Fundamentals of Water-Wise Gardening

BAWSCA and the City of Mountain View

October 16, 2013

Sherri D. Osaka

Sustainable Landscape Designs

www.sustainable-landscape.com

Top Six Ways to Save Water in the Garden

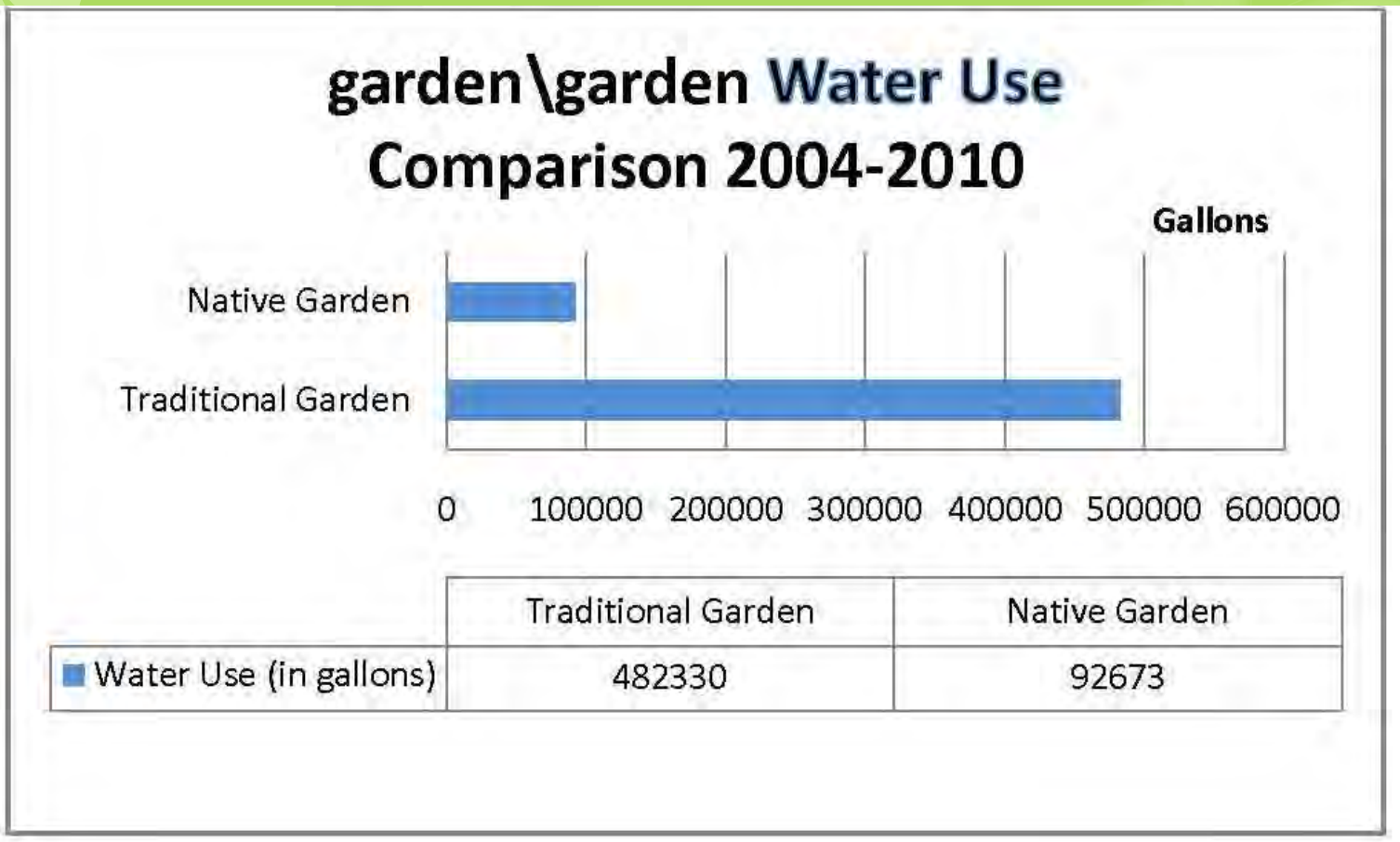
- Fix all leaks
- Replace the lawn
- Switch to climate appropriate plants
- Change to drip irrigation
- Improve your soil
- Keep water on-site

