### SOUTH FLORIDA WATER MANAGEMENT DISTRICT

Water Utilities WATER DEMAND REDUCTION During the 2007-2009 Water Shortage Restrictions



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## **EXECUTIVE SUMMARY**

South Florida experienced three consecutive years of drought between 2007 and 2009. On July 2, 2007, Lake Okeechobee reached its lowest water level in recorded history at +8.82 feet National Geodetic Vertical Datum. In response to these dry conditions, water levels in many groundwater monitor wells in south Florida were at the lowest 10<sup>th</sup> percentile in history. The South Florida Water Management District (SFWMD or District) issued water shortage orders in various basins placing water users, including public water suppliers, under water restrictions in an effort to reduce demand and stretch existing water supplies. The purpose of this document is to determine water savings resulting from phased water restrictions.

District staff reviewed water demand data from 45 utilities located in the Lower East Coast, Lower West Coast, and Upper East Coast water supply planning areas. These data were compiled and analyzed and the following trends and results are noted:

- The decrease in water use can most likely be attributed in part to both a mandatory reduction in outdoor irrigation and voluntary indoor water consumption reductions.
- More than 105 billion gallons of potable water were saved District-wide from March 2007 through April 2009.
- Water savings continue, although the amounts have begun to diminish with the easing of the drought, relaxing of water restrictions, enforcement, and reduced public messaging and media attention.
- Of all the counties, Palm Beach realized the greatest savings during the 2007 Phase III restrictions, with an average savings of 34.3 percent from the pre-restriction period. Miami-Dade and Monroe counties' greatest savings occurred during the 2008 Phase III restrictions, reaching a 9.8 percent savings over the pre-restriction time frame.

A marked decrease in both indoor and outdoor water use occurred in response to water shortage restrictions, even though the restrictions mainly addressed outdoor uses. Consumer behavior changed with each subsequent water shortage order to follow the modified restrictions. The effectiveness of water shortage rules increased when messaging and enforcement was consistent on both regional and local levels. The District believes a consistent environment of water conservation, efficiency, and technology is key in order to maximize water savings and affect long-term sustainable change.

# TABLE OF CONTENTS

Executive Summary i
Table of Contents ii
List of Appendices ii
List of Tablesiii
List of Figuresiii
Introduction1
Purpose and Scope    1      Water Shortage Plan    1      Working with Utilities    6
Methodology
Data Collection9
Analyses Completed9
External Variables Affecting Results 10
Water Savings Results
Lower East Coast
Lower West Coast
Upper East Coast
Overall
Findings

## LIST OF APPENDICES

Appendix A: Water Savings Graphs	A-1
Appendix B: 2007 Drought Rate/Surcharge of Selected SFWMD Utilities	B-1
Appendix C: Utilities at Risk and Utilities of Concern	C-1
Appendix D: List of Utilities Surveyed	D-1
Appendix E: Summary of Water Shortage Orders	E-1
Appendix F: 2006-2009 Lake Okeechobee Water Shortage Analysis	F-1

# LIST OF TABLES

Table 1.	SFWMD phased water use restrictions	. 2
Table 2.	Use categories and restrictions.	. 3
Table 3.	Drought surcharge report summary (number of utilities). July 2007	10
Table 4.	Data from enforcement agencies other than the SFWMD. (2007-2009)	12
Table 5.	SFWMD enforcement data	12
Table 6.	Regional potable water savings from 3/22/07 through 4/30/09 (in million gallons)	13

## LIST OF FIGURES

Figure 1.	Map of District regions and major water features5
Figure 2.	Kissimmee Basin Utility Service Areas. Some utility service areas cross SFWMD boundaries into other water management districts
Figure 3.	Water demand comparison of each phase to the 28-day period preceding water restrictions - LEC utilities: Broward and Palm Beach counties
Figure 4.	Water demand comparison of each phase to the 28-day period preceding water restrictions - LEC utilities: Miami-Dade and Monroe counties
Figure 5.	Daily demand weekly average - LEC utilities: Broward and Palm Beach counties
Figure 6.	Daily demand weekly average - LEC utilities: Miami-Dade and Monroe counties
Figure 7.	Daily demand monthly average - LWC utilities: Collier and Lee counties 18
Figure 8.	Average daily demand - UEC utilities: Martin County 19
Figure 9.	Average daily demand - UEC utilities: St. Lucie County

### INTRODUCTION

South Florida experienced one of the driest times in recorded history with 2006 and 2007 being the driest back-to-back calendar years on record since 1932 (SFWMD and National Weather Service records). Lake Okeechobee, the heart of south Florida's regional water management system, reached its all-time record low level of +8.82 feet National Geodetic Vertical Datum on July 2, 2007. The lake continued to set daily records for the lowest water level from June 3, 2007 through March 18, 2008. Both ground and surface water levels in much of the regional water management system were extremely low during this period. Subsequently, the 2008–2009 south Florida dry season ranks as the driest since recordkeeping began in 1932.

The south Florida hydrologic system is driven by rainfall. Water shortages can occur in years with low rainfall. To better manage water resources during these conditions, the SFWMD established the Water Shortage Plan in 1982 and amended it in 2003. The plan is contained in Chapter 40E-21 of the Florida Administrative Code (F.A.C.) and enables the District to:

- Protect the water resources from harm.
- Assure equitable distribution of available water resources among all water users during shortage, consistent with the goals of minimizing adverse economic, social, and health related impacts.
- Provide advance knowledge of the means by which water apportionments and reductions will be made during times of shortage.
- Promote greater security for water use permittees.

## PURPOSE AND SCOPE

The SFWMD's Governing Board and staff understand that water use limitations have an impact on businesses, utilities, the environment, and residents. Determining the water savings realized throughout the phased water restrictions allows the District to maintain the restrictions that result in water savings, while eliminating less effective restrictions, and provides the knowledge necessary to improve the SFWMD Water Shortage Plan.

#### Water Shortage Plan

The Water Shortage Plan and rules are used to manage water use when there is insufficient groundwater or surface water available to meet user needs or when conditions require temporary reduction in use according to Section 373.246 of the Florida Statutes and Chapter 40E-21, F.A.C. The goal is to protect the

remaining supply through conservation and assure a fair distribution of this supply. **Table 1** presents the specific water use restrictions established by the District according to the severity of the water shortage.

Phase	Percent Reduction Goal in Overall Demand
Phase I, Moderate	Less than 15% reduction in overall demand
Phase II, Severe	Less than 30% reduction in overall demand
Phase III, Extreme	Less than 45% reduction in overall demand
Phase IV, Critical	Less than 60% reduction in overall demand

Table 1. SFWMD phased water use restrictions.

The Water Shortage Plan identifies specific water saving measures to implement with each phase by user type. Because it is not possible to manage all water use individually, the District restrictions are written with the expectation that public utilities, in combination with agricultural and other self-supplied irrigation users (golf courses, homeowner associations, and individual residents, etc.) collectively achieve the overall percent reduction goals. Some uses were not restricted, such as water for health and safety, while industrial/commercial use was to be voluntarily reduced. **Table 2** shows the most common use categories and the most significant restrictions.

