E
Water Conservation

INTRODUCTION

Water conservation, covered in **Chapter 5** of the Planning Document of this update, is essential to water supply planning and water resource management. Water conservation is considered a water source option because it reduces or delays the need for future expansion of the water supply infrastructure.

This appendix provides further detail about water conservation in the Lower East Coast (LEC) Planning Area and includes the following:

- Water Savings Incentive Program (WaterSIP) projects funded for Fiscal Year (FY) 2005–FY 2012
- Status of water conservation implementation
- Water conservation rate structures
- Water conservation versus development of additional water supplies

WATERSIP

This program is a series of implementation strategies approved by the South Florida Water Management District (SFWMD) Governing Board in September 2008. The program is the result of a Water Conservation Summit hosted by the SFWMD's Water Resources Advisory Commission (WRAC) and a series of public meetings.

The program is designed to bring about a permanent reduction in individual water use and is organized into 1) regulatory, 2) voluntary and incentive-based, and 3) education and marketing initiatives. Under the umbrella of these initiatives, the SFWMD and other agencies offer numerous water conservation tools, building codes requiring use of water efficient appliances and fixtures, and more efficient landscape and irrigation practices. Chapter 5 in the *2011–2012 Water Supply Plan Support Document* (Support Document) (SFWMD 2012) provides additional background information about the development of this program.

Table E-1 lists the projects supported by the WaterSIP from FY 2005–2012.

Table E-1. WaterSIP projects funded in the LEC Planning Area FY 2005–FY 2012.

County	Entity Name	Project Title	Total Project Cost	Approved Funding	Proposed Water Savings (MGY)[a]
FY 2012					
Palm Beach	West Palm Beach, City of	Community Water Conservation Strategies – Phase II	$50,000	$20,000	4.67
Broward	Broward County Natural Resources Planning and Management Division on behalf of Broward Water Partnership	High Efficiency Toilet (HET) Rebate Program	$200,000	$50,000	7.85
	Coral Springs, City of	Automatic Flushers for Distribution System	$81,000	$35,000	7.00
Miami-Dade	Miami-Dade Water and Sewer Department (MDWASD)	Residential HET Rebate Project 2011–2012	$81,500	$30,000	12.70
Monroe	Florida Keys Aqueduct Authority (FKAA)	HET Retrofit Rebate Program	$20,000	$10,000	2.30
FY 2011					
Palm Beach	West Palm Beach, City of	Community Water Conservation Strategies – Phase I (residential indoor retrofit/ commercial pre-rinse spray valves)	$61,868	$24,200	68.96
	Glades Utility Authority	Water Meter Change Out (automated meter reading)	$154,470	$50,000	24.00
Broward	Pompano Beach, City of	Restaurant Spray Valves	$17,300	$5,500	11.30
	Margate, City of	Prerinse Spray Valve Replacement Program	$17,300	$6,600	10.10
	Sunrise, City of	Automatic Flushing Devices	$59,800	$29,900	10.26
	Tamarac, City of	Indoor Plumbing Retrofit Project	$90,750	$13,437	8.22
Miami-Dade	MDWASD	Residential HET Rebate Program	$122,000	$25,000	21.17
Monroe	FKAA	HET Retrofit Rebate Program	$20,000	$7,925	2.30
FY 2010					
Palm Beach	Palm Beach Parks and Recreation Department	Irrigation System Improvement Program	$74,240	$37,120	21.44
Broward	Fort Lauderdale, City of	Automatic Line Flushing Devices	$30,049	$15,000	18.70
	Lighthouse Point, City of	Water Conservation to Irrigation Systems on All City-Owned Properties	$66,000	$33,000	9.70
	Pompano Beach, City of	Showerhead, Bath, & Kitchen Aerators Kit Distribution	$29,900	$14,950	56.21
	Broward County	USEPA WaterSense® HET Replacement/ Credit Program	$300,000	$75,000	15.20
	Plantation, City of	HET Retrofit	$100,000	$50,000	10.22
Miami-Dade	North Miami Beach, City of	Rain Sensor Controller Retrofit Program	$16,000	$8,000	3.36
	MDWASD	Senior and Low Income Full Plumbing Retrofit Project – Phase IV	$315,000	$75,000	23.40
		Homeowner Association Landscape Irrigation Evaluations – Phase IV	$230,750	$38,875	15.70
		Residential HET Rebate Program	$125,000	$50,000	10.50
Monroe	FKAA	HET Rebate Program	$60,000	$30,000	4.38

a. MGY – million gallons per year.

Table E-1. Continued.

County	Entity Name	Project Title	Total Project Cost	Approved Funding	Proposed Water Savings (MGY)[a]
FY 2009					
Palm Beach	Pahokee, City of	Water Meter Change Out	$226,500	$50,000	8.76
	West Palm Beach, City of	Landscape Irrigation Technology Retrofit Project – Phase II	$100,000	$50,000	3.00
	Florida Atlantic University Division of Research	Water Conservation Landscaping Project	$37,500	$18,750	0.30
	School District of Palm Beach County	Waterless Urinal Installation Project	$23,040	$11,520	0.10
Broward	Fort Lauderdale, City of Parks & Recreation	Rain Sensor and Irrigation System Technology Installation	$37,247	$18,360	60.00
	Oakland Park, City of	Water Conservation Measures – Indoor Plumbing Fixture Retrofit Project	$17,500	$8,750	103.00
	Tamarac, City of	Indoor Plumbing Retrofit Project	$57,000	$27,000	13.60
	Plantation, City of	Dual Flush/HET Retrofit Rebate Program	$100,000	$50,000	10.00
	Miramar, City of	Residential Plumbing Fixture Replacement Program	$19,500	$9,750	6.60
	Coconut Creek, City of	Residential Dual Flush Valve Installation	$100,000	$50,000	5.50
	Miramar, City of	Flush Valve Replacement Program	$2,600	$1,300	1.12
	Hallandale Beach, City of	Selective Volume Flush Toilet Retrofit Program	$50,000	$25,000	10.00
	Hollywood, City of	Automatic Water Line Flushing Program	$59,840	$29,920	4.16
	14th Street Townhomes Association	Indoor Plumbing Retrofit and Rain Shut-Off Device Program	$30,574	$15,286	2.27
	Plantation, City of	Distribution System Automatic Flushing Devices	$103,218	$50,000	0.54
Miami-Dade	North Miami Beach, City of	Showerhead Exchange Program	$50,000	$25,000	36.80
	MDWASD	Senior and Low Income Full Plumbing Retrofit Project Phase III	$308,000	$25,000	23.40
		Industrial, Commercial, and Institutional Plumbing Fixture Retrofit Rebate Project	$113,800	$25,000	15.33
		Water Loss Reduction Plan – Automatic Meter Reading with Leak Detection Monitoring Project	$241,000	$25,000	24.00
		Industrial, Commercial, and Institutional Water Use Evaluations Project	$250,000	$25,000	18.20
		Urban Conservation Unit Project Water Irrigation Evaluation with Soil Moisture Sensor	$224,500	$17,875	22.80
		Multi-Family High Efficiency Full Retrofit Project	$129,000	$25,000	9.80
		Single Family HET Rebate Project	$125,000	$25,000	10.50
	Miami Springs, City of	Rain Sensors for Miami Springs	$2,220	$1,110	2.45
	Opa Locka, City of	Automatic Hydrant Flushing	$100,000	$50,000	8.40
	North Miami Beach, City of	Rain Harvesting Irrigation Program	$14,000	$7,000	0.54
Monroe	FKAA	HET Retrofit Rebate in Paradise	$100,000	$25,000	7.00
		Cisterns in Paradise: Florida Keys Rain Catchment Initiative	$100,000	$25,000	0.90

a. MGY – million gallons per year.

