST OF E-2W	31	16.6
L-26	143+93	HAGEN RANCH ROAD	29	16.6/16.5
L-26	200+20	JOG ROAD	20	16.6
L-26	252+50	WEST OF E-3	33	16.4
L-26	253+00	EAST OF E-3	43	16.4
L-26	278+60	WEST OF MILITARY TRAIL	5	16.5
L-26	280+25	EAST OF MILITARY TRAIL	5	14.3
L-26	387+33	CONGRESS AVENUE	211	11.4/11.1
L-26	416+13	SOUTHWEST 18TH STREET	271	10.9
L-27	10+00	EAST OF E-1	40	17.0
L-27	113+00	WEST OF E-2W	48	16.7
L-27	136+60	EAST OF E-2E	66	16.7
L-27	183+90	25 FT. PLATTED ROADWAY	33	16.8
L-27	500+40	EAST OF E-3	16	16.4
L-27	548+86	DUNES ROAD	17	14.0
L-27	629+60	SOUTHWEST 23RD CIRCLE DRIVE	173	12.4/11.1
L-27	664+30	SOUTHWEST 11TH STREET	232	11.0

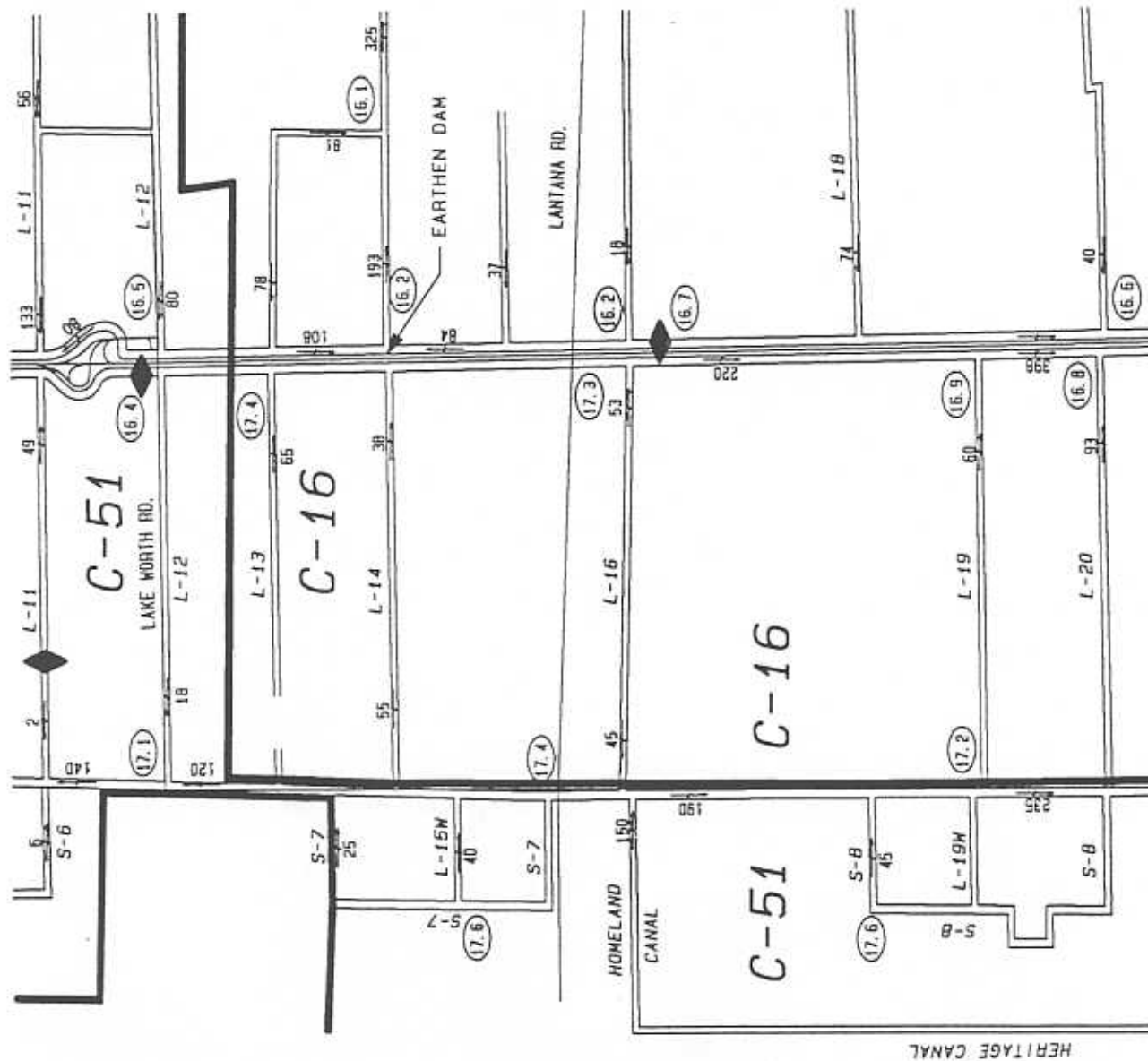


MOCK, ROOS & ASSOCIATES, INC.
ENGINEERS • SURVEYORS • PLANNERS
5720 CORPORATE WAY
WEST PALM BEACH, FLORIDA 33407
Phone: 407 683-3113 Fax: 407 478-7248



LWDD C-16 BASIN
DESIGN DISCHARGES AND STAGES
INDEX MAP

FIGURE No. 9

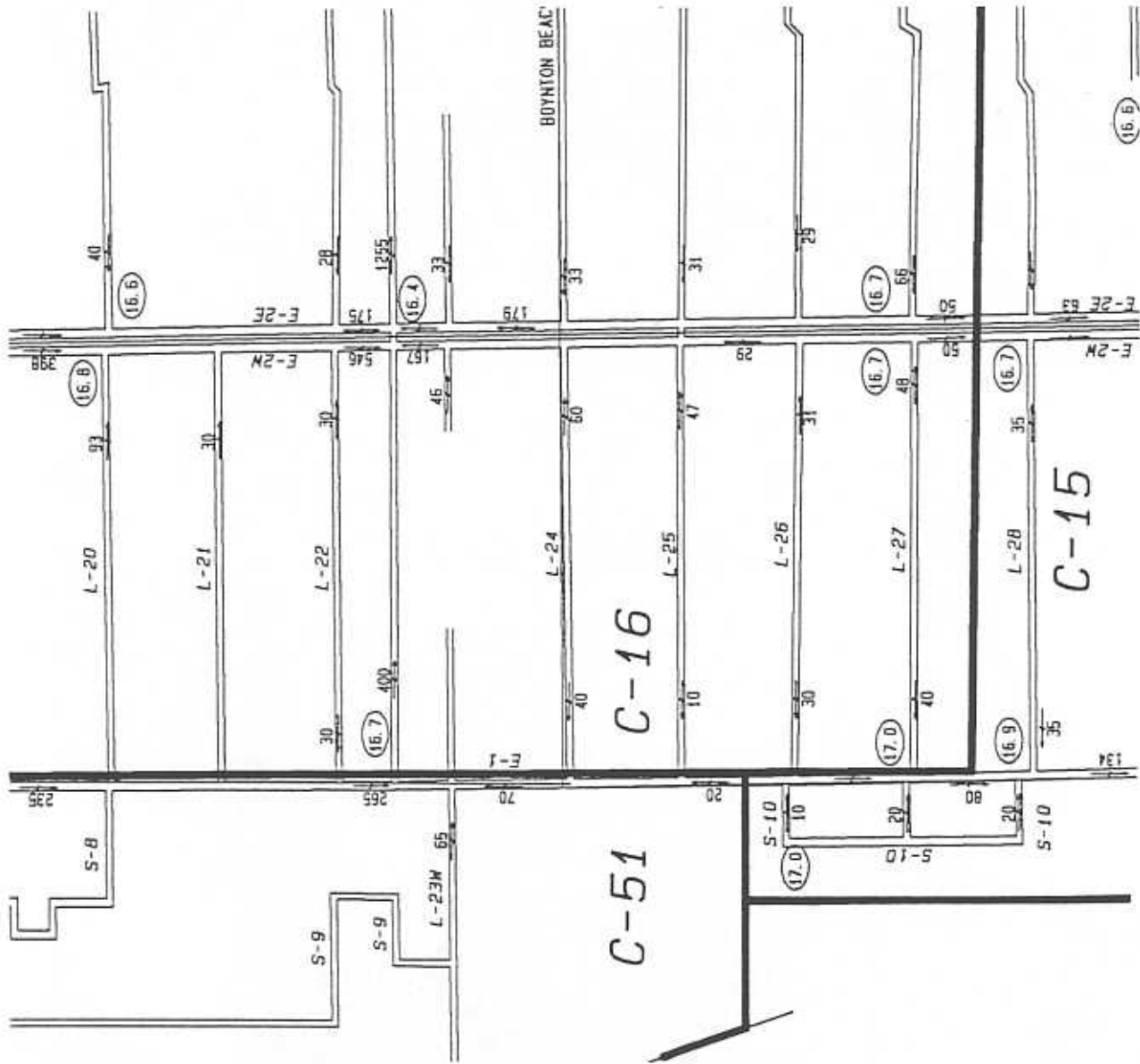


(16.1) = DESIGN STAGE; 50 = DESIGN DISCHARGE AND FLOW DIRECTION

MOCK, ROOS & ASSOCIATES, INC.
 ENGINEERS • SURVEYORS • PLANNERS
 5720 CORPORATE WAY
 WEST PALM BEACH, FLORIDA 33407
 Phone: 407 683-3113 Fax: 407 478-7248

LAKE WORTH DRAINAGE DISTRICT
 C-16 BASIN
 DESIGN DISCHARGES AND STAGES

FIGURE No. 9-A



(16.1) = DESIGN STAGE; 50 = DESIGN DISCHARGE AND FLOW DIRECTION

MOCK, ROOS & ASSOCIATES, INC.
 ENGINEERS • SURVEYORS • PLANNERS
 5720 CORPORATE WAY
 WEST PALM BEACH, FLORIDA 33407
 Phone: 407 683-3113 Fax: 407 478-7248