With respect to the Water Shortage Plan, it is not expected that individual public water supply utilities will reach the percent reduction for a given phase on their own. In addition, because each utility is at a different point in conservation implementation, it is not expected that all utilities will achieve the same level of demand reduction.

In October 2006, as rainfall in the District significantly decreased and levels in Lake Okeechobee and Lake Istokpoga declined below their regulation schedules, water shortage restrictions were imposed for the agricultural users in the North Indian Prairie Basin (IPB). The Lake Okeechobee Service Area (LOSA) order became effective November 17, 2006. Subsequently, a water shortage warning for the Lower East Coast Planning Area (LEC) was announced in December. As conditions worsened, the first in a series of water shortage orders and restrictions were then imposed for the LOSA in March 2007. Restrictions were then imposed for the Lower West Coast Planning Area (LWC) and the Upper East Coast Planning Area (UEC) in April 2007. The LWC restrictions superseded the District's existing year-round landscape irrigation rule, which limits irrigation to 3 days per week in Collier, Lee, and Charlotte counties. Lee County and Cape Coral elected to implement more conservative ordinances, allowing irrigation 2 days per week. In addition, the LWC restrictions superseded local ordinances relative to hours and days of landscape irrigation.

	Restrictions (with start date)						
	Phase	Phase	Phase	Phase	Phase	Phase	Phase
llse Categories	(2/22/07)	 (4/12/07)	(E/16/07)	 (7/11/07)	(1/15/09)	 (4/19/09)	(0/26/09)
Essential Lise (health and safety)	(3/22/07)	(4/13/07)	(5/16/07)	(//1//0/)	(1/15/08)	(4/16/08)	(9/20/08)
Not restricted	✓	✓	✓	✓	✓	✓	✓
Domestic Use							
Voluntarily reduce use	✓	✓	✓				
Car washing allowed only on irrigation days	✓	✓	✓				
Water Utility Use							
Recommend reduction of water pressure to 45 psi (at end of delivery line)	✓			✓	✓	~	
Require reduction of water pressure to 45 psi (at end of delivery line)		1	1				
New water line flushing and disinfecting between 7 p.m. and 7 a.m. only	✓	✓	1				
Require informational signs when line flushing				✓	✓	✓	
Some areas required to report water use weekly		✓	✓				
Some areas required to report water use bi-weekly				✓			
Diversion and Impoundment into Non-District Fa	cilities						
Eliminated, except to save water that would otherwise be lost to tide	✓	✓	✓	✓			
Agriculture/Nursery							
Allocations decreased by 15% for LOSA and IPB	✓						
Allocations decreased by 30% for LOSA and IPB		✓		✓			
Allocations decreased by 45% for LOSA and IPB**			1		✓	1	
Restricted hours for overhead irrigation for most areas	✓	✓	✓	✓	✓	✓	
Some areas required to report water use weekly			✓		✓	✓	
Established water delivery plans to facilitate equitable sharing of water in LOSA and IPB	1	1	1	1	1	1	
Landscape Irrigation/Recreation							
Landscape/athletic field irrigation limited to 3 days/week	1						
Landscape irrigation limited to 2 days/week		✓		✓		1	1
Landscape irrigation limited to 1 day/week			1		✓		
Athletic field irrigation limited to 2 days/week		✓					
Athletic field irrigation limited to 3 days/week			✓	✓	✓	✓	
Golf Course Use							
Allocations decreased by 15%	✓						
Allocations decreased by 30%		✓		✓		✓	
Allocations decreased by 45%			✓		✓		
Required to report water use weekly	✓	✓	✓	✓	✓	✓	

#### Table 2. Use categories and restrictions.

\* Phase modified to pertain to landscape irrigation only. \*\* LOSA allocations were again decreased by 45% from May 15, 2009 to July 2, 2009.

As conditions fluctuated, orders were modified consistent with meteorologic and hydrologic data. Water shortage orders were issued based on affected areas/counties/cities, water sources, and use classes. **Appendix E** provides a list of the water shortage orders, dates enacted, and limitations on landscape irrigation. **Figure 1** shows a map of District regions and major water features. **Appendix F** presents a chart of Lake Okeechobee levels and water restrictions during the 2006–2009 water shortage.

This water shortage was unique because of its longer duration, as past water shortages only lasted for several months. In April 2009, the LEC had been under landscape irrigation restrictions for 25 months, and the LWC and UEC had landscape irrigation restrictions for 24 months. The length of this water shortage had financial impact on a number of industries, including agriculture, nurseries, and recreational fishing. The demand reductions resulted in declines in utility revenue. The revenue decrease was not the same for all utilities, as there were variations in the lowered demand levels, and some utilities had water shortage surcharges to offset the decrease in revenue.

It is important to note that as water shortage lessons were learned, subsequent water shortage orders were written to reflect this knowledge, to focus the restrictions on activities that demonstrated water savings, and to enhance public education and outreach. The initial orders in 2007 contained detailed rules about most types of outdoor water use, including irrigation, pressure washing, car washing, utility line flushing, and recreation. Some of the detailed rules, such as nighttime line flushing or car and pressure washing on only certain days did not appear to result in substantial water savings, but did generate a number of variance requests. In 2007, the District held meetings with interested water users to better understand the water restriction experiences of utilities, parks and recreation facilities, and nursery growers in an effort to reduce the number of variance requests, increase compliance with the water restrictions, and focus on efforts to reduce use. Improvements to restrictions in 2008 included rules allowing additional watering to establish new plants, while still restricting overall landscape irrigation, and daytime utility line flushing, provided explanatory signs are used.



Figure 1. Map of District regions and major water features.

#### Working with Utilities

Special reporting requirements were instituted to provide District staff with utility pumpage information needed to manage the water shortage. In March 2007, many LEC utilities were required to begin reporting groundwater and surface water withdrawals, water levels, chloride concentrations (in coastal wells), and purchases of water from adjacent interconnected suppliers. Utilities from the LWC and the UEC began reporting in April 2007. Of particular interest to the District were the following:

- Utilities with coastal wellfields that might be susceptible to saltwater intrusion as a result of lowered groundwater levels.
- Utilities using surface water that could be affected by reduced availability due to low rainfall.

These utilities were divided into three categories:

- 1. <u>COASTAL UTILITIES AT RISK</u> Utilities with a coastal wellfield near the saltwater interface, no western wellfield that a majority of withdrawals could be shifted to, no developed alternative sources of water, and limited ability to meet user needs through interconnects with other utilities.
- 2. <u>COASTAL UTILITIES OF CONCERN</u> Utilities with a coastal wellfield that have the ability to shift pumpage to a western wellfield or have an alternative source not vulnerable to saltwater intrusion.
- 3. <u>SURFACE WATER UTILITIES OF CONCERN</u> Utilities dependent on lakes or impoundments for water supply and require rainfall to maintain water levels.

**Appendix C** provides additional information about the Utilities at Risk and Utilities of Concern.

## METHODOLOGY

To quantify water savings from public water supply utilities, the District asked utilities from the LEC, LWC, and UEC to provide daily finished water distribution data from September 1, 2005 through April 30, 2009. Information from 18 months prior to urban water restrictions (9/01/05-3/21/07) was collected to establish a "baseline" to determine the seasonal effects on water use and compare water consumption from the pre-restriction period with the water restriction period. **Appendix D** provides a list of 45 utilities reviewed for this report.

