

URBANGREEN™
Stormwater Solutions

Rainwater Harvesting

11/17/2010

ASCE Region 9 Stormwater Committee

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UrbanGreen Rain Water Harvesting

Agenda

- Regulatory Context
  - LID Hierarchy
  - Feasibility Criteria
- System Design
  - Components
  - Design Considerations
  - Predicting Runoff reduction

NPDES Permit Requirements

- Recent Santa Ana Region NPDES Permits Include Rainwater Harvest Guidance
  - Prevent then Mitigate
    - Retain to the maximum extent technically feasible, then biotreat the rest of the design storm

- Key Questions:
  - Is this appropriate in the Inland Empire?
  - Are regional or local systems most feasible?
  - How big should my cistern be?
  - What water uses are allowed?
  - Is disinfection required?
  - What regulatory reviews are required?

"The **mitigative or structural site design BMPs shall also be prioritized** (from highest to lowest priority): **(1) Infiltration BMPs** (examples include permeable pavement with infiltration beds, dry wells, infiltration trenches, surface and sub-surface infiltration basins. The Permittees should work with local groundwater management agencies to ensure that infiltration Treatment Control BMPs are designed appropriately**; (2) BMPs that harvest and use** (e.g., cisterns and rain barrels); **and (3) Vegetated BMPs** that promote evapotranspiration including bioretention, biofiltration and bio-treatment.

-2010 San Bernardino NPDES Permit

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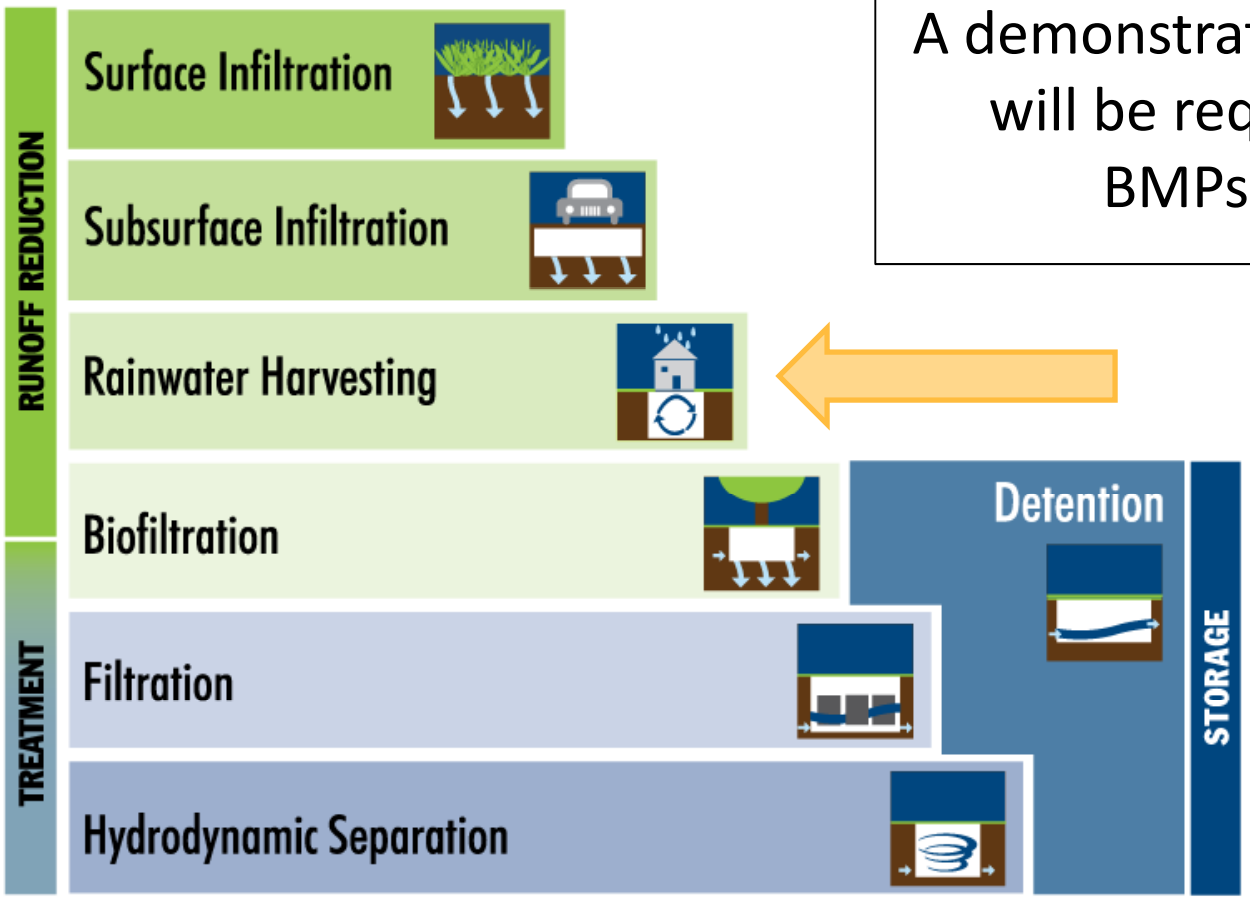
Stormwater Selection Staircase



A demonstration of infeasibility will be required if treatment BMPs are proposed

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What is "Harvesting" as LID practice?

Traditional Water Harvesting *is the collection and reuse of stormwater, grey water, and other sources to reduce or* ***eliminate the consumption of municipal potable water****.*

Rainwater Harvesting for LID *is the collection and reuse of stormwater for beneficial purposes to reduce or* ***eliminate post-construction runoff.***

Rainwater Harvesting – Two Perspectives

	Conservation Focus	Stormwater Focus
Primary Goal	Reduced municipal demand	Eliminate runoff (pollution prevention)
Secondary Benefits	Reduce SW Runoff, Energy, CO_2	Conservation, Energy, CO_2
Catchment Area	Maximize, to Increase Supply	Minimize, to Reduce Supply
Water Usage	Minimize and Conserve	Find Reuse Applications
Seasonal Challenge	Dry Season – not enough rain	Wet Season – too much rain
Cistern Goal	Keep it full	Empty it quickly
Economic ROI	Negative – "external costs" not included in market price of water	Positive – best LID solution in many cases

Runoff Reduction: Beyond Irrigation

- **For Runoff Reduction**
  - Find reuse applications during wet season
- **Applications**
  - Irrigation
  - Toilet flushing
  - Clothes washing
  - Vehicle washing
  - Process water (cooling makeup)
  - Fire suppression

Irrigation May Not Be Enough to Offset Stormwater Runoff

Rainwater Harvest Feasibility

- Demand must exist
  - AB 1881 requires low water use landscaping
  - Seasonal , episodic rainfall patterns
- Water rights must be respected
- End use(s) must not be prohibited
  - Indoor use may trigger Title 22 compliance
  - Plumbing code must be followed although RWH is not explicitly described
  - Spray irrigation may trigger public health concern
- Regional harvest or groundwater replenishment facilities may obviate need for local facilities
- Not needed if site demand is met with reclaimed water

Typical System Components

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Passive System Design and Components

- Typically intercept roof runoff only
- Influent screened to remove coarse organics
- Typically drain within 48 hours
- Typically discharge to landscaping that does not need the water at that time
- Discharge must be retained within landscaping
- 100 ft^2 of roof are produces 46 gallons of runoff in a 0.75” storm

