Technical Memorandum

FREQUENCY ANALYSIS OF ONE AND THREE-DAY RAINFALL MAXIMA FOR CENTRAL AND SOUTHERN FLORIDA

by
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Department of Research and Evaluation
South Florida Water Management District

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ACKNOWLEDGMENTS

The expertise provided by Shawn Sculley in the statistical analysis was invaluable for the completion of this project. Medardo Molina provided a thorough review of the technical aspects of this investigation. Tom MacVicar supplied valuable suggestions for analyzing and presenting the final results. Barbara Brown should be recognized for her tremendous effort in the actual retrieval and analysis of the enormous amount of daily rainfall record that was processed, as well as Terrie McRorie for her excellent work digitizing the isohyetal map. Nettie Winograd is credited for her fine job typing and editing this report. Finally, special thanks to those that reviewed this analysis.

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I. INTRODUCTION

The South Florida Water Management District (District) is committed to maintaining the most accurate and up-to-date rainfall frequency data for use in evaluating permit applications submitted to the District. The *Frequency Analysis of Rainfall Maximums for Central and Southern Florida, Technical Publication 81-3 (MacVicar,1981)* presents the results of a comprehensive frequency analysis of maximum rainfall events of 1-, 2-, 3- and 5-day duration along with seasonal and annual durations. The 1- and 3-day duration maximum rainfall events are the most commonly considered by the District's Regulation Department in the permit review process described in the *Management And Storage of Surface Waters, Permit Information Manual, Volume IV (1989).* The purpose of this report is to update the 1- and 3-day duration frequency analysis included in the Permit Information Manual with the additional data that has become available in recent years. This data allows for additional gages to be added to the analysis while also increasing the reliability of long-term existing gages that were used in the earlier study. Refined and more stringent criteria have been developed to determine whether a particular station year should be used. Only station years that have a 90 percent probability of including the annual maximum event in the observed values were included. Even with these stricter criteria, the number of stations used in the analysis increased from 140 in the earlier analysis to 156 in this analysis. The number of station-years increased from 4,606 to 5,587, or by 21 percent.

The density of rain gages increased the greatest in the Kissimmee River Valley where only sparse data was available for the earlier study. A few gages were eliminated due to more strigent criteria used in selecting the station-years to be analyzed.

II. DATA SOURCES

The sources of data for this study include all the rainfall gages within or near the District for which at least 20 years of quality daily record is available. The data was obtained from the same sources used in the 1981 analysis. These include data that were obtained from the Weather Bureau Records, the South Florida Water Management District, the Lake Worth Drainage District, and the Corps of Engineers. The data that became available in recent years facilitates the production of rainfall frequency maps for South Florida using a higher quality and denser network of rain gages than those used in the earlier study. Figure 1 illustrates the areal distribution of these rain gages along with an indication of the number of years of reliable record at a particular station. More specific information about the rainfall gages will be found in the appendix.

The majority of the rainfall values represent gage readings taken once a day. The time of day that readings are taken varies between stations. In certain cases, hourly values are summed over 24-hour periods to obtain the daily values. No attempt was made to adjust all the daily data to the same 24-hour period, or to estimate maximum 24-hour rainfall from observational daily measurements. No adjustments for bias due to gage type or exposure were made. This analysis was based completely on the daily observations, as was the original analysis completed by the District in 1981.

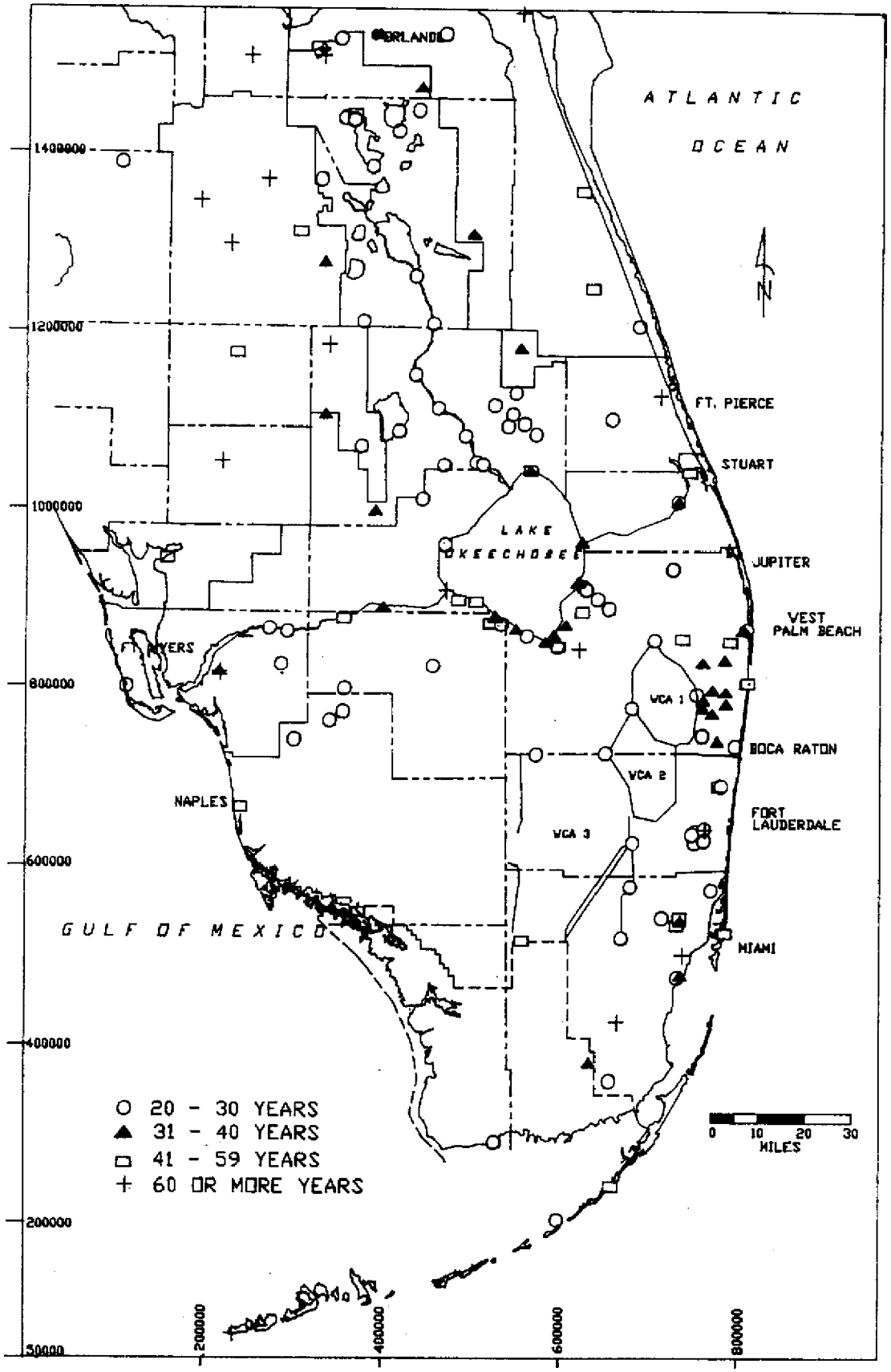

Figure 1. Rainfall Gauge Location

III. DATA PREPARATION

Each year of data is assumed to represent an independent event at that location. A filler technique similar to that used in the previous analysis was used to estimate rainfall at stations that contained missing record. This linear interpolation scheme uses the ratio of the average annual precipitation at nearby stations to that at the station with missing record to determine a weighting factor between the rainfall at the nearby stations and the one with missing data. Then the missing rainfall value may be estimated by the relationship

$$P_x = \frac{1}{N} \sum_{i=1}^{N} \frac{M_x}{M_i} * P_i$$

where

P_x is the estimated daily precipitation at the station with missing record,
M_x is the average annual precipitation at the station with missing record,
M_i is the average annual precipitation at ith nearby station,
N is the number of nearby stations used for estimate,
P_i is daily precipitation at the ith nearby station.

This method is known as the normal ratio method (Paulhus and Kohler, 1952).

Certain stations have accumulated rainfall totals during weekends and holidays. These stations may otherwise have reliable daily records. It is desirable to include these records in the analysis. An accumulated rainfall total was distributed over the individual days during which the rainfall was accumulated based on the temporal distribution of rainfall at the nearby stations that had daily record available. The relationship used to estimate the daily rainfall was the same as for the missing rainfall with the exception that the annual mean rainfall values M_x and M_i are replaced by the accumulated values A_x and A_i. Again, the subscript x refers to the rainfall station that the value is being estimated and the subscript i refers to the ith of n stations used to estimate the daily values. These estimated daily rainfall values were treated the same as observed values if the length of the accumulated period was less than or equal to five days. When the period of accumulated rainfall values was longer than five days, the daily estimates will not be as reliable as those estimated from rainfall totals accumulated over short periods and are flagged as estimated values.

