EFFECTIVE USE OF RECLAIMED WATER DEMONSTRATED TO OFFSET WATER DEMAND

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BACKGROUND

The District has cooperatively funded reclaimed water projects since FY 1987 in order to offset (replace) existing or proposed high quality ground and surface-water withdrawals. In order to obtain a detailed inventory and profile of the offsets achieved to date, District staff researched utility reports, Florida Department of Environmental Protection (DEP) reports, District reports, and consulted utility staff regarding water demands and all known or planned reuse projects. In addition, since FY 1997, the District has required an offset report from its cooperators for all cooperatively funded reclaimed water projects. The offset reports are required to be submitted to the District three years after the completion of the project, and must demonstrate that the project meets specific offset criteria. Thus far the data in these reports, as well as in other reports on irrigation demand and reuse offsets, confirm that the use of reclaimed water directly correlates to reductions in the use of potable and untreated potable quality water. The methodology for determining irrigation demands and offsets is comparable to the methodology used in determining potable supply demands and projections.

MEASURING OFFSETS

Agricultural, Recreational and Industrial (Non-residential) Offsets

The offsets achieved by agriculture, golf course, recreational, and industrial customers are readily quantified, as most of these customer types have meters and were previously using a known quantity of water for a specified purpose (i.e. irrigation of a golf course, supply to a cooling tower). Offsets are determined on a case-by-case basis, and have been tracked since the mid-1980's by utilities, the DEP, and (if cooperatively funded) the District. Table 1 lists the average daily reclaimed water flows and offsets reported by cooperators in the Tampa Bay area (Hillsborough, Pasco and Pinellas counties) as of the year 2000.

Table 1. Non-residential Reclaimed Water Use and Offset in the Tampa Bay Area, 2000

Category	Customers (#)	Use (mgd)	Offset (mgd*)
Agricultural	7	0.7	0.5
Recreational	756	34.2	21.7
Industrial	35	12.2	12.2
TOTAL	**798**	**47.1**	**33.4**

* mgd = million gallons per day

Residential Offset Requires More Analysis

The number of residential reclaimed water customers and the associated utilization amounts are readily quantified. According to residential reclaimed water use data reported by cooperators in the Tampa Bay area, as of the year 2000, there were 31,300

residential customers using nearly 28 million gallons per day (mgd) of reclaimed water. Determining the offsets achieved by supplying reclaimed water to residential customers requires more in-depth analysis. Measuring offset can be difficult, as most residential irrigation use is measured (metered) together with interior water uses such as showers, toilet flushing, and clothes washing. In addition, a number of factors can influence residential potable water use. These factors include, but are not limited to, climatic conditions, water rates, the degree of customer education, plumbing retrofit programs, and requirements such as irrigation restrictions.

Irrigation Meter Studies

Landscape irrigation is generally the targeted water demand to be offset with reclaimed water. As such, a good indicator of offsets achievable by each residential customer is the average amount of water used by a single-family residence for irrigation. Some irrigation systems are separately metered from indoor potable use, and some utilities have compiled measured, long-term data on the average amount of water used for irrigation. Data from three recently completed reports demonstrate an average of 395 gallons per day (gpd) per single-family residence of potable water used for irrigation, as illustrated in Table 2.

Table 2. Metered Potable Irrigation Use

Utility	Source	Per Customer Use (gpd)
Tampa Water Department	*City of Tampa STAR Potable Irrigation Meter Study*, 2002	404
Tampa Water Department	*City of Tampa City 2001 Irrigation Meter Use by Residential Customers, 2002*	349
Manatee County Utilities	*Manatee County Potable Irrigation Meter Use 1990-2001*, 2002	432
Average		**395**

Reclaimed Water Irrigation Use Studies

Data is readily available from utilities that investigated the amount of potable water used by residential customers prior to reclaimed water service, and the amount of potable water used by the same customers after reclaimed water service was provided. These data clearly demonstrate that reclaimed water projects reduced potable water demand. For example, Table 3 illustrates data from reclaimed water projects in Pinellas County that resulted in an average of 330 gallons per day of potable water offset per single-family residence.