LAKE WORTH DRAINAGE DISTRICT
 C-16 BASIN
 DESIGN DISCHARGES AND STAGES

FIGURE No. 9-B

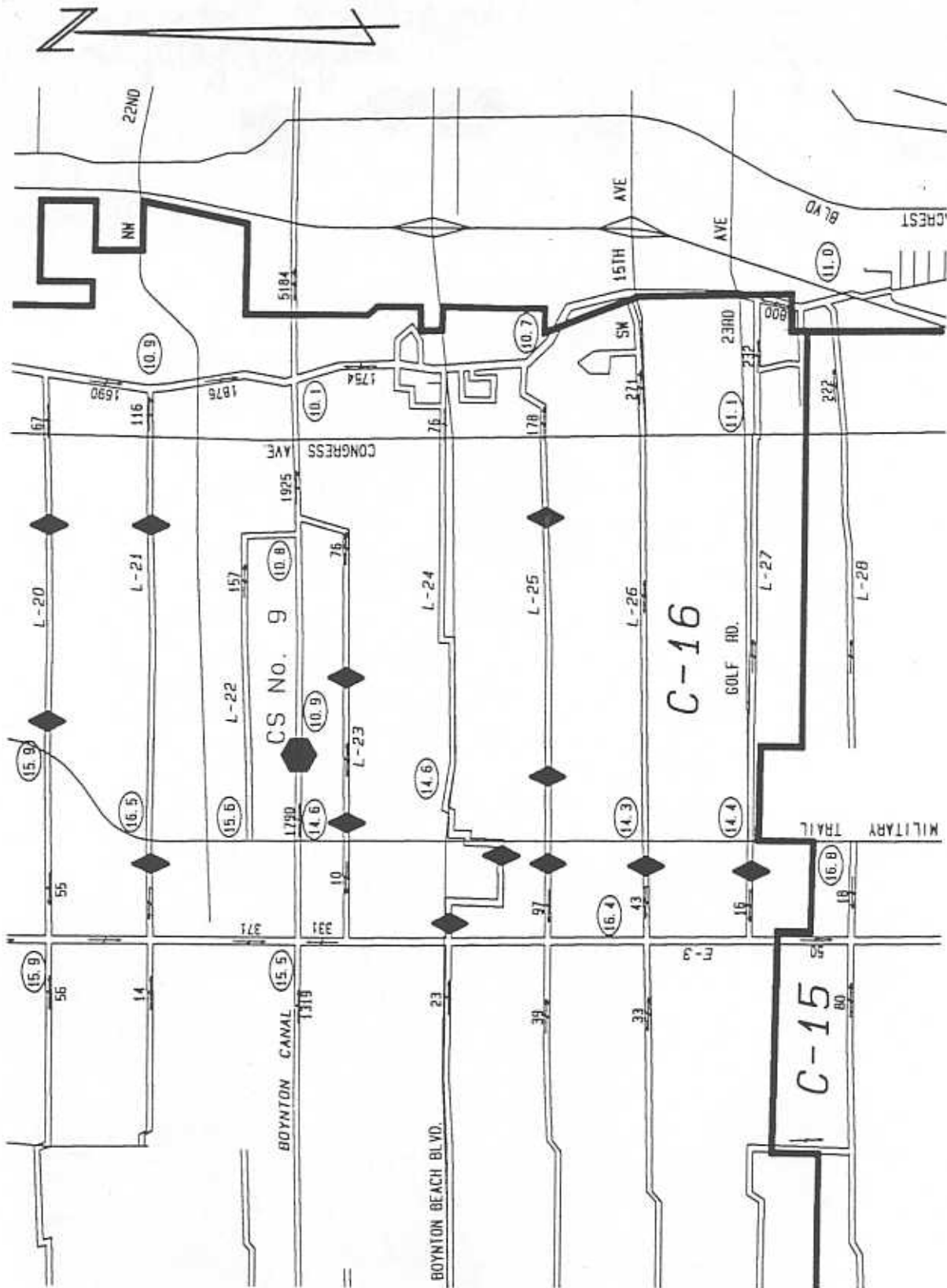


(16.1) = DESIGN STAGE; 50 = DESIGN DISCHARGE AND FLOW DIRECTION

MOCK, ROOS & ASSOCIATES, INC.
 ENGINEERS • SURVEYORS • PLANNERS
 5720 CORPORATE WAY
 WEST PALM BEACH, FLORIDA 33407
 Phone: 407 683-3113 Fax: 407 478-7248

LAKE WORTH DRAINAGE DISTRICT
C-16 BASIN
DESIGN DISCHARGES AND STAGES

FIGURE No. 9-C



(16.1) = DESIGN STAGE; 50 = DESIGN DISCHARGE AND FLOW DIRECTION

MOCK, ROOS & ASSOCIATES, INC.
 ENGINEERS • SURVEYORS • PLANNERS
 5720 CORPORATE WAY
 WEST PALM BEACH, FLORIDA 33407
 Phone: 407 683-3113 Fax: 407 478-7248



LAKE WORTH DRAINAGE DISTRICT
 C-16 BASIN
 DESIGN DISCHARGES AND STAGES

FIGURE No. 9-0

C. C-15 Basin:

The resulting design discharges and stages for a 10-year, 24-hour District-wide storm event are given in Table 4 and can be seen on Figures 10-A through 10-D.

Changes to the design discharges and stages given in the Surface Water Management Plan for the LWDD C-15 Basin are due to the exchange of discharges between the individual basins during a District-wide storm event. An exchange of discharges between basins would occur to equalize stages at basin boundaries.

Study results indicate that during the design event, approximately 800 cfs would flow north from the C-15 Basin to the C-16 Basin via the E-4 Canal and approximately 50 cfs would flow into the C-15 Basin from the C-16 Basin along each of the equalizing canals E-1, E-2W, E-2E and E-3. This exchange of discharges between basins resulted in lowering design stages within the C-15 Basin along the E-4 Canal, Lake Ida and a section of the L-38 Canal east of the LWDD Control Structure No. 12.

TABLE 4
DESIGN DISCHARGES AND STAGES: C-15 BASIN

LWDD CANAL	STATION	LOCATION	DESIGN DISCHARGE (CFS)	DESIGN STAGE (FT. NGVD)
E-1	287+40	SPANISH ISLES BLVD.	48	16.4
E-1	378+00	SOUTH OF L-38	115	16.2
E-1	380+00	NORTH OF L-38	288	16.2
E-1	459+40	L-35	226	16.3
E-1	515+30	L-33	151	16.4
E-1	568+90	L-31	87	16.1
E-1	597+00	NORTH OF L-30	173	16.7
E-1	677+60	L-27W	80	17.0
E-2W	270+32	L-41	87	16.0
E-2W	324+61	L-39	173	16.0
E-2W	353+50	NORTH OF L-38	219	15.8
E-2W	435+00	L-35	178	16.1
E-2W	491+90	L-33	123	16.3
E-2W	546+39	L-31	57	16.4
E-2W	574+90	NORTH OF L-30	150	16.5
E-2W	626+80	L-28	85	16.7
E-2E	299+11	L-40	46	15.7
E-2E	352+20	SOUTH OF L-38	66	15.7
E-2E	353+00	NORTH OF L-38	312	15.7
E-2E	487+90	L-33	229	16.3
E-2E	542+20	L-31	66	16.5
E-2E	595+70	L-29	73	16.6
E-2-1/2	37+10	L-37	103	16.0
E-2-1/2	90+50	L-35	8	16.5
E-3	270+30	L-41	171	15.4
E-3	351+40	SOUTH OF L-38	351	14.7

TABLE 4
DESIGN DISCHARGES AND STAGES: C-15 BASIN

LWDD CANAL	STATION	LOCATION	DESIGN DISCHARGE (CFS)	DESIGN STAGE (FT. NGVD)
E-3	351+90	NORTH OF L-38	360	14.7
E-3	375+10	L-37	339	15.5
E-3	432+00	L-35	154	16.0
E-3	486+00	L-33	144	16.3
E-3	541+30	L-31	308	15.5
E-3	595+20	L-29	390	15.9
E-3-1/2E	538+30	L-29	39	11.1
E-3-1/2(3)	432+50	L-35	230	10.1
E-3-1/2(4)	351+60	L-31	155	12.5
E-4	373+70	SOUTH OF L-38	20	8.5
E-4	374+70	NORTH OF L-38	1450	8.5
E-4	408+90	GERMANTOWN ROAD	1364	8.9/8.8
E-4	453+52	LAWSON BLVD.	1108	9.7
E-4	537+00	L-32	850	11.0
E-4	552+06	I-95	790	11.0
E-4	632+26	LAKE DRIVE	790	11.0
E-4	686+55	I-95	-	11.0
L-28	10+20	E-1	35	16.9
L-28	113+70	E-2W	35	16.7
L-28	114+20	E-2E	10	16.6
L-28	251+30	WEST OF E-3	80	16.3
L-28	252+00	EAST OF E-3	18	16.3
L-28	322+99	DUNES ROAD	86	12.1
L-28	407+59	CONGRESS AVENUE	165	11.4
L-28	441+50	E-4	218	11.0

TABLE 4
DESIGN DISCHARGES AND STAGES: C-15 BASIN

LWDD CANAL	STATION	LOCATION	DESIGN DISCHARGE (CFS)	DESIGN STAGE (FT. NGVD)
L-29	10+00	E-1	32	16.8
L-29	113+07	E-2W	32	16.6
L-29	116+50	E-2E	10	16.6
L-29	253+90	WEST OF E-3	88	15.9
L-29	254+80	EAST OF E-3	33	15.9
L-30	10+60	E-1	160	16.7
L-30	113+40	WEST OF E-2W	190	16.5
L-30	115+90	EAST OF E-2E	495	16.5
L-30	224+69	EL CLAIR RANCH ROAD	550	15.5
L-30	254+50	WEST OF CONTROL STRUCTURE NO. 11	1370	15.2
L-30	327+00	L-29	1525	12.2
L-30	398+40	E-3-1/2E	1645	11.2
L-31	10+50	E-1	37	16.6
L-31	108+40	E-2W	32	16.4
L-31	118+20	E-2E	39	16.5
L-31	267+10	WEST OF E-3	54	15.8
L-31	267+70	EAST OF E-3	15	15.9
L-31	321+39	BARWICK ROAD	85	12.5/12.3
L-32	10+00	E-1	27	16.5
L-32	103+30	E-2W	39	16.4
L-32	106+30	E-2E	77	16.4
L-32	223+00	EL CLAIR RANCH ROAD	29	17.5
L-32	249+60	WEST OF E-3	66	16.1
L-32	250+00	EAST OF E-3	38	16.1
L-32	303+51	BARWICK ROAD	51	14.7/14.5