In the previous District rainfall analysis, station-years with up to 150 days of estimated data were included. In this analysis, only station years that have at least a 90 percent probability of including the annual maximum event in the observed values were included. In determining these probabilities, consideration was not only given to the number of missing or estimated days, but also to what month of the year the missing value occurred. The probability that a given daily maximum rainfall event is included in the observed data of a particular year may be represented by the following equation

$$pdmi = [1 - [\sum_{m=1}^{12} \frac{nmd_m}{nd_m} * Pr_m]]*100$$

where

pdmi is the probability, expressed as a percentage, of the daily maximum event being included for a given station year,
nmd is the number of missing days in month m,
nd is the number of days in month m,
Pr is the probability for the maximum event to occur during month m.

Long term rainfall stations representing different regions of the District were examined to determine the likelihood of a maximum rainfall event occurring during a particular month of a year. The frequency distributions for the annual maximum 1- and 3-day duration events appear in Figure 2 and Figure 3 for the Keys, Lower East Coast (LEC), Lower West Coast (LWC), Everglades Agricultural Area (EAA), and Kissimmee Valley. The distributions vary significantly from one region of the District to another. The months of June and September generally have the highest probability for the annual maximum 1- and 3-day duration events to occur while the period of December through March has a minimal probability for occurrence of these same events.

IV. FREQUENCY ANALYSIS

The two-parameter Gumbel distribution was chosen as the probability function for analyzing the series of maximum annual rainfall events. This distribution is essentially log-normal distribution with constant skewness (Chow, Ven T., 1954) and also known as Fisher Tippet Type I distribution. It was chosen because it is widely accepted by practicing professionals, the results are easily compared with other similar analysis including the earlier District analysis and that its use has already been established as a design standard. Its cumulative distribution function, defined as the probability that any outcome in X will be less than or equal to a stated limiting value x, may be expressed as

$$P(X \leq x) = exp\{-exp[-a(x-u)]\}$$

where a and u are a function of the mean and standard deviation.

V. RESULTS

The rainfall depths for the 3-, 5-, 10-, 25- and 100-year return periods for the 1-day and 10-, 25-, and 100-year return periods for the 3-day duration maximum events were computed for each rain gage included in this analysis. The validity of using the Gumbel distribution for this task was tested using the Kolmogorov-Smirnov goodness-of-fit test. In this test, the maximum difference between the stepwise cumulative frequency function derived from the data set and that of the theoretical distribution function determined by the Gumbel method over the range of observed values, is used as a measure of the discrepancy between the theoretical distribution and the observed data.

