This presentation premiered at WaterSmart Innovations

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INNOVATIONS

SmartLink™
Wireless Landscape Network

Roadblocks to Effective Irrigation

Why we have trouble saving water?

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Water Cost & Drought

1. As of 2015 – Average water cost approaching $5.00 per 1,000 gallons in top 50 cities
2. Average 6% increase in 2015 in top 50 cities
3. 41% increase since 2010
4. Extreme/Exceptional Drought

Year	% of USA
2000	4.15
2001	5.12
2002	16.08
2003	17.86
2004	12.55
2005	3.19
2006	7.93
2007	8.63
2008	3.45
2009	2.34
2010	0.44
2011	18.50
2012	17.20
2013	14.63
2014	12.70
2015	11.82
2016	5.16

Source: EPA WaterSense, Circle of Blue Water Survey, US Drought Monitor

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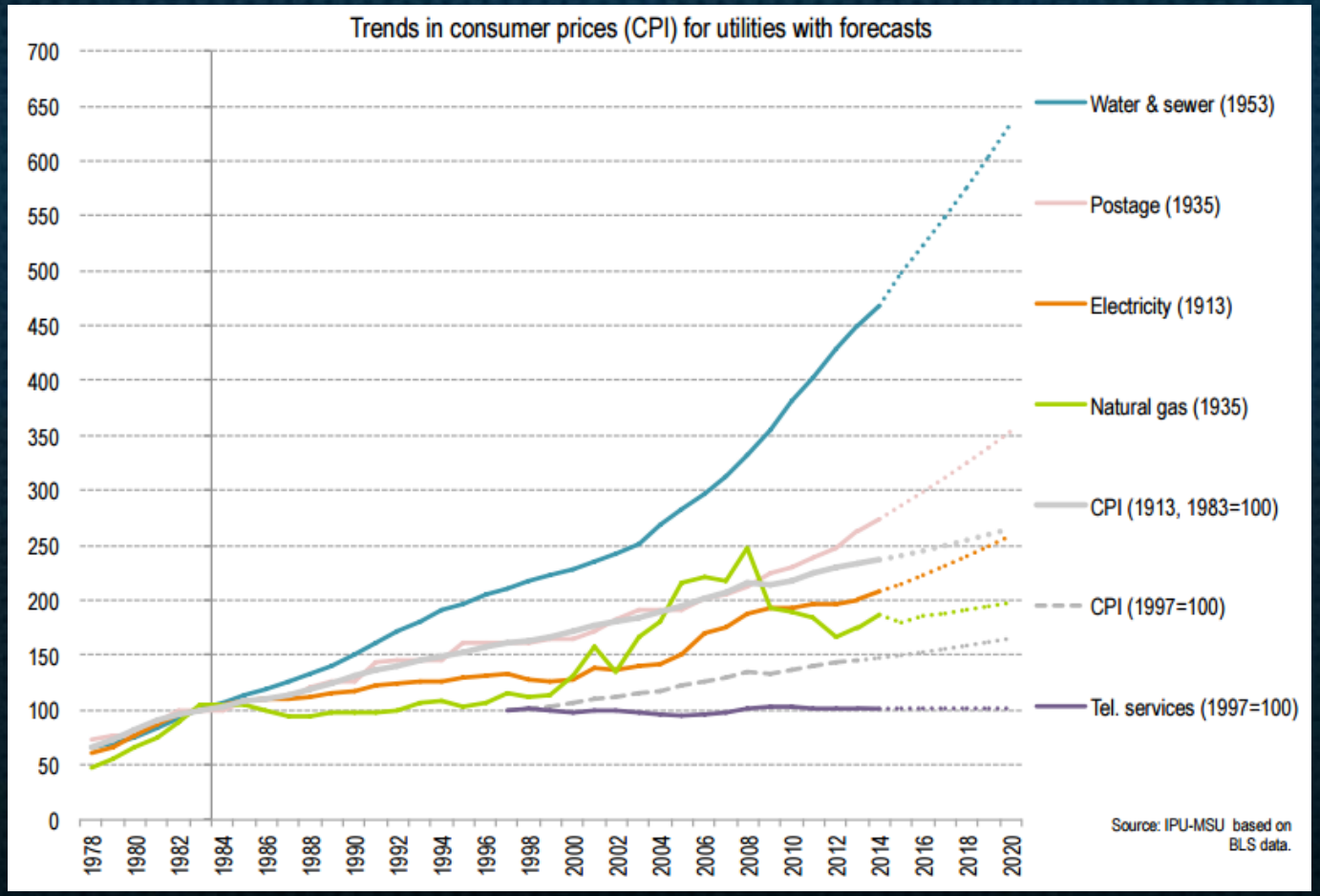
Water Matters More



"The amount that Americans pay for water is rising faster than U.S. inflation and faster than the amount paid to any other utility service — be it gas, electricity, or telephone charges..." Circle of Blue Survey

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Impact of Water Waste Beyond the Water Expense

In other words…..

"Unless we account for how the irrigation system is managed over the long-term, we are wasting our time changing out irrigation equipment"

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Smart Irrigation

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Problem: Still Using Old Technology

Dumb still rules

90%+ of new controllers sold today are not "smart".

Waters only on a schedule

Non-smart controllers don't account for weather, plant type, soil or local conditions.

No remote access for urgent issues

Requires a trip, making it inefficient for responding to issues.