Quantifying water savings that result from water restrictions using utility data is not straightforward and is further complicated by several factors, including the following:

**BULK SALES** Bulk sales were not included because not all utilities were surveyed. This means the water sold to other utilities was not completely captured. Therefore, only water purchased was used in calculations to determine utility specific savings. On a county basis, bulk water sales and purchases offset each other and the lack of incorporation did not influence the results of this report.

QUALITY OF DATA The data were requested in four separate instances: June 2007, April 2008, October 2008, and May 2009. The June 2007 data request included measurements from September 1, 2005 through May 31, 2007, while the April 2008 request solicited data from June 1, 2007 through March 31, 2008. There was considerable time between the first two data requests and some utilities had questions about the data provided for the first request and the calculation of raw water versus finished water. The data provided in June 2007 and April 2008 were not consistent in format, requiring extra work to allow for comparison across utilities. Due to issues between the first two data sets, with the October 2008 data request, the District asked utilities to provide another data set ranging from September 1, 2005 through September 30, 2008. The final data request was in May 2009 for the period between October 2008 and April 2009. Previously reported data was provided to the utilities to minimize their effort.

**DATA FORMAT** In response to the 2007 request, data were sent to the SFWMD in varying formats, as the District did not specify a particular format for submittal of the data. The District established a specific format for the 2008 requests for all utilities to use. In October 2008, differences between the June 2007 and April 2008 datasets were eliminated by requesting a data set spanning the entire period from September 2005 through September 2008. Data was updated in May 2009 to include daily reporting through the end of April 2009.

Utilities in the Kissimmee Basin Water Supply Planning Area were also included in the data collection, but these data were not used in the final tabulations because of unique circumstances within the Kissimmee Basin. The counties in this planning area are under the jurisdiction of more than one water management district. Generally, the utilities in the northern planning area follow the St. Johns River Water Management District year-round water shortage rules, which at this time limit irrigation to 2 days per week without assigning these days to a specific watering schedule. Reductions may be seen in the data, but cannot be attributed to specific days. Similarly, Southwest Florida Water Management District manages outdoor irrigation using house numbers divided among the days of the week. In addition, the service areas of several of the utilities cross SFWMD boundaries with water distributed in both directions and the utilities' demand distribution data are not tabulated by water management district regions (Figure 2). Figure 2 maps those utilities having services area that overlap water management district boundaries, which can have more than one set of water shortage regulations. Due to this combination of varied regulations and data



formatting, the Kissimmee Basin data could not be readily compared to data from the other areas.

Figure 2. Kissimmee Basin Utility Service Areas. Some utility service areas (represented by the various colors) cross SFWMD boundaries into other water management districts.

#### Data Collection

The data requested from utilities included:

**PRODUCTION CAPACITY** The rated capacity of the treatment facility as approved by the Florida Department of Environmental Protection.

FINISHED WATER PRODUCED Actual volume of treated water produced prior to delivery to customers.

FINISHED BULK WATER PURCHASED Volume of bulk water purchased from other utilities for distribution within the utility.

FINISHED BULK WATER SOLD Volume of bulk water sold to another utility for distribution.

FINISHED WATER DISTRIBUTED (DAILY DEMAND) Volume of treated water distributed to customers, including water purchased. In most cases, this is the same as finished water produced.

In this analysis, water use is presented in million gallons per day (MGD) and occurred from September 1, 2005 through April 30, 2009. The data from the utilities were analyzed using Microsoft® Excel software (see **Appendix A**). The daily demand (finished water distributed) was graphed where daily demand was determined to be either finished water produced or finished water distributed, depending on which utility data were complete.

#### Analyses Completed

The water used in each phase of the restrictions was compared to the baseline of the average daily demand data for the 28-day period before water restrictions were imposed, called pre-restriction or "Pre" on the graphs (see **Appendix A**). Daily demand is the value used in the following analyses:

- Water demand comparison of each water restriction phase to the 28-day period preceding all water restrictions for the three water supply planning areas and respective percent water savings.
- Daily demand weekly averages by water supply planning areas from September 1, 2005 through April 30, 2009.
- Daily demand monthly averages by water supply planning areas from September 1, 2005 through April 30, 2009.
- Average daily demand days of the week for each of the phases and the 28-day pre-restriction time frame for each county.
- Weekday averages by county for each phase measured against that similar time frame in the prior year (pre-restriction).

### **External Variables Affecting Results**

A number of external variables affected the water savings estimates obtained by utilities:

**IRRIGATION WITH NON-POTABLE WATER** A number of customers use private wells or surface water rather than public utilities for either part or all of their water supply. This information was not included in the study because the data were not available. As anticipated, utilities with a high percentage of customers using non-potable water for irrigation show lower savings than utilities with a high percentage of irrigation from the utility system.

<u>DROUGHT SURCHARGES</u> A drought surcharge is a charge, typically a percent, incorporated into utility rate structures to increase the cost of water during water shortage restrictions to offset decreases in revenue due to decreased water use. Drought surcharges can be an effective tool to reduce overall demand and stabilize the financial program. Typically, these surcharges apply to customers using more than a specified volume, often 10,000 gallons of water each month. The District surveyed south Florida utilities in July 2007 for drought surcharges. Results indicate 17 of 49 utilities had surcharges in place. **Table 3** presents a surcharge summary by county, and **Appendix B** provides the full report.

County	Drought Surcharge	No Drought Surcharge	Total Surveyed
Broward	8	9	17
Collier	1	2	3
Hendry	0	1	1
Lee	1	2	3
Martin	0	3	3
Miami-Dade	0	5	5
Monroe	1	0	1
Okeechobee	0	1	1
Palm Beach	5	8	13
St. Lucie	1	1	2
Total	17	32	49

Table 3. Drought surcharge report summary (number of utilities). July 2007.

LOCAL (MUNICIPAL AND COUNTY) ORDINANCES Some municipalities and counties, including a number from the LWC, implemented year-round landscape irrigation ordinances prior to the water shortage restrictions establishing 2 or 3 day per week irrigation schedules. In these areas, the water shortage restrictions were similar to the local government's existing measures and the District expected to see little increased savings.

Local ordinances and land development codes also affect irrigation sources. For example, some municipalities regulate property appearances such that if groundwater is used for irrigation, the system must be designed and maintained in a manner that eliminates iron or other elements that stain buildings, sidewalks, walls, etc. This results in most of the irrigation coming from the utility's potable system. In these areas, high water savings are expected. Other municipalities do not allow potable water to be used for irrigation; reclaimed water, groundwater, or surface water must be used. In these areas, low water savings are anticipated.

**RAINFALL TOTALS** The amount of rainfall in an area greatly affects the amount of water needed for irrigation. Rainfall in south Florida is generally localized and the data from the District weather stations are better suited to long-term trends rather than the short time frame of this effort. The smallest unit studied in this document was the county; to generalize rainfall totals would be misleading. However, when looking at the water savings data, rainfall must be taken into account, as it should affect outdoor watering. Experience has shown however, that automatic sprinkler timers without operational rain or soil moisture sensors allow irrigation to continue even when sufficient rainfall occurs.