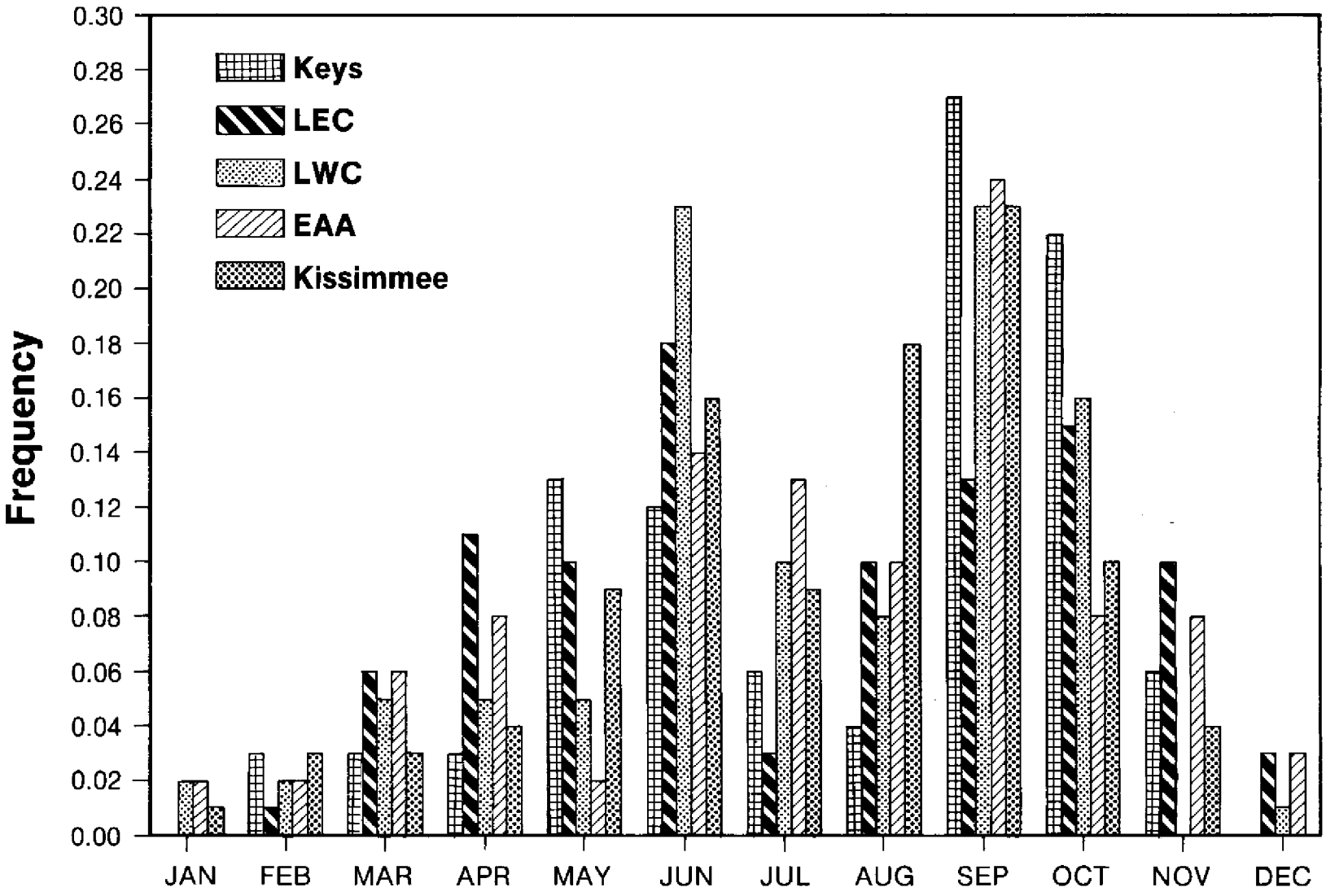

Figure 2. Distribution of Maximum One Day RF Events

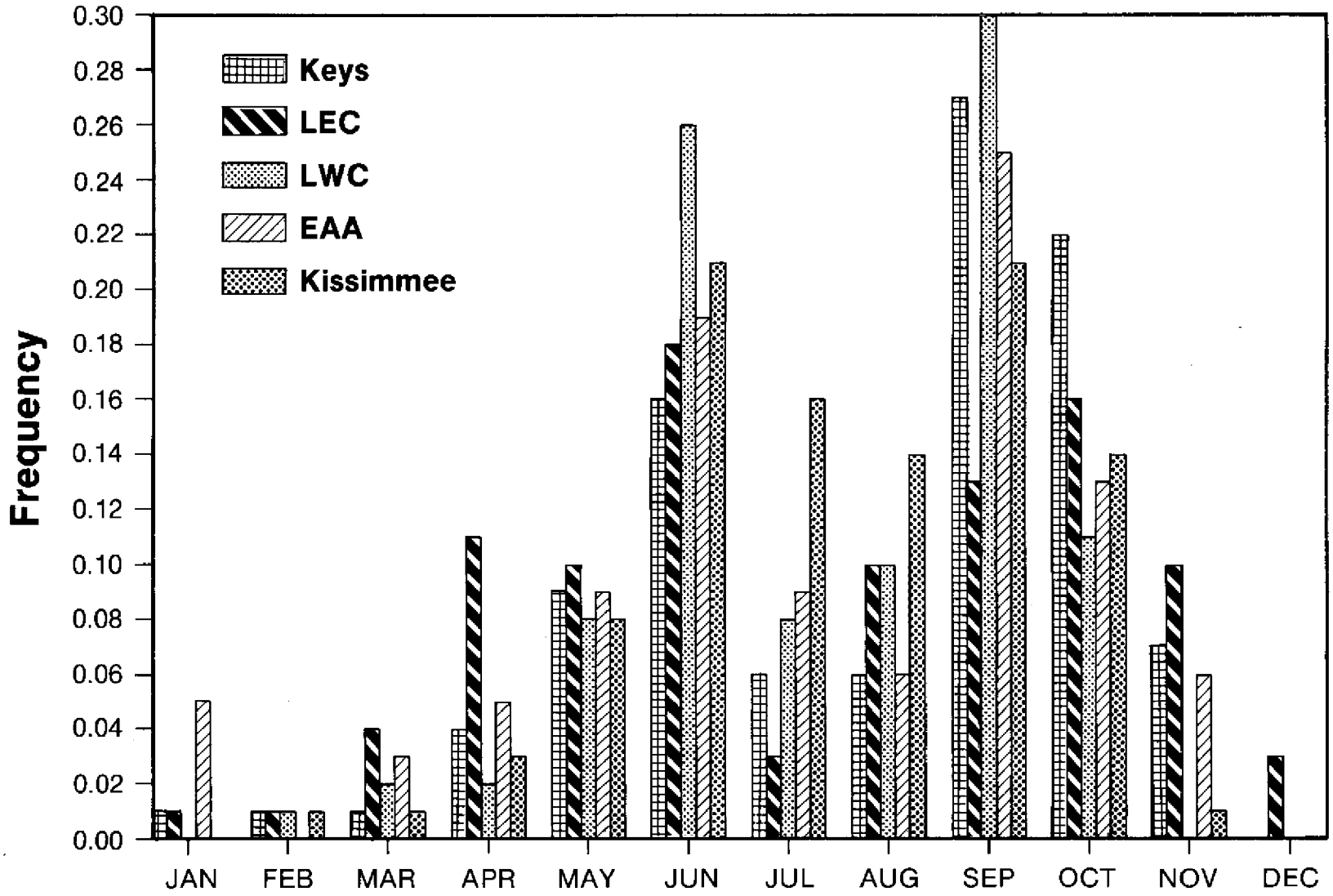

Figure 3. Distribution of Maximum Three Day RF Events

For a specified sample size and the computed maximum difference, a level of significance (α) of the goodness-of-fit can be estimated. For a significance level α, there is a 100 * (1-α)% chance that the population does not follow a specific distribution. In this analysis, 50 percent of the rainfall stations had a significance level of 0.69 or greater for the 1-day maximum events. For the 3-day events, 50 percent of the stations had a significance level of about 0.78. This indicates that over 50 percent of the stations had less than or equal to a 31 percent chance of not following Gumbel distribution for 1-day events, and less than or equal to a 22 percent chance of not following the 3-day events. The test for the 1-day and 3-day events for goodness of fit are independent of each other.

Once rainfall depths were computed, isohyetal maps were produced which illustrate the areal variation in rainfall depths associated with specific return periods and durations. Isohyetals, or lines of equal depths of rainfall, were manually drawn. Large variations in rainfall may occur between stations due to the complex interactions of large scale storm systems with mesoscale systems (1-100 kilometers) such as sea and lake breeze circulations. Rainfall intensities from large scale storm events are often enhanced (or diminished) at locations that normally favor (or resist) the formation of storms due to the mesoscale factors. Examples of regions of enhancement are along the Lower East Coast due to the sea breeze circulations, and to the south of Lake Okeechobee due to lake breeze effects. According to the results of numerical experiments (Pielke,1974), maximum rainfall amounts, due to the sea breeze circulations interacting with the prevailing summertime southeasterly winds, normally would occur several miles inland along the Lower East Coast. These same results indicate the maximum rainfall events on the Lower West Coast would be much closer to the coastline. Examples of regions that would expect lesser maximums would be over and immediately downwind of water bodies where the air is more stable and more generally in the interior regions of South Florida. In summary, the results of this analysis indicate that regions of largest 1- and 3-day duration maximum events occur in many of the same regions that would be greatly enhanced by mesoscale circulations, and illustrate the importance that these circulations have on depicting the location and intensity of maximum storm events.

Other factors affecting the computed values at each rain gauge include the number and period of the years that quality record was available at the gauge, the type of rain gauge being used, the exposure of the rain gauge, and how well the Gumbel distribution fits the data at a particular gauge. It is difficult to account for all the variations that occur between stations. When station values differ significantly from those of nearby stations, the data of this station was checked to verify the cause of the disparity, and to decide whether this gauge indeed included reliable data. In regions that data was sufficient, only stations with greater than 30 years of record were considered.

Figures 4-8 include the 1-day rainfall totals for the 3-, 5-, 10-, 25-, and 100- year return period events, while figures 9-11 include the 3-day rainfall totals for the 10-, 25-, 100-year return period.

