

# Water catchments

Butte College

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# zones

## ENERGY FLOWS

zone 1 House & surroundings ( intensive gardens, herb gardens, water fountains.. )

zone 2 Close to the house ( small animals, some fruit trees.. )

zone 3 Big scale gardens and orchards, cows, goats, etc

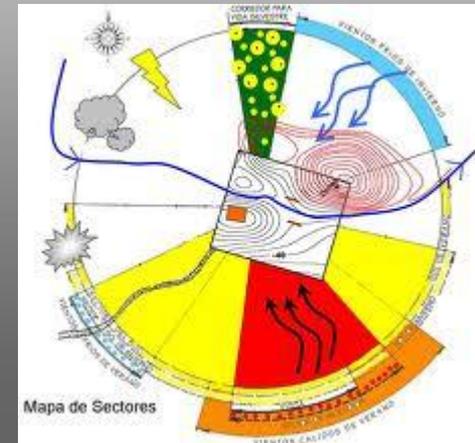
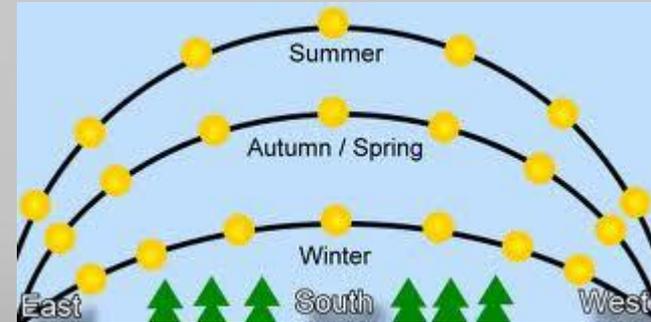
zone 4 Wood piles, storage, foraging trees, fire brakes, river,

