This presentation premiered at WaterSmart Innovations

watersmartinnovations.com

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INNOVATIONS

Water Harvesting
+ High Efficiency Irrigation
= Sustainable Water Use

Session W-1138
Wednesday 3:45 PM

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IRRIGATION CONSULTING • REP SERVICES

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WATER HARVESTING SOLUTIONS

Sustainable Irrigation Process

Harvest
- Collection, Pre-filtration, Storage
- Stabilization & Sanitation
- Final Filtration & Pressurization

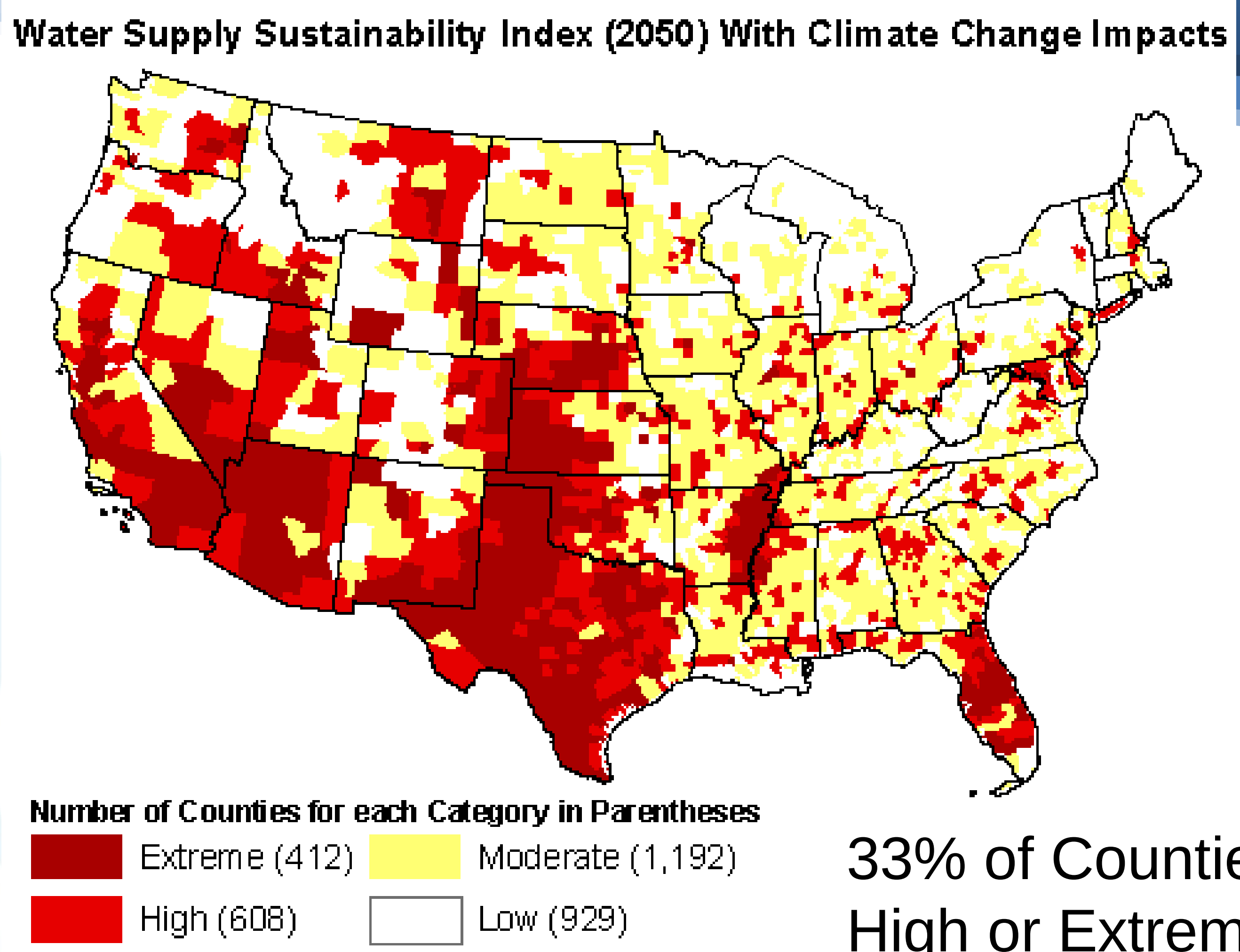
Control
- Monitor Weather Data
- Calculate Actual Plant Water Demand
- Apply Only as Much as Required

Apply
- Choice of Spray, Drip, Subsurface Applications
- Zone layouts
- Water-efficient Applicators

Learning Objectives

1. Understand the urgency of reducing the use of municipal water for irrigation
2. *Supply*: Learn how on-site water can be harvested for irrigation; Understand the major components of a harvesting system
3. *Controls*: Review concept of Evapo-Transpiration and learn how ET-based irrigation and water harvesting work together
4. *Application*: Learn how efficient irrigation design and components complete the sustainable irrigation cycle

A Water Crisis on the Horizon



33% of Counties in High or Extreme Water Crisis by 2050

Water Rates will Rise Rapidly

$1.00 THE NATION'S NEWS SEPTEMBER 28–30, 2012 **WEEKEND**

USA TODAY™
09.28.12
A GANNETT COMPANY

"I don't know how they expect people to keep paying more for water with . . . everything else going up."

Jacquelyn Moncrief
Philadelphia

COVER STORY SPECIAL REPORT

NATION'S WATER COSTS RUSHING HIGHER

RESIDENTIAL WATER BILL INCREASES
PAST 12 YEARS

ATLANTA	▲ 233%
SAN FRANCISCO	▲ 211%
WILMINGTON, DEL.	▲ 200%
PHILADELPHIA	▲ 164%
PORTLAND, ORE.	▲ 161%
SIOUX FALLS, S.D.	▲ 140%

WATER RATE INCREASES IN 100 MUNICIPALITIES, 5A

ROBERT DEUTSCH, USA TODAY

Israeli PM urges 'red line' for Iran

NEWSLINE

While most Americans worry about gas and heating oil prices, water rates have surged in the past dozen years, according to a USA TODAY study of 100 municipalities. Prices at least doubled in more than a quarter of the locations and even tripled in a few.

Restrictions on Irrigation will Force Change

The 10 Biggest U.S. Cities That Risk Running Out of Water

NOV 10 2010, 6:00 PM ET | Comment

Some of the nation's largest metropolitan areas are in danger of running out of water in the next decades, according to a survey of studies conducted by 24/7 Wall St.

South Florida faces tougher watering restrictions

Recommend 3

7 Tweet

Submit

Drought concerns move all of South Florida to twice-a-week watering

March 22, 2011 | By Andy Reid, Sun Sentinel

Drought conditions Tuesday triggered emergency watering restrictions for all of South Florida, requiring more cutbacks for many residents already under year-round landscape watering limits.

All of South Florida now must limit landscape watering to twice a week, according to the South Florida Water Management District. Golf courses and agriculture also face new irrigation restrictions.

Sec. 6-182. Rainwater Harvesting Plan. Tucson, AZ

A. All commercial development and site plans submitted after June 1, 2010 shall include a rainwater harvesting plan. The rainwater harvesting plan shall include a landscape water budget and an implementation plan.

1. The landscape water budget shall calculate the estimated volume of water required yearly for all site landscaping detailed in the development and/or landscape plan.
2. The implementation plan shall show how any combination of capture, conveyance, storage, and distribution will be utilized on-site to harvest rainwater. Implementation plans shall comply with applicable Development Standards for water harvesting applications.