TABLE 4

DESIGN DISCHARGES AND STAGES: C-15 BASIN

LWDD CANAL	STATION	LOCATION	DESIGN DISCHARGE (CFS)	DESIGN STAGE (FT. NGVD)
L-32	367+06	E-4	294	10.9
L-33	10+00	E-1	37	16.4
L-33	105+00	E-2W	27	16.3
L-33	118+10	E-2E	72	16.3
L-33	260+60	WEST OF E-3	82	16.3
L-33	261+00	EAST OF E-3	74	16.0
L-33	372+70	E-4	271	10.7
L-34	12+61	E-1	38	16.4
L-34	104+80	E-2W	21	16.2
L-34	117+41	E-2E	30	16.3
L-34	212+50	EL CLAIR RANCH ROAD	40	17.1
L-34	251+00	WEST OF E-3	56	16.3
L-34	251+40	EAST OF E-3	6	16.3
L-35	10+00	E-1	36	16.3
L-35	105+60	E-2W	20	16.1
L-35	157+40	E-2-1/2	8	16.5
L-35	197+70	CARTER ROAD	20	16.3
L-35	251+15	WEST OF E-3	86	16.0
L-35	332+55	E-3-1/2 (3)	57	10.1
L-36	10+00	E-1	26	16.3
L-36	106+16	E-2W	39	16.0
L-36	157+80	E-2-1/2	54	16.3
L-36	198+55	CARTER ROAD	30	16.3
L-36	251+65	WEST OF E-3	55	15.8
L-36	326+70	SPANISH WELLS DRIVE	51	10.9
L-36	359+00	E-4	336	8.9

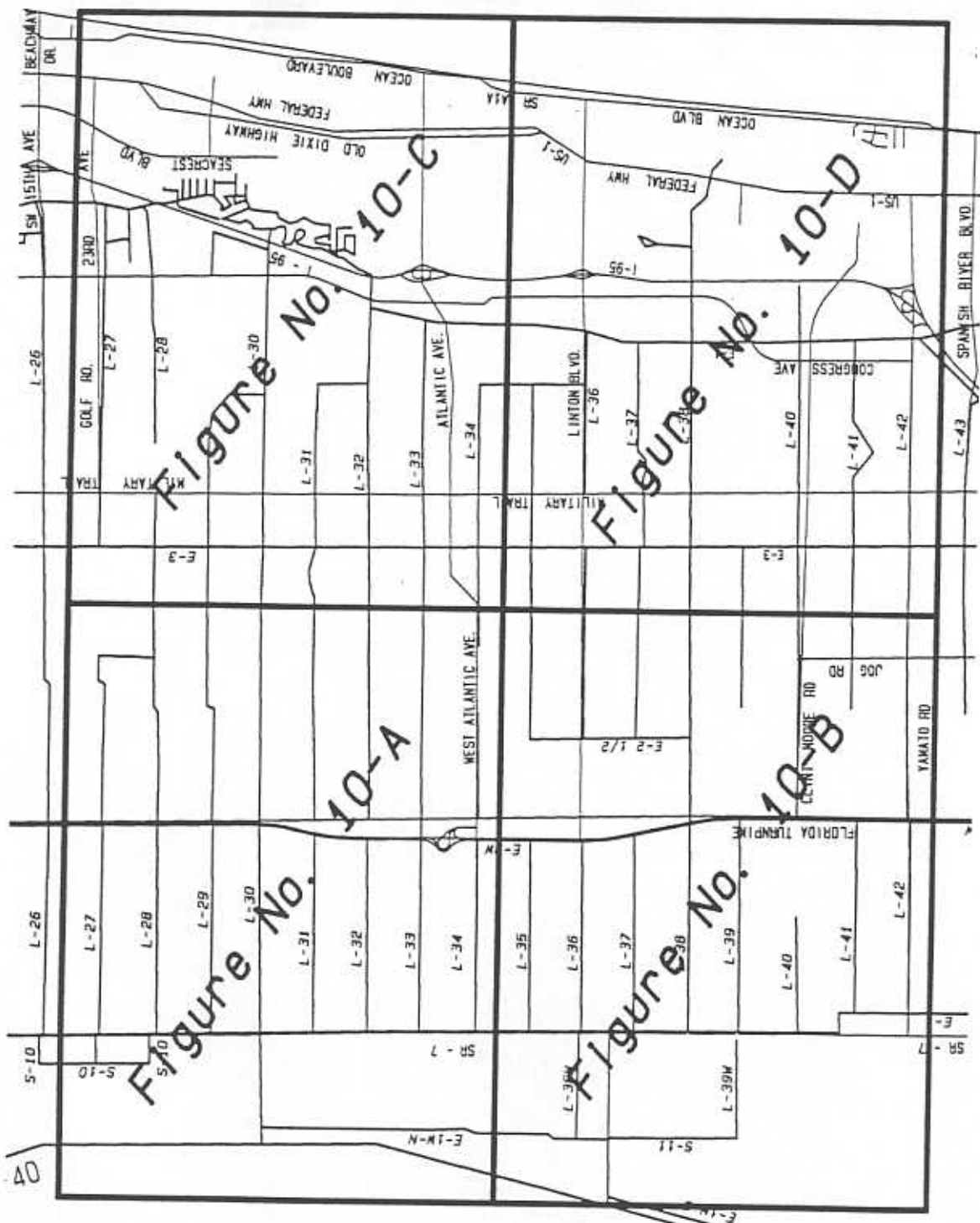
TABLE 4
DESIGN DISCHARGES AND STAGES: C-15 BASIN

LWDD CANAL	STATION	LOCATION	DESIGN DISCHARGE (CFS)	DESIGN STAGE (FT. NGVD)
L-37	10+00	E-1	36	16.3
L-37	110+76	E-2W	31	15.9
L-37	158+00	E-2-1/2	23	16.0
L-37	251+65	WEST OF E-3	39	15.6
L-37	252+30	EAST OF E-3	13	15.6
L-37	358+60	E-4	88	8.9
L-38	10+60	E-1	400	16.2
L-38	114+10	E-2W	870	15.8
L-38	117+80	E-2E	1305	15.7
L-38	157+45	E-2-1/2	1460	15.4
L-38	252+50	E-3	2270	14.7
L-38	253+90	CONTROL STRUCTURE NO. 12	2270	14.4/10.7
L-38	353+70	E-4	3780	8.5
L-39	10+50	E-1	22	16.2
L-39	114+06	E-2W	46	15.9
L-39	200+00	JOG ROAD	98	16.2/15.0
L-39	253+80	WEST OF E-3	98	15.0
L-40	11+40	E-1	29	16.3
L-40	119+70	E-2E	14	15.7
L-40	198+68	JOG ROAD	10	15.5
L-40	252+38	WEST OF E-3	34	15.2
L-40	253+40	EAST OF E-3	5	15.2
L-41	21+50	E-1	35	16.4
L-41	114+00	E-2W	64	16.0
L-41	199+94	JOG ROAD	43	16.9/16.8

TABLE 4

DESIGN DISCHARGES AND STAGES: C-15 BASIN

LWDD CANAL	STATION	LOCATION	DESIGN DISCHARGE (CFS)	DESIGN STAGE (FT. NGVD)
L-41	253+10	WEST OF E-3	93	15.3
L-41	253+40	EAST OF E-3	14	15.3
L-42	114+35	E-2W	23	16.0
L-42	119+40	E-2E	23	15.7
L-42	253+20	WEST OF E-3	40	15.5
L-42	253+70	EAST OF E-3	24	15.5
L-27W	36+10	E-1	20	17.0
S-10	10+00	E-1	20	16.9
S-10	117+50	WEST OF STATE ROAD NO. 7	10	17.0

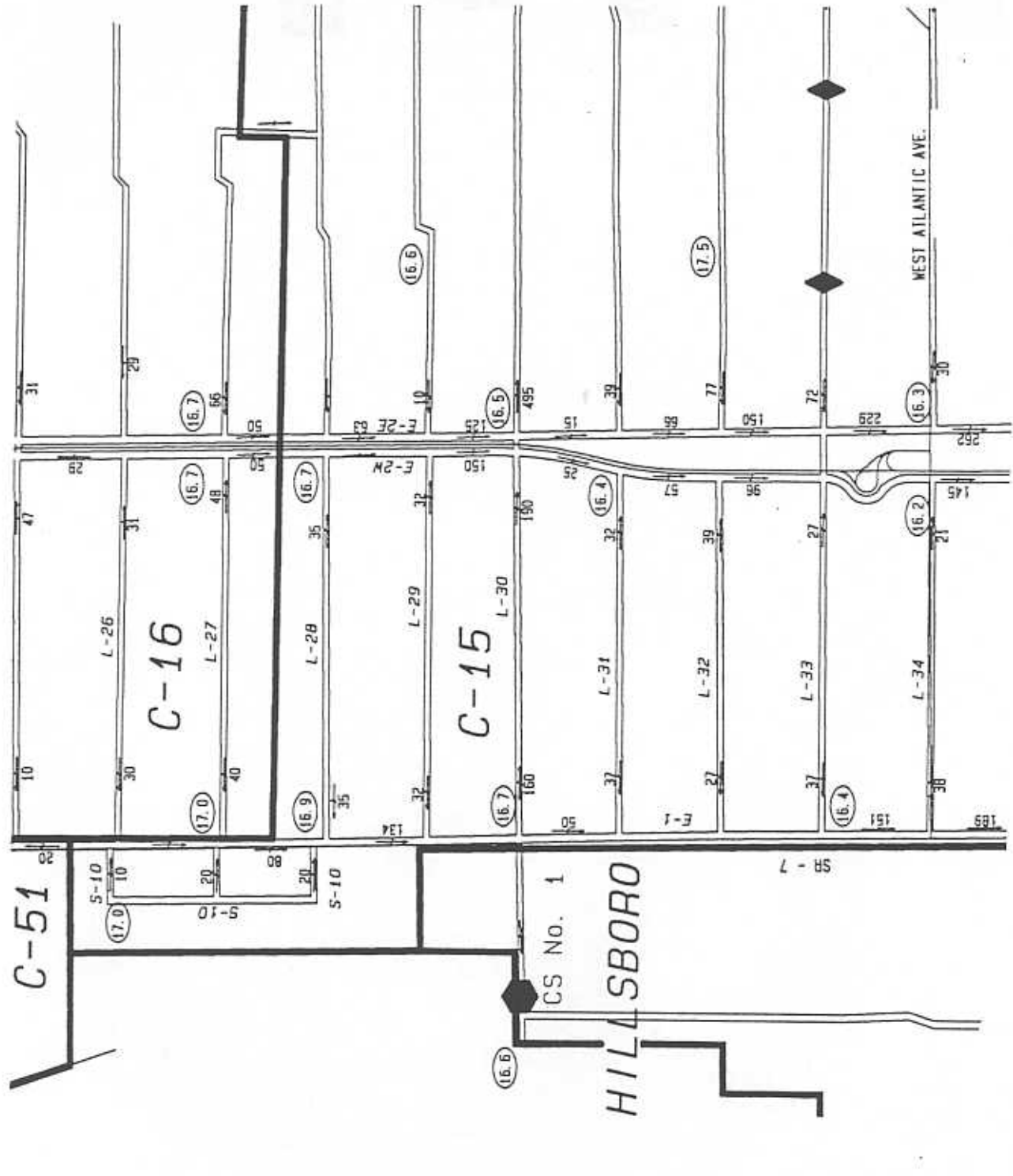


MOCK, ROOS & ASSOCIATES, INC.
ENGINEERS • SURVEYORS • PLANNERS
5720 CORPORATE WAY
WEST PALM BEACH, FLORIDA 33407
Phone: 407 683-3113 Fax: 407 478-7248