zone 5 Wild, respected, inspiration areas

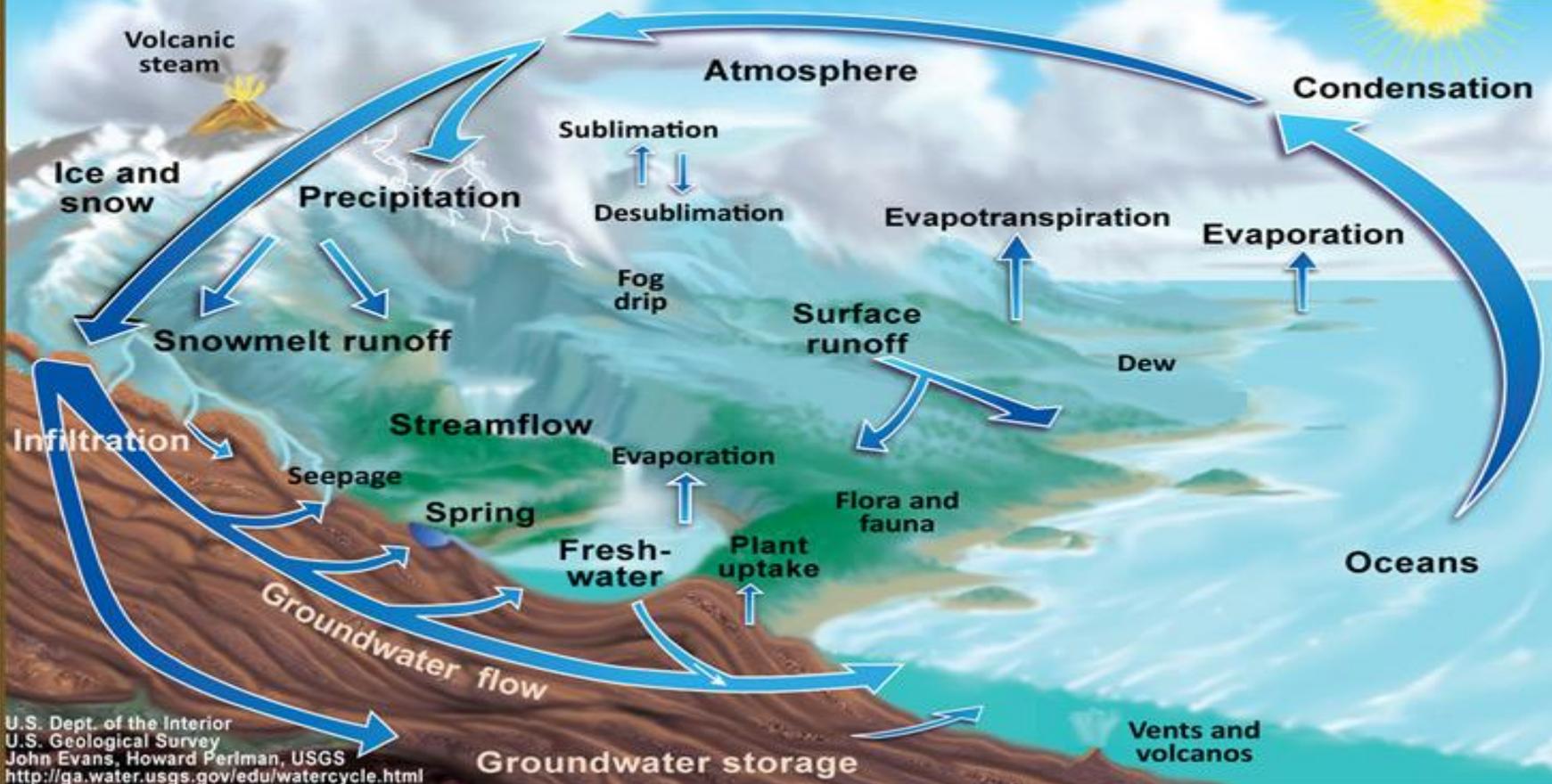


# sectors

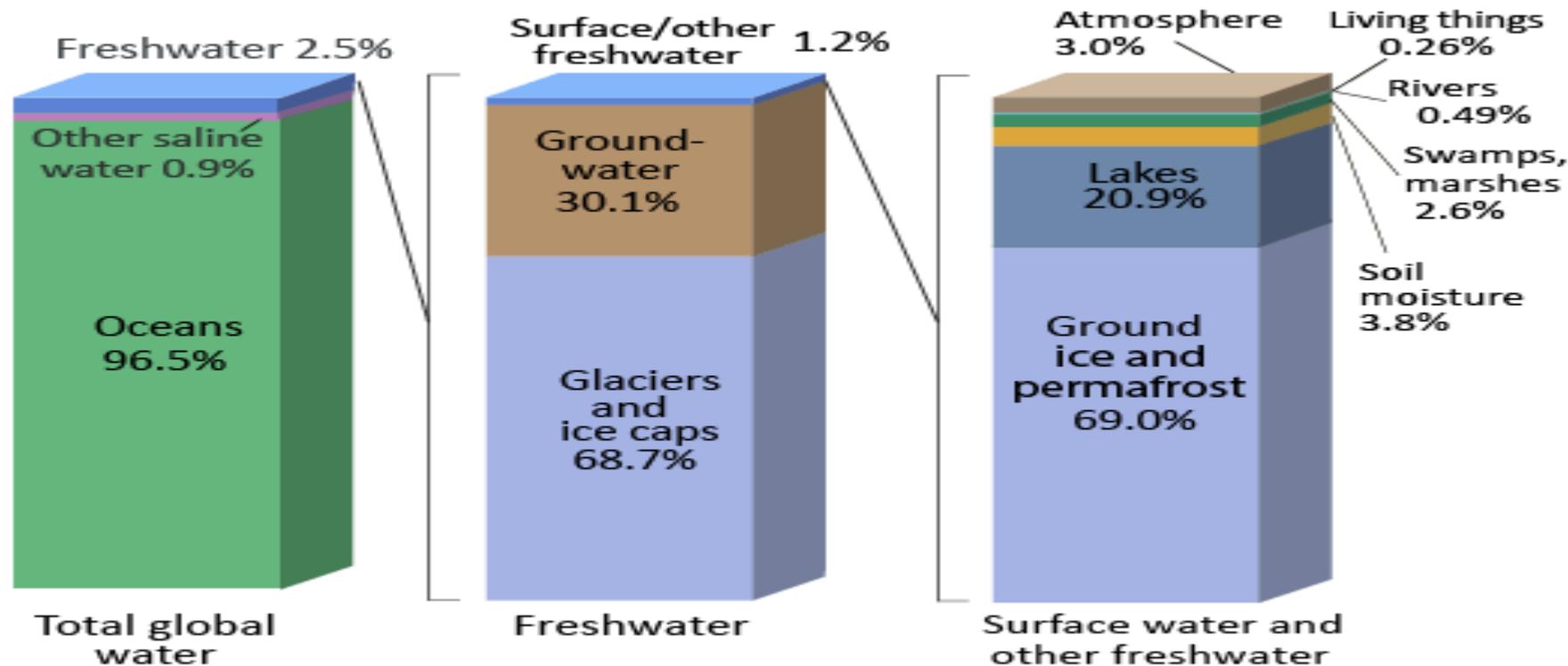
- fire
- wind
- floods
- land slides
- frost
- predators
- noise
- erosion



# The Water Cycle



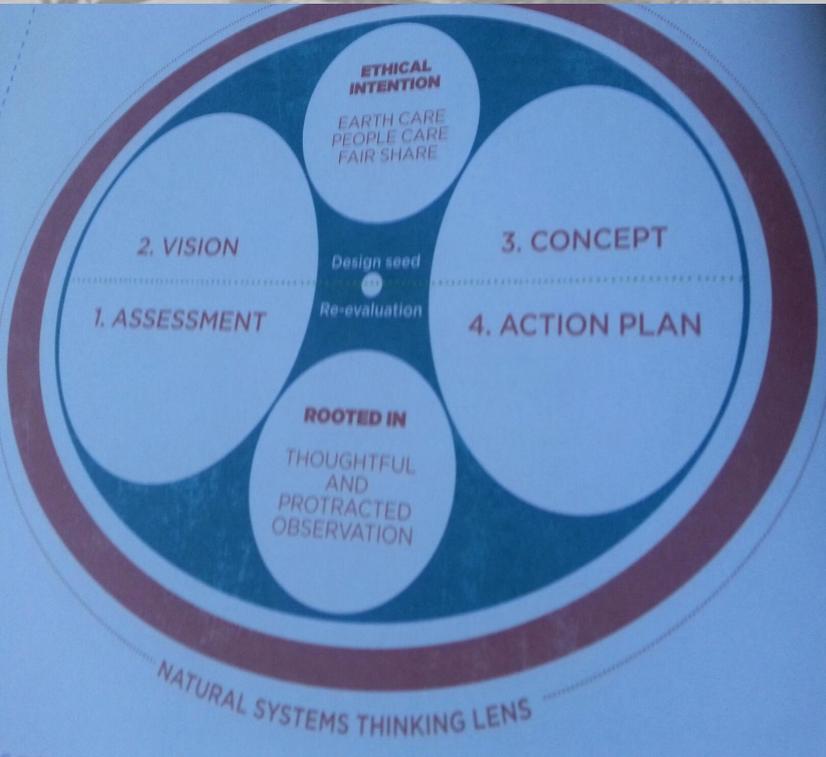
# Where is Earth's Water?



Source: Igor Shiklomanov's chapter "World fresh water resources" in Peter H. Gleick (editor), 1993, *Water in Crisis: A Guide to the World's Fresh Water Resources*.

NOTE: Numbers are rounded, so percent summations may not add to 100.

# site analysis & plan



## What do we want to create?

- goals
- population
- budget
- existing water systems
- climate
- time/management
- slope
- soil & grey water
- landscape & irrigation
- and more..



# Our personal water use

shower..

bath..

drinking.. glasses...

dishwasher..

washing dishes by hand..