No flow

Water waste due to breaks accounts for 30-40% of loss

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Problem: Mismanaged “Smart” Technology

Lack Maintenance Continuity

High turn over of maintenance personnel and companies

“Smart” is turned off

Some studies estimate 80% of “smart” technology is disconnected or turned off

Lack of Compliance

Project water saving certification/design lacks long term verification of Smart technology compliance

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Problem: Limited Visibility

It only comes out at night

Irrigation typically takes place at night. Water waste often disappears by daylight

Unknown problems

Often sprinkler breaks go undiscovered for weeks

Solo management

Irrigation tech is only person who interacts with irrigation system regularly

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6 Factors of Efficient Irrigation

1. Use Weather/Soil-based Scheduling with Rain Shut-off Device
2. Use Efficient Irrigation Sprinklers
3. Monitor Flow
4. Account for Soil Infiltration
5. Remote Monitor and Control
6. Regular Site Inspections

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#1 Use Weather-based Scheduling with Rain Shut-off

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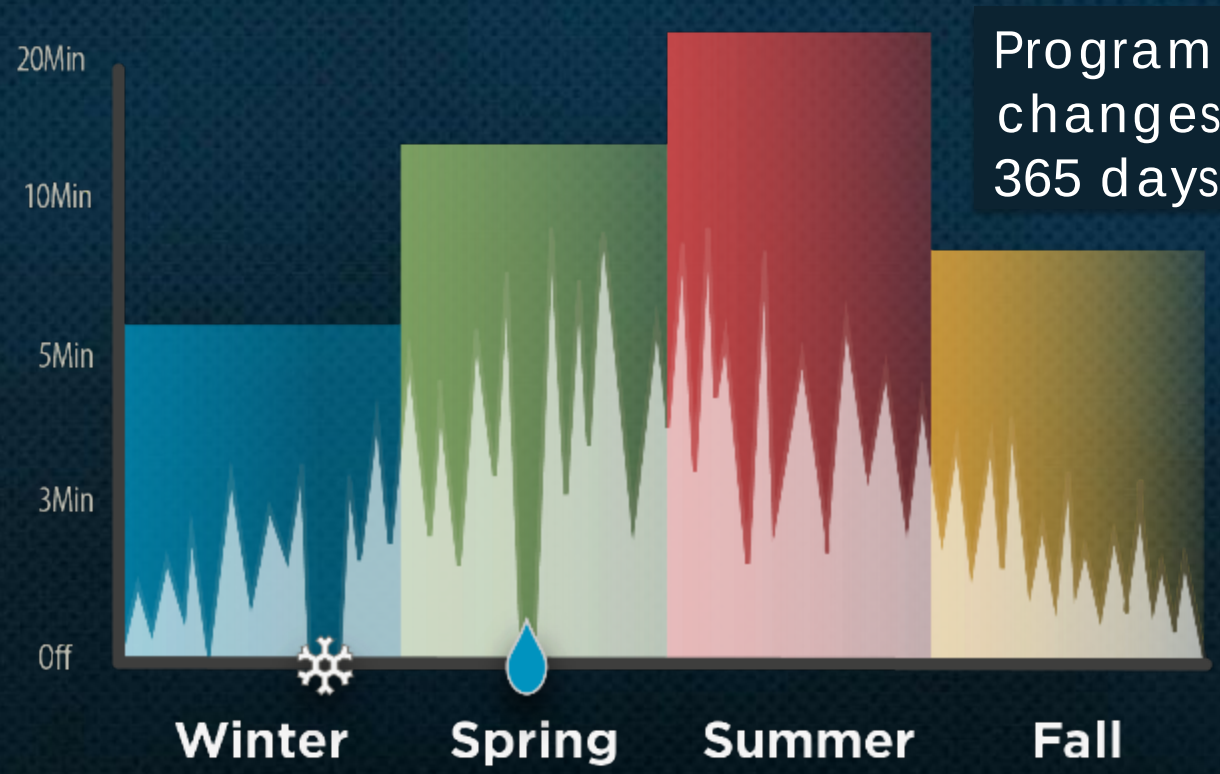
Weather-based Run Times

Smart technology waters for actual plant need



Program changes made 365 days a year

Several studies show most smart controllers will save about 25% of the water applied by a traditional controller.

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Smart Control
Typical Variables Needed

1. Evapotranspiration
2. Local Rain Collection
3. Exposure
4. Sprinkler Application Rate
5. Soil Infiltration Rate
6. Slope
7. Plant Species
8. Root Zone Depth
9. Plant Maturity
10. Plant Density
11. Time of Year
12. Soil Compaction
13. ET Adjustment
14. Tree Canopy

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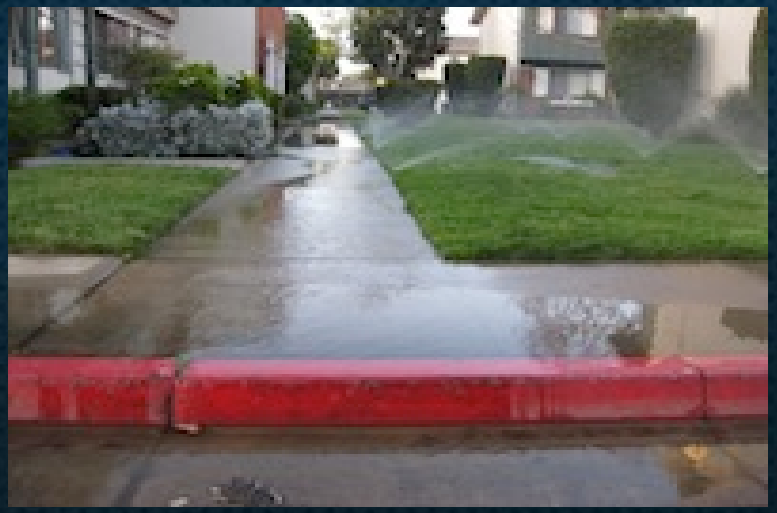
Why “Smart” Controllers Fail



- Complicated technology and/or system set-up
- Data variables not accurate (ie….derived from catalog)
- No easy/quick way to adjust for site specific conditions
- Initial dramatic reduction in total water applied causes plant stress
- Set it and Forget it mentality

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Impact of Water Restrictions on Smart Control

- Day of the Week and Time of Day restrictions cause users to turn “smart” off
- Few regulatory accommodations for smart users
- Treat symptoms rather than cause
  - Rotating nozzles – helps with soil infiltration but causes 3x longer run times
  - Turfgrass removal – replaces water-thirsty grass without addressing bad irrigation practices