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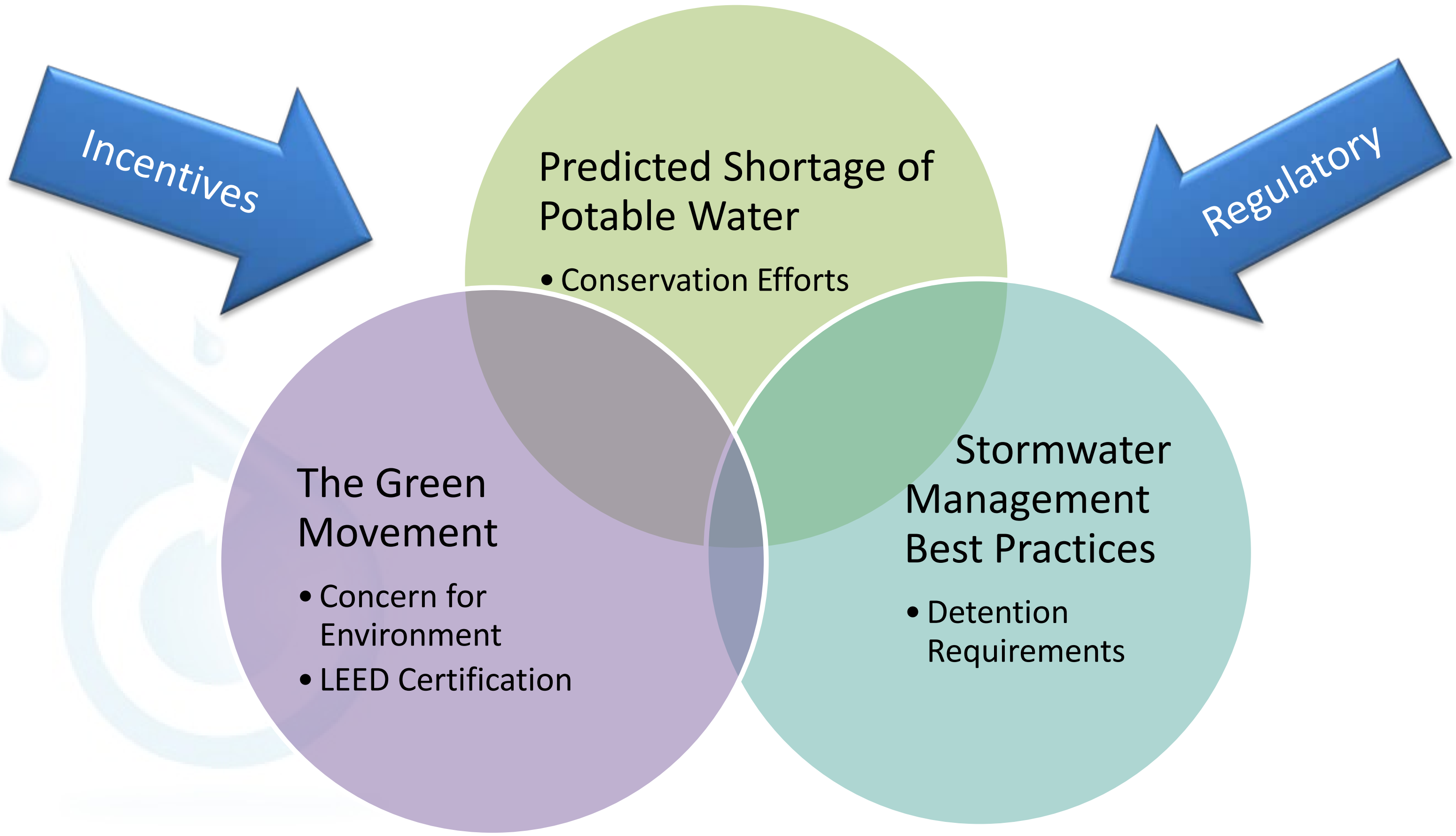
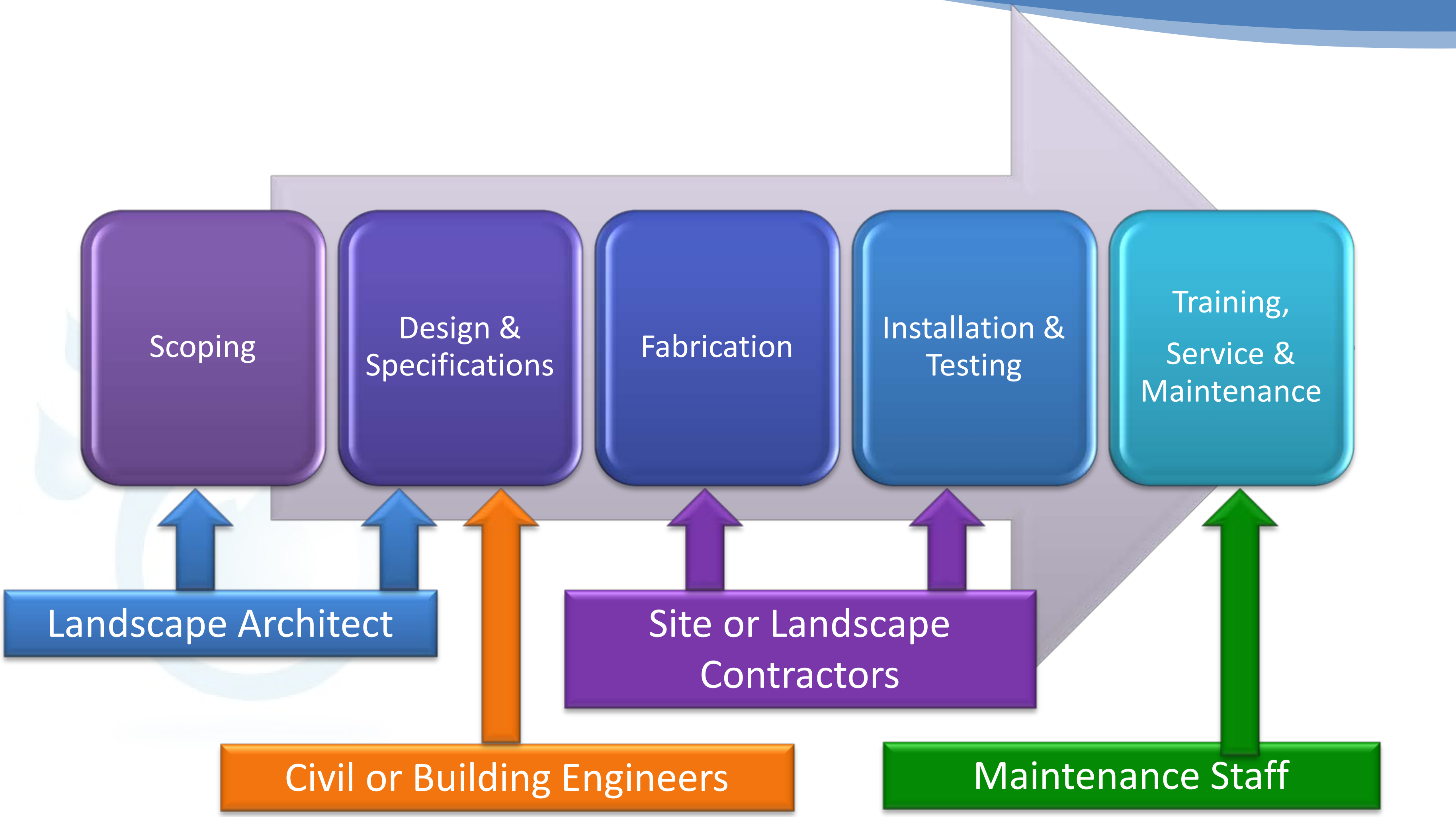
Megatrends Support Water Harvesting



Harvesting System Process Touches Multiple Stakeholders



Scoping: Evaluating Water Sources & Applications

Potential Sources

- Rooftop rainwater
- Surface stormwater
- Greywater from showers, sinks, washers
- Cooling condensate
- Steam condensate
- Groundwater ejectors
- Cooling tower "blow down"
- Process wastewater

Potential Uses

- Landscape irrigation
- Toilet flushing
- Cooling tower "make-up"
- Green roof irrigation
- Boiler "make-up"
- Truck washing
- Washing machines

Estimating Irrigation Demand

Four Groups/Classes

1. Group A

   Turf/Lawn areas (approx # acres)

2. Group B

   High intensity & entry (# of acres)