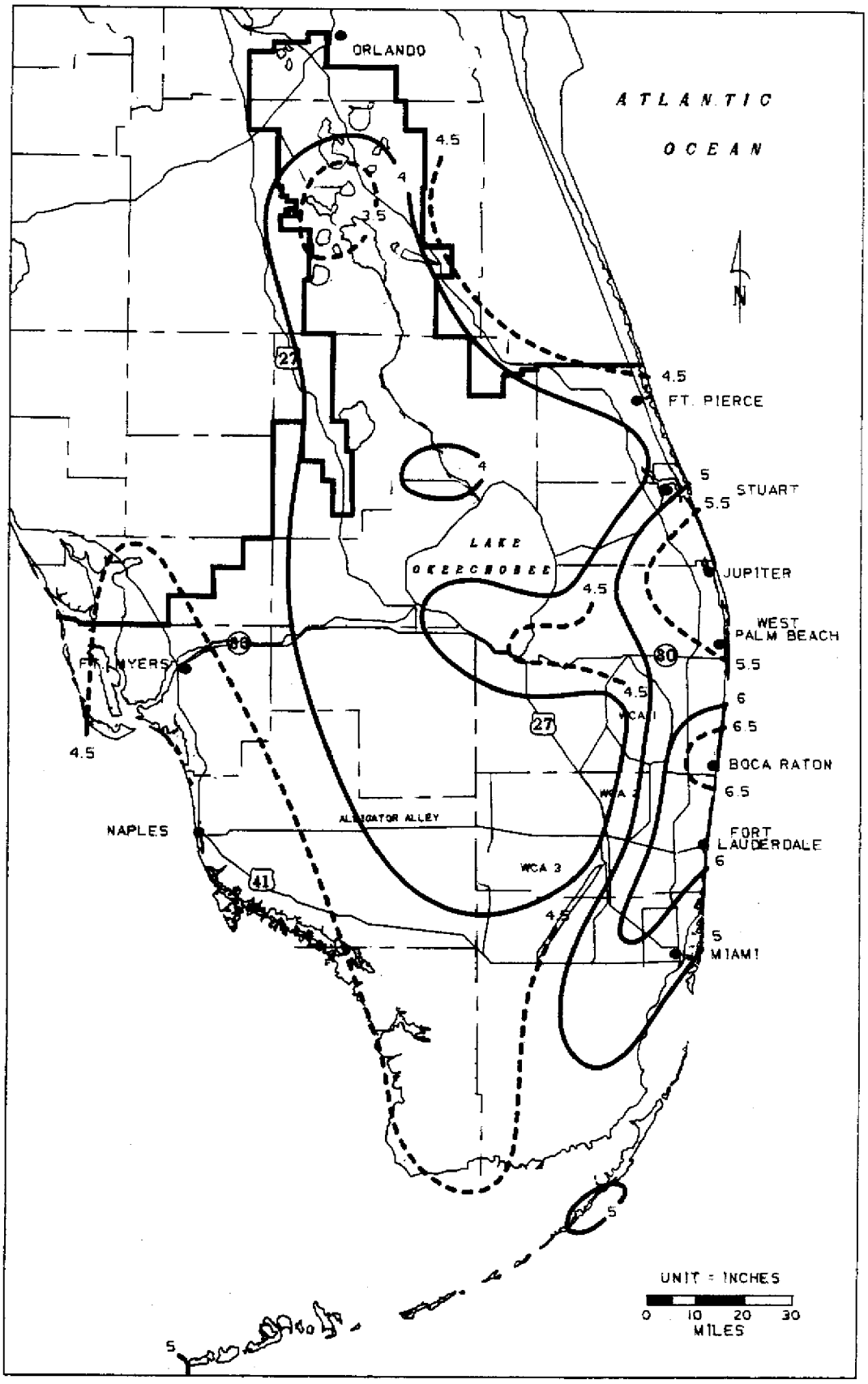

Figure 4. 1-Day Rainfall: 3 Year Return Period

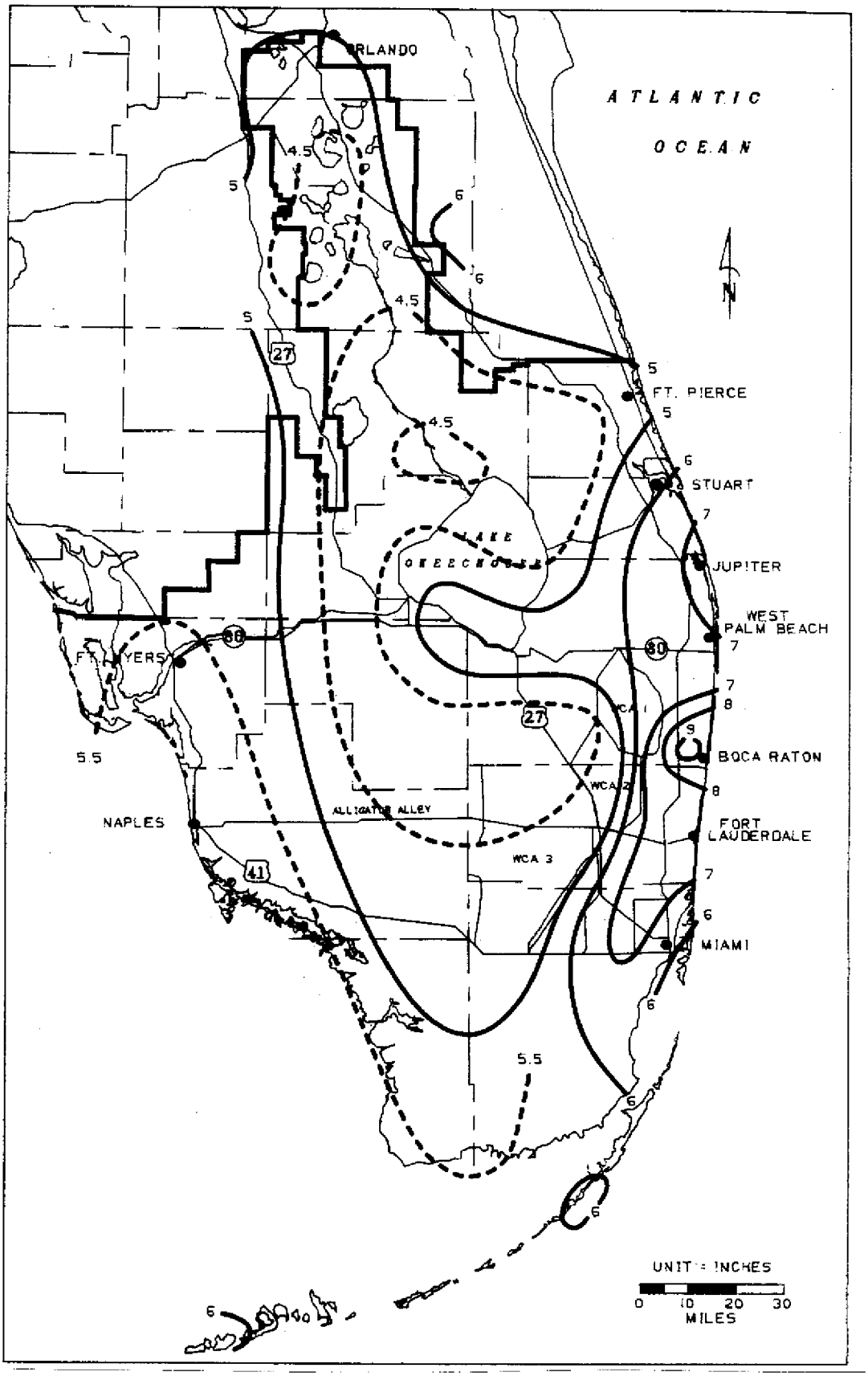

Figure 5. 1-Day Rainfall: 5 Year Return Period

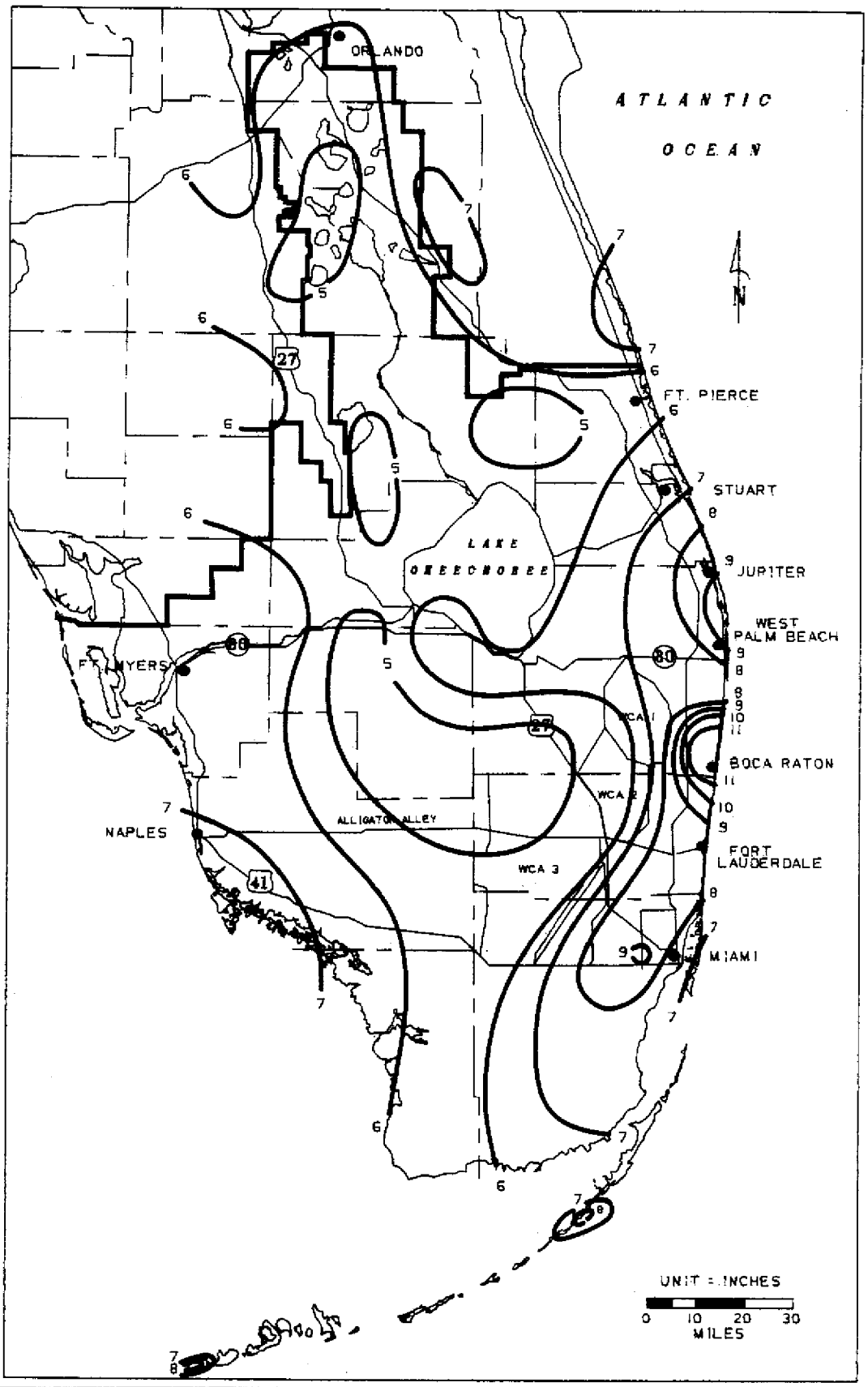

Figure 6. 1-Day Rainfall: 10 Year Return Period

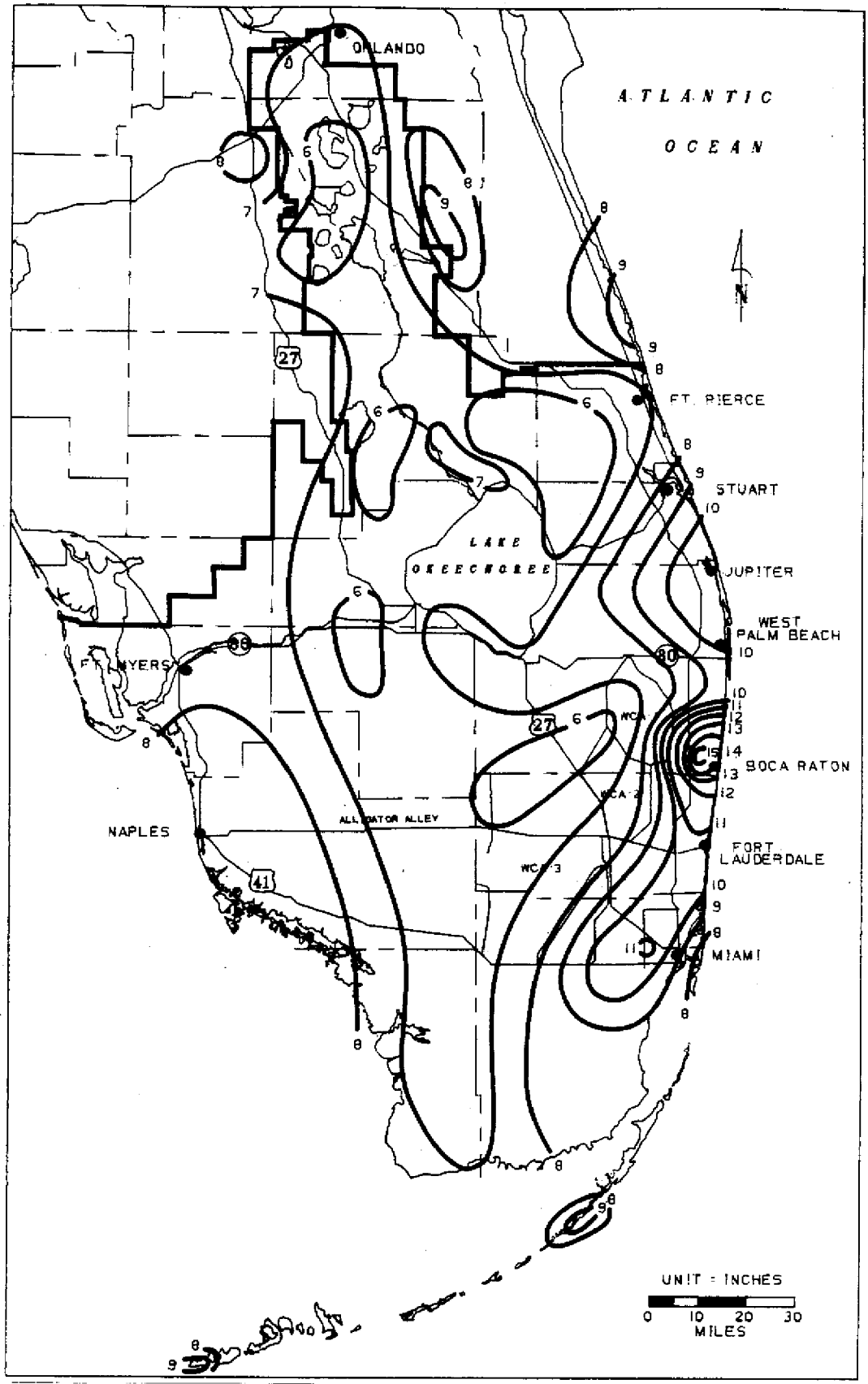

Figure 7. 1-Day Rainfall: 25 Year Return Period

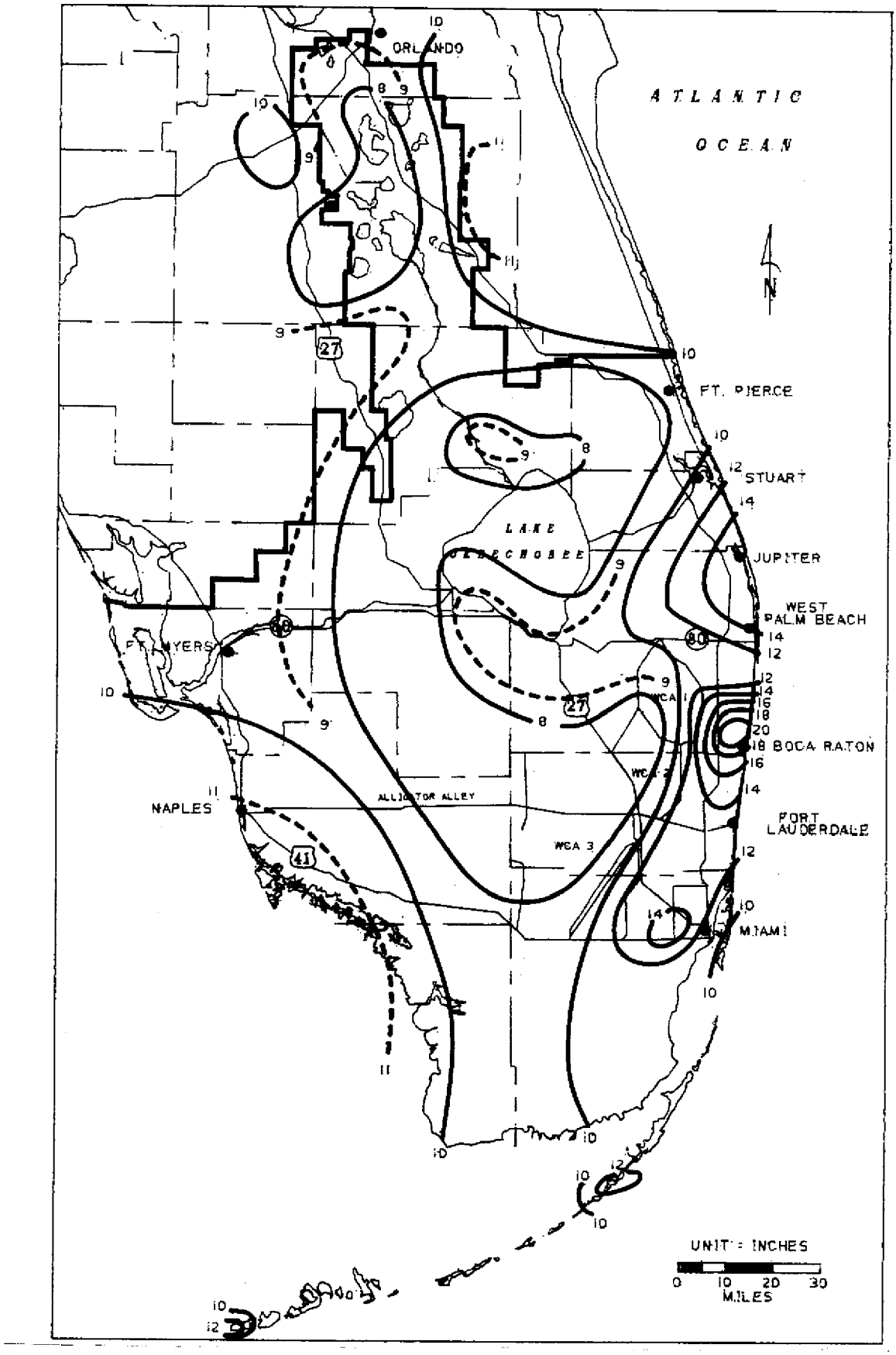