**INCONSISTENT MESSAGING** Some governments and utilities strenuously and publicly disagreed with the Phase III restrictions implemented District-wide in January 2008. Public statements and letters were sent to customers that were contradictory to the District's message. A clear, consistent message to consumers is important to obtain their cooperation with restrictions.

**POPULATION** The data were analyzed regardless of population changes during the study period. Land use coverages and densities for each municipality were not consistent and each type of land use and density differed in water consumption. Neither of these variables was studied. Residential seasonality also affected the amount of water consumed. People owning second homes tend to live in Florida during Florida's dry season, between the months of November and April. In addition, tourism is highest during these months. As population increases, water consumption tends to increase, along with pressure on water resources.

Population variables likely affected the use of water and the differences can be seen in the results. For example, the SFWMD imposed Phase III restrictions twice in Palm Beach and Broward counties. The first restriction occurred during the summer, when populations were lowest and the second occurred during the first few months of 2008, when populations were highest. Reported data indicate water savings during both Phase III restrictions; however, resultant savings during the winter were not as great and this might be attributed, in part, to an increase in the seasonal population. However, the percent of seasonal residents in Florida (approximately 7 percent of the state population) does not equate to the percent drop in water use. Any effect on outdoor irrigation would be minimal as many irrigation systems operate on timers, even while residences are vacant. Potential effects of seasonality could be documented by analyzing seasonal fluctuations of water use in years prior to the water shortage. WATER SHORTAGE ENFORCEMENT ACTIVITIES Florida Statutes mandate that individual municipalities and counties assist in water restriction enforcement efforts, as requested by the District. The SFWMD took responsibility for enforcing water restrictions among users with individual and general water use permits. Local governments were asked to take the lead in enforcing water restrictions for commercial sites using potable irrigation water and individual homeowners using potable, surface, or well water for irrigation (Table 4). For some local governments, water restrictions were enforced by code enforcement officers, while others enforced the restrictions with law enforcement officers. Due to the local nature of this task, there was little enforcement consistency either among the municipalities or between phases of restrictions. Reports submitted to the District by local enforcement show as a general trend, the longer the water shortage continued, the less water restrictions were enforced. The SFWMD monitored and enforced compliance for those entities requiring consumptive use permits (generally users other than single-family homes and duplexes as shown in Table 5). Beginning in 2008, all commercial sites, including those using potable water for irrigation were also monitored for compliance.

	2007		20	08	20		
County	Warnings	Citations	Warnings	Citations	Warnings	Citations	Total
Broward	1,876	1,334	1,175	809	216	90	5,500
Collier	169	400	614	552	142	7	1,884
Glades	0	0	0	0	0	0	0
Hendry	12	124	19	3	0	0	158
Lee	1,290	1,375	1,318	3,548	45	442	8,018
Martin	335	75	217	16	11	0	654
Miami-Dade	2,056	923	876	1,274	313	680	6,122
Monroe	2	7	3	5	4	0	21
Okeechobee	5	0	33	3	0	0	41
Orlando	N/A	N/A	3,243	663	490	16	4,412
Palm Beach	3,963	8,020	1,056	1,818	515	491	15,863
St. Lucie	2,009	38	122	167	154	40	2,530
Total	11,717	12,296	8,676	8,858	1,890	1,766	45,203

Table 4. Data from enforcement agencies other than the SFWMD. (2007-2009)

Note: Data recorded through April 30, 2009.

2007	20	08	2009	
Citations	Warnings	Citations	Warnings*	Total
801	463	41	63	1,368

Note: No report of warnings or citations issued between November 2008 and February 2009. Data recorded through April 30, 2009. **PUBLIC OUTREACH EFFORTS** Since March 2007, the District has distributed more than 1.3 million publications; received more than 645,000 visits to water conservation and water shortage Web pages; received more than 32,000 calls to the Citizen Information Hotline; generated more than 4,000 media "hits" in state, national, and international media outlets; and developed numerous campaigns for television, including government access channels, print, and radio. The most recent campaign added movie theaters to the list of outlets used. A number of utilities also produced and distributed information directly to customers about the mandatory restrictions and made details available on their Web sites.

#### Water Savings Results

Although the data collection methods were the same for each utility, multiregional, multi-county, and multi-utility comparisons should be drawn cautiously. Each utility had unique circumstances including: the mix of single-family to multi-family dwellings; average household size; ratio of residential to other uses (industrial, commercial, agricultural); size and age (and therefore, technology) of the water delivery system; use of non-potable sources for irrigation; seasonality of residents; existing conservation programs; etc. Each of these factors can influence the effectiveness of water restrictions.

More than 105 billion gallons of water were saved by these utilities during the period of March 22, 2007 through April 30, 2009 (**Table 6**) as compared to the 28-day pre-restriction period. Representative graphs to illustrate water savings for each region are presented as follows; see **Appendix A** for the full set of graphs.

			-				
	Phase I (3/22/07- 4/12/07)	Phase II (4/13/07- 5/15/07)	Phase III (5/16/07- 7/10/07)	Phase II (7/11/07- 1/14/08)	Phase III (1/15/08- 4/17/08)	Phase II (4/18/08- 4/30/09)	Total
LEC Total	662	11,186	6,767	14,910	12,798	32,608	78,931
Miami-Dade & Monroe	172	9,382			3,665	8,600	21,819
Broward & Palm Beach	490	1,804	6,767	14,910	9,133	24,009	57,112
LWC Total		7,578			2,278	10,707	20,563
UEC Total	*131	*1,970			814	2,556	5,471
Total LEC, LWC, and UEC							104,965

Table 6. Regional potable water savings from 3/22/07 through 4/30/09(in million gallons).

#### Total Savings = 105 Billion Gallons

Note: Calculated from savings per day multiplied by number of days. Errors are due to rounding. UEC Phase 1 dates are 4/13/07-5/15/07 and Phase II dates are 5/16/07-1/14/08.

#### Lower East Coast

The Lower East Coast Planning Area (LEC) includes essentially all of Miami-Dade, Broward, and Palm Beach counties, most of Monroe County, and the eastern portions of Hendry and Collier counties. However, only Miami-Dade, Broward, Palm Beach, and Monroe counties are considered for this report. The majority of the population is concentrated in the eastern portion of these counties and therefore, the utilities serving these areas were surveyed.

Generally, savings increased with each increase in restrictions (from 3 days of irrigation to 2 or from 2 days of irrigation to 1) for the entire LEC area.

Palm Beach County realized the greatest savings, which occurred during the 2007 Phase III restrictions (5/16/07-7/10/07), with an average savings of 34.3 percent from the pre-restriction period. Miami-Dade and Monroe counties' greatest savings occurred during 2008 Phase III restrictions, reaching a 9.8 percent savings over the pre-restriction time frame. Trends seen in the Daily Demand Weekly and Monthly Average graphs (Appendix A) show a downward trend in water consumption over the 3-year study period generally beginning with the phased restrictions. The Average Daily Demand charts (in Appendix A) show outdoor irrigation cycling through weekdays for each phased restriction. This closely corresponded to the irrigation days permitted under water shortage orders, at least for Broward and Palm Beach counties. Miami-Dade and Monroe counties did not show meaningful adherence to the irrigation schedules. The water savings were evident in the Water Demand Comparison graphs (Appendix A) showing daily averages compared to the same period the previous year. Not only was water consumption reduced on the required days, a marked reduction in overall consumption occurred between the measured periods. The graphs also appear to indicate that indoor use decreased as the daily water use generally decreased on all days, not just those days with no irrigation.