LWDD C-15 BASIN
DESIGN DISCHARGES AND STAGES
INDEX MAP

FIGURE No. 10



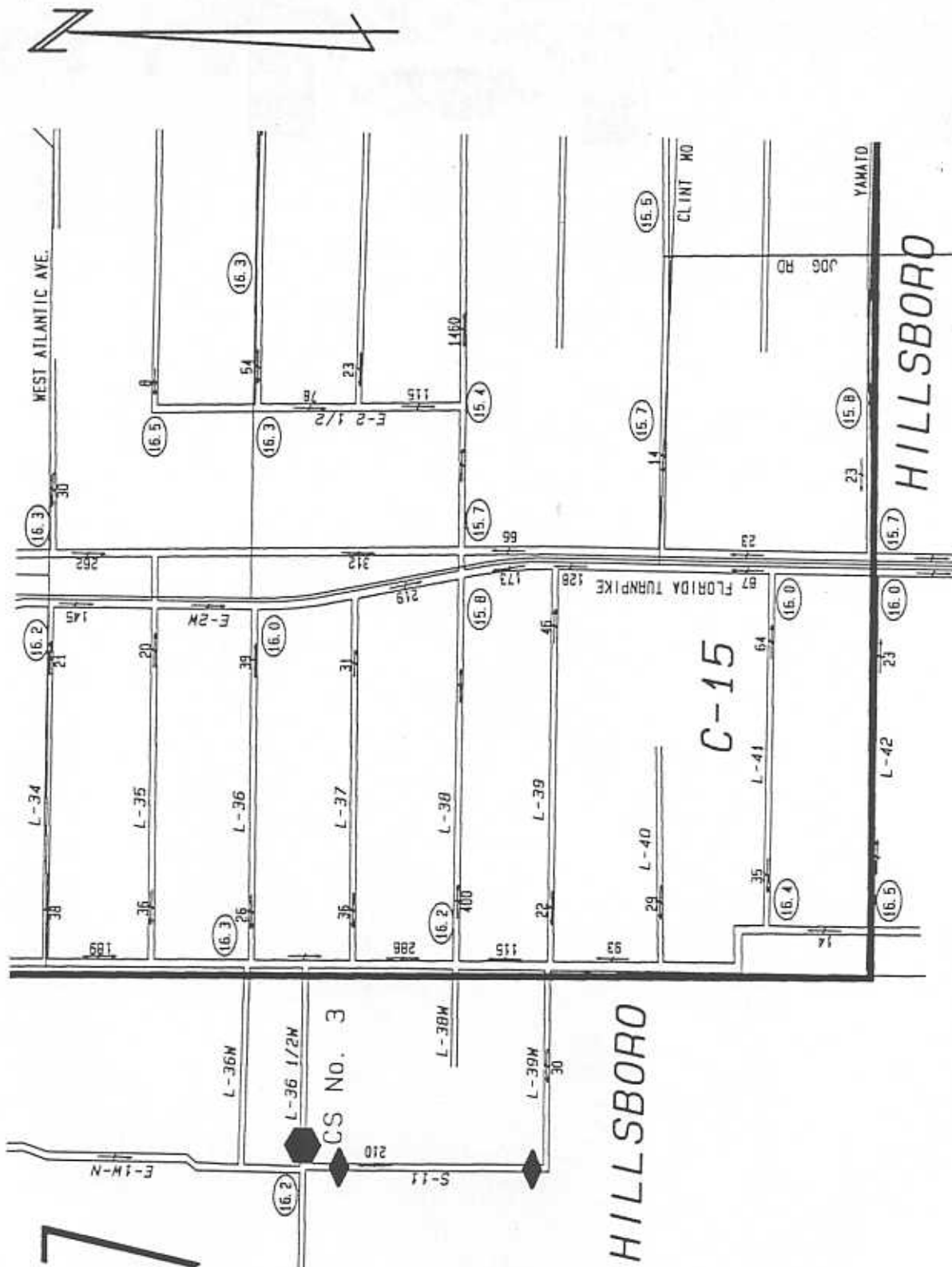
(16.1) = DESIGN STAGE; 50 = DESIGN DISCHARGE AND FLOW DIRECTION

MOCK, ROOS & ASSOCIATES, INC.
 ENGINEERS • SURVEYORS • PLANNERS
 5720 CORPORATE WAY
 WEST PALM BEACH, FLORIDA 33407
 Phone: 407 583-3113 Fax: 407 478-7248



LAKE WORTH DRAINAGE DISTRICT
 C-15 BASIN
 DESIGN DISCHARGES AND STAGES

FIGURE No. 10-A



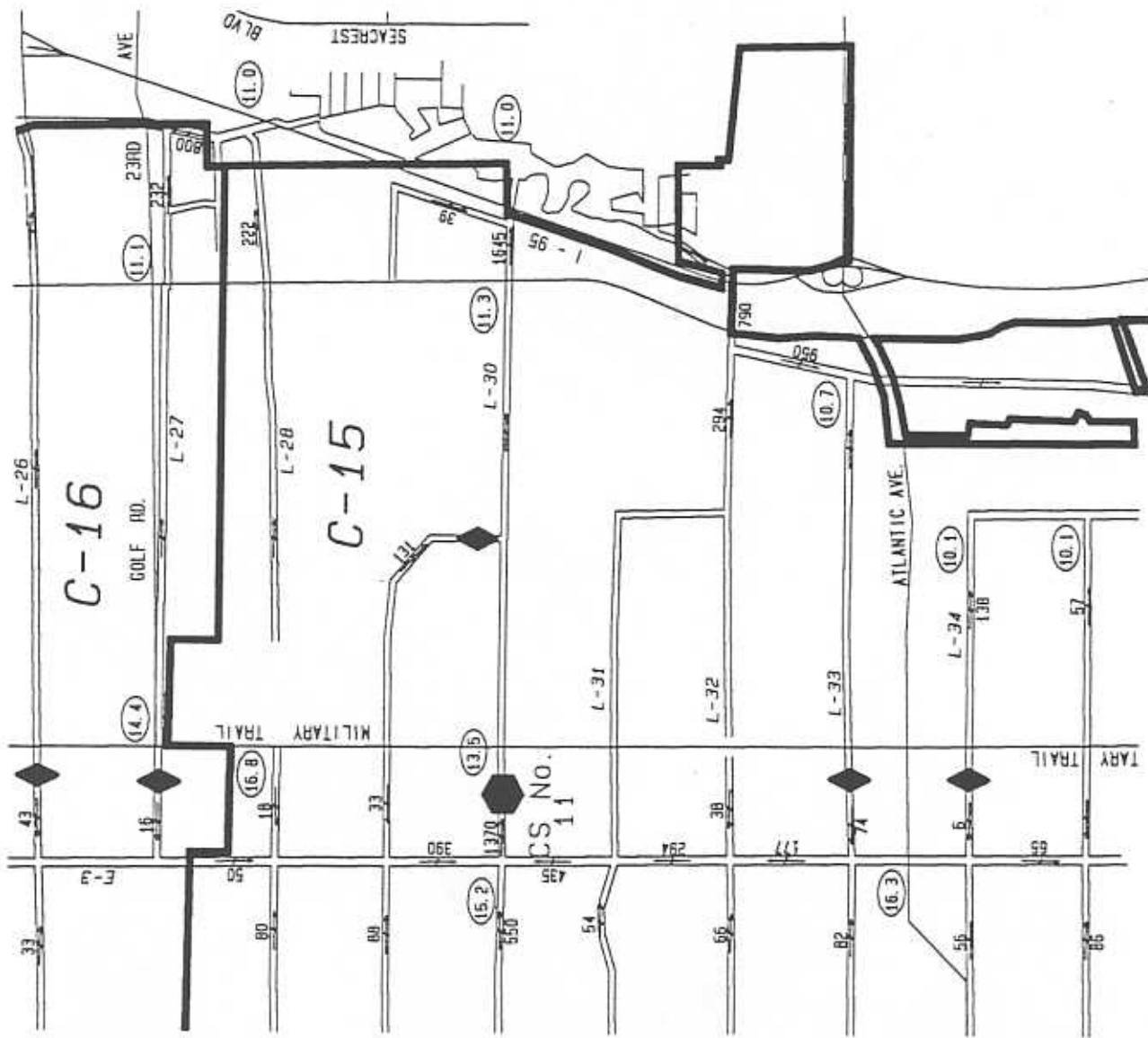
(16.1) = DESIGN STAGE; 50 = DESIGN DISCHARGE AND FLOW DIRECTION

MOCK, ROOS & ASSOCIATES, INC.
 ENGINEERS • SURVEYORS • PLANNERS
 5720 CORPORATE WAY
 WEST PALM BEACH, FLORIDA 33407
 Phone: 407 683-3113 Fax: 407 478-7248