Table 3. Potable Offsets by Residential Reclaimed Water Service

Utility Name	Source	Per Customer Offset (gpd)
Largo Reclaimed Water	*Potable Water Use Study-Del Robles Subdivision*, 1995	261
Pinellas County Utilities	*Reclaimed Water Savings and Economic Impact in Tierra Verde*, 1999	544
Pinellas County Utilities/St. Pete Beach Reclaimed Water	*Reclaimed Water Savings and Economic Impact in St. Pete Beach*, 1999	296
St. Petersburg Utilities	*Florida Water Resources Journal*, August 2001	220
Average		**330**

Tampa Bay Water

Tampa Bay Water and their consultant (Hazen and Sawyer) have reviewed data to quantify residential irrigation use, existing potable water offsets, and the impact of water conservation and reclaimed water efforts on future potable water demand. In conjunction with this review, the District's use of 300 gpd per single-family residential reclaimed water system hook-up is reasonable. In addition, Tampa Bay Water's 1998 *Regional Water Supply Demand Management Implementation Plan* indicates that the use of reclaimed water would offset 250 to 335 gpd per single-family residential reuse customer. Tampa Bay Water's consultant's report on long term demand forecasting, scheduled to be completed in 2003, is also expected to include information on reuse offsets and its impact on demand.

Per Capita Water Use

The per capita water use has generally declined within the District, although fluctuations are evident during prolonged drought periods, such as 1999 and 2000. The overall decline in per capita use is attributed, in part, to the utilization of reclaimed water in lieu of traditional sources. (*Water Supply Needs and Sources*. SWFWMD, 1992.)

CONCLUSION

Available data that can be used to determine if the use of reclaimed water in lieu of potable (either treated or untreated) water sources reduces water demand have been described previously in the paper and include: (1) potable irrigation meter studies, (2) pre-post reclaimed water service studies, (3) utility's pre-project analysis for their reclaimed water cooperative funding project applications, (4) Tampa Bay Water data, and (5) per capita water use. The methodology for determining irrigation demands and offsets is comparable to the methodology used in determining potable supply demands and projections.

Upon evaluation of the data as described in this paper, it is clear that reclaimed water service to customers previously using potable-quality water sources results in the offset of those sources. The total estimated offset of potable-quality sources achieved by the year 2000 in all user groups within the Tampa Bay area is summarized in Table 4.

Table 4. Reclaimed Water Use and Offset in the Tampa Bay Area, 2000

Category	Customers	Use (gpd)	Offset (gpd)
Agricultural	7	0.7	0.5
Recreational	756	34.3	21.7
Industrial	35	12.2	12.2
Residential	31,303	27.9	9.3
Total	**32,101**	**75.1**	**43.7**

St. Petersburg Reclaimed Water System Demonstrated to Offset Potable and Non-Potable Water Demand (2002 Data)

The City of St. Petersburg's initial reclaimed water system was cooperatively funded by the US EPA and the City starting in 1977, and grew into one of the largest and most emulated reclaimed water system in the nation. To sum up the potable water benefits related to St. Petersburg's investment in reclaimed water, *"The growth in the reclaimed water system demand since 1977 has significantly contributed to suppressing potable water demands"* (William D. Johnson, Director of St. Petersburg Public Utilities Department, 1998). The District has cooperatively funded St. Petersburg reclaimed water projects since FY 1991 in order to offset (replace) existing potable quality water uses.