Figures 3 through 6 show examples of Water Demand Comparison and Appendix A presents Daily Demand Average Weekly and Monthly graphs.







Figure 4. Water demand comparison of each phase to the 28-day period preceding water restrictions - LEC utilities: Miami-Dade and Monroe counties.



Figure 5. Daily demand weekly average - LEC utilities: Broward and Palm Beach counties.



Figure 6. Daily demand weekly average - LEC utilities: Miami-Dade and Monroe counties.

#### Lower West Coast

The Lower West Coast Planning Area (LWC) includes all of Lee County, most of Collier and Hendry counties, and portions of Glades, Charlotte, and mainland Monroe counties. Lee and Collier counties are the only counties representing the LWC in this report as they contain the region's highest populations (Monroe County is considered to be in the LEC).

Water savings did not significantly increase from Phase II to Phase III restrictions (from 2 days of irrigation to 1) for the LWC area, but instead remained relatively constant. Year-round landscape irrigation rules (3 days per week) have been in place for this area for a number of years. These rules establish days and hours for irrigation. In Lee County, county ordinances only allow watering 2-days per week and minimal savings were expected during similar Phase II restrictions. However, significant savings were realized with implementation of Phase II restrictions in both Lee and Collier counties.

The greatest water savings observed in Collier County occurred during the second Phase II restrictions (4/18/08-4/30/09) when an average of 26.0 percent reduction from the pre-restriction period was realized. For Lee County, the greatest water savings occurred during the first Phase II restrictions (4/13/07-1/14/08), with an average 23.4 percent reduction from when the prerestriction period was recorded. Trends seen in the Daily Demand Weekly and Monthly Average graphs show a downward trend in water consumption over the 3-year study period, generally beginning with phased restrictions. The peaks in water consumption originally reached in the pre-restriction period and during Phase I restrictions, were not seen in subsequent restrictions. As with the LEC, the Average Daily Demand charts show the outdoor irrigation cycling for each of the phase restrictions, closely corresponding to the irrigation days permitted under orders. Water savings are evident in the Water Demand Comparison graphs, which show daily averages compared to the same period of the previous year. Not only was water consumption reduced on the required days, a reduction in overall consumption occurred between measured periods.

It should be noted that several utilities had variances in place spreading the hours of irrigation over several days. This meant each property could only irrigate two times per week, but irrigation was distributed over more days of the week.

Figure 7 shows an example of a Daily Demand Average Monthly graph as presented in Appendix A.



Figure 7. Daily demand monthly average - LWC utilities: Collier and Lee counties.

**Upper East Coast** 

The Upper East Coast Planning Area (UEC) includes Martin and St. Lucie counties, and eastern Okeechobee County. However, there are no utilities in eastern Okeechobee County, so no Okeechobee data are included in this region of the study.

Savings in the UEC increased with each escalation in water restrictions (from 3 days of irrigation to 2 or from 2 days of irrigation to 1). The greatest savings seen in Martin and St. Lucie counties occurred during the 2008 Phase III (1/15/08-4/17/08) restrictions and averaged 24.3 percent and 16.9 percent, respectively, from the pre-restriction period. Trends seen in the Daily Demand Weekly and Monthly Average graphs show a slight downward trend with a tempering of the extreme highs and lows in water consumption over the 3-year study period generally beginning with phased restrictions. The Average Daily Demand charts show the outdoor irrigation cycling for each of the phased restrictions, which closely correspond to the irrigation days permitted under orders. The water savings were evident in the Water Demand Comparison graphs showing daily averages compared to the same period of the previous year. Not only was water consumption generally reduced on the required days, but a marked reduction in overall consumption occurred between the measured periods. It is likely that this overall decrease is at least partially due to a decrease in indoor use.



Figures 8 and 9 show examples of Average Daily Demand graphs as presented in Appendix A.

Figure 8. Average daily demand - UEC utilities: Martin County.



Figure 9. Average daily demand - UEC utilities: St. Lucie County.

#### Overall

Using comparisons included in **Appendix A**, Phase I reductions ranged from 2.0 percent in Miami-Dade and Monroe counties to 9.6 percent in Martin County. Phase II reductions ranged from 6.6 percent in Broward County (4/13/07-5/15/07) to 26.0 percent in Collier County (4/18/08-4/30/09). The LWC has had year-round landscape irrigation rule in place since 2003, which limit irrigation to a maximum of three days per week. Some local governments, like Lee County and Cape Coral, implemented ordinances that limit irrigation to 2 days per week, the same as the Phase II restrictions. It is interesting to note that the LWC, having year-round irrigation rules in place, achieved the greatest savings during the Phase II restrictions. The reductions observed in Phase III ranged from 9.8 percent in Miami-Dade and Monroe counties (1/15/08-4/17/08) to 34.3 percent in Palm Beach County (5/16/07-7/10/07).

In looking at use by average daily demand, it was generally clear to see which days were assigned as irrigation days. Of interest, use dropped on all days with increasing restrictions. The District had anticipated that use might increase on irrigation days because all irrigation was occurring on the same days and this potential increase would be offset by lowered use on non-irrigation days, but this was only seen in Collier County.

Enforcement likely played an important role in water savings. Saturday was not an irrigation day under the 2008 Phase III restrictions, yet this day showed the greatest use in Miami-Dade and Monroe counties.

### FINDINGS

Results indicate outdoor water use restrictions were an effective strategy to dramatically reduce potable water demand during periods of water shortage. The method used to calculate savings is useful on a shorter time frame, but to fully analyze water shortage rule effects, external variables need to be considered and evaluated. Actual water demand is localized and influenced by several variables, such as soil type, evapotranspiration rates, and precipitation events. When drought surcharges, public education efforts, and existing ordinances are factored in, it becomes difficult to single out one particular impact on consumption. These challenges should be considered by the District as they develop future water restrictions that better serve the District and the populace during these events. As many of the aforementioned factors are not within the District's control, focus should be on public awareness, outreach, and effective use of irrigation.

While restrictions continued, a noticeable increase in water savings remained. However, as water restrictions were modified, the relative savings began to diminish. Difficulties in automatic sprinkler timer readjustments, perception of local conditions, mixed messages from public officials, and decreased enforcement activity negatively affected water savings in the long run. Implementation of water shortage rules is relatively straightforward; enforcement and maintenance of conservation practices are more challenging.

The analysis presented herein demonstrates that utility customers decreased both indoor and outdoor water use in response to water restrictions even though the water shortage restrictions mainly addressed outdoor use. With each subsequent water shortage order, consumer behavior changed to emulate the modified restrictions, although concern was expressed about customers irrigating on their designated day regardless of need. The effectiveness of water shortage rules increased when messaging and enforcement were consistent regionally and locally. A consistent environment of water conservation, efficiency, and technology should maximize water savings and affect long-term sustainable change.

# **A** Water Savings Graphs

# POTABLE WATER SAVED IN THE LOWER EAST COAST

Broward and Palm Beach Counties



Figure A-1. Water demand comparison of each phase to the 28-day period preceding water restrictions - LEC utilities: Broward and Palm Beach counties.