Table E-1. Continued.

County	Entity Name	Project Title	Total Project Cost	Approved Funding	Proposed Water Savings (MGY)[a]
FY 2008					
Palm Beach	Palm Healthcare Foundation	Rainwater Collection & Irrigation System	$75,000	$20,588	0.33
Broward	Hollywood, City of	Restaurant Pre-rinse Spray Valve Replacement Program	$13,974	$6,987	9.20
	Tamarac, City of	Indoor Plumbing Retrofit	$92,100	$42,000	17.90
	Coral Springs, City of	Automatic Flushers for Distribution	$99,950	$49,975	20.52
	Coconut Creek, City of	Prerinse Spray Valve Retrofit	$4,500	$2,250	1.97
	Hallandale Beach, City of	Rain Sensor Retrofit Program	$100,000	$25,000	23.00
Miami-Dade	North Miami Beach, City of	Advanced Automated Flushing Technology	$20,000	$10,000	34.00
		Showerhead Exchange Program	$50,000	$25,000	36.80
		Water Demand Management Using Fixed-Ratio Network Meter Reading Technology	$300,000	$25,000	48.00
	MDWASD	Single Family Plumbing Fixture Retrofit Kit Exchange	$36,790	$12,000	0.70
		Multi-family Plumbing Retrofit Kit Exchange	$31,400	$9,200	0.70
Monroe	FKAA	Low Flow Retrofit Program	$64,000	$32,000	4.48
FY 2007					
Palm Beach	West Palm Beach, City of	Landscape Irrigation Efficiency Project	$100,000	$50,000	27.00
Broward	Hollywood, City of	Showerhead Exchange Program	$16,435	$8,218	36.00
Miami-Dade	North Miami Beach, City of	Fixed Radio Network Meter Reading Technology	$300,000	$50,000	48.00
	MDWASD	Plumbing Fixture Retrofit Seniors' Pilot	$212,500	$50,000	15.60
		Water Use Evaluations	$250,000	$50,000	18.25
		Landscape Irrigation Efficiency Project	$64,000	$32,000	7.40
		Low Flow Toilet Rebate Project	$120,500	$50,000	6.00
	Virginia Gardens	Sports Field Irrigation Project	$56,000	$28,000	6.50
Monroe	FKAA	Prerinse Spray Valve Retrofit	$100,000	$25,000	53.40
FY 2006					
Palm Beach	Pompano Beach, City of	Automatic Flushing Devices	$20,000	$7,500	0.14
Broward	Tamarac, City of	Plumbing and Irrigation Retrofit	$58,200	$30,000	25.00
	Plantation, City of	Water Savings Grass Installation	$312,280	$50,000	78.00
	Coconut Creek, City of	Sabal Pines Park Wash Station	$95,000	$40,000	0.50
Miami-Dade	Town of Medley	Water Consumption Awareness, Leak Detection	$100,595	$50,000	21.20
	Roots in the City, Inc.	Water Reclamation	$72,000	$36,000	0.30
	Plaza Del Prado Condominium	Water Conservation	$159,800	$50,000	7.90
	City of Miami Springs	"Save Your Water – Save Your Dollars"	$15,155	$5,000	14.60
	Miami-Dade Cooperative Extension Service Division	Residential Irrigation Efficiency Project	$100,000	$25,000	7.00
	Town of Medley	Public Restrooms Water Use Reduction Program	$30,000	$7,500	0.45
FY 2005					
Palm Beach	United Civic Organization of Century Village, Inc.	Convert Irrigation System to Reclaimed	$115,000	$25,000	74.70
	City of Boynton Beach Utilities	Turf Replacement	$100,000	$50,000	7.60
Miami-Dade	FKAA	Showerhead Retrofit for Hotels	$100,000	$50,000	15.00
		Totals	**$8,430,145**	**$2,480,346**	**1,457.00**

a. MGY – million gallons per year.

PUBLIC WATER SUPPLY CONSERVATION

Goal-Based Water Conservation Plans and Tools

A goal-based water conservation plan allows utilities to achieve agreed-upon conservation goals to help meet future water supply needs and potentially eliminate the need to construct additional water supply facilities or wells. A well designed program identifies a variety of methods and practices that decrease water demand to meet numeric goals. The practices selected should reflect, among other parameters, population projections, existing per capita use, participation rates, and the service area's water use profile.

In general, water conservation planning tools can help a utility accomplish the following:

- Develop a service area water use profile
- Evaluate and compare the costs and benefits of various conservation measures
- Create a mid- to long-range conservation (or demand management) plan

The Alliance for Water Efficiency's has developed the Water Conservation Tracking Tool, which can assist utilities in developing goal-based plans. The tool is a Microsoft® Excel-based model, which uses baseline demand data for each water use sector (customer class) and avoided cost data to evaluate and design utility conservation programs. It contains a library of predefined water conservation measures users can select for evaluation. Water savings, costs, and benefits of each measure can be examined and tracked for each year of the proposed program. The tracking tool features comprehensive and highly developed economic analyses of each water conservation option accounting for program costs using time valued dollars. The tool recently concluded a beta testing period and is now available free of charge to Alliance for Water Efficiency members from the following website: http://www.allianceforwaterefficiency.org.

WaterSense®

WaterSense® is a program established by the United States Environmental Protection Agency (USEPA) to protect the future of our nation's water supply by promoting water efficiency and enhancing the market for water efficient products, programs, and practices. The SFWMD became a WaterSense® Promotional Partner in 2009. WaterSense® helps consumers identify water efficient products that meet rigorous efficiency and performance criteria. Products tested and proven at least 20 percent more efficient than those meeting current federal standards without compromising performance standards are awarded the WaterSense® label.

When designing and planning a retrofit program, the SFWMD recommends utilities and municipalities refer to the WaterSense® program for standards, criteria and information. The SFWMD also encourages local municipalities to become a WaterSense® promotional partner and amend or enact local plumbing ordinances to require WaterSense® fixtures in

new construction and in retrofit programs. Partners in the LEC Planning Area are numerous. More information about this program is available from the WaterSense® website, http://www.epa.gov/watersense.