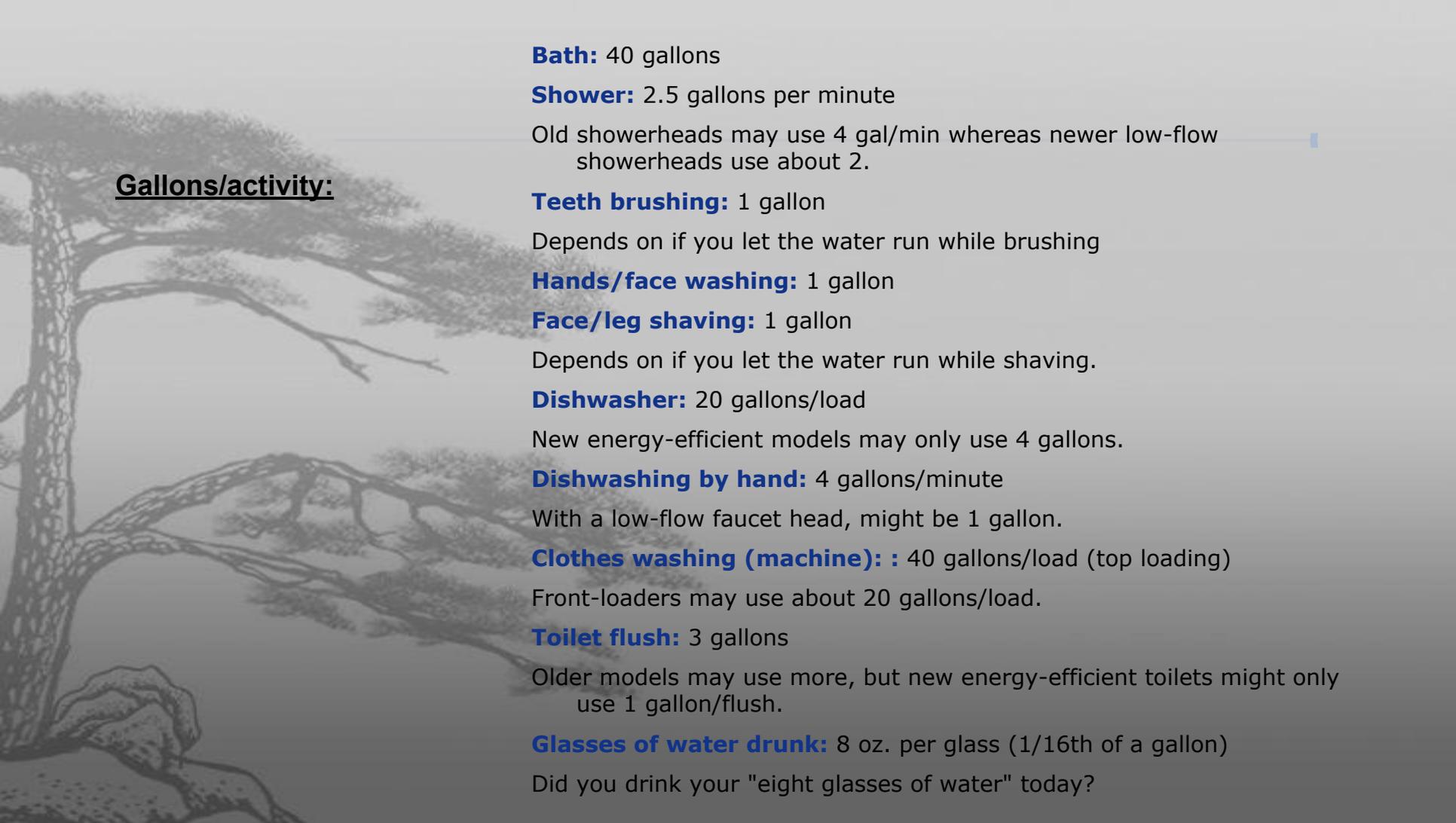
laundry..

toilet flushes..

tooth brushing..

face washing..

**PERSONAL TEST**



**Gallons/activity:**

**Bath:** 40 gallons

**Shower:** 2.5 gallons per minute

Old showerheads may use 4 gal/min whereas newer low-flow showerheads use about 2.

**Teeth brushing:** 1 gallon

Depends on if you let the water run while brushing

**Hands/face washing:** 1 gallon

**Face/leg shaving:** 1 gallon

Depends on if you let the water run while shaving.

**Dishwasher:** 20 gallons/load

New energy-efficient models may only use 4 gallons.

**Dishwashing by hand:** 4 gallons/minute

With a low-flow faucet head, might be 1 gallon.

**Clothes washing (machine):** : 40 gallons/load (top loading)

Front-loaders may use about 20 gallons/load.

**Toilet flush:** 3 gallons

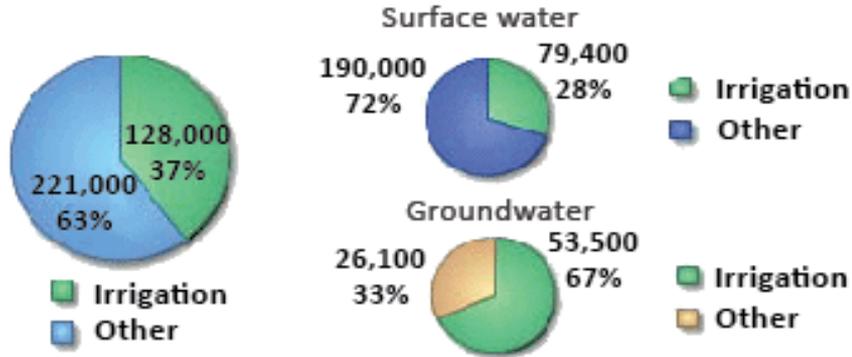
Older models may use more, but new energy-efficient toilets might only use 1 gallon/flush.

**Glasses of water drunk:** 8 oz. per glass (1/16th of a gallon)

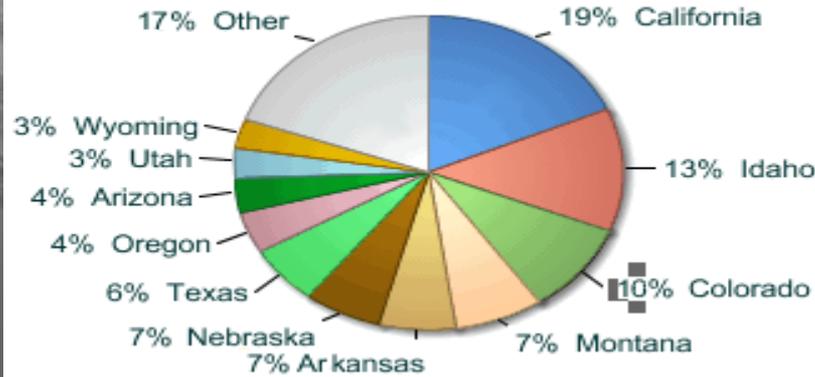
Did you drink your "eight glasses of water" today?