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What We Really Need

- Simple, easy-to-use and adjust weather or soil based irrigation scheduling
- Proper use of soil infiltration scheduling
- Water restrictions that maximize the use of existing smart technology not restrict it
- Accountability

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#2 Use Efficient Irrigation Sprinklers

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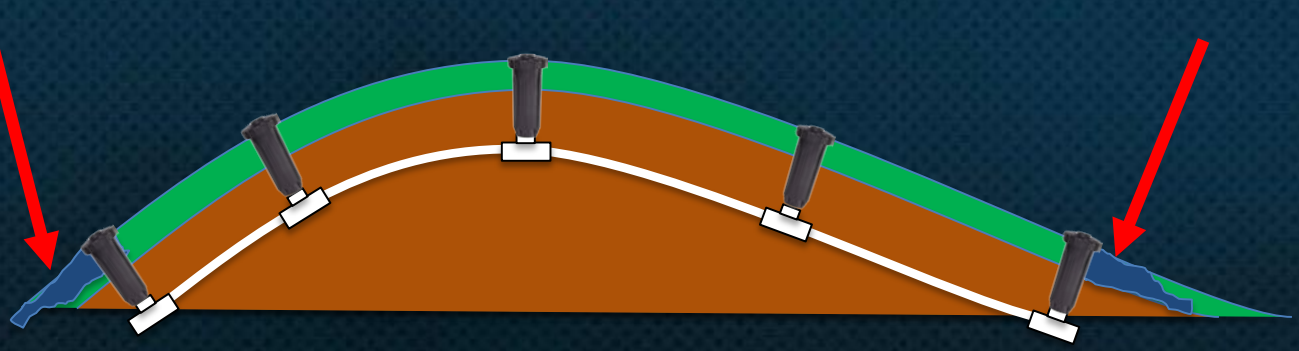
Efficient Irrigation
Check Valves



Sprayhead and rotor check valves save water and prevents soil erosion from low-head drainage.

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Efficient Irrigation
Pressure Regulation

- Optimum pressure for sprayheads with standard nozzle is 30 PSI
  - 23% increase in PR from 30 - 50psi
- For every 10 PSI over the optimum you can waste 12-16%* to the air!

*Source: Bernoulli's Equation

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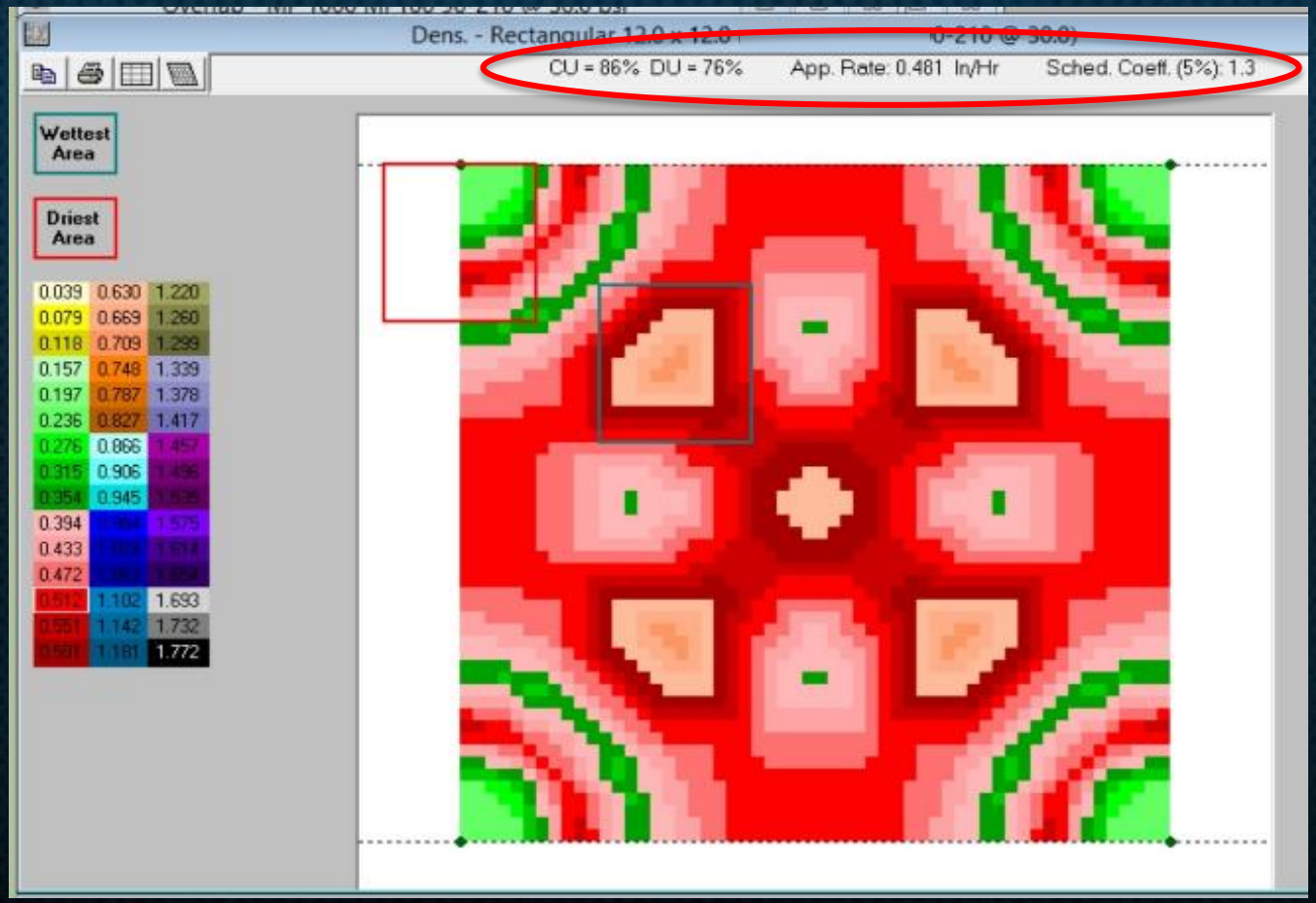
Efficient Irrigation
High Efficiency Nozzles