#### Miami-Dade and Monroe Counties



Figure A-2. Water demand comparison of each phase to the 28-day period preceding water restrictions - LEC utilities: Miami-Dade and Monroe counties.



Figure A-3. Daily demand weekly average - LEC Utilities: Broward and Palm Beach counties.



Figure A-4. Daily demand weekly average - LEC utilities: Miami-Dade and Monroe counties.

# WATER DEMAND MONTHLY AVERAGES IN THE LOWER EAST COAST



Figure A-5. Daily demand monthly average - LEC utilities: Broward and Palm Beach counties.



Figure A-6. Daily demand monthly average - LEC utilities: Miami-Dade and Monroe counties.

# AVERAGE DAILY DEMAND IN THE LOWER EAST COAST



Figure A-7. Average daily demand - LEC utilities: Broward County.



Figure A-8. Average daily demand - LEC utilities: Palm Beach County.



Figure A-9. Average daily demand - LEC utilities: Miami-Dade and Monroe counties.
#### WEEKDAY AVERAGES IN THE LOWER EAST COAST



LEC utilities: Broward County



Figure A-13. Water demand comparison 2006-2007 and 2007-2008 (PH2) LEC utilities: Broward County







Figure A-15. Water demand comparison 2006-2007, 2007-2008, and 2008-2009 (PH2) LEC utilities: Broward County











Figure A-18. Water demand comparison 2006 and 2007 (PH3) LEC utilities: Palm Beach County



Figure A-19. Water demand comparison 2006-2007 and 2007-2008 (PH2) LEC utilities: Palm Beach County



Figure A-20. Water demand comparison 2006, 2007, and 2008 (PH3) LEC utilities: Palm Beach County



Figure A-21. Water demand comparison 2006-2007, 2007-2008, and 2008-2009 (PH2) LEC utilities: Palm Beach County



Figure A-22. Water demand comparison 2006 and 2007 (PH1) LEC utilities: Miami-Dade and Monroe counties



Figure A-23. Water demand comparison 2006-2007 and 2007-2008 (PH2) LEC utilities: Miami-Dade and Monroe counties



Figure A-24. Water demand comparison 2006, 2007, and 2008 (PH3) LEC utilities: Miami-Dade and Monroe counties



Figure A-25. Water demand comparison 2006-2007, 2007-2008, and 2008-2009 (PH2) LEC utilities: Miami-Dade and Monroe counties

### POTABLE WATER SAVED IN THE LOWER WEST COAST

**Collier and Lee Counties** 



Figure A-26. Water demand comparison of each phase to the 28-day period preceding water restrictions - LWC utilities: Lee and Collier counties.

#### WATER DEMAND WEEKLY AVERAGE IN THE LOWER WEST COAST



Figure A-27. Daily demand weekly average - LWC utilities: Lee and Collier counties.

## WATER DEMAND MONTHLY AVERAGES IN THE LOWER WEST COAST



Figure A-28. Daily demand monthly average - LWC utilities: Lee and Collier counties.

#### AVERAGE DAILY DEMAND IN THE LOWER WEST COAST



Figure A-29. Average daily demand - LWC utilities: Lee County.



Figure A-30. Average daily demand - LWC utilities: Collier County.

#### WEEKDAY AVERAGES IN THE LOWER WEST COAST



Figure A-31. Water demand comparison 2006-2007 and 2007-2008 (PH2) LWC utilities: Lee County



Figure A-32. Water demand comparison 2006, 2007, and 2008 (PH3) LWC utilities: Lee County



Figure A-33. Water demand comparison 2006-2007, 2007-2008, and 2008-2009 (PH2) LWC utilities: Lee County



Figure A-34. Water demand comparison 2006-2007 and 2007-2008 (PH2) LWC utilities: Collier County



Figure A-35. Water demand comparison 2006, 2007, and 2008 (PH3) LWC utilities: Collier County



Figure A-36. Water demand comparison 2006-2007, 2007-2008, and 2008-2009 (PH2) LWC utilities: Collier County

#### POTABLE WATER SAVED IN THE UPPER EAST COAST

Martin and St. Lucie Counties



Figure A-37. Water demand comparison of each phase to the 28-day period preceding water restrictions - UEC utilities: Martin and St. Lucie counties.

#### WATER DEMAND WEEKLY AVERAGE IN THE UPPER EAST COAST



Figure A-38. Daily demand weekly average - UEC utilities: Martin and St. Lucie counties.

## WATER DEMAND MONTHLY AVERAGES IN THE UPPER EAST COAST



Figure A-39. Daily demand monthly average - UEC utilities: Martin and St. Lucie counties.

## AVERAGE DAILY DEMAND IN THE UPPER EAST COAST



Figure A-40. Average daily demand - UEC utilities: Martin County.



Figure A-41. Average daily demand - UEC utilities: St. Lucie County.

#### WEEKDAY AVERAGES IN THE UPPER EAST COAST







Figure A-43. Water demand comparison 2006-2007 and 2007-2008 (PH2) UEC utilities: Martin County







Figure A-45. Water demand comparison 2006-2007, 2007-2008, and 2008-2009 (PH2) UEC utilities: Martin County



Figure A-46. Water demand comparison 2006 and 2007 (PH1) UEC utilities: St. Lucie County



Figure A-47. Water demand comparison 2006-2007 and 2007-2008 (PH2) UEC utilities: St. Lucie County



Figure A-48. Water demand comparison 2006, 2007, and 2008 (PH3) UEC utilities: St. Lucie County



Figure A-49. Water demand comparison 2006-2007, 2007-2008, and 2008-2009 (PH2) UEC utilities: St. Lucie County

# B

#### 2007 Drought Rate/ Surcharge of Selected SFWMD Utilities

#### 2007 DROUGHT RATE/SURCHARGE SURVEY OF SELECTED SFWMD UTILITIES JULY 30, 2007 (REVISED AUGUST 15, 2007)

An email survey was sent to 49 utilities on June 28, 2007 inquiring as to which had a Drought Rate/Surcharge in place that would take effect upon the SFWMD declaring water restrictions. The following questions were asked:

- Does your utility have a Drought Rate/Surcharge? Yes/No
- How is the Rate/Surcharge applied? 1) flat surcharge over a base usage amount; 2) increase in water rates above a certain base use; 3) increase in all rates; and 4) other (describe)
- What is the Rate/Surcharge (if not provided above)?
- How does the Drought Rate/Surcharge take effect? How are customers notified?
- What is the approximate date that your utility's governing body enacted the Drought Rate/Surcharge (adopted it not when it went into effect for this drought)?

County		Yes	No	Total
Broward		8	9	17
Collier		1	2	3
Hendry		0	1	1
Lee		1	2	3
Martin		0	3	3
Miami-Dade		0	5	5
Monroe		1	0	1
Okeechobee		0	1	1
Palm Beach		5	8	13
St. Lucie		1	1	2
	Totals	17	32	49

The following table summarizes the results:

Of the 49 utilities, 17 (about 1/3) had a Drought Rate/Surcharge in place. Two more replied that they were conducting a Rate/Surcharge study. The responses varied, but the majority of the Drought Rate/Surcharges are activated with the District's Water Shortage Declarations. Most of these Rate/Surcharges are increases in all rates over a base amount. The percent increases vary based on the different phases of water shortage restrictions. The most common percentage increases among utilities surveyed are: Phase I - 15%, Phase II-30%, Phase III-45%, and Phase IV-60%.