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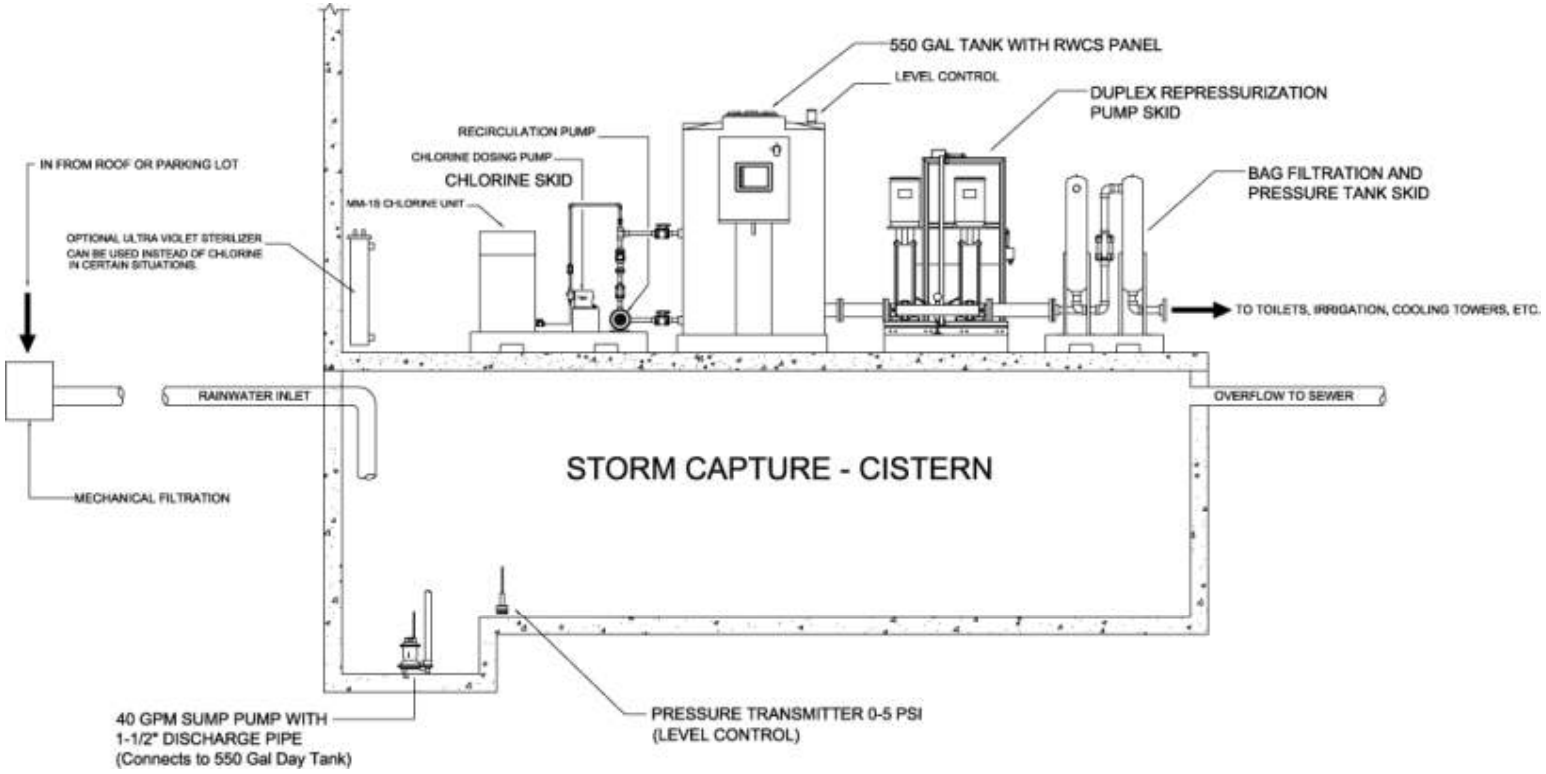
Active System Components

- Catchment
- Pre-treatment
- Storage
- Makeup H_2O
- Pumps
- Treatment
- Disinfection
- Controls



System Components: Catchment

- Catchment
- Pretreatment
- Storage
- Makeup H_2O
- Pumps
- Treatment
- Disinfection
- Controls

- Catchment Size
  - Minimize for SW LID
- Rooftop
  - Cleaner, elevation/head, smaller area
  - All applications (potential for potable)
  - Finer solids, roof material, leaves, bacteria
  - Simple pretreatment
- Surface (parking, courtyards, etc)
  - More pollutants
  - Gross solids, trash/debris, oil, soluble metals, bacteria
  - Unlikely for potable
  - Advanced pretreatment
  - Avoid: industrial, spill potential, chemicals, etc

Note: Pretreatment and disinfection requirements may be less stringent for rooftop

System Components: Pretreatment

Catchment

Pretreatment

Storage

Makeup H_2O

Pumps

Treatment

Disinfection

Controls

- First Flush Diverters and Pretreatment
  - Keep storage clean, reduce maintenance
  - Protect downstream filters and pumps
  - Reduce BOD, organic decomposition uses O_2
  - Anaerobic conditions produce SO_2 (odor)
  - Screening: 200um to 2000 um (rooftop)
  - Filtration/Separation: 20um to 200um (surface)

Code Note: First flush diverter and pretreatment may be required

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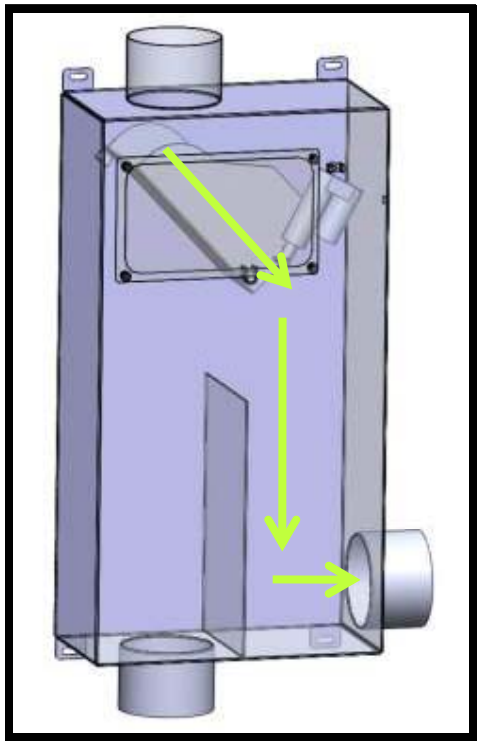
CONTECH Products – 1st Flush Diverter

Programmable 1st Flush Diversion



- User defined "First Flush" – time based
  - Depth of rainfall, time since last storm
- Maximizes collection & run-off reduction
  - Divert ONLY the first flush
  - Does not reset during lulls in rainfall
- Automatic Reset
  - Based on time since recent rainfall
- Meet building codes requirements
  - Diverts first flush to Keep cistern cleaner
- Complete System
  - Rain gage
  - Bypass module
  - Connects to system controller

Example: Divert 0.05" if no rain in last 3 days

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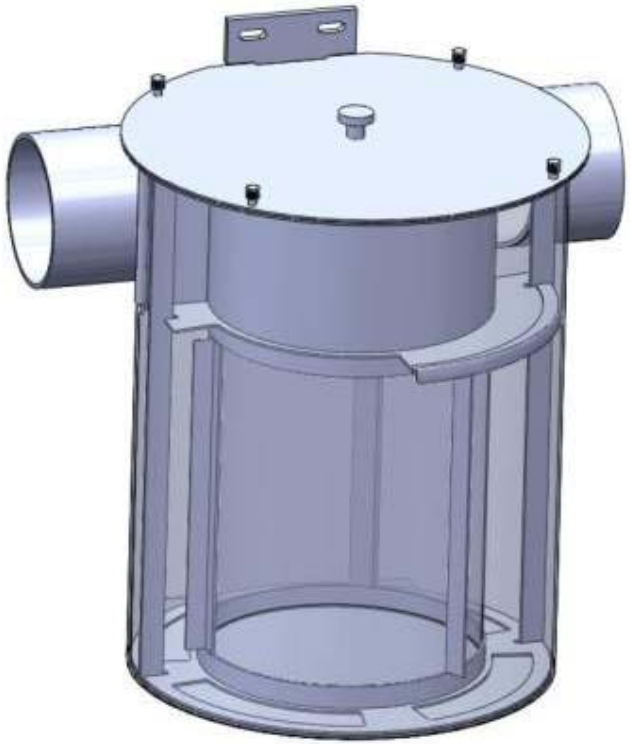
CONTECH Products - Pretreatment