# our personal irrigation usage

Total freshwater withdrawals, 2005  
Million gallons per day



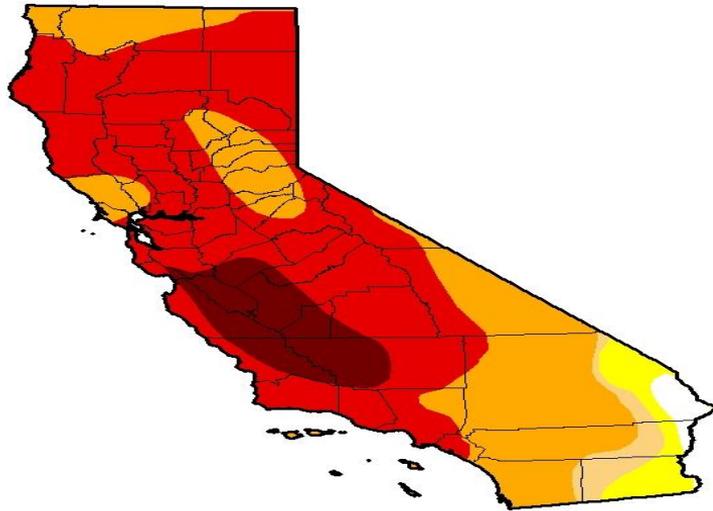
Irrigation Water Withdrawals, 2005



<https://water.usgs.gov/edu/wuir.html>

# drought planning

## U.S. Drought Monitor California



**February 11, 2014**  
(Released Thursday, Feb. 13, 2014)  
Valid 7 a.m. EST

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
<b>Current</b>	1.43	98.57	94.54	91.59	60.94	9.81
<b>Last Week</b> 2/4/2014	1.43	98.57	94.18	89.91	67.13	9.81
<b>3 Months Ago</b> 11/12/2013	2.61	97.39	96.00	84.12	11.36	0.00
<b>Start of Calendar Year</b> 1/20/2013	2.61	97.39	94.25	87.53	27.59	0.00
<b>Start of Water Year</b> 10/1/2013	2.63	97.37	95.95	84.12	11.36	0.00
<b>One Year Ago</b> 2/12/2013	34.53	65.47	47.18	23.72	0.00	0.00

### Intensity:



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

**Author:**  
David Miskus  
NOAA/NWS/NCEP/CPC



<http://droughtmonitor.unl.edu/>

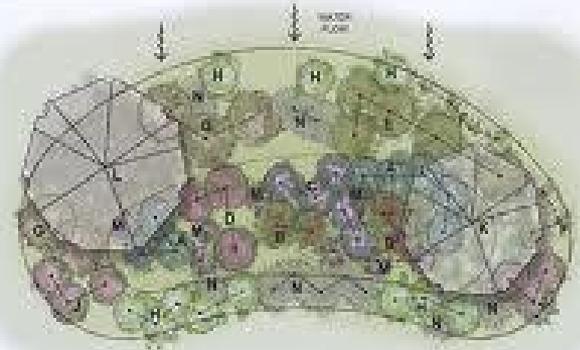
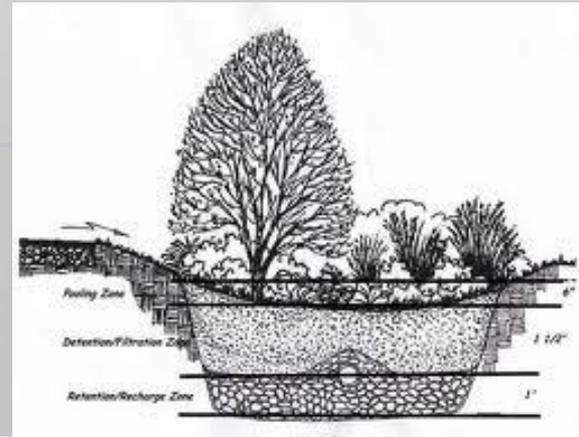
## Running out of water

State officials say these communities and water districts could run out of water within 100 days:



drought tolerant plants shrubs, trees and perennials in the links

# rain gardens



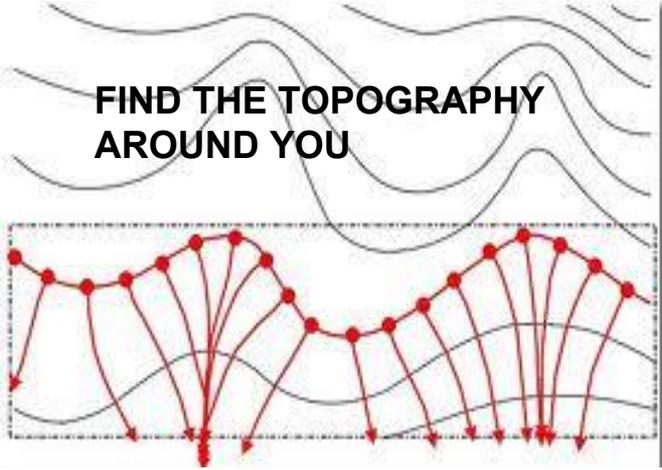
**BRUNNEN ALPARDALIS - 1988**  
(1/1)

- |  |   |
|--|---|
| <ul style="list-style-type: none"> <li>A. Brunnen - Center font</li> <li>B. Cyrtolobos - Tall shrub</li> <li>C. Lonicera - Flowering shrub</li> <li>D. Rosa - Flowering shrub</li> <li>E. Cornus - Flowering shrub</li> <li>F. Ilex - Flowering shrub</li> <li>G. Rubus - Flowering shrub</li> <li>H. Phlox - Flowering shrub</li> <li>I. Spiraea - Flowering shrub</li> <li>J. Spiraea - Flowering shrub</li> <li>K. Spiraea - Flowering shrub</li> <li>L. Spiraea - Flowering shrub</li> <li>M. Spiraea - Flowering shrub</li> <li>N. Spiraea - Flowering shrub</li> <li>O. Spiraea - Flowering shrub</li> <li>P. Spiraea - Flowering shrub</li> <li>Q. Spiraea - Flowering shrub</li> <li>R. Spiraea - Flowering shrub</li> <li>S. Spiraea - Flowering shrub</li> <li>T. Spiraea - Flowering shrub</li> <li>U. Spiraea - Flowering shrub</li> <li>V. Spiraea - Flowering shrub</li> <li>W. Spiraea - Flowering shrub</li> <li>X. Spiraea - Flowering shrub</li> <li>Y. Spiraea - Flowering shrub</li> <li>Z. Spiraea - Flowering shrub</li> </ul> | <ul style="list-style-type: none"> <li>1. Spiraea - Flowering shrub</li> <li>2. Spiraea - Flowering shrub</li> <li>3. Spiraea - Flowering shrub</li> <li>4. Spiraea - Flowering shrub</li> <li>5. Spiraea - Flowering shrub</li> <li>6. Spiraea - Flowering shrub</li> <li>7. Spiraea - Flowering shrub</li> <li>8. Spiraea - Flowering shrub</li> <li>9. Spiraea - Flowering shrub</li> <li>10. Spiraea - Flowering shrub</li> <li>11. Spiraea - Flowering shrub</li> <li>12. Spiraea - Flowering shrub</li> <li>13. Spiraea - Flowering shrub</li> <li>14. Spiraea - Flowering shrub</li> <li>15. Spiraea - Flowering shrub</li> <li>16. Spiraea - Flowering shrub</li> <li>17. Spiraea - Flowering shrub</li> <li>18. Spiraea - Flowering shrub</li> <li>19. Spiraea - Flowering shrub</li> <li>20. Spiraea - Flowering shrub</li> <li>21. Spiraea - Flowering shrub</li> <li>22. Spiraea - Flowering shrub</li> <li>23. Spiraea - Flowering shrub</li> <li>24. Spiraea - Flowering shrub</li> <li>25. Spiraea - Flowering shrub</li> <li>26. Spiraea - Flowering shrub</li> <li>27. Spiraea - Flowering shrub</li> <li>28. Spiraea - Flowering shrub</li> <li>29. Spiraea - Flowering shrub</li> <li>30. Spiraea - Flowering shrub</li> <li>31. Spiraea - Flowering shrub</li> <li>32. Spiraea - Flowering shrub</li> <li>33. Spiraea - Flowering shrub</li> <li>34. Spiraea - Flowering shrub</li> <li>35. Spiraea - Flowering shrub</li> <li>36. Spiraea - Flowering shrub</li> <li>37. Spiraea - Flowering shrub</li> <li>38. Spiraea - Flowering shrub</li> <li>39. Spiraea - Flowering shrub</li> <li>40. Spiraea - Flowering shrub</li> <li>41. Spiraea - Flowering shrub</li> <li>42. Spiraea - Flowering shrub</li> <li>43. Spiraea - Flowering shrub</li> <li>44. Spiraea - Flowering shrub</li> <li>45. Spiraea - Flowering shrub</li> <li>46. Spiraea - Flowering shrub</li> <li>47. Spiraea - Flowering shrub</li> <li>48. Spiraea - Flowering shrub</li> <li>49. Spiraea - Flowering shrub</li> <li>50. Spiraea - Flowering shrub</li> </ul> |
|--|---|