For additional information regarding this survey, contact Barbara Powell at (561) 682-2236 or Mark Elsner at (561) 682-6156.

	Drought Rate/			How Rate/Surcharge is	Date Rate/ Surcharge	Rate Study
Utility	Surcharge	Type of Rate/ Surcharge	Specific Rate/Surcharge	activated	enacted	Underway
Broward County						
Broward County	Yes	Decrease level that inverted block rates apply	TBD	Tied to mandatory phased restrictions	2006	
Cooper City	No	N/A	N/A	N/A	N/A	No
Coral Springs	No	N/A	N/A	N/A	2007	No
Coral Springs Imp. District	No	N/A	N/A	N/A	N/A	No
Dania Beach	Yes	Increase in all rates	30%	June noticed	2007	
Davie	Yes	Increase in all rates	Phase I: 15% Phase II: 30% Phase III: 45% Phase IV: 60%	Phase I restrictions year round. Increases tied to mandatory phased restrictions	2007	
Deerfield Beach	No	N/A	N/A	N/A	N/A	No
Fort Lauderdale	Yes	Increase based on different base rates	Above a base rate of 8,000 gal/month for Phase I and II Above a base rate of 4,000 gal/month for Phase III and IV Phase I: 5% Phase II: 8% Phase III: 17% Phase IV: 31%	Tied to mandatory phased restrictions	2006	
Hallandale	No	N/A	N/A	N/A	N/A	No
Hollywood	Yes	Increase in all rates above a certain base use	Above base rate of 4,000 gal/month Phase I: 15% Phase II: 30% Phase III: 45% Phase IV: 60%	Tied to mandatory phased restrictions	2005	
Lauderhill	No	N/A	N/A	N/A	N/A	No
Miramar	No	N/A	N/A	N/A	N/A	No
North Springs Imp. District	No	N/A	N/A	N/A		No
Pembroke Pines	Yes	Increase in all rates above a certain base use	Phase I: 25% Phase II: 50%	Surcharge tied to mandatory phased restrictions. Residential use (over the base of 5,000 gal/month) receive the surcharge if monthly use is >70% of the average 12 month yearly consumption ( >90 % for commercial users)	2001	
Plantation	Yes	Increase in all rates above a	Above base rate of 6,000 gal/month		2002	

	Drought Rate/			How Rate/Surcharge is	Date Rate/ Surcharge	Rate Study
Utility	Surcharge	Type of Rate/ Surcharge	Specific Rate/Surcharge	activated	enacted	Underway
		certain base use	Phase I: 15% Phase II: 30% Phase III: 45% Phase IV: 60%			
Pompano Beach	Yes	Increase in all rates	18%	Phase I water restriction with a 15% or greater reduction in water use by city ordinance	2007	
Sunrise	No	N/A	N/A	N/A	N/A	No
Collier County	-					
Collier County	Yes	Incremental increases	Phase I: year round Phase II: 15% increment Phase III: 30% increment	Parallels each incremental phase of water use restriction with the first increment at 15%.	2002	No
Marco Island	No	N/A	N/A	N/A	N/A	No
Naples	No	N/A	N/A	N/A	N/A	Yes
Hendry County						
Clewiston	No	N/A	N/A	N/A	N/A	No
Okeechobee County						
Okeechobee	No	N/A	N/A	N/A	N/A	No
Lee County						
Bonita Springs	No	N/A	N/A	N/A	N/A	No
Cape Coral	No	N/A	N/A	N/A	N/A	No
Lee County	Yes	Increase in all rates	Phase I: 18 % Phase II: > 18 %	Tied to mandatory phased restrictions	2002	
Martin County						
Martin County	No	N/A	N/A	N/A	N/A	No
South Martin Regional	No	N/A	N/A	N/A	N/A	No
Stuart	No	N/A	N/A	N/A	N/A	No
Miami-Dade County						
Florida City	No	N/A	N/A	N/A	N/A	No
Homestead	No	N/A	N/A	N/A	N/A	No
Miami-Dade	No	N/A	N/A	N/A	N/A	Yes
North Miami	No	N/A	N/A	N/A	N/A	No
North Miami Beach	No	N/A	N/A	N/A	N/A	No

	Drought Rate/			How Rate/Surcharge is	Date Rate/ Surcharge	Rate Study
Utility	Surcharge	Type of Rate/ Surcharge	Specific Rate/Surcharge	activated	enacted	Underway
Monroe County						
FKAA	Yes	Increase in water rates above a certain base use	Above base rate of 6,000 gal/month Phase I: 15% Phase II: 30% Phase III: 45% Phase IV: 60%	FKAA Board of Directors' approval	2002	
Palm Beach County						
Boca Raton	No	N/A	N/A	N/A	N/A	No
Boynton Beach	Yes	Increase in water rates above a certain base use	Above base rate of 9,000 gal/month Phase I: 15% Phase II: 30% Phase III: 45% Phase IV: 60%	Tied to mandatory phased restrictions	1985	
Delray Beach	Yes	Increase in water rates above a certain base use	Above base rate of 15,000 gal/month. Phase I: 15% Phase II: 30% Phase III: 45% Phase IV: 60%	Tied to mandatory phased restrictions	1992	
Jupiter	No	N/A	N/A	N/A	N/A	No
Lake Worth	Yes	Increase in water rates above a certain base use	Above base rate of 5,000 gal/month Phase I: 15% Phase II: 30% Phase III: 45% Phase IV: 60%	Tied to mandatory phased restrictions	2001	
Lantana	No	N/A	N/A	N/A	N/A	No
Pahokee	No	N/A	N/A	N/A	N/A	No
Palm Beach County	No	N/A	N/A	N/A	N/A	No
Riviera Beach	No	N/A	N/A	N/A	N/A	No
Seacoast	No	N/A	N/A	N/A	N/A	No
Tequesta	Yes	Increase in all rates	18% flat rate	Tied to mandatory phased restrictions	1977	
Wellington	No	N/A	N/A	N/A	N/A	No
West Palm Beach	Yes	Increase in water rates above a certain base use	Above base rate of 5,984 gal/month Phase I: 10% Phase II: 20% Phase III: 30%	Tied to mandatory phased restrictions	2004	

Utility	Drought Rate/ Surcharge	Type of Rate/ Surcharge	Specific Rate/Surcharge	How Rate/Surcharge is activated	Date Rate/ Surcharge enacted	Rate Study Underway
St. Lucie County						
Fort Pierce	No	N/A	N/A	N/A	N/A	No
Port St. Lucie	Yes	Increase in all rates	Phase I: 15% Phase II: 30% Phase III: 45% Phase IV: 60%	Tied to mandatory phased restrictions. Requires City Council approval prior to becoming effective. Can be increased by Utility Dept. Director	1994	

#### C Utilities at Risk and Utilities of Concern

#### C-2 | Appendix C: Utilites at Risk and Utilities of Concern

Utility/Facility	Source	County
Lee County - Olga	Surface Water	Lee
Marco Island - Marco Lakes	Surface Water	Collier
Cape Coral - IQ System	Surface Water	Lee
Okeechobee Utilities Authority	Surface Water	Okeechobee
City of West Palm Beach	Surface Water	Palm Beach
US Sugar - Clewiston *	Surface Water	Hendry
City of Pahokee *	Surface Water	Palm Beach
City of Belle Glade *	Surface Water	Palm Beach
City of South Bay *	Surface Water	Palm Beach

 Table C-1.
 Surface Water Utilities of Concern.