LAKE WORTH DRAINAGE DISTRICT
 C-15 BASIN
 DESIGN DISCHARGES AND STAGES

FIGURE No. 10-B



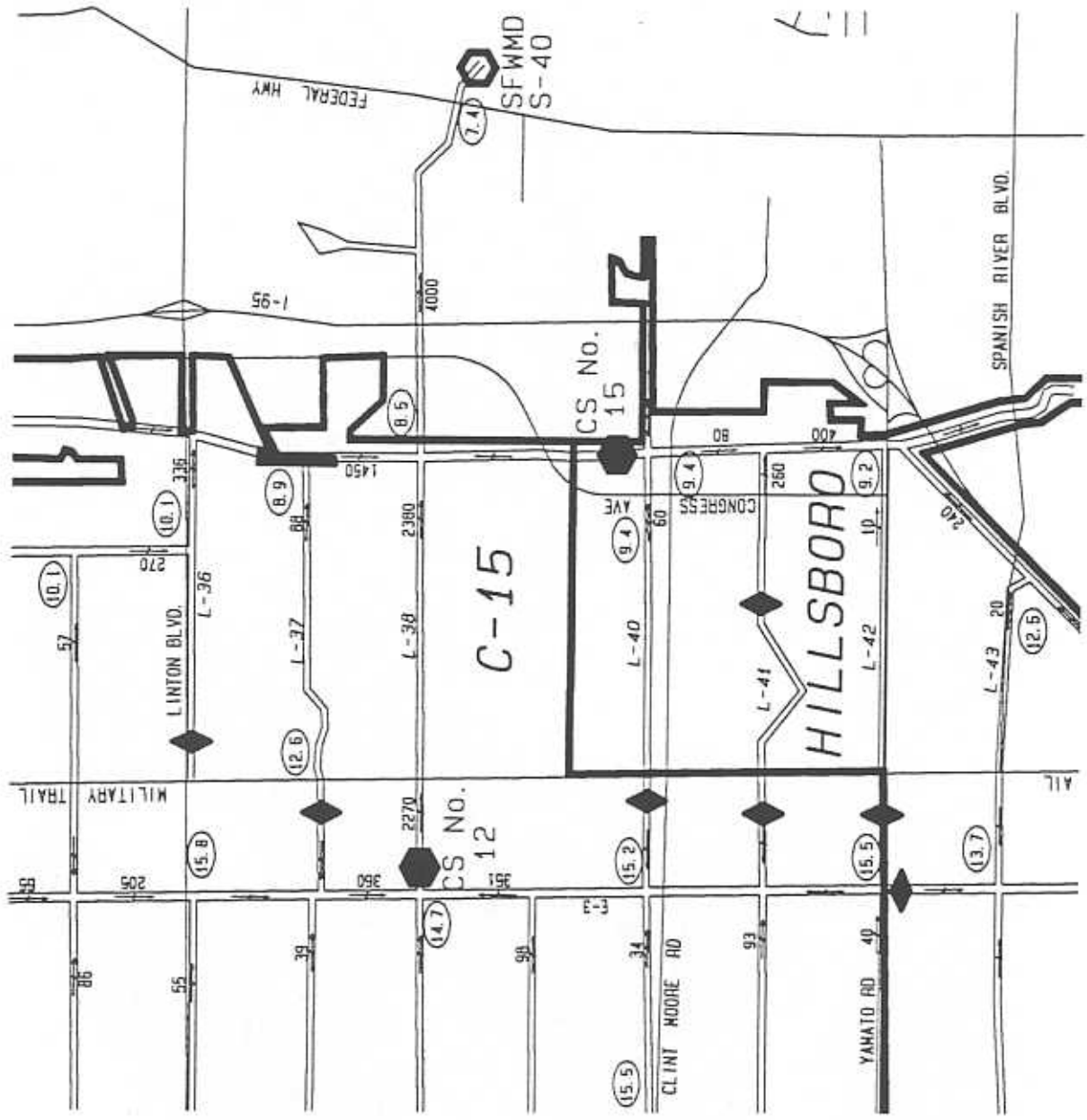
(16.1) = DESIGN STAGE; $\overline{50}$ = DESIGN DISCHARGE AND FLOW DIRECTION

MOCK, ROOS & ASSOCIATES, INC.
ENGINEERS • SURVEYORS • PLANNERS
5720 CORPORATE WAY
WEST PALM BEACH, FLORIDA 33407
Phone: 407 683-3113 Fax: 407 478-7248



LAKE WORTH DRAINAGE DISTRICT
C-15 BASIN
DESIGN DISCHARGES AND STAGES

FIGURE No. 10-C



(16.1) = DESIGN STAGE; 50' = DESIGN DISCHARGE AND FLOW DIRECTION

MOCK, ROOS & ASSOCIATES, INC.
 ENGINEERS • SURVEYORS • PLANNERS
 5720 CORPORATE WAY
 WEST PALM BEACH, FLORIDA 33407
 Phone: 407 683-3113 Fax: 407 478-7248



LAKE WORTH DRAINAGE DISTRICT
 C-15 BASIN
 DESIGN DISCHARGES AND STAGES

FIGURE No. 10-D

D. Hillsboro Basin:

The resulting design discharges and stages for a 10-year, 24 hour District-wide storm event are given in Table 5 and can be seen on Figures 11-A through 11-E.

Results indicated that due to the water control structures at the E-1, E-3 and E-4 Canals, no exchanges of flow between the C-15 and Hillsboro Basins are indicated. Therefore, stages throughout the Hillsboro Basin are unchanged from the stages given in the Surface Water Management Plan for the LWDD Hillsboro Basin with the exception of the stages along the E-1 Canal from the L-42 Canal to the LWDD Control Structure No. 19. After reviewing the hydrology and hydraulics of this section of the E-1 Canal along with input from LWDD regarding the operation of the LWDD Control Structure No. 19, it was determined that opening the gates of this structure during a District-wide storm event could create adverse stages south of the structure. Therefore for the purposes of this study it was assumed that the gates of the LWDD Control Structure No. 19 would remain closed during the design storm event. This resulted in raising design stages within the Hillsboro Basin along a section of the E-1 Canal north of the LWDD Control Structure No. 19.

TABLE 5

DESIGN DISCHARGES AND STAGES: HILLSBORO BASIN

LWDD CANAL	STATION	LOCATION	DESIGN DISCHARGE (CFS)	DESIGN STAGE (FT. NGVD)
E-1	10+62	CONTROL STRUCTURE NO. 14	370	13.4
E-1	87+00	L-48	310	13.4
E-1	114+20	L-47	290	13.4
E-1	167+60	CONTROL STRUCTURE NO. 19	90	16.5/13.4
E-1	241+34	NEW ENGLAND BLVD.	0	16.5
E-1E	39+60	SOUTHWEST 14TH STREET	200	13.5
E-1-1/2	0+60	CONTROL STRUCTURE	430	13.7/10.5
E-1-1/2	44+59	SOUTHWEST 8TH STREET	110	15.6/15.0
E-2W	1+33	CONTROL STRUCTURE NO. 17W	630	12.0/10.1
E-2W	50+50	L-49	610	14.5
E-2W	131+60	L-46	380	15.1
E-2W	158+80	L-45	270	15.5
E-2W	191+10	L-44	180	15.5
E-2E	0+79	CONTROL STRUCTURE NO. 17E	530	11.5/10.0
E-2E	77+40	L-48	380	13.0
E-2E	104+50	L-47	170	13.0
E-2E	189+80	L-44	110	15.4
E-3	2+20	CONTROL STRUCTURE NO. 16	810	12.7/7.0
E-3	54+30	L-49	730	13.0
E-3	108+60	L-47	390	13.2
E-3	162+20	L-45	280	13.7
E-3	195+50	L-44	250	13.7
E-4	0+00	HILLSBORO CANAL	2050	4.5
E-4	97+30	L-48	1790	5.2
E-4	146+70	L-46	1480	6.0
E-4	160+68	SALINITY CONTROL STRUCTURE	1250	8.7/6.4

TABLE 5
DESIGN DISCHARGES AND STAGES: HILLSBORO BASIN

LWDD CANAL	STATION	LOCATION	DESIGN DISCHARGE (CFS)	DESIGN STAGE (FT:NGVD)
E-4	253+15	I-95	650	9.3
E-4	292+90	L-41	400	9.4
E-4	320+30	L-40	80	9.4
L-50	0+00	E-2E	80	12.3
L-50	96+81	CANARY PALM DRIVE	20	13.5
L-50	139+00	E-3	130	13.0
L-50	33+85	SOUTHWEST 12TH AVENUE	190	11.5/10.2
L-50	86+00	E-4	380	4.8
L-49	51+60	E-2W	170	15.0/14.5
L-49	0+00	E-2E	130	12.5
L-49	0+00	POWERLINE ROAD	100	13.7/13.4
L-49	133+80	E-3	120	13.0
L-49	0+00	L-50	20	12.8
L-49	22+31	SOUTHWEST 12TH AVENUE	280	10.6/9.6
L-49	77+50	E-4	440	5.0
L-48	53+61	LYONS ROAD	50	15.4
L-48	105+00	E-2W	30	14.7
L-48	0+00	E-2E	140	12.6
L-48	52+84	POWERLINE ROAD	0	14.4
L-48	133+28	E-3	310	13.2
L-48	73+97	SOUTHWEST 12TH AVENUE	70	9.4/9.1
L-48	96+30	ROYAL PALM ROAD	230	8.3
L-48	130+73	E-4	330	5.1
L-47	0+00	E-1	100	13.4
L-47	104+40	CASA DEL LAGO	100	16.5/16.0
L-47	0+00	E-2E	190	13.0

