Year 1 of Implementing Smart Irrigation Controllers in Orange County

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Introduction

• Limited water resources in central Florida
  – Limiting groundwater withdrawals to 2013 demand
  – Increasing population past 2013 requires reductions in consumptive water use
  – Over half of residential water use goes to irrigation
Objective

• Evaluate two types of smart controllers to determine whether they can reduce irrigation application of high water users in Orange County
Selection of High Water Users

**Gross Irrigation Requirement (GIR) = 3.0 in/month**

1. $1.5 \times GIR = 4.6 \text{ in/month}$

2. $4 \times GIR = 12.1 \text{ in/month}$

Area where ‘potential cooperators’ were identified

7,407 possible participants
Survey Respondents

- Out of the 7,407 that met the initial study requirements, 843 responded to the questionnaire
On-site Evaluations

IRRIGATION SYSTEM EVALUATION

- Address: 
- Timer location: Garage □ Outside wall □ Other: 
- Original schedule: 
  - A) Start time(s): Mon □ Tue □ Wed □ Thu □ Fri □ Sat □ Sun □ 
  - B) Run time/zone (min): 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7 □ 8 □ 
- Rain sensor: Location: Roofline □ Not connected □ Obstructed □ Misplaced □ Absent □

<table>
<thead>
<tr>
<th>Irrigation Zones (stations)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
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</thead>
<tbody>
<tr>
<td>Zone location from the house</td>
<td>a. Front</td>
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<td>□</td>
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<td>□</td>
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<td>b. Left</td>
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<td></td>
<td>c. Center</td>
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<td></td>
<td>d. Right</td>
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<td>e. Back</td>
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<td>□</td>
<td>□</td>
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<tr>
<td>Sun reaching the zone</td>
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<td>□</td>
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<td>□</td>
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<tr>
<td></td>
<td>b. Mostly sunny</td>
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<td>□</td>
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<td></td>
<td>c. Mostly shady</td>
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<td>□</td>
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<tr>
<td></td>
<td>d. Full shade</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
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<tr>
<td>Plant type</td>
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<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
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<tr>
<td></td>
<td>b. Ornamentals</td>
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<td></td>
<td>c. Mixed (%)</td>
<td>□</td>
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<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Turf Quality (1=Dead, 9=Top Qual.)</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
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<tr>
<td>Num. of irrigation heads</td>
<td>a. Sprinklers</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
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<td></td>
<td>b. Rotors</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
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<td>□</td>
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<td></td>
<td>c. Microirrigation</td>
<td>□</td>
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<td>□</td>
<td>□</td>
<td>□</td>
</tr>
</tbody>
</table>

Irrigated Area: Calculated (Aerial photo) ft² Corrected (in situ) ft²
Flow Test: Run time per zone minutes Meter reading before _______ Meter reading after _______

Comments:

FOR UF USE ONLY
Summary of Final Participants
Smart Technologies

- ET Controller (ET)
  - Rain Bird ESP-SMT

- Soil Moisture Sensor (SMS)
  - Baseline WaterTec S100
Summary of Treatments

• Monitoring Period
  – 10 Nov 2011 through 14 Jan 2013

• Treatments
  – ET
  – ET + Edu
  – SMS
  – SMS + Edu
  – Comparison (MO)
Contractor Installations

- **ET**
  - Contractor programmed with default landscape settings
  - Irrigation allowed daily
  - Contractor rarely interacted with homeowner

- **SMS**
  - Contractor re-programmed time clocks for daily irrigation, 20 minutes for spray and 45 minutes for rotor
  - Burial at 6” depth by loosely packing with soil in a hole
  - Contractor rarely interacted with homeowner
Educational Training

• ET + Edu
  – On-site reprogramming by UF-IFAS
  – Approx. five minute tutorial on how to use the controller

• SMS + Edu
  – Burial at 3” depth inserted into soil column
  – On-site reprogramming by UF-IFAS
    (0.25” per event, 2 events per day, 3 d/wk)
  – Approx. five minute tutorial on how to use the controller
Educational Training

Smart Controller Quick-Start Guide: Baseline WaterTec S100

Smart Controller Quick-Start Guide: Rain Bird ESP-SMT
## Summary of Final Participants