Popular Rotating Nozzle

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Efficient Irrigation
High Efficiency Nozzles

Standard MPR Nozzle

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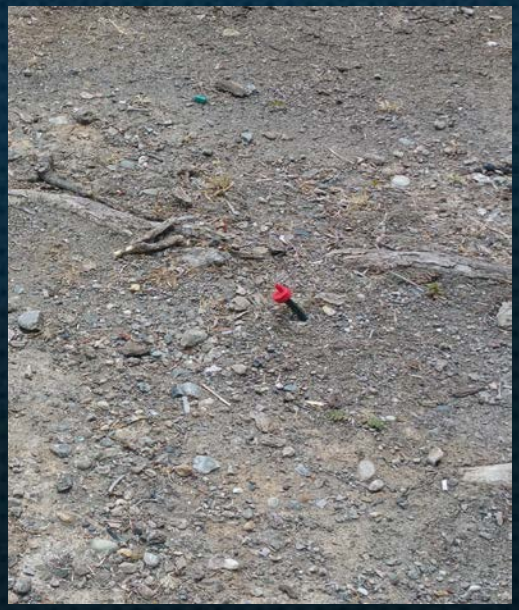
Low Volume / Drip
Water Saving Drip?



Drip irrigation can also waste a lot of water

- Proper irrigation scheduling is difficult at best
- Soil infiltration is a factor
- Drip is often unseen

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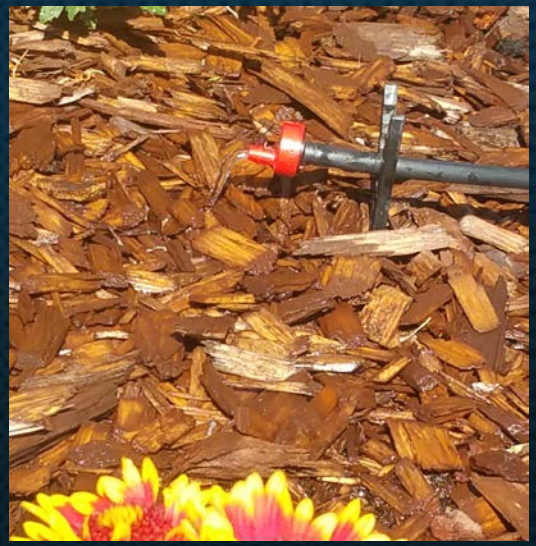
Low Volume / Drip
Water Saving Drip?



EXAMPLE:
5 Gallon Shrub – 4-6 gallons/week

AVERAGE
- 60 min/cycle
- 4 days a week
- (2) 1 GPH emitters

(2) 1GPH x 60 min = 2 gallons x 4 days = 8 gallons

2 gallons wasted PER PLANT per week (25%)

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Low Volume / Drip
Water Saving Drip?

Soil Wetted Area

Soil Type	Wetted Area at 1 GPH Diameter (feet)
Sand	3.0 – 3.5
Sandy loam	4.5 – 5.0
Loam	5.0 – 6.0
Clay loam	6.0 – 7.0
Clay	7.0 – 8.0

Source: Irrigation Association (2007)

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Low Volume / Drip
Water Saving Drip?

Application Rate of In-line Emitter Tubing

SOIL TYPE	CLAY	LOAM	SAND
Emitter Discharge Rate	½ GPH	1 GPH	2 GPH
Emitter Spacing	24”	18”	12”
Nominal Line Spacing	20”	16”	14”
Application Rate	.24”/hr	.80”/hr	2.74”/hr
Time to Apply ¼”	62 min	19 min	6 min

Source: Dura-Flo™ PC Dripperline – NDS, Inc

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Low Volume / Drip
Water Saving Drip?

Bottom Line with Drip

- Must use ET scheduling with proper Application Rate
  - Calculated with soil infiltration and wetted area
- Must cycle run times

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#3 Monitor Flow

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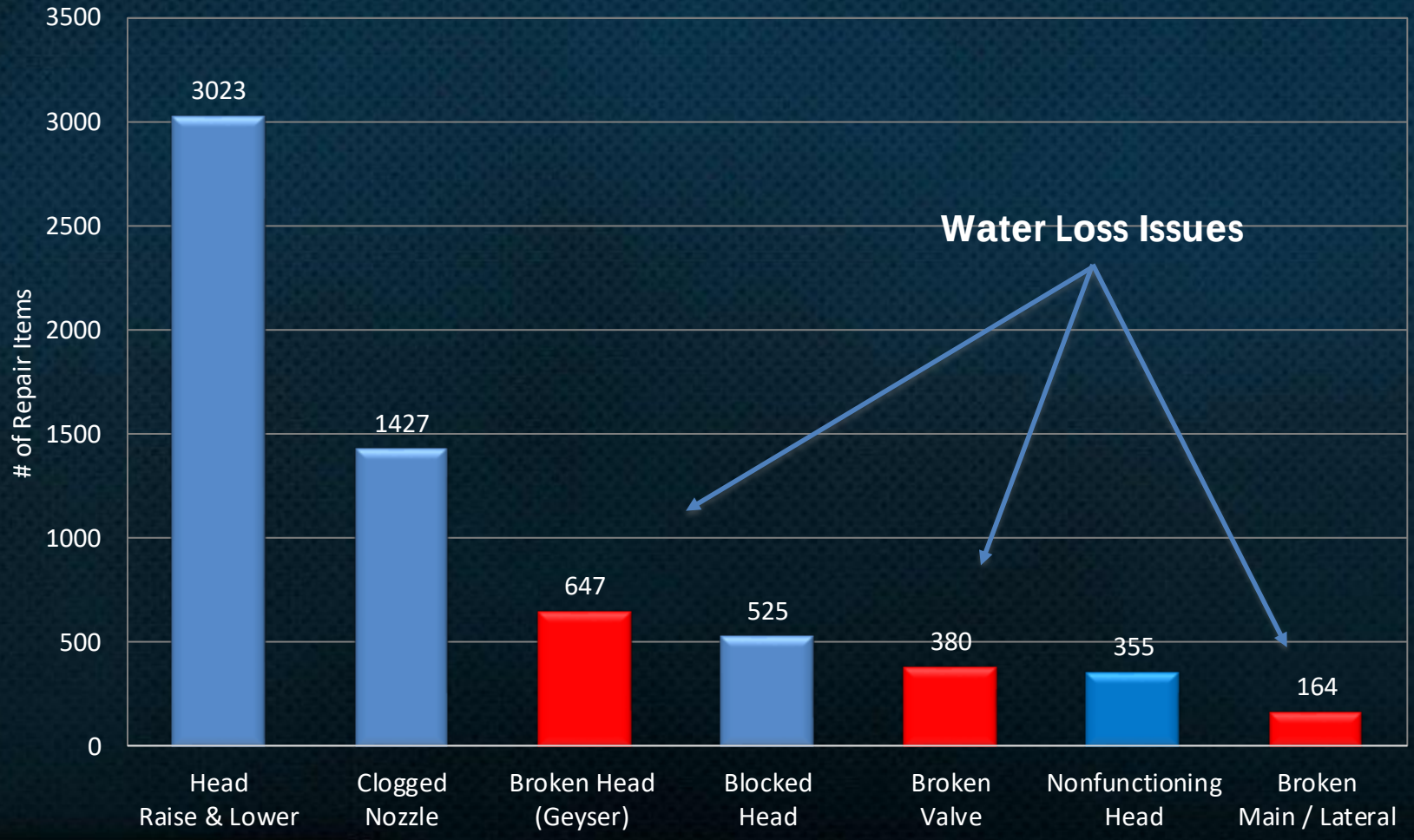
Monitor Flow