Available data that can be used to determine if the use of reclaimed water in lieu of potable (either treated or untreated) water sources reduces water demand include: (1) potable irrigation meter studies, (2) pre-post reclaimed water service studies, (3) utility's pre-project analysis for their reclaimed water cooperative funding project applications, (4) Tampa Bay Water data, and (5) per capita water use. The methodology for determining irrigation demands and offsets is comparable to the methodology used in determining potable supply demands and projections. Upon evaluation of the data it is clear that reclaimed water service to customers previously using potable, ground, and surface water sources results in the offset of those sources. District and City staff concurred on methodology and amounts for the total estimated offset of potable and non-potable sources achieved by the year 2000 in all user groups in St. Petersburg. An updated version with 2002 data is summarized below.

Reclaimed Water Use and Offset in St. Petersburg, 2002

Category	Customers (#)	Use (mgd1)	Potable Offset (mgd1)	Non-Potable Offset (mgd1)	Total Offset (mgd1)
Agricultural	0	0	0	0	0
Recreational	437	6.38	0.96	2.87	3.83
Golf	6	2.76	0	2.07	2.07
Industrial	20(2)	1.84(3)	1.38	.46	1.84
Residential	9801	9.09	1.59	0.54	2.13
TOTAL	**10,264**	**20.07**	**3.93(4)**	**5.94**	**9.87**

1 mgd = million gallons per day.
2 Many industrial customers are listed as commercial customers by the City.
3 Amount of use reported to FDEP (2.32mgd) reduced to eliminate extraneous uses at WWTPs.
4 According to data supplied by St. Petersburg, between 1984 and 2002 the City reduced their total potable water demands by more than 11 million gallons per day. The reduction was achieved through multiple water conservation measures including irrigation restrictions, low volume toilet retrofit projects, indoor fixture retrofit projects and approximately 4 mgd in offsets achieved by their reclaimed water system.

Customer types and offset methodology include the following:
Recreational includes recreational, aesthetic, and commercial irrigation use and offset is calculated at 60 percent efficiency of which ¼ is associated with potable offset and ¾ non-potable offset. Examples of customers include parks, schools and businesses.

Golf includes only golf course use and offset is calculated at 75 percent efficiency with all offsets associated with non-potable water.

Industrial includes process and cooling water uses. Offset is calculated at 100 percent efficiency of which ¾ is associated with potable offset and ¼ non-potable offset. Examples of customers include the City's four wastewater treatment plants process water, Tropicana Field cooling towers, Ceridian cooling towers, and St. Anthony's Hospital cooling tower.

Residential includes single-family irrigation use (927 gpd City 2002 average) and offset is calculated at 217 gallons per day (gpd) per customer of which ¾ is associated with potable offset and ¼ non-potable offset.

RECLAIMED WATER OFFSET REPORT. The CITY must submit a report, three years after PROJECT completion, documenting that at least fifty percent (50%) of the PROJECT's reclaimed water, offsets existing or planned ground water or surface water withdrawals under normal operating conditions. The report will show the average annual daily flows three years previous and three years post reclaimed water, and the number of active reclaimed water customers. The CITY will obtain the DISTRICT's approval of the report before the report is finalized, and the DISTRICT will not unreasonably withhold its approval. This provision will survive the term of this Agreement.

Example Three-Year Post Construction Reclaimed Water Offset Report

(For Example Purposes Only)

Evening Shade Reclaimed Water Project (K000)

In response to a Cooperative Funding Initiative request from the City of Evening Shade, the Manasota Basin Board approved the funding of this project as part of their fiscal year (FY) 2000 budget. The reclaimed water transmission and distribution project consisted of the construction of approximately 27,500 linear feet of a 12-inch reclaimed water transmission main, and 60,000 linear feet of 2-inch to 4-inch distribution lines.

The Evening Shade Reclaimed Water Project's main is designed to supply reclaimed water to the western area of the City along Reynolds Road. The project is providing reclaimed water service to "Jupiter Heights" residential subdivision, 12 commercial customers, two small City parks, the Jupiter Heights Golf Course, one industrial cooling tower at the City Hall and small local tree farm. The main part of the project is to provide reclaimed service to the residential development that consists of 1200 single-family homes that were previously using potable and well water for irrigation.

