

**FINAL**

**CITY OF TAMPA**

**LANDSCAPE WATER AUDIT**

**AUGUST 1993**

**HDR**

Tampa

**HDR** Engineering, inc.  
Suite **300**  
5100 W. Kennedy Blvd.  
Tampa, FL  
**33609-1806**

## 1.0 INTRODUCTION

### 1.1 scope of services

The City of Tampa and HDR Engineering entered into a **project** agreement for The City of Tampa Landscape Water **Audit and Improvement** Program. This program was made available through a **cooperative funding agreement** with Southwest Florida Water **Management District**. Specifically, the **scope of** services provided by HDR Engineering, Inc. **to** the City of Tampa were as follows:

- Participate in the landscape and water audit of twenty-five **(25) properties** taking **part in the program**.
- Prepare a **property-specific** Action/Site Plan with site data and recommendations for landscape/irrigation improvement.
- Prepare a brief data summary for all twenty-five (25) sites.
- Contact audit site **manager/owner** and **determine** mechanism for accomplishing landscape/irrigation improvements.
- Landscape/irrigation improvements, verify implementation of the Action Plan, and arrange for reimbursement to owner.

### 1.2 water **Conservation** in Florida

Florida normally receives ample **rainfall** during the year, however, the **rainfall** is not equally distributed throughout the year. The fifty (50) inches or so of rain received annually in Florida is concentrated between June and October. This results in drought periods requiring outdoor irrigation for turf and landscaped areas.

Typically, Florida residents use approximately 150 gallons of water per capita per day (**gpcd**) with statewide water use estimated at a ~~50/50~~ split for indoor and outdoor use. Outdoor irrigation accounts for much of our water use. A water conserving landscape will save on water, energy, and maintenance.

### 1.3 History of the City of Tampa Water Conservation Program

In 1989, the City of Tampa began implementation of its comprehensive **water** conservation program. The goals of this program are: (1) to reduce average day demands by **fifteen** percent by 1999, and (2) to reduce the dry **season** (March 15 - June 15) to average day demand ratio to **1.10:1.0**.

**Tampa provides water service** to approximately 1 **15,000 clientele**. Apartments, commercial **properties**, and educational **facilities** comprise approximately **thirty-six percent** of average daily water use and consume more than **25-million** gallons of water each day.

The 1992 program targeted **multi-family** and commercial water users, as well as educational facilities. The **program "keyed-in"** on large **outdoor** water users by sending a letter of interest (**Appendix A, Exhibit 1**), to **approximately 285** clients consistently paying a surcharge on water **used** for irrigation. In addition the client was **required** to have a separate irrigation meter. This **letter** described the voluntary water audit program and encouraged participation.

#### **1.4 purpose/-**

The purpose of this program was to sponsor research at twenty-five **(25)** selected **properties** to **determine** irrigation efficiency and potential for improvement. Recommendations concerning **irrigation** and landscaping improvements were offered for implementation. A follow-up will **determine** water use, **efficiency** and cost **effectiveness** of the implemented programs.

#### **1.5 Project Objectives**

- To determine irrigation efficiency of apartments and commercial properties.
- To recommend **landscape** improvements and offer incentives to implement changes to allow for comparative analysis.
- To create and promote **case** studies for this class of **water** customers.
- To recognize businesses for exemplary performance regarding outdoor water conservation efforts.

## 2.0 PROJECT TEAM

This water conservation **program** relied on the diverse expertise of its team members. West Coast Regional Water Supply Authority (**WCRWSA**) addressed irrigation system uniformity, **efficiency**, scheduling and design. They produced the irrigation section of the individual evaluations.

The Master Gardeners under the supervision of the Hillsborough County Cooperative Extension **Service assisted** in the audit and offered special expertise in landscape design, landscape **materials**, and landscape **maintenance** practices to conserve **water**.

The Soil Conservation **Service** (SCS) was also instrumental in evaluating irrigation system criteria.

**HDR Engineering coordinated** the team effort audits, prepared action reports, and coordinated implementation programs and reimbursement.

### 3.0 LANDSCAPE/WATER AUDIT

The letter of participation sent out to 285 high-water users did not produce an over abundance of interested clients. A short, one-page questionnaire was returned to the Tampa Water Department (Appendix A, Exhibit 2). The questions determined the qualifications and audit-interest of the client. The results of this questionnaire are quantified in Table 1. The questionnaires, with the name and phone numbers of a contact person, were forwarded to HDR Engineering for follow-up phone calls. Every contact person was called and twenty-five (25) audits were scheduled. (Appointments were made in groups of 6 or 8; two appointments per week were scheduled monthly.) Audits were generally scheduled for Monday and Tuesday mornings. Length of time required per audit varied with size of property and complexity of landscape and irrigation system. Table 2 lists audit sites and dates. Audits began July 7, 1992 (with one "practice" audit on May 11, 1992), and extended through November 17, 1992.

The twenty-five participating sites included business complexes (28%), private commercial properties (28%), multi-family developments (condominiums, apartments, etc.--32%), and educational facilities (12%).



