Brent Mecham

ASIC 2016 REGIONAL CONFERENCES

Southeast, Southwest, Northeast, & California

American Society of Irrigation Consultants

Codes, Standards and Green Initiatives

Brent Mecham, CID, CLWM, CLIA, CIC, CAIS

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Market Transformation

Voluntary

- BMPs
- Standards
- Green Initiatives
- Consumer Expectations

Mandatory

- Ordinances
- Codes
- Executive Orders

Executive Orders

- Executive Order 13514 -- Federal Leadership in Environmental, Energy, and Economic Performance 10/5/2009
- Executive Order 13693-- Planning for Federal Sustainability in the Next Decade 3/19/2015

Executive Order 13514 --

- The Executive Order requires agencies to meet a number of energy, water, and waste reduction targets, including:
- *26% improvement in water efficiency by 2020;*

Executive Order 13514

- To help achieve these policy goals, CEQ issued on October 31, 2011 Guidance for Federal Agencies on Sustainable Practices for Designed Landscapes,

Executive Order 13514

- Water Resource Goals
  - Reduce, with aim to eliminate, the use of potable water, natural surface water (such as lakes, rivers, and streams), and groundwater withdrawals for landscape irrigation:

Executive Order 13693-- Planning for Federal Sustainability (& resiliency) in the Next Decade

- Ensure 25 percent of their total energy (electric and thermal) consumption is from clean energy sources by 2025.
- Reduce energy use in Federal buildings by 2.5 percent per year between 2015 and 2025.
- Reduce per-mile GHG emissions from Federal fleets by 30 percent from 2014 levels by 2025, and increase the percentage of zero emission and plug in hybrid vehicles in Federal fleets.
- ***Reduce water intensity in Federal buildings by 2 percent per year through 2025.***

Executive Order 13693-

- Guiding Principles for Sustainable Federal Buildings and Associated Instructions
  - The Council on Environmental Quality February 2016

Guiding Principles

- (f) improve agency water use efficiency and management, including stormwater management by:
  - (i) reducing agency potable water consumption intensity measured in gallons per gross square foot by 36 percent by fiscal year 2025 through reductions of 2 percent annually through fiscal year 2025 relative to a baseline of the agency's water consumption in fiscal year 2007;
  - (ii) installing water meters and collecting and utilizing building and facility water balance data to improve water conservation and management;
  - (iii) reducing agency industrial, landscaping, and agricultural (ILA) water consumption measured in gallons by 2 percent annually through fiscal year 2025 relative to a baseline of the agency's ILA water consumption in fiscal year 2010; and
  - (iv) installing appropriate green infrastructure features on federally owned property to help with stormwater and wastewater management;

GP—new buildings

- b. Outdoor Water Use: Use water efficient landscapes that incorporate native, non-invasive, drought tolerant, and low maintenance plant species and employ water efficient irrigation strategies to reduce outdoor potable water consumption. Install water meters for irrigation systems serving more than 25,000 square feet of landscaping.
- c. Alternative Water: Implement cost effective methods to utilize alternative sources of water such as harvested rainwater, treated wastewater, air handler condensate capture, grey water, and reclaimed water, to the extent permitted under local laws and regulations.

GP—existing buildings

- Outdoor Water Use: Use water efficient landscape and irrigation strategies to reduce outdoor potable water consumption.
  - The installation of water meters is required for irrigation systems serving more than 25,000 square feet of landscaping.
- Alternative Water: Implement cost effective methods to utilize alternative sources of water such as harvested rainwater, treated wastewater, air handler condensate capture, grey water, and reclaimed water, to the extent permitted under local laws and regulations.

III. Protect and Conserve Water

- Indoor Water Use
  - Build to ASHRAE 189.1-2014 sections 6.3.2, 6.4.2, and 6.4.3 or current comparable ASHRAE standards
    - Water-Efficient Products
    - Water Meters
    - Cooling Towers
    - Single Pass Cooling
- Outdoor Water Use
  - Separately meter water for irrigation systems greater than 25,000 sf
  - Use water efficient landscapes
  - Limit potable water use for irrigation to 50% or more below conventional practices using methodologies from ASHRAE 189.1-2014 section 6.5.1 . . . to calculate water use of conventional practices
- Alternative Water
  - Consider alternative sources of water where cost-effective . . .
- Stormwater Management
  - For new construction meet or exceed EISA section 438 stormwater management requirements

Gov. Brown Executive Order 5/9/2016

- Continues Executive Orders
- Use Water More Wisely
  - Mandatory reduction of potable water use
  - New water use targets building on the 20% reduction by 2020
  - Outdoor irrigation (water budget)

CA Executive Order (continued)

- Eliminate Water Waste
  - Prohibit water waste
    - No runoff from lawn watering
    - No irrigation within 48 hours of precipitation
    - No irrigating ornamental turf on public medians
  - Minimize system leaks
  - CEC shall certify innovative technologies that also increase energy efficiency

CA Executive Order (continued)

- Strengthen local drought resilience
- Improve Agricultural water use efficiency and drought planning
  - Update requirements for Agricultural Water Management Plans by January 10, 2017

Irrigation BMPs

- BMP & Practice Guidelines
- Design
- Installation
- Management
- Appendices
  - Inspection & Commissioning
  - Water Budgeting
  - Scheduling

IRRIGATION ASSOCIATION & AMERICAN SOCIETY OF IRRIGATION CONSULTANTS

Landscape Irrigation Best Management Practices

May 2014

Prepared by the Irrigation Association and American Society of Irrigation Consultants

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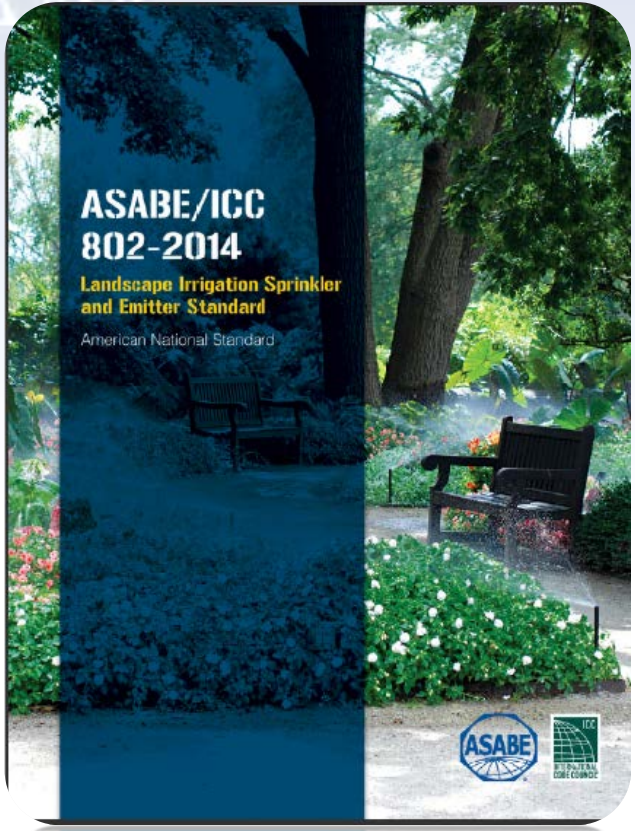
The Irrigation Association and the American Society of Irrigation Consultants have developed the *Landscape Irrigation Best Management Practices* for landscape and irrigation professionals and policy makers who must preserve and extend the water supply while protecting water quality. The BMPs will aid key stakeholders (policy makers, water purveyors, designers, installation and maintenance contractors, and consumers) to develop and implement appropriate codes and standards for effective water stewardship in the landscape.



Tests—Sprinklers & Bubblers

- Flow Rate
- Distance of Throw
- Distribution Uniformity
- Burst Pressure
- Check Valve
- Pressure Regulation

Tests—Emitters and Microsprays

- Uniformity of flow rate
- Flow rate as a function of pressure
- Emitter exponent for PC emission devices
- Check valve function

ANSI/ASABE S623

Determining Landscape Plant Water Demands

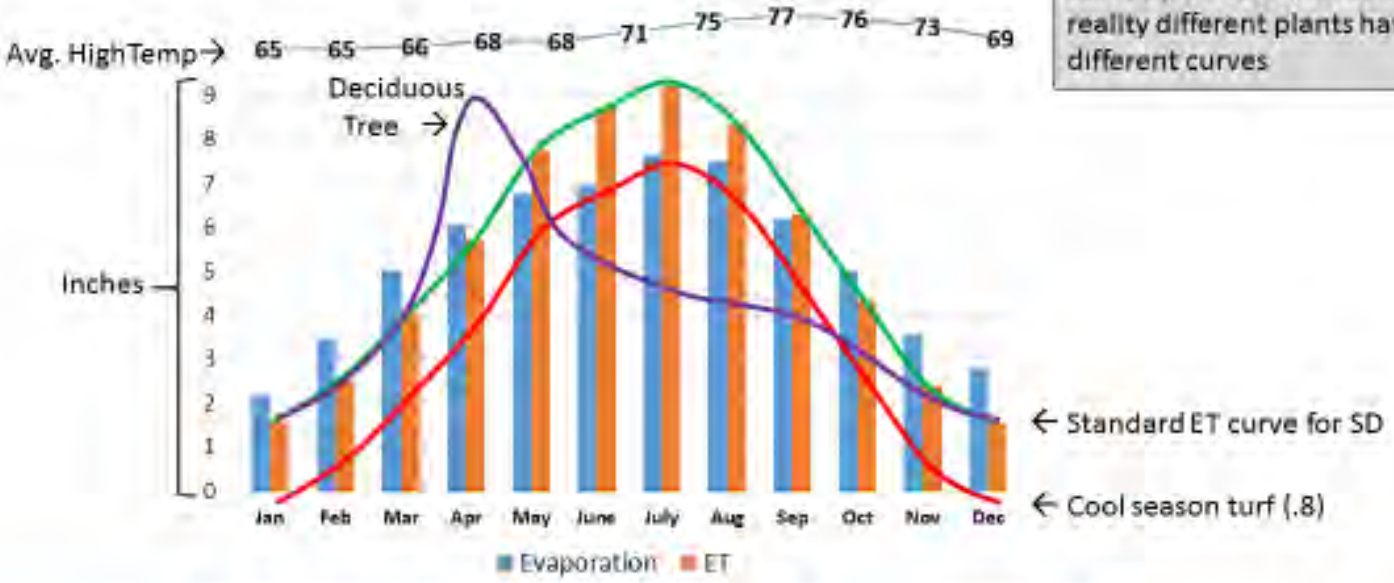
EPA WaterSense photo gallery

Annual Average Fraction of ET_o

Plant Type	Plant Factor
Turf – Cool Season	0.8
Turf – Warm Season	0.6
Annual Flowers	0.8
Woody plants, herbaceous perennials—Wet* (> 20 inches of precipitation)	0.7
Woody plants, herbaceous perennials—Dry*	0.5
Desert plants (< 10 inches of precipitation)	0.3

San Diego CA

One challenge to using ET data is that a crop coefficient only moves the curve up or down, when in reality different plants have different curves



San Diego goes from 1.55 to 9.30 with only 12° of Temperature change.