# ground catchments- swales

**FIND THE TOPOGRAPHY  
AROUND YOU**



...and open areas for annual gardens and/or small livestock grazing

**BUILD SWALES TO SLOW & SINK  
WATER WHERE YOU NEED IT**



Designed by Midwest Permaculture for  
Design for Sustainable Communities, 2010. 11

**A FRAME-CONTOUR**



# how does a swale work?

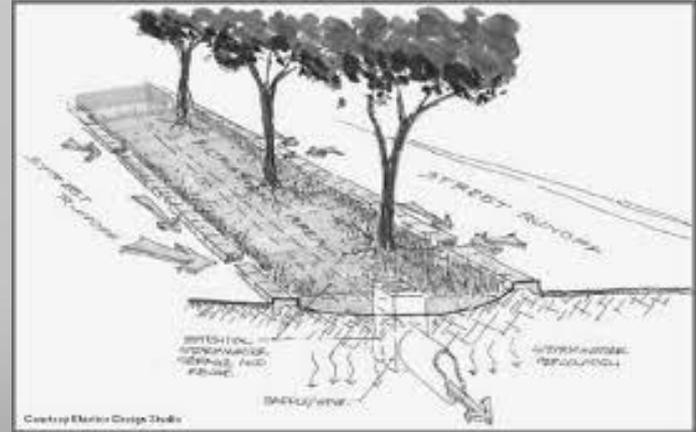
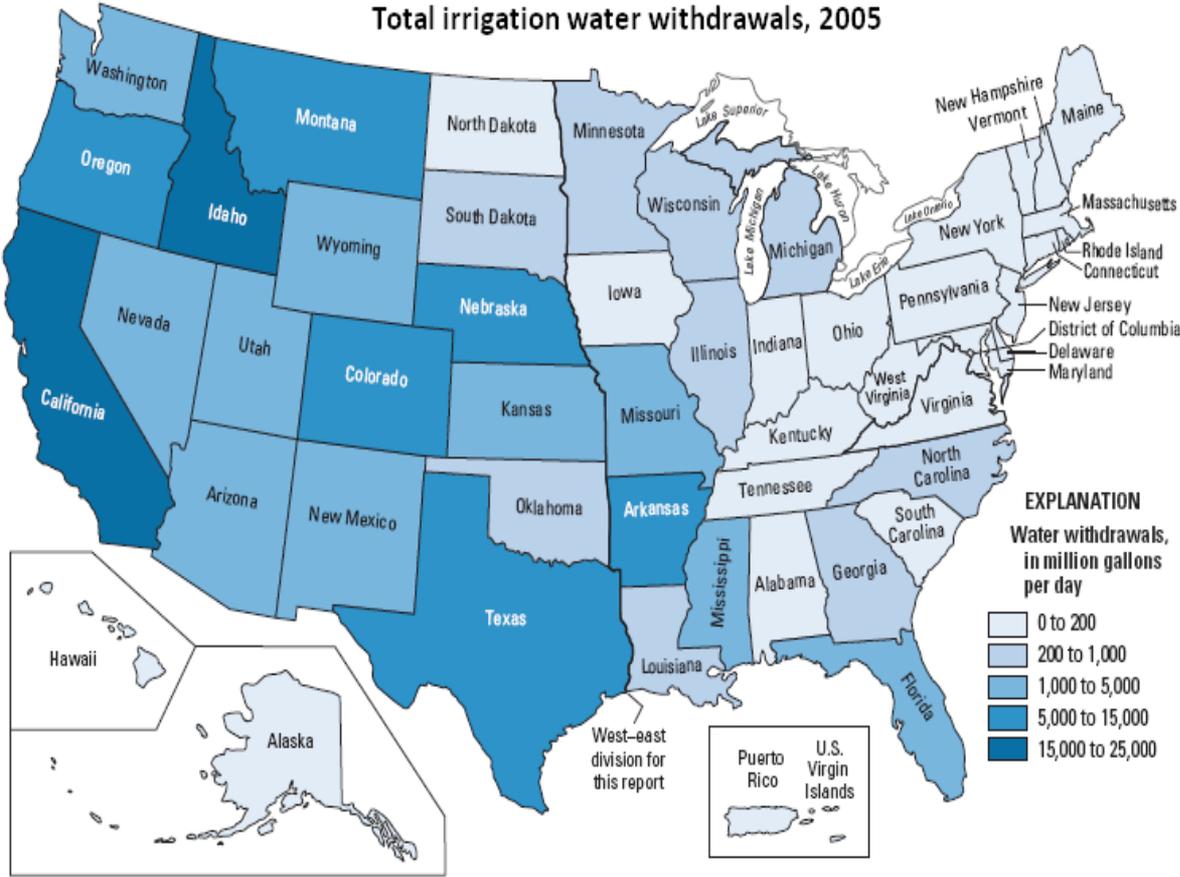