500 Site Audit



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Monitor Flow

ET vs Flow Sensing

- Water lost to multiple breaks can easily exceed the savings gained through weather-based scheduling
- Savings can easily double if both flow sensing and weather-based scheduling are used together

Flow Sensing Accuracy

Today's flow sensors are highly accurate and have a broader range that those available even 5 years ago

Size	Minimum GPM	Maximum GPM	Friction Loss at Max flow
1 inch flow sensor	0.86	52	0.25 psi
1 1/2 inch flow sensor	1.8	108	0.18 psi
2 inch flow sensor	2.8	170	0.15 psi

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Monitor Flow

Flow Sensing is a Necessity

Size	GPM	30 Min cycle	Week - Peak	Month - Peak	Mar-Sep	% of Seasonal Budget*
1 drip emitter on ¼" tubing	1	30	120	480	2,880	0.79%
1 inch break	25	750	3,000	12,000	72,000	19.86%
2 inch break	75	2,250	9,000	36,000	216,000	59.59%

** Per average ½ acre site*

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#4 Account for Soil Infiltration

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Account for Soil Infiltration

Smart watering technology needs to apply water based on soil absorption…through “cycling” run times and allowing irrigation to “soak” as the water infiltrates into the soil

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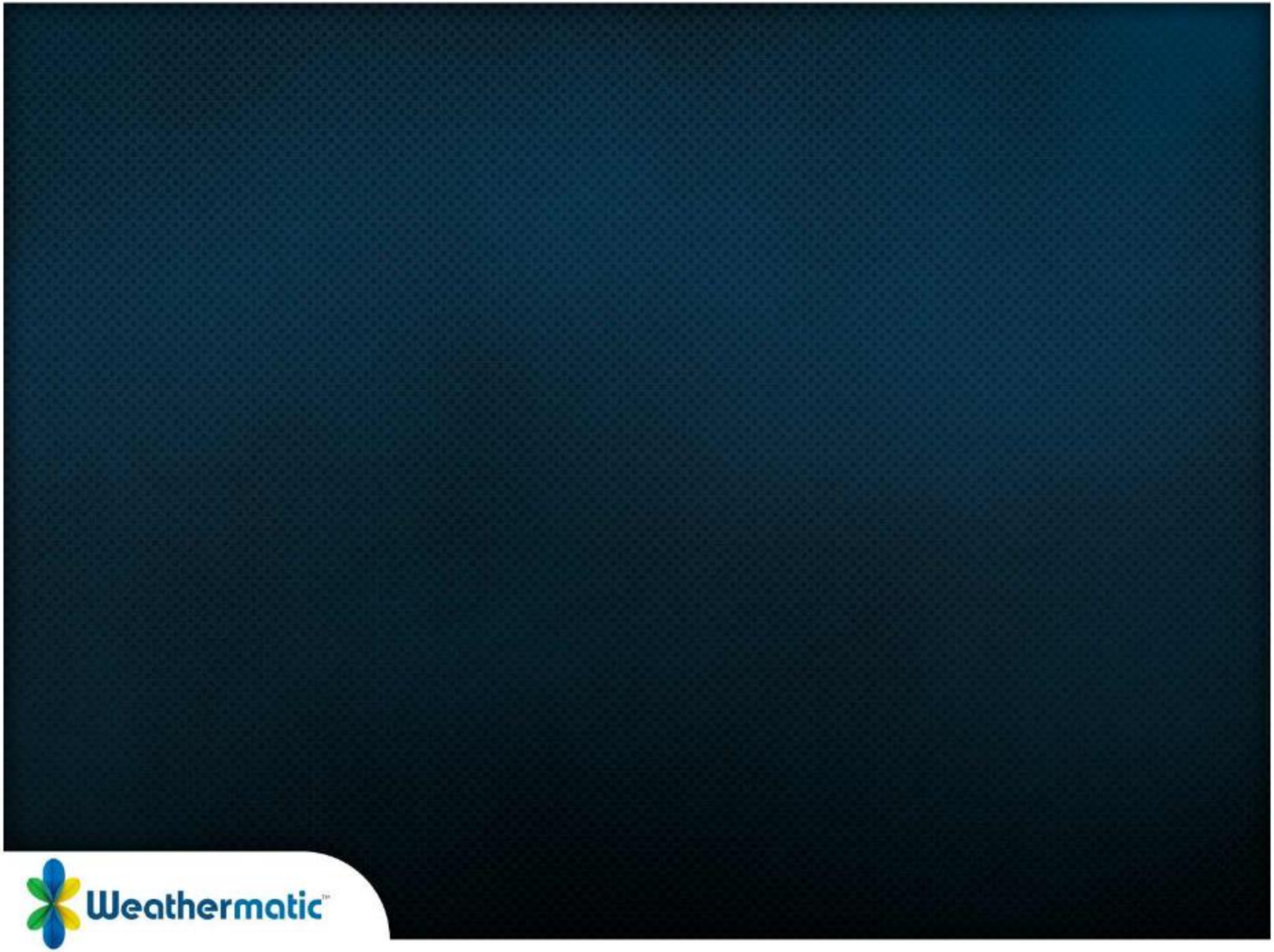
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Soil Infiltration - Example