Other ANSI Standards

PINS—Professional Qualifications Standard for Rainwater Catchment System Designers

- IAPMO (ASSE Chapter) (ASSE International Chapter of IAPMO)
- This standard applies to any individual involved in the design, installation, maintenance, and inspection of rainwater catchment systems. The system catches rain water, which can be used for a variety of plumbing and/or irrigation applications. This standard identifies a minimum level of knowledge required to install, design, and inspect these systems. Project Need: There is not currently a standard that sets minimum training requirements for individuals who install, design, or inspect rainwater catchment systems. Stakeholders: Building owners, managers, plumbing professionals, engineers, inspectors, AHJs and the general public. MHI (Material Handling Industry)
- Marianne Waickman marianne.waickman@asse-plumbing.org Contact: Fax: E-mail: BSR/IAPMO 21000-201x,

Standards in Progress

- ASABE S626 20XX **Landscape Irrigation System Uniformity and Application Rate Testing**
- ASABE S627 20XX **Weather-based Landscape Irrigation Control Systems**
- ASABE S633 draft **Soil Moisture Sensor for Landscape Irrigation** in beta testing

Market Trends

- Native-type landscapes that won't require irrigation.
- Minimal turf grass areas.
- No potable water for irrigation.

Codes

- Shift to write standards in mandatory language.
- Adopted by code setting bodies or rating systems
- ICC, IAPMO, CalGreen

**ASHRAE 189.1—2014

- Standard for High-Performance Green Buildings
- Continuous maintenance next version 2017
- A number of proposed irrigation provisions

** = influencing the market significantly

IgCC--2015

- Has numerous irrigation requirements
- ASHRAE 189.1 is alternate compliance path
- MOU between ICC-ASHARE-USGBC/LEED-AIA
- 2018 IgCC will use ASHRAE 189.1 as technical content and qualifies as LEED

IAPMO Green Technical Supplement

- 2015 version has a number of irrigation provisions.
- Becoming WEStand-2017 using water provisions.
- Additional / modified provisions for irrigation.

Green Building Initiative

- Green Globes
- 2010 ANSI Standard
- Rating System for “greenness”

National Green Building Standard

- 2015 version not yet released
- Rating system for residential properties
- EPA Water Budget Tool
  - Points for less turf
  - Follow BMP document
  - Mandatory irrigation plan by certified WS labeled program
  - WS labeled controllers
  - Pressure regulation
  - Maximum Precipitation Rate 1.20 in/h
  - Points for non potable water use

LEED v4

- Prerequisites:
  - Option 1 No irrigation
  - Option 2 Water Budget Tool, 30% reduction
- Credits
  - 50% reduction 1 point
  - 100% reduction 2 points
- Confusion about water, versus potable water
- Points for using onsite harvested water

Sustainable SITES v2

- Patterned after LEED
  - Use EPA Water budget tool with 50% reduction
  - Landscape that doesn't require permanent irrigation.
- Credits
  - Reduce demand by 75% 4 pts.
  - Significantly reduce (no potable water) 5 pts.
  - Eliminate long-term irrigation 6 pts.

Observation

- Efficiency = reduction or elimination
- Assumes no benefit comes from plants
  - LID
  - UHI effect
- Natives are superior
- No points for superior irrigation systems
- No follow up to the water budget

Strategy

- Use of BMP document
- IA has written a model landscape irrigation ordinance
  - Works with existing landscape ordinances
  - Modify for local circumstances
- Separate landscape issues from irrigation issues

Concern

- Lack of understanding that plants provide and create ecosystem services that gets more valuable with time.
- Benefits are enhanced with actively growing plants—they need water.
- Trade water for _____

Alternate Water Resources

Rick Clelan & John Russell

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Rick Clelan

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SkyHARVESTER™

Water Conservation Systems

Rick Clelan, Landscape Market Manager

WATERTRONICS™
A LINDSAY COMPANY

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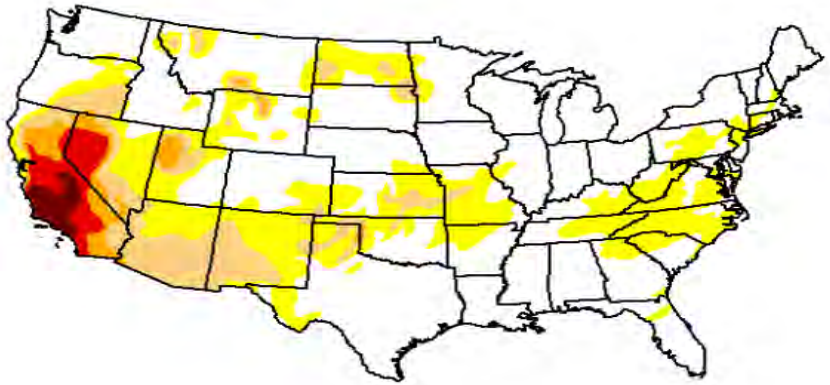
All the water that will ever be is right now

National Geographic, October 1983



U.S. Drought Monitor
CONUS



April 19, 2016

(Released Thursday, Apr. 21, 2016)

Valid 8 a.m. EDT

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	60.72	39.28	15.44	5.94	3.44	1.11
Last Week 4/12/2016	60.80	39.20	17.75	6.10	3.76	1.71
3 Months Ago 1/19/2016	71.24	28.76	16.37	8.51	4.84	2.42
Start of Calendar Year 12/29/2015	66.99	33.01	18.74	11.56	6.28	2.70
Start of Water Year 9/29/2015	44.91	55.09	31.36	20.09	11.45	3.00
One Year Ago 4/21/2015	46.62	53.38	37.13	18.97	8.57	3.55

Intensity:

- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

Author(s):
Richard Tinker
CPC/NOAA/NWS/NCEP

USDA

National Drought Mitigation Center

http://droughtmonitor.unl.edu/

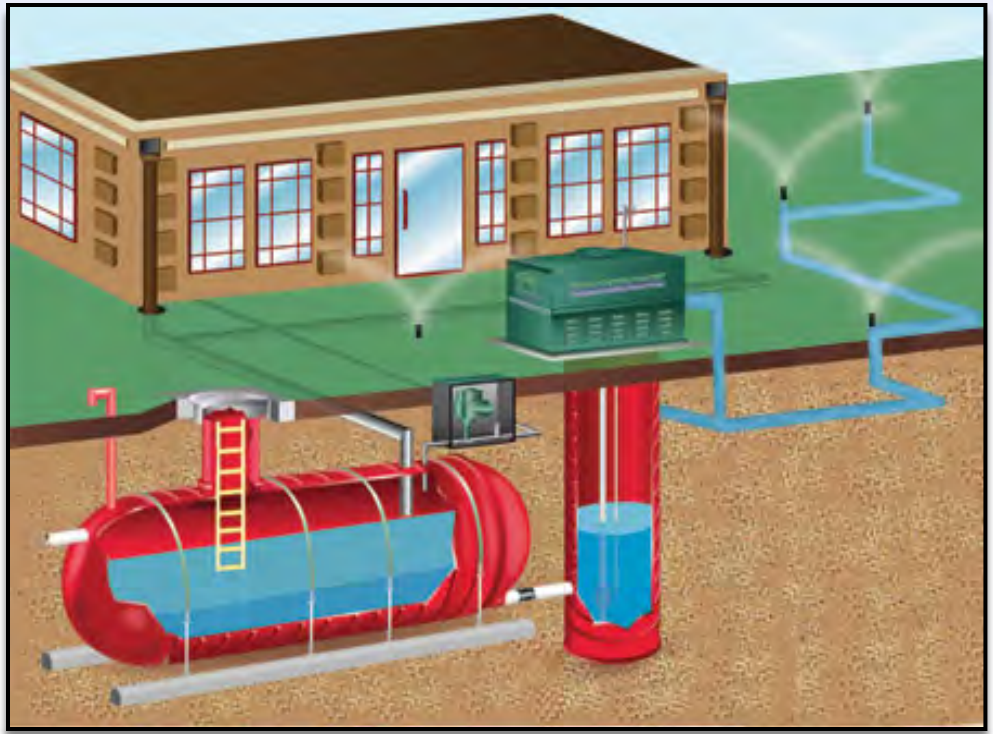
SkyHarvester™ Solution

Develop a water collection and distribution system that harvest's water from multiple sources and delivers it efficiently to multiple applications, automatically.

ASIC

SkyHARVESTER™

Water Conservation Systems



Water Harvesting

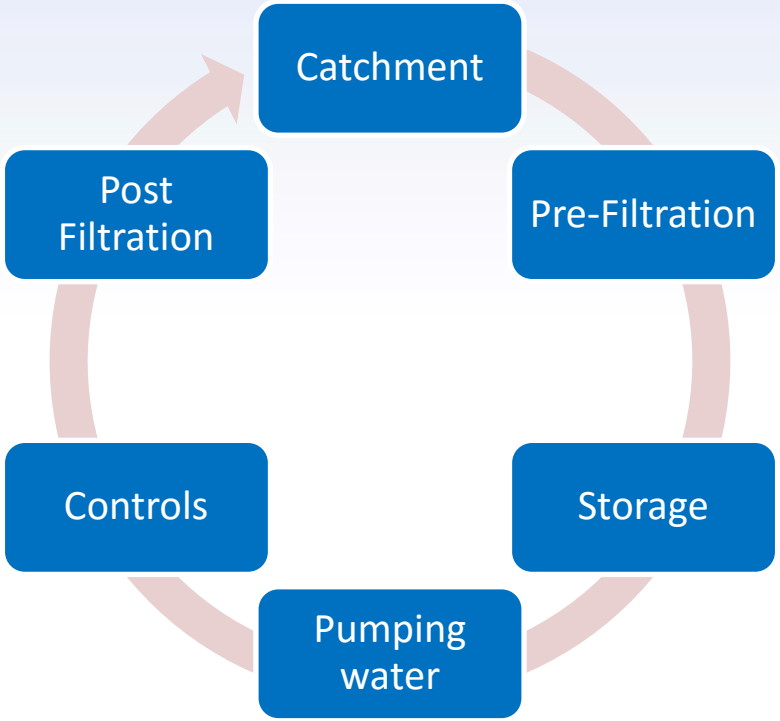
- Moving beyond “Rainwater” Harvesting
  - Rainwater
  - Stormwater
  - AC condensate
- Take advantage of all possible sources
  - Understanding that each source comes with its own challenges
    - Example: stormwater off a parking lot contains petrochemicals, this must be accounted for in design.
    - Water from green roofs has extremely high TDS and is not recommended for interior building applications.