Table 1 - Continued  
 Water Conservation **Questionnaire** Results

PERCENT LAWN WATERED WITH PERMANENT IRRIGATION SYSTEM																											
0-25%																											
26-50%																											
51-75%																											
76-100%																											
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	

9

SOURCE OF WATER USED IN LANDSCAPE																											
Metered City Water																											
Privately Owned Well																											
Both City and Well Water																											
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	

Table 1 - Continued  
 Water Conservation Questionnaire Results

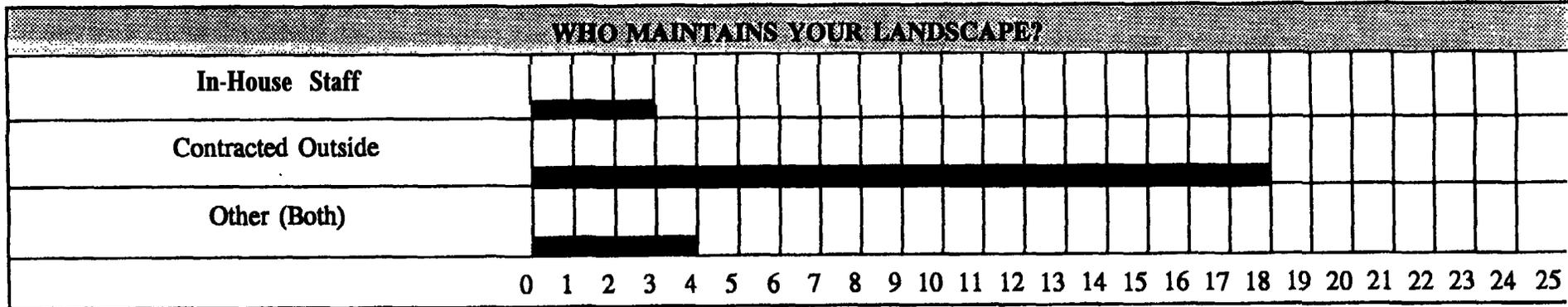
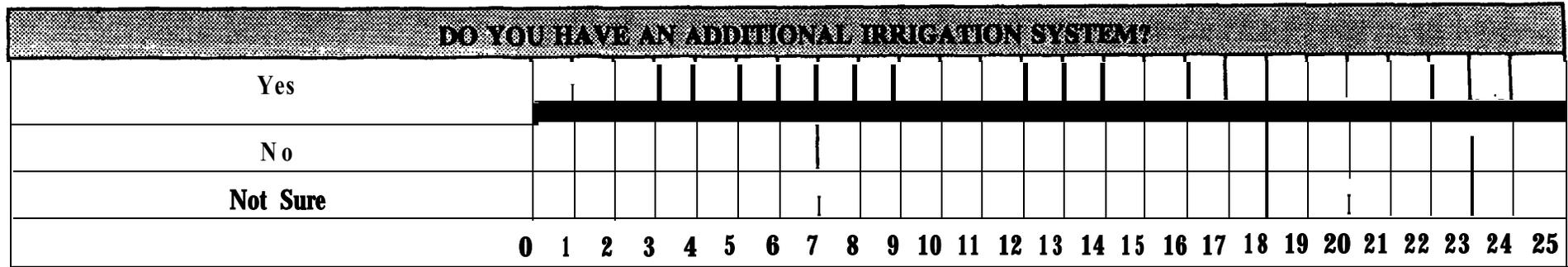


Table 2  
Audit Sites

DATE	Site No.	AUDIT SITE
05/11/92	0	Banyan Club Apartments (Practice Audit), 4302 Gunn Highway, Tampa, Florida 33624
07/07/92	1	Seddon Cove (Attn: Geoffrey Langdon), Harbour Island, 777 South Harbour Island Boulevard, Suite 270, Tampa, Florida 33602
07/14/92	2	Sylvia Campbell, OMDOPA (Attn: Kelly Allen), 217 Matanzas Avenue South, Tampa, Florida 33609
07/20/92	3	Instructional Services Center (Attn: William H. Taylor), 3993 East 21st Avenue, Tampa, Florida 33605
07/21/92	4	Concord Center Institute (Attn: Thomas L. Buck), 4202 West Spruce Street, Tampa, Florida 33609
07/27/92	5	Dominoes Pizza Distributor (Attn: James B. Lucas), 6704 Park East Boulevard, Tampa, Florida 33610
07/28/92	6	Crown Herald (Attn: Tim Parker), 590 South Johns Road, Tampa, Florida 33634
08/03/92	7	Paragon Group (Attn: Beth Dwyer), Bay West Commerce Park, 5660 West Cypress Street, Tampa, Florida 33607
08/17/92	8	Island Chateau Condominium (Attn: Dean Xenick), 160 Columbia Drive, Tampa, Florida 33606
08/18/92	9	Bay Plaza I (Attn: Jennifer Rendahl), 932 South Bay Plaza Boulevard, Tampa, Florida 33619
08/31/92	10	Sabal Homes of Florida, Inc. (Attn: Jim Lee), Post Office Box 951, Brandon, Florida 33509
09/08/92	11	Sabal Corporation (Attn: Jan Imbriani), 3720 Princess Palm Avenue, Tampa, Florida 33619
09/13/92	12	Luby's Cafeteria (Attn: Paul Bohn/Riddley Ruth), 11616 North Nebraska, Tampa, Florida 33613
09/15/92	13	Ban Ex Corporation (Attn: Mary Lynn Banning/Chip Denyko), 5755 Hoover Boulevard, Tampa, Florida 33611
09/21/92	14	Fletcher Regency c/o Burt Company (Attn: Lynn Heard), 238 East Davis Boulevard, Tampa, Florida 33606
09/22/92	15	Fireman's Fund Insurance Company (Attn: James Blake), 5310 Cypress Center Drive, Tampa, Florida 33609
09/28/92	16	Loscien Professional Center (Attn: Mike Robinson), 6302 Benjamin, Suite 400, Tampa, Florida 33634
09/29/92	17	Beaumont Business Center, Inc. (Attn: Cheri Herring), 5411 Beaumont Center Boulevard, Suite 755, Tampa, Florida 33634
10/05/92	18	Cimarron Apartments (Attn: Mary Gonzales), 7314 Jackson Springs Road, Tampa, Florida 33364
10/12/92	19	Spinnaker Cove Condo Association (Attn: Allene Dierkscheide), 4334 Arbor House Drive, Tampa, Florida 33615
10/19/92	20	Adeste Condominiums (Attn: Rozanne Clark), 4341-4379 Bayshore, Green Acre Properties, 4131 Gunn Highway, Tampa, Florida 33624
10/20/92	21	Bayshore Presbyterian Apartments (Attn: Beverly Marshall), 2909 Barcelona, Tampa, Florida 33629
10/26/92	22	5001 Cypress Street Entrance (Attn: Jack Cohen), Suite 500, Tampa, Florida 33607
11/03/92	23	Beach Place Runaway Center (Attn: Barry Drew), 201 Beach Place, Tampa, Florida 33606
11/10/92	24	Westchester Manor (Attn: Ben Stinson), 9039 Westchester Circle, Tampa, Florida 33604
11/17/92	25	MacDill Federal Credit Union (Attn: Paul Rayfield), 6701 South Dale Mabry, Tampa, Florida 33611