LEED Silver Certified Hotel

- Five sprayhead zones
- Rotating nozzles
- Cool season turf
- Clay soil
- 21 degree slope
- Slopes to parking lot

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Soil Infiltration - Example

Soil Type & Slope Matters!

How much run time?

Run time =

- 16 minutes
- 3 cycles a day
- 4 days a week

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Soil Infiltration - Example

Clay Soil Infiltration Rate

Degrees	Precipitation Rate										
	0.5	0.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00
0	15'	12'	10'	9'	8'	7'	6'	5'	4'	3'	3'
1	12' 18"	9' 50"	8' 12"	7' 23"	6' 34"	5' 44"	4' 55"	4' 6"	3' 17"	2' 28"	2' 28"
2	11' 15"	9" 0"	7' 30"	6' 45"	6' 0"	5' 15"	4' 30"	3' 45"	3' 0"	2' 15"	2' 15"
3	10' 21"	8' 16"	6' 54"	6' 13"	5' 31"	4' 50"	4' 8"	3' 27"	2' 46"	2' 4"	2' 4"
4	9' 45"	7' 48"	6' 30"	5' 51"	5' 12"	4' 33"	3' 54"	3' 15"	2' 36"	1' 57"	1' 57"
5	9'	7' 12"	6' 0"	5' 0"	4' 48"	4' 12"	3' 36"	3' 0"	2' 24"	1' 48"	1' 48"
6	8' 33"	6' 50"	5' 42"	5' 8"	4' 34"	3' 59"	3' 25"	2' 51"	2' 17"	1' 43"	1' 43"
7	7' 57"	6' 21"	5' 18"	4' 46"	4' 14"	3' 43"	3' 11"	2' 39"	2' 7"	1' 35"	1' 35"
8	7' 30"	6' 0"	5' 0"	4' 0"	4' 0"	3' 30"	3' 0"	2' 30"	2' 0"	1' 30"	1' 30"
9	7' 3"	5' 38"	4' 42"	4' 14"	3' 46"	3' 17"	2' 49"	2' 21"	1' 53"	1' 25"	1' 25"
10	6' 36"	5' 16"	4' 24"	3' 58"	3' 31"	3' 5"	2' 38"	2' 12"	1' 46"	1' 19"	1' 19"
11	6' 18"	5' 2"	4' 12"	3' 47"	3' 22"	2' 56"	2' 31"	2' 6"	1' 41"	1' 16"	1' 16"
12	5' 51"	4' 40"	3' 54"	3' 31"	3' 7"	2' 44"	2' 20"	1' 57"	1' 34"	1' 10"	1' 10"
13	5' 33"	4' 26"	3' 42"	3' 20"	2' 58"	2' 35"	2' 13"	1' 51"	1' 29"	1' 7"	1' 7"
14	5' 6"	4' 4"	3' 24"	3' 4"	2' 43"	2' 23"	2' 2"	1' 42"	1' 22"	1' 1"	1' 1"
15	4' 48"	3' 50"	3' 12"	2' 53"	2' 34"	2' 14"	1' 55"	1' 36"	1' 17"	0' 58"	0' 58"
16	4' 30"	3' 36"	3' 0"	2' 0"	2' 24"	2' 6"	1' 48"	1' 30"	1' 12"	0' 54"	0' 54"
17	4' 12"	3' 21"	2' 48"	2' 31"	2' 14"	1' 58"	1' 41"	1' 24"	1' 7"	0' 50"	0' 50"
18	3' 54"	3' 7"	2' 36"	2' 20"	2' 5"	1' 49"	1' 34"	1' 18"	1' 2"	0' 47"	0' 47"
19	3' 36"	2' 52"	2' 24"	2' 10"	1' 55"	1' 41"	1' 26"	1' 12"	0' 58"	0' 43"	0' 43"
20	3' 18"	2' 38"	2' 12"	1' 59"	1' 46"	1' 32"	1' 19"	1' 6"	0' 53"	0' 40"	0' 40"
21	**3'**	2' 24"	2' 0"	1' 0"	1' 36"	1' 24"	1' 12"	1' 0"	0' 48"	0' 36"	0' 36"
22	2' 51"	2' 16"	1' 54"	1' 43"	1' 31"	1' 20"	1' 8"	0' 57"	0' 46"	0' 34"	0' 34"
23	2' 33"	2' 2"	1' 42"	1' 32"	1' 22"	1' 11"	1' 1"	0' 51"	0' 41"	0' 31"	0' 31"
24	2' 24"	1' 55"	1' 36"	1' 26"	1' 17"	1' 7"	0' 58"	0' 48"	0' 38"	0' 29"	0' 29"
25	2' 6"	1' 40"	1' 24"	1' 16"	1' 7"	0' 59"	0' 50"	0' 42"	0' 34"	0' 25"	0' 25"