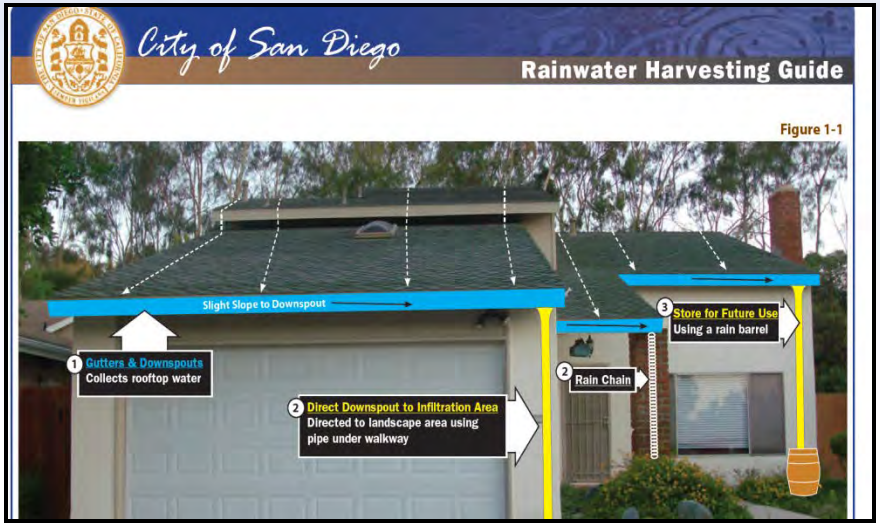
Water Harvesting

- Defining your intent
  - LEED Accreditation
  - Rainwater harvesting for what application(s)
  - Stormwater mitigation
  - Government mandate
- Determine your budget
- Develop the solution
  - Single-source integrated solution is key (don't "split-out" the system).
  - Make sure all design parties are involved during Design & Construction!
    - Architect, Civil Engineer, Plumbing Engineer, Mechanical Engineer, Landscape Architect, Irrigation Consultant

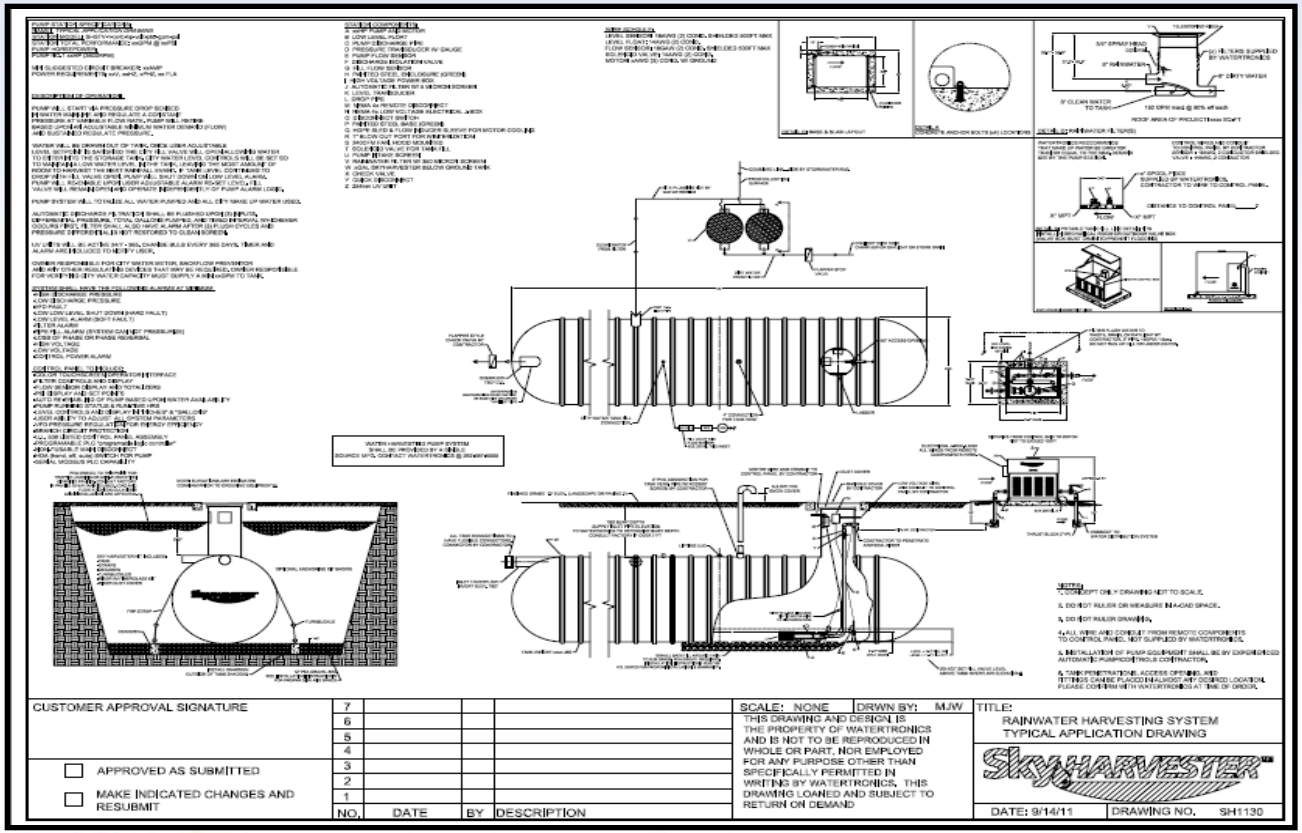
Involved Organizations

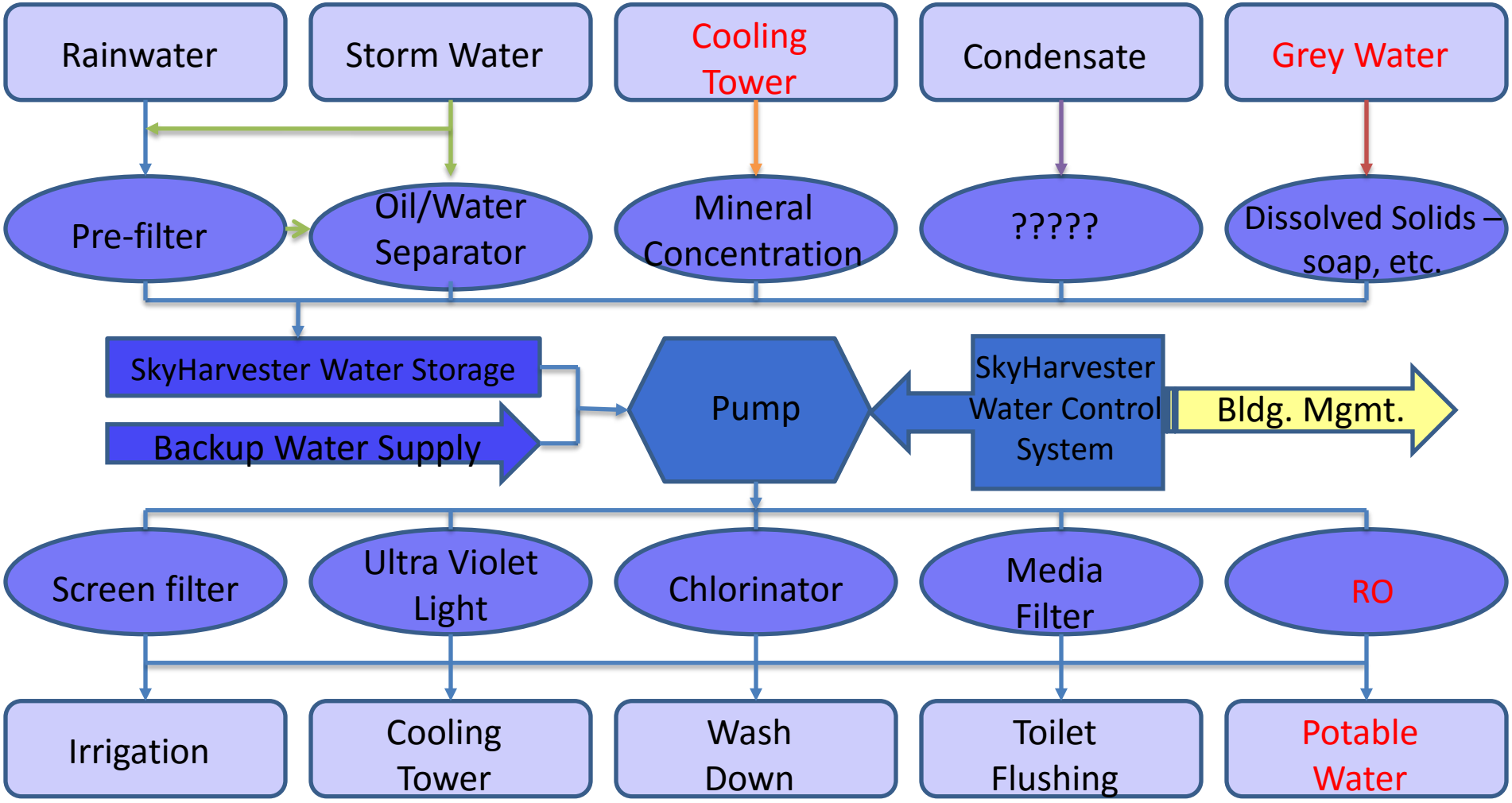
Water Harvesting - Major Components




City of San Diego
Rainwater Harvesting Guide
Figure 1-1
Slight Slope to Downspout
1 Gutters & Downspouts
Collects rooftop water
2 Direct Downspout to Infiltration Area
Directed to landscape area using pipe under walkway
2 Rain Chain
3 Store for Future Use
Using a rain barrel

Design Document




Rainwater
Storm Water
Cooling Tower
Condensate
Grey Water
Pre-filter
Oil/Water Separator
Mineral Concentration
?????
Dissolved Solids – soap, etc.
SkyHarvester Water Storage
Backup Water Supply
Pump
SkyHarvester Water Control System
Bldg. Mgmt.
Screen filter
Ultra Violet Light
Chlorinator
Media Filter
RO
Irrigation
Cooling Tower
Wash Down
Toilet Flushing
Potable Water


Pre-Filter
3 Main Components
Pump & Control Skid
Tank

Design of Components – Pre Filtration

Why Pre-Filtration?

Components - Pre filter

- The best way to filter the water is at the source. The sooner we incorporate filtration, the better the rest of the system operates.
- Primarily particle filtration (TSS – total suspended solids)
- Oil/Water separation (Stormwater only – Hydro-Dynamic Separator)

Image courtesy of Graf

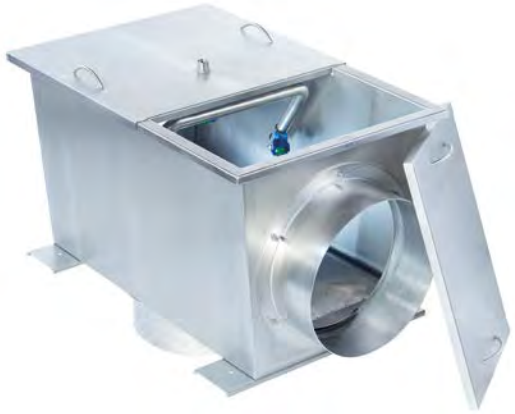
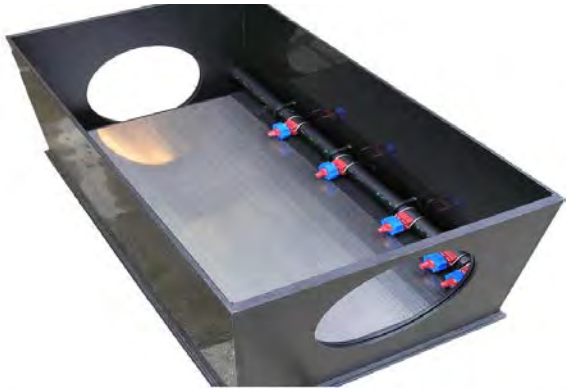


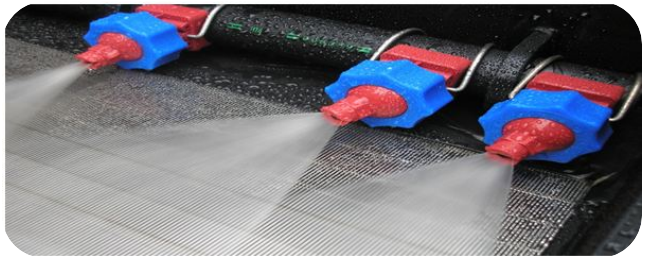
Image courtesy of Graf

Image courtesy of Contech

Design of Components - Pre filtration

- All Gravity type rainwater filters work on an efficiency principle
  - 200gpm @ 90% eff. = 180gpm to storage tank
- Sizes from 32 GPM to about 4,000gpm
- Some can be flushed with pressurized water
- Approx. 350-1000 micron screens (.013” - .04”)
- Exception: Hydro-Dynamic separators 80% /100 micron





Design of Components - Pre filtration

Commercial Installation Examples

Components - Storage

- Storage could be any vessel that can hold or retain water
- Tanks or Ponds
- Separate containment, or built into building foundation
- Below or Above ground

Image courtesy of Norwesco

Design of Components - Storage

Determining Tank Size (4) Part function

1. What is your usage per time period (gallons/day)
2. Potential of collection
3. What your budget is
4. Any city code requirements

End usage and end usage patterns can also effect tank size.