Downspout CDS



- In-line, down-spout screen
  - Easy access, above ground, building mounted
- Non Clogging
  - Continuous Deflection Separation
- High performance
  - 1200um aperture
  - 200 gpm capacity
  - Standard 6” inlet and outlet connections
- Easy Maintenance
  - Removable, stainless steel screen
  - No replacement parts

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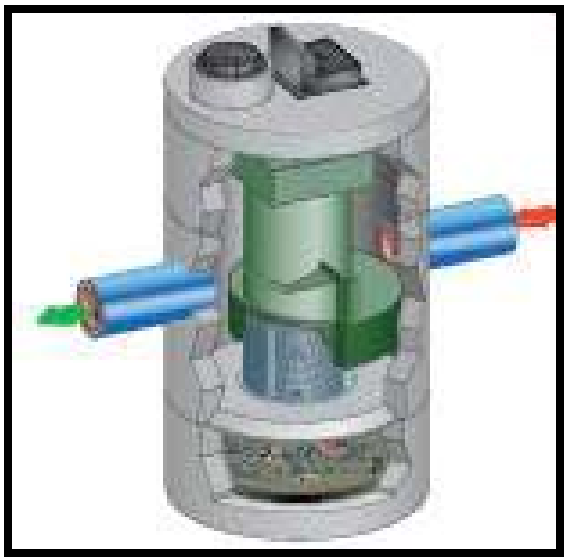
CONTECH Products - Pretreatment



- Underground Pretreatment
- Large treatment capacity
- Full capture
- 100% capture of harvested water
- Non-clogging
- On-line and off-line options
- Economical
- Easy maintenance

System Components: Storage

Code Note: Calming inlet and floating outlet may be required

Catchment

Pretreatment

Storage

Makeup H_2O

Pumps

Treatment

Disinfection

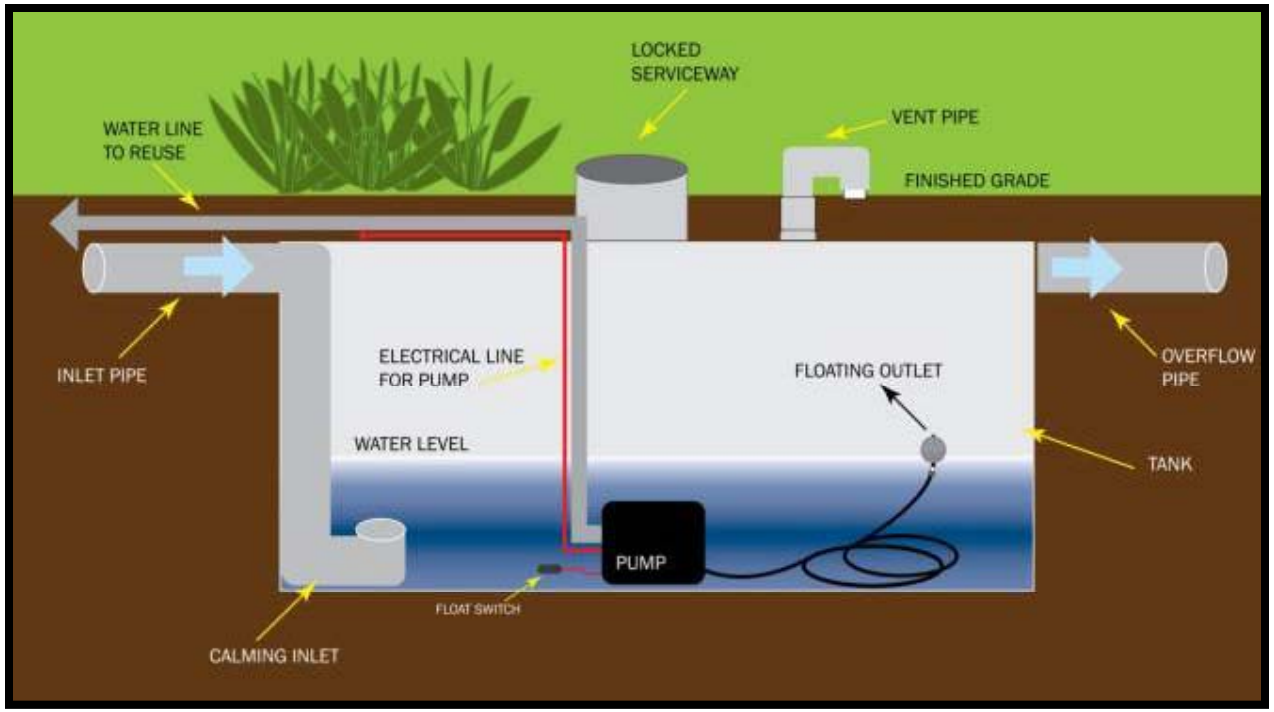
Controls

- Storage
  - Above ground (smaller)
  - Below ground under parking to save space (larger)
  - Metal, plastic, concrete
  - 1,000 gallons to 100,000+ cubic feet
  - Sized to minimize annual runoff = larger storage
  - Sized to reduce domestic use = smaller storage
  - Typical target: 80% of annual rainfall capture
  - Calming inlets, floating outlets promotes settling

UrbanGreen Cisterns

Standard Components

- Inlet
- Overflow
- Transfer Pipe (not shown)
- Calming Inlet
- Floating Outlet
- Access and Vent



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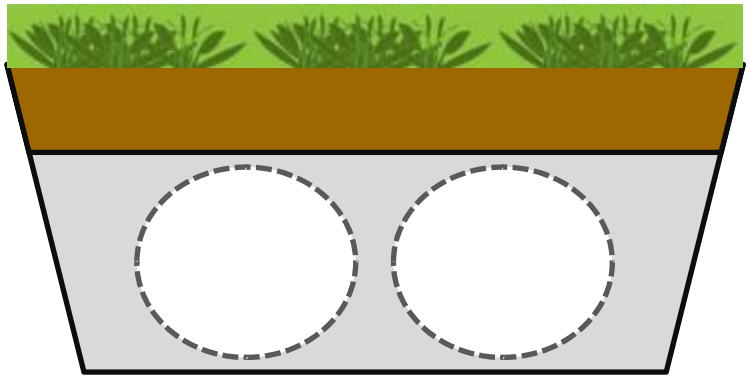
UrbanGreen Cistern – Wrapped Cisterns

- Massive Storage – flexible/scalable
- Cost Effective – as low as $0.50/gal
- Combine with Biofiltraiton
- Seal excavation with Pond Liner
- Perforated CMP
- ChamberMaxx
- Life based on liner integrity



Price Example: 200,000 gallons
- 96” perf CMP w/ liner
- $100,000, $0.50/gallon

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UrbanGreen Cistern – Wrapped Cisterns

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UrbanGreen Cistern – Wrapped Cisterns

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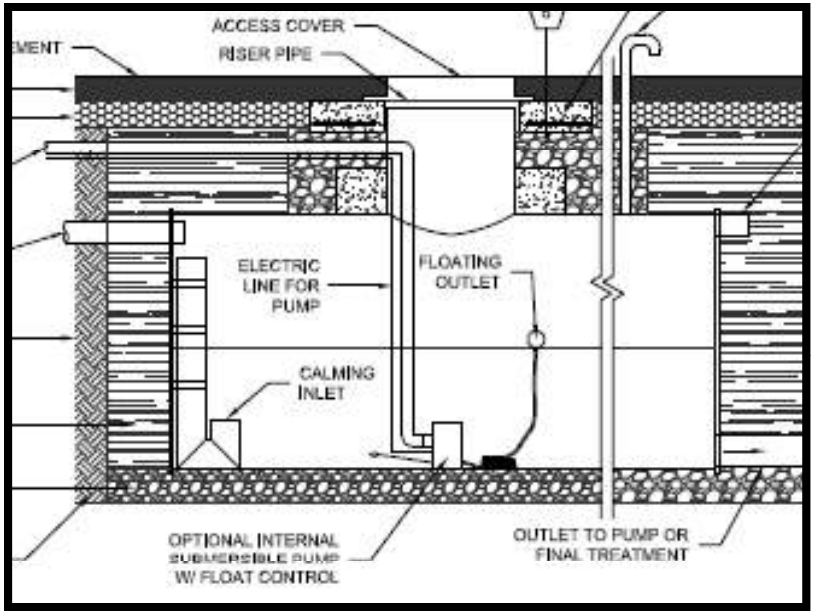
UrbanGreen Cistern – BGM