Appliance Retrofits

Newer water fixtures and appliances provide significant water savings compared with older appliances and fixtures. For example, a more efficient washing machine generates a potential estimated savings of 20 gallons of water per use, so a family washing five loads of laundry each week could save more than 5,000 gallons of water per year. **Table E-2** shows water consumption for common indoor fixtures and appliances.

Table E-2. Gallons of water consumed for common indoor water fixtures and appliances.

	Water Consumption					
	Toilets (gallons per flush)	**Showerheads (gallons per minute)**	**Faucets (gallons per minute)**	**Urinals (gallons per flush)**	**Dishwashers (gallons per load)**	**Clothes Washers (gallons per load)**
Pre-1984	5.0–7.0	5.0–8.0	4.0–7.0	5.0	14.0	56.0
1984–1994	3.5–4.5	2.8-4.0	2.8–3.0	1.5–4.5	10.5–12.0	39.0–51.0
Post-1994	1.6	2.5[a]	2.5[a]	1.0	10.5	27.0[b]
WaterSense® Max	1.3	2.0	1.5	0.5	--	--
Highest Efficiency	0.8–1.0	1.2–1.5	0.5–1.0	0.0–0.125[c]	4.5–6.5	16.0–22.0

a. At 80 pounds per square inch or 2.2 gallons per minute at 60 pounds per square inch.

b. Post-1998.

c. Waterless urinals are only recommended under specific conditions.

The SFWMD recommends several online resources for consumers, building managers, utilities, and municipalities for research and comparison of indoor retrofit program devices:

- ENERGY STAR® Program (www.energystar.gov)
- Consortium for Energy Efficiency (www.cee1.org)
- Food Service Technology Center (www.fishnick.com)
- USEPA WaterSense® Program (www.epa.gov/WaterSense/)
- Alliance for Water Efficiency (www.allianceforwaterefficiency.org)
- California Urban Water Conservation Council (www.cuwcc.org)
- Conserve Florida Water Clearinghouse (http://www.conservefloridawater.org/overview.asp)

Water CHAMP℠

The Water Conservation Hotel and Motel Program (Water CHAMP℠) recognizes lodging facilities that have taken steps to increase water use efficiency. Specifically, participating properties conduct voluntary linen and towel reuse programs and install high efficiency (1 gallon per minute) faucet aerators in guest bathrooms. Participation in the Water CHAMP℠ supports the water conservation criteria needed to join the Florida Green Lodging Program, which was recently approved by the Florida Department of Environmental Protection (FDEP). **Table E-3** summarizes the Water CHAMP℠ water conservation potential for the LEC Planning Area.

Table E-3. Potential water savings of the Water CHAMP℠ in the LEC Planning Area.[a]

County	Number of Hotel and Motel Units[a]	Number of Rooms in Florida Green Lodging Program	Potential Water CHAMP Rooms	Potential Water Savings[b] (MGY)[c]
Broward	30,500	10,786	19,714	86.3
Miami-Dade	48,490	13,679	34,811	152.5
Monroe	7,957	2,912	3,515[d]	15.4
Palm Beach	16,822	9,077	7,745	33.9
LEC Planning Area Totals	103,769	36,454	62,270	288.1

a. Accounts for hotels, motels, and bed-and-breakfast properties.
b. Potential savings over nonconserving hotels built to current plumbing standards.
c. MGY – million gallons per year (water).
d. Excludes 1,530 rooms currently enrolled in the program.
Source: Florida Department of Business and Professional Regulation (http://www.myfloridalicense.com/dbpr/)

Potential Water Savings

The SFWMD advocates the adoption of local building ordinances that incorporate the WaterSense® and ENERGY STAR® fixture and appliance standards and/or follow Florida Water Star℠ or Leadership in Energy and Environmental Design (LEED) building criteria. Water savings resulting from residential indoor retrofits were estimated for Palm Beach, Broward, Miami-Dade, and Monroe counties using county parcel and population data, and a methodology similar to that used by the Conserve Florida Water Clearinghouse EZ Guide (2009). **Table E-4** summarizes potential water use savings in the LEC Planning Area based on the following assumptions:

- High efficiency fixtures are implemented by both single and multiple family residential units.
- Measures to realize a 15 or 35 percent reduction in water use are implemented by all Industrial/Commercial/Institutional (ICI) Self-Supply equivalent square footage.

The estimated water use reductions in **Table E-4** assume 100 percent participation in conservation activities for the ICI Self-Supply water use category and residential indoor water use. These numbers illustrate maximum potential water savings based on a particular set of assumptions and are not intended to serve as a realistic objective.

Table E-4. Summary of potential savings in millions of gallons per year (MGY) of the ICI Self-Supply water use category and residential indoor water use through water conservation in Palm Beach, Broward, Miami-Dade, and Monroe counties.[a]

Indoor Water Use	Savings in MGY							
	Palm Beach County		Broward County		Miami-Dade County		Monroe County	
Single Family Residential								
Pre-1984	4,204.6		7,149.2		9,536.1		464.9	
1984–1994	1,995.9		1,773.6		1,519.4		147.9	
Post-1994	1,096.8		983.7		904.1		55.2	
Multiple Family Residential								
Pre-1984	1,301.1		2,566.2		5,747.5		152.7	
1984–1994	451.4		616.4		599.9		17.5	
Post-1994	215.9		259.2		356.0		4.6	
Total Residential Savings	9,265.7		13,348.3		18,662.9		842.8	
Indoor Water Use	**Efficiency Increase in MGY**							
	15%	**35%**	**15%**	**35%**	**15%**	**35%**	**15%**	**35%**
Industrial	130.2	303.8	287.4	670.7	473.6	1,105.1	3.1	7.3
Commercial	1,042.4	2,432.2	1,382.0	3,224.8	2,255.5	5,267.7	92.4	215.7
Institutional	398.5	929.9	492.5	1,149.1	844.1	1,969.5	29.1	68.0
Total ICI Savings	1,571.1	3,665.9	2,162.0	5,044.6	3,573.2	8,337.4	124.7	290.9
Total Savings	**10,836.8**	**12,931.6**	**15,510.3**	**18,392.9**	**22,236.0**	**27,000.2**	**967.4**	**1,133.6**

a. Replacement with high efficiency features.

Table E-5 through **Table E-8** in the *Public Water Supply – Conservation* section provide the status of Public Water Supply (PWS) water conservation implementation for Palm Beach, Broward, Miami-Dade, and Monroe counties, respectively.

Table E-5. Palm Beach County PWS water conservation implementation status.