Garden/ Garden Study
City of Santa Monica

Traditional Garden

Native Garden

Garden /Garden Study
City of Santa Monica

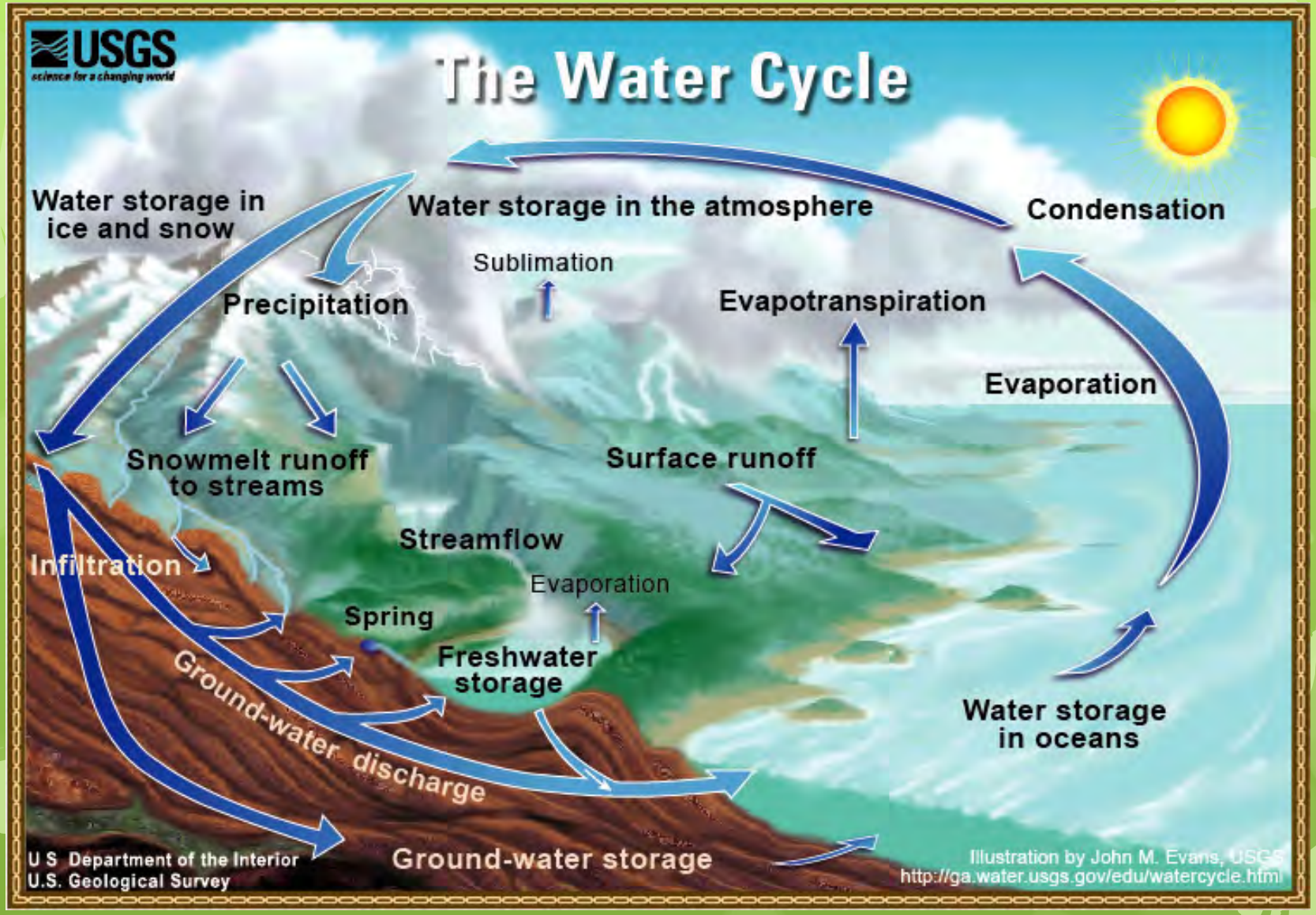


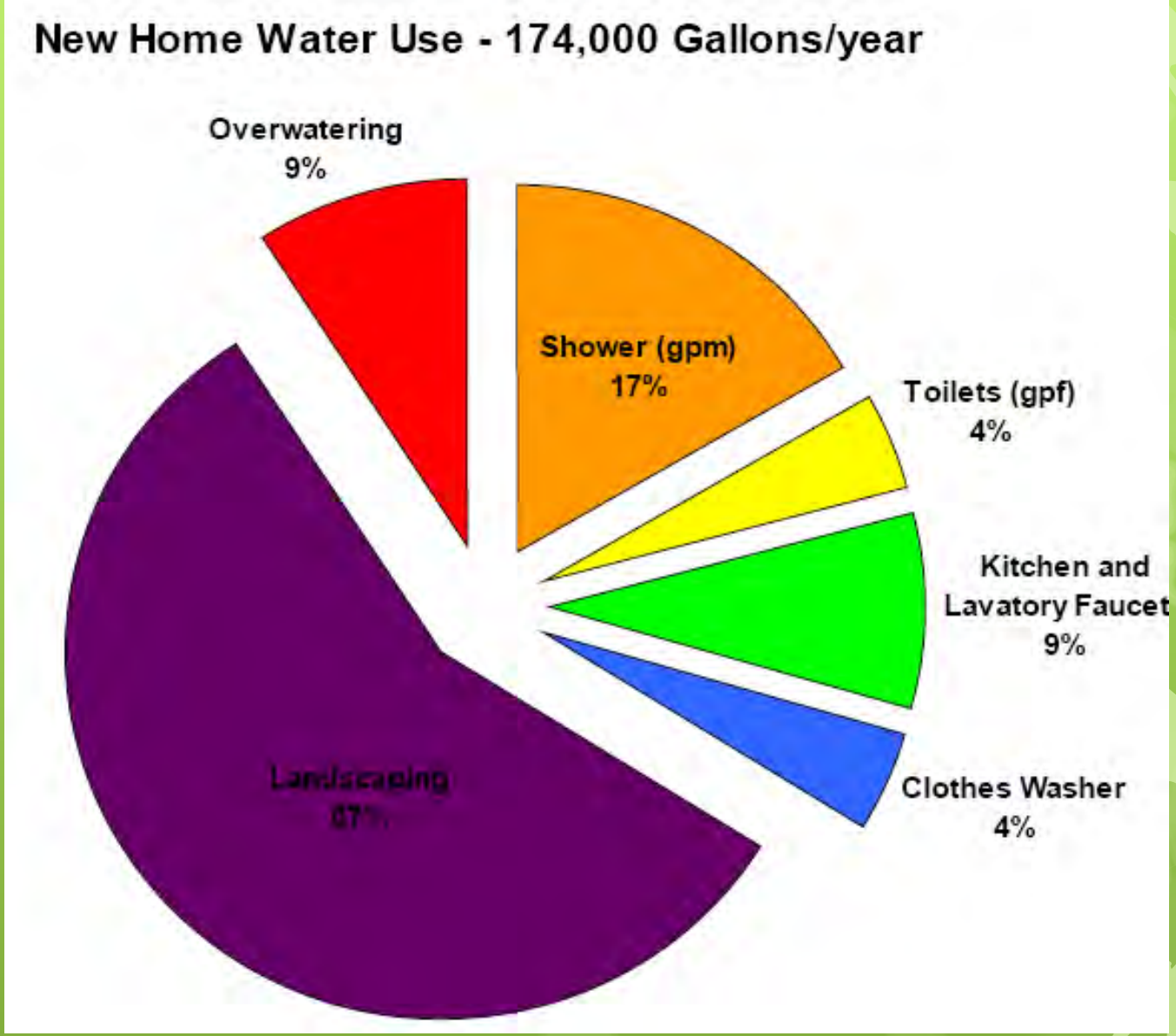
	Traditional Garden	Native Garden
Water Use (in gallons)	482330	92673

81% less water!

Garden /Garden Study
City of Santa Monica

Garden /Garden Study
City of Santa Monica


USGS
science for a changing world
The Water Cycle
Water storage in ice and snow
Water storage in the atmosphere
Condensation
Sublimation
Precipitation
Evapotranspiration
Evaporation
Snowmelt runoff to streams
Surface runoff
Streamflow
Infiltration
Evaporation
Spring
Freshwater storage
Ground-water discharge
Water storage in oceans
Ground-water storage
U S Department of the Interior
U.S. Geological Survey
Illustration by John M. Evans, USGS
http://ga.water.usgs.gov/edu/watercycle.html



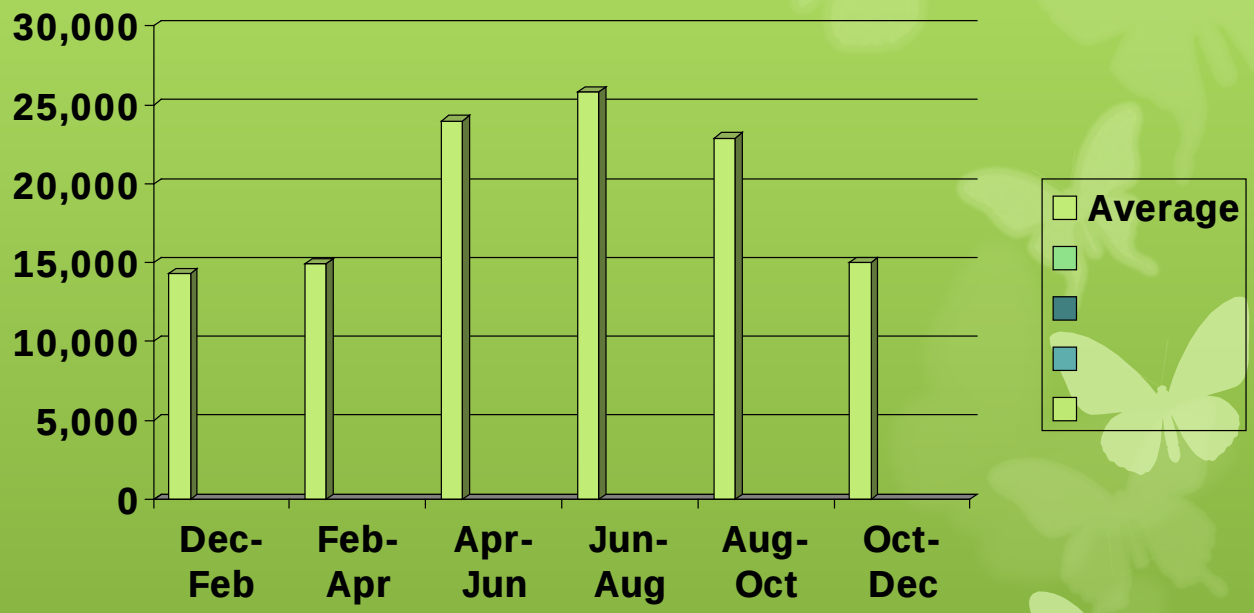
Landscaping
57%

Source: California Building Industry Association report, January 2010

Water Use in Bay Area Home

11,000 square foot lot, pool, low water landscape

- About 120,000 gallons per year
- 90,000 gallons inside house
- 30,000 gallons outside house

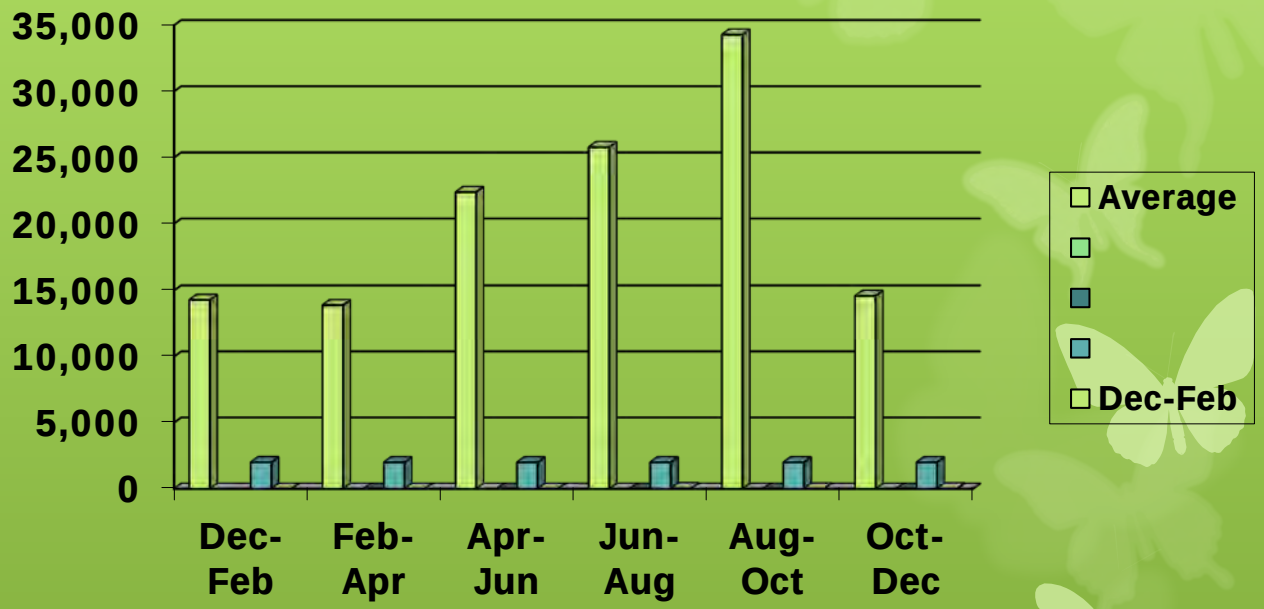


About 30 percent for outdoor use

Water Use in Bay Area Home

11,000 square foot lot, pool, low water landscape

- About 106,000 gallons per year
- 85,000 gallons inside house
- 21,000 gallons outside house



About 20 percent for outdoor use

Energy Used for Water

The State Water Project

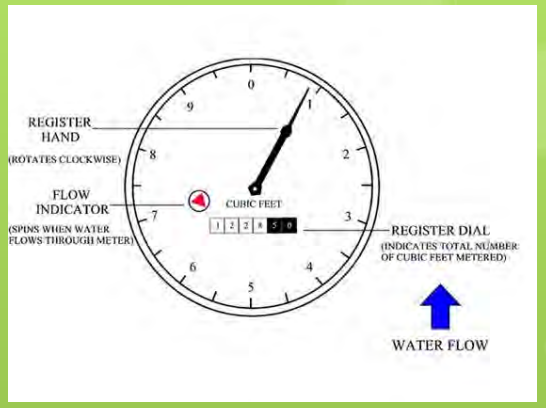
Reservoir high in the Hollywood Hills

15-20% of all energy used in California is water related (cleaning, moving, heating)

Top Tip for Saving Water in the Garden

Fix all Leaks

Read your water meter



One in every 10 homes has a leak that is wasting at least 90 gallons of water per day.