The project was anticipated have 720 active customers who would utilize 0.9 mgd of reclaimed water supply at build out (2010). The overall project cost was estimated at $4,000,000 and the offset at build out was estimated at 0.5 mgd. The estimated cost/benefit for this project was $1.98/1000 gallons. Construction was completed on budget on January 29, 2001; eleven months ahead of schedule and the project has since been online and supplying customers.

The City is continuing their commitment to the efficient use of reclaimed water and the conservation of the potable water supply. This is being accomplished through education of the public, daytime watering restrictions, requiring property owners to discontinue the use of potable water for irrigation purposes when reclaimed water is available, and all City reuse projects include the installation of individual meters coupled with volume based rates for all customer types.

The following information is to comply with the Reclaimed Water Offset Report requirement (50% minimum efficiency) (*Note: All Projects funded after FY2001 are 50% minimum efficiency)* contained in the SWFWMD Funding Agreement 00CON000000 (Paragraph 7 in exhibit A).

The project has 700 active (online and using reuse) residential reclaimed water customers, out of the total 1200 residences in the subdivision that received reclaimed water connection boxes as part of the project. Of the 700 active users, 633 were previously using potable water for all their irrigation needs, and 67 were primarily using deep wells with some supplemental potable irrigation. To date a total average of 548,100 gpd of reclaimed water is being supplied to offset 227,000 gpd of potable water

and 30,000 gpd of groundwater for a total residential offset of 257,000 gpd (annual daily average).

The project has 8 active commercial irrigation customers (of the 12 potential) that utilize an average total of 25,833 gpd to offset 15,500 gpd of potable water.

Both of the project's anticipated recreational park customers connected to the reuse system and have utilized an average of 8,257 gpd of reuse to offset 6,193 gpd of potable water previously used for irrigation of Fields Park and Anderson Park.

The Jupiter Heights Golf Course connected to the system and uses an average of 258,000 gpd of reclaimed water to offset 193,500 gpd of groundwater previously used for irrigation.

The Evening Shade City Hall connected their air conditioner cooling tower to the system and has been utilizing an average of 20,000 gpd of reclaimed water to offset 20,000 gpd of potable water previously used by the tower.

The Bandit Tree Farm is the project's lone agricultural customer and has utilized an average of 25,000 gpd of reclaimed water to offset 18,750 gpd of groundwater that it previously used for irrigation.

The project's 713 active customers represent a 59% connection rate, which complies with 50% minimum connection rate specified in the Cooperative Funding Initiative Agreement for the project (1217 total service boxes installed).

The total project utilizes an average of 885,190 gpd of reclaimed water to offset an average of 510,943 gpd of traditional water sources (268,693 gpd potable and 242,250 gpd deep well offsets), which results in a 58% Offset Efficiency (complies with 50% minimum offset efficiency specified in the Cooperative Funding Initiative Agreement).

Evening Shade Reclaimed Water Project (K000) Calculations
See Attached Spreadsheet

3 YEAR RECLAIMED WATER OFFSET REPORT SPREADSHEET FOR THE EVENING SHADE RECLAIMED WATER PROJECT (K000)

Customer Type	Number of Reclaimed Water Services Installed in the Project Service Area	Number of Active Connections (online & using reuse) in the Project Service Area	Pre-Reuse Total Potable Consumption (domestic + irrigation), gpd	Post-Reuse Total Potable Consumption gpd	Actual Reclaimed Water Use gpd	Potable Offset gpd	Deep Well Offset gpd	Total Offset gpd
Single Family Residential	1200	700	527,000	300,000 gpd	548,100 gpd	227,000 gpd	30,000 gpd	**257,000 gpd**
Commercial	12	8	(37,945 + 7,570) = 45,515 gpd	30,015 gpd	25,833 gpd	15,500 gpd	0	**15,500 gpd**
Recreational	2	2	6,193 gpd	0	8,257 gpd	6,193 gpd	0	**6,193 gpd**
Golf	1	1	N/A	N/A	258,000 gpd	N/A	193,500 gpd	**193,500 gpd**
Industrial (cooling tower & process water)	1	1	50,000 gpd	30,000 gpd	20,000 gpd	20,000 gpd	0	**20,000 gpd**
Agricultural	1	1	N/A	N/A	25,000 gpd	N/A	18,750 gpd	**18,750 gpd**
Natural System Restoration	0	0	N/A	N/A	N/A	N/A	N/A	**N/A**
Project Totals	**1217**	**713**	**628,708 gpd**	**360,015 gpd**	**885,190 gpd**	**268,693 gpd**	**242,250 gpd**	**510,943 gpd**