Below Ground Metal

- Contiguous Tanks – NO JOINTS
  - Up to 48’ Long
  - 48” and larger
- Connect Multiple Tanks – NO JOINTS
- Fully sealed
  - Fabrication and seams
  - 25-50 year life
  - Sealing reports in process
  - Factory tested upon request
- Rated to 8 psi (tested to 13psi)
- Best Use: General purpose to 100k gal
- 96” x 48’ = 18,000 gallons



Price Examples:

- 5,000 gallons
  - 72” x 24’, $6,500, $1.20/gallon
- 25,000 gallons
  - Two 96’ x 33’ Tanks
  - $19,500, $0.78/gallon

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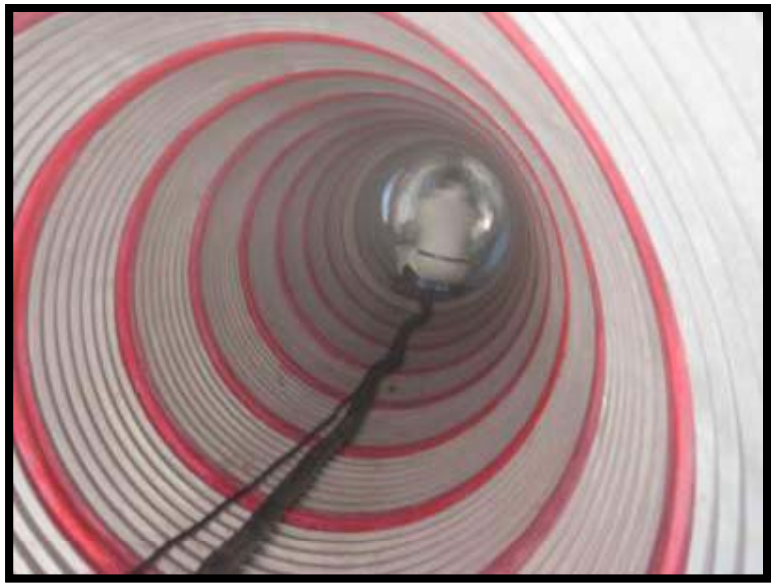
UrbanGreen Cistern – BGM

Sealing

- Adapted from industrial tank lining
- Rated to 8psi, tested to 13psi



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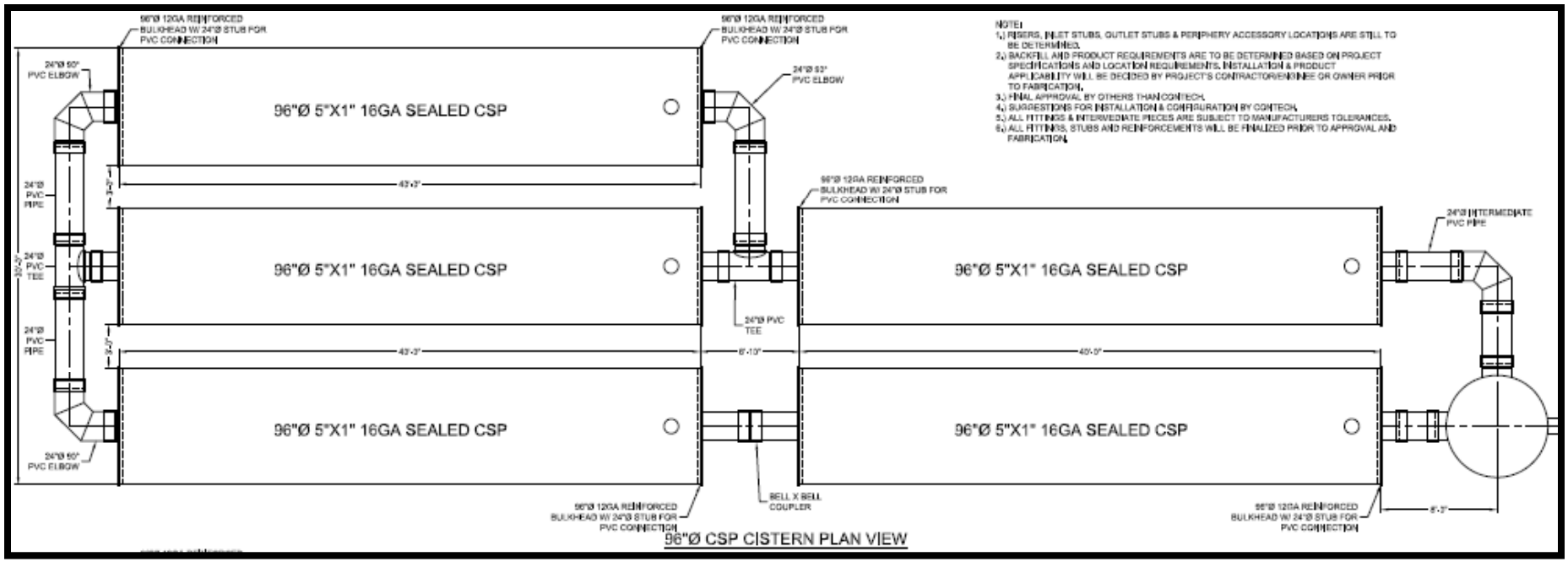
UrbanGreen Cistern – BGM

Below Ground Metal

- Up to 48’ long
- Connect multiple tanks together
- Small diameter, water tight connections
- 120” x 48’ = 28,000 gallons



No Joints

UrbanGreen Cistern – SRPE

Steel Reinforced Polyethylene

- 14’ and 22’ Tanks
- Long Barrels
  - 48” and larger
  - Small diameter headers
- Up to 15 Psi
  - Bell and Spigot or Electrofusion
- Longest Life
  - Up to 100 yrs for lower pressure ratings
- Best Use – Critical Storage
  - Long Life
  - Near foundations
  - On slopes
  - Potable

Price Examples:

- 2,950 gallons
  - 72” x 14’, $7,600, $2.57/gallon
- 100,000 gallons
  - Four 96” x 66’ barrels
  - $73,000, $0.73/gallon

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UrbanGreen SRPE Cistern – Tucson, AZ

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UrbanGreen SRPE Cistern – Redondo Beach, CA

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Gilardi Ranch, Bodega CA

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UrbanGreen Cistern – AGM

Above Ground Metal

- Vertical steel tanks
  - 72” to 120” diameter
  - Heights to 20 ft
- Rated to 8 psi (20ft head)
- Up to 100 Year Life
  - Replaceable liner option
- Best Use – Above Ground
  - Close to building
  - RWH Showcase
  - Easy access and maintenance

Coming soon!