#### 4.0 IRRIGATION AND LANDSCAPE EVALUATION

An Environmental Landscape Management **Commercial** Questionnaire and cover letter (Appendix A, Exhibit 3) was mailed in advance of audits or **filled** out on-site at each audit. This **questionnaire provided** information on site analysis, planting and landscape design, irrigation, **fertilization**, pest control, mowing, mulching, pruning, recycling and information sources. Blue **prints** and schematics of the landscape and irrigation **system** were requested but **often** were not available. The attendance of **maintenance personnel** or someone **familiar** with the irrigation system was also requested and **sometimes** unavailable. This was found to be very useful not only for the auditors' information and benefit, but also for "educating" the maintenance/management personnel. (There was a positive correlation between actively **participating** site personnel and actual implementation of the recommendations.) **The** team audit generally "walked through" each operating irrigation zone making appropriate notes on **landscape/irrigation** recommendations. At this time, recommendations on scheduling **were** made (time per zone, irrigation days per week, and seasonal variations). Scheduling changes **were suggested** and **encouraged** which would substantially decrease water use. Whenever possible, these scheduling changes were discussed with the client or landscape/irrigation **maintenance personnel**. **The recommended** schedules were also included in the written evaluations/reports **mailed to the client**.

West **Coast** Regional Water **Supply** Authority (**WCRWSA**) operated their Mobile Irrigation Laboratory Evaluation Program. This program was developed by the University of Florida's Institute of Food and **Agricultural** Sciences. The program evaluates the irrigation system through a series of field tests for uniformity, adequacy, and efficiency. Previous WCRWSA audits show that water use efficiency averages approximately forty percent, meaning that sixty percent of the irrigation water is wasted. Through improvements to irrigation equipment, scheduling, management, and design, a maximum of eighty percent efficiency can be achieved. Recommendations were made on the basis of the results of these tests as well as field observations. Problems resulting from inadequate maintenance and repairs were often observed on site. Other frequent recommendations involved problems resulting from maturing **landscapes** requiring taller risers or overgrown turf interference. Broken heads, **leaks** and other **repair-**related problems were noted. The frequent inspection of systems was emphasized particularly those in parking lots and other busy areas. "Best Management **Practices**" were routinely included in recommendations as well as a basic irrigation scheduling and individual recommendations based on observations of each zone.

The **landscape** design and **maintenance** evaluation listed specific recommendations for observed problem spots seen in the landscape. **Xeriscape** landscaping principles were encouraged. **Xeriscape** landscaping is defined as quality landscaping that conserves water and protects the environment. The recommendations promoted through the **landscape/water** audit were based on the seven basic principles of **Xeriscape** landscaping:

1. **Planning and design** - This is the most important step for a **successful Xeriscape** landscape. It often includes cost-minimizing phased installation.

2. **Appropriate plant selection** - Well-adapted, drought tolerant plants are necessary **as** well as “the right plant for the right place.”
3. **Soil analysis** - Matching plants to soil **pH** and drainage factors is important.
4. **Practical turf areas** - Turf is a big water user and should be located only in areas where it is **necessary**.
5. **Efficient irrigation** - Efficient irrigation systems must **be** properly designed, **operated**, maintained, and scheduled.
6. **use of mulches** - **Mulches** retain moisture, reduce weeds, control soil temperatures and erosion, and are aesthetically pleasing.
7. **Appropriate maintenance** - **Proper** mowing, pruning, weeding, fertilization, pest control, and irrigation improve the efficiency of **the** landscape.

Common recommendations included reduction of turf areas, especially in mixed **turf/landscape** zones or narrow or otherwise “impractical” turf areas. The replacement of turf with drought tolerant groundcovers and replacement of “thirsty” annuals with low-water use **perennials** were often recommended. An automatic rain shut-off **device** was recommended at every site. Whenever possible, verbal on-site recommendations were made to management or **maintenance personnel**. An irrigation/landscape evaluation was sent to each site with a cover letter (**Appendix A, Exhibit 4**) explaining the program and encouraging participation.

The client was encouraged to determine the **recommendations** to be implemented. Follow-up phone calls to each site were made to answer any questions and aid in determining the most useful and water-efficient implementation program. If a tight budget threatened implementation, the client was encouraged to look at inexpensive but water-efficient recommendations such as irrigation repairs and a rain shut-off **device** as well as scheduling and maintenance practice **alterations**.

## 5.0 IMPLEMENTATION OF RECOMMENDATIONS

Of the original twenty-five (25) sites audited, twelve (12) sites followed through with **implementation** of some recommendations and were reimbursed for half of their total costs. **Reimbursable** amounts (half of total costs) ranged from \$117.38 to **\$6,581.00** (See Table 3). **The** average amount was \$2,500. The total amount reimbursed for the twelve (12) sites was **\$29,254.51**. Implemented recommendations ranged **from** adding a rain shut-off device and **repairing** broken nozzles to retrofitting a landscape and irrigation system (See the twelve **Individual** Water Audit Reports-Table 3). For the most part, even the **thirteen (13)** sites which chose not to follow through with recommendations, benefitted from the program.