PWS Utility	Irrigation Hours Ordinance	Florida-Friendly Landscape™ Ordinance[a]	Ultralow Volume Fixtures Ordinance[b]	Rain Sensor Ordinance	Water Conservation Rate Structure	Leak Detect & Repair Program[c]	Public Education Program[d]	Consumptive Use Permit Number
A.G. Holley State Hospital[e]	NA[f]	NA	NA	NA	NA	yes	yes	50-01092-W
Boca Raton, City of	yes[g]	yes	yes	yes	yes	yes	yes	50-00367-W
Boynton Beach, City of	yes	yes	yes	yes	yes	yes	yes	50-00499-W
Delray Beach Water and Sewer Department, City of	yes	yes[h]	yes	yes	yes	yes	yes	50-00177-W
Glades Utility Authority	no	no	no	no	yes	yes	yes	50-06857-W
Golf, Village of	yes	yes	yes	no	yes	yes	yes	50-00612-W
Highland Beach, Town of	yes	yes	yes	yes	yes	yes	yes	50-00346-W
Jupiter, Town of	yes	yes	yes	yes	yes	yes	yes	50-00010-W
Lake Worth Utilities, City of	yes[i]	yes	yes	no	yes	yes	yes	50-00234-W
Lantana, Town of	yes	yes	yes	yes	yes	yes	yes	50-00575-W
Manalapan, Town of	yes	yes	yes	yes	no	yes	yes	50-00506-W
Mangonia Park, Town of	yes	no	yes	yes	no	yes	yes	50-00030-W
Maralago Cay	NA	NA	NA	NA	no[j]	yes	yes	50-01283-W
Palm Beach County Water Utilities Department	yes	yes	yes	yes	yes	yes	yes	50-00135-W 50-00444-W 50-06857-W
Palm Springs, Village of	yes[g]	yes[g]	yes	no	yes	yes	yes	50-00036-W
Riviera Beach, City of	yes	yes[h]	yes	yes	yes	yes	yes[h]	50-00460-W
Seacoast Utility Authority	yes	yes	yes	yes	yes	yes	yes	50-00365-W
Seminole Improvement District[k]	NA	NA	NA	NA	yes	yes	yes	50-03711-W
Tequesta, Village of	yes	yes[h]	yes	yes[h]	yes	yes	yes	50-00046-W
Wellington Public Utilities Department	yes	no	yes	yes	yes	yes	yes	50-00464-W
West Palm Beach Public Utilities, City of	yes	yes	yes	yes	yes	no[l]	yes	50-00615-W

a. Includes Xeriscape™ ordinances that have not been updated to reflect Florida-Friendly Landscaping™ principles.
b. Utility either adopts its own ordinance or follows the Florida Building Code.
c. Program initiated when unaccounted for water is greater than 10 percent.
d. Program can vary depending on permit requirements and other factors.
e. A.G. Holley State Hospital closed in 2012.
f. NA – not applicable.
g. Adheres to Palm Beach County code of ordinances.
h. Ordinance in development as part of the consumptive use permit renewal process.
i. One-day-per-week irrigation ordinance, which is more restrictive than SFWMD year-round restrictions.
j. Per conversation with George McDonald, P.E., of McDonald Group International, Inc., consultant to Maralago Cay.
k. This utility does not have the authority to enact ordinances. It complies with local government ordinances.
l. Per David Hanks, Utility Director, City of West Palm Beach, a leak detection program will be implemented upon the purchase of leak detection equipment in 2012.

Table E-6. Broward County PWS water conservation implementation status.

PWS Utility	Irrigation Hours Ordinance	Florida-Friendly Landscape™ Ordinance[a]	Ultralow Volume Fixtures Ordinance[b]	Rain Sensor Ordinance	Water Conservation Rate Structure	Leak Detect & Repair Program[c]	Public Education Program[d]	Consumptive Use Permit Number
Broward County Water & Wastewater Services	yes	yes	yes	yes	yes	yes	yes	06-00146-W
Cooper City Utility Department, City of	yes[e]	no[f]	yes	yes[e]	yes	yes	yes	06-00365-W
Coral Springs, City of	yes[f]	yes[f]	yes	yes[f]	yes	yes	yes	06-00102-W
Coral Springs Improvement District[g]	NA[h]	NA	NA	NA	yes	yes	yes	06-00100-W
Dania Beach, City of	yes	yes[f]	yes	yes[f]	yes	yes	yes	06-00187-W
Davie, Town of	yes[e]	yes	yes	yes	yes	yes	yes	06-00134-W
Deerfield Beach, City of	yes	yes	yes	yes	yes	yes	yes	06-00082-W
Fort Lauderdale, City of	yes[i]	yes	yes[e]	yes	yes	yes	yes	06-00123-W
Hallandale Beach, City of	yes	yes	yes	yes	yes	yes	yes	06-00138-W
Hillsboro Beach, Town of	yes	yes	yes	yes	yes	yes	yes	06-00101-W
Hollywood, City of	yes	no[j]	yes	no	yes	yes	yes	06-00038-W
Lauderhill, City of	yes	yes	yes	yes	yes	yes	yes	06-00129-W
Margate, City of	yes	yes	yes	yes	yes	yes	yes	06-00121-W
Miramar, City of	yes	yes	yes	yes	yes	yes	yes	06-00054-W
North Lauderdale, City of	yes	yes	yes	yes	yes	yes	yes	06-00004-W
North Springs Improvement District[g]	NA	NA	NA	NA	yes	yes	yes	06-00274-W
Parkland Utilities, Inc.	yes[e]	yes[e]	yes[e]	yes[e]	no	yes	yes	06-00242-W
Pembroke Pines, City of	yes	yes	yes	yes	yes	yes	yes	06-00135-W
Plantation, City of	yes	yes	yes	yes	yes	yes	yes	06-00103-W
Pompano Beach, City of	yes	yes	yes	yes	yes	yes	yes	06-00070-W
Royal Utility Corporation[g]	NA	NA	NA	NA	no	yes	yes	06-00003-W
Seminole Tribe of Florida Utility[k]	NA	NA	NA	NA	NA	NA	NA	06-02088-W
Sunrise, City of	yes	yes	yes	yes	yes	yes	yes	06-00120-W
Tamarac, City of	yes	yes	yes	yes	yes	yes	yes	06-00071-W
Tindall Hammock Irrigation and Soil Conservation District[g, l]	NA	NA	NA	NA	no	no	yes	06-00170-W

a. Includes Xeriscape™ ordinances that have not been updated to reflect Florida-Friendly Landscaping™ principles.
b. Utility either adopts its own ordinance or follows the Florida Building Code.
c. Program initiated when unaccounted for water is greater than 10 percent.
d. Program can vary depending on permit requirements and other factors.
e. Adheres to Broward County code of ordinances.
f. Ordinance in development as part of the consumptive use permit renewal process.
g. This utility does not have the authority to enact ordinances. It complies with local government ordinances.
h. NA – not applicable
i. City of Fort Lauderdale ordinance allows three-day-per-week landscape irrigation.
j. Only applicable to the preservation of trees.
k. The Seminole Tribe of Florida is not required to comply with the SFWMD *Basis of Review for Water Use Permit Application within the South Florida Water Management District* (SFWMD 2010) water conservation measures.
l. Previously Ferncrest Utilities, Inc.

Table E-7. Miami-Dade County PWS water conservation implementation status.