3. Group C

   Mod. intensity beds (# of acres)

4. Group 4

   Temporary irrigation (# of acres)

Monthly Components:

- Effective Rainfall
- ET Value (for the month)
- Difference (ER-ET)
- Weight Factor (%)
- Irrigation Efficiency (%)
- Amount Needed (inches)
- Number of Acres
- Gallons

  (# of acres **x** 27,154 gallons/acre-inch **x** amount needed)

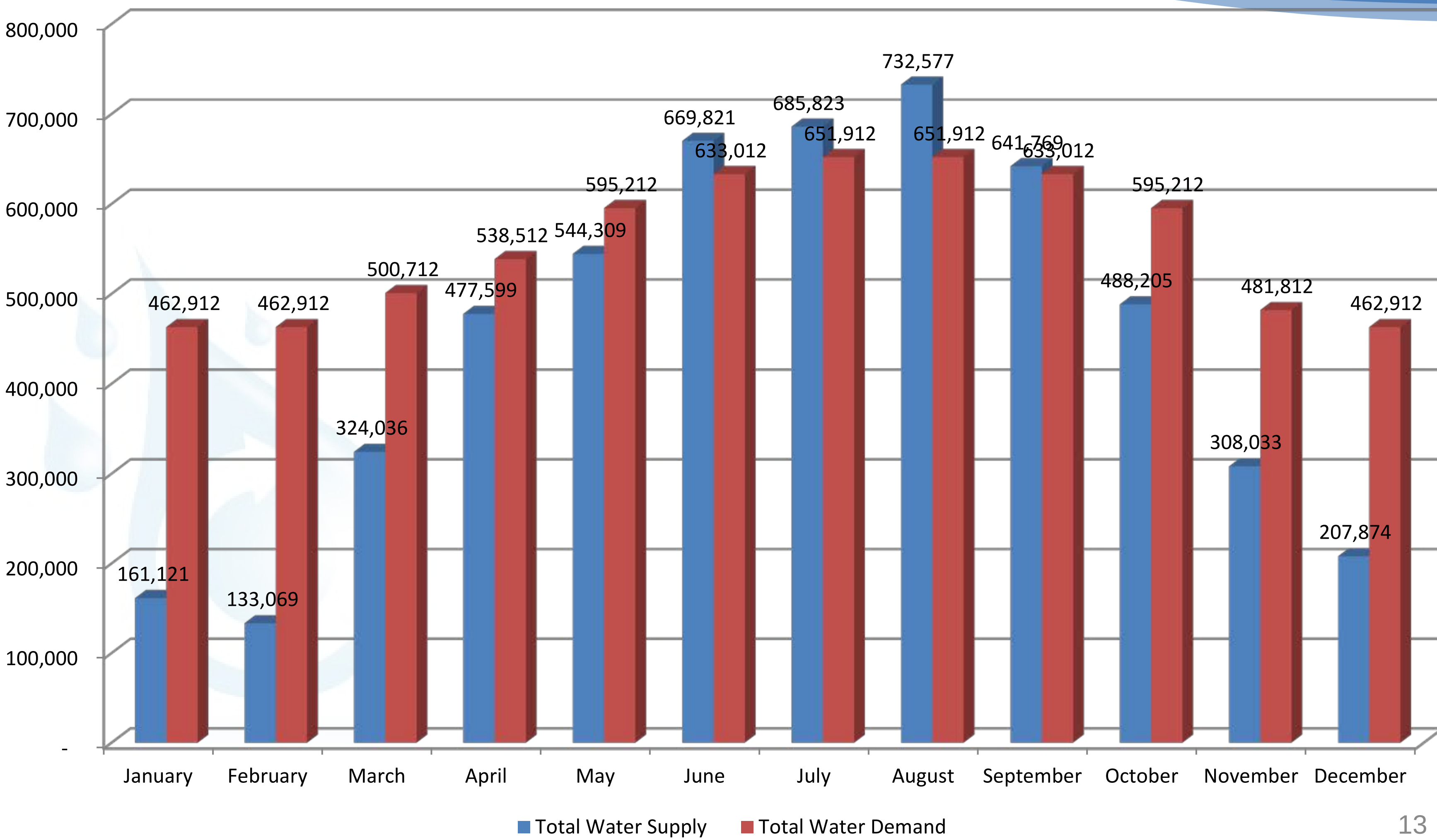
Tabulation (July – Midwest)

Grp	RF	ER	ET	Diff.	Weight (%)	Irrig. Effic.	Needed	Acres	Gallons
A	3.6”	2.7”	7.61”	4.91”	100%	65%	7.55”	11.7	2,398,649
B	3.6”	2.7”	7.61”	4.91”	70%	90%	3.82”	2.4	248,948
C	3.6”	2.7”	7.61”	4.91”	65%	90%	3.55”	6.0	578,380
D	3.6”	2.41”	7.61”	5.20”	60%	60%	5.20”	14.2	2,005,051

Total Gallons (July) = 5,231,028

Grp = Group
RF = Rainfall (monthly average)
ER = Effective Rainfall (75-50%)
ET = Evapotranspiration Rate (per month; region specific)

Scoping: Matching Supply to Demand



Cistern Modeling Identifies Optimal Rainwater Storage Capacity

Different cistern size options are modeled using six years of daily rainfall history for the location

Cistern Size	% of Total Demand Met	Non-Potable Gallons Used	Gallons Change from Previous Increment	Rain Event Size Capable of Being Handled (inches):
5,000	52.45%	227,422	-	2/5
10,000	71.40%	309,612	82,190	4/5
15,000	81.21%	352,163	42,551	1 1/5
20,000	86.77%	376,252	24,089	1 3/5
25,000	89.88%	389,752	13,501	2
30,000	**92.31%**	**400,280**	**10,527**	**2 3/8**
35,000	94.01%	407,628	7,348	2 7/9
40,000	95.28%	413,164	5,536	3 1/6
45,000	96.18%	417,045	3,882	3 4/7
50,000	96.58%	418,808	1,763	4
55,000	96.97%	420,475	1,667	4 1/3
60,000	97.35%	422,142	1,667	4 3/4
65,000	97.74%	423,808	1,667	5 1/6
70,000	98.12%	425,475	1,667	5 5/9
75,000	98.51%	427,142	1,667	6
80,000	98.89%	428,808	1,667	6 1/3