In an irrigation application, the rainwater system only needs to provide the water needed for plants between the natural rain events!

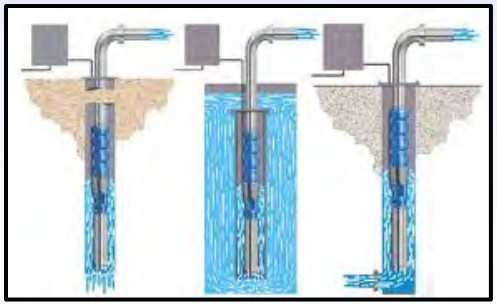
Components – Pumping/Controls

- The heart of the water harvesting system
- Submersible or above grade pumps
- Controls all peripheral components (level, flow, pressure, & filter sensors etc.)
- Make a water manager out of the end user
- Quantify ROI and contain data about system

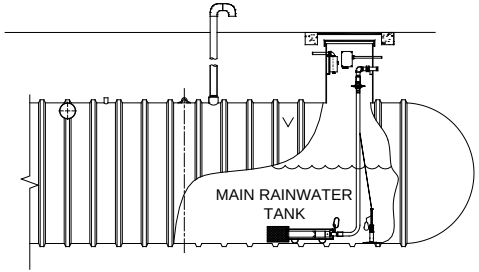
Types of Pumps

Horizontal Centrifugal

Water well submersible turbine, installed Vertically or Horizontal



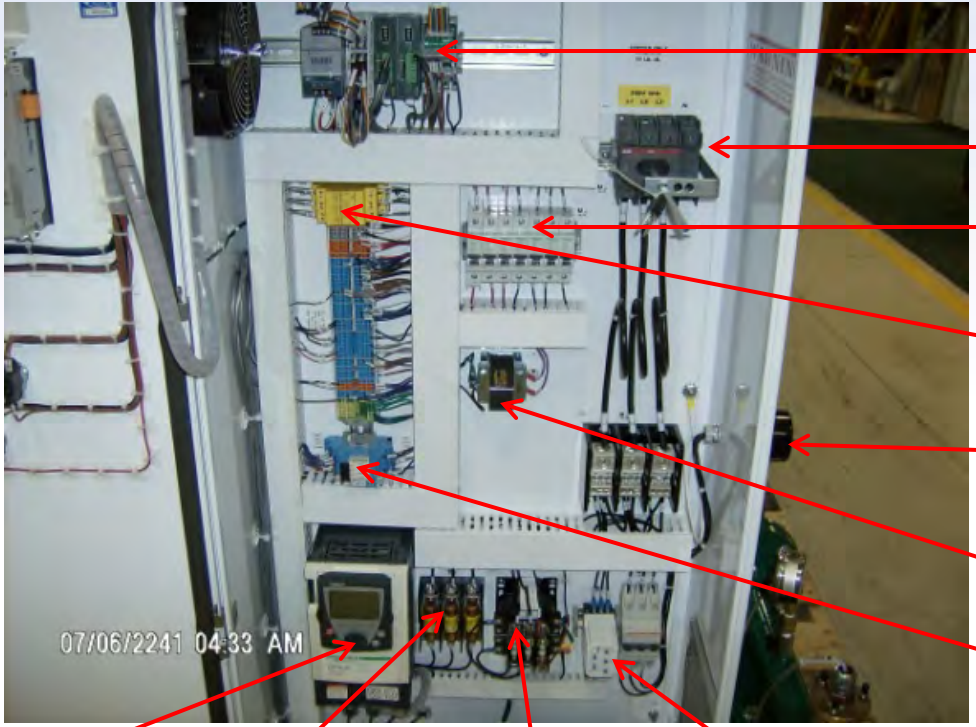
Submersible pump in Flow Inducer tube.



Components - Controls

U.L.508 Dead-front panel
Ventilation / Cooling
Nema Rating for Environment
High and Low Voltage components

Components – Control Panel



PLC 24V DC

460V DISCONNECT

CIRCUIT BREAKERS
Control power, touch screen, PLC

SURGE SUPRESSORS
ANALOG SENSORS

LIGHTNING ARRESTOR

460/24VAC TRANSFORMER

24V DC RELAYS

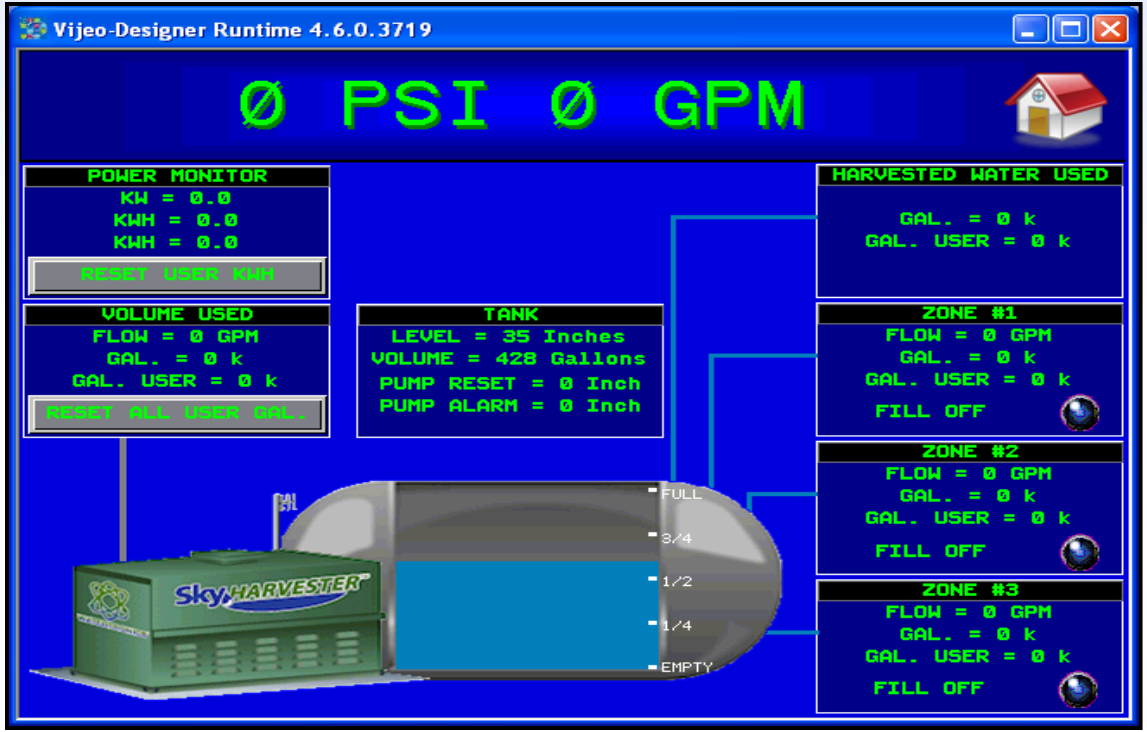
VFD

VFD Fuses

460/120 AC TRANSFORMER

PHASE MONITOR & CIRCUIT BREAKER

Operator Interface Example



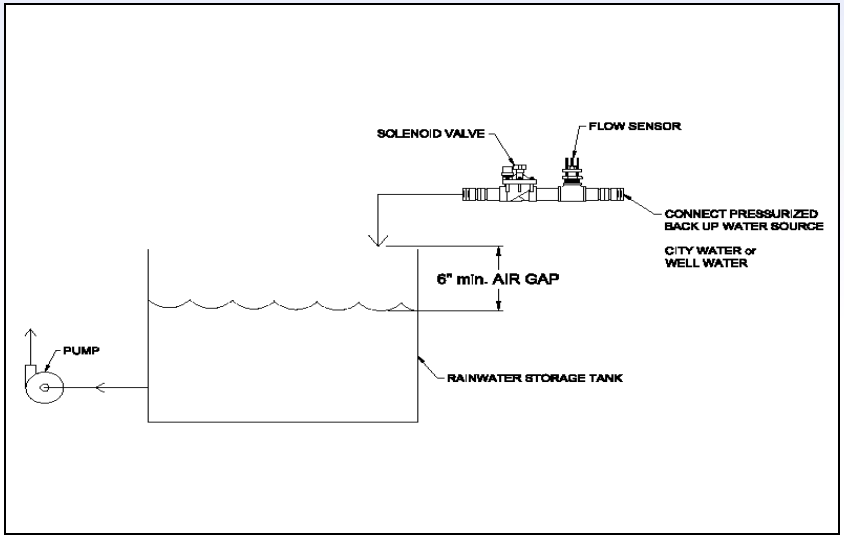
Level Controls

How to integrate a back up water source

1. Do we need a back up water source?
2. Will the back up water source go to the reservoir or direct to the water distribution system?
3. Does the back up water source have the proper flow and pressure to satisfy the water distribution system demand?
4. The back up water source requirements change based upon the following possible scenarios.
    1. Back up water will go to the reservoir
    2. Back up water will go direct to the water distribution system

Let's take a look at some examples

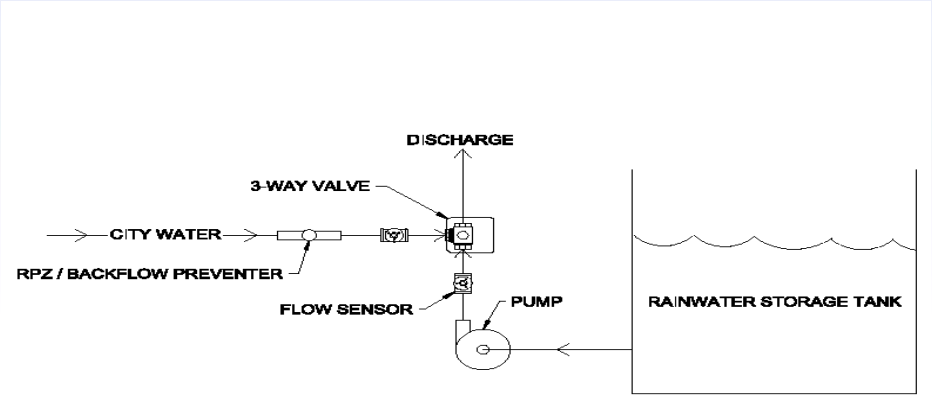
Level Controls (Tank Fill)



Back up water must have the proper flow to the tank (pressure not important)

Controls must maintain a low water level in the tank leaving the most amount of room to capture the next rain event. Do not set fill valve to fill tank to full level.

Level Controls (Direct to Distribution)



Local codes must allow for this type of connection.

Back up water must have the proper flow and pressure at connection to rainwater system.