**Every** site was different! It would be difficult to find a correlation in amount spent and water **saved**. There were too many variables. For the most part, clients were willing to make major changes only if they had already budgeted for major irrigation/landscape projects. Some of the more **successful** implementation sites, such as Island Chateau Condominiums and Beach Place Department of Children's Services, involved enthusiastic volunteers. **Other successful** site managers **worked** very closely with a maintenance crew or landscape nursery that were themselves very **involved, concerned** and knowledgeable about water conservation. This included Beaumont Business Center and Sabal Park. The landscape maintenance service at Beaumont Business Center actually absorbed twenty percent of the landscaping costs. The landscape maintenance service at Sabal Park initiated some major drip irrigation retrofits and other changes.

Table 3  
Tampa Landscape and Water Audit Program Participants

#	AUDIT SITE	REIMBURSABLE AMOUNT	CHECK DATE
1	Sylvia Campbell, OMDOPA 217 Matanzas Avenue South, Tampa, Florida 33609	\$134.00	01/28/93
2	Island Chateau Condominium 160 Columbia Drive, Tampa, Florida 33606	\$3,550.71	03/11/93
3	Bay Plaza I 9325 Bay Plaza Boulevard, Suite 212, Tampa, Florida 33619	\$5,786.08	04/30/93
4	Sabal Park 3720 Princess Palm Avenue, Tampa, Florida	\$1,786.98	05/15/93
5	Luby's Cafeteria 11616 N. Nebraska, Tampa, Florida 33613	\$1,197.50	05/19/93
6	Ban Ex Corporation 5755 Hoover Boulevard, Tampa, Florida 33611	\$1,055.00	04/01/93
7	Beaumont Business Center, Inc. 5411 Beaumont Center Blvd., Suite 755, Tampa, Florida 33634	\$6,581.00	04/08/93
8	Spinnaker Cove Condo 4334 Harbour House Drive, Tampa, Florida 33615	\$3,438.16	03/11/93
9	Adeste c/o Green Acre Properties 4131 Gunn Highway, Tampa, Florida 33615	\$917.50	05/15/93
10	5001 Cypress Properties 5001 Cypress Street, Suite 500, Tampa, Florida 33607	\$117.38	04/30/93
11	Beach Place Department of Children's Services 201 Beach Place, Tampa, Florida 33606	\$2,950.20	03/18/93
12	Westchester Manor 9039 Westchester Circle, Tampa, Florida 33604	\$1,740.00	04/22/93
<b>TOTAL</b>		<b>\$29,254.51</b>	

## 6.0 IRRIGATION DURATION/SCHEDULING REVISIONS

It was discovered that in every case recommendations could be made for scheduling changes, which saved the client water -- sometimes up to sixty-six percent savings by rescheduling. This **included** reducing zone times, **eliminating** irrigation days (cutting back from **two** times per week to once per week), and/or initiating seasonal irrigation schedules (See Table 4). Table 4 shows the approximate potential water savings based on changes to the irrigation duration. This change is shown in **annual** estimated water use before and after scheduling changes as well as the potential dollars and gallons to be saved.

Additionally, specific duration revisions are listed on the twelve individual water audit reports for the implementing sites.

Settings were recommended based on irrigation type (spray or rotor), vegetation irrigated (turf and non-turf), aesthetic quality necessary, irrigation output, and other **landscape-specific** items. Seasonal recommendations were also made such as:

<b>Non-turf</b>	1 time per week	April-October
	<b>1 time every 2 weeks</b>	Other months
<b>Turf</b>	1 time every 4 days	April - October
	1 time per week	November and March
	1 time every 10 days	Other months

Spray - 15 minutes / Rotor (turf) - 45 minutes / Rotor & Spray/zone - 30 minutes

**In** some instances, it was possible to recommend irrigation of some zones one time per week and others two times per week. If the clock was not capable of this demand, two clocks could be utilized by rewiring one clock for one time per week zones and the other clock for two times per week zones.

In most cases, irrigation duration/scheduling revisions were the simplest, most cost-effective, and efficient means of reducing irrigation water demands. However, it should be noted that there was no way of "enforcing" these recommendations other than relying on educating the client and demonstrating cost savings. When the site manager was present during the site review, we requested permission to reschedule time clocks. This included changing the irrigation days to correct watering days and time-of-the-day as well as changes in zone duration.

