Stanford University
Water Efficiency Program
Pilot Study at the School of Medicine
Locations: SIM1, CCSR, LKSC
Using Weather-based Controllers for landscape Irrigation

WC Program: Marty Laporte, Adam Kern, Jennifer Fitch
SOM Staff: Gary Malinverno, Robert Esqueda, Tom Nye
HydroPoint Data Systems Inc.
May – December 2012
Purpose of Study

- Determine if there are significant water savings from using weather-based (ET) irrigation controllers (product provider’s estimate at start of study was a 23% reduction in water use and in cost for water)
- Identify if water savings can be achieved without detriment to the health and appearance of the landscape
- Determine if cost savings can be attributed to saved water and staff time by using ET controller technology
ET Controller Technology – How it Works

❖ Uses the National Oceanic and Atmospheric Administration (NOAA) weather data, in real time, and from over 40,000 weather stations on government regulated networks, as well as other data sources including Doppler Radar, atmospheric readings and satellite imagery.

❖ The final output is local weather data, accurate at a resolution of 1 sq km.

❖ Weather data includes calculated evapotranspiration (ET). ET factors include: plant water use (based on type of plant), planting density, wind and sun exposure, percent shade, and irrigation efficiency. ET calculations are refined on an hourly basis.

❖ Weather data is sent nightly to each ET controller, via wireless communication networks. Both the data, and the communications, are included in the annual service.

Source: HydroPoint Data Systems Inc. WeatherTRAK Fact Sheets, January 2012
Weather-based (ET) Controllers and Rain Sensor

ET Controllers installed in May 2012 at: LKSC, CCSR, SIM1 and Hagey/Loading Dock

Note: There is currently no metering data for the Hagey/Loading Dock meter, so it is not included in our analysis.
### Pilot Study Site Boundaries

#### Map Key
- Weather-based Controller in pilot study
- Water Meter
- Turf
- Non Turf
- Site Boundary

#### Table:

<table>
<thead>
<tr>
<th></th>
<th>CCSR</th>
<th>LKSC</th>
<th>SIM1</th>
<th>Hagey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Non-Turf (sq ft)</td>
<td>39,659</td>
<td>43,154</td>
<td>13,083</td>
<td>11,509</td>
</tr>
<tr>
<td>Total Turf (sq ft)</td>
<td>51,516</td>
<td>32,079</td>
<td>1,567</td>
<td>0</td>
</tr>
<tr>
<td>Total Landscaping (sq ft)</td>
<td>91,175</td>
<td>75,233</td>
<td>14,650</td>
<td>11,509</td>
</tr>
</tbody>
</table>

Note: CCSR turf removal completed in 3/2013; new total acreage = 1.38 acres
Paid for by Water Conservation Program with assistance from product provider:

- Cost of 6 month trial (May – November 2012) = $9,984.48 (includes service fee, listed below)
- Product provider service fee during Pilot Study (6 months) was $112.50/controller = $675.00 for 6 controllers

If School of Medicine chooses to continue using ET technology after the Pilot Study ends:

- Additional **one-time** cost for School of Medicine to purchase equipment = $13,859.28
- Annual service fee of $225/controller = $1,350.00 for 6 controllers
- **Total cost** to School of Medicine for continuing service = $15,209.28

If School of Medicine chooses **NOT** to continue using ET technology after the Pilot Study ends:

- Original controllers will be reinstalled – paid for by Water Conservation Program, approximate cost of re-installation $3,000 ($ 500 per controller)
Over 1 acre of turf

Landscape installed 2003

Various plant and tree types

Approx. 800 sq. ft. of turf

CCSR

0.71 acre grass conversion to parking lot completed 3/2013
ET Controller Installed

Total 29,269,169 Gallons

Monthly for 2012

Consumption (Gallons)

Month

January
February
March
April
May
June
July
August
September
October
November
December

LKSC
Landscape installed 2010

- Fruit trees
- Herb garden

- Approx. 0.60 acre of Turf
- Approx. 500 sq. ft. of turf
- Approx. 4,000 sq. ft. of turf

Total 7,447,398 Gallons

Monthly for 2012

Consumption (Gallons)