<table>
<thead>
<tr>
<th>Group Name</th>
<th>Soil type</th>
<th>ET&lt;sup&gt;a&lt;/sup&gt;</th>
<th>ET + Edu&lt;sup&gt;b&lt;/sup&gt;</th>
<th>SMS&lt;sup&gt;c&lt;/sup&gt;</th>
<th>SMS + Edu</th>
<th>MO&lt;sup&gt;d&lt;/sup&gt;</th>
<th>Total</th>
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</thead>
<tbody>
<tr>
<td>Hunters Creek A</td>
<td>Flatwoods</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>20</td>
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<tr>
<td>Hunters Creek B</td>
<td>Flatwoods</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>20</td>
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<tr>
<td>Keenes Pointe Area</td>
<td>Sand</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>19</td>
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<td>North Tanner Road Area</td>
<td>Sand</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>5</td>
<td>5</td>
<td>15</td>
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<td>Turtle Creek Area</td>
<td>Sand</td>
<td>4</td>
<td>4</td>
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<td>4</td>
<td>4</td>
<td>20</td>
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<tr>
<td>Waterford Lakes – East</td>
<td>Flatwoods</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>20</td>
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<tr>
<td>Waterford Lakes – South</td>
<td>Flatwoods</td>
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<td>20</td>
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<td>Waterford Lakes – West</td>
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<td>Sweetwater Apopka Area</td>
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<td>5</td>
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<td>13</td>
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<td><strong>Total</strong></td>
<td></td>
<td><strong>28</strong></td>
<td><strong>38</strong></td>
<td><strong>28</strong></td>
<td><strong>38</strong></td>
<td><strong>35</strong></td>
<td><strong>167</strong></td>
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</tbody>
</table>

<sup>a</sup> ET designates cooperators that received a Rain Bird ESP-SMT ET controller  
<sup>b</sup> Edu designates cooperators that received an on-site educational training  
<sup>c</sup> SMS designates cooperators that received a Baseline WaterTec S100 soil moisture sensor  
<sup>d</sup> MO designates cooperators that did not receive a technology
Turfgrass Quality

• What is the turfgrass quality rating?
Preliminary Results

Cumulative Irrigation (in)

- ET
- ET+Educated
- SMS
- SMS+Educated
- Comparison

<table>
<thead>
<tr>
<th>Date (2011-2013)</th>
<th>ET</th>
<th>ET+Educated</th>
<th>SMS</th>
<th>SMS+Educated</th>
<th>Comparison</th>
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<tbody>
<tr>
<td>11/10</td>
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<tr>
<td>2/18</td>
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<td>5/28</td>
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<td>9/5</td>
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<td>12/14</td>
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</table>

- ET: 23%
- ET+Educated: 30%
- SMS: 41%
- SMS+Educated: 49%
Preliminary Results

### Average Weekly Irrigation Application (in)

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Average Weekly Irrigation</th>
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<tbody>
<tr>
<td>Comparison</td>
<td>1.12 ( a )</td>
</tr>
<tr>
<td>ET</td>
<td>0.87 ( b )</td>
</tr>
<tr>
<td>ET+Edu</td>
<td>0.69 ( cd )</td>
</tr>
<tr>
<td>SMS</td>
<td>0.73 ( c )</td>
</tr>
<tr>
<td>SMS+Edu</td>
<td>0.60 ( d )</td>
</tr>
</tbody>
</table>

Average Ratios:
- 1.7-2.5
- 1.3-2.0
- 1.0-1.6
- 1.1-1.7
- 0.9-1.4
Preliminary Results

**Sands**
- GIR Range
- Comparison
- ET
- ET+Edu
- SMS
- SMS+Edu

**Flatwoods**
- GIR Range
- Comparison
- ET
- ET+Edu
- SMS
- SMS+Edu

Cumulative Irrigation Application (mm)

Date (2012-2013)
Preliminary Results

- Turfgrass Quality

<table>
<thead>
<tr>
<th>Season</th>
<th>Average Turfgrass Quality</th>
<th>Comparison</th>
<th>ET+Edu</th>
<th>SMS+Edu</th>
<th>ET</th>
<th>SMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before treatments</td>
<td>6.4 abcd</td>
<td></td>
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<td></td>
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<tr>
<td>Fall 2011</td>
<td>6.7 c</td>
<td></td>
<td></td>
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<tr>
<td>Winter 2011-2012</td>
<td>6.2 d</td>
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<td>Spring 2012</td>
<td>6.6 c</td>
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<tr>
<td>Summer 2012</td>
<td>7.6 a</td>
<td></td>
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<tr>
<td>Fall 2012</td>
<td>7.1 b</td>
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</table>

Note: Comparison, ET+Edu, SMS+Edu, ET, SMS.
Conclusions

• Water savings were achieved by adding a smart controller
• Additional water savings occurred from more accurate programming and homeowner education
• Since turfgrass quality fluctuates with weather regardless of treatment, there may be additional uncaptured water savings
Future Work

• Continued data collection and analyses → 2014
• Develop better benchmarks for over- and under-irrigation
• Commercial properties – Just installed!
  – Four properties located throughout county
  – Selected ET controllers as smart technology
  – Results will be based on comparisons to historical irrigation habits
Questions?