\* These utilities changed to a groundwater source (Floridan Aquifer) during the period of the water shortage and are no longer on the Utilities of Concern list.

Utility/Facility	Source	County
South Martin Regional Utility	Groundwater	Martin
Martin County Utilities - North (Jensen)	Groundwater	Martin
Fort Pierce Utilities Authority	Groundwater	St. Lucie
Bonita Springs Utilities	Groundwater	Lee
Naples	Groundwater	Collier
Tequesta	Groundwater	Palm Beach
Jupiter	Groundwater	Palm Beach
Riviera Beach	Groundwater	Palm Beach
Boynton Beach	Groundwater	Palm Beach
Delray Beach	Groundwater	Palm Beach
Boca Raton	Groundwater	Palm Beach
Deerfield Beach	Groundwater	Broward
Broward County District 2A wellfield	Groundwater	Broward
Pompano Beach	Groundwater	Broward
Hollywood	Groundwater	Broward
North Miami	Groundwater	Miami-Dade
North Miami Beach	Groundwater	Miami-Dade
Miami-Dade Central wellfields (Hialeah-Preston)	Groundwater	Miami-Dade
Miami-Dade Central wellfields (Alexander Orr)	Groundwater	Miami-Dade

 Table C-2.
 Coastal Utilities of Concern.

Utility/Facility	Source	County
Stuart	Groundwater	Martin
Miles Grant Water and Sewer Company	Groundwater	Martin
Lantana	Groundwater	Palm Beach
Lake Worth	Groundwater	Palm Beach
Hillsboro Beach	Groundwater	Broward
Dania Beach	Groundwater	Broward
Hallandale Beach	Groundwater	Broward
Florida City	Groundwater	Miami-Dade
Homestead	Groundwater	Miami-Dade
Florida Keys Aqueduct Authority	Groundwater	Miami-Dade
Miami-Dade South Wellfields (Newton, elevated Tank, Naranja, Leisure City, Roberta Hunter, and Caribbean Park )	Groundwater	Miami-Dade

Table C-3. Coastal Utilities at Risk.

### D List of Utilities Surveyed
Lower East Coast				
Broward County				
Broward County Water & Wastewater Services 2A/North Regional, South Regional and District 1				
Cooper City Utilities Department				
City of Coral Springs				
Coral Springs Improvement District				
City of Dania Beach				
Town of Davie				
City of Deerfield Beach				
City of Fort Lauderdale				
City of Hallandale Beach				
City of Hollywood				
City of Miramar				
North Springs Improvement District				
City of Pembroke Pines				
City of Plantation Public Water Supply				
City of Pompano Beach Utilities Department				
Sunrise Utilities Department				
Palm Beach County				
City of Boca Raton				
City of Boynton Beach				
City of Delray Beach				
Town of Jupiter				
City of Lake Worth				
Town of Lantana				
Palm Beach County Water Utilities Department				
City of Riviera Beach				
Seacoast Utility Authority				
Village of Tequesta				
Village of Wellington/Acme Development District				
City of West Palm Beach				
Miami-Dade & Monroe Counties				
Florida Keys Aqueduct Authority				
Florida City Water and Sewer Department				
City of Homestead				
Miami-Dade County Water and Sewer Department				

 Table D-1.
 Lower East Coast Utilities Surveyed.

Miami-Dade County Water and Sewer Department

City of North Miami

City of North Miami Beach

## Table D-2.Lower West Coast, Upper East Coast, and Kissimmee BasinUtilities Surveyed.

Lower West Coast				
Collier County				
Collier County Water-Sewer District				
City of Marco Island				
City of Naples				
Lee County				
Bonita Springs Utilities				
City of Cape Coral				
Lee County Utilities				
Upper East Coast				
Martin County				
Martin County Utilities Department				
South Martin Regional Utility				
City of Stuart				
St. Lucie County				
City of Port St. Lucie				
Fort Pierce Utilities Authority				
Kissimmee Basin				
(data not included in report)				
Okeechobee County				
Okeechobee Utility Authority				
Orange County				
Orange County Public Utilities				
Orlando Utilities Commission				
Osceola County				
Reedy Creek Improvement District				
City of St. Cloud				
Toho Water Authority				

## E Summary of Water Shortage Orders

## E-2 | Appendix E: Summary of Water Shortage Orders

Lower East Coast	Order No.	Effective Date	Irrigation Days
Modified Phase I	2007-034-DAO-WS	3/22/07 @5:00 P.M.	3 days per week
Modified Phase II	2007-056-DAO-WS	4/13/07	2 days per week
Modification to Order 2007-056-DAO-WS	2007-100-DAO-WS	4/24/07	2 days per week
Modified Phase III - Palm Beach & Broward	2007-107-DAO-WS	5/16/07	1 day per week
Modified Phase II & III	2007-406-DAO-WS	7/11/07	2 days per week (1 day per week in Lantana, Lake Worth, Dania Beach, and Hallandale Beach)
Modified Phase III	2007-870-DAO-WS	1/15/08	1 day per week
Modified Phase II	2008-166-DAO-WS	4/25/08	2 days per week
Lower West Coast	Order No.	Effective Date	Irrigation Days
Modified Phase II	2007-060-DAO-WS	4/13/07	2 days per week
Modification to Order 2007-060-DAO-WS	2007-099-DAO-WS	4/23/07	2 days per week
Modified Phase III	2007-870-DAO-WS	1/15/08	1 day per week
Modified Phase II	2008-166-DAO-WS	4/25/08	2 days per week
Upper East Coast	Order No.	Effective Date	Irrigation Days
Modified Phase I	2007-058-DAO-WS	4/13/07	3 days per week
Modified Phase II - Martin & St. Lucie	2007-106-DAO-WS	5/16/07	2 days per week
Modified Phase II	2007-407-DAO-WS	7/11/07	2 days per week
Modified Phase III	2007-870-DAO-WS	1/15/08	1 day per week
Modified Phase II	2008-166-DAO-WS	4/25/08	2 days per week
Modified Phase II	2008-420-DAO-WS	9/26/08	2 days per week (landscape irrigation)

Table E-1. Water Shortage Orders in the Lower East Coast, Lower West Coast, and Upper East Coast.

Note: The regions are comprised of all or parts of the following counties: LEC - Monroe, Miami-Dade, Broward, Palm Beach, Hendry and Collier; LWC - Charlotte, Hendry, Lee, Collier, Monroe and Glades; and UEC - Martin, St. Lucie, and Okeechobee.

## F 2006–2009 Lake Okeechobee Water Shortage Analysis



Figure F-1. Lake Okeechobee during the 2006-2009 Water Shortage.



sfwmd **dov** 

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