Figure 8. 1-Day Rainfall: 100 Year Return Period

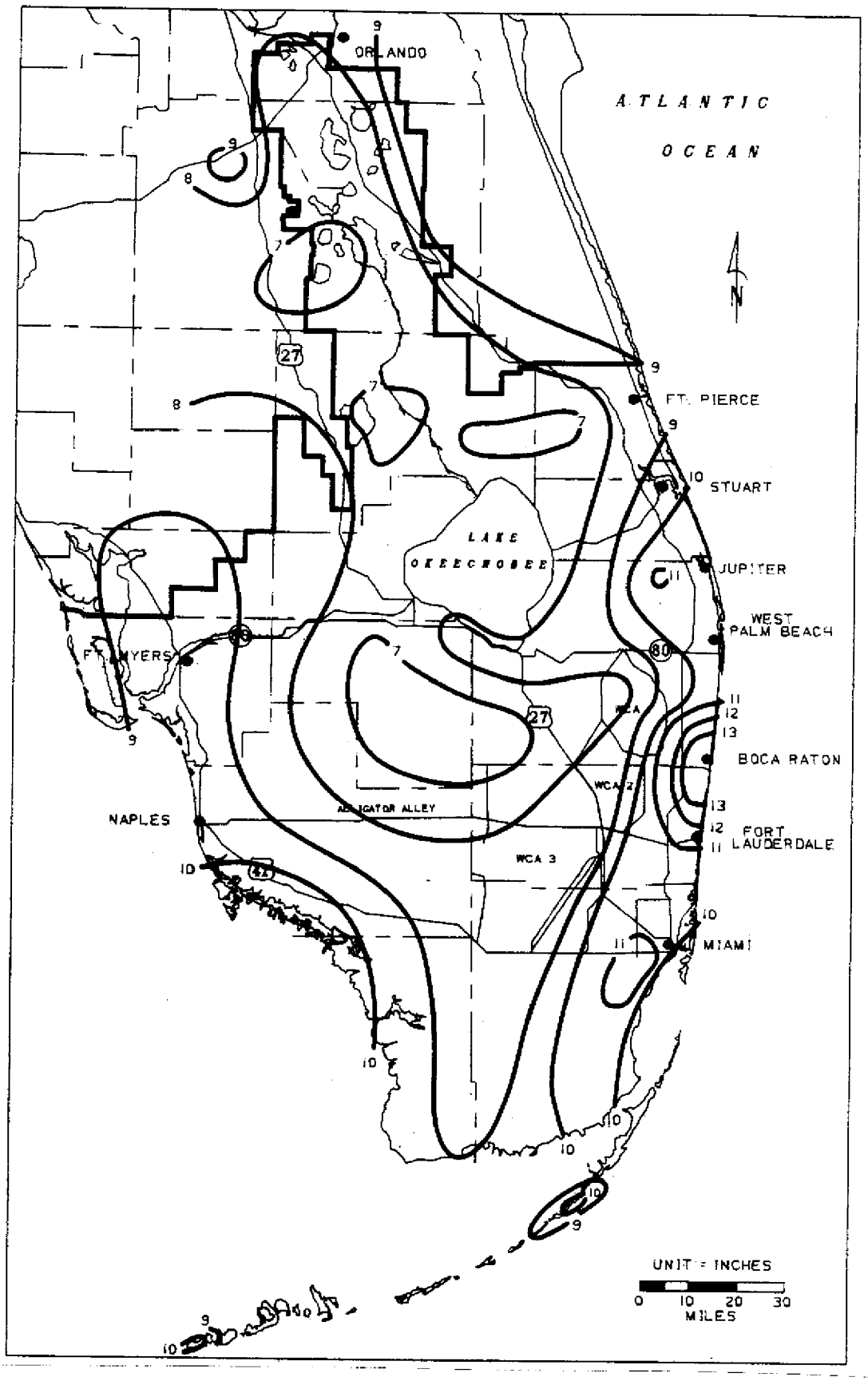

Figure 9. 3-Day Rainfall: 10 Year Return Period

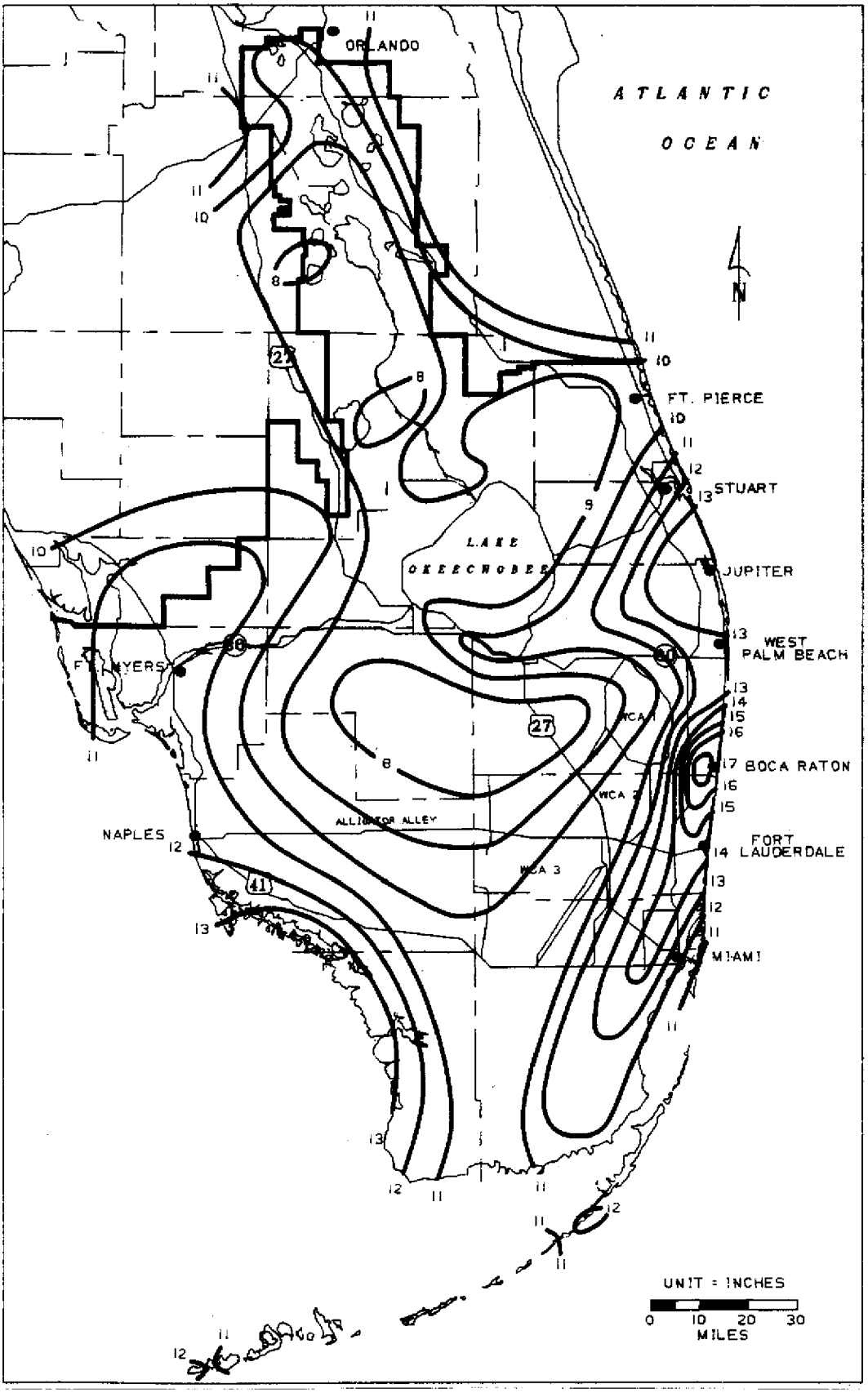

Figure 10. 3-Day Rainfall: 25 Year Return Period

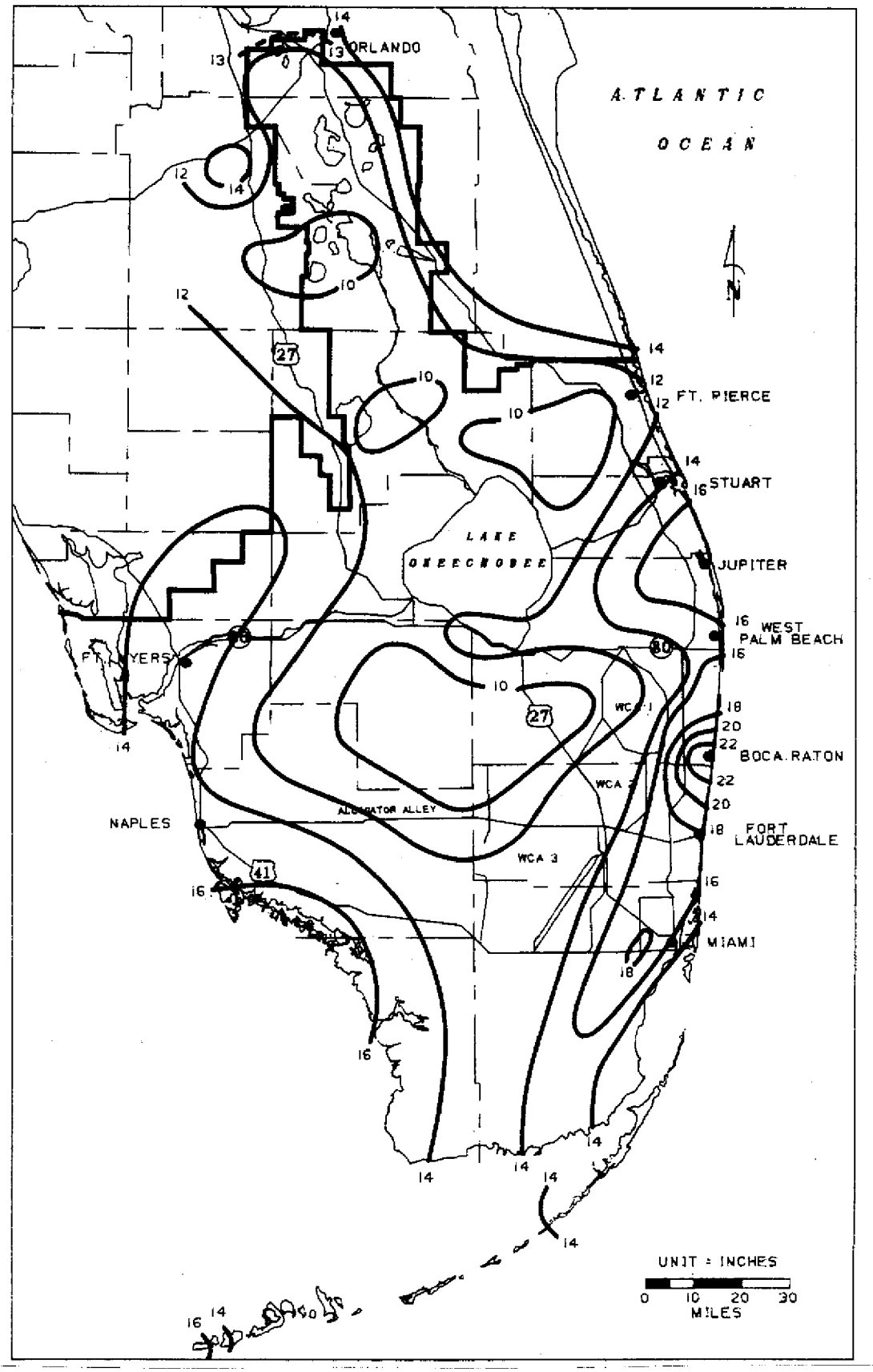

Figure 11. 3-Day Rainfall: 100 Year Return Period

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VI. SUMMARY

The inclusion of additional rainfall gauges, and the greater number of years of record available, allowed greater reliability and detail to be included in the isohyetal maps than earlier District analysis. The general pattern of larger maximum rainfall events along the coastal regions, particularly the Lower East Coast, still exist with only minor changes in the computed extreme events.