Table 5 West Coast Regional Water Supply Authority's Site Water Usage Summary

Evaluation Site Completed	Annual Estimated Water Use Per Year At Current Duration	Annual Estimated Water Use Per Year With New Duration	Approximate Annual Dollars Saved With Duration Changes	Approximate Annual Gallons Saved With Duration Changes
Seddon Cove Condominium	<b>\$1,316.97</b>	\$939.50	\$377.47	366,476
Sylvia Campbell, OMDOPA	\$324.60	\$193.06	\$131.54	127,709
Instructional Services Center	\$351.30	\$316.22	\$35.08	34,058
Dominoes Pizza Distributor	\$558.08	\$310.29	\$247.79	240,573
Crown Herald	\$910.18	\$576.71	\$333.47	323,757
The Paragon Group	<b>\$2,036.97</b>	\$999.06	<b>\$1,037.91</b>	<b>1,007,680</b>
Island Chateau Condominium	<b>\$1,009.46</b>	\$406.39	\$603.07	585,505
<b>Sabai Homes of Florida, Inc.</b>	\$693.95	\$693.95	\$ 0 . 0 0	<b>0</b>
Ban Ex Corporation	<b>\$1,166.37</b>	\$977.61	\$188.76	183,262
<b>Fletcher Regency</b>	<b>\$0.00</b>	<b>\$201.83</b>	<b>(\$201.83)</b>	<b>(195,951)</b>
<b>Fireman's Fund Insurance Company</b>	<b>\$941.19</b>	<b>\$768.07</b>	<b>\$173.12</b>	<b>168,078</b>
<b>Loscien Professional Center</b>	<b>\$1,041.84</b>	<b>\$353.51</b>	<b>\$688.33</b>	<b>668,282</b>
<b>Beaumont Business Center</b>	<b>\$1,552.04</b>	<b>\$1,156.58</b>	<b>\$395.46</b>	<b>383,942</b>
<b>Cimarron Apartments</b>	<b>\$1,418.59</b>	<b>\$1,150.89</b>	<b>\$267.70</b>	<b>259,903</b>
<b>Spinnaker Cove Condo Association</b>	<b>\$1,712.02</b>	<b>\$1,182.63</b>	<b>\$529.39</b>	<b>513,971</b>
<b>Adeste Condominiums</b>	<b>\$420.93</b>	<b>\$210.47</b>	<b>\$210.46</b>	<b>204,330</b>
<b>5001 Cypress Street Enterprise</b>	<b>\$263.08</b>	<b>\$131.54</b>	<b>\$131.54</b>	<b>127,709</b>
<b>Beach Place Runaway Center</b>	<b>\$0.00</b>	<b>\$172.55</b>	<b>(\$172.55)</b>	<b>(167,524)</b>
<b>Westchester Manor</b>	<b>\$1,112.47</b>	<b>\$1,315.80</b>	<b>(\$203.33)</b>	<b>(197,408)</b>
<b>ANNUAL TOTALS</b>	<b>\$16,830.04</b>	<b>\$12,056.66</b>	<b>\$4,773.38</b>	<b>4,634,350</b>

## 7.0 WEST COAST REGIONAL **WATER** SUPPLY AUTHORITY **MOBILE** IRRIGATION LABORATORY RESULTS

Table 6 is a summary of the initial mobile irrigation laboratory results of West Coast Regional Water Supply Authority.

The prime objective of the Mobile Irrigation Laboratory program is to determine and make management recommendations on the proper usage of irrigation systems. Pre-evaluation information is collected from the client and on-site field data is collected utilizing a series of different data points. The information is entered into a computer program to determine distribution uniformity, potential efficiency, **deficit** fraction, and application rate adequate for a particular system.

A definition of the following terms is necessary to understand the results of the summary sheet.

### Distribution of **Uniformity**

The distribution uniformity (**DU**) is a measure of how evenly water is applied by the **sprinklers**. When a **perfectly** uniform application is made the DU is one-hundred percent. In the field a DU of seventy percent or higher is considered good. As **DU decreases**, the potential efficiency of the system also decreases, since some of the plants and turf will receive insufficient water and others will be overwatered.

### Potential Efficiency

The potential **efficiency (PE)** is the amount of water which could be beneficially used by the turf to satisfy the water needs compared to the total amount of water applied. No irrigation system is completely uniform, therefore some areas of the lawn are overwatered and some are underwatered. A PE of less than seventy-five percent usually indicates a design or maintenance problem.

### Deficit Fraction

Due to water use restrictions, cost of water, or management decisions, some areas of the soil do not receive the amount **of** water needed to fully replenish the **turf root** zone. This area is referred to as the under-irrigated area. The deficit fraction (**DF**) attempts to answer the question-”Is the area a little under-irrigated or severely-under-irrigated?” A deficit fraction of forty percent or lower is presently considered **acceptable** in turf.

### **Maximum Allowable Depletion**

**Refers** to water loss in the root zone. How much water reduction should be allowed before irrigation occurs? This “wilt” stage is generally at fifty percent.

### Irrigation Adequacy Level

This **term refers** to the aesthetic or functional quality required for the **turf/landscape**. The more highly visible the site is or the higher the aesthetic quality required, the longer or more frequent the irrigation duration. The level is dependent on water restrictions. The “average” **turf/landscape** Irrigation Adequacy Level is fifty percent for maintaining a healthy, attractive lawn/landscape.

Distribution uniformity is determined by **use** of a timed catch-can test to measure volumes. In addition, pressures and flows are taken at each rotor type sprinkler head so that discharge variations and pressure variation can be evaluated.

Understanding these terms, the sites can be **evaluated** using Table 6. Since the Distribution Uniformity (**DU**) should be seventy percent or higher to be considered good, it is discouraging to note that none of the seventeen (17) **sites** received a seventy percent rating. The ratings ranged from a high of sixty-six percent for Sabal Homes of Florida to a low of seven percent for the area tested at Seddon Cove Condominiums. The average DU for the seventeen (17) tested sites was thirty-eight percent. (It should be noted that eight (8) sites **were** not tested with catch-cans because of increased wind **velocities** due to seasonal weather fluctuations, i.e., frequent afternoon showers.)

The Potential Efficiency (**PE**) is affected by DU, so it follows that PE rates are generally low also, although three (3) sites are seventy-five percent or better (Sabal Homes-7896, Ban Ex **Corporation--80%**, and **Loscien** Professional Center-75%).

The sites with Deficit Fraction (**DF**) ratings considered acceptable (**<40%**) include Sylvia Campbell's office - **34%**, Crown Herald - **35%**, Island Chateau Condominiums - **28%**, Sabal Homes - **21%**, Sabal Corporation - **32%**, Ban Ex - **30%**, and Beaumont Business Center - 24%. The average is forty-four percent.