Controls must switch back to rainwater based upon availability in tank

Discharge Filtration

Automatic Screen Filtration

-Controlled via the rainwater control panel

-Reverses flow across the screen

-Internal self cleaning mechanism

-Flushes on differential pressure, timed interval, or total gallons pumped

-Note screen area when sizing

MANUAL

AUTOMATIC

Ultra Violet Disinfection

UV basics

-254nm wave length UV light is used to render organisms inactive or unable to reproduce

-Water is in contact with light for a period of time. Energy is transmitted to the water (mj/cm2)

-Pick a dose (30mj/cm2) organisms require a certain amount of energy to be deactivated

-Pick a flow rate with a given UVT% (actual UVT of water not known without water sample.)

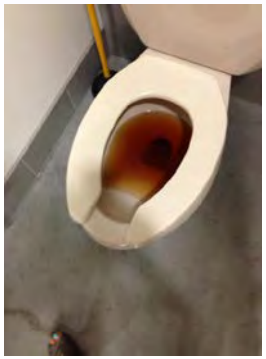
Water Quality Requirements for UV

Dose: Light Energy delivered into the water “mj/cm2” (see also destruction chart)
Ultra-Violet Transmittance %: Light’s Ability to Penetrate the Water
Flow Rate: Maximum GPM able to be disinfect at criteria above.
General Requirements

- 7grains or less of Hardness
- .3ppm of iron
- UVT% must be per the mfg. performance curve
- .05 ppm of manganese (dark black metal)

If the UVT% of the water through the UV unit is different than what you sized the UV for, the dose is NOT DELIVERED!





Chlorine Injection –Disinfection/Color

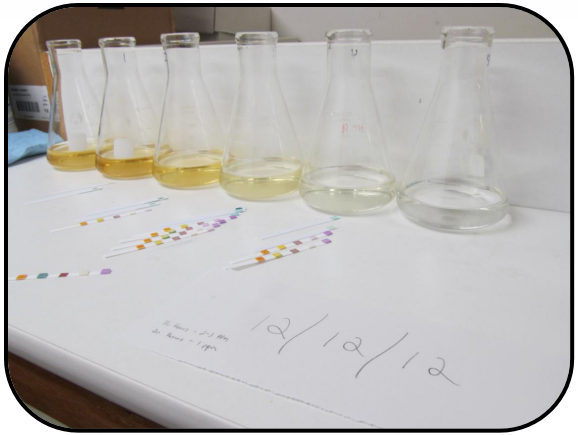
Chlorine Recirculation System on Day Tank (maintains 2-3ppm residual chlorine level)

-Uses separate pump in Day Tank Start/Stop via timer

-Water sent through CHL Analyzer (PH & CHL sensor)

-Dosing pump injects to maintain set point of CHL in PPM

-30gal holding tank (uses household bleach/pool shock)



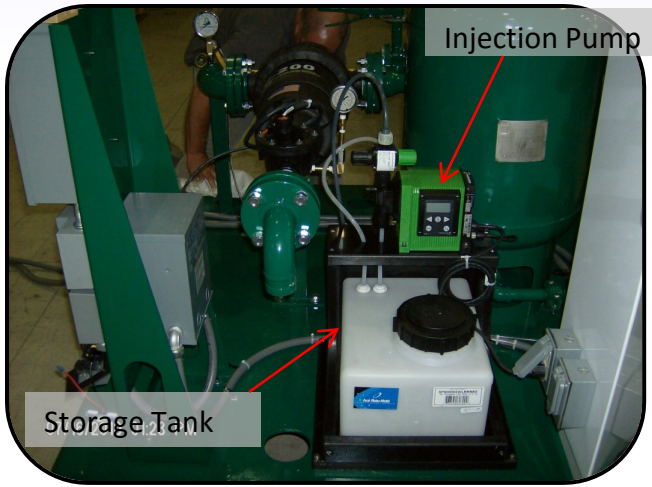
- *Chlorine will also effect color of water. It changes the way molecules reflect visible light to the naked eye.*
- *Like a stain removal on white T-Shirt.*

Dye Injection

-Dye offers a visual identification that the water is non-potable.

-System injects proportional to the flow rate to the piping system to maintain constant ratio of chlorine or dye. This will keep a consistent color or concentration across the entire flow rate.

-Dosing is ~1ppm-3ppm (mg/L)



City of Ocean Springs Splash Pad

- 3k Below ground storage tank
- Submersible pump in tank
- Control skid with filtration (outdoors)
- Back up water will fill tank
- Fully flooded excavation installation
- Harvested splash pad water for irrigation

KC Performing Arts – Irrigation/Green Roof

- 80k Below ground storage tank
- Flooded suction pump in mech room
- Harvested water from a green roof
- Back up water will fill tank
- Multiple tank / traffic rated
- Green roof filtered water @ 100 micron

Bemis Center for Contemporary Arts
Rainwater Harvesting

Radio Flyer - Irrigation

- 40k above ground storage tank
- Flooded suction pump w/ 100 micron filter
- Back up water will fill tank
- Cold weather environment

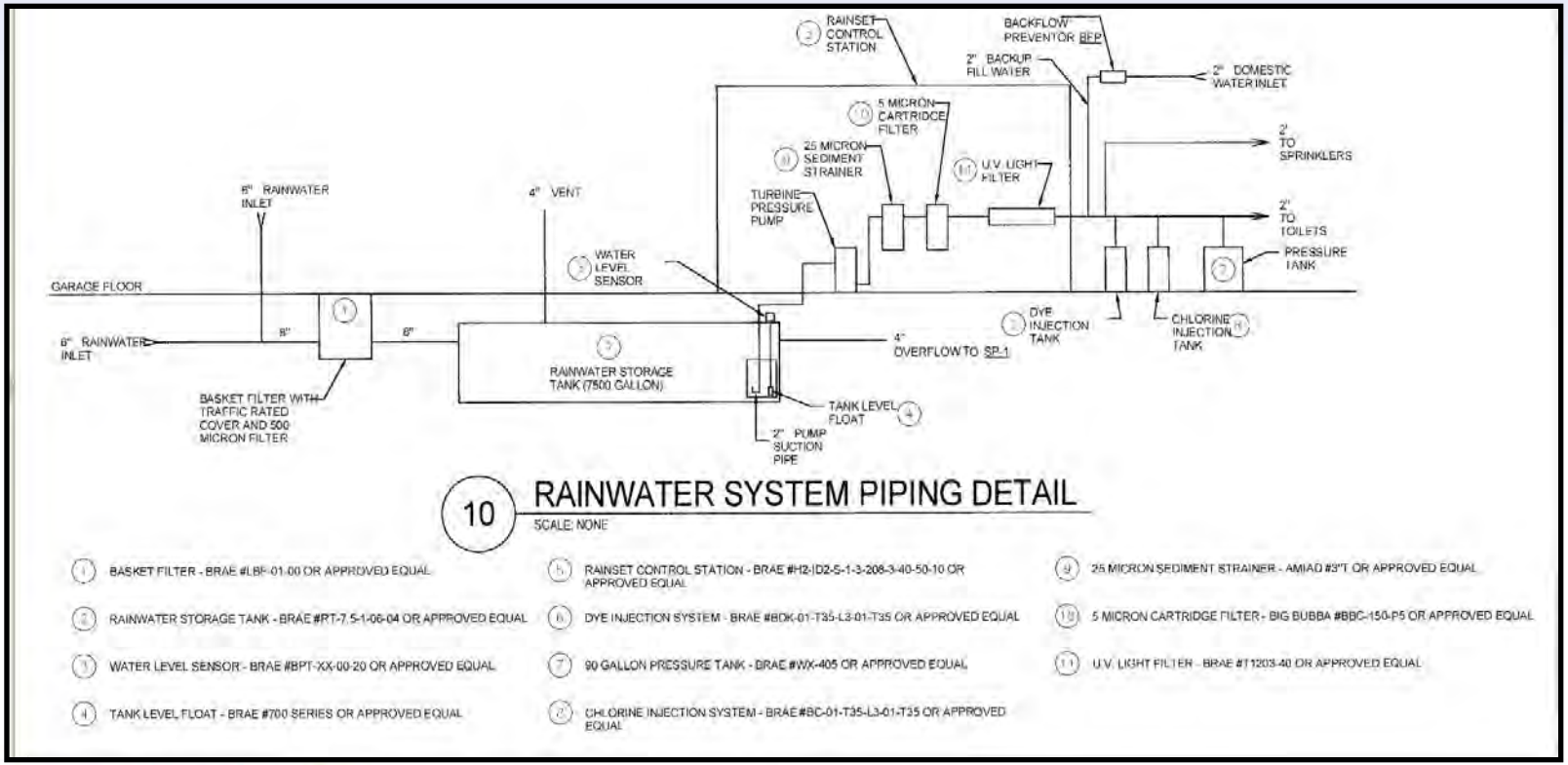
Vantage Career Center - Ohio

- (2) 15,000 gal below ground tanks
- Submersible pump in tank / 60gpm @ 60psi
- (4) 350 micron tank pre-filters
- Automated city back up water plumbed direct
- Flushes all toilets in school
- 5 micron filtration and UV & dye
- 52,430 sq-ft roof
- Min 256,000gal saved yearly

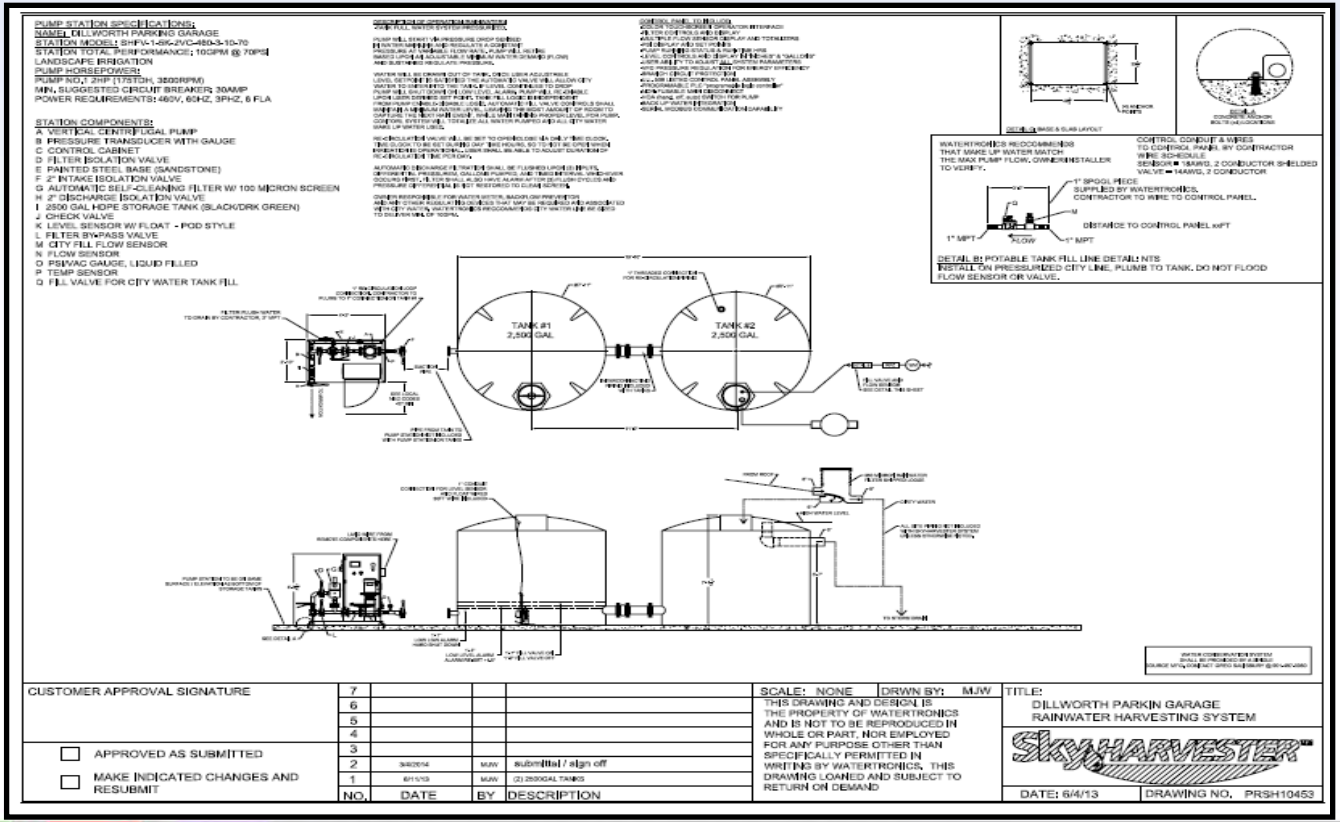
Oakville Transit – Wash Application

- 30k Below ground storage tank
- Submersible pump in tank
- Control skid with filtration
- Back up water direct to wash system