Top Tip for Saving Water in the Garden

Eliminate or Reduce the Lawn

Kentucky Bluegrass – 80% ET

Bermuda grass – 60% ET

Drought-tolerant natives:
Low water -20% ET
Very low water <10% ET

Why to Lose the Lawn

- Lawns require up to 1” of water per week when it’s not raining
- Most fertilizers are made from petrochemicals adding to our oil supply problems and also to global warming.
- Every 40-pound bag of lawn fertilizer contains the fossil-fuel equivalent of 2.5 gallons of gasoline www.safelawns.org and Natural Home magazine July/August 2007
- Running a lawn mower one hour emits as much air pollution as driving 20 miles (U.S. EPA)
- 65% of fertilizer put on each yard will end up in runoff - Natural Home magazine July/August 2007
- Homeowners use 20 times more pesticides per acre than farmers (US EPA)
- Yardwaste comprises 20 percent of landfill waste on average, but can be as much as 50%. U.S. EPA Natural Home

Santa Clara Valley Water District

- High Water Using Landscape Conversion
  - $2.00 /sq. ft.
  - Max = no limit!
  - Palo Alto - $4 /sq. ft
  - Morgan Hill -$3-4/ sq. ft

Imagine.. Create... Enjoy...

Lawn Be Gone!

Rebates of $1.00 Per Square Foot of Lawn Replaced

Visit www.bawsca.org

- To view BAWSCA's Water Wise Gardening In the Bay Area for Water-Efficient Gardening ideas and inspirations! www.bawscawatersavingplants.com
- For a list of FREE Water-Efficient Landscape Classes offered throughout the Bay Area. www.bawsca.org/classes

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Bay Area Water Supply & Conservation Agency

650-349-3000
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Effective July 1, 2014 through June 30, 2015

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List of Participating Water Agencies

- **Alameda County Water District (RSF, RMF, CII)** (510) 668-6534 www.acwd.org
- **City of Brisbane/Guadalupe Valley Municipal Improvement District (RSF, CII)** 415-508-2130 www.ci.brisbane.ca.us
- **Coastside County Water District (RSF, RMF, CII)** 650-726-4405 www.coastsidewater.org
- **City of Foster City/Estero Municipal Improvement District (RSF, RMF, CII)** 650-286-8140 www.fostercity.org
- **Mid-Peninsula Water District (RSF)** 650-591-8941 www.midpeninsulawater.org
- **North Coast County Water District (RSF)** (650) 355-3462 www.nccwd.com
- **City of San Bruno (RSF, RMF)** 650-616-7162 www.sanbruno.ca.gov

Alameda County Water District
510.668.6534
www.acwd.org

Photos By Stephanie Penn

ACWD
ALAMEDA COUNTY WATER DISTRICT

Water-Efficient Landscape Rebate Program

Photo By Stephanie Penn

Trade in your high-maintenance and water-thirsty lawn for a more natural, low maintenance, and water-efficient landscape, and ACWD will give you money back for doing it!

Get a Rebate of up to $1,500-$20,000*

**Rebate is based on $1.00 per square foot of lawn converted to water-efficient landscape. Single family residential customers are eligible for up to $1,500, multi-family residential, commercial and industrial customers are eligible for up to $20,000. Rebates are issued on a first-come, first-served basis. Funding is limited and may be exhausted without prior notice.*

ACWD
ALAMEDA COUNTY WATER DISTRICT

Water-Efficient Landscape Rebate Program

Photo By Stephanie Penn

Trade in your high-maintenance and water-thirsty lawn for a more natural, low maintenance, and water-efficient landscape, and ACWD will give you money back for doing it!

Get a Rebate of up to $500-$3,000*

Effective July 1, 2012

**Rebate is based on $0.50 per square foot of lawn converted to water-efficient landscape. Single family residential customers are eligible for up to $500, multi-family residential, commercial and industrial customers are eligible for up to $3,000.*

ACWD
ALAMEDA COUNTY WATER DISTRICT

Walkable, Mowable Lawn Alternatives

Red fescue: *Festuca rubra*

Walkable, Mowable Lawn Alternatives

Delta BlueGrass “Native Bentgrass™” (*Agrostis pallens*)

Walkable, Mowable Lawn Alternatives

Delta BlueGrass “Delta Grassland Mix™”
(*Festuca rubra ‘Molate’, Koelaria macrantha, Deschampsia elongata*)

Walkable, Mowable Lawn Alternatives

Photo from Greenlee Nursery, La Jolla, CA

Design/ Photo: Sherri Osaka

Meadow sedge, *Carex pansa*

Walkable, Mowable Lawn Alternatives

Design by Stephanie Morris

Yarrow Lawn, *Achillea millefolium*

Design by Stephanie Morris

Lawn Alternatives – Walkable Perennials

Seathrift, *Armeria maritima* “lawn”

Lawn Alternatives – Walkable Perennials

Seathrift, *Armeria maritima* “lawn” by Agi Kehoe

Lawn Alternatives - Perennials

Dymondia margaratae Silver Carpet

Photo at Sierra Azul Nursery by Deva Luna

Wild Rye – *(Leymus condensatus ‘Canyon Prince’)*

Subsurface Drip Irrigation for Lawns

Lawn and meadows use subsurface drip irrigation—Recommend Netafim Techline CV products

Bunch Grasses

Deer grass *(Muhlenbergia rigens)*

Bunch Grasses

Idaho fescue *(Festuca idahoensis)*

Lawn Alternatives - Shrubs

Ceanothus ‘Yankee Point’ by Stephanie Curtis, Curtis Horticulture

Lawn Alternative - Shrubs

Ceanothus Hearstiorum

Ceanothus ‘Anchor Bay’

Lawn Alternatives - Shrubs

Coyote Bush, *Baccharis pilularis 'Twin Peaks'*

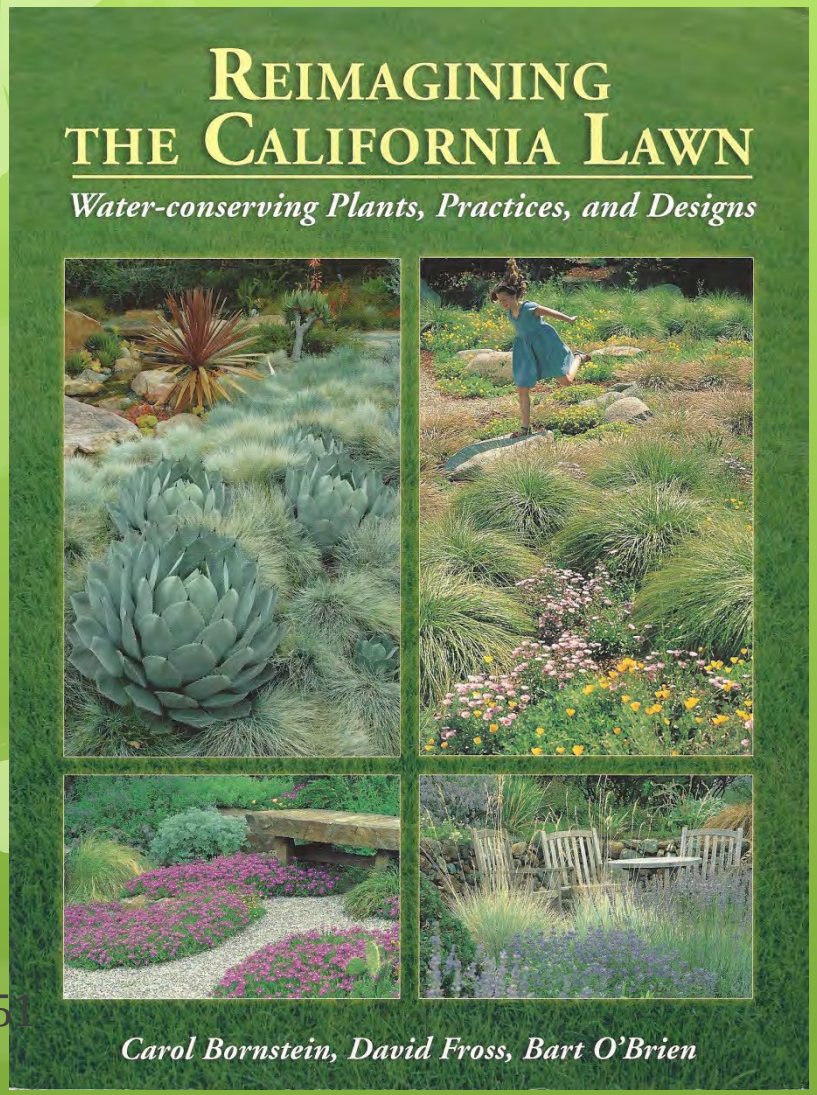
Sand Hill sage: *Artemisia pycnocephalus 'David's Choice'*

Photo: Deva Luna, Design: Sherri Osaka

Creeping sage
Salvia sonomensis ‘Dara’s Choice’