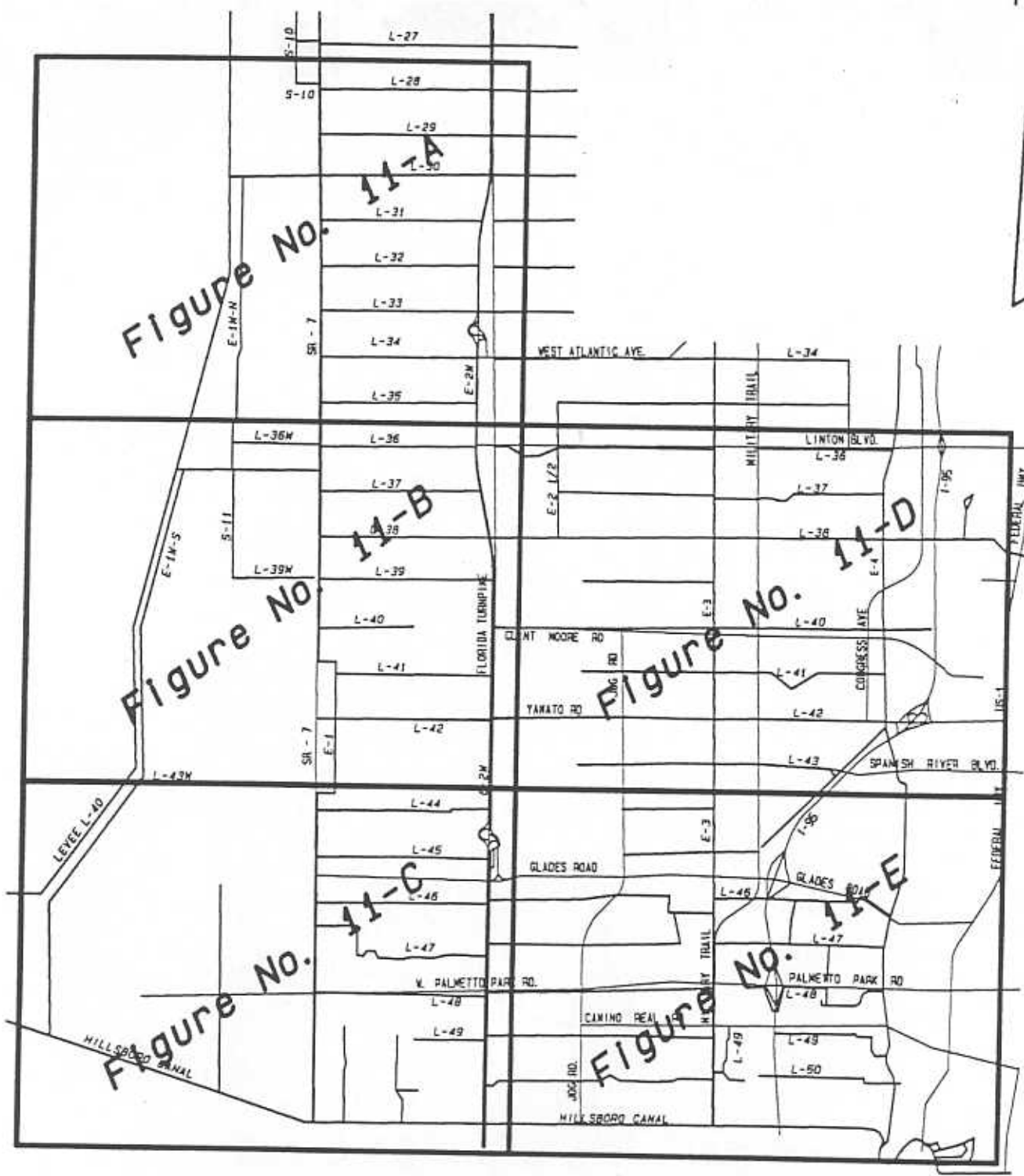
TABLE 5

DESIGN DISCHARGES AND STAGES: HILLSBORO BASIN

LWDD CANAL	STATION	LOCATION	DESIGN DISCHARGE (CFS)	DESIGN STAGE (FT..NGVD)
L-47	54+19	POWERLINE ROAD	40	13.5
L-47	128+77	L-46	10	13.3
L-47	43+66	NORTHWEST 15TH AVENUE	100	10.2
L-47	77+33	NORTHWEST 9TH COURT	330	9.5/8.7
E-3-1/2	0+00	L-47	90	10.5
L-46	0+00	E-1	40	15.0
L-46	104+40	E-2W	100	15.0
L-46	0+00	E-2E	50	13.2
L-46	75+43	POWERLINE ROAD	20	13.4
L-46	147+90	E-3	40	13.3
L-46	46+40	NORTHWEST 15TH AVENUE	140	11.0/10.5
L-46	110+00	E-4	350	6.2
L-45	0+00	E-1	120	15.0
L-45	104+40	E-2W	90	15.5
L-45	54+70	COUNTRY CLUB BLVD.	-	18.7
L-45	139+96	ST. ANDREWS BLVD.	40	13.5
L-45	166+57	E-3	60	13.5
L-44	0+00	E-1	50	13.6
L-44	105+43	E-2W	50	15.5
L-44	47+00	BOCA WEST DRIVE	-	19.0
L-44	138+50	ST. ANDREWS BLVD.	140	14.7
L-44	175+21	E-3	150	13.7
L-43	95+47	POWERLINE ROAD	20	14.1
L-43	153+84	E-3	50	13.7
L-43	70+39	E-3-1/2	20	12.5
E-3-1/2	49+70	L-43	220	12.5

TABLE 5
DESIGN DISCHARGES AND STAGES: HILLSBORO BASIN

LWDD CANAL	STATION	LOCATION	DESIGN DISCHARGE (CFS)	DESIGN STAGE (FT. NGVD)
E-3-1/2	0+00	E-4	240	9.0
L-42	161+40	MILITARY TRAIL	-	9.5
L-42	186+25	BROKEN SOUND BLVD.	5	9.3
L-42	235+91	E-4	10	9.2
L-41	195+36	BROKEN SOUND BLVD.	10	11.0
L-41	248+78	E-4	260	9.5
L-40	260+00	WEST OF MILITARY TRAIL	10	13.0
L-40	324+07	CONGRESS AVENUE	60	9.4
L-40	364+40	I-95	-	9.3
E-1WS	0+00	HILLSBORO CANAL	660	11.2
E-1WS	172+60	CONTROL STRUCTURE NO. 20	590	15.7/14.7
E-1WN	384+00	L-36-1/2W	570	16.2
E-1WN	507+20	L-32W	340	16.5
E-1WN	534+36	L-31W	-	16.5
L-43W	0+00	E-1WS	80	14.7
L-42W	0+00	L-43W	60	14.7
S-11	0+00	L-36-1/2W	210	16.2
L-39W	0+00	S-11	30	18.0
L-39W	0+00	S-11	130	18.0
L-36-1/2W	358+35	E-1WS	620	16.0
L-36W	3+45	E-1WN	40	16.6
L-34W	0+00	E-1WN	80	16.6
L-32W	0+00	E-1WN	160	16.6
L-31W	0+00	E-1WN	100	16.6
L-30W	0+00	E-1WN	30	16.6

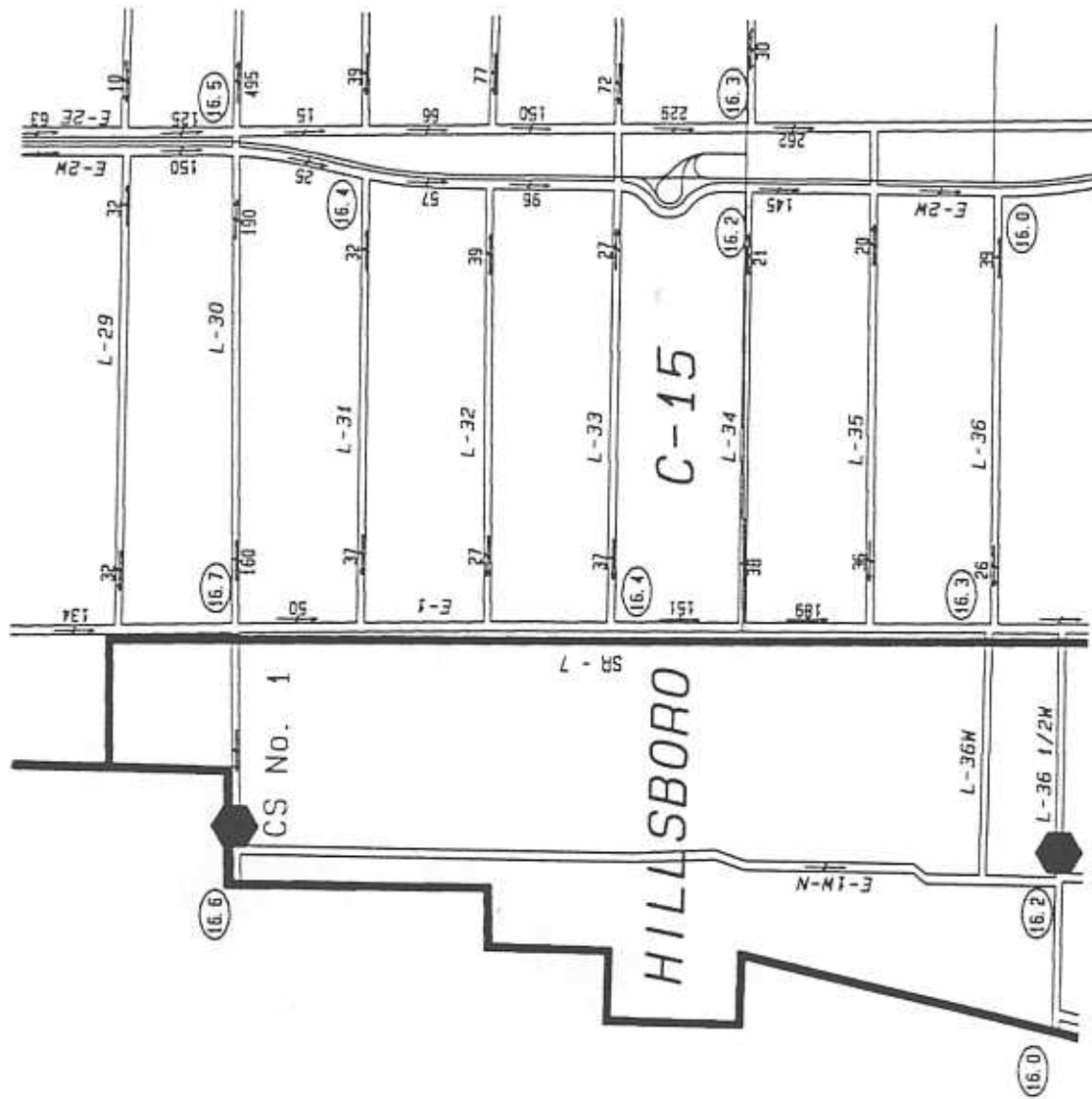


MOCK, ROOS & ASSOCIATES, INC.
 ENGINEERS • SURVEYORS • PLANNERS
 5720 CORPORATE WAY
 WEST PALM BEACH, FLORIDA 33407
 Phone: 407 683-3113 Fax: 407 478-7248