Month

Jan  Feb  Mar  Apr  May  Jun  Jul  Aug  Sept  Oct  Nov  Dec

Historical Averages

2009  2010  2011  2012
Variety of plants & shrubs

Approx. 1,500 sq. ft. of turf

SIM1
Landscape installed 2010

Variety of plants & shrubs

Approx. 1,500 sq. ft. of turf
## Water Savings

Note: negative numbers indicate a decrease from 2011/2012 to 2012/2013

<table>
<thead>
<tr>
<th></th>
<th>CCSR (L1656)</th>
<th>LKSC (L1718)</th>
<th>SIM1 (L1721)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Difference in Gallons per bill period</td>
<td>Difference in average Gallons per day</td>
<td>Difference in Gallons per bill period</td>
</tr>
<tr>
<td>May from 2011 to 2012</td>
<td>-97,539</td>
<td>-6,015</td>
<td>-80,934</td>
</tr>
<tr>
<td>June from 2011 to 2012</td>
<td>-344,454</td>
<td>-6,166</td>
<td>-140,549</td>
</tr>
<tr>
<td>July from 2011 to 2012</td>
<td>-22,141</td>
<td>-1,513</td>
<td>-69,489</td>
</tr>
<tr>
<td>August from 2011 to 2012</td>
<td>62,234</td>
<td>224</td>
<td>-90,732</td>
</tr>
<tr>
<td>September 2011 to 2012</td>
<td>-181,240</td>
<td>-5,192</td>
<td>57,222</td>
</tr>
<tr>
<td>October 2011 to 2012</td>
<td>-121,849</td>
<td>-2,476</td>
<td>-240,183</td>
</tr>
<tr>
<td>November 2011 to 2012</td>
<td>-70,088</td>
<td>-4,053</td>
<td>2,768</td>
</tr>
<tr>
<td>December 2011 to 2012</td>
<td>-80,560</td>
<td>-2,999</td>
<td>73,080</td>
</tr>
<tr>
<td>February 2012 to 2013</td>
<td>23,786</td>
<td>850</td>
<td>-9,874</td>
</tr>
<tr>
<td>March 2012 to 2013</td>
<td>-119,605</td>
<td>-2,741</td>
<td>-25,582</td>
</tr>
<tr>
<td>April 2012 to 2013</td>
<td>66,722</td>
<td>2,614</td>
<td>94,173</td>
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### Annual Savings/Avg. Gallons per Day

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<tr>
<td></td>
<td>-996,411</td>
<td>-2,563</td>
<td>-686,534</td>
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**Total Annual Savings**

-1,938,816

**Total Avg. GPD Savings**

-5,186
ET Controller saved time and money for School of Medicine:

- Controllers automatically adjusted irrigation schedule in response to weather/rain
- When needed controllers were adjusted from computer/smart phone (irrigation off for events, etc.)
- Response time was expedited

### Change in Cost ($ savings) for Landscape Irrigation Water
(Water Use, cost in 2011 vs. 2012 & 2012 vs. 2013*)

*Water cost FY11: $3.51/1,000 gals, Water cost FY12: $3.92/1,000 gals, Water cost FY13: $3.88/1,000 gals*

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<tr>
<td>May (2011 vs. 2012)</td>
<td>212</td>
<td>212</td>
<td>-67</td>
</tr>
<tr>
<td>June (2011 vs. 2012)</td>
<td>1,058</td>
<td>412</td>
<td>172</td>
</tr>
<tr>
<td>July (2011 vs. 2012)</td>
<td>-137</td>
<td>112</td>
<td>-94</td>
</tr>
<tr>
<td>August (2011 vs. 2012)</td>
<td>-475</td>
<td>194</td>
<td>-283</td>
</tr>
<tr>
<td>September (2011 vs. 2012)</td>
<td>729</td>
<td>-210</td>
<td>96</td>
</tr>
<tr>
<td>October (2011 vs. 2012)</td>
<td>488</td>
<td>949</td>
<td>1,160</td>
</tr>
<tr>
<td>November (2011 vs. 2012)</td>
<td>277</td>
<td>-7</td>
<td>39</td>
</tr>
<tr>
<td>December (2011 vs. 2012)</td>
<td>316</td>
<td>287</td>
<td>92</td>
</tr>
<tr>
<td>January (2012 vs. 2013)</td>
<td>438</td>
<td>440</td>
<td>185</td>
</tr>
<tr>
<td>February (2012 vs. 2013)</td>
<td>-92</td>
<td>41</td>
<td>56</td>
</tr>
<tr>
<td>March (2012 vs. 2013)</td>
<td>473</td>
<td>104</td>
<td>35</td>
</tr>
<tr>
<td>April (2012 vs. 2013)</td>
<td>-255</td>
<td>-363</td>
<td>-516</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$ 3,032</strong></td>
<td><strong>$ 2,170</strong></td>
<td><strong>$ 874</strong></td>
</tr>
<tr>
<td><strong>Annual Total savings ($)</strong></td>
<td><strong>$ 6,077</strong></td>
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Cost Benefit/Simple Payback

<table>
<thead>
<tr>
<th>Cost of ET Controllers</th>
<th>Water Cost Savings ($)</th>
<th>Simple Payback</th>
</tr>
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<tbody>
<tr>
<td>(Original pilot study cost: $9,984.48 + Additional cost required for SOM to purchase equipment: $15,209.28) Costs include equipment &amp; service fees</td>
<td>$6,077</td>
<td>4 years</td>
</tr>
<tr>
<td>Total Cost: $25,193.76</td>
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School of Medicine Consumption Ruler

Comparison is normalized by using water use per acre of landscaping

Gallons per Day of Water Used per Acre of Landscaping from May 2011 to April 2012 Bill Periods

Gallons per Day of Water Used per Acre of Landscaping from May 2012 to April 2013 Bill Periods

Gallons per Day of Water Used per Acre of Landscaping from May 2013 to April 2014 Bill Periods
Reasons for Reducing Water Use

➢ Stretching Stanford University’s water resources and supplies
  ▪ Lake Water used for irrigation – stretch finite amount of Lake Water
➢ Reducing demands on system pressure during peak irrigation times
➢ Practice sustainable water management

Felt Lake – December 2006

Felt Lake - August 2001
Summary & Conclusions

• For the three test sites after 1 year with the new equipment:
  – There was a **26% reduction** in water use
    • Average of **5,186 gallons per day saved**
    • Total of almost 2 million gallons saved annually
  – **22% reduction in cost of water**
    • Saved over **$6,000**
  – Reduction in time landscape staff spent onsite
    • Controllers automatically adjust for weather/rain
    • When needed, controllers can be adjusted by remotely using computer or smart-phone
  – Simple Payback (based on water cost savings)
    • Project would be paid off from savings after **4 years**
Any Questions?
Contact the Water Planning & Stewardship team:

suwater.stanford.edu/wps

Water Resources website:

suwater.stanford.edu