PWS Utility	Irrigation Hours Ordinance	Florida-Friendly Landscape™ Ordinance[a]	Ultralow Volume Fixtures Ordinance[b]	Rain Sensor Ordinance	Water Conservation Rate Structure	Leak Detect & Repair Program[c]	Public Education Program[d]	Consumptive Use Permit Number
Americana Village	yes	yes	yes	yes	yes[e]	yes[e]	yes[e]	13-02004-W
Florida City Water and Sewer Department	no	no	no	no	no	no	no	13-00029-W
Homestead, City of	yes	yes	yes	yes	yes	yes	yes	13-00046-W
Miami-Dade Water and Sewer Department (MDWASD)	yes	yes	yes	yes	yes	yes	yes	13-00017-W
North Miami, City of	no	no	yes	no	no	yes	yes	13-00059-W
North Miami Beach, City of	yes	yes	yes	yes	yes	yes	yes	13-00060-W

a. Includes Xeriscape™ ordinances that have not been updated to reflect Florida-Friendly Landscaping™ principles.
b. Utility either adopts its own ordinance or follows the Florida Building Code.
c. Program initiated when unaccounted for water is greater than 10 percent.
d. Program can vary depending on permit requirements and other factors.
e. Adheres to MDWASD water rates.

Table E-8. Monroe County PWS water conservation implementation status.

PWS Utility	Irrigation Hours Ordinance	Florida-Friendly Landscape™ Ordinance[a]	Ultra Low Volume Fixtures Ordinance[b]	Rain Sensor Ordinance	Water Conservation Rate Structure	Leak Detect & Repair Program[c]	Public Education Program[d]	Consumptive Use Permit Number
Florida Keys Aqueduct Authority (FKAA)	yes	yes	yes	yes	yes	yes	yes	13-00005-W

a. Includes Xeriscape™ ordinances that have not been updated to reflect Florida-Friendly Landscaping™ principles.
b. Utility either adopts its own ordinance or follows the Florida Building Code.
c. Program initiated when unaccounted for water is greater than 10 percent.
d. Program can vary depending on permit requirements and other factors.

WATER CONSERVATION RATE STRUCTURES

Table E-9 in the *Water Conservation Rate Structures* section provides information on single family residential water rates for each utility. Some PWS utilities listed in **Table E-9** provide water to municipal entities within their service area that then resell the water to their residents. These entities often create water rate structures that anticipate the cost of the purchased water plus an added handling fee. These rate structures, in turn, have an impact on conservation measures that residents employ, which influences the per capita use rate (PCUR) of the utility.

Table E-9. Single family residential water rates in the LEC Planning Area by dollars per each 1,000 gallons.

Utility Name	Effective Date	Utility Tax	Single Family Residential Water Rates Cost per 1,000 gallons							Cost per 3,000 Gallons	Cost per 7,000 Gallons	Cost per 10,000 Gallons
			Base Charge	1	2	3	4	5	6			
Palm Beach County												
Boca Raton, City of (inside city)	October 2010	-	**$12.13**	**$0.713** 0–25,000	**$1.717** 25,001–50,000	**$2.189** >50,000	-	-	-	**$14.27**	**$17.12**	**$19.26**
Boca Raton, City of (outside city)	October 2010	-	**$15.16**	**$0.891** 0–25,000	**$2.146** 25,001–50,000	**$2.736** >50,000	-	-	-	**$17.83**	**$20.51**	**$23.18**
Boynton Beach, City of (in city)	October 2010	-	**$10.76**	**$1.44** 0–9,000	**$2.58** 9,001–30,000	**$3.44** 30,001–50,000	**$4.24** >50,000	-	-	**$15.08**	**$20.84**	**$26.30**
Boynton Beach, City of (outside city)	October 2010	-	**$13.45**	**$1.80** 0–9,000	**$3.23** 9,001–30,000	**$4.30** 30,001–50,000	**$5.30** >50,000	-	-	**$18.85**	**$26.05**	**$32.88**
Delray Beach Water and Sewer Department, City of (in city)	October 2010	-	**$15.72**	**$0.00** 0–3,000	**$1.25** 3,001–12,000	**$2.00** 12,001–25,000	**$3.50** 25,001–50,000	**$4.50** >50,000	-	**$15.72**	**$20.72**	**$24.47**
Delray Beach, Water and Sewer Department, City of (outside city)	October 2010	-	**$19.65**	**$0.00** 0–3,000	**$1.56** 3,001–12,000	**$2.50** 12,001–25,000	**$4.38** 25,001–50,000	**$5.63** >50,000	-	**$19.65**	**$25.89**	**$30.57**
Glades Utility Authority	October 2012	-	**$16.75**	**$1.50** 0–3,000	**$4.67** 3,001–6,000	**$5.80** 6,001–15,000	**$7.50** >15,000	-	-	**$21.25**	**$41.06**	**$58.46**
Golf, Village of (in city)	-	-	**$29.58**	**$0.00** 0–10,000	**$0.95** >10,000	-	-	-	-	**$29.58**	**$29.58**	**$29.58**
Golf, Village of (outside city)	-	-	**$36.98**	**$0.00** 0–10,000	**$1.18** >10,000	-	-	-	-	**$36.98**	**$36.98**	**$36.98**
Highland Beach, Town of	December 2009	-	**$15.00**	**$2.15** 0–9,500	**$3.74** 9,501–24,500	**$4.60** >24,501	-	-	-	**$21.45**	**$30.05**	**$37.30**
Hypoluxo, Town of[a]	July 2008	-	**$40.39**	**$2.22**	-	-	-	-	-	**$47.05**	**$55.93**	**$62.59**

a. Water provided by the City of Boynton Beach and resold by this utility.

Table E-9. Continued.