Photo Deva Luna,
Design Sherri Osaka

Lawn Alternative Resourse

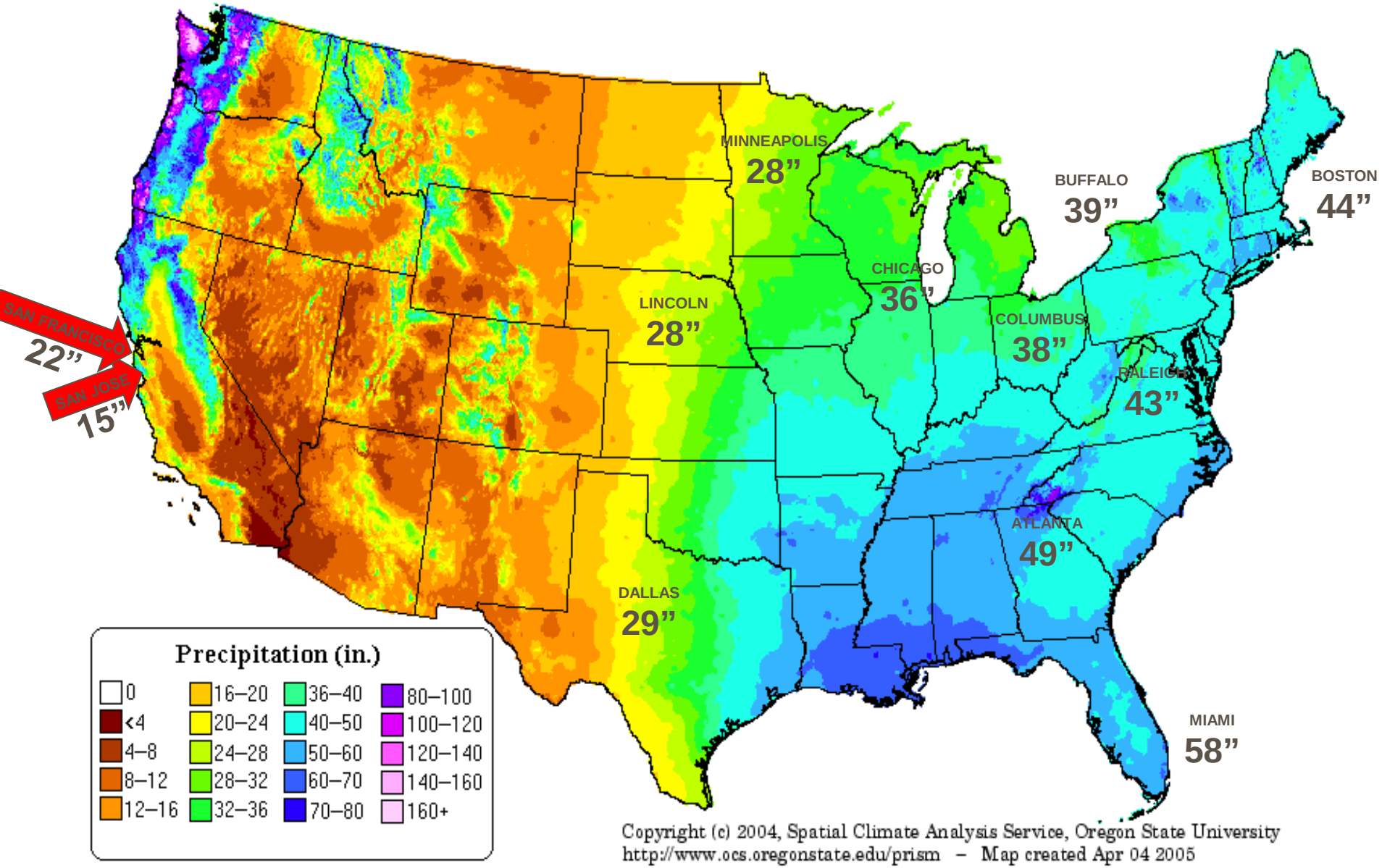


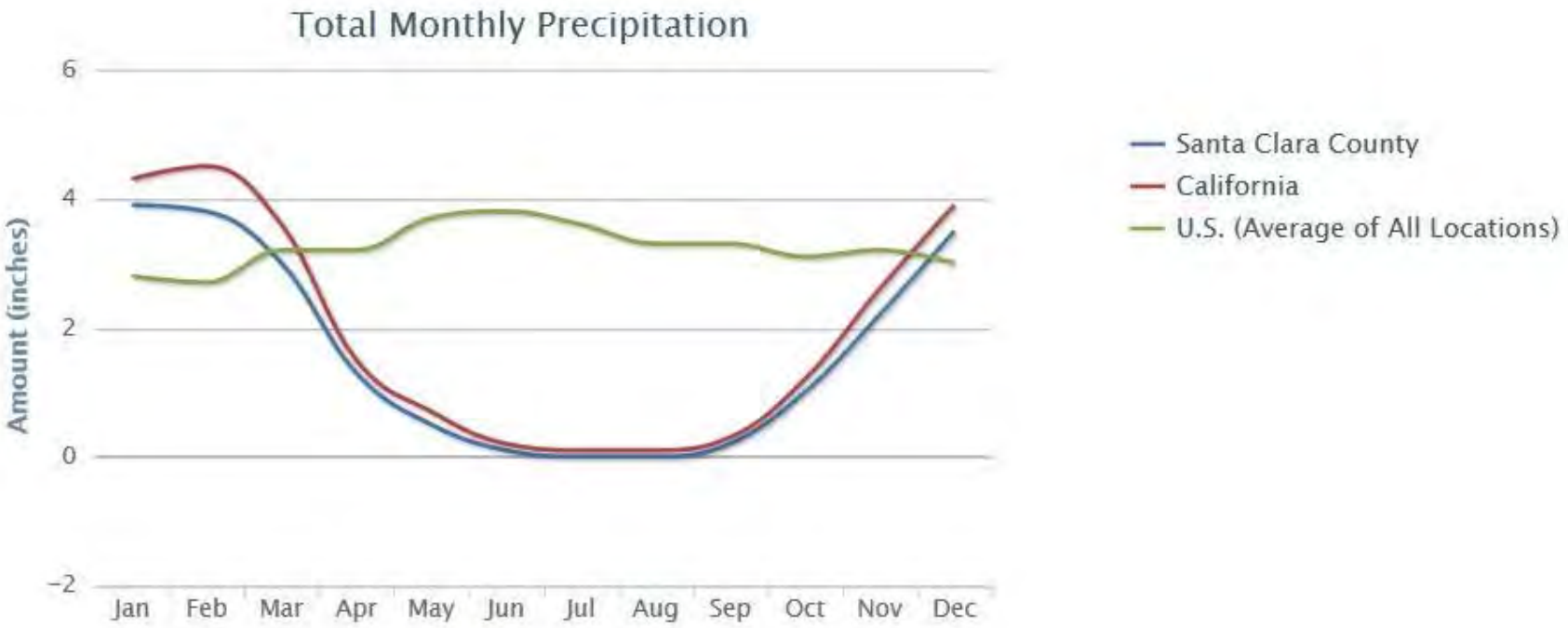
Many Alternatives to a European Lawn!