Bid Document

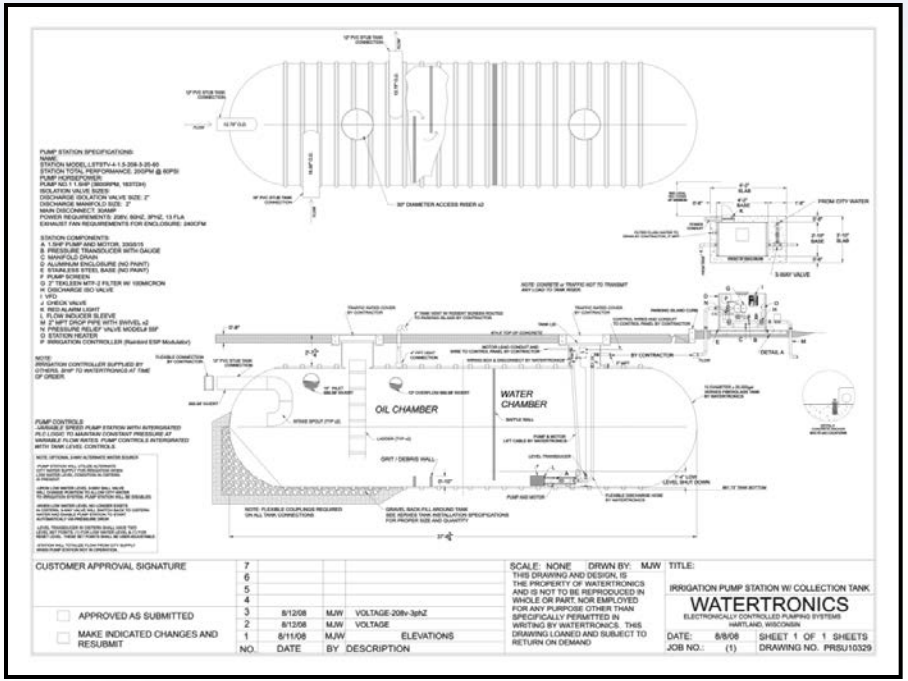


Design Document



Water Harvesting

- The range of water harvesting is vast understanding the project intent and budget is key to a successful project.
  - Systems vary from basic to very complex with advanced controls
  - Pricing ranges as system requirements are established





All the water that will ever be is right now

National Geographic, October 1983



John Russell

ASIC 2016 REGIONAL CONFERENCES

Southeast, Southwest, Northeast, & California

American Society of Irrigation Consultants

WaterSprout

design | build | maintain

GREYWATER SYSTEMS

John Russell, President
WaterSprout, inc.
www.watersprout.org

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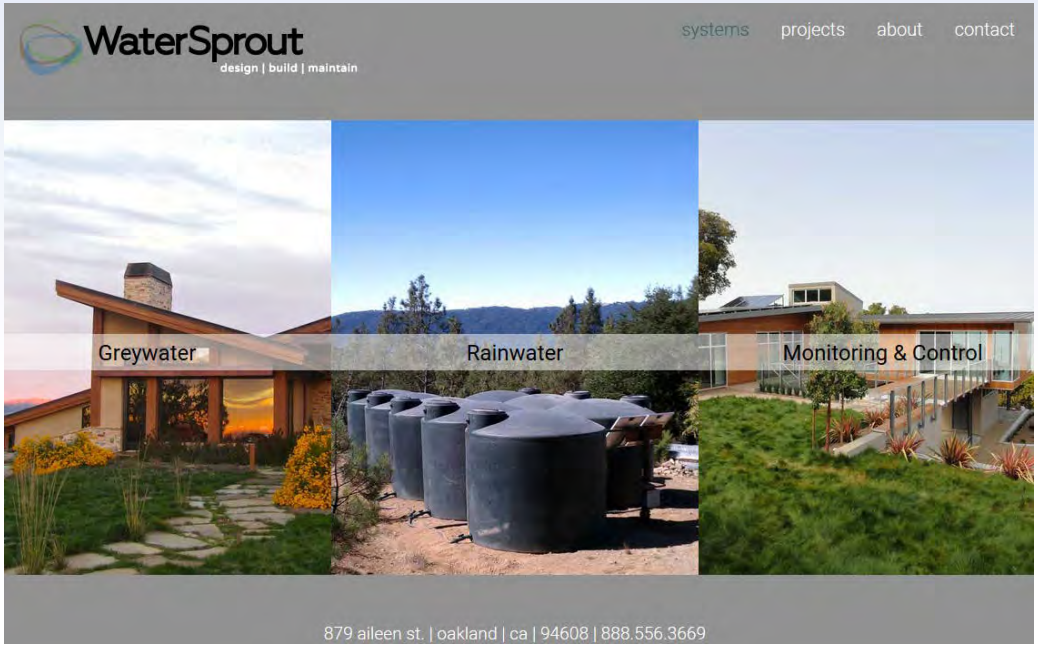
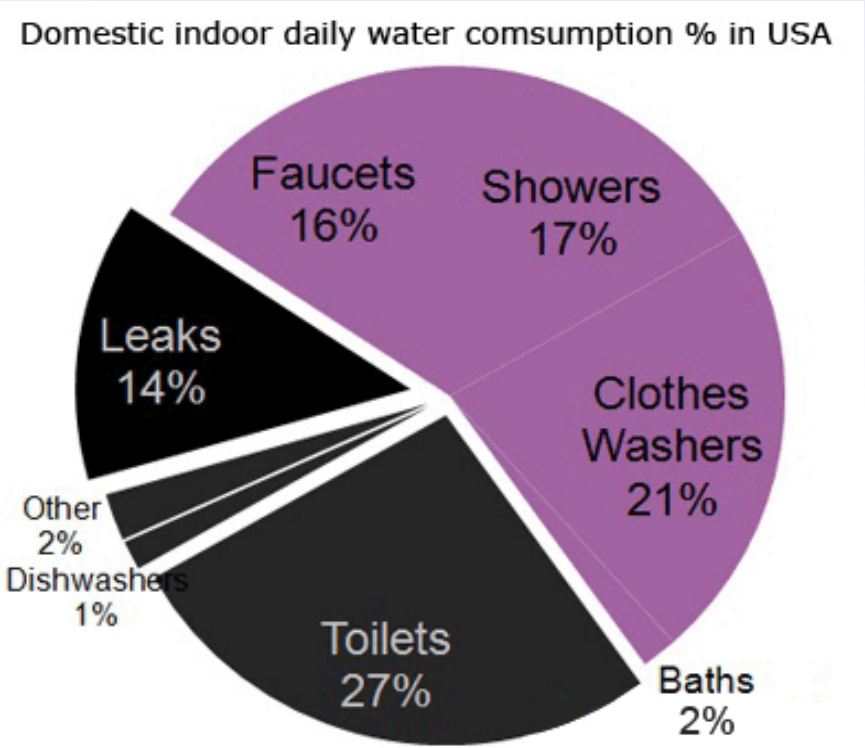
WaterSprout Services: design/build



- Greywater, rainwater, groundwater & water-use monitoring
- Residential & Commercial
- Over 180 systems installed in Northern California

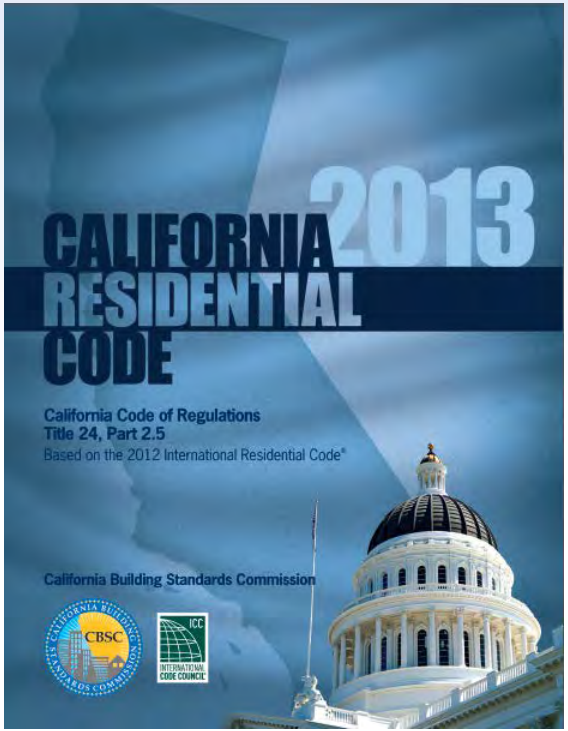
Greywater: What is it?



Source: American Water Works Research foundation

- **Greywater** is drainage water from showers/baths, bathroom sinks, laundry machines: **54%**
- **Blackwater** is from toilets and kitchen sinks/garbage disposals: **44%**

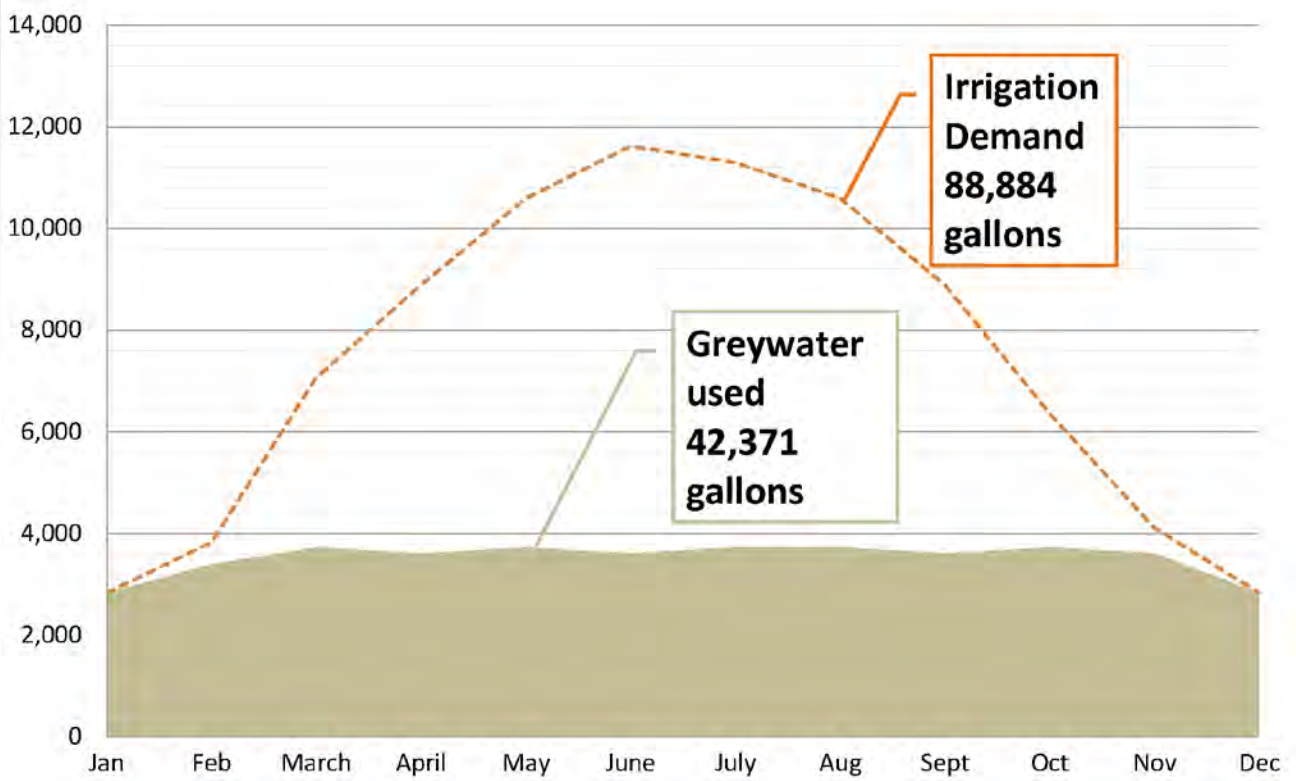
Greywater: California plumbing code



- **“untreated”** greywater used for sub-surface irrigation, per CPC 1601.0. Requires no disinfection