Notes:

1. The Project had a **Total Project Offset of 510,943 gpd.**
2. The Project had a total **Offset Efficiency of 58%**
(510,943 gpd in offsets divided by 885,190 gpd in reclaimed use)
3. The Project had an average residential use of 783 gpd and average offset of 367 gpd.
4. The Project has a **Connection Rate of 59%** (713 divided by 1217 customers).

Reclaimed Water Customer Type and Efficiency

Approximate Beneficial Offset to the Environment

Industrial and Power Generation **100%**
(normally use the same regardless of source)

Agricultural and Recreational/Aesthetic **75%**
(normally do not over-water)

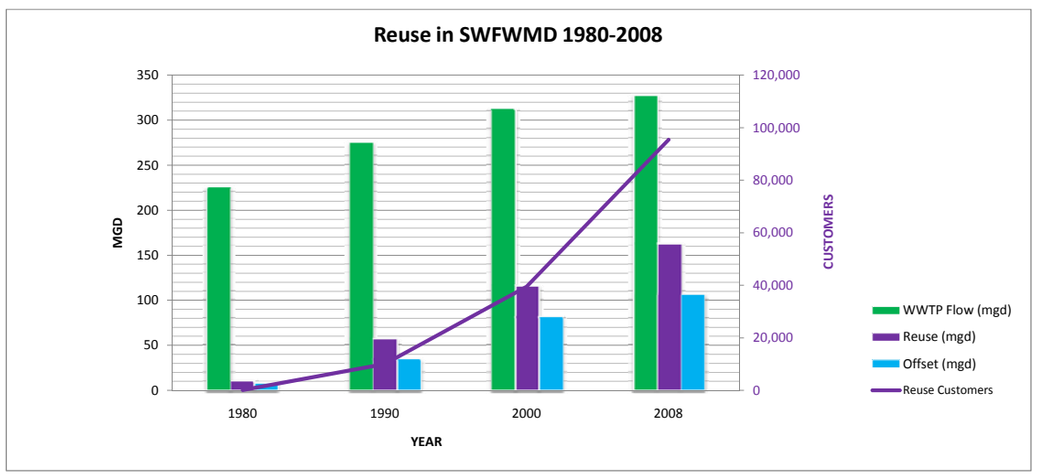
Public Supply Irrigation **40%**
(25%-35% for flat rate, 45%-55% for metered)

All Type Customer Average **60%**
(1/4 Ind&PG, 1/4 Ag.&R/A, and ½ PS)