Table - 1

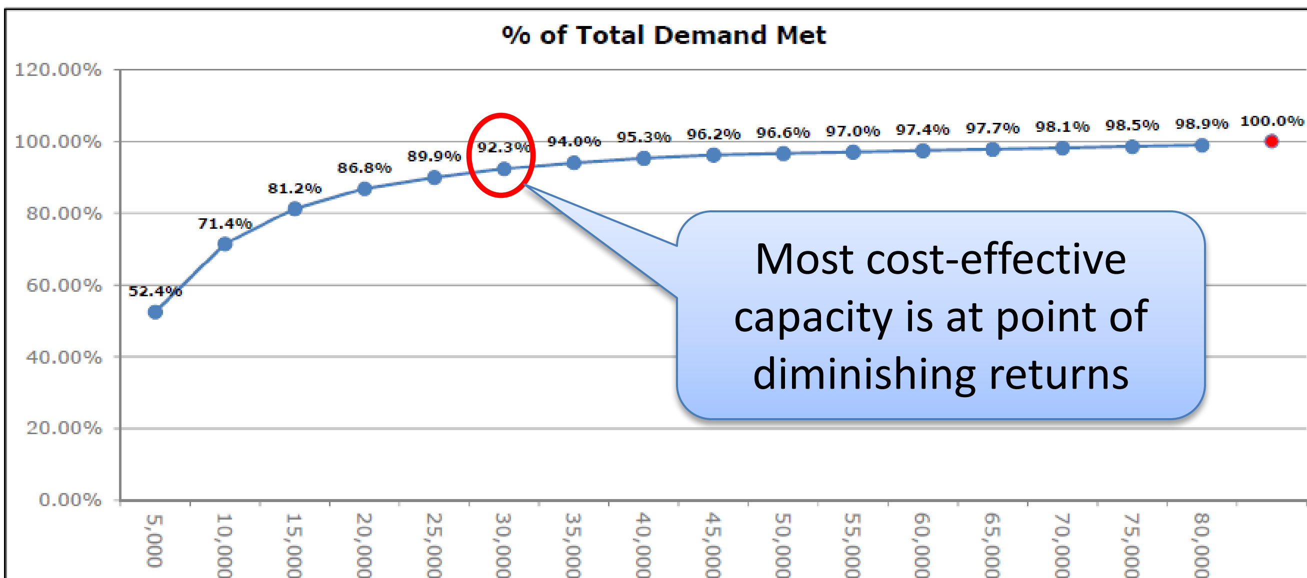
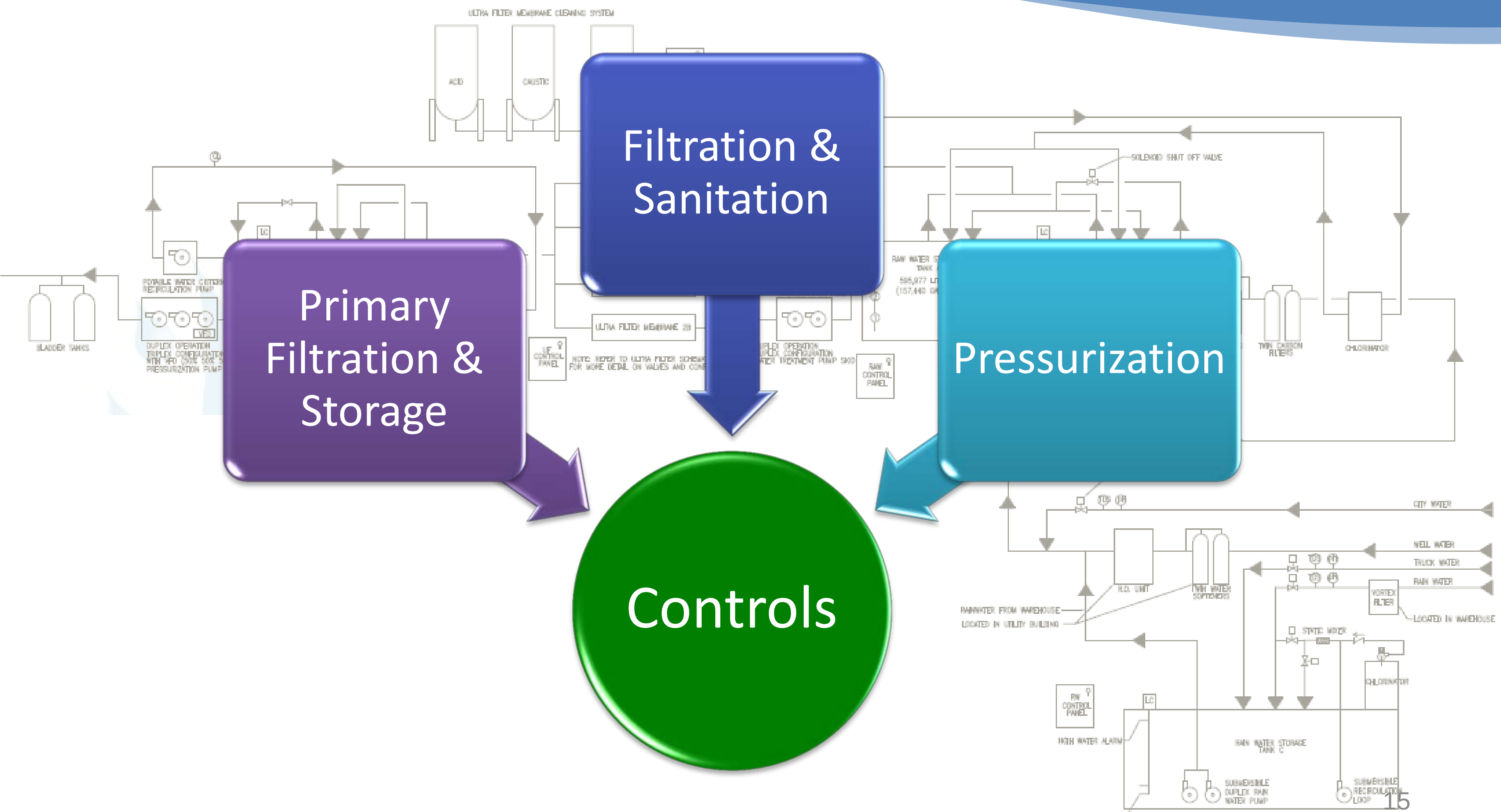


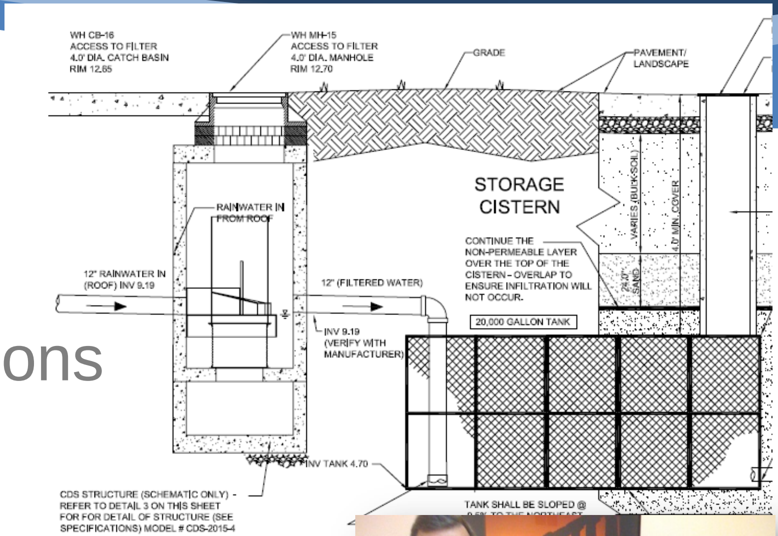
Table - 2

System Components are Customized to Each Project



Proper Pretreatment Protects Water Quality in Cistern

- Considerations
  - Water Sources
  - Flow Rates at Peak GPM
  - Mechanical vs. biological options