- **“treated”** greywater used for spray irrigation, toilets, urinals ect., per CPC 1604.0

Greywater: How much?



- 1 person produces 20-40 gallons of greywater per day
- Family of 4 will produce **30-60K gallons** annually

Greywater: water quality

Source: Greywater Action

Greywater Testing Results							
		Median	Min	Max	Samples in "generally safe" range	Samples in "slight to medium" risk range	Samples in "severe" risk range
EC (mmhos/cm)	greywater	0.31	0.07	4.82	85%	14%[2]	1%
	municipal water[1]	0.38	0.04	1.64			
TDS (ppm)	greywater	193	47	3133	84%	15%[2]	1%
	municipal water[1]	240	29	846			
SAR[3]	greywater	1.8	0.35	64	80%	18%[2]	2%
	municipal water[1]	no data available					
pH	greywater	6.5	5.5	9.7			
	municipal water[1]	8.3	6.7	9.7			
Boron (ppm)	greywater	0.04	0.003	4.55	92%	5%[2]	3%
	municipal water[1]	0.31	ND	0.88			
Chlorine (ppm)	greywater	24	4	210	94%	6%[2]	0%
	municipal water[1]	24	3	394			
Sodium (ppm)	greywater	32	7	1024	85%	13%[2]	2%
	municipal water[1]	23	3	140			

Greywater: cleaning products

- No powdered laundry detergents, or high salt detergents
- No anti-bacterial soap
- Avoid borax (boron) and sodium in products
- Use chlorine bleach alternatives i.e. hydrogen peroxide

Greywater Systems: current market

flotender™

REWATER SYSTEMS, INC.

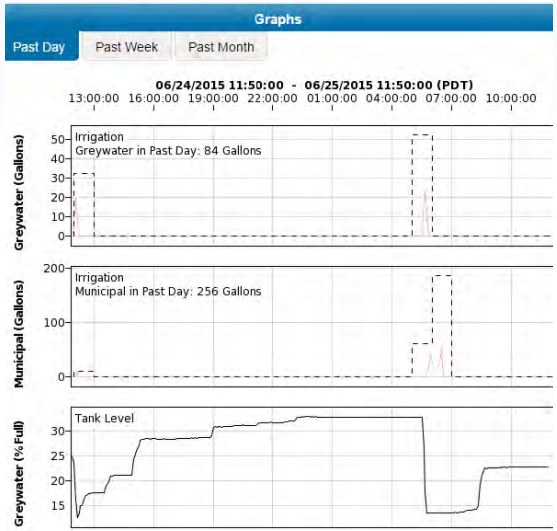
Nexus eWater

Aqua2use®
"The Answer for Greywater Reuse"

wahaso
WATER HARVESTING SOLUTIONS

- Some old and many new systems coming into market.
- Most don't operate as typical irrigation systems, or contain proprietary drip or controllers

Greywater Systems: WaterSprout



- Operates the same as traditional irrigation system.
- Compatible with all brands of irrigation controllers.
- Uses common irrigation dispersal methods
- Water-use monitoring & alarms

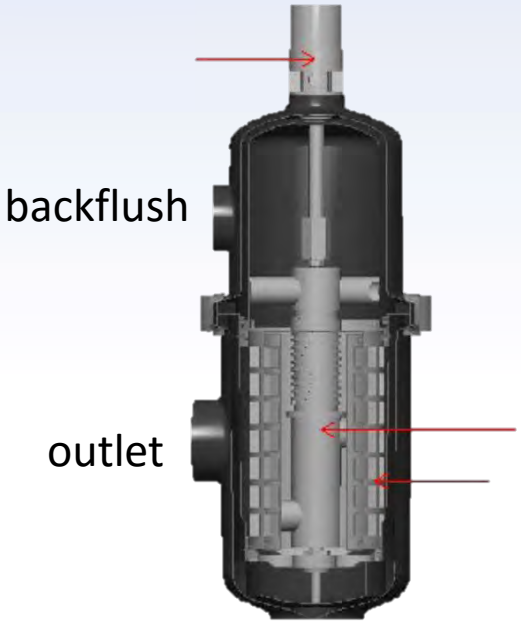
Greywater Storage: how long?

- CPC requires greywater storage less than 24 hours.
- In our experience, greywater can be stored up to 4 days.
- Longer storage of greywater can lead to odors in landscape duration irrigation cycle.

Greywater Storage: how much?

- Greywater storage size depends upon daily greywater supply and irrigation demand
- Residential: 250 gallon tank for up to 6 people
- Multi-family: 500-1,000+ gallon tank depending upon supply and demand

Greywater Filtration: screen filter



SCREEN BACKFLUSH FILTER

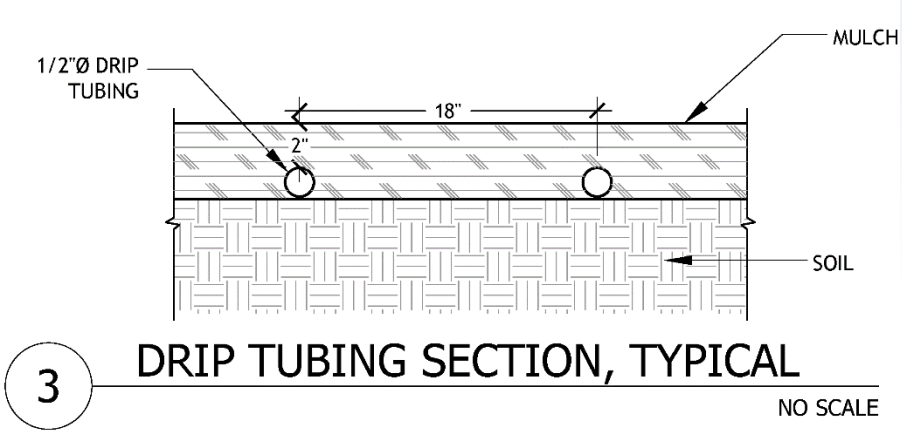
- Filtration to 100 micron for drip irrigation, no disinfection needed for “untreated” greywater.
- Use auto-backflushing filters on greywater POC to irrigation mainline.
- **Avoid** filters which require manual cleaning (screen and disc)!!!

Greywater Filtration: media filter

SAND BACKFLUSH FILTER

- Filtration to 100 micron for drip irrigation, no disinfection needed
- Use auto-backflushing filters on greywater POC to irrigation mainline
- **Avoid** filters which require manual cleaning (screen and disc)!!!

Greywater Application: sub-surface



- Greywater is applied sub-surface below 2" of soil or mulch per code
- Greywater cannot pond, puddle, or be accessible to humans
- Greywater cannot be sprayed through air, unless using a NSF 350 "treated" system.

Greywater Application: non-drip

DEEP TREE WATERING

BUBBLER

- Greywater can be applied by any system where dispersal is 2” or more beneath ground surface
- Deep tree watering
- Bubblers in valve boxes
- Ect.

Greywater Application: dripperline

- Geoflow drip tubing is made specifically for greywater and blackwater dispersal
- Can be buried up to 9" deep
- Contains Rootguard and Geoshield, an anti-microbial inner coating

Greywater Application: hose bibs

- Hose bibs should be of underground quick coupling type to prevent human contact.

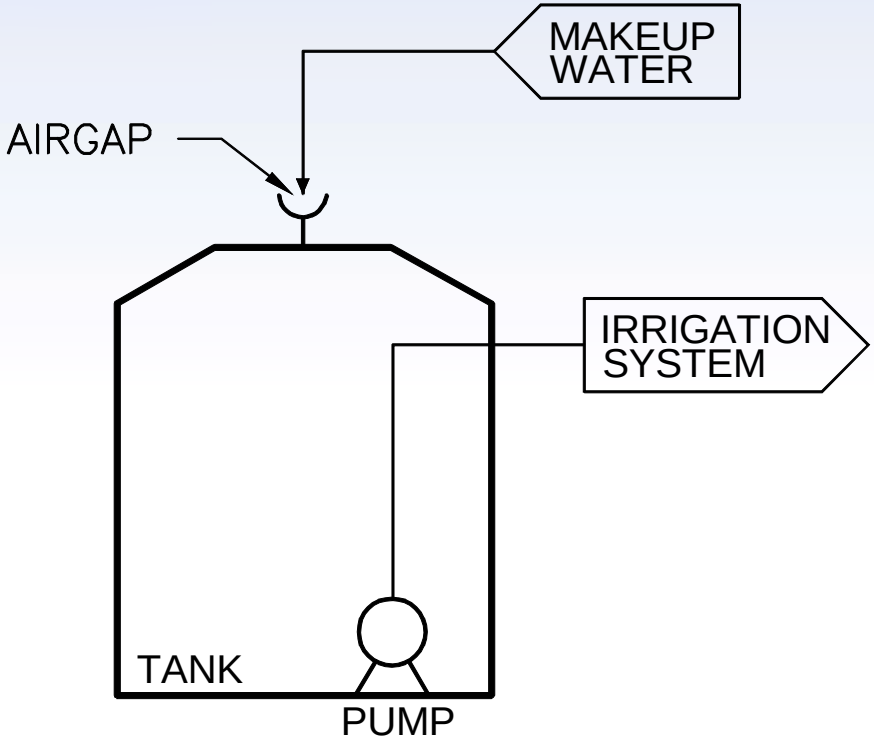
Greywater Application

Greywater Cannot be Applied To:

- Green roofs
- Pots on hardscape
- Flow through planters
- Root crop vegetables
- Acid loving plants
- Spray irrigation (unless “treated”)