Utility Name	Effective Date	Utility Tax	Single Family Residential Water Rates Cost per 1,000 gallons							Cost per 3,000 Gallons	Cost per 7,000 Gallons	Cost per 10,000 Gallons
			Base Charge	1	2	3	4	5	6			
Jupiter, Town of (inside city)	November 2009	-	**$18.28**	**$1.14** 0–6,000	**$1.55** 6,001–14,000	**$2.74** 14,001–30,000	**$3.62** >30,000	-	-	**$21.70**	**$26.67**	**$31.32**
Jupiter, Town of (outside city)	November 2009	-	**$22.85**	**$1.43** 0–6,000	**$1.94** 6,001–14,000	**$3.43** 14,001–30,000	**$4.53** >30,000	-	-	**$27.14**	**$33.37**	**$39.19**
Lake Worth Utilities, City of	October 2010	-	**$12.50**	**$2.69** 0–4,000	**$4.15** 4,001–8,000	**$5.60** 8,001–12,000	**$9.81** 12,001–20,000	**$12.26** >20,000	-	**$20.57**	**$35.71**	**$51.06**
Lantana, Town of	July 2009	-	**$19.06**	**$1.18** 0–5,000	**$1.79** 5,001–10,000	**$2.52** 10,001–20,000	**$3.06** 20,001–40,000	**$3.15** >40,000	-	**$22.60**	**$28.54**	**$33.91**
Manalapan, Town of	July 2008	-	**$33.66**	**$1.85**	-	-	-	-	-	**$39.21**	**$46.61**	**$52.16**
Mangonia Park, Town of	-	-	**$11.58**	**$1.95**	-	-	-	-	-	**$17.43**	**$25.23**	
Maralago Cay	NA[a]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Palm Beach County Water Utilities Department	November 2010	-	**$10.95**	**$1.09** 0–4,000	**$2.45** 4,001–10,000	**$6.15** 10,001–25,000	**$7.64** >25,000	-	-	**$14.22**	**$22.66**	**$30.01**
Palm Springs, Village of (in city)	October 2010	-	**$8.90**	**$2.34** 0–6,000	**$3.04** 6,001–20,000	**$3.74** >21,000	-	-	-	**$15.92**	**$25.98**	**$35.10**
Palm Springs, Village of (outside city)	October 2010	-	**$11.12**	**$2.93** 0–6,000	**$3.79** 6,001–20,000	**$4.68** >21,000	-	-	-	**$19.91**	**$32.49**	**$43.86**
Riviera Beach, City of	-	-	**$12.22**	**$2.51** 0–9,000	**$3.14** 9,001–14,000	**$3.77** 14,001–19,000	**$4.40** >19,000	-	-	**$19.75**	**$29.79**	**$37.95**
Seacoast Utility Authority	December 2010	-	**$17.27**	**$0.88** 0–6,000	**$3.45** 6,001–30,000	**$5.19** >30,000	-	-	-	**$19.91**	**$26.00**	**$36.35**
Seminole Improvement District[b]	NA	-	**$0.00**	**$2.00**	-	-	-	-	-	**$6.00**	**$14.00**	**$20.00**

a. NA – not available.
b. No rate structure.

Table E-9. Continued.

Utility Name	Effective Date	Utility Tax	Single Family Residential Water Rates Cost per 1,000 gallons							Cost per 3,000 Gallons	Cost per 7,000 Gallons	Cost per 10,000 Gallons
			Base Charge	1	2	3	4	5	6			
Tequesta, Village of (in city)	October 2010	9%	**$13.27**	**$2.11** 0–12,000	**$3.54** 12,001–25,000	**$4.81** 25,001–40,000	**$6.17** >40,000	-	-	**$21.36**	**$32.49**	**$42.31**
Tequesta, Village of (outside city)	October 2010	-	**$16.59**	**$2.64** 0–12,000	**$4.43** 12,001–25,000	**$6.01** 25,001–40,000	**$7.71** >40,000	-	-	**$24.51**	**$35.07**	**$42.99**
Wellington Public Utilities Department (in city)	October 2010	-	**$16.46**	**$1.86** 0–6,000	**$2.77** 6,001–15,000	**$3.72** 15,001–25,000	**$6.11** >25,000	-	-	**$22.04**	**$30.39**	**$38.70**
Wellington Public Utilities Department (outside city)	October 2010	-	**$20.56**	**$2.32** 0–6,000	**$3.46** 6,001–15,000	**$4.64** 15,001–25,000	**$7.63** >25,000	-	-	**$27.52**	**$37.94**	**$48.32**
West Palm Beach Public Utilities, City of (in city)	October 2010	-	**$17.70**	**$2.05** 0–6,000	**$2.57** 6,001–12,000	**$3.02** 12,000–26,900	**$3.54** 26,901–56,850	**$4.08** 56,851–149,600	**$4.58** >149,600	**$23.85**	**$32.57**	**$40.28**
West Palm Beach Public Utilities, City of (outside city)	October 2010	-	**$22.13**	**$2.56** 0–6,000	**$3.21** 6,001–12,000	**$3.78** 12,001–26,900	**$4.43** 26,901–56,850	**$5.10** 56,851–149,600	**$5.73** >149,600	**$29.81**	**$40.70**	**$50.33**
Broward County												
Broward County Water & Wastewater Services	October 2010	-	**$14.20**	**$1.32** 0–3,000	**$2.31** 3,001–6,000	**$4.79** 6,001–12,000	**$6.43** >12,000	-	-	**$18.16**	**$29.88**	**$44.25**
Coconut Creek[a]	April 2011	8%	**$14.96**	**$3.50** 0–3,000	**$4.99** 3,001–7,000	**$6.24** 7,001–10,000	**$8.41** 10,001–20,000	**$11.77** >20,000	-	**$27.50**	**$49.05**	**$69.27**
Cooper City Utility Department, City of	NA[b]	-	**$10.91**	**$2.70** 0–5,000	**$3.12** 5,001–10,000	**$3.96** 10,001–20,000	**$5.20** >20,000	-	-	**$19.01**	**$30.65**	**$40.01**
Coral Springs, City of	NA	-	**$12.55**	**$1.47** 0–4,000	**$2.10** 4,001–8,000	**$2.63** 8,001–12,000	**$3.53** 12,001–20,000	**$5.33** >20,000	-	**$16.96**	**$24.73**	**$32.09**
Coral Springs Improvement District	October 2010		**$15.69**	**$0.00** 0–3,000	**$2.98** 3,001–12,600	**$4.72** 12,601–25,200	**$6.47** >25,200	-	-	**$15.69**	**$27.61**	**$36.55**

a. Water provided by Broward County Water and Wastewater Services and resold by this utility.
b. NA – not available.

Table E-9. Continued.

Utility Name	Effective Date	Utility Tax	Single Family Residential Water Rates Cost per 1,000 gallons							Cost per 3,000 Gallons	Cost per 7,000 Gallons	Cost per 10,000 Gallons
			Base Charge	1	2	3	4	5	6			
Dania Beach, City of	January 2011	-	**$12.50**	**$3.54** 0–5,000	**$5.67** 5,001–14,000	**$7.09** >14,000	-	-	-	**$23.12**	**$41.54**	**$58.55**
Davie, Town of	October 2010	-	**$17.40**	**$2.87** 0–5,000	**$4.28** 5,001–10,000	**$5.72** 10,001–20,000	**$7.15** 20,001–30,000	**$8.60** 30,001–50,000	**$10.03** >50,000	**$26.01**	**$40.31**	**$53.15**
Deerfield Beach, City of	March 2008	-	**$15.00**	**$2.65** 0–6,000	**$3.67** 6,001–12,000	**$4.03** >12,000	-	-	-	**$22.95**	**$34.57**	**$45.58**
Fort Lauderdale, City of	August 2010	-	**$4.95**	**$1.51** 0–3,000	**$3.36** 3,001–8,000	**$4.20** 8,001–12,000	**$5.66** 12,001–20,000	**$8.21** >20,000	-	**$9.48**	**$22.92**	Aug-10
Hallandale Beach, City of	October 2009	10%	**$21.00**	**$1.03** 0–2,000	**$1.10** 2,001–5,000	**$1.43** 5,001–10,000	**$2.25** 10,001–25,000	**$2.45** >25,000	-	**$26.58**	**$32.14**	**$36.86**
Hillsboro Beach, Town of	January 2011	-	**$24.00**	**$0.00** 0–2,000	**$3.40** 2,001–9,000	**$4.19** 9,001–17,000	**$4.87** >17,000	-	-	**$27.40**	**$41.00**	**$51.99**
Hollywood, City of	October 2010	-	**$4.76**	**$2.70** 0–3,740	**$5.39** 3,741–7,480	**$6.72** 7,481–11,220	**$8.07** 11,221–14,960	**$9.41** >14,960	-	**$12.86**	**$32.43**	**$51.95**
Lauderhill, City of[a]	October 2010	10%	**$10.74**	**$1.73**	-	-	-	-	-	**$17.52**	**$25.14**	**$30.84**
Lighthouse Point[b]	October 2010	-	**$14.20**	**$1.32** 0–3,000	**$2.31** 3,001–6,000	**$4.79** 6,001–12,000	**$6.43** >12,000	-	-	**$18.16**	**$29.88**	**$44.25**
Margate, City of (inside city)	October 2010	-	**$10.72**	**$3.21** 0–6,000	**$4.01** 6,001–15,000	**$4.82** 15,001–25,000	**$5.61** >25,000	-	-	**$20.35**	**$33.99**	**$46.02**
Margate, City of (outside city)	October 2010	-	**$13.40**	**$4.01** 0–6,000	**$5.01** 6,001–15,000	**$6.03** 15,001–25,000	**$7.01** >25,000	-	-	**$25.43**	**$42.47**	**$57.50**
Miramar, City of	May 2011	10%	**$10.73**	**$2.13** 0–5,000	**$2.61** 5,001–15,000	**$3.27** >15,000	-	-	-	**$18.83**	**$29.26**	**$37.87**