Natural Filtration Through Vegetated Swale

Mechanical Separators

Storage Methodology a Key Variable

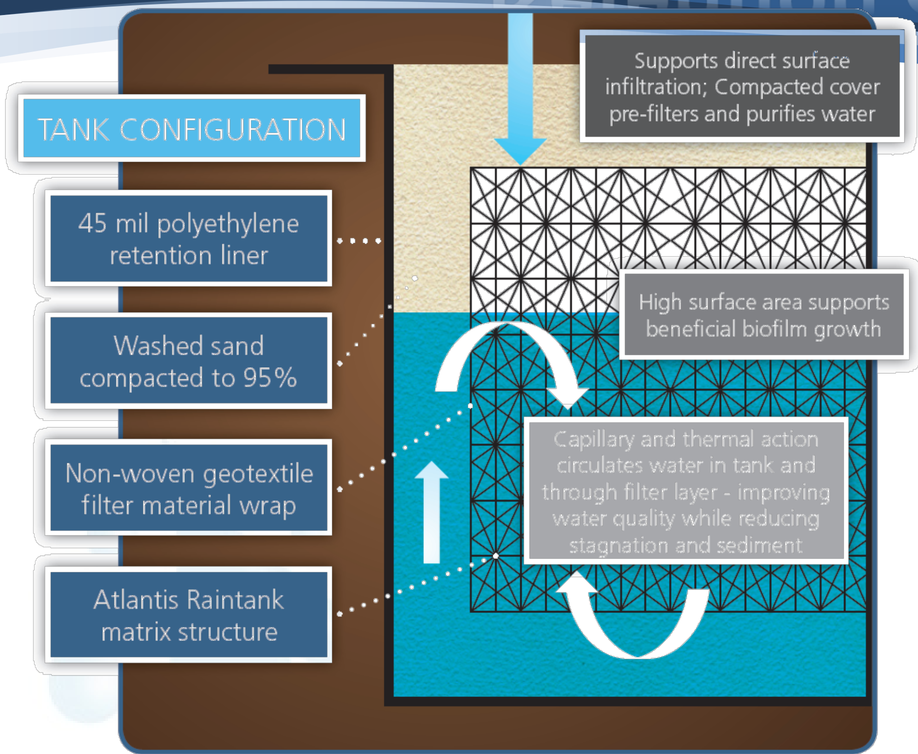
Underground Fiberglass Tanks

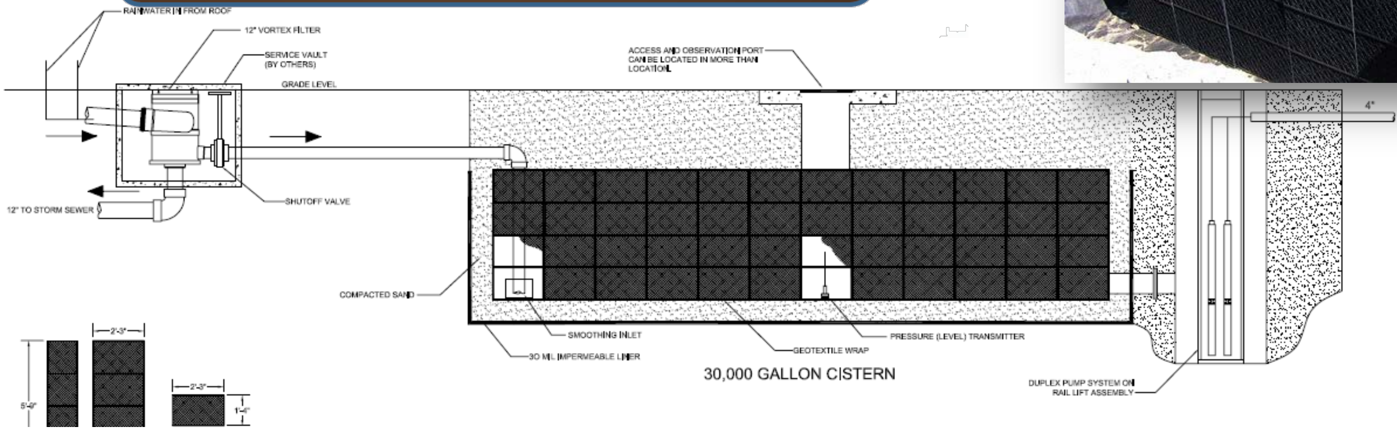
Stormwater Chamber System

Concrete Vaults

Steel Tanks

Polypropylene Structures Ideal for Retention & Reuse

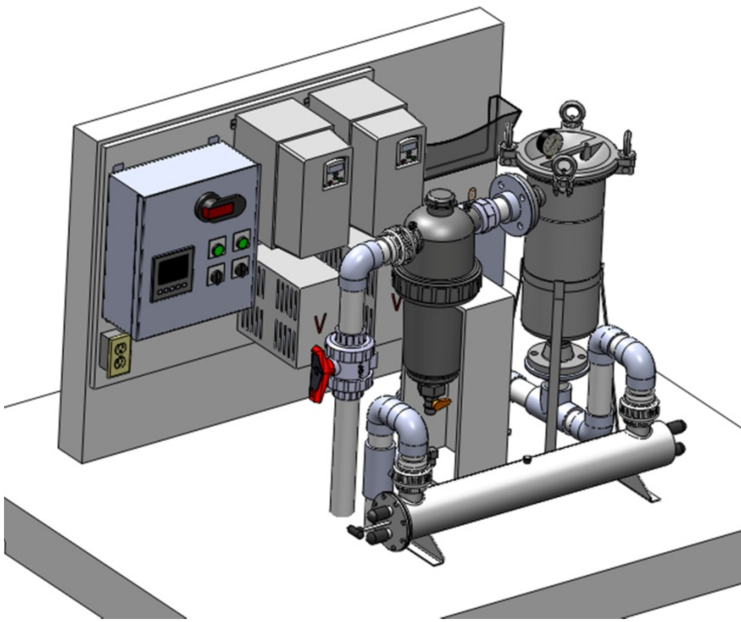


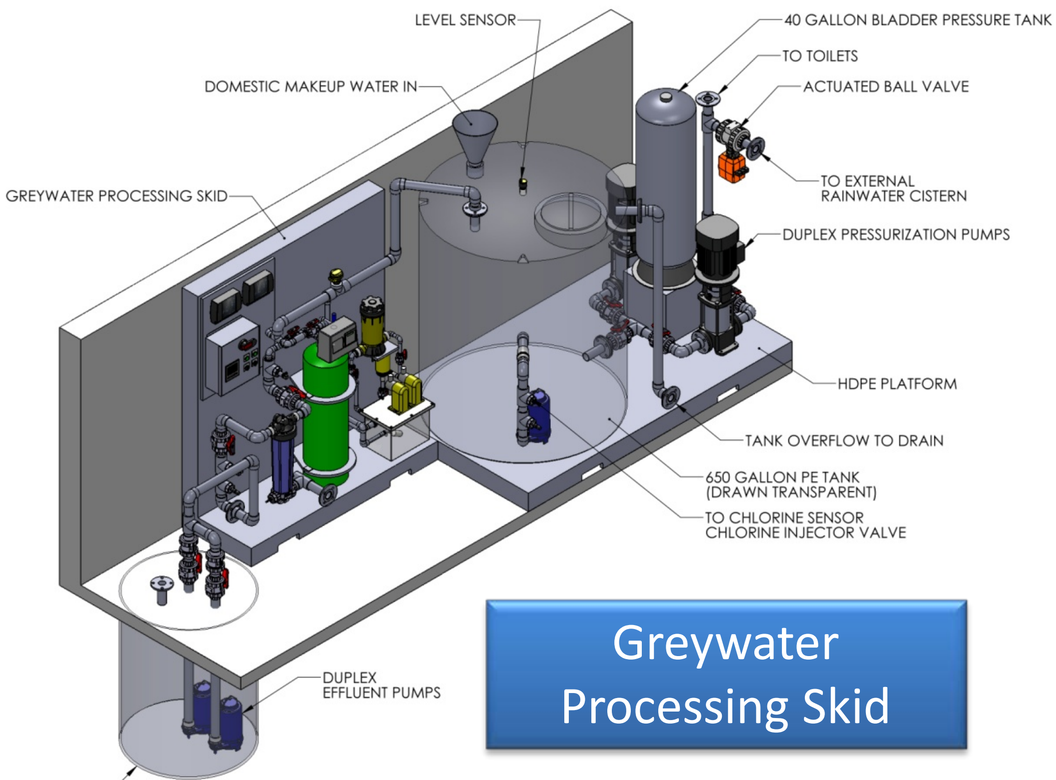


Processing: Filtration & Sanitation

- Processing Considerations
  - Source and application of water
  - Cost vs. maintenance trade-off

Rainwater Processing Skid

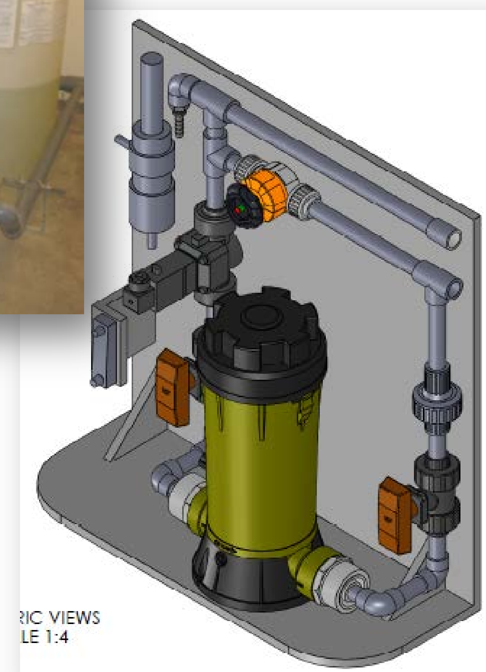




Greywater Processing Skid

Stored Water Must be Stabilized and Rendered Safe for Application

- Considerations
  - How will water be used?
  - System output demand
  - Methodology: UV, Chlorine, Chlorine Dioxide, Ozone
  - Local codes