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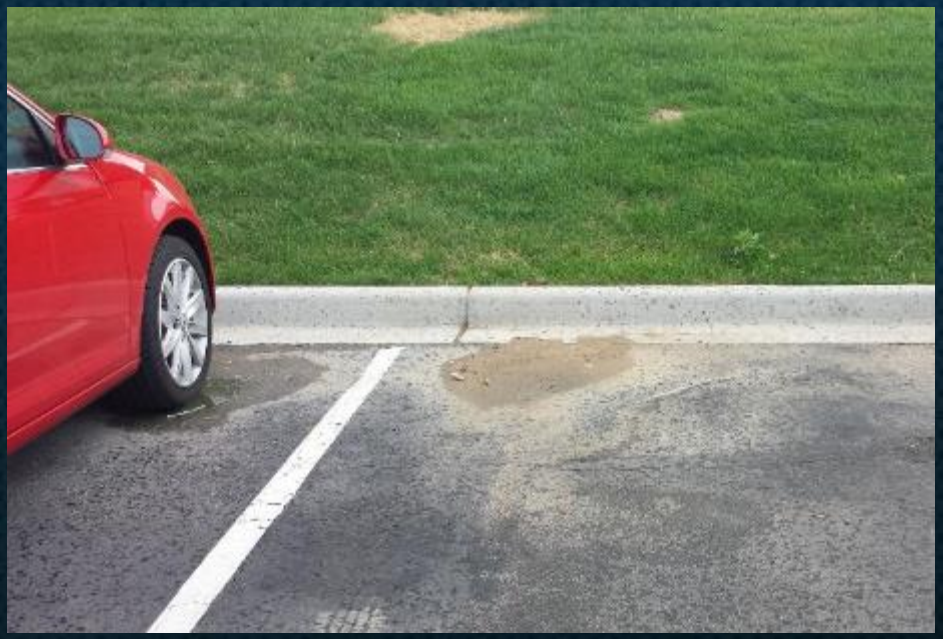
Soil Infiltration - Example

Wasted Water



- Water cost = $3.60 unit
- 13 minutes 3 times a day wasted
- 21,578 gallons/week
- 863,120 gallons/season
- $4,200 year

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Soil Infiltration - Example

Additional Cost

Water Damage to Asphalt Parking Lot

Cost of asphalt repair:

$6.00 - $12.00 sq ft

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Soil Infiltration - Example

Wasted Water – Parking Lot Damage

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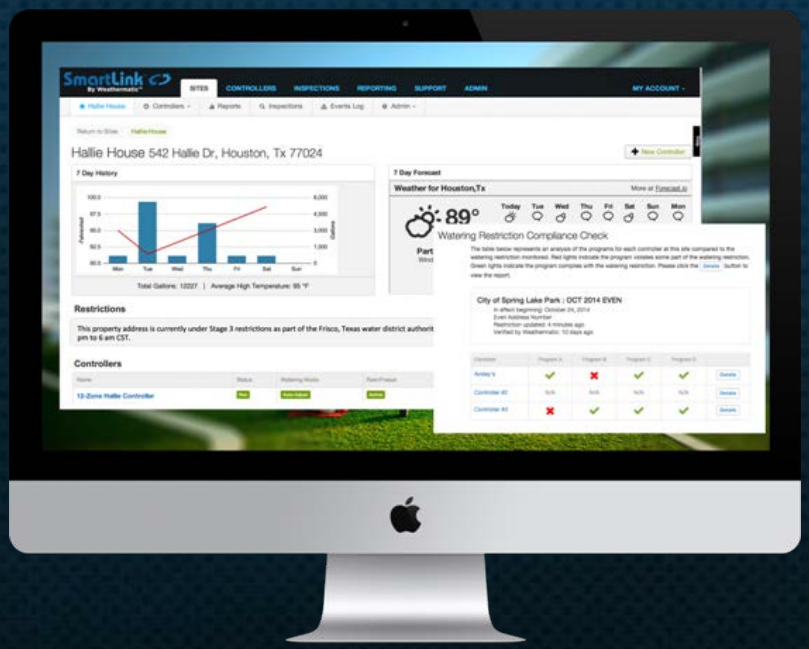
#5 Remote Monitor & Control



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Why Remote Monitoring and Control

Night time operation

Irrigation typically takes place at night. Often sprinkler breaks go undiscovered for weeks

Regular sprinkler checks

Most systems are checked once a month at best (average is 8 weeks)

What you don't know DOES hurt you

- Smart is turned off - Large number of smart controllers are turned to standard mode
- Rain/freeze sensor is disconnected or turned off
- Alarms are active but no one is watching

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Remote Monitor and Control

Remote access

Access from multiple internet connected devices saves time, fuel, labor, and enables a quick response

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Remote Monitor and Control

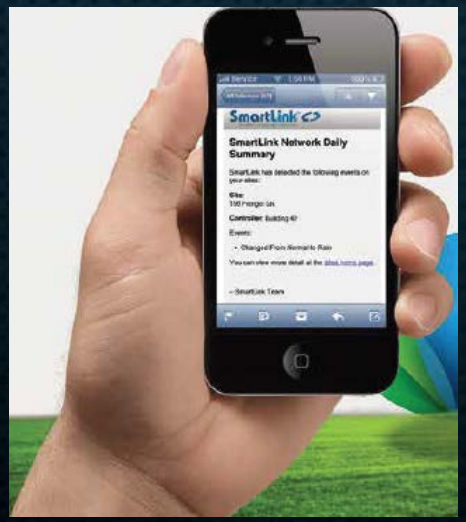
Multiple Users

Visibility by multiple users insures system is monitored regularly and alarms are attended to quickly

Proactive notification

Automated system notification of alerts and alarms requiring user attention such as:

- High/Low flow alarm
- System off alert
- ET vs Standard changes alert
- Communication failure alarm



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#6 Site Inspections

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Regular Site Inspections

Excessive Runoff

Broken Main

Broken Lateral

Broken Head

Dangerous Iced Parking Lot

Damage due to broken lateral

Landscape & Hardscape Damage

Geyser

Hardscape Damage due to Runoff

Broken Head

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Regular Site Inspections

Remote access and proactive communication from a controller doesn't give us a complete picture