a. No rate structure.
b. Water provided by Broward County Water & Wastewater Services and resold by this utility.

Table E-9. Continued.

Utility Name	Effective Date	Utility Tax	Single Family Residential Water Rates Cost per 1,000 gallons							Cost per 3,000 Gallons	Cost per 7,000 Gallons	Cost per 10,000 Gallons
			Base Charge	1	2	3	4	5	6			
North Lauderdale, City of	May 2009	-	**$11.44**	**$2.77** 0–10,000	**$4.71** >10,000	-	-	-	-	**$19.75**	**$30.83**	**$39.14**
North Springs Improvement District	NA[a]	-	**$17.85**	**$1.73** 0–12,600	**$3.45** 12,601–25,200	**$5.18** >25,200	-	-	-	**$23.04**	**$29.96**	**$35.15**
Parkland Utilities, Inc.[b]	April 2011	-	**$18.70**	**$4.38** 0–3,000	**$6.24** 3,001–7,000	**$7.80** 7,001–10,000	**$10.51** 10,001–20,000	**$14.71** >20,000	-	**$31.84**	**$56.80**	**$80.20**
Pembroke Park[c]	October 2010	-	**$14.20**	**$1.32** 0–3,000	**$2.31** 3,001–6,000	**$4.79** 6,001–12,000	**$6.43** >12,000	-	-	**$18.16**	**$29.88**	**$44.25**
Pembroke Pines, City of	October 2010	-	**$11.93**	**$0.00** 0–3,000	**$4.64** >3,000	-	-	-	-	**$11.93**	**$30.49**	**$44.41**
Plantation, City of	October 2010	-	**$11.06**	**$1.57** 0–6,000	**$3.14** 6,001–12,000	**$4.72** 12,001–20,000	**$6.29** 20,001–30,000	**$7.86** 30,001–50,000	**$9.43** >50,000	**$15.77**	**$23.62**	**$33.04**
Pompano Beach, City of (inside city)	January 2011	-	**$12.88**	**$2.24** 0–10,000	**$3.07** 10,001–15,000	**$4.27** 15,001–25,000	**$6.00** >25,000	-	-	**$19.60**	**$28.56**	**$35.28**
Pompano Beach, City of (outside city)	January 2011	-	**$16.10**	**$2.80** 0–10,000	**$3.84** 10,001–15,000	**$5.34** 15,001–25,000	**$7.50** >25,000	-	-	**$24.50**	**$35.70**	**$44.10**
Oakland Park, City of[c]	October 2010	-	**$12.54**	**$4.19** 0–3,000	**$4.86** 3,001–8,000	**$5.75** 8,001–14,000	**$6.64** >14,000	-	-	**$25.11**	**$44.55**	**$60.91**
Royal Utility Corporation[d]	August 2010	-	**$11.19**	**$2.87**	-	-	-	-	-	**$19.80**	**$31.28**	**$39.89**
Seminole Tribe of Florida Utility[e]	NA	-	-	**$3.39**	-	-	-	-	-	**$10.17**	**$23.73**	**$33.90**

a. NA – not available.
b. Water provided by Coconut Creek and resold by this utility.
c. Water provided by Broward County Water & Wastewater Services and resold by this utility.
d. No rate structure.
e. Service provided by the Town of Davie.

Table E-9. Continued.

Utility Name	Effective Date	Utility Tax	Single Family Residential Water Rates Cost per 1,000 gallons							Cost per 3,000 Gallons	Cost per 7,000 Gallons	Cost per 10,000 Gallons
			Base Charge	1	2	3	4	5	6			
Sunrise, City of (in city)	October 2010	10%	**$14.35**	**$2.81** 0–30,000	**$3.57** >30,000	-	-	-	-	**$25.06**	**$37.42**	**$46.70**
Sunrise, City of (outside city)	October 2010	-	**$17.94**	**$3.51** 0–30,000	**$4.46** >30,000	-	-	-	-	**$28.47**	**$42.51**	**$53.04**
Sunrise, City of (Southwest Plant)	October 2010	-	**$15.15**	**$3.74**						**$25.68**	**$40.64**	**$51.86**
Tamarac, City of	NA[a]	-	**$9.57**	**$1.80** 0–6,000	**$2.24** 6,001–15,000	**$2.64** >15,000	-	-	-	**$14.97**	**$22.61**	NA
Tindall Hammock Irrigation and Soil Conservation District[b]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wilton Manors[c]	NA	10%	**$28.36**	**$3.47** 0–15,000	**$4.34** 15,001–30,000	**$5.42** >30,000	-	-	-	**$42.65**	**$57.92**	**$69.37**
Miami-Dade County												
Americana Village	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Florida City Water and Sewer Department	NA	-	**$6.10**	**$0.00** 0–2,000	**$2.00** >2,000	-	-	-	-	**$8.10**	**$16.10**	**$22.10**
Homestead, City of	April 2010	-	**$7.01**	**$0.80** 0–3,000	**$1.11** 3,001–9,000	**$1.30** 9,001–14,000	**$1.75** >14,000	-	-	**$9.41**	**$13.85**	**$17.37**
MDWASD	October 2011	-	**$3.20**	**$0.50** 0–3,740	**$3.00** 3,741–6,750	**$3.90** 6,751–12,716	**$5.16** >12,717	-	-	**$4.70**	**$15.08**	**$26.78**
North Miami, City of	July 2012	25%	**$11.40**	**$1.73** 0–5,000	**$2.42** 5,001–12,000	**$3.11** 12,001–20,000	**$3.46** >20,000	-	-	**$20.74**	**$31.11**	**$42.78**
North Miami Beach, City of	October 2011	-	**$11.94**	**$2.94** 0–7,000	**$3.28** 7,001–12,000	**$4.08** >12,000	-	-	-	**$20.76**	**$32.52**	**$42.36**
Monroe County												
Florida Keys Aqueduct Authority	May 2011	-	**$13.04**	**$5.47** 0–6,000	**$8.00** 6,001–12,000	**$8.96** 12,001–30,000	**$9.99** 30,001–50,000	**$10.97** >50,000	-	**$29.45**	**$56.39**	**$80.39**

a. NA – not available.
b. Previously Ferncrest Utilities, Inc.
c, Water provided by the City of Fort Lauderdale and resold by this utility.