Ultra-Violet Sterilization

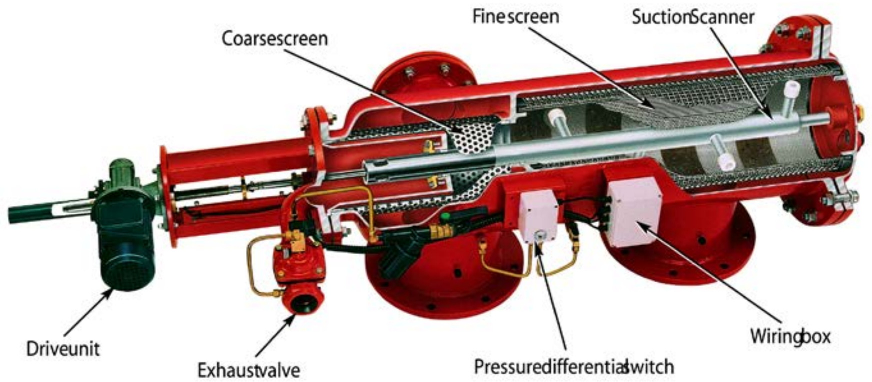
Chlorine Dosing Systems

"Polishing" Completes Treatment Steps

- Filtration Considerations
  - Source and application of water
  - Cost vs. maintenance trade-off
  - Final filtration options: bag, sand, carbon, R/O

High Capacity Bag Filtration

Self-Cleaning Filters



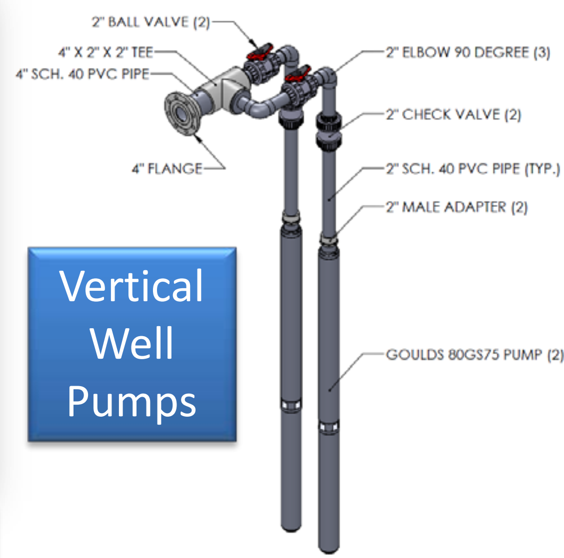
Pressurization

- Pressurization Considerations
  - Water use requirements – pressure & flow rates
  - Reliability importance – critical or non-critical use
  - Options: single – triplex; submersible; solar powered

Lower Volume Systems

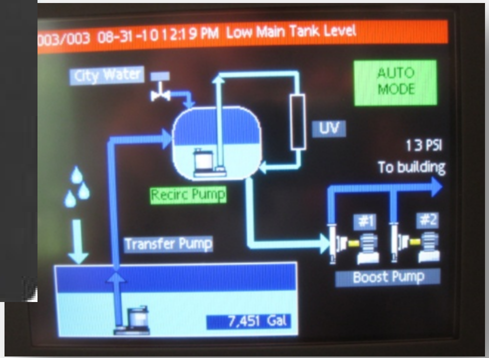
High Capacity Industrial-Grade Skid

Vertical Well Pumps



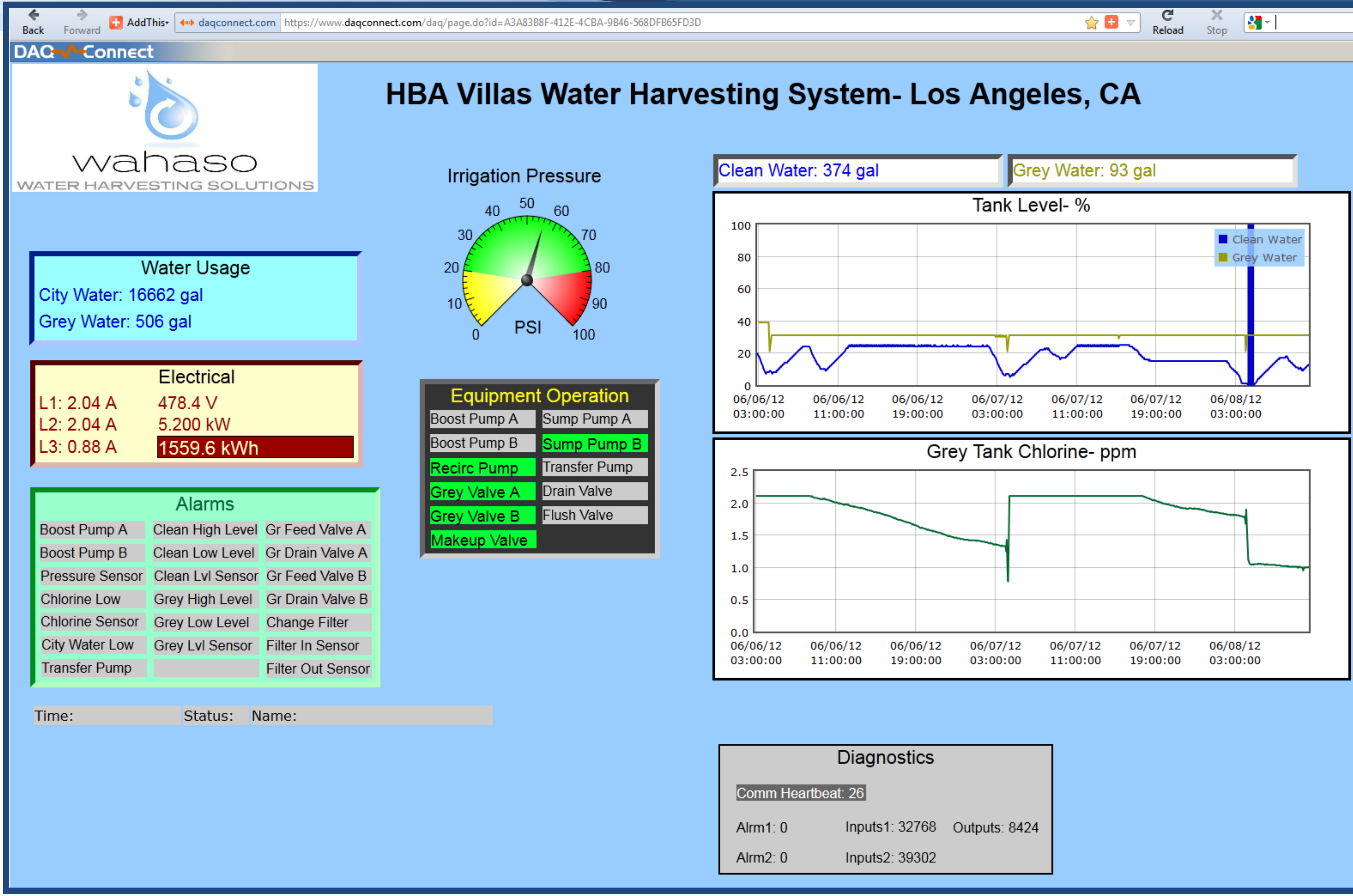
Control System Monitors and Control all System Activity

- Controller Considerations
  - Complexity of system
  - Need to record and report system statistics
  - Integration with irrigation control
  - Connectivity to Building Automation System
  - Educational opportunities