Items typically found only during site inspection

Smart irrigation cannot take the place of a good system inspection

- Sprinklers out of rotation or not rotating
- Sprinklers installed too low or too high
- Sprinklers tilted
- Sprinkler spraying building, tree, street, sign, etc..
- Mismatched sprinkler nozzles that cause dry spots

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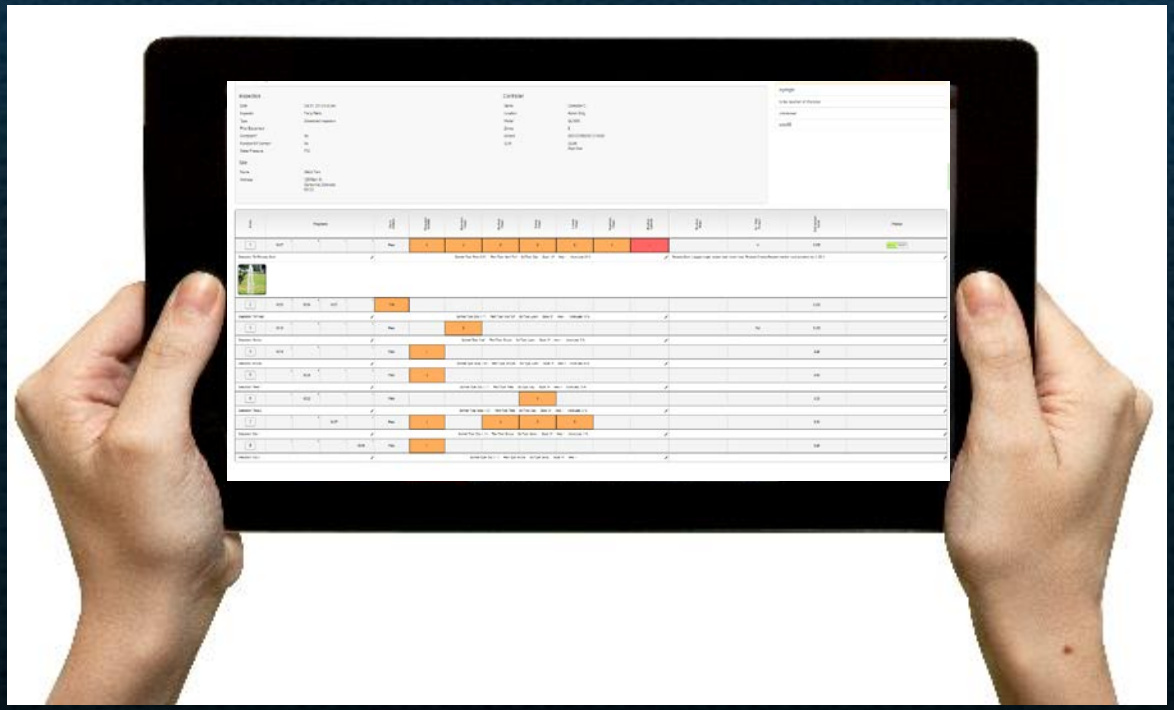
Regular Site Inspections

Documented Inspections

Regular documented sprinkler checks need to be part of any water conservation strategy



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6 Factors of Efficient Irrigation

1. Use Weather/Soil-based Scheduling with Rain Shut-off Device
2. Use Efficient Irrigation Sprinklers
3. Monitor Flow
4. Account for Soil Infiltration
5. Remote Monitor and Control
6. Regular Site Inspections

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Summary
Water Management Truths

Accounting for all 6 Factors

Irrigation systems are NOT likely to reach its water saving potential without accounting for the 6 essential ingredients outlined above

Water Savings Not the only Cost Factor

The water rate and water savings should NOT be sole factor in executing a sustainability program considering the non-water related savings in multiple budget areas: landscape, hardscape, and other O&M areas.

Water Damage can exceed Cost of Water

If a site has irrigation, the watering must be matched to the plant water requirement or risk damaging the site with cost of damages exceeding the water cost.

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Summary
Water Management Truths

Liability is a Factor

Risk mitigation is a critical consideration due to the potential liabilities (i.e. watering during a freeze)

Time is Money

Repairs must be identified and addressed timely.

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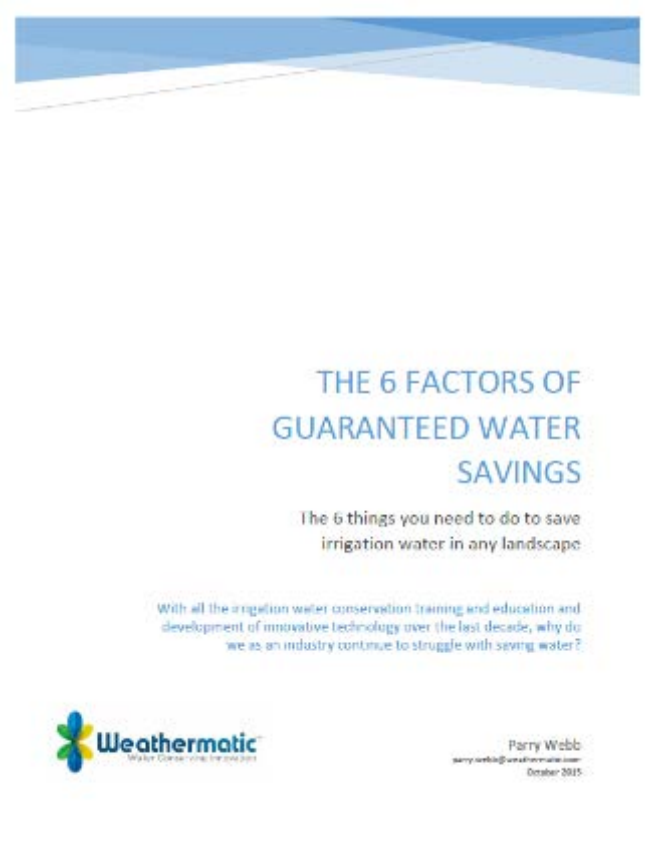
Interested in Learning More?

Weathermatic White Paper



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