Appendix N: 2008 District Totals Summary Page

County	IND			RAC			AG			GC			RES			NSR			Total					Disposal				
	Flow	Offset	# of Cus	Flow	Offset	# of Cus	Flow	Offset	# of Cus	Flow	Offset	# of Cus	Flow	Offset	# of Cus	Flow	Offset	# of Cus	WW	Reuse	Offset	# of Cus	Stored	Spray	RIB	Surface	Deepwell	Total
CHARLOTTE	0.28	0.28	1	0.05	0.03	5				2.36	1.77	15	0.34	0.21	685				8.91	3.12	2.29	706	0.18	0.57	0.18		4.39	5.14
CITRUS										0.02	0.02	1							3.38	0.02	0.02	1		2.10	1.59			3.69
DESOTO				0.05	0.03	1	0.39	0.29	7	0.15	0.12	1	0.01	0.00	1				1.12	0.60	0.44	10		0.40	0.17	0.01		0.58
HARDEE	0.72	0.72	2																1.11	0.72	0.72	2		0.39				0.39
HERNANDO	0.83	0.83	1							1.56	1.17	4							4.68	2.40	2.01	5			2.29			2.29
HIGHLANDS																			1.99	0.00	0.00	0		0.03	1.96			1.99
HILLSBOROUGH - NTB[1]	12.09	12.09	7	1.88	1.13	66	0.31	0.23	1	0.99	0.74	14	8.90	4.36	14,529				81.05	26.04	20.42	14,617		0.01	0.22	65.11		65.34
HILLSBOROUGH - SWUCA	5.82	5.82	12	0.80	0.48	10				1.03	0.77	7	3.69	1.19	3,980				17.06	9.46	6.40	4,009		0.64	0.10	8.15		8.89
LAKE[2]				0.10	0.06	9				0.68	0.51	6																0.00
LEVY																			0.16	0.00	0.00	0		0.16				0.16
MANATEE	0.08	0.08	3	2.31	1.39	25	4.60	3.45	5	2.05	1.54	9	8.90	3.13	10,425				26.85	17.94	9.58	10,467				4.76	4.00	8.76
MARION[3]				0.36	0.21	2				1.07	0.80	6							2.72	1.43	1.02	8		0.67	0.58			1.25
PASCO	0.36	0.36	2	2.85	1.71	62	0.54	0.40	4	3.36	2.52	20	9.50	4.04	13,476				26.65	16.60	9.04	13,564	0.18	0.73	8.81			9.54
PINELLAS	7.49	7.49	36	10.87	6.52	1034	0.01	0.01	1	7.20	5.40	43	28.98	11.84	39,456				95.97	54.56	31.36	40,570	1.18			24.95	14.77	39.72
POLK[4]	8.11	8.11	9	0.63	0.38	6	0.44	0.33	3	0.78	0.58	9	1.54	0.90	3,000	0.21	0.21	1	28.27	11.71	10.51	3,028		2.75	4.70	11.33		18.78
SARASOTA				1.13	0.68	39	0.27	0.20	2	7.48	5.61	42	3.72	2.47	8,243				21.62	12.62	8.98	8,326		1.91	0.05	4.19	2.95	9.10
SUMTER[2]				1.74	1.04	10				2.77	2.08	23							5.65	5.29	3.70	48		0.31	0.21			0.52
Totals	**35.78**	**35.78**	**73**	**22.77**	**13.66**	**1269**	**6.56**	**4.91**	**23**	**31.50**	**23.63**	**200**	**65.58**	**28.14**	**93,795**	**0.21**	**0.21**	**1**	**327.19**	**162.51**	**106.49**	**95,361**	**1.54**	**10.67**	**20.86**	**118.50**	**26.11**	**176.14**

[1] **Portions (~10 mgd) of Tampa's Reuse go to a closed loop system at CF Industries and are classified as both Reuse and Disposal**
[2] **Sumter totals includes reuse from The Villages WWTP in Lake Co. (~0.78 mgd)**
[3] **Portions of Flows come from WWTP outside of District**
[4] **Portions (~2 mgd) of Lakeland's Reuse go to the Lakeland power plant and also gets discharged as blowdown into the wetland system**



Reuse in SWFWMD 1980-2008

	1980	1990	2000	2008
WWTP Flow (mgd)	225	275	311.78	327.19
Reuse (mgd)	10	57	115.53	162.51
Offset (mgd)	7.5	34	81.2	106.49
Reuse Customers	150	10,000	39,468	95,361

1980 Data via survey of utility historical data
1990 Data via interpolation of 1992 FDER (FDEP) Reuse Inventory data (no 1990 Reuse Inventory produced)
2000 and 2008 Data via respective FDEP Reuse Inventory data
Note: 2008 data represents the most recently published FDEP data