Additional gauges with 20 years record in the interior regions, especially in the lower Kissimmee Valley region, allowed for additional detail to be added to these maps in this region. The last 20 years have tended to be drier in the interior sections of south and central Florida which also lowered the maximum expected values of the computed extreme events in this region.

The precipitation regime over Lake Okeechobee and the surrounding ocean is completely different than that over the land mass of Florida. These maps were generated based on measurements taken over land mass and should not be used to estimate rainfall over Lake Okeechobee or nearby marine areas.

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APPENDIX

Rainfall Station Basic Information

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MRF	X-COORDINATE	Y-COORDINATE	STATION NAME	COUNTY	# OF YEARS	PERIOD OF RECORD
101	760265	747202	BOCA RATON RD. & RANGELINE (LWDD)	PALM BEACH	30	1940-1990
102	776952	740543	BOCA RATON & POWERLINE (LWDD)	PALM BEACH	31	1928-1990
104	781828	691200	POMPANO FARMERS MARKET	BROWARD	26	1957-1990
108	762544	643218	DIXIE WATER PLANT	BROWARD	26	1957-1990
109	752896	640535	SEWELL'S LOCK	BROWARD	28	1957-1990
114	752148	628213	GILL REALTY	BROWARD	26	1957-1990
115	682565	628263	S-9 PUMP S. NEW RIVER CANAL	BROWARD	28	1960-1990
117	715639	543205	MIAMI FIELD STATION	DADE	23	1965-1990
12	416025	1423525	BROOKS PROPERTY	OSCEOLA	25	1962-1990
124	656799	362549	C-111 BELOW S18-C NEAR FLORIDA CITY	DADE	20	1967-1990
125C	521033	873820	TOWNSITE U.S. SUGAR	PALM BEACH	44	1929-1972
135	625983	915303	PELICAN LAKE DRAINAGE DISTRICT #1	PALM BEACH	26	1957-1990
137	642244	901321	PAHOKEE 1	PALM BEACH	27	1957-1990
138	654786	890764	PAHOKEE 2	PALM BEACH	28	1957-1989
18	386437	1383658	S-61 SPILLWAY ON C-35 AT LAKE TOHO.	OSCEOLA	21	1965-1989
20	329486	1369272	ST.CLAIR RESORT / LAKE MARION (BELFORT)	POLK	23	1965-1990
206	287610	826801	LEHIGH ACRES 1	LEE	29	1960-1990
227	273583	868071	S-79 SPILLWAY & LOCK ON CALOOSAHATCHEE RIVER	LEE	21	1965-1987
242	356865	773499	SOUTH FLORIDA FIELD LAB - USDA IMMOKALEE	COLLIER	28	1959-1990
243	302280	742319	CORKSCREW SWAMP AT SANCTUARY HEADQUARTERS	COLLIER	29	1959-1990
250	294334	865035	ALVA FARMS / YODER BROS.	LEE	20	1968-1990
27	436062	1261202	S-65 SPILLWAY ON LAKE KISSIMMEE AT C-38	OSCEOLA	21	1965-1990
301	806048	866561	PLANT INTAKE - CITY OF WEST PALM BEACH	PALM BEACH	40	1944-1990
32	456226	1208640	S-65A SPILLWAY ON C-38	OSCEOLA	21	1965-1990
33	377178	1211052	LAKE ARBUCKLE NEAR AVON PARK	POLK	20	1965-1989
35	436787	1151538	S-65B SPILLWAY & LOCK ON C-38	OKEECHOBEE	20	1965-1990
37	657594	1102720	FT. PIERCE FIELD STATION	ST. LUCIE	24	1965-1990
38	462596	1114447	S65-C SPILLWAY ON C-38	OKEECHOBEE	20	1966-1990
4001	549280	1132131	WILLIAMSON DITCH AT S-27 NEAR OKEECHOBEE	OKEECHOBEE	28	1955-1983
4002	525414	1118073	TAYLOR CREEK - BASSETT 2	OKEECHOBEE	26	1955-1983
4003	545793	1107892	TAYLOR CREEK - RAULERSON 3	OKEECHOBEE	25	1955-1983
4005	540578	1094558	TAYLOR CREEK - DIXIE 5	OKEECHOBEE	28	1955-1983
4006	559331	1097307	TAYLOR CREEK - MOBLEY 6	OKEECHOBEE	27	1955-1983
4007	572516	1085515	TAYLOR CREEK - OPAL 7	OKEECHOBEE	27	1955-1983
41	418201	1089067	S-68 SPILLWAY ON C-41A AT LAKE ISTOKPOGA	HIGHLANDS	22	1965-1990
43	492874	1083532	S-65D SPILLWAY ON C-38	OKEECHOBEE	24	1965-1990
45	512728	1051121	S-65E SPILLWAY & LOCK ON C-38 AT LAKE OKEECHOBEE	OKEECHOBEE	24	1964-1990
46	469037	1050626	BRIGHTON	HIGHLANDS	22	1960-1987
47	566180	1044413	HGS-6/S-193 ON TAYLOR CREEK AT LAKE OKEECHOBEE	OKEECHOBEE	50	1938-1989
48	444796	1012322	S-70 SPILLWAY ON C-41 AT INDIAN RESERVATION	GLADES	22	1965-1990
49	732327	1009774	S-80 SPILLWAY & LOCK ON ST. LUCIE CANAL TIDEWATER	MARTIN	23	1958-1987
51	624749	963965	PORT MAYACA LOCK (CORPS OF ENGINEERS)	MARTIN	37	1951-1988
52	470688	961467	S-131	GLADES	22	1965-1990
54	726808	934890	PRATT & WHITNEY	PALM BEACH	29	1957-1989
55	619735	919751	HGS-5 ON LAKE OKEECHOBEE TO W.P.B. CANAL	PALM BEACH	34	1951-1988
56	471558	910880	HGS-1 ON LAKE OKEECHOBEE	GLADES	37	1951-1988
57	629617	911780	PELICAN LAKE DRAINAGE DISTRICT #2	PALM BEACH	29	1957-1989
60	484688	899361	BENBOW - U.S. SUGAR	GLADES	45	1929-1973
6000	419942	1629643	SANFORD	SEMINOLE	42	1913-1956
6001	425268	1623573	SANFORD EXPERIMENT STATION	SEMINOLE	32	1956-1989
6002	281243	1642307	EUSTIS 2S	LAKE	53	1900-1958
6003	249059	1507870	CLERMONT	LAKE	78	1900-1989
6004	105297	1387048	HILLSBOROUGH RIVER STATE PARK	HILLSBOROUGH	27	1943-1989
6006	193525	1345958	LAKELAND WB CITY	POLK	71	1915-1989
6007	227513	1297131	BARTOW	POLK	77	1895-1989
6009	268945	1369683	LAKE ALFRED - EXPERIMENT STATION	POLK	60	1924-1989
6010	305910	1310403	MOUNTAIN LAKE	POLK	52	1935-1989