The Average Application Rate is a **numerical** average of all catch-can data converted into inches per hour and varies from **.11** inches per hour to **.46** inches per hour, with an average of **.28** inches per hour. Pressure variations vary from seven percent to ninety-two percent. Discharge variations vary from six percent to one-hundred-sixty-one percent.

A listing of Common Irrigation Problems and Solutions offered by WCRWSA follows Table 6.

Table 6  
Mobile Irrigation Laboratory Results

Site Name	Site #	Discharge Variation (%)	Pressure Variation (%)	Matching Ratio Variation (%)	Average Application Rate (in/hr)	Maximum Allowable Depletion (%)	Irrigation Adequacy Level (%)	Potential Efficiency (%)	Reported Field Efficiency (%)	Deficit Fraction (%)	Distribution Uniformity (%)	Uniformity Coefficient (%)
Seddon Cove Condominiums	1	161	23	298	0.27	50	50	31	16	72	7	21
Sylvia Campbell, OMDOPA	2	90	71	191	0.12	50	50	70	55	34	46	58
Instructional School Services	3	26	15	103	0.31	50	50	71	56	56	27	50
Concord Career Institute	4											
Dominoes Pizza Distributor	5	20	7	20	0.27	50	50	44	29	52	17	19
Crown Herald	6	11	19	11	0.17	50	50	70	55	35	45	61
Paragon Group	7	66	36	213	0.32	50	50	62	47	42	37	46
Island Chateau Condominiums	8	55	71	46	0.42	50	50	71	56	28	53	61
Bay Plaza I	9	138	92	138	0.46	50	50	53	38	72	11	28
Sabal Homes of Florida, Inc.	10	24	17	24	0.28	50	50	78	59	21	66	74
Sabal Corporation	11	35	10	35	0.55	50	50	74	63	32	55	65
Luby's Cafeteria	12											
Ban Ex Corporation	13	104	14	284	0.16	50	50	80	65	30	55	69
Fletcher Regency	14											
Fireman's Fund Insurance Co.	15	6	9	6	0.38	50	50	73	58	64	17	45
Loecien Professional Center	16	66	15	82	0.11	50	50	75	60	54	44	66
Beaumont Business Center	17	142	78	142	0.13	50	50	63	48	24	51	58
Cimarron Apartments	18											
Spinnaker Cove Condo Assoc.	19											
Adeste Condominiums	20											
Bayshore Presbyterian Apts.	21											
5001 Cypress Street Ent.	22											
Beach Place Runaway Ctr.	23											
Westchester Manor	24											
MacDill Federal Credit Union	25											
<b>Averages</b>		<b>67.43</b>	<b>34.07</b>	<b>113.79</b>	<b>0.28</b>			<b>65.36</b>	<b>50.36</b>	<b>44.00</b>	<b>37.93</b>	<b>51.50</b>
<b>Standard Deviation</b>		<b>50.12</b>	<b>38.94</b>	<b>96.76</b>	<b>28.94</b>			<b>13.40</b>	<b>13.40</b>	<b>16.87</b>	<b>18.12</b>	<b>17.08</b>

## WEST COAST REGIONAL WATER SUPPLY AUTHORITY COMMON IRRIGATION PROBLEMS/ SOLUTIONS

**BROKEN SPRINKLER HEADS** - Turn on each irrigation zone and visually examine it. If any **sprinkler** heads are broken, make sure that zone is shut off until repairs can be made. Several sprinkler types have replacement parts. Those without may need to be **replaced** completely. **Make** replacements with the same type components. This is very important because substituting parts can change the uniformity, pressure, and application rate of the designed irrigation system. An irrigation supply store should provide adequate **replacement** components and information.

**MIXED SPRINKLERS** - Sprinklers with **different** application rates are often used within the same zone. Sprayhead type sprinklers, commonly used for shrub areas and sometimes for turf, have higher application rates than rotor type **sprinklers**. When the two types are mixed in the same zone, the shrubs are generally overwatered while the **turf** receives the correct application. To correct this problem, shrubs and turf should be placed on separate zones.

If the controller has room for an additional **zone**, one could be added. If the controller is full, a new zone could be added and operated manually. Unless this problem is severe, it may be more effective to reduce the irrigation duration for that particular zone.

**TURF INTERFERENCE** - A common problem with both turf and shrubs is that the vegetation often interferes with the sprinkler spray pattern. Turf height, overgrowth and large shrubs can interfere with sprinkler trajectories. The only way to correct this problem is to turn the system on and **visually** inspect each zone. Trim vegetation where needed or, if necessary, add an extension to the sprinkler head (for pop-ups consider replacing heads). Trimming may be necessary several times during the year. This should be undertaken as an active component of your landscape management plan.

**UNMATCHED PRECIPITATION RATES** - Sprinklers are designed to cover **different** arcs of a circle (**90, 180, 360-degrees**). The flow rates should be selected to match the arc covered by the **sprinkler**. A sprinkler covering a **90-degree** arc should **deliver** half the flow (ex: 1.3 gpm) of a similar sprinkler covering a **180-degree** arc (ex: 2.5 gpm). These would be **considered** matched sprinklers.

It is often **easier** for the **installer** to use the same gpm head, **regardless** of placement, than to spend additional time and money installing the proper sprinklers. This is a very common problem with turf **sprinklers**. A nozzle or head replacement should rectify this depending on your brand of sprinklers.

**BASIC IRRIGATION SCHEDULE** - **Observe** local water restrictions regarding time and day. It is best to apply water during the early hours of the morning. Otherwise, irrigate by demand and consider skipping your day when there is significant rain (0.5" or more). The soil will only hold a certain amount of water. It **does** not help to over-irrigate past the point of **filling** that **volume** of soil containing roots. The irrigation duration should distribute enough water that,

when **applied** less **frequently**, will encourage the development of deeper roots, greater soil moisture storage and promote a more drought tolerant landscape.