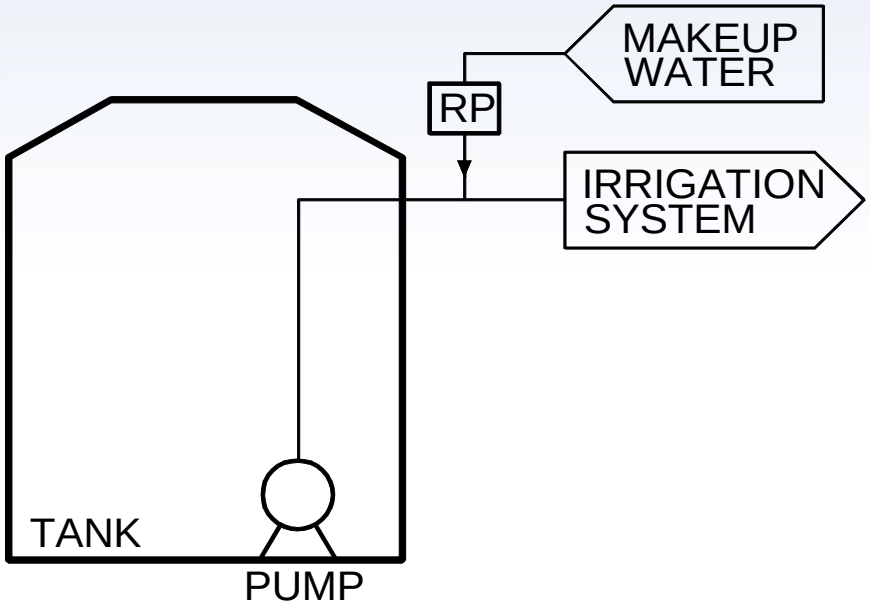
Solution: Two irrigation mainlines

Makeup Water: indirect connection



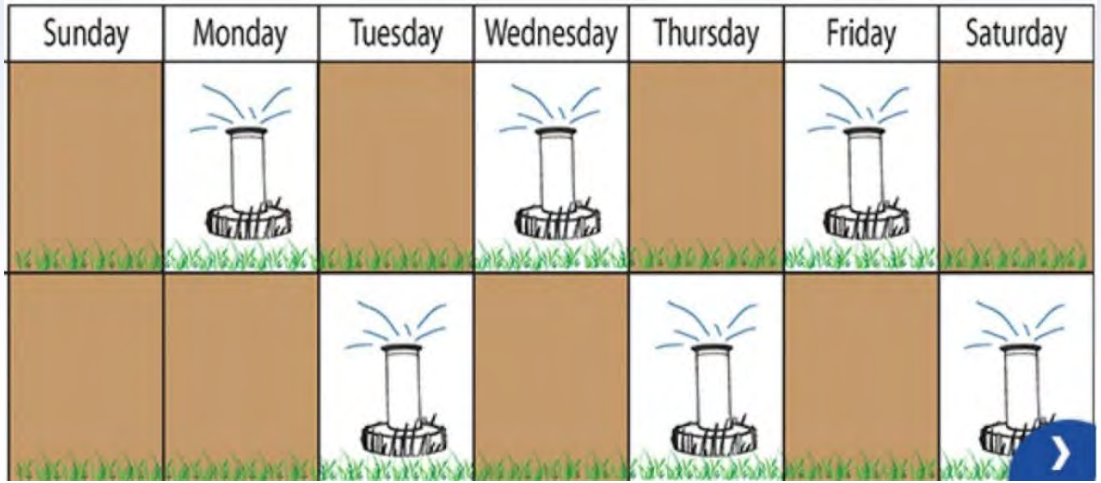
- Safest form of backflow prevention
- Approved by all agencies
- Increased dependence upon pumping system
- Increased electrical costs

Makeup Water: direct connection



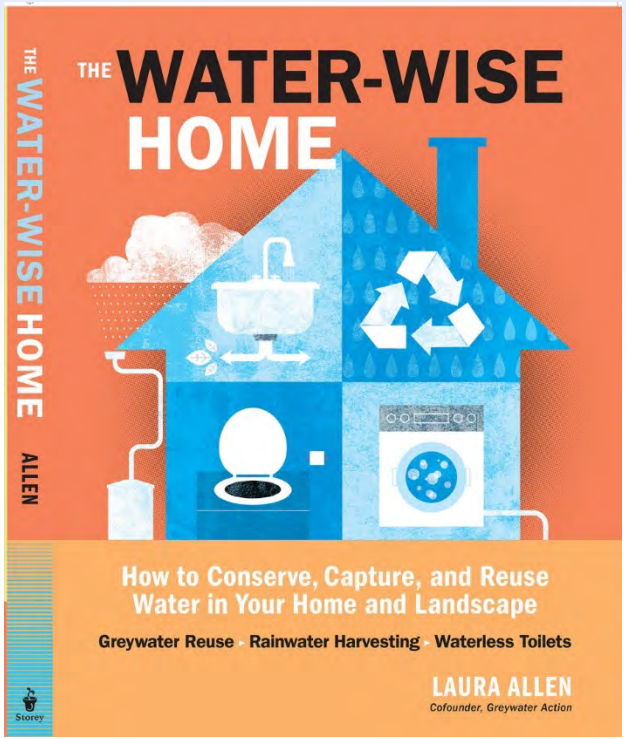
- Don't need to pump the makeup water to irrigation
- Irrigation system can run even if greywater system is down
- Although CPC allows RPs, some local jurisdictions do not
- RPs require annual testing

Greywater : Irrigation Scheduling



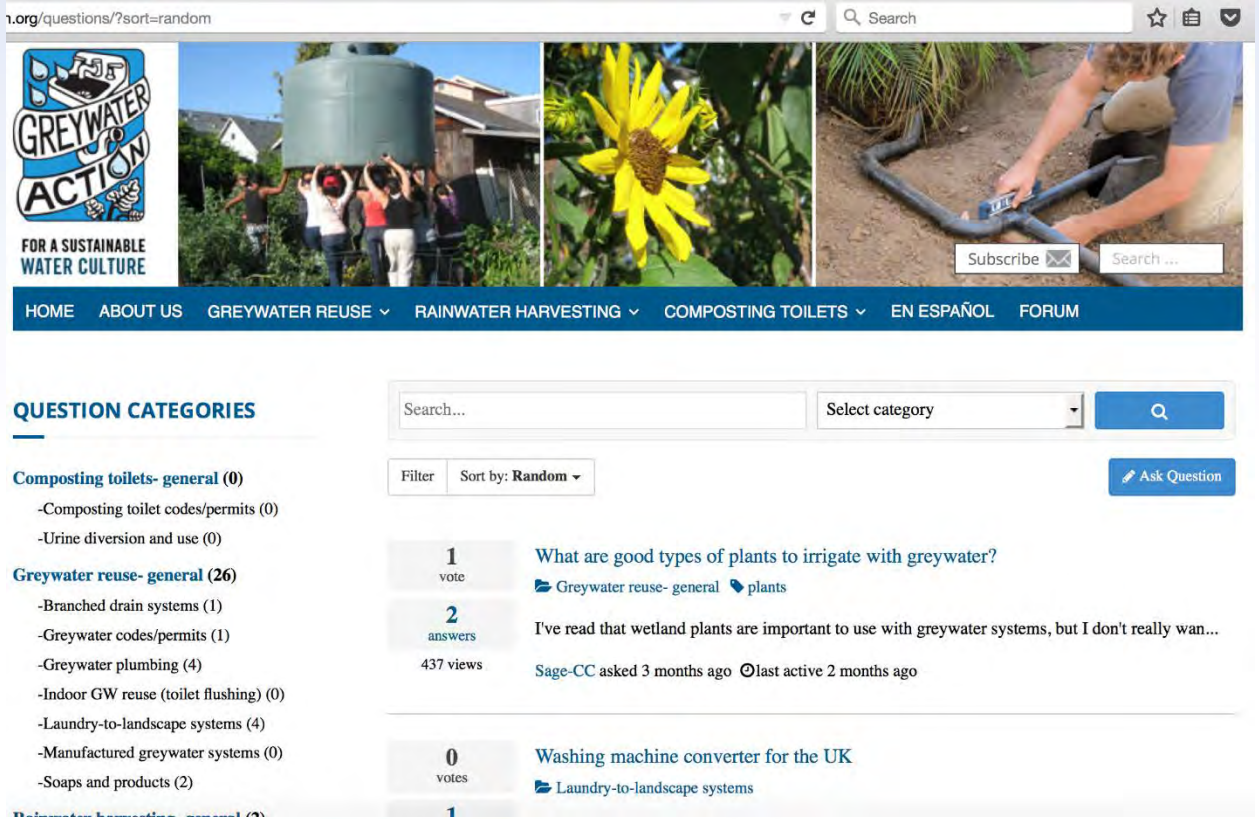
- "Spread out" valve run times throughout the week to prevent loss of greywater
- Use controllers station delay feature allow GW tank to fill between valve runs

Greywater Resources



- Good book about simple greywater systems

Greywater Resources



- Greywater Action website. Best online resource for greywater questions

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David Zoldoske

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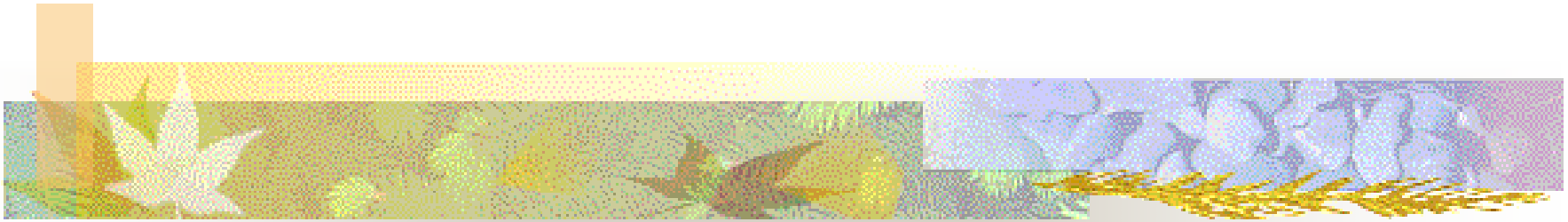
CIT Update

ASIC 2016 REGIONAL CONFERENCE
San Luis Obispo, California



David F. Zoldoske, Director
Center for Irrigation Technology
California State University, Fresno

Using Steel Rods to Increase Irrigation Efficiency

- Install specially treated steel rods (8in x 1/4in) in Turf Grass plot
- Place in ***off-set grid (6 foot)***
- Evaluate if rods reduce water demand by taking additional water from atmosphere
- **<u>Testing currently ongoing</u>**


HORTAU

Establishing an Innovation Cluster

- The California Energy Commission funded four regional “clusters” at $5 million each
- They are located in San Diego, Los Angeles, Bay area, and the Central Valley
- Fresno State was awarded the Central Valley contract- it starts today!

BlueTechValley Energy Innovation Cluster: Serving the Central Valley Region

Center for Irrigation Technology

Water/Energy Technology Incubator

- We will promote the development of technologies in Water and Agriculture, among others
- Irrigation and water management will be a major focus for entrepreneurs and innovation
- Technical, financial and business support will be provided to ensure commercial adoption
- Technologies and services must benefit the electrical ratepayer

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Fresno State is Developing a New Strategic Plan on Water:

and We Would Like Your Input!

Discussion on the Role and Activities of CIT

- CIT has a long history of testing and evaluating irrigation equipment
  - **What other activities or services should we provide?**
    - ✓Remote sensing
    - ✓Data collecting and data management
    - ✓White Papers and policy
    - ✓Standards and codes
    - ✓Other?

What Other Partnerships Should CIT and the ASIC Explore?

Please feel free to contact me at:

davidzo@csufresno.edu


Questions ?
Thank You !

THANK YOU!

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