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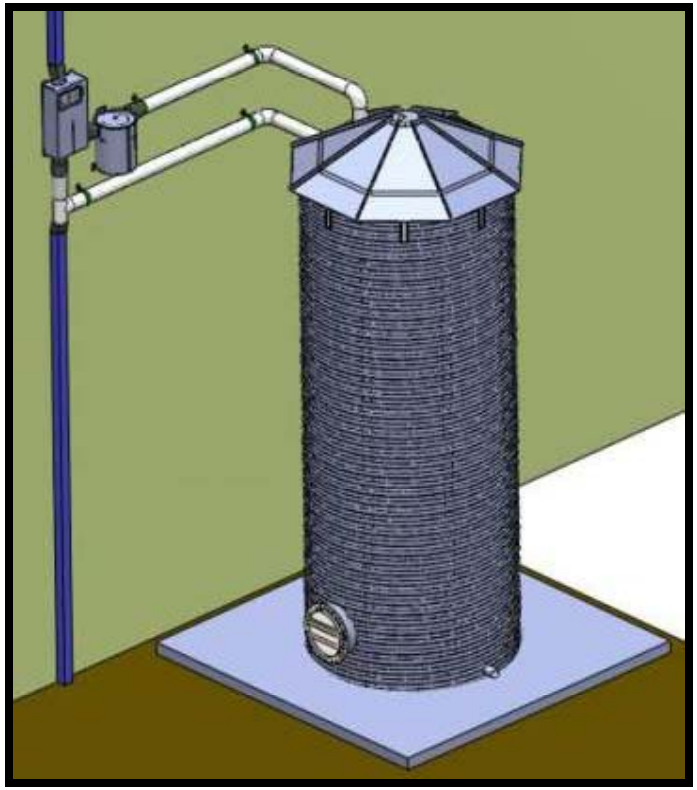
UrbanGreen Cistern – AGM

Portland Manufacturing Facility

- Two 96” x 20’ tall cisterns
- 7,500 gallons total
- Complete mechanical system
- Cartridge wash station
- CSF media production
- Install December 2010



Coming soon!

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UrbanGreen Cistern – AGM

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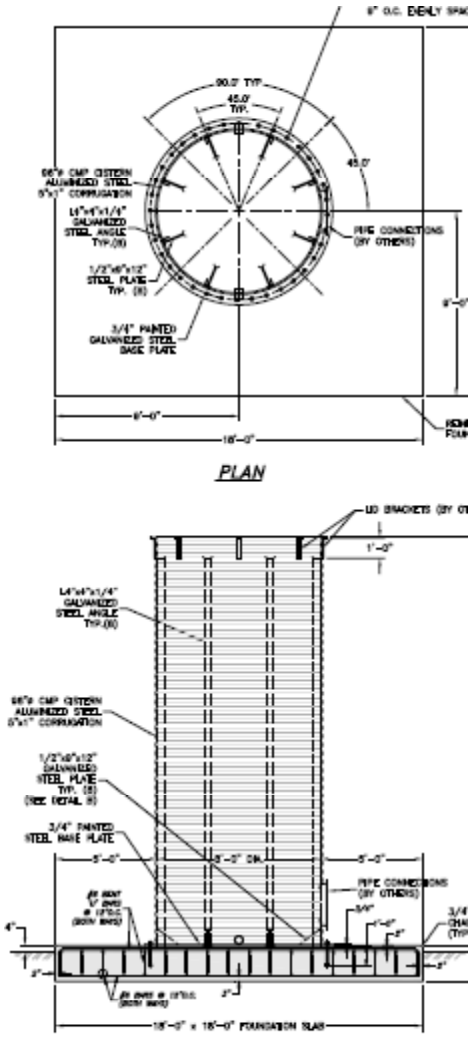
UrbanGreen Cistern – AGM

Above Ground Metal

- Generic Foundation
  - Available upon request
  - Provided as example
  - Customer responsible for site specific foundation
- Stamped Foundation
  - Modest fee
  - Full evaluation: soil, wind, seismic
  - Must have soils report



Available in Q3

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CONTECH Products - Cisterns

Type	Product	Options	Water Tight Rating		Pricing (per gallon)	Best Use
Below Ground	**Wrapped** (pond liner)	Perforated CMP ChamberMaxx	Non Pressurized	10-25 yrs (longer life liner options possible)	$0.50 - $1.0	Infiltration Inlet Large Storage (100k gal and up) Non-critical storage
	BGM Below Ground Metal	Single Tanks (up to 48' Long) Multiple Tanks (no joints, daisy chain)	Up to 8 psi	25-75 yrs (depends on soil)	$0.65 to $2.0	Small/Medium Size (3k to 100k gal) General Use
	SRPE Steel Reinforced Polyethylene	Tanks (14' or 22') Barrels (No Headers)	15 psi	50-100 yrs (depends diameter and pressure)	$1.70 to $4.0 $0.60 to $1.40 *(+ shipping)*	Medium/Large Systems Water Critical (near building, slope, potable)
Above Ground	**AGM** Above Ground Metal	72" to 15' tall 96" to 20' tall 120" TBD	Up to 8 psi (20ft head)	25-100 yrs (Metal life 100 yrs, replaceable liner)	$0.75 to $3.0 *(+ foundation)*	Above Ground Up to 10k gal

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System Components: Makeup H_2O

Catchment

Pretreatment

Storage

Makeup H_2O

Pumps

Treatment

Disinfection

Controls

- Municipal Makeup
  - Air-gap options
    - Direct cistern fill
    - Downstream wet-well fill
    - Day tank fill
  - Direct backup connection
    - Backflow preventers
    - Check valves

Code Note: air gap may be required, separate reuse lines required

System Components: Pumps & Treatment

Catchment

Pretreatment

Storage

Makeup H_2O

Pumps

Treatment

Disinfection

Controls

- Pumps
  - Pressure pump(s) sized for volume required
  - Can be multiplex for backup and maintenance
- Final Treatment
  - 0.5um to 5um
  - Water clarity (aesthetics)
  - Improves disinfection (uv)
  - Protects downstream fixtures
  - Manual or automatic back flush

System Components: Disinfection

Catchment

Pretreatment

Storage

Makeup H_2O

Pumps

Treatment

Disinfection

Controls

- Disinfection
  - Prevent water born illness, kills bacteria and viruses
  - UV for immediate use (irrigation)
  - Chlorination for residual treatment (toilets, washing)
  - Required for building code, sometimes even irrigation

Code Note: disinfection may be required – even for irrigation

System Components

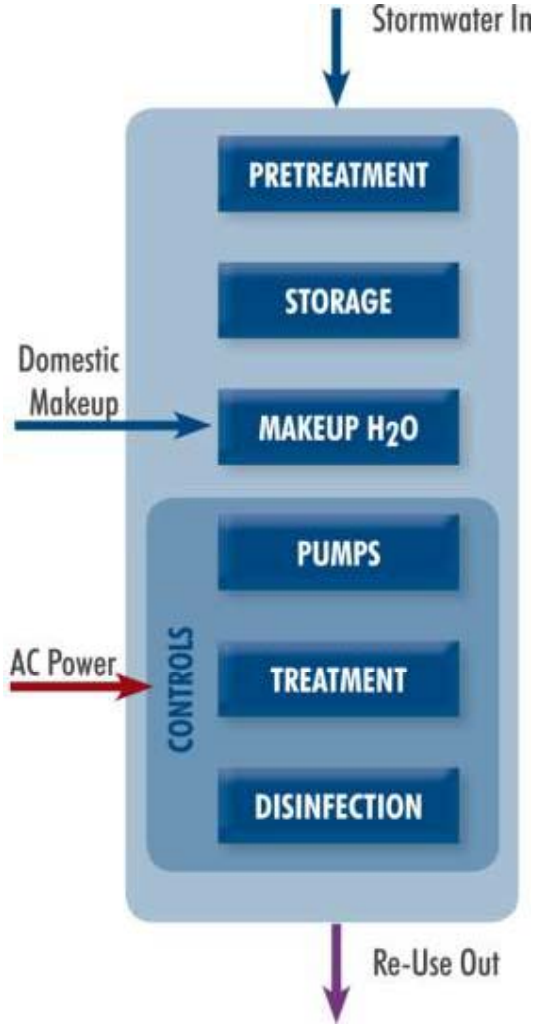
- Catchment
- Pretreatment
- Storage
- Makeup H_2O
- Pumps
- Treatment
- Disinfection
- **Controls**