**GREEN FILTERS FOR  
OILS & QUENCHALS**

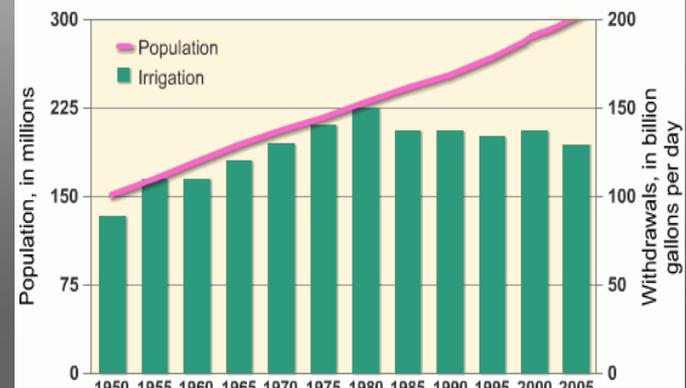
**ALWAYS ON CONTOUR.. letting the water slowly sink into the landscape and filling up the swale surface area, hydrating both sides**

# GROWING POPULATION

Total irrigation water withdrawals, 2005



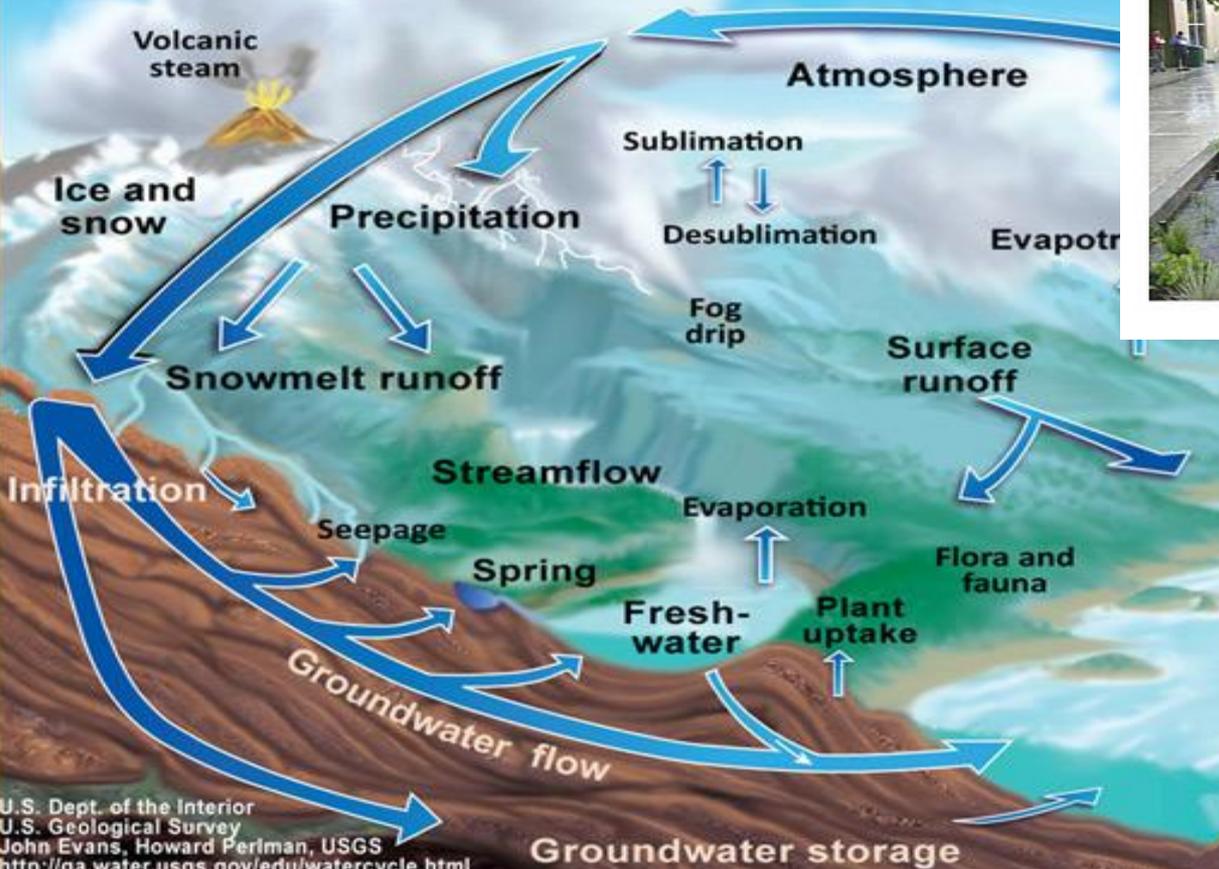
Trends in population and irrigation withdrawals, 1950-2005



# orchids & food forest on swales



# The Water Cycle



## SE Division Street New Seasons Market

Landscape planters in sidewalk area take street runoff while beautifying a commercial/retail zone.



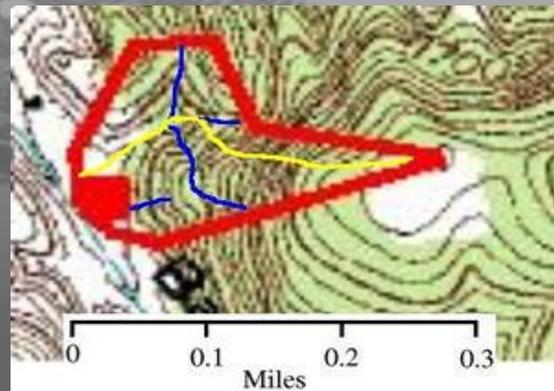
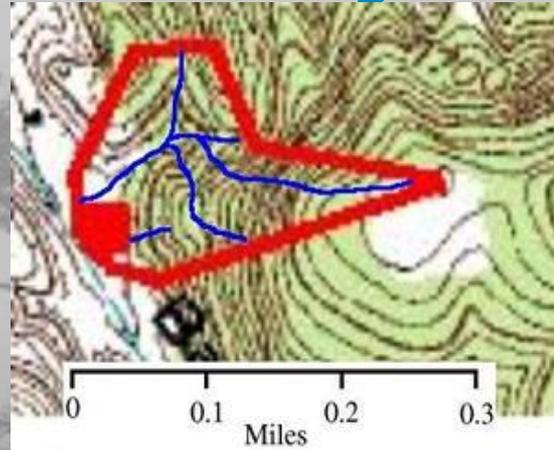
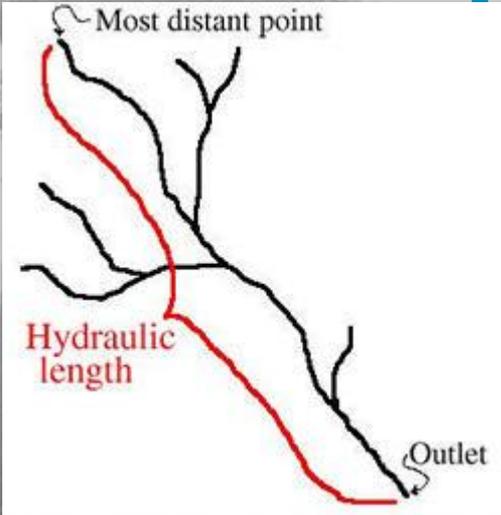
### NATURAL SYSTEM BENEFITS