LWDD HILLSBORO BASIN
 DESIGN DISCHARGES AND STAGES
 INDEX MAP

FIGURE No. 11



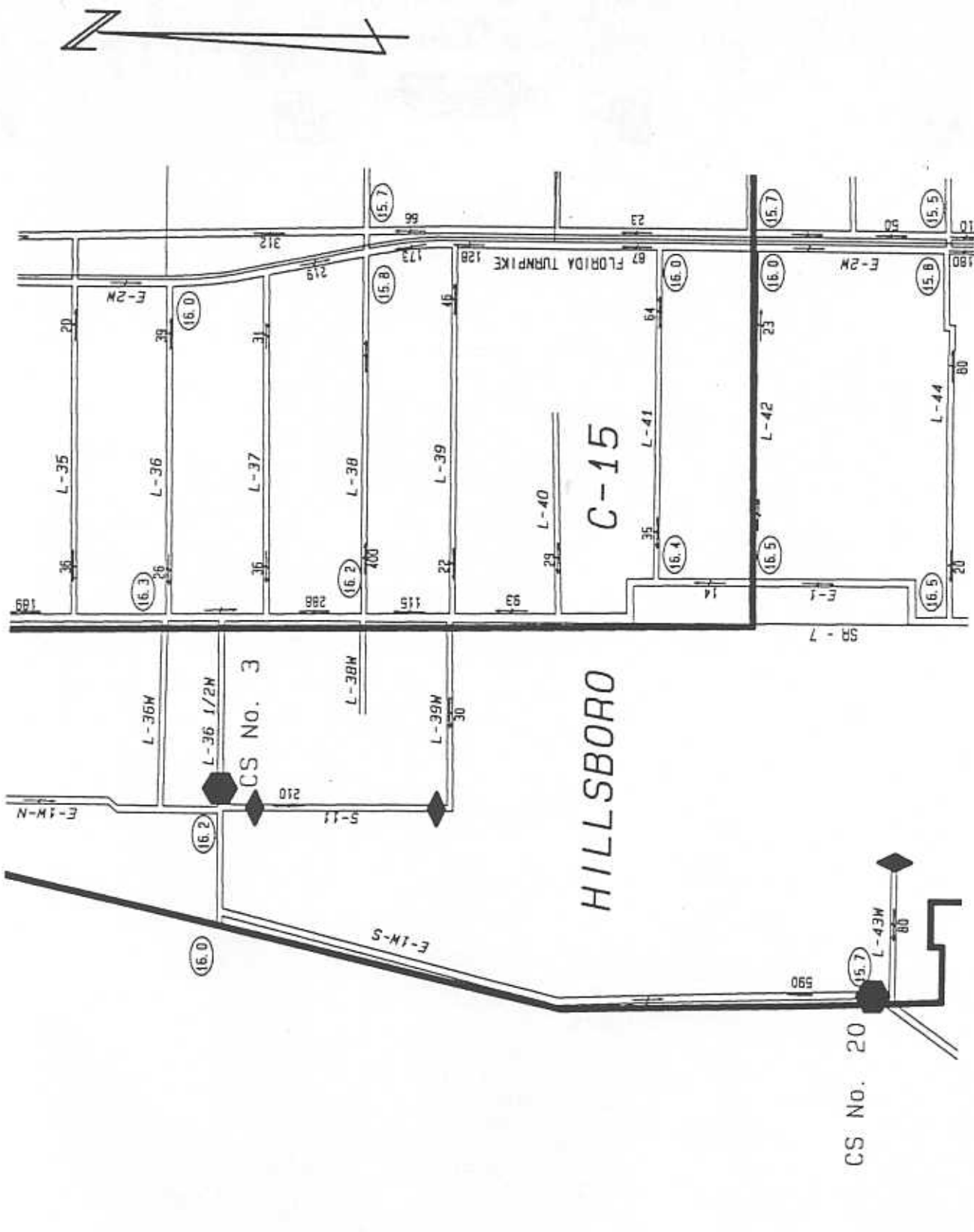
16.1 = DESIGN STAGE; 50 = DESIGN DISCHARGE AND FLOW DIRECTION

MOCK, ROOS & ASSOCIATES, INC.
ENGINEERS • SURVEYORS • PLANNERS
5720 CORPORATE WAY
WEST PALM BEACH, FLORIDA 33407
Phone: 407 683-3113 Fax: 407 478-7248



LAKE WORTH DRAINAGE DISTRICT
HILLSBORO BASIN
DESIGN DISCHARGES AND STAGES

FIGURE No. 11-A



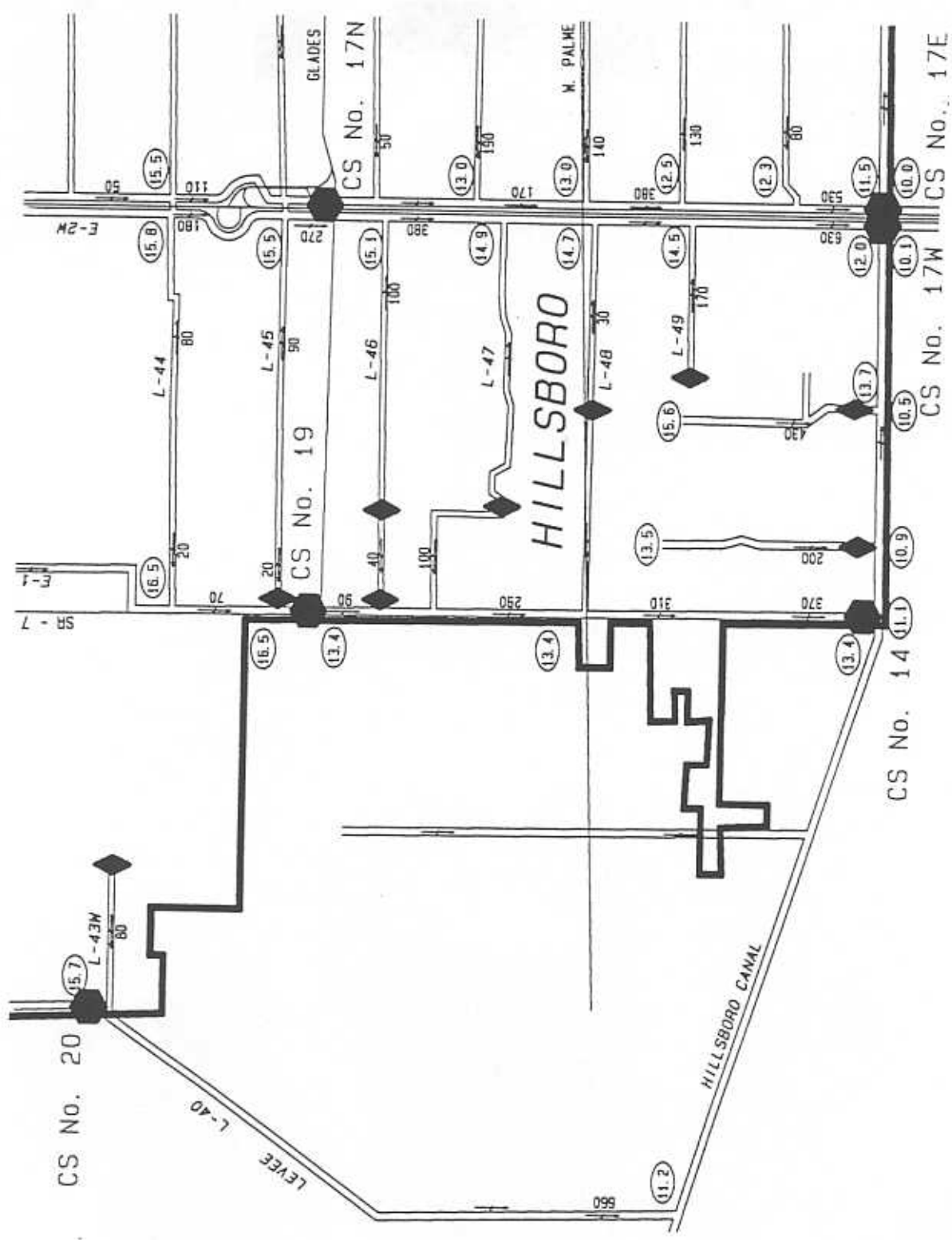
16.1 = DESIGN STAGE; \downarrow 50 = DESIGN DISCHARGE AND FLOW DIRECTION

MOCK, ROOS & ASSOCIATES, INC.
 ENGINEERS • SURVEYORS • PLANNERS
 5720 CORPORATE WAY
 WEST PALM BEACH, FLORIDA 33407
 Phone: 407 683-3113 Fax: 407 478-7248