MRF	X-COORDINATE	Y-COORDINATE	STATION NAME	COUNTY	# OF YEARS	PERIOD OF RECORD
6011	333930	1276041	BABSON	POLK	34	1947-1989
6012	235413	1175990	WAUCHULA 2N	HARDEE	54	1933-1989
6013	339309	1185133	CITY OF AVON PARK	HIGHLANDS	72	1892-1989
6014	335392	1107293	DESOTO CITY 8SW	HIGHLANDS	34	1925-1989
6015	218370	1054921	ARCADIA	DESOTO	68	1907-1989
6016	157880	946317	PUNTA GORDA	CHARLOTTE	47	1914-1965
6018	553473	1556879	TITUSVILLE 2W	BREVARD	70	1901-1989
6019	500000	1308412	NITTAW 1S	OSCEOLA	31	1942-1972
6020	553988	1181211	FORT DRUM 5NW	OKEECHOBEE	31	1956-1989
6021	634746	1248049	FELLSMERE	INDIAN RIVER	59	1911-1979
6022	623624	1357078	MELBOURNE	BREVARD	43	1937-1989
6023	687945	1206155	VERO BEACH FAA AIRPORT	INDIAN RIVER	23	1943-1984
6024	330750	1508125	ISLEWORTH	ORANGE	65	1918-1983
6025	441050	1472053	HART LAKE	ORANGE	33	1942-1979
6026	365917	1441943	KISSIMMEE	OSCEOLA	44	1893-1959
6027	365180	1435686	KISSIMMEE	OSCEOLA	30	1948-1989
6031	375491	1072312	LAKE PLACID 2SW	HIGHLANDS	30	1933-1968
6032	710834	1128713	FORT PIERCE	ST.LUCIE	82	1901-1989
6033	505416	1053946	OKEECHOBEE 9W	HIGHLANDS	20	1930-1974
6034	565637	1044204	HGS-6/S-193 ON TAYLOR CREEK TO LAKE OKEECHOBEE	OKEECHOBEE	32	1948-1989
6038	471558	910880	HGS-1 ON LAKE OKEECHOBEE	GLADES	69	1918-1989
6039	526649	880690	HGS-2 ON LAKE OKEECHOBEE AT CLEWISTON	HENDRY	39	1948-1989
6042	621618	921247	CANAL POINT USDA	PALM BEACH	35	1922-1989
6044	356775	879515	LA BELLE	HENDRY	49	1929-1989
6046	341832	763455	LAKE TRAFFORD	COLLIER	23	1942-1968
6047	240884	667430	NAPLES	COLLIER	43	1942-1989
6048	372647	549519	EVERGLADES	COLLIER	59	1924-1989
6049	234088	79499	KEY WEST (MIX OF RECORDER AND STANDARD CAN)	MONROE	63	1832-1974
6053	659150	243843	TAVERNIER	MONROE	46	1936-1989
6054	557322	518377	TAMIAMI TRAIL AT 40 MILE BEND	DADE	45	1941-1989
6058	736091	479102	COCONUT GROVE 7S	DADE	34	1923-1958
6059	732990	476965	MIAMI 125 S.W.	DADE	24	1958-1988
6063	786202	526653	MIAMI BEACH	DADE	48	1927-1989
6065	735761	539676	MIAMI AIRPORT WSMO AP (NOAA STATION 5663)	DADE	40	1948-1989
6066	734826	543507	HIALEAH	DADE	44	1941-1989
6068	749358	637485	FT.LAUDERDALE EXPERIMENT STATION	BROWARD	24	1953-1981
6069	762544	643218	FT. LAUDERDALE	BROWARD	68	1912-1989
6070	762622	630698	DANIA 4 WNW	BROWARD	28	1942-1973
6071	778640	691381	POMPANO BEACH	BROWARD	43	1941-1989
6073	810575	806713	HYPOLUXO	PALM BEACH	52	1890-1959
6074	737004	856114	LOXAHATCHEE	PALM BEACH	45	1941-1988
6075	790907	853022	WEST PALM BEACH AIRPORT	PALM BEACH	48	1939-1989
6077	350156	1526836	LAKE WAWASSEE	ORANGE	24	1939-1964
6079	392985	1532754	ORLANDO WB AIRPORT	ORANGE	31	1948-1989
6080	113082	801290	CAPTIVA	LEE	27	1939-1967
6082	743789	1042558	STAURT 1N	MARTIN	45	1935-1989
6091	810124	867296	WEST PALM BEACH	PALM BEACH	26	1929-1960
6093	217472	817624	FT. MEYERS	LEE	75	1851-1989
61	504893	898249	LIBERTY POINT - U.S. SUGAR	GLADES	45	1929-1973
6100	467896	1532617	BITHLO (FORMERLY CHRISTMAS)	ORANGE	24	1958-1988
6107	633984	382765	ROYAL PALM RANGER	DADE	38	1949-1989
6118	457793	824768	DEVIL'S GARDEN TOWER (DUPLICATES)	HENDRY	25	1956-1989
6119	620845	844509	BELLE GLADE EXPERIMENT STATION	PALM BEACH	62	1924-1989
6125	528210	293637	FLAMINGO	MONROE	24	1962-1989
6126	664357	427084	HOMESTEAD EXPERIMENT STATION	DADE	37	1910-1989
62	526649	880690	HGS-2 ON LAKE OKEECHOBEE AT CLEWISTON	HENDRY	37	1951-1988
63	534089	872719	CLEWISTON FIELD STATION	HENDRY	20	1968-1990

MRF	X-COORDINATE	Y-COORDINATE	STATION NAME	COUNTY	# OF YEARS	PERIOD OF RECORD
65	624709	887229	PELICAN 34 - U.S. SUGAR	PALM BEACH	45	1929-1973
67	606168	872233	RUNYON - U.S. SUGAR	PALM BEACH	32	1942-1973
68	550416	866576	RITTA - U.S. SUGAR	PALM BEACH	36	1913-1973
69	563018	859420	MIAMI CANAL AT HGS-3 & S-3 AT LAKE HARBOR	PALM BEACH	21	1967-1990
70	593020	860558	HGS-4 ON LAKE OKEECHOBEE AT HILLS. & N. NEW RIVER	PALM BEACH	36	1951-1988
7027	365896	1435884	KISSIMMEE 2	OSCEOLA	25	1940-1972
7035	732327	1009774	S-80 SPILLWAY & LOCK ON ST. LUCIE CANAL TIDEWATER	MARTIN	37	1940-1989
7036	391538	999564	VENUS 4 SSW	HIGHLANDS	36	1928-1978
7037	624749	963967	PORT MAYACA LOCK (CORPS OF ENGINEERS)	MARTIN	39	1940-1989
7039	526649	881699	HGS-2 ON LAKE OKEECHOBEE AT CLEWISTON	HENDRY	40	1936-1989
7040	592686	860287	HGS-4 ON LAKE OKEECHOBEE AT HILLS. & NEW RIVER	PALM BEACH	40	1937-1989
7041	619721	919826	HGS-5 ON LAKE OKEECHOBEE TO W.P.B. CANAL	PALM BEACH	40	1940-1988
7043	400590	892412	SPILLWAY & LOCK ON CALOOSAHATCHEE RIVER	GLADES	38	1936-1989
7045	358317	799744	FELDA - RECORDING GUAGE	HENDRY	26	1941-1972
7050	267390	91429	KEY WEST WSO AIRPORT	MONROE	38	1941-1989
7052	599437	206018	LIGNUMVITAE KEY - RECORDING GUAGE	MONROE	27	1941-1976
7057	737977	502333	MIAMI WB CITY	DADE	69	1901-1983
7065	731490	535110	MIAMI AIRPORT WSMO AP (NOAA STATION 5663)	DADE	46	1939-1989
7067	680128	578682	PENNSUCO 5NW	DADE	30	1941-1989
7072	797636	735636	BOCA RATON	PALM BEACH	20	1948-1989
7079	392985	1532753	ORLANDO WB AIRPORT	ORANGE	40	1940-1989
7086	651660	727791	NORTH NEW RIVER CANAL 2	PALM BEACH	25	1940-1981
7088	670038	521196	TAMIAMI CANAL AT DADE - BROWARD LEVEE	DADE	21	1941-1966
7093	216752	818636	FT. MEYERS - RECORDING GUAGE	LEE	32	1941-1989
72	583269	852796	SOUTH SHORE - U.S. SUGAR	PALM BEACH	32	1940-1972
73	597341	847274	SOUTH BAY (BELFORT)	PALM BEACH	27	1959-1990
73C	597341	847274	SOUTH BAY (BELFORT)	PALM BEACH	45	1929-1981
76	706624	854741	S-5A ON W.P.B. CANAL AT W.C.A.1	PALM BEACH	28	1956-1990
78	785339	831476	GREENACRES (LWDD)	PALM BEACH	31	1928-1990
8	438597	1446710	LAKE MYRTLE (2A35)	OSCEOLA	20	1953-1990
81	759669	828885	LAKE WORTH RD. AND E1 (LWDD)	PALM BEACH	31	1940-1990
84	786400	795838	BOYNTON RD. & MILITARY TR. (LWDD)	PALM BEACH	31	1940-1990
85	771212	798465	BOYNTON RD. & E2 (LWDD)	PALM BEACH	32	1928-1990
88	760656	786988	LATERAL 28 & RANGELINE (LWDD)	PALM BEACH	32	1940-1990
89	754166	793410	W.C.A. 1 IN LEVEE L-40 NEAR BOAT RAMP	PALM BEACH	20	1960-1990
9	355982	1438445	KISSIMMEE FIELD STATION	OSCEOLA	21	1964-1990
90	786766	782109	LAKE WORTH DRAINAGE DISTRICT OFFICE (LWDD)	PALM BEACH	31	1955-1990
9018	770999	574816	STONEBRAKER	DADE	23	1953-1979
92	771113	771605	DELRAY RD. & E2 (LWDD)	PALM BEACH	32	1928-1990
93	759988	777391	LATERAL 32 & RANGELINE (LWDD)	PALM BEACH	31	1955-1990
95	681286	777786	HILLSBORO CANAL AT S-6 NEAR SHAWANO	PALM BEACH	27	1960-1990
98	573893	726262	S-8 SPILLWAY ON MIAMI CANAL	PALM BEACH	22	1962-1990