- Controls
  - 1st flush diverter
  - Domestic makeup
  - Pumps and backwashing
  - Disinfection
  - System monitoring
  - System measurement and reporting

Integrated Mechanical Systems

Configurable systems to meet site specific requirements

- Catchment
- Pretreatment
- Storage
- **Makeup H_2O**
- **Pumps**
- **Treatment**
- **Disinfection**
- **Controls**



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Mechanical System Components

Typical Components Options

- Treatment
  - Screens; filters; ultra filtration
  - manual or auto back flush
- Make-up Water
  - Day-tank with air-gap; back-flow preventer
- Disinfection
  - UV; chlorination
  - Instant; recirculation
- Pressurization
  - Suction pumps; submersible pumps
- Controls
  - Operation; monitoring ; tie to building mgmt
- Power Supply
  - 120/240/480v; 1-phase, 3-phase
- Enclosure
  - Indoor; Outdoor; Underground

Building block components

Designed to match project needs

Infinite combinations

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Example: Mechanical System

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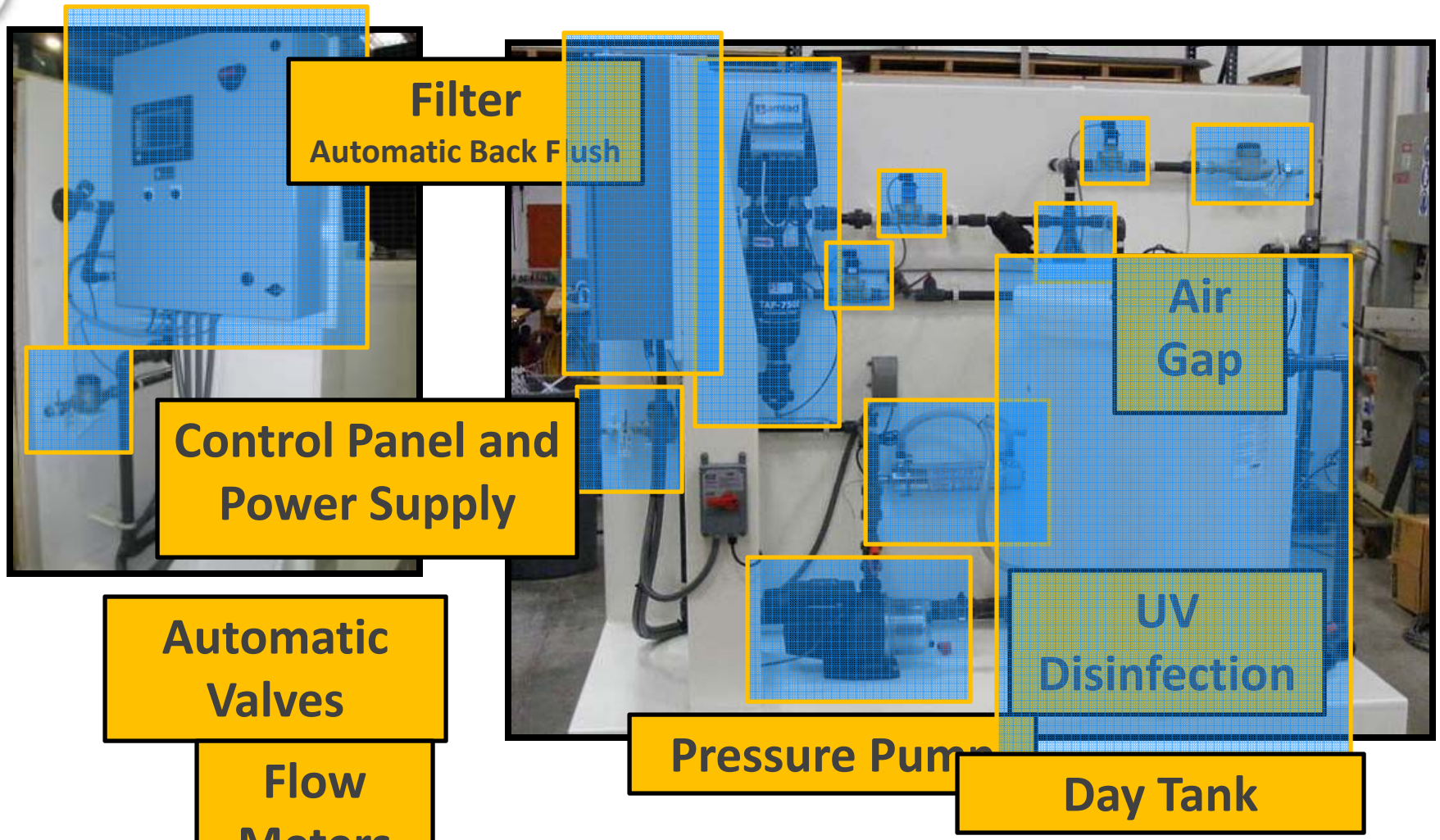
Example: Pump and Controls



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Example: Mechanical System

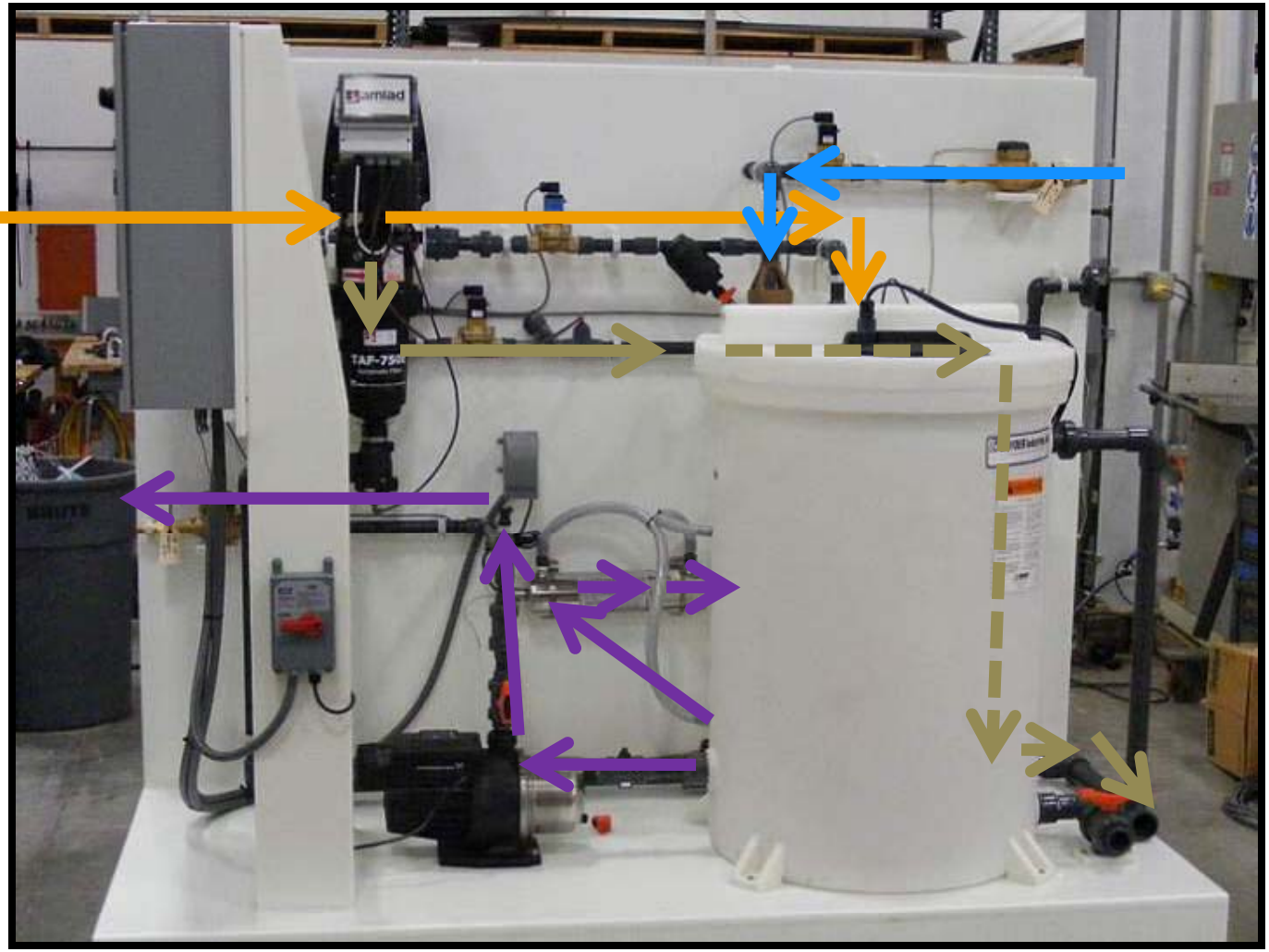
Water from cistern, through filter, to day tank