LAKE WORTH DRAINAGE DISTRICT
 HILLSBORO BASIN
 DESIGN DISCHARGES AND STAGES

FIGURE No. 11-B

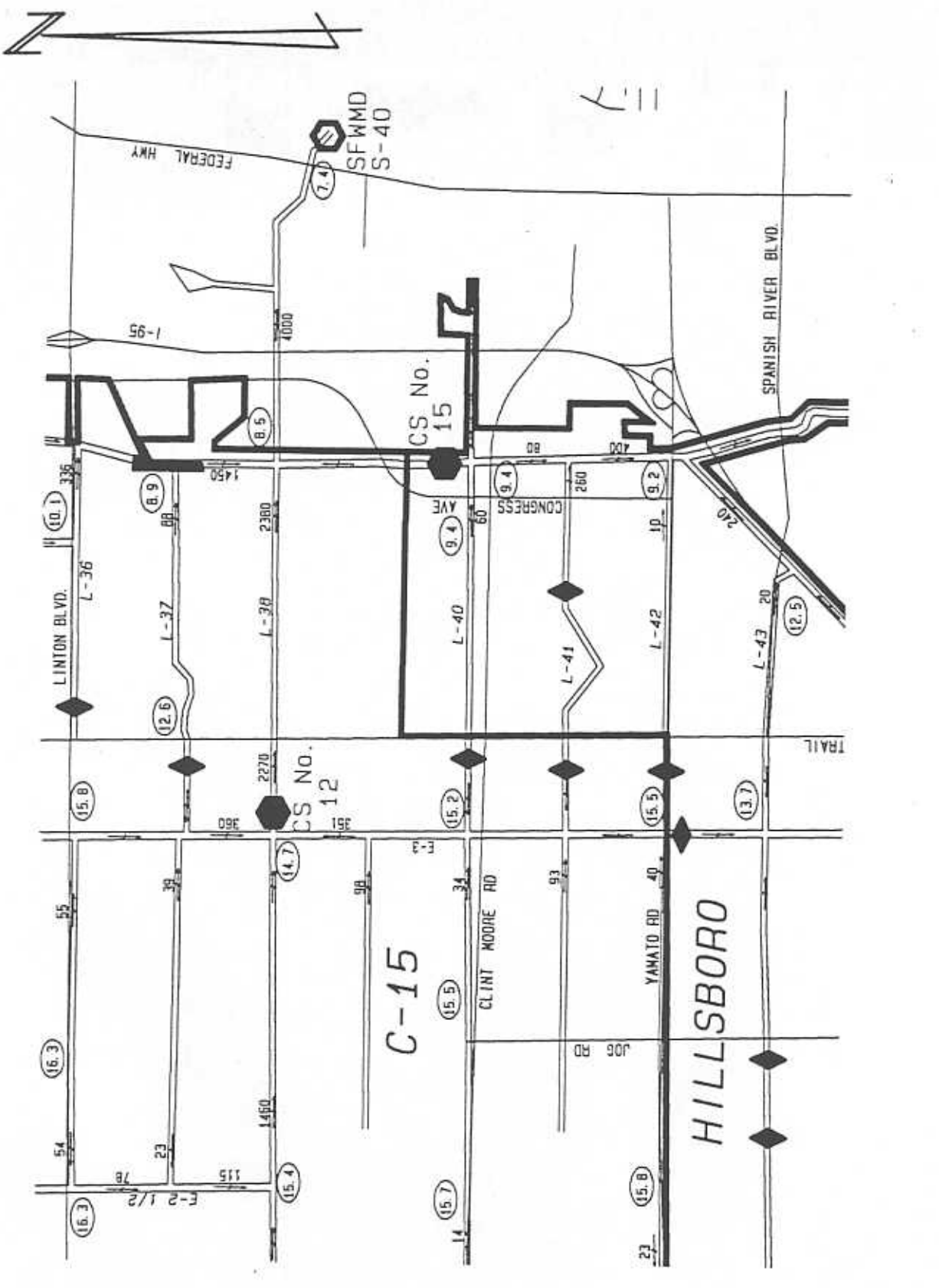


○ 16.1 = DESIGN STAGE; ↘ 50 = DESIGN DISCHARGE AND FLOW DIRECTION

MOCK, ROOS & ASSOCIATES, INC.
 ENGINEERS • SURVEYORS • PLANNERS
 5720 CORPORATE WAY
 WEST PALM BEACH, FLORIDA 33407
 Phone: 407 583-3113 Fax: 407 478-7248

LAKE WORTH DRAINAGE DISTRICT
 HILLSBORO BASIN
 DESIGN DISCHARGES AND STAGES

FIGURE No. 11-C

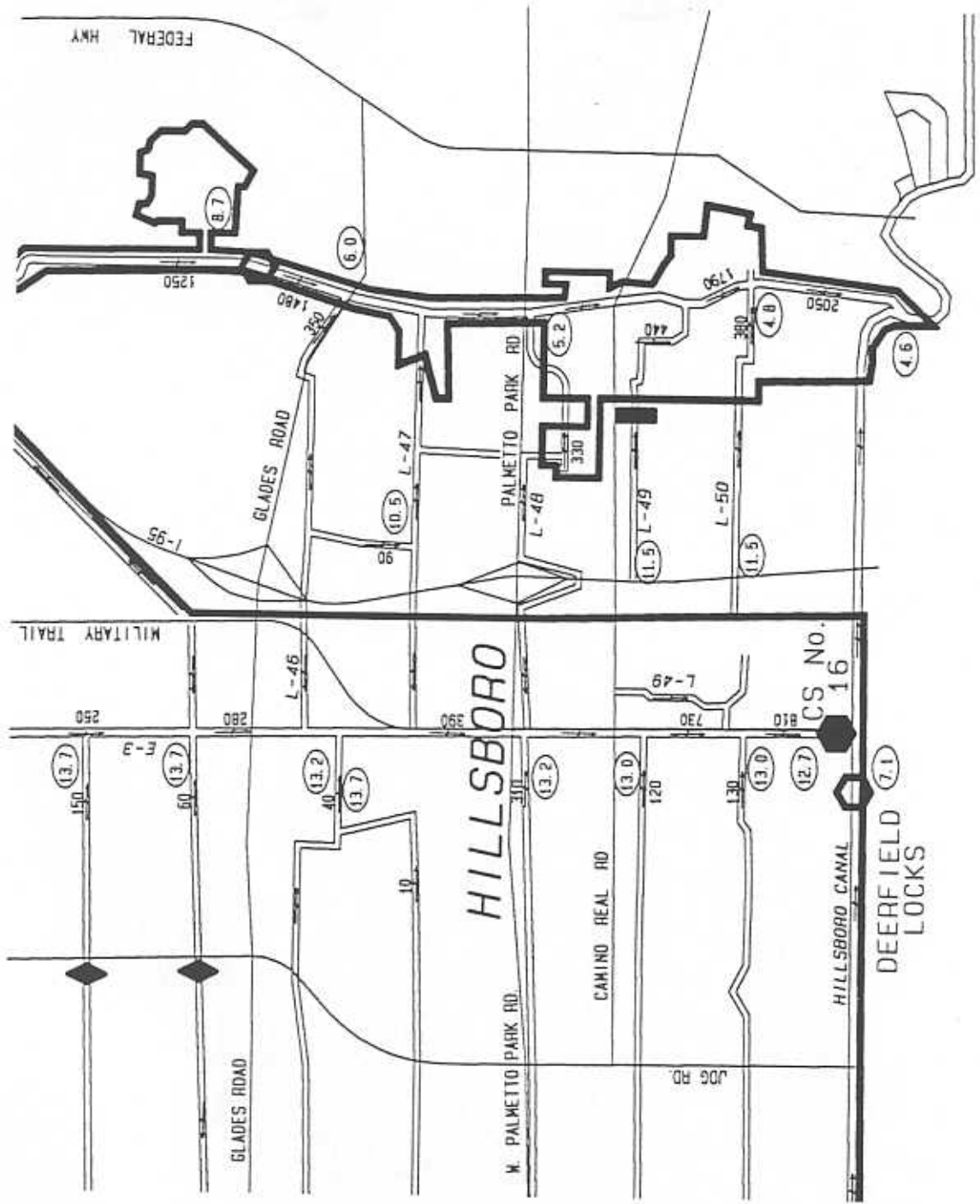


(16.1) = DESIGN STAGE; 50 = DESIGN DISCHARGE AND FLOW DIRECTION

MOCK, ROOS & ASSOCIATES, INC.
 ENGINEERS • SURVEYORS • PLANNERS
 5720 CORPORATE WAY
 WEST PALM BEACH, FLORIDA 33407
 Phone: 407 683-3113 Fax: 407 478-7248

LAKE WORTH DRAINAGE DISTRICT
 HILLSBORO BASIN
 DESIGN DISCHARGES AND STAGES

FIGURE No. 11-D



(16.1) = DESIGN STAGE; 50 = DESIGN DISCHARGE AND FLOW DIRECTION

MOCK, ROOS & ASSOCIATES, INC.
 ENGINEERS • SURVEYORS • PLANNERS
 5720 CORPORATE WAY
 WEST PALM BEACH, FLORIDA 33407
 Phone: 407 683-3113 Fax: 407 478-7248



LAKE WORTH DRAINAGE DISTRICT
 HILLSBORO BASIN
 DESIGN DISCHARGES AND STAGES

FIGURE No. 11-E

VI. RECOMMENDATIONS:

A. C-51 Basin:

Recommended improvements for the C-51 Basin are identified in the Surface Water Management Plan for the LWDD C-51 Basin. Implementation of channel improvements may occur through the LWDD canal maintenance program or through permits issued by LWDD for projects adjacent to the canals. Replacement of culvert crossings and minor water control structures may occur through the LWDD maintenance program and through permitting of roadway improvements.

In addition to the recommended improvements identified in the Surface Water Management Plan for the LWDD C-51 Basin, the results of this study indicated that minor water control structures should be considered for laterals L-5 through L-11 at Military Trail.

Based on the results of this study, the following recommendations are made:

1. The minor water control structures at Military Trail should be designed to maintain a control elevation of 13.0 ft. NGVD west of Military Trail. The control elevation east of Military Trail is 8.5 feet NGVD.
2. During a District-wide storm event some flow is indicated from the E-3 Canal south to the L-14 Canal. Therefore, if the Lake Worth Road crossing of the E-3 Canal were to be replaced, consideration of this flow is necessary in order to minimize

headloss (and stages along the E-3 Canal and laterals L-5 to L-12 between the E-3 Canal and Military Trail).

3. The minor water control structures at Military Trail should be designed to allow flow from west of Military Trail to east of Military Trail during the design event in order to reduce design stages west of Military Trail.
4. The flow from the E-3 Canal to the L-14 Canal should be considered during the design of LWDD Control Structure No. 8 along the L-14 Canal. Consideration should also be given to automation of the LWDD Control Structure No. 8 for maximum response time.
5. Results also indicate interbasin flow from Lake Osborne north to the E-4 Canal. This flow should be considered during the design or replacement of any crossings of the E-4 Canal. Also the E-4 Canal should be inspected for obstructions which would restrict flow and any obstructions found should be removed.

B. C-16 Basin:

Recommended improvements for the C-16 Basin are identified in the Surface Water Management Plan for the LWDD C-16 Basin. Implementation of channel improvements may occur through the LWDD canal maintenance program or through permits issued by LWDD for projects adjacent to the canals. Replacement of culvert

crossings and minor water control structures may occur through the LWDD maintenance program and through permitting of roadway improvements.

C. C-15 Basin:

Recommended improvements for the C-15 Basin are identified in the Surface Water Management Plan for the LWDD C-15 Basin. Implementation of channel improvements may occur through the LWDD canal maintenance program or through permits issued by LWDD for projects adjacent to the canals. Replacement of culvert crossings and minor water control structures may occur through the LWDD maintenance program and through permitting of roadway improvements.

D. Hillsboro Basin:

Recommended improvements for the Hillsboro Basin are identified in the Surface Water Management Plan for the LWDD Hillsboro Basin. Implementation of channel improvements may occur through the LWDD canal maintenance program or through permits issued by LWDD for projects adjacent to the canals. Replacement of culvert crossings and minor water control structures may occur through the LWDD maintenance program and through permitting of roadway improvements.

VII. SUMMARY AND CONCLUSIONS:

The capacity of the LWDD system with recommended improvements is equivalent to a 10-year, 24-hour storm event (with the exception of a section of the L-2 and E-3½-8 Canals as shown on Figure 8-C), assuming a District-wide storm event with an exchange of flows between the individual basins. A 10 year storm event corresponds to a design frequency of one in ten years, or on the average, a 10 percent chance of occurring in any given year. Channel and structural improvements recommended for each of the four (4) major drainage basins within LWDD would increase the present capacity of the LWDD canal system to the design capacity determined by this study. The improvements recommended in the Surface Water Management Plans should therefore be prioritized, designed and scheduled for future implementation. In addition, efforts to control vegetation and siltation within channels should be made to improve the channel's conveyance and the LWDD should continue with the current permit program and discharge restrictions for new projects.

Due to the complexity of the LWDD canal system and due to the gradual transformation of the District from agricultural to residential, consideration should be given to automation of all water control structures with remote sensing for close monitoring and quick response times to alleviate localized flooding.