WATER CONSERVATION VERSUS DEVELOPMENT OF ALTERNATIVE WATER SUPPLIES

For many utilities, water conservation can be more cost-effective than developing alternative water supply solutions. The costs associated with three alternative water supply development scenarios were evaluated:

- Full facility construction, between 1 and 5 million gallons per day (MGD), using the Surficial Aquifer System (fresh water) or the Upper Floridan aquifer (brackish water) as the water source.
- Expansion of current facility production through the addition of a low pressure reverse osmosis (RO) train.
- Expansion of current facility production using a nanofiltration train.

Alternative Water Supply Options

Full Facility Construction

Costs for full facility construction to provide 1 to 5 MGD capacity range from $3.42 per 1,000 gallons for a nanofiltration facility using fresh groundwater, to $11.33 per 1,000 gallons for a low pressure RO facility using brackish groundwater (CDM 2007a, 2007b). Costs include expenses for raw water supply, pretreatment, nanofiltration, or RO process train(s), and post-treatment. Costs such as annual operations and maintenance expenses, and renewal and replacement fund deposits that are not part of the operations and maintenance expense, are also included. The cost estimates presented in this appendix are considered to be order-of-magnitude estimates as defined by the American Association of Cost Engineers and accurate within +50 percent or -30 percent.

Low Pressure Reverse Osmosis Facility Expansion

Facility expansion costs through the purchase and operation of 1 to 5 MGD capacity low pressure RO trains range from $3.69 to $10.38 per 1,000 gallons (CDM 2007a, 2007b). Facility expansion costs include expenses for cartridge filters, membrane feed pumps, pretreatment chemicals, RO membrane units, piping inside the membrane building, cleaning system, instruments and controls, and electrical equipment.

Nanofiltration Facility Expansion

Facility expansion costs for the purchase and operation of 1 to 5 MGD nanofiltration process trains range from $3.13 to $9.07 per 1,000 gallons of finished water (CDM 2007a, 2007b). Facility expansion costs include expenses for cartridge filters, membrane feed pumps, pretreatment chemicals, nanofiltation membrane units, piping inside the membrane building, cleaning system, instruments and controls, and electrical equipment.

Water Conservation versus Alternative Water Supply Options

Typical conservation programs support the purchase and installation of plumbing and irrigation fixtures such as efficient toilets, faucet aerators, showerheads, irrigation spray heads, rain and soil moisture sensors, and computerized irrigation controllers for large-scale irrigation. The cost of 1,000 gallons of water saved is based on the cost of all devices across the service life and the number of gallons saved per day normalized to 1,000 gallons. The actual figure is calculated as follows: [(cost per device x number of devices)/service life/365]/(gallons saved per day by all devices in program/1,000). Water conservation projects exceeding $3.00 per 1,000 gallons of water saved are typically not implemented by utilities; therefore, projects with costs above this threshold were not included in this comparison.

Table E-10 compares the production costs of developing 1,000 gallons of water supply and the costs of saving 1,000 gallons through water conservation. **Table E-11** shows the costs per day to develop 1, 3, or 5 MGD of water supply versus water conservation.

Table E-10. Comparison of alternative water supply development production costs and water conservation costs for 1,000 gallons.

Water Conservation	New Facility Construction		Expansion of Existing Facility	
Typical Retrofit/Replacement Programs	Nanofiltration Capacity 1 to 5 MGD	Low Pressure RO Capacity 1 to 5 MGD	Nanofiltraion Process Train Capacity 1 to 5 MGD	Low Pressure RO Train Capacity 1 to 5 MGD
$0.40 – $3.00	$9.46 – $3.42	$11.33 – $4.41	$9.07 – $3.13	$10.38 – $3.69

Table E-11. Comparison of alternative water supply development production and water conservation costs per day.

		New Facility Construction		Expansion of Existing Facility	
	Water Conservation	Nanofiltration Capacity 1 to 5 MGD	Low Pressure RO Capacity 1 to 5 MGD	Nanofiltration Process Train Capacity 1 to 5 MGD	Low Pressure RO Train Capacity 1 to 5 MGD
1 MGD	$400 – $3,000	$9,460	$11,330	$9,070	$10,380
3 MGD	$1,200 – $9,000	$13,500	$17,430	$12,330	$14,580
5 MGD	$2,000 – $15,000	$17,100	$22,050	$15,650	$18,450

As shown in **Table E-11**, the unit cost per 1,000 gallons of finished water goes down as facility expansion capacity increases from 1 to 5 MGD. In addition to economies of scale, fixed capital costs associated with treatment processes and equipment do not decrease with the reduction in the facility treatment capacity. For example, the fixed capital cost of a deep injection well for concentrate disposal for a 1-MGD low pressure RO water treatment facility is the same as the cost for concentrate disposal for a 5- or 20-MGD low pressure RO

facility. The concentrate disposal cost becomes a much larger component of the total project cost as the facility's expanded capacity decreases. For this reason, many utilities do not consider low pressure RO (or other membrane water treatment process expansions) cost-effective below the 3- to 5-MGD capacity range.

The cost ranges for common water treatment technologies shown in **Table E-11** illustrate an inverse relationship of cost to production. This is due to initial fixed capital costs and economies of scale in production. The cost range for conservation items (per 1,000 gallons saved) relates to the costs for the various conservation items themselves (faucet aerators, toilets, irrigation hardware, etc.) minus any shared costs with end users (via utility rebate programs) and the cost of program administration. The fixed savings rates of each conservation item can have a linear effect on total program cost as the program size increases, in contrast to common water treatment technologies. Once administrative and end user shared costs have been established, the costs and savings rates of the individual conservation items are likely to be the strongest driver of conservation program expenses.

Within the 1- to 5-MGD capacity range that was evaluated, the unit cost for the production of new water using an upgraded technical process is nearly identical for the costs of capacity expansion of an existing facility and the construction of a new facility. Both water supply development cost options are significantly higher than the cost of water conservation. In addition to being cost-effective, when properly planned and monitored, conservation can be as reliable as an alternative water supply source in many cases.

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