# PG&E Water Conservation Showcase 2009

## Rainwater Harvesting - A Local Water Management Strategy

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## CASE STUDIES

- Rainwater catchment for toilet and landscape irrigation
  - Permitted in SF under the new rainwater guidelines
- Groundwater catchment for landscape irrigation
  - Can provide year round irrigation using underground seeps
  - Often overlooked source of water
- Rainwater garden mitigating stormwater runoff
  - Effective landscape method to keep stormwater onsite

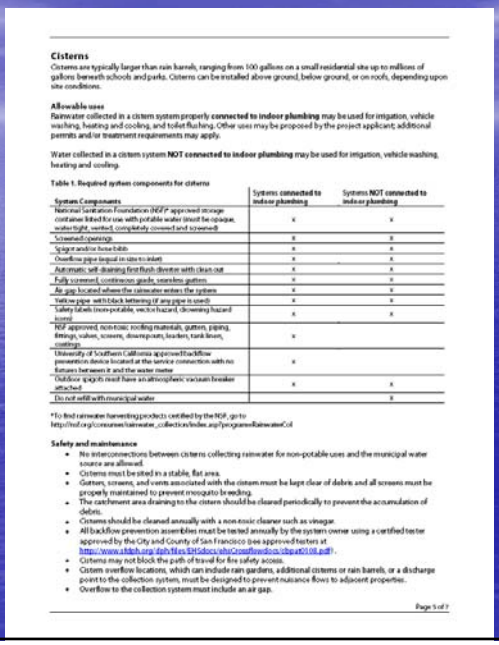
# San Francisco Rainwater Permitting Requirements

- "Rainwater ... may be used for irrigation, vehicle washing, heating and cooling, and toilet flushing"

  - Allows use of rainwater for non-potable uses without requiring treatment to potable standards.

  - Prescriptive based requirements rather than performance based

# Cistern Requirements



**Cisterns**

Cisterns are typically larger than rain barrels, ranging from 100 gallons on a small residential site up to millions of gallons beneath schools and parks. Cisterns can be installed above ground, below ground, or on roofs, depending upon site conditions.

**Allowable uses**

Rainwater collected in a cistern system properly **connected to indoor plumbing** may be used for irrigation, vehicle washing, heating and cooling, and toilet flushing. Other uses may be proposed by the project applicant; additional permits and/or treatment requirements may apply.

Water collected in a cistern system **NOT connected to indoor plumbing** may be used for irrigation, vehicle washing, heating and cooling.

**Table 1. Required system components for cisterns**

| System Components | Systems **connected to** indoor plumbing | Systems **NOT connected to** indoor plumbing |
|---|---|---|
| National Sanitation Foundation (NSF)* approved storage container listed for use with potable water (must be opaque, watertight, vented, completely covered and screened) | x | x |
| Screened openings | x | x |
| Spigot and/or hose bibb | x | x |
| Overflow pipe (equal in size to inlet) | x | x |
| Automatic self-draining first flush diverter with clean out | x | x |
| Fully screened, continuous gaskt, seamless gutters | x | x |
| Air gap located where the rainwater enters the system | x | x |
| Yellow pipe with black lettering (if any pipe is used) | x | x |
| Safety labels (non-potable, vector hazard, drowning hazard icons) | x | x |
| NSF approved, non-toxic roofing materials, gutters, piping, fittings, valves, screens, downspouts, leaders, tank liners, coatings | x | |
| University of Southern California approved backflow prevention device located at the service connection with no fixtures between it and the water meter | x | |
| Outdoor spigots must have an atmospheric vacuum breaker attached | x | x |
| Do not refill with municipal water | | x |

*To find rainwater harvesting products certified by the NSF, go to http://nsf.org/consumer/rainwater_collection/index.asp?program=RainwaterCol

**Safety and maintenance**

- No interconnections between cisterns collecting rainwater for non-potable uses and the municipal water source are allowed.
- Cisterns must be sited in a stable, flat area.
- Gutters, screens, and vents associated with the cistern must be kept clear of debris and all screens must be properly maintained to prevent mosquito breeding.
- The catchment area draining to the cistern should be cleared periodically to prevent the accumulation of debris.
- Cisterns should be cleaned annually with a non-toxic cleaner such as vinegar.
- All backflow prevention assemblies must be tested annually by the system owner using a certified tester approved by the City and County of San Francisco (see approved testers at http://www.sfdph.org/dph/files/EHSdocs/ehsCrossflowdocs/cbpat0108.pdf).
- Cisterns may not block the path of travel for fire safety access.
- Cistern overflow locations, which can include rain gardens, additional cisterns or rain barrels, or a discharge point to the collection system, must be designed to prevent nuisance flows to adjacent properties.
- Overflow to the collection system must include an air gap.

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# Rainwater Catchment System

San Francisco, California

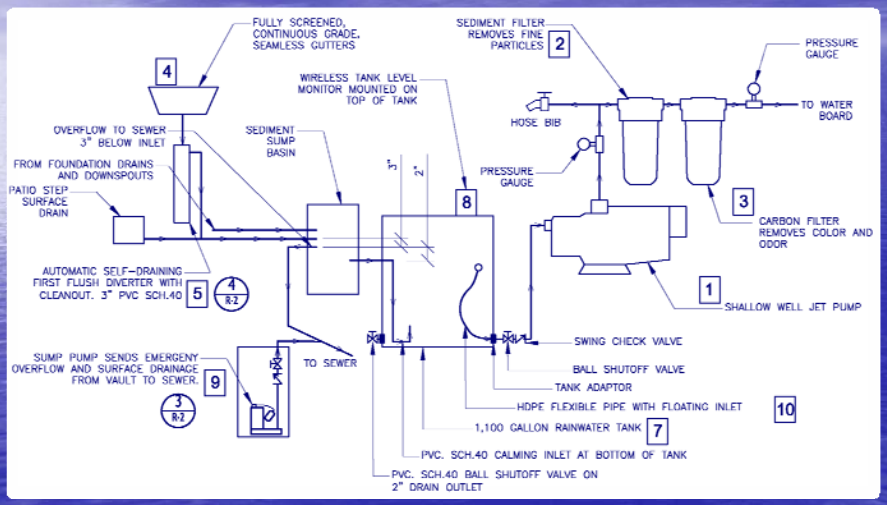
- Rainwater catchment system earning LEED points for house renovation.

- 1,100 gallon cistern capturing rainwater from roof and groundwater through foundation drain.

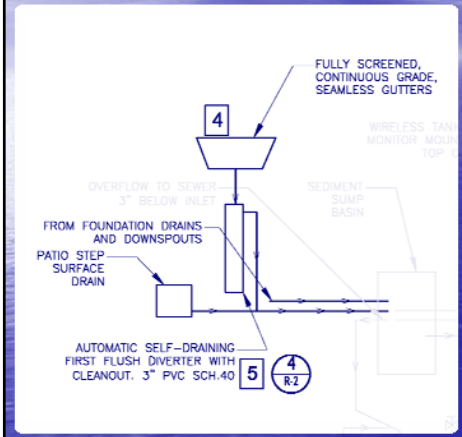
- Rainwater used in the residence for toilet flushing and for landscape irrigation.

- Will supply a consistent supply of water from November to May, possibly year-long depending on groundwater supply.

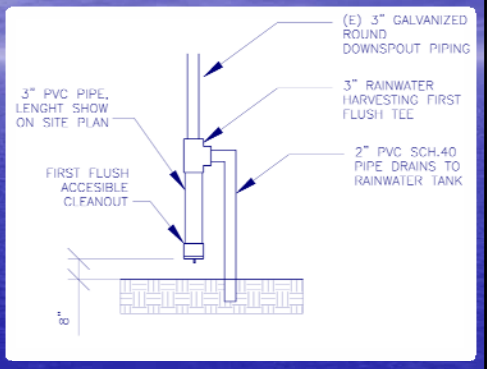
# Rainwater System Schematic



# Gutters and First Flush Devices

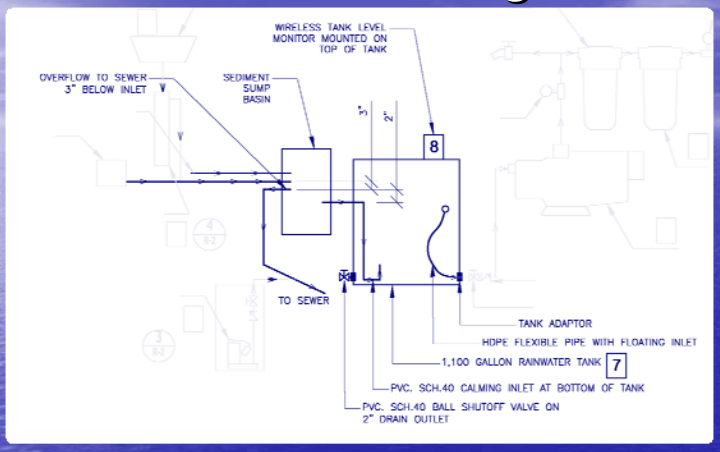



- Gutter screening keeps leaves and debris out of system



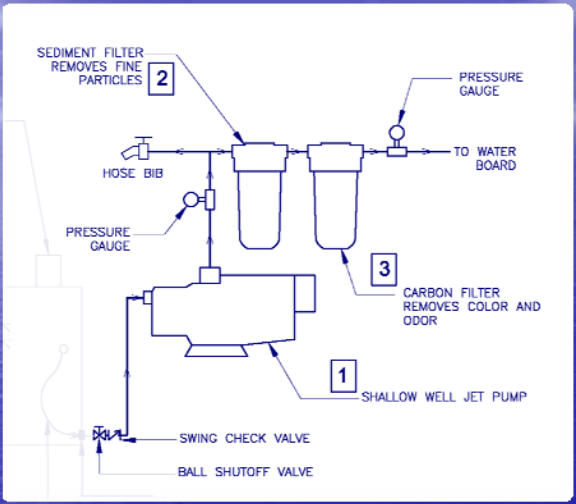

- First flush device diverts dirtiest water from the beginning of each rain event. 1-2 gallons for every 100 sqft.. of catchment area

# Cistern Storage



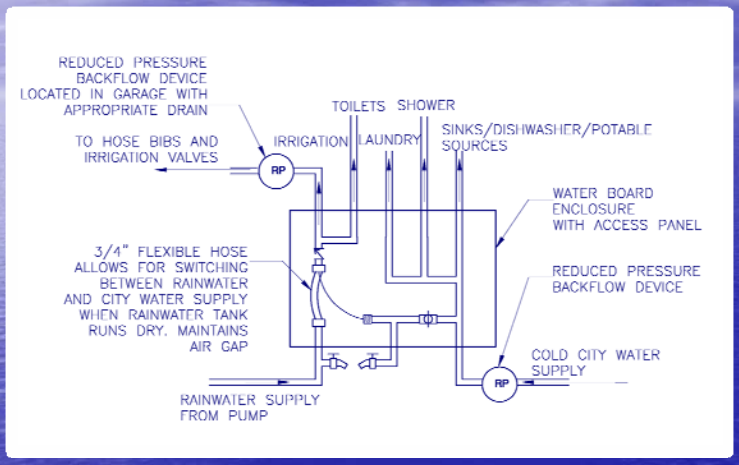

- Cistern must be NSF approved for potable water.
- Safety labels on piping and cisterns.
- Inlet to cistern must have an air gap.
- Overflow from cistern can go to rain gardens, other cisterns, or sewer.
- Overflow from cistern must include an air gap.

# Pumping and Filtration




- Landscape drip irrigation requires 100 micron filtration.
- Filters need annual replacing.
- Carbon filter may not be necessary for toilet water.

# Rainwater/City Water Switching




- No pipe connection between the rainwater system and city water allowed.
- Backflow prevention devices required on service connection.
- Homeowner manually switches to city water when rainwater runs out to eliminate pumping costs.

# Groundwater Catchment System

Woodside, California

- Constant water seep detected in late summer during construction of landscape retaining walls.

- 500 gallon underground cistern collects all site drainage. Irrigation pump uses collected drainage water for irrigation.

- Cistern overflow directed towards dry creek bed and to street curb during heavy flows.

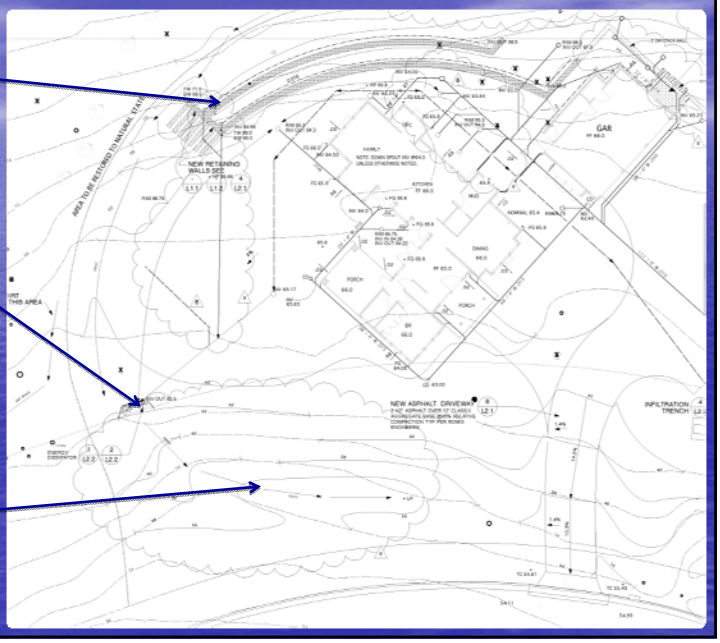
- 1 GPM groundwater flow able to water 1 acre landscape.

# Groundwater Site Plan

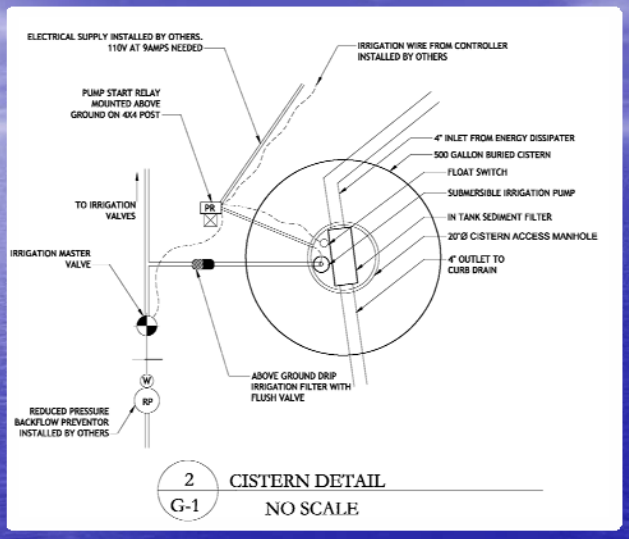
Retaining walls

All site drainage routed to rock dissipater

Creek bed moves overflow water to curb

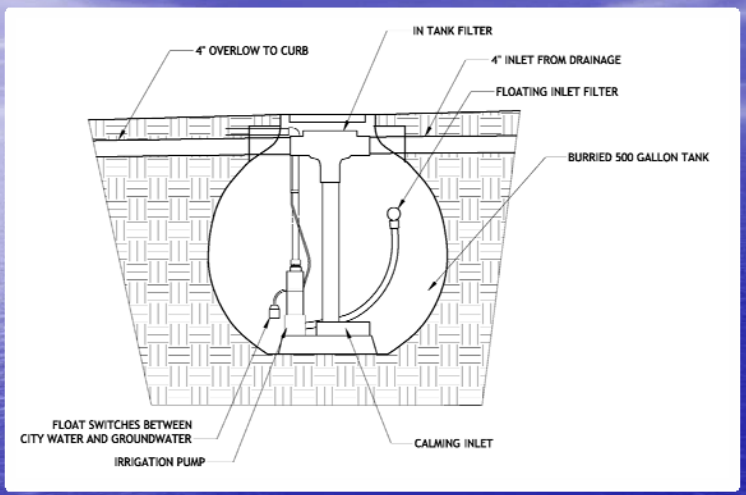


# Cistern Schematic




- 4 hour programmable delay between irrigation valve openings allows cistern to refill.
- Float switch automates switching between pump and city water.

# Cistern Section




- In tank filter keeps larger debris from entering tank.
- Calming inlet prevents incoming water from disturbing sediment layer on bottom of tank.
- Floating inlet filter on pump draws cleanest water from tank.

# Cistern Siting

Cistern connected to pipe that drains entire site.

In tank filter

500 gallon buried cistern

# Rainwater Gardens and Stormwater Runoff

- Increase the amount of water that filters into the ground, which recharges local and regional aquifers

- Protect streams and lakes from pollutants carried by urban stormwater runoff.

- Help protect communities from flooding and drainage problems

- Provide valuable habitat for birds, butterflies and many beneficial insects.

# Rainwater Gardens

- Rainwater from the roof is drained to a dug out basin with mounded edges

# Bioswales

- Water from an impervious surface is drained to a vegetated basin where it slowly filters into the ground

# Rainwater Garden

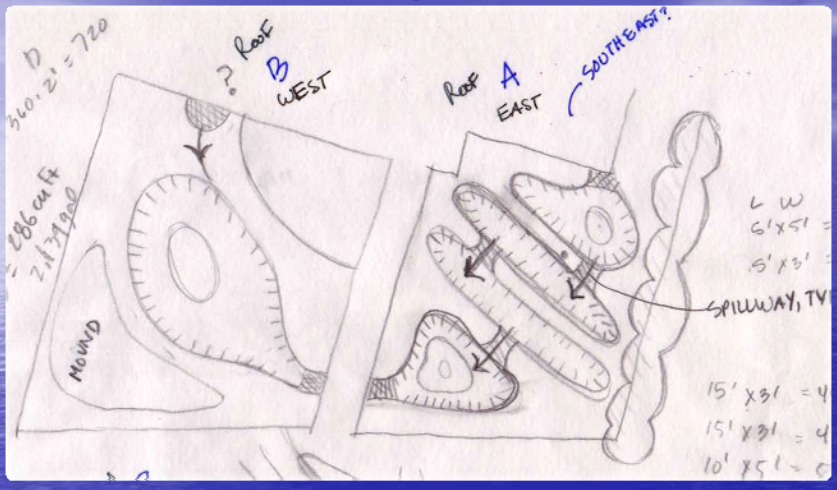
Berkeley, California

- Demonstration garden installed at the Berkeley Eco-house during a day long workshop.

- Half the roof drains to the front yard where infiltration basins hold the water , allowing it to slowly percolate into the ground.

- Rainwater garden is planted with California native plants to attract beneficial wildlife.

# Concept Plan



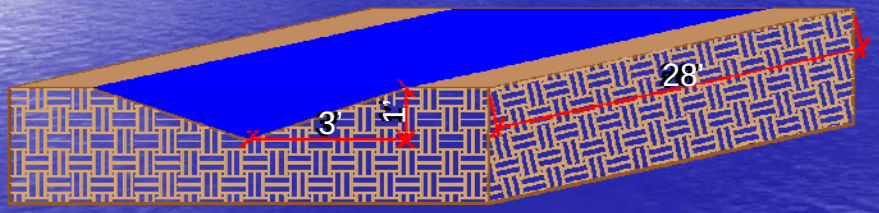

- Multiple smaller basins which overflow into one another on east side of yard.

- One large basin on west side of yard. Connected under walkway

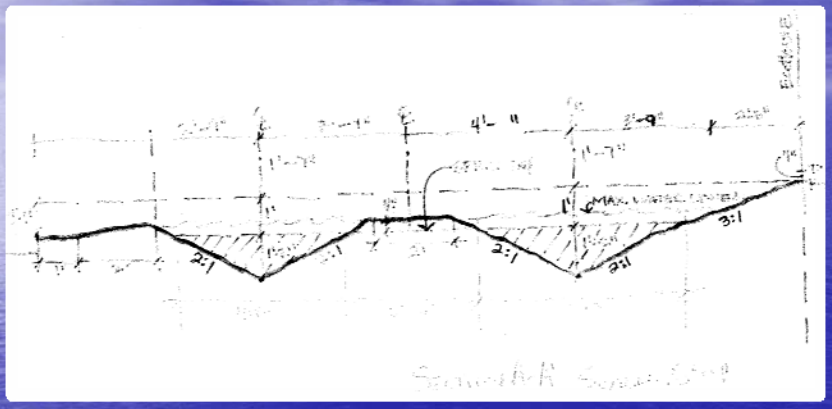
# Rainwater Garden Calculations

- General rule of thumb in Bay Area, design basin volume to hold 1” of rainfall for your roof catchment area.

1,000 sqft. x 1” rainfall / 12” per foot = 83 cubic ft.




# Typical Cross Section




- Avoid slopes greater than 2 to 1 on basin walls to reduce soil erosion.

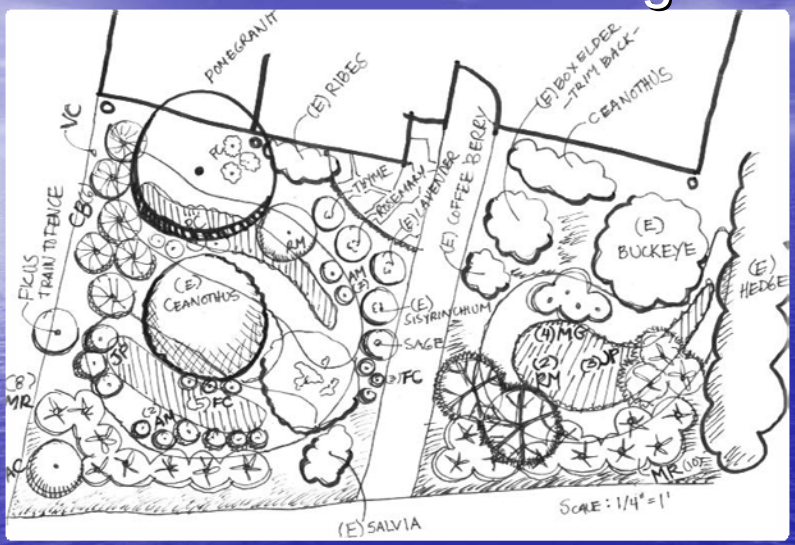
- In general, wide shallow infiltration basins will drain water quicker than deep narrow basins.

# Rainwater Garden Construction

- Leveling the spillway

- Basins taking shape

# Rainwater Garden Planting Plan




- Dry loving native plants on top of berms and mounds.
- Water tolerant natives on sides of berms and in basins.

## Rainwater Garden Planting

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# Rainwater Resources

- Rainwater Harvesting for Dry lands and Beyond by Brad Landcaster

- Rainwater Harvesting for the Mechanically Challenged by Suzy Banks

- Online rainwater harvesting community www.harvestH20.com

- American Rainwater Catchment Systems Association (ARCSA) www.arcsa.org

- Water Environment Research Foundation www.werf.com