Non-turf irrigation should occur once per week during the months of April - October and once every two weeks during other periods. Shrub zones with no turf generally require about 15 minutes of irrigation, but consider plant material (**zeric** plants may require less frequent irrigation). Turf irrigation should occur once every 4 days during the months of April - October and once per week during November and March, and once every 10 days during the rest of the year. These recommen&tions do not consider **rainfall** episodes. Modify irrigation schedules as noted in the first paragraph.

When the time comes to make the seasonal duration changes, use this opportunity to also inspect the irrigation system. Turn on each irrigation zone and visually examine all sprinkler heads (Are they broken, spraying in the wrong direction, or not rotating?). Take notes for later reference. Five minutes of operating time is allowed per zone for this inspection.

A rain shut-off device is also a useful tool to use along with the irrigation controller. They cost about \$30.00. The device can be mounted to an eave or rain gutter away from trees and wired directly to the controller. A local irrigation supply store should offer several types.

---

## **8.0 SITE REVIEW AND REIMBURSEMENT**

All sites were photographed during the original audit site visit and slides dated and captioned. If sites implemented recommendations, **"after"** slide-photos were **also** taken for comparison **value**.

The site review was scheduled after all chosen recommendations were implemented. A "walk through" determined that irrigation and landscape retrofits were properly implemented and installed. Often follow-up suggestions resulted in **further** improvements. Irrigation systems were operated at each zone to assess repairs and improvements. Rain shut-off device locations and settings were checked for **efficient** use. At the **final** site review, the client supplied copies of all paid invoices, receipts, and work orders **for implemented** recommendations. **This** included copies of hourly work **schedules** for on-staff personnel. An invoice for half of the total implementation was billed to HDR Engineering for reimbursement.

## 9.0 ACKNOWLEDGEMENTS

The final task was the dispersal of twenty-five (25) landscape signs acknowledging the participation of the selected sites and sponsors (Appendix A, Exhibit 5). The sign with SAVE IT TAMPA logos acknowledges participants of the City of Tampa Landscape Improvement Program and its sponsors -- Southwest Florida Water Management District, Hillsborough County Extension Service and Master Gardeners, West Cost Regional Water Supply Authority, and the Soil **Conservation** Service. The signs were awarded to each audit site participant along with congratulations for their participation. Hopefully, the sign will be displayed in a prominent site in the landscape to encourage participation and water conservation by others. The signs cost \$90.00 each for a total of **\$2,300.00**.

## 10.0 RESULTS

The detailed results of the landscape water audits, recommendations and implementations **are** found in the tiles of the twelve (12) implemented sites. A summary of each of the twenty-five **(25)** audit sites is included in this report **along** with Audit Reports of the twelve (12) implementing sites (Table 4). The accompanying slides illustrate the **"before"** and "after" landscape retrofits. Additional figures are being tallied by Dr. Glen Israel, Ph.D., Assistant **Professor**, Program **Development** and Evaluation Specialist with **IFAS** at the University of **Florida** in Gainesville. In addition, the City of Tampa will follow-up on several of the implemented sites to **evaluate** their water savings since the retrofits. Water savings at several of these sites should be quite remarkable. There should be definite water savings at all twelve (12) implemented sites, and noticeable savings at most of the **thirteen** (13) other sites which did not actually implement recommendations, but did for the most part, change watering practices **and** schedules. In **addition**, West Coast Regional Water Supply Authority (WCRWSA) has produced a Summary of the mobile irrigation laboratory results of **all** twenty-five (25) sites with averages for use in comparisons, and "before and after" data (Section 7.0). They also did some usage comparisons before and after irrigation scheduling alterations and a list of common irrigation problems and solutions. A summary of the approximate potential water savings based on changes to irrigation duration is insightful and documents projected savings of up to sixty-six percent (average - 28%). (Section 6.0).

Other results which should be emphasized include:

- The water savings as **related** to scheduling/duration changes documented in Table 4 are **especially** meaningful. The importance of water savings based **on scheduling cannot be** over-emphasized, particularly in light of the fact that this is a **"cost-free"** alteration. With scheduling changes, there is no cost of implementation and no cost to the landscape in terms of the aesthetic quality of the landscape. A combination of scheduling changes often reduced outdoor water use in excess of **fifty** percent. This savings was available to **all** participants whether they chose to spend money on implementing recommendations or not.
- The Distribution Uniformity **(DU)**, the measure of how evenly water is applied by the sprinklers, was particularly low for **the** audit sites in general. Since perfect uniformity is rated one-hundred percent, and seventy percent or higher is considered good, it was disappointing that the tested sites averaged thirty-eight percent and that none of the sites received a "good" rating (70% or higher). The DU in turn affects the Potential Efficiency **(PE)**. A low DU **results in a** low PE **as** measured by **the amount of water which could be beneficially used by the turf to satisfy the water needs compared to the** total amount of water applied. In other words, all the sites in the study (which were indicative of Tampa commercial sites in general) were wasting water due to **less-than-**optimal irrigation design.
- There was a **definite** positive correlation between involving the site manager in the actual landscape/water audit and a higher rate of implementation. It is also important to note

that this resulted in a one-on-one “teaching moment” which could have long-term positive **effects** with the manager taking the time to learn about outdoor water conservation.