Top Tip for Saving Water in the Garden

Choose Climate-Appropriate Plants

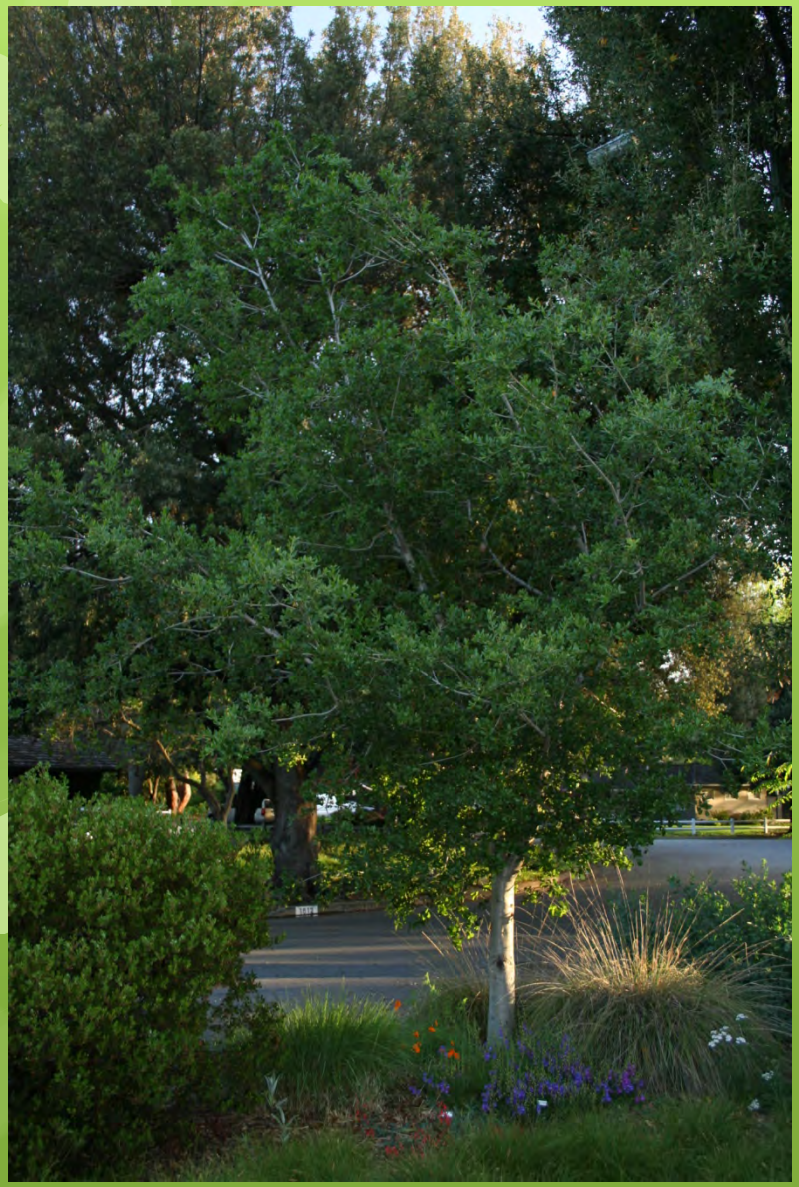
Annual Precipitation





http://www.usa.com/santa-clara-county-ca-weather.htm

Very Low Water – Coast live oak



Quercus agrifolia

Very Low Water - Toyon

Heteromeles arbutifolia

Very Low Water - Buckeye

Aesculus californica

Jean Struther’s Buckeye

Very low water – Western redbud

Cercis occidentalis

Very Low Water – Manzanitas

Very Low Water – Manzanitas

Arctostaphylos densiflorus ‘Howard McMinn’

Very Low Water – Wild Lilac

Ceanothus ‘Ray Hartman’
Photo from “Ceanothus” by Fross and Wilken

Very Low Water – Flannel Bush

Fremontodendron californica

Very Low Water – Bush Poppy

Dendromecon rigida

Very Low Water – Nevin Mahonia

Mahonia nevinii

Very Low Water – Woolly Blue Curls

Trichostema lanatum

Very Low Water – Coyote Mint

Monardella villosa obispoensis

Very Low Water – Wild Rye

Photo at Sierra Azul Nursery by Deva Luna

Leymus condensatus ‘Canyon Prince’

Very Low Water – Grasses

Festuca idahoensis

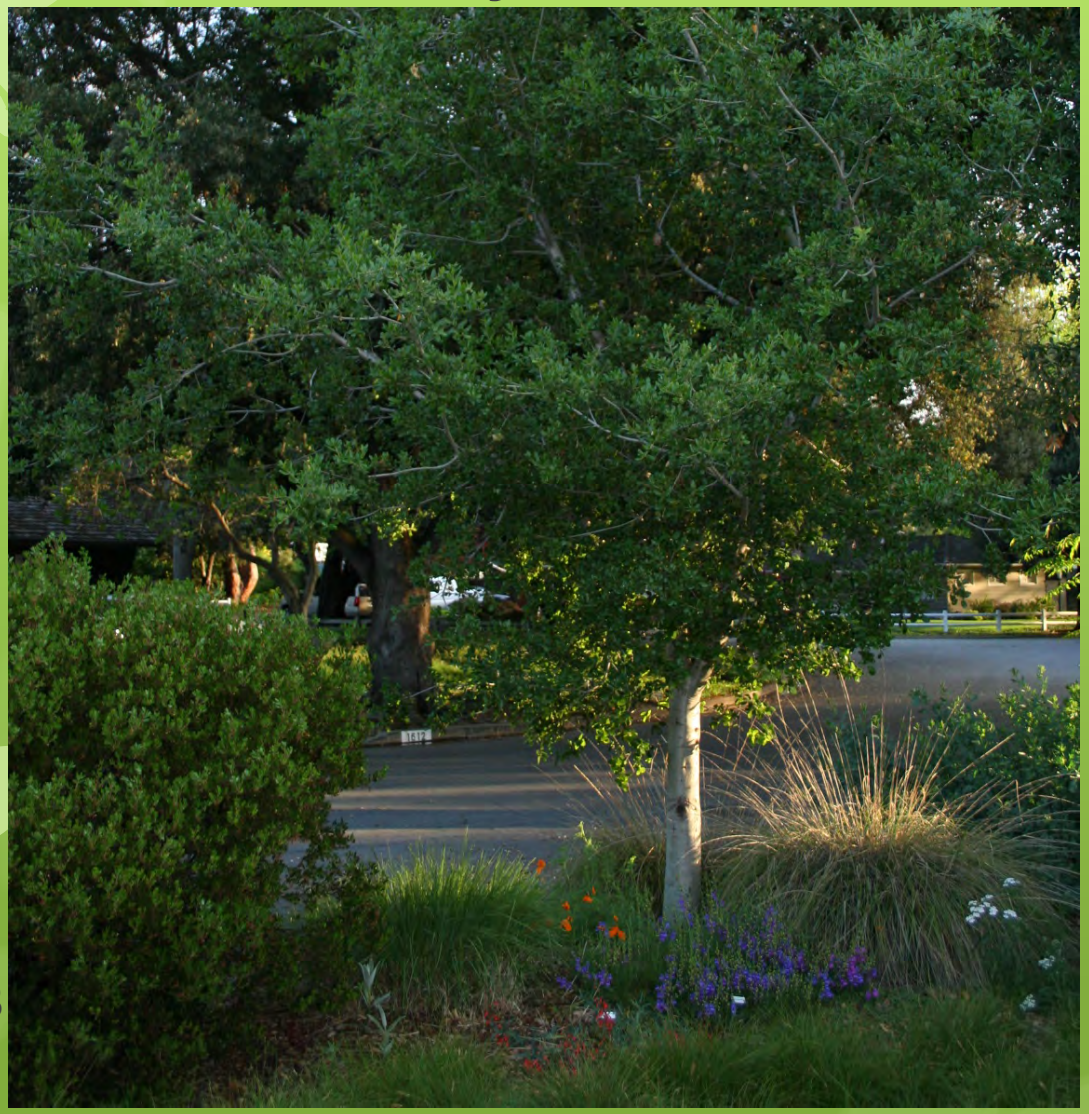
Nasella pulchra

Case Study – Hand watering

Case Study – Hand watering

Case Study – Hand watering

Case Study – No Watering



Top Tip for Saving Water in the Garden

Switch to Drip Irrigation

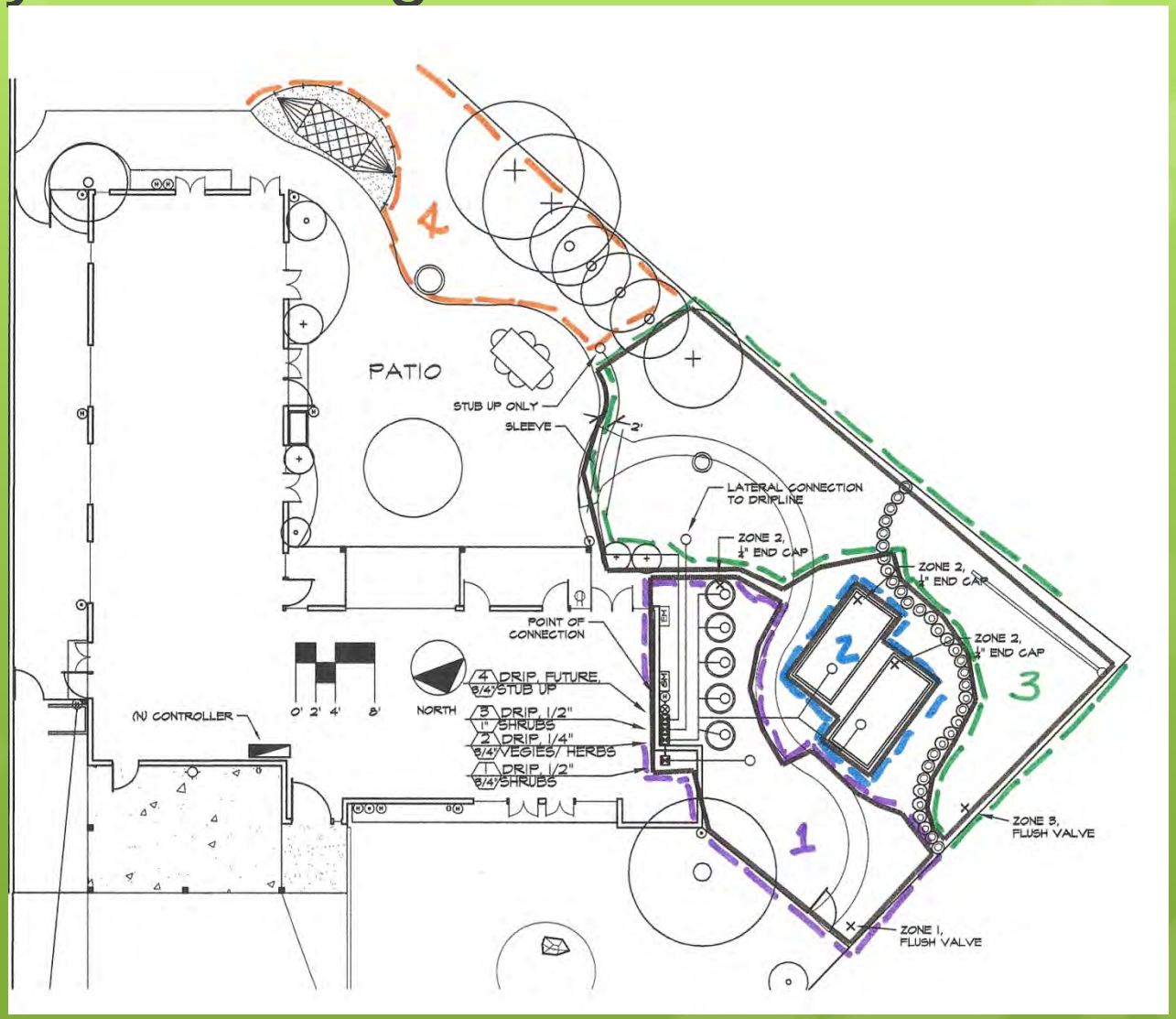
Why Spray Irrigation is Wasteful

- Most estimates rate spray irrigation as 50 to 75% efficient

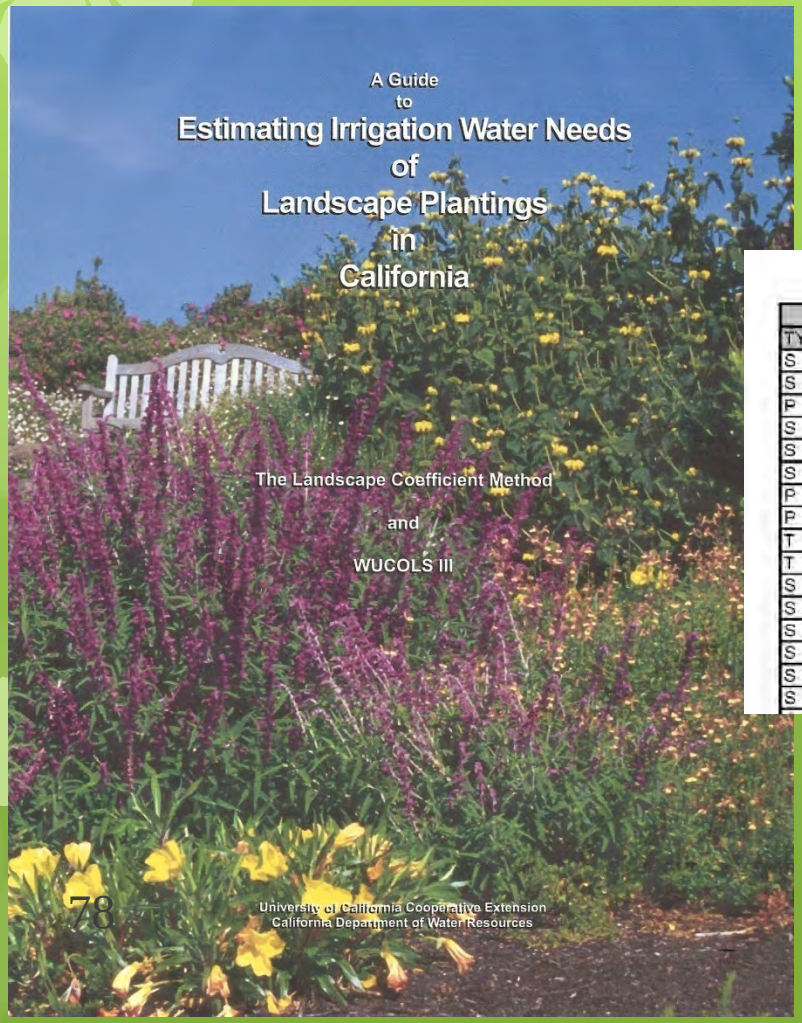
Why Spray Irrigation is Wasteful

- Misting
- Overspray
- Runoff
- Wind
- Poor design

Hydrozoning



Water Use Classifications of Landscape Species (WUCOLS)

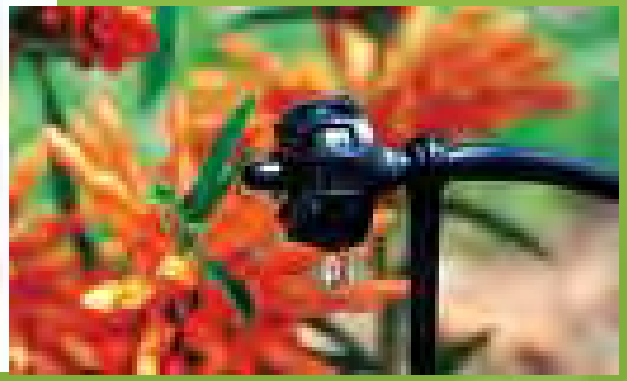


Species Evaluation List--1999

			REGIONAL EVALUATIONS						
TYPE	BOTANICAL NAME	COMMON NAME	1	2	3	4	5	6	INVASIVE
S	Brugmansia spp.	angel's trumpet	M	/	M	H	/	/	
S	Brunfelsia pauciflora	yesterday today and tomorrow	M	M	M	H	/	H	
P	Brunnera macrophylla	Siberian bugloss	H	H	H	?	?	?	
S	Buddleja alternifolia	fountain butterfly bush	L	L	M	/	M	M	
S	Buddleja davidii	butterfly bush	L	L	M	M	M	M	
S	Buddleja marrubiifolia	woolly butterfly bush	?	L	?	L	/	L	
P	Bulbine frutescens	stalked bulbine	L	?	L	L	/	L	
P	Bulbinella robusta	bulbinella	L	?	?	?	?	?	
T	Bursera hindsiana	bursera	?	?	/	/	/	M	
T	Butia capitata	pindo palm	L	L	L	L	L	L	
S	Buxus microphylla japonica	Japanese boxwood	M	M	M	M	M	M	
S	Buxus sempervirens	English boxwood	M	M	M	/	M	M	
S	Caesalpinea cacalaco	cascalote	?	?	?	?	/	L	
S	Caesalpinea gilliesii	desert bird of paradise	L	L	L	L	M	M	
S	Caesalpinea mexicana	Mexican bird of paradise	?	/	?	L	/	L	
S	Caesalpinea platyloba		?	?	?	?	?	?	

Components of Drip Irrigation

- Valves with filters and pressure regulator
- Drip emitters
- Inline emitters
- End caps



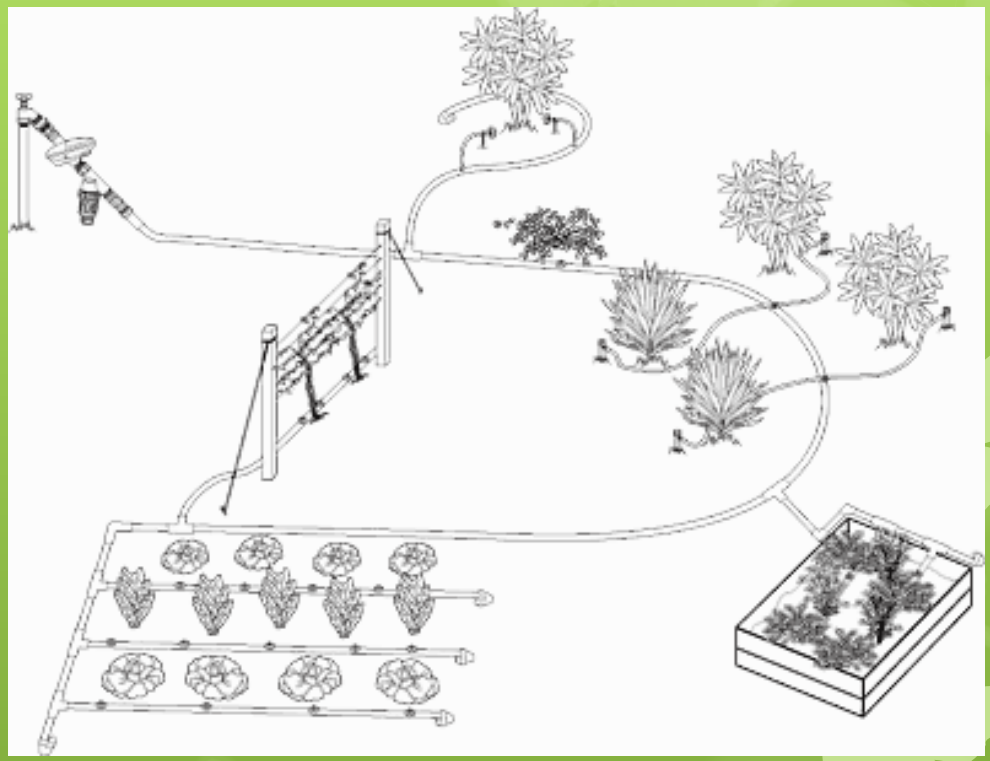
Changing from Spray to Drip

- Rainbird Kit
  - 200 mesh filter
  - 30 PSI pressure regulator

Better choice than Rainbird Kit

Two Drip Irrigation Methods

- Per Plant Method
  - Add emitters per each plant
  - More efficient when plants are small
  - Less expensive to install
  - Limits root and plant growth
  - Requires more maintenance
  - Can adjust for differing water requirements



Two Drip Irrigation Methods

- Grid Method
  - Waters all the soil, mimics rainfall
  - Inefficient when plants are small
  - Better long term for growth
  - More expensive to install
  - Must hydrozone!

Weather-based Controller

- Use weather information to determine precise water needs, adjusted daily
- Some charge monthly fee for connection to weather station
- Some have an on-site station
- Many manufacturers: Rainbird, Toro, Hunter, Irritrol, ET Water, Hydropoint, etc.

Top Tip for Saving Water in the Garden

Improve Your Soil

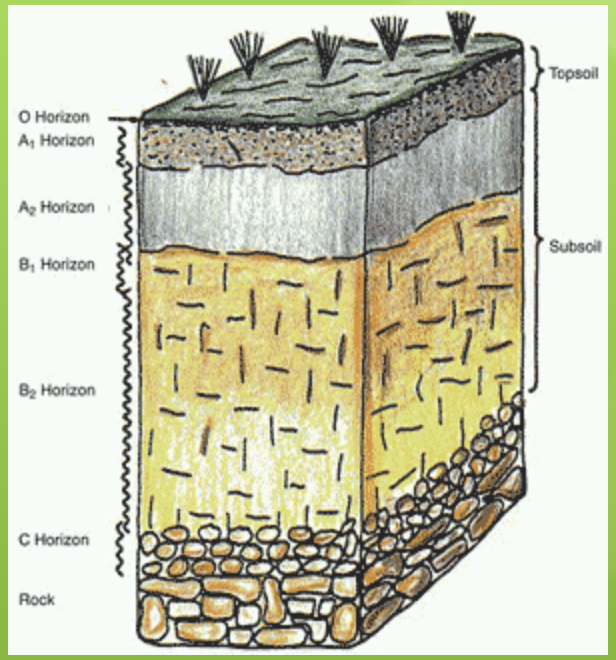
The Soil Problem

Loss of natural capital:

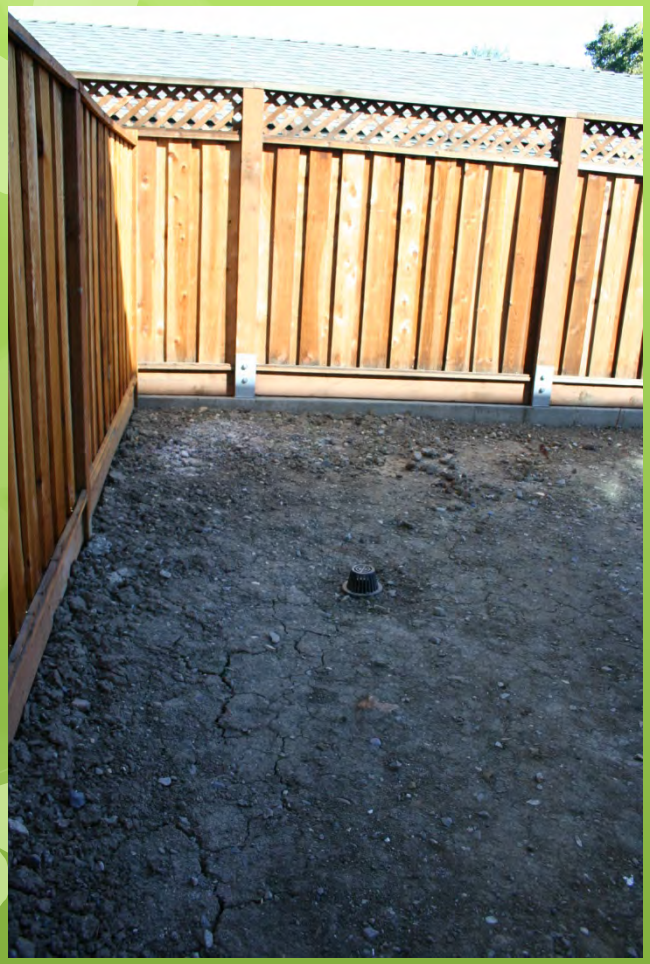
- No top soil
- Lifeless soil

Benefits of healthy soils

- Support plant growth
- Holds water
- Cleans water

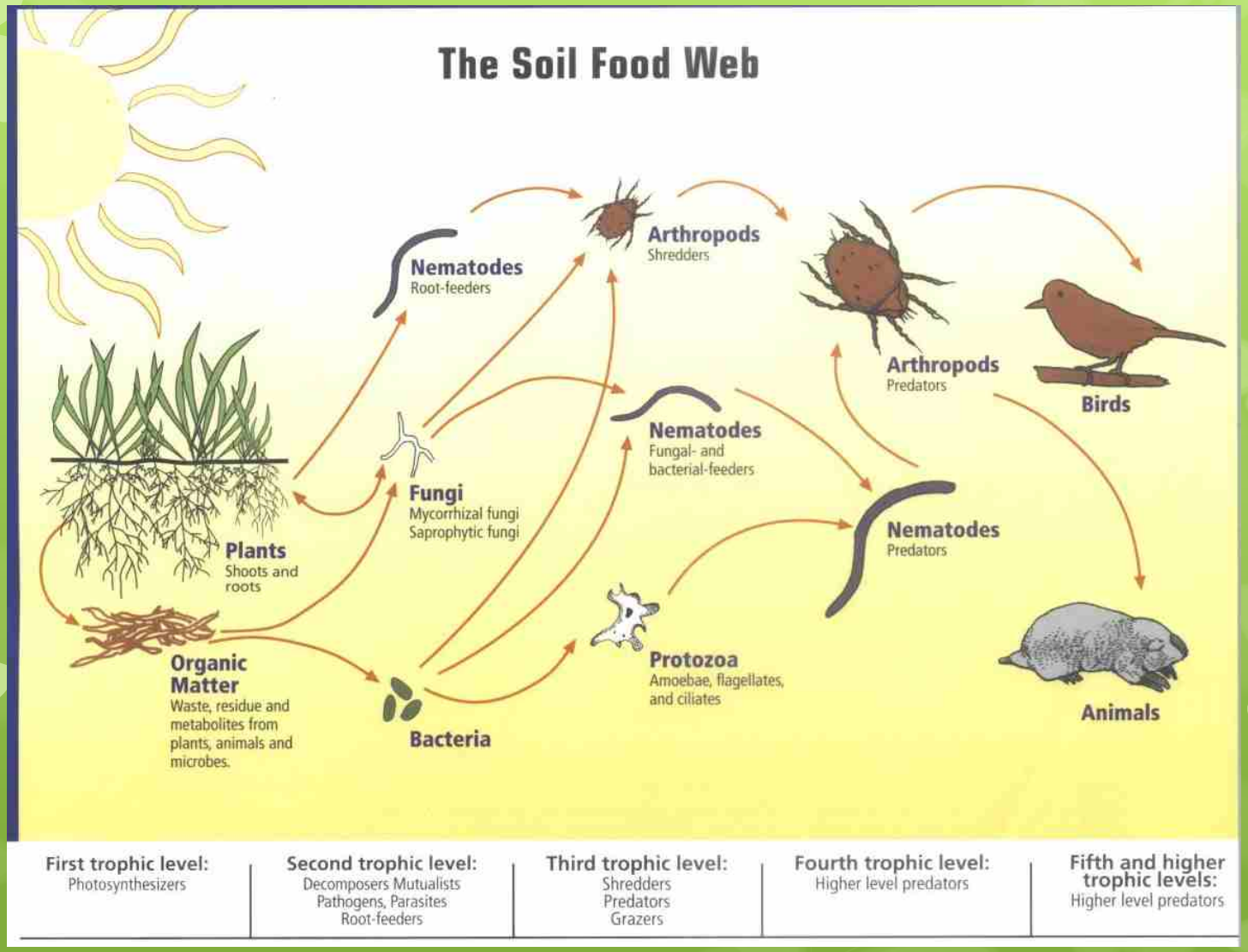


Soil protection



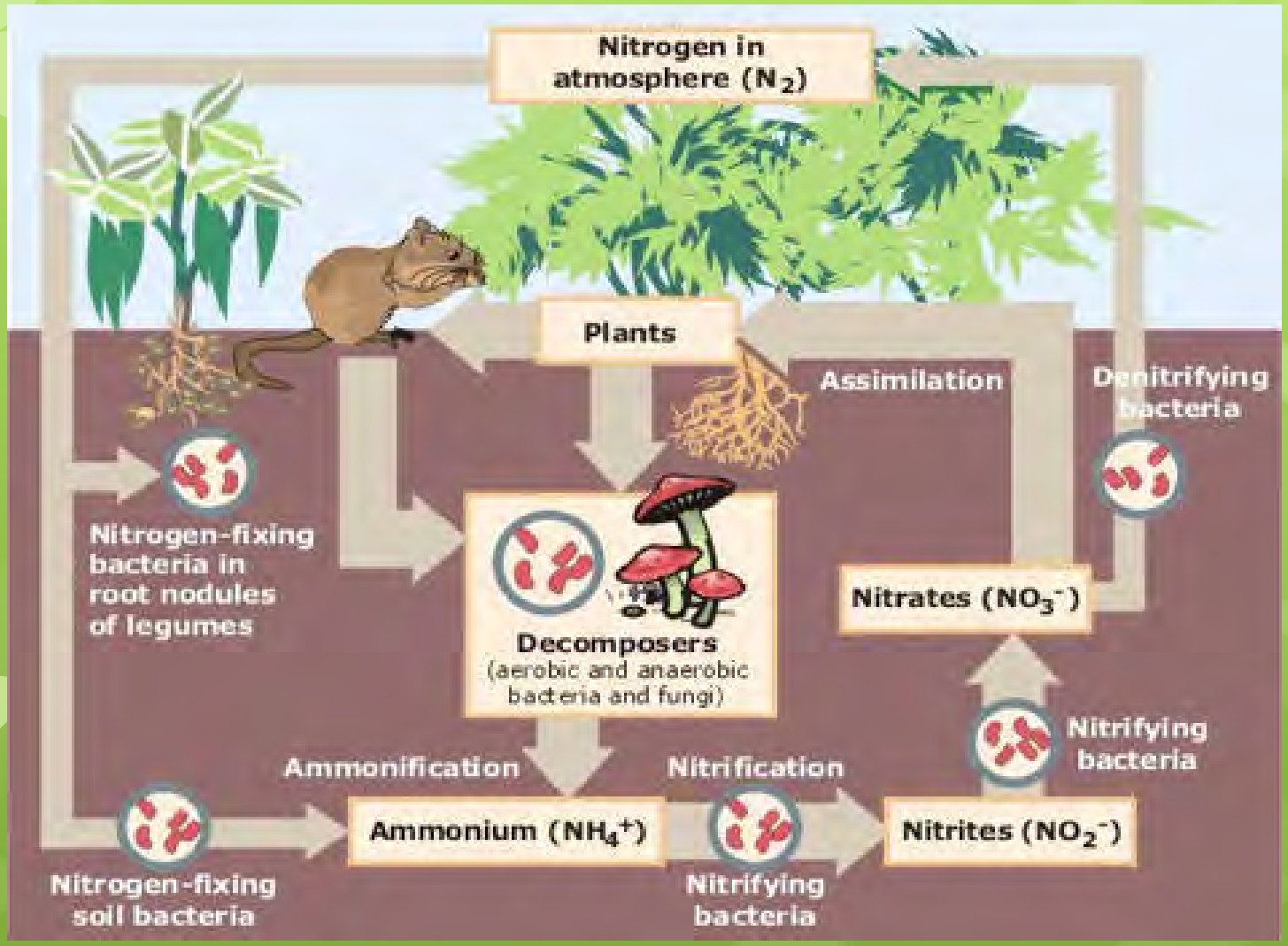
No top soil at new housing development,
Water puddles, won’t soak in
Won’t support plant life

Soil Biology – It's Alive!



From *Soil Biology Primer* published by Soil and Water Conservation Society

Nitrogen Cycle



Courtesy EPA, Source: http://www.uwsp.edu/geo/faculty/ritter/geog101/textbook/earth_system/biogeochemical_cycles.html

Soil Biology & Plant Health

Two Bugs Are Better Than One

In the experiment depicted here, blue grama grass was grown in sterile soil. Bacteria were added to the soil in some pots. Bacteria and bacteria-eating nematodes were added to other pots.

The plants in soil with both bacteria and nematodes grew fastest. Although this was an artificial environment, the study demonstrated that the interaction between two organisms benefited plants.

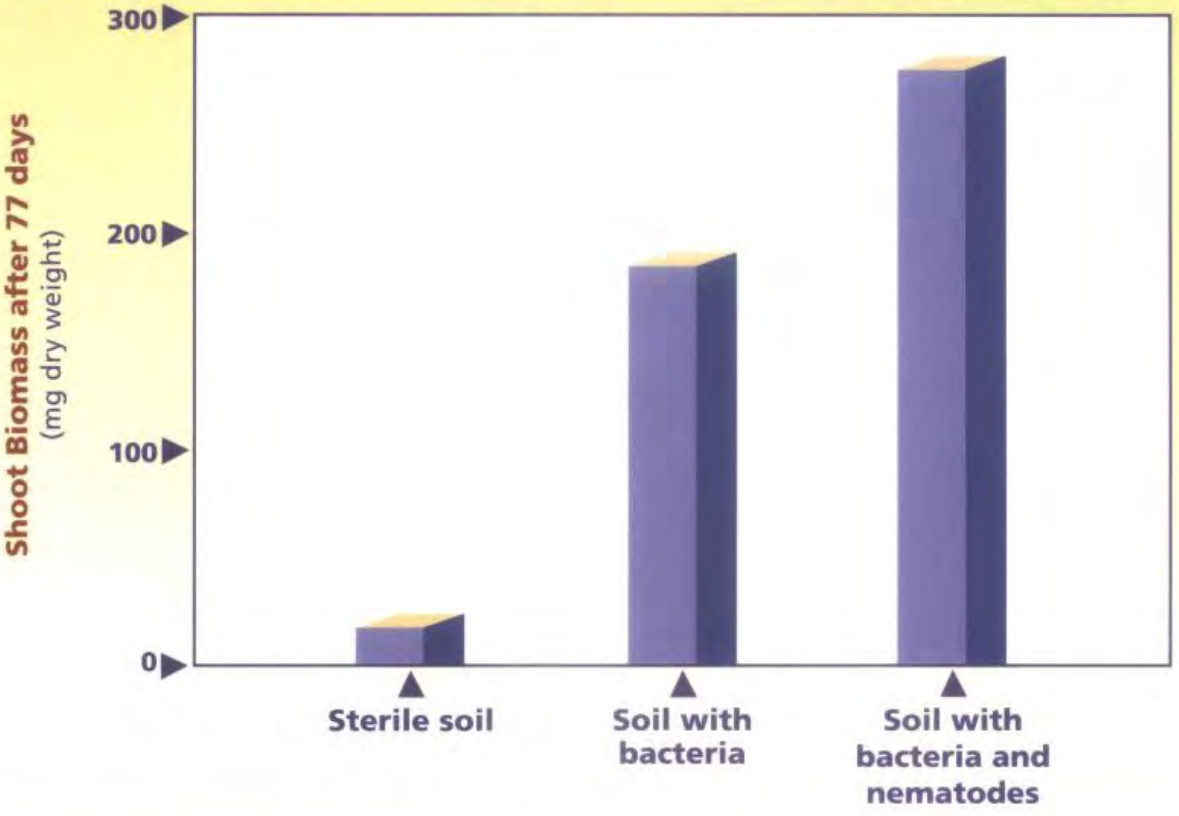


Figure 6

From *Soil Biology Primer* published by Soil and Water Conservation Society

Eliminate Waste - Mulching

- Mulch prunings and removed plants
- Keep “arbor chips” after professional tree service
- Create own mulch with electric chipper

Eliminate Waste – Grass Cycling

Eliminate Waste, Feed the Soil, Compost!

Steve's Earth Engine – Cedar

Biostack compost bin (made from recycled plastic)

Compost aids water retention

- “Numerous studies have found an increase in the moisture holding capacity and moisture retention capacity of soil as a result of compost applications (Hortenstine and Rothwell, 1972; Bengston and Cornette, 1973; Epstein et al., 1976). Therefore, the incorporation of compost into the soil of turf sites will reduce the need to irrigate.”
- For instance, on a typical site in Redmond with little slope, and little wind, turf grown on compost-amended soil can reduce peak summer irrigation needs by 60% when compared to sites with un-amended topsoil.

- **Guidelines for Landscaping with Compost-Amended Soils by City of Redmond, Washington, September 1998**

Gallion Irrigation in Houston, TX "Instant Deep Watering Microbes"

Gene Barnes developed a system that puts water and air deep into the soil.

Eliminate Petroleum Fertilizers

- Compost & compost tea
- Grass Cycle
- Test soil
- Organic amendments only when needed
- Cover crops – grow your own amendments

Bee and buckwheat blossoms, Vetch blossom
Sustainable Farming Association of Minnesota

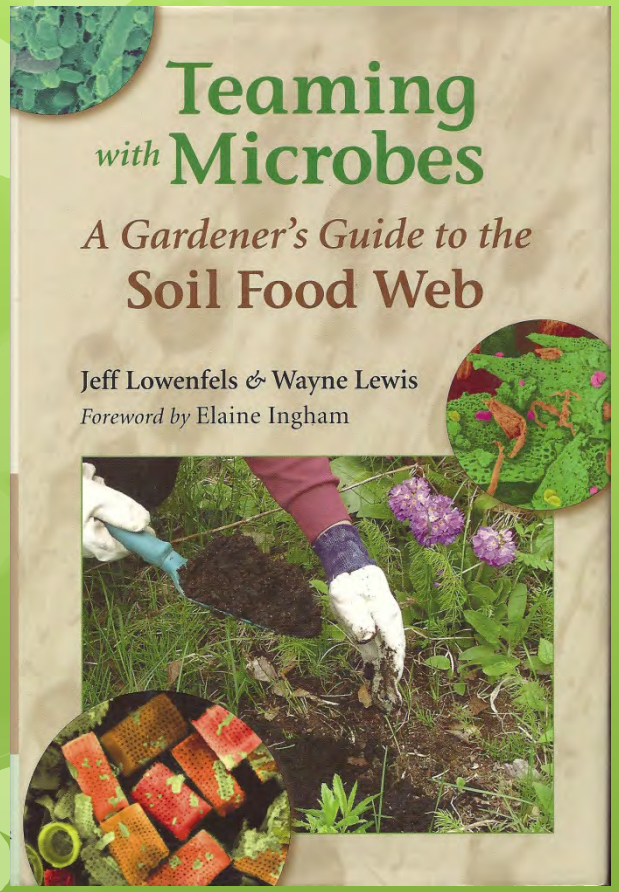
Improving Soil Biology

- No tilling
- No chemicals or petrochemicals
- No solarization

Photo: www.denver.gov.org

Eriogonum grande var. rubescens
Red-flowered buckwheat

Soil Health References



- "Worms Eat my Garbage" by Mary Appelhof
- "Soil Biology Primer" by Soil and Water Conservation Society