- ✓ Provide Habitat
- ✓ Slowly Release Storm Flow
- ✓ Filter Pollutants
- ✓ Recharge Groundwater
- ✓ Reduce Erosion



Vents and volcanos

# water pathways+ road runoff



# runoff coefficients



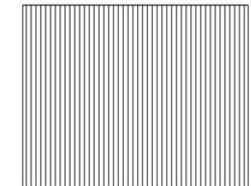
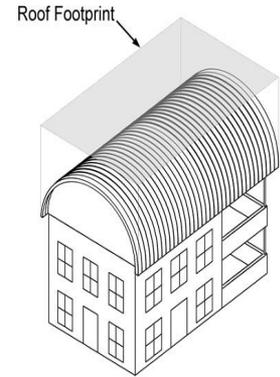
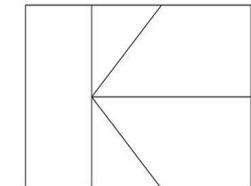
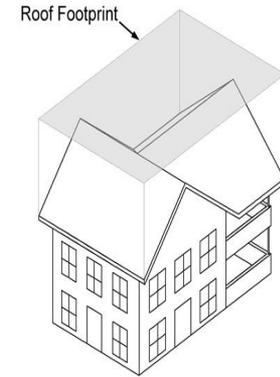
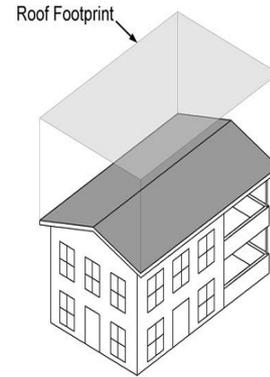
-ASPHALT/CONCRETE	0.95
-BRICK	0.82
-ROOF INCLINED	1.00
-ROOF FLAT	0.90
-LAWN/SANDY SOIL/ FLAT	0.20
-LAWN/HEAVY SOIL	0.20
-WOODY ÁREAS	0.15

# roof calculations

-square & rectangle:

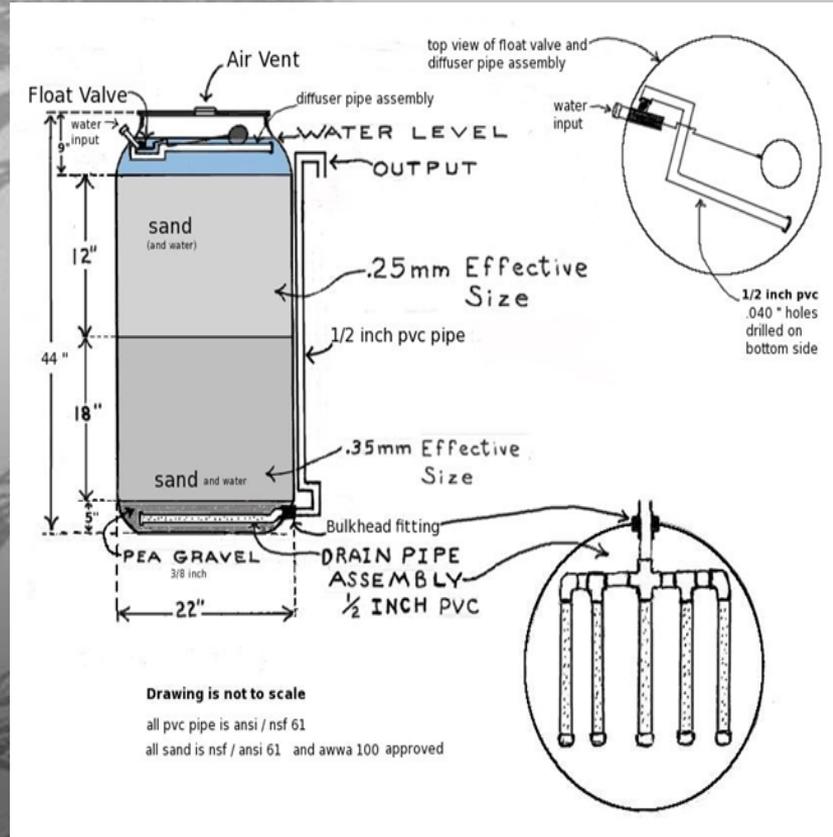
$$\text{Harvested water (gal)} = \text{catchment area (ft}^2\text{)} \times \text{rainfall depth (in.)} \times 0.623 \text{ conversion factor}$$

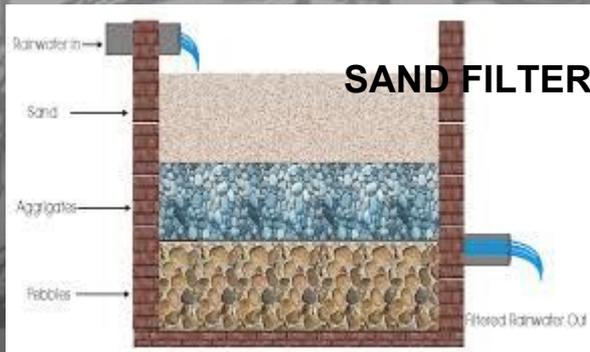
AVERAGE RAINFALL COLLECTED FROM A ROOF [GALLONS]							
Inches of Rain	SQUARE FEET OF ROOF						
	2000	1500	2000	2500	3000	3500	4000
37.5	7,790	13,689	19,588	25,487	31,386	37,285	43,184
33.8	7,401	13,221	14,962	18,703	21,442	26,183	29,923
31.5	7,269	12,954	14,838	17,928	21,507	25,083	28,878
31.0	6,857	13,288	13,735	17,184	20,572	24,061	27,430
30.5	6,545	9,815	13,081	16,364	19,617	23,900	26,383
30.0	6,338	8,351	12,568	15,580	18,702	21,879	24,886
29.5	5,932	8,683	13,841	14,800	17,767	20,735	23,889
29.0	5,611	8,406	13,221	14,003	16,832	19,637	22,442
28.5	5,299	7,989	12,188	13,187	15,897	18,546	21,299
28.0	4,987	7,481	9,374	12,448	14,962	17,485	20,849
27.5	4,675	7,003	9,351	11,689	14,027	16,364	18,702
27.0	4,363	6,586	8,728	10,910	13,091	15,279	17,655
26.5	4,052	6,078	8,184	10,130	12,156	14,187	16,208
26.0	3,740	5,621	7,481	9,351	11,221	13,081	14,962
25.5	3,428	5,163	6,857	8,572	10,286	12,000	13,715
25.0	3,117	4,676	6,234	7,793	9,311	10,900	12,468
24.5	2,805	4,208	5,611	7,003	8,415	9,829	11,221
24.0	2,494	3,780	4,987	6,214	7,601	8,728	9,936
23.5	2,382	3,273	4,364	5,455	6,548	7,637	8,738
23.0	1,870	2,805	3,740	4,626	5,611	6,545	7,481
22.5	1,558	2,338	3,117	3,896	4,678	5,601	6,236
22.0	1,247	1,870	2,494	3,117	3,740	4,364	4,987
21.5	935	1,403	1,870	2,338	2,805	3,273	3,740
21.0	623	935	1,247	1,558	1,870	2,182	2,494
20.5	312	488	623	778	935	1,091	1,247