Back flush from filter to drain

Makeup water to day tank when required

UV disinfection loop

Pressure pump to re-use application



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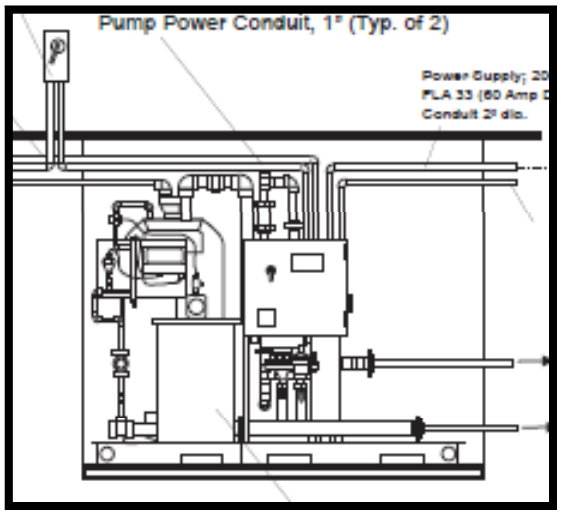
Mechanical System – Install Location

Indoor
Skid Mounted

Outdoor
Enclosure

Underground
Vault



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Mechanical System – Price Estimates

Simple Systems

- Irrigation only
- Low Demand: 10-25 gpm
- Basic treatment,
- $5,000 - $20,000

Typical Systems

- Irrigation and toilet flushing
- Filtration and chlorination
- $15,000 - $50,000

Advanced Systems

- Multiple cisterns/sources to control
- Redundant systems
- Advanced treatment and monitoring
- $50k to $100k+

Design

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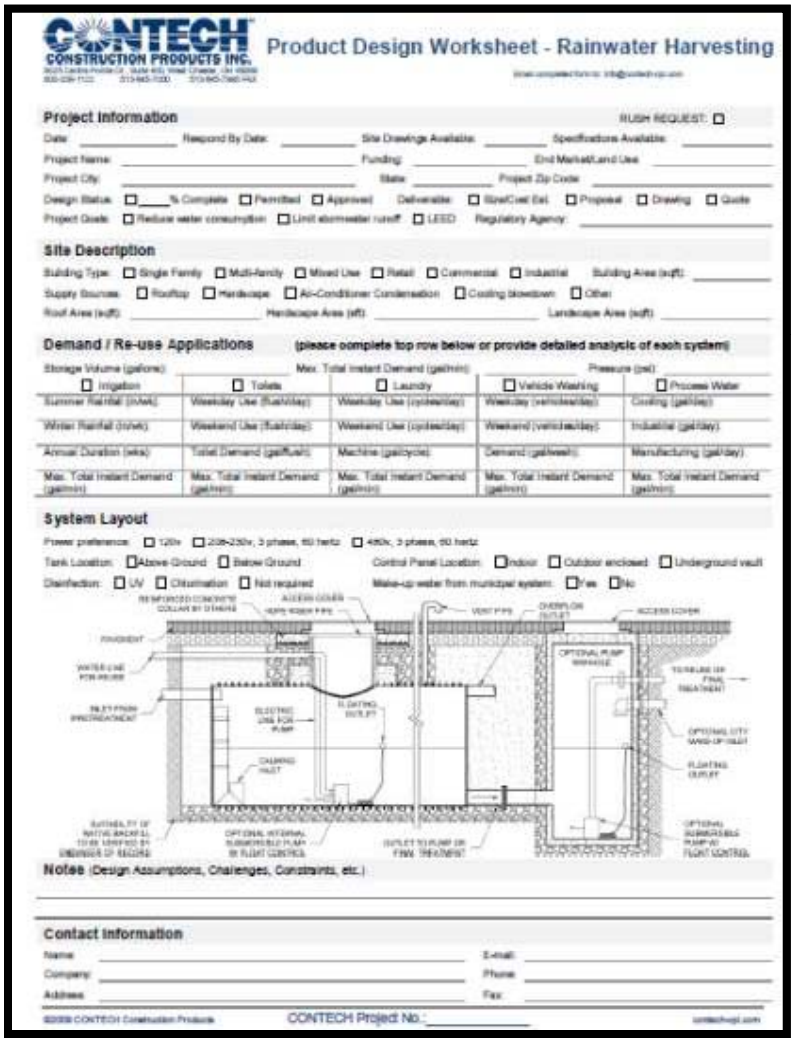
Design: Project Design Worksheet



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Product Design Worksheet - Rainwater Harvesting

Project Information

RUSH REQUEST: ☐

Date: _____ Respond By Date: _____ Site Drawings Available: _____ Specifications Available: _____

Project Name: _____ Funding: _____ End Market/Land Use: _____

Project City: _____ State: _____ Project Zip Code: _____

Design Status: ☐ ____% Complete ☐ Permitted ☐ Approved Deliverable: ☐ Bid/Cost Est ☐ Proposal ☐ Drawing ☐ Quote

Project Goals: ☐ Reduce water consumption ☐ Limit stormwater runoff ☐ LEED Regulatory Agency: _____

Site Description

Building Type: ☐ Single Family ☐ Multi-Family ☐ Mixed Use ☐ Retail ☐ Commercial ☐ Industrial Building Area (sqft): _____

Supply Sources: ☐ Rooftop ☐ Hardscape ☐ Air-Conditioner Condensation ☐ Cooling blowdown ☐ Other

Roof Area (sqft): _____ Hardscape Area (sf): _____ Landscape Area (sqft): _____

Demand / Re-use Applications (please complete top row below or provide detailed analysis of each system)

Storage Volume (gallons): _____ Max. Total Instant Demand (gal/min): _____ Pressure (psi): _____

☐ Irrigation	☐ Toilets	☐ Laundry	☐ Vehicle Washing	☐ Process Water
Summer Rainfall (in/wk)	Weekday Use (flush/day)	Weekday Use (cycles/day)	Weekday (vehicles/day)	Cooling (gal/day)
Winter Rainfall (in/wk)	Weekend Use (flush/day)	Weekend Use (cycles/day)	Weekend (vehicles/day)	Industrial (gal/day)
Annual Duration (wks)	Total Demand (gal/flush)	Machine (gal/cycle)	Demand (gal/week)	Manufacturing (gal/day)
Max. Total Instant Demand (gal/min)	Max. Total Instant Demand (gal/min)	Max. Total Instant Demand (gal/min)	Max. Total Instant Demand (gal/min)	Max. Total Instant Demand (gal/min)

System Layout

Power preference: ☐ 120v ☐ 208-230v, 3 phase, 60 hertz ☐ 480v, 3 phase, 60 hertz

Tank Location: ☐ Above Ground ☐ Below Ground Control Panel Location: ☐ Indoor ☐ Outdoor enclosed ☐ Underground vault

Disinfection: ☐ UV ☐ Chlorination ☐ Not required Make-up water from municipal system: ☐ Yes ☐ No

Notes (Design Assumptions, Challenges, Constraints, etc.)