- No direct positive correlation was found between the amount of money spent for implementation and the amount of water saved. The amount of money spent **appeared** to be based on the amount of money available/budget by the site manager for landscaping/irrigation improvements.. In addition, site managers seemed more **interested** in retrofitting the landscape to the irrigation system rather than retrofitting the irrigation system to the landscape, particularly when larger sums of money were spent for implementation. It **appeared** that managers were more **interested** in “seeing” where the money was going so that changes were made for aesthetic improvement rather than “invisible” irrigation system improvement. The five most expensive implementations were primarily landscaping retrofits design to increase the efficiency of existing irrigation systems (with minor changes). Only one of the five implemented an extensive irrigation **and** landscape retrofit. (See Table 2 for implementation amounts and Table 3 for individual site implementation plans.)
- The project team soon came to realize that certain recommendations would be made for almost every site-including rain shut-off devices, “Best Management Practices,” scheduling alterations, simple irrigation repairs such as broken nozzles and **leaks**, taller risers for a maturing landscape, and **taller** pop-ups for turf **interference**. However, it was also quite evident that every site was unique, and the team provided diverse expertise in recommending **site-specific** irrigation and landscape improvements. Often, the landscape maintenance personnel familiar with the site were helpful in making recommendations.
- Irrigation systems are designed to be unobtrusive and an invisible element of the landscape. They operate during early morning hours when no one is present. **Unfortunately**, “out of sight, out of mind” is a factor. Systems are often neglected and scheduled maintenance is rarely practiced. Systems with broken and clogged nozzles and heads, leaks, and turf/shrub interference were found to be the norm rather than the exception. Poor maintenance results in wasted water and lower quality landscapes. Encouragement of regularly scheduled maintenance checks should be a high priority.

## 11.0 PROGRAM IMPROVEMENT AND RECOMMENDATIONS

This was a pilot project for all involved. It was very much a learning experience with techniques and knowledge **increasing** as the program evolved. It is important to “grow from this **experience**” and provide helpful, useful information for others **interested** in a program of this nature. The following comments, suggestions and recommendations should prove useful to others interested or involved in future landscape water audit programs.

### Implementation With Budgetary Constraints

- It became clear early on that many commercial business enterprises must adhere to budgets already “cast in stone.” If there was no money budgeted for the current year for landscaping or irrigation improvements, it was often very difficult to “find” the money even though the program reimbursed half of the implementation costs and saved on water costs as well. It is therefore, important to introduce this plan well in advance of implementation.
- Because several of the program participants were seemingly enthusiastic but bound by budgetary constraints, a follow-up on non-implementing participants should be encouraged.
- In at least one case, the manager was able to foresee the savings in water costs and use future “water money” for implementing a water conserving project. Sabal Park manager could foresee saving enough water (money!!) over the next year to pay for the **necessary** changes.
- If a client is financially unable to implement, it is often helpful to suggest “Best Management Practices’ and scheduling changes. Often, the client is at least able to make minor irrigation system repairs and add a rain shut-off device. These are inexpensive but highly efficient water conservation measures.

### Comprehensive Approach to Water Conservation

- The comprehensive effort provided **by** diverse team members cannot be **over-emphasized**. In most cases, implementation **involved** improvements/retrofits to the landscape **and** irrigation system. The two parts of the program complement each other and **provide** a more comprehensive approach to water conservation.
- Several clients who became **involved** in the walk-through audit were dismayed at the condition of their irrigation systems. **Irrigation** systems generally operate during the early morning hours and go unobserved by manager/owners. The maintenance of these systems is often a part of a landscape maintenance operation contract. **Clearly**, maintenance is **often** lacking. This prompted several managers to demand better **service**, and in at least one case, a new landscape maintenance service was **retained**.

## Water Conservation Education

- Although the technical irrigation **evaluation** is significant and useful, it should definitely be follow-up with a “plain English” explanation since terms like “potential efficiency” and “deficit fraction” are challenging for some people and mind-boggling for others.
- Education continues to be our best tool for water conservation for residential and commercial water-users alike. The “teaching opportunity” with property managers and **landscape personnel was invaluable. Education material based on** landscape/water audits such as videos or brochures would be worthwhile. It would also be helpful in the future to provide **high-profile** publicity for the program in general.

## Maximizing Program Efforts

- Another reason for low participation may have been a misconceived idea that the client would be “lockxi-in” to expensive retrofitting of the landscape or irrigations system. It must be stressed from the onset of the program that all implementation is voluntary and up to the client.
- The program depends on much one-on-one communication between the coordinator and the client. Even enthusiastic clients tended to be reluctant when it came down to implementing and spending the money. Phone calls, encouragement and reminders were **necessary** to complete implementation. Letters with **deadline** dates were also useful.
- Involving volunteer groups with implementations was often advantageous. Whether working with volunteers (residents) of condominiums or apartments, or volunteers (Master Gardeners and youth garden club) at a youth runaway home, project costs were reduced and enthusiasm tended to promote the goals of the project.
- **Offering** the client an added bonus other than water **conservation** was also helpful. In many cases, beautification of the **landscape** was added incentive. Often there was a reduction in maintenance -- such as mowing and edging. This also was an appealing incentive. In one case, a well thought out drought tolerant landscape including thorny shrubs provide the added benefit of discouraging vagrants in a landscaped parking lot with a history of this problem.

## 12.0 ACKNOWLEDGEMENT OF PROJECT TEAM

The red success of this program goes to an enthusiastic team made up of people with a common motivation **and** goal of water conservation. The diverse expertise of the group members gave the team a **comprehensive** approach to water conservation.

### HDR Engineering

Betsy Davis

### West Coast Regional Water Supply Authority

Dave Bracciano  
Sue Burttle

### Soil Conservation Service

Dave Sleeper  
Gail Huff

### Hillsborough County Extension Service & Master Gardeners

Sydney Park-Brown  
Dorene Bradley  
Allison Murray  
**Norie** Walcott  
**Polly** Ryan