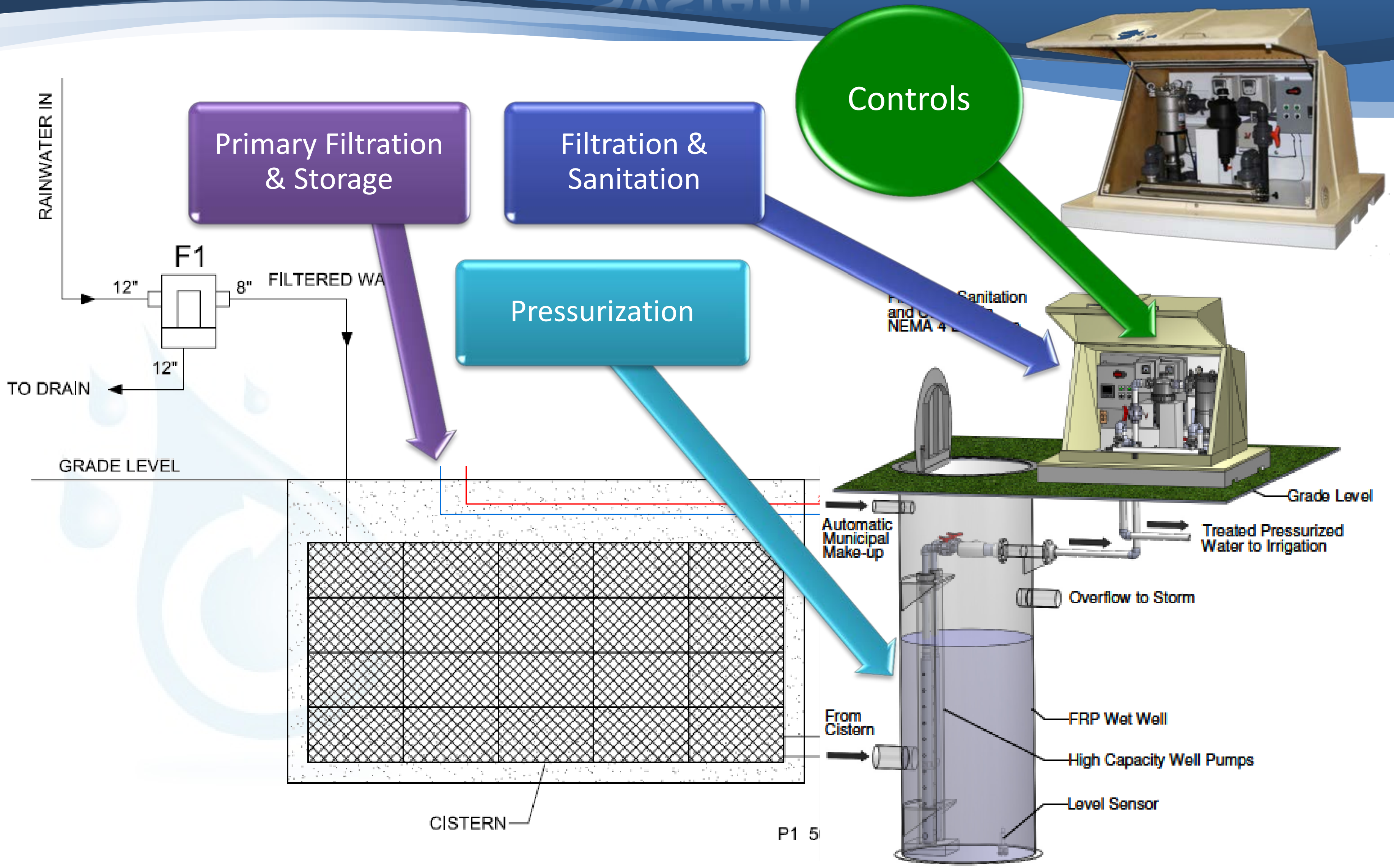


Remote Access Capability

Remote Panel Monitoring



Typical Sustainable Irrigation Harvesting System



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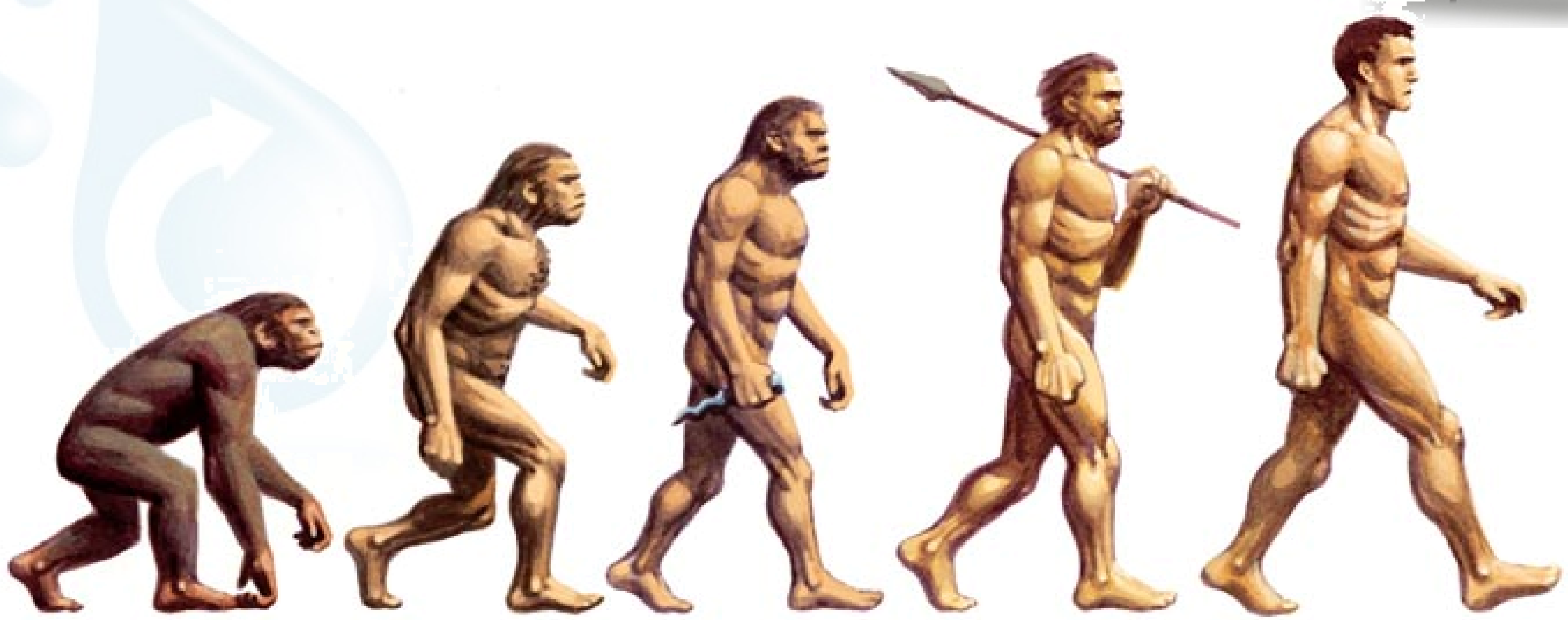
Evolution of Irrigation Control



Weather-Based Controllers

- Network of national weather-stations
- Monthly/annual fee for service access
- Runtime-settings are re-adjusted nightly
- Zone-specific characteristics recognized:

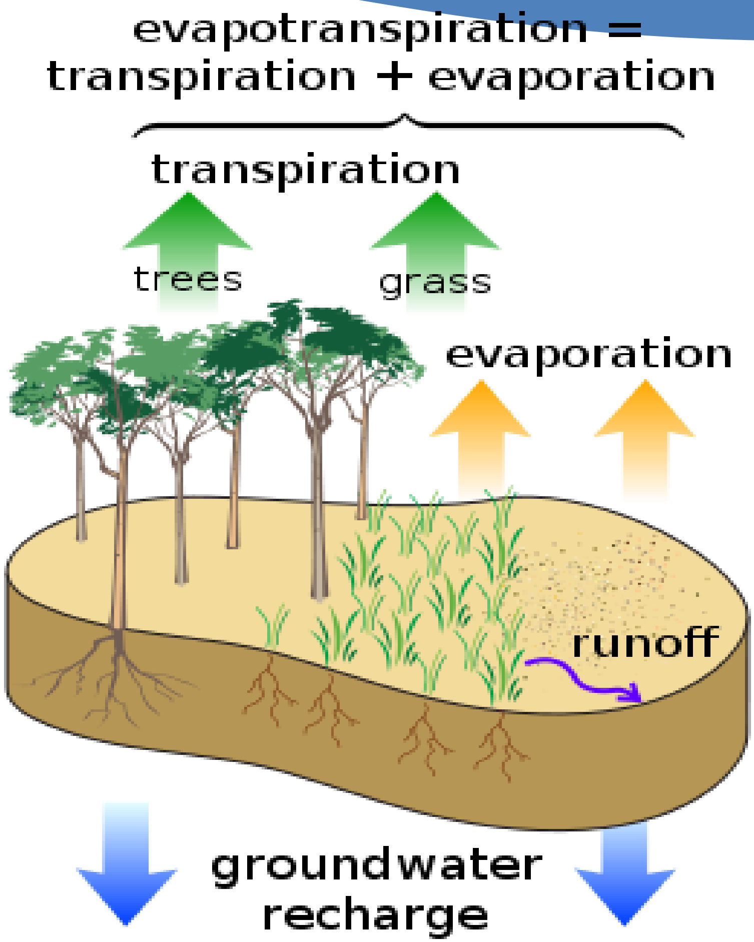
  (plants, soils, sun, slope, sprinkler/drip type, precip-rates)

- Saves between 30-50% water over user-set controllers

EvapoTranspiration (the ET in ETwater)

- ET is the loss of water from the earth & plants to atmosphere
  - Evaporation from ground
  - Transpiration from plants
- ET changes as weather changes
- Different plants = different ET

$$ET_o = \frac{\Delta R_n + \rho_a c_p (\delta q) g_a}{(\Delta + \gamma (1 + g_a / g_s)) \lambda_v}$$



How the ET Water System Works

1. **User enters landscape profile online, saved in cloud …**
   (**<u>Note</u>**: *extensive training is vital !*)
2. Local weather stations capture weather and rainfall data
3. ET Water servers compute EvapoTranspiration and daily irrigation schedules
4. **Field-based smart controllers connect wirelessly with servers to exchange schedules and data**

How the ET Water System Works

Can also use smartphone for real-time control

1. User enters landscape profile online, saved in cloud
2. Local weather stations capture weather and rainfall data
3. ET Water servers compute EvapoTranspiration and irrigation schedules daily
4. Field-based smart controllers connect wirelessly with servers to exchange schedules and data
5. **Smart controllers execute daily irrigation schedules**

Wireless Rain Sensors

- 500 ft. range (transmitter to receiver)
- Selectable water conservation modes (with 1 & 2 day extended rain-delay settings)
- 5-year coin-cell battery life
- Low-battery life indicator alerts when the transmitter battery needs to be changed (typically every 4-5 years)

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Three Ways to Reduce Irrigation Water Use

- Reduce site water requirements
  - reduction of high & moderate-need plants
- Increase irrigation system efficiencies
  - improve DU in turf areas
  - use pressure-regulation
  - conversion to drip & point-source emitters
- Improve management practices
  - regular checks, repairs & monitoring
  - appropriate programming of Smart controllers
  - frequent communication of user groups

Responsible Alternatives to Irrigation Bans

- Water-wise landscape development plans
- Use products that irrigate more efficiently
- Use water-harvesting practices
- Limit watering-days
- Provide training & apply mandatory program settings on weather-based controllers
- Promote a "***lighter shade of green***"

  (deep green is not necessarily healthier for plants)

While Harvesting Water, Become "WaterSmart"

Commercial landscapes still require water to thrive…

- Use plants that require less supplemental water (less turf), but still provide environmental benefits.
- Strive to balance the landscape's water demand with the non-potable water available for irrigation.



Creating Sustainable Irrigation

Commit to using 'WaterSmart' practices…

1. Discharge less water (lower precipitation rates)
2. Apply water to plants more efficiently (below 70% is poor)
3. Use pressure-regulation to ensure optimum operation
4. Use rain-sensors that delay water-resumption after rain events
5. Rely on weather-based controllers that enable runtimes (& days) to be modified, based upon onsite conditions.

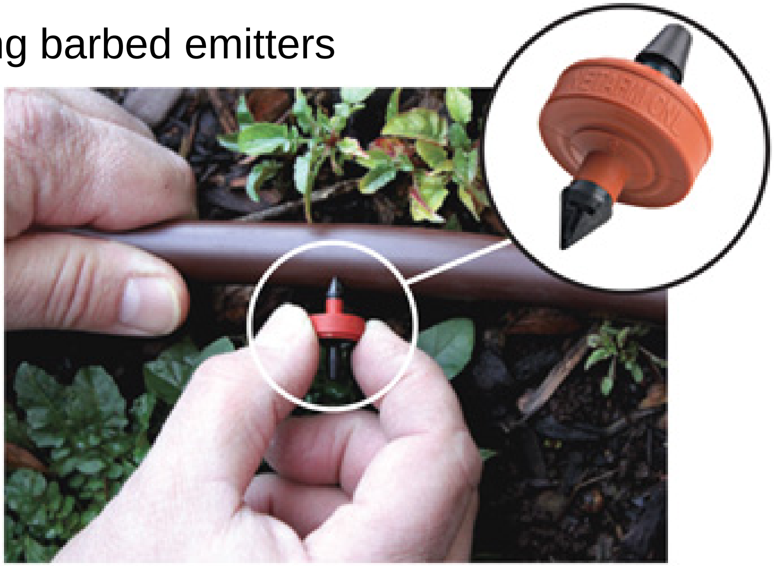




Micro / Drip Irrigation

- Drip-emitters (varying outputs: 0.26 gph or 0.4, 0.6, or 0.9)
- Point-source emitters (0.5 gph or 1.0 gph or 2.0 gph)
- Most applications are 90%-95% efficient, and very capable of achieving the ‘water efficiency’ credit on LEED projects.

Self-piercing barbed emitters



Sprays with Enhanced Features

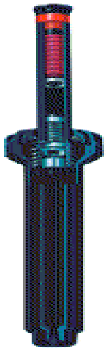
With Shutdown Device

- When nozzle is removed, filter-basket lifts and device slips upward, seals off flow.

With PR & Shutdown

Two features combined…

- Pressure regulated at 30 psi. Prevents sprinklers from 'fogging', being carried away by wind drift.
- Shutdown device is also in place.



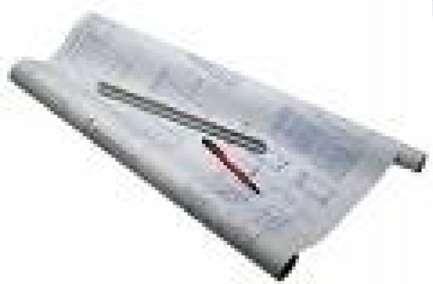
Use State-of-the-Art Nozzle Technology

- Compared to standard MPR nozzles, certain nozzles can discharge 30% less
- Precipitation rate is at 1.0 inch/hour
- Greater efficiency of application (72 vs 60)
- Additional arcs vs standard (60, 150, 210 deg)
- Male-threaded *and* female-threaded

Multi-Stream Rotating Nozzles

- Lower precipitation rates (Approx 0.4-0.5 inches/hour)
- Commonly used mid-range (17-25 ft.)
- Efficient application
- Flexible in design; adaptive to varying geometry of landscape edges.

“Green” Irrigation Systems do not *just happen*…



It takes…

Pre-planning, Coordination, Training



Make a Difference…

Begin implementing 'WaterSmart' Systems!!

QUESTIONS?

Water Harvesting + High Efficiency Irrigation = Sustainable Water-Use

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