Contact Information

Name: _____ E-mail: _____

Company: _____ Phone: _____

Address: _____ Fax: _____

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Project Information

Site Information

- Water to be harvested

Demand Information

- Re-Use Applications

System Layout

- Aboveground/belowground cistern
- Indoor/outdoor mechanical

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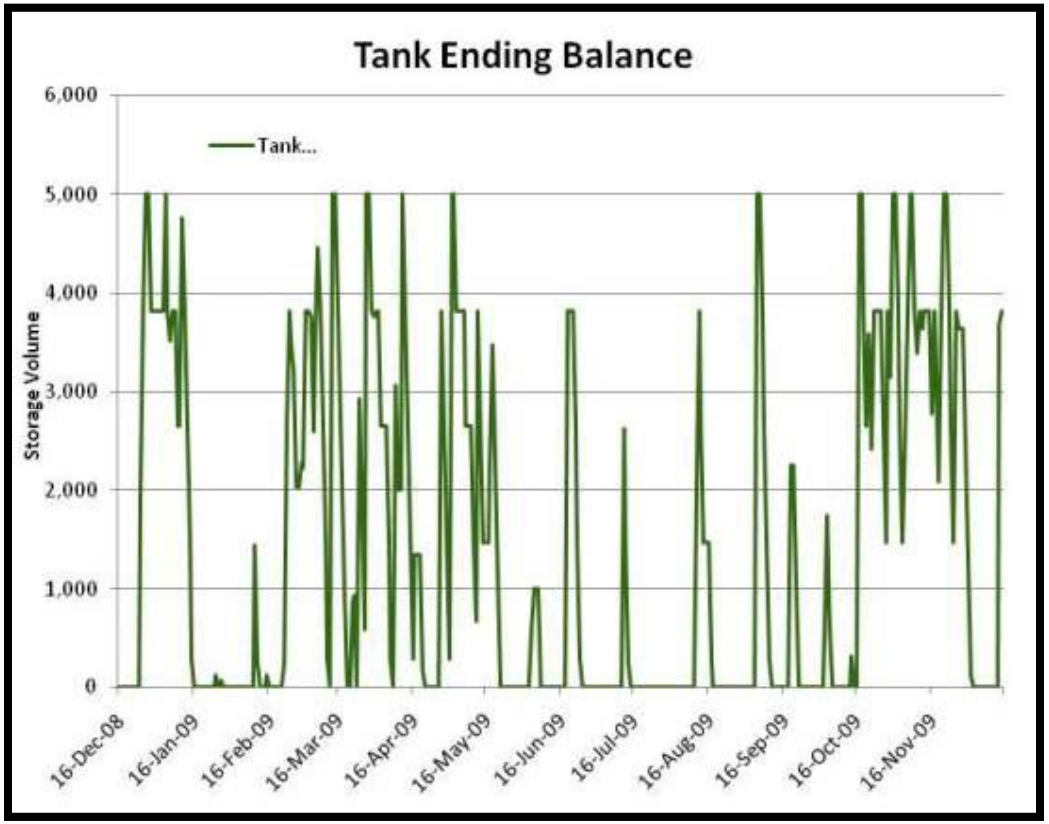
Design Process

Design Elements

- Client Input
  - –Catchment areas
  - –Water budget and demand pattern
- CONTECH Input
  - –Local rainfall
  - –SW regulations
  - –runoff reduction requirements
- CONTECH Deliverables
  - –Cistern sizing
  - –Treatment sizing
  - – Municipal supply reduction
  - – Runoff reduction



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URBANGREEN™
Stormwater Solutions from CONTECH

Design: Cistern and Runoff Reduction

URBANGREEN™ leaving a greener footprint on your site. CONTECH CONSTRUCTION PRODUCTS INC.

Rainwater Harvesting Solutions

Cistern Size	89,000

Stormwater Supply		
Source	Include?	Area
Rooftop	yes	20,000
Surface	no	0
Total Capture Area		20,000

Secondary Supply		
Source	Include?	Gal/Yr
AC Condensation	no	0
Gray Water	no	0
Total Secondary		0

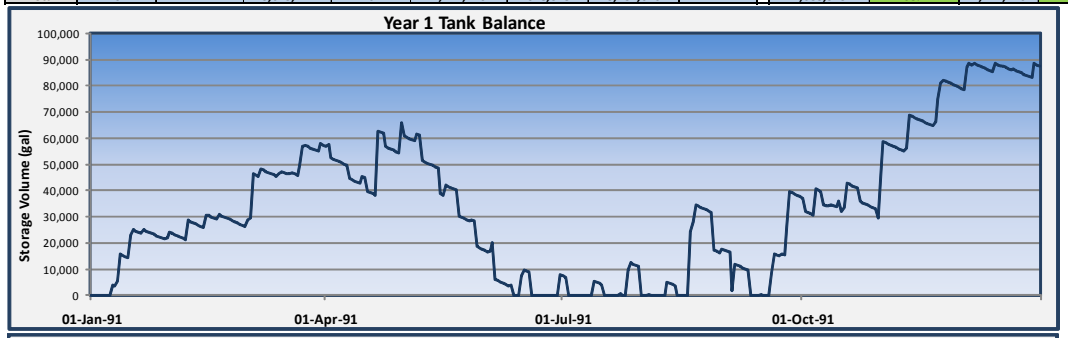
Demand	
Application	Include
Toilet	yes
Laundry	yes
Irrigation	yes

Location
Boston

Small Storm (No Runoff)	0.05
Design Storm Depth	2.00

	Actual Rainfall	Rainfall Between 0.05 & 2	Targeted Runoff	Secondary Supply	Total Water Captured	Overflow	Total Demand	Tank Ending Balance	City Makeup	Water Savings	Runoff Reduction		Total Runoff & Sewer Reduction	
J-91	42	35	440,447	0	437,393	3,055	490,439	87,620	140,666	71%	437,393	99%	437,393	99%
J-92	43	35	431,222	0	373,788	57,434	490,439	88,171	117,201	76%	373,788	87%	373,788	87%
J-93	43	37	462,139	0	315,689	146,450	490,439	87,809	174,387	64%	315,689	68%	315,689	68%
J-94	47.6	41.2	513,502	0	376,316	137,186	490,439	85,781	112,094	77%	376,316	73%	376,316	73%
J-95	35.1	29.3	365,149	0	289,963	75,186	490,439	83,941	198,636	59%	289,963	79%	289,963	79%
J-96	52.5	40.8	509,014	0	361,372	147,642	490,439	86,950	132,075	73%	361,372	71%	361,372	71%
J-97	29.7	24.7	308,301	0	256,905	51,395	489,979	62,796	208,919	57%	256,905	83%	256,905	83%
Total	264	218	3,029,774	0	2,411,426	618,348	3,432,610	---	1,083,979	68%	2,411,426	80%	2,411,426	80%

Cistern Dimensions	
Diameter	Length
4	947
6	421
8	237
10	151
12	105
16	59



Water Savings				
Water Rate	$0.0036	Sewer Rate	$0.009	
		Savings		
Year	Gallons	Water	Sewer	Total
J-91	437,393	$1,596	$3,801	$5,397
J-92	373,788	$1,364	$3,248	$4,612
J-93	315,689	$1,152	$2,743	$3,895
J-94	376,316	$1,373	$3,270	$4,644
J-95	289,963	$1,058	$2,520	$3,578
J-96	361,372	$1,319	$3,140	$4,459
J-97	256,905	$938	$2,232	$3,170
Total Savings	2,411,426	$8,801	$20,955	$29,756

Water Rate Samples - per CCF			
	Tier 1	Tier 2	Tier 3
Portland, OR	$2.73	$2.73	$2.73
San Diego, CA	$3.51	$3.80	$4.27
Long Beach, CA	$2.20	$2.44	$3.66
Sewer Rates - per CCF			
Portland, OR	$6.50		

QUESTIONS?

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