Roof material  
Slope  
Sizing catchment area

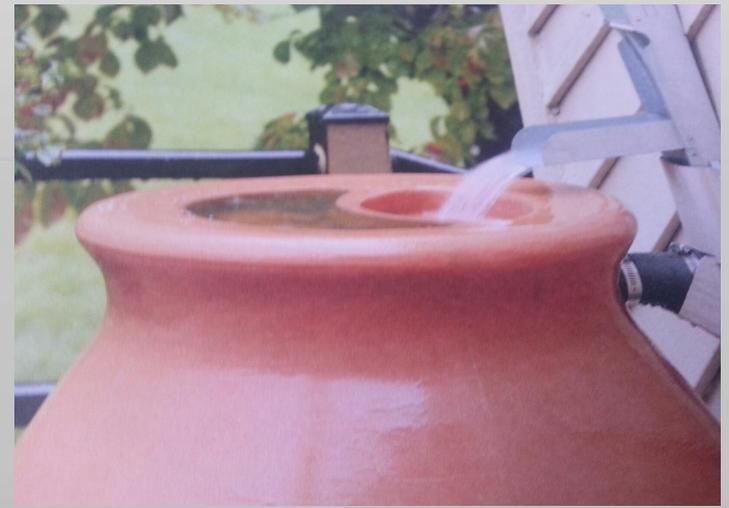
# filtering roof water





# simple catchments

55g TANK



# ferro cement tanks

## PROS

cheap materials  
group building  
long term solution  
applicable to poor areas  
permanent tanks  
inside the ground  
above ground  
round/cylinder structures

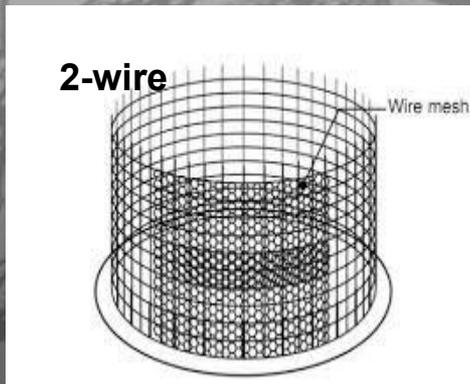
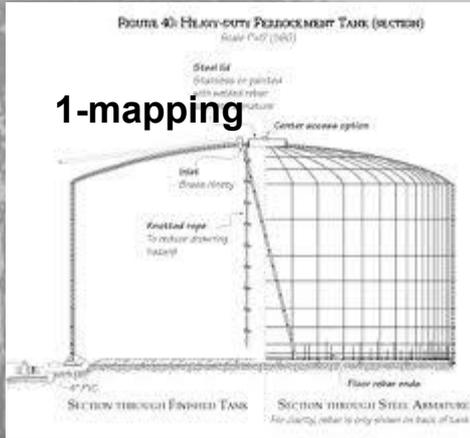


## CONS

labour intensive



# ferro cement tanks



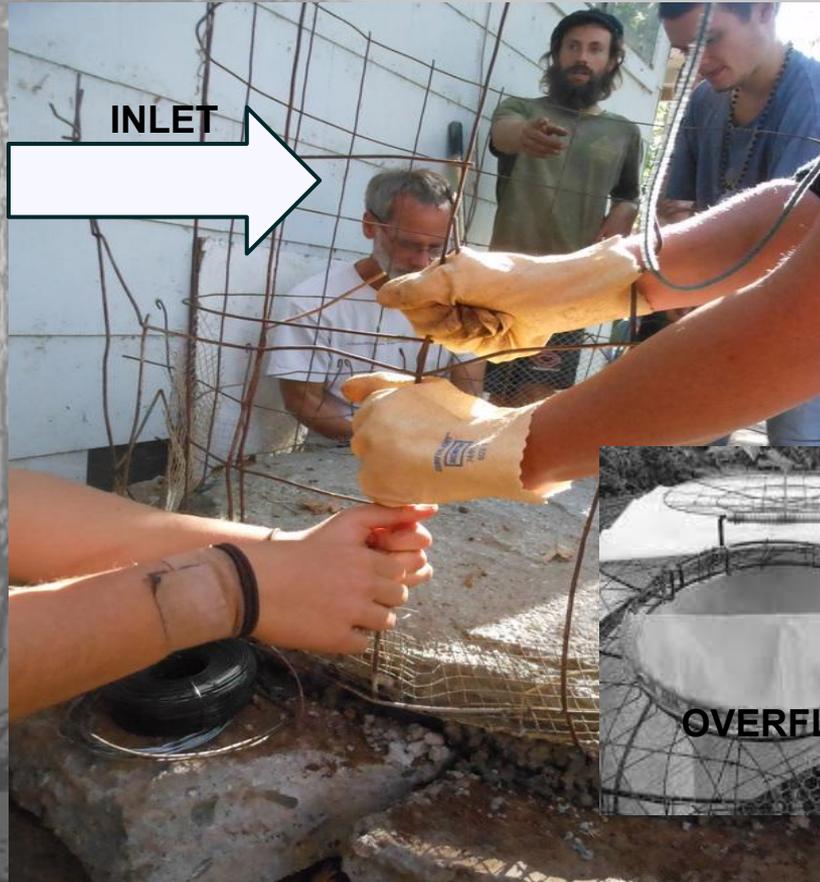
# 1-Base+ wire base



# 2-Wire walls



# 3-Add inlets/outlets/piping



# 4- MIX: 3 sand+1 cement



# 5- Plaster walls both sides



# 6- add roof & seal



# tank pressure & volume



# grey water



Ibiza  
animal CSA

pdf with details  
on links

grey water workshop  
grub

# links

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All year long pollinators

<http://www.rhs.org.uk/Gardening/Sustainable-gardening/Plants-for-pollinators>

pest control

drought tolerant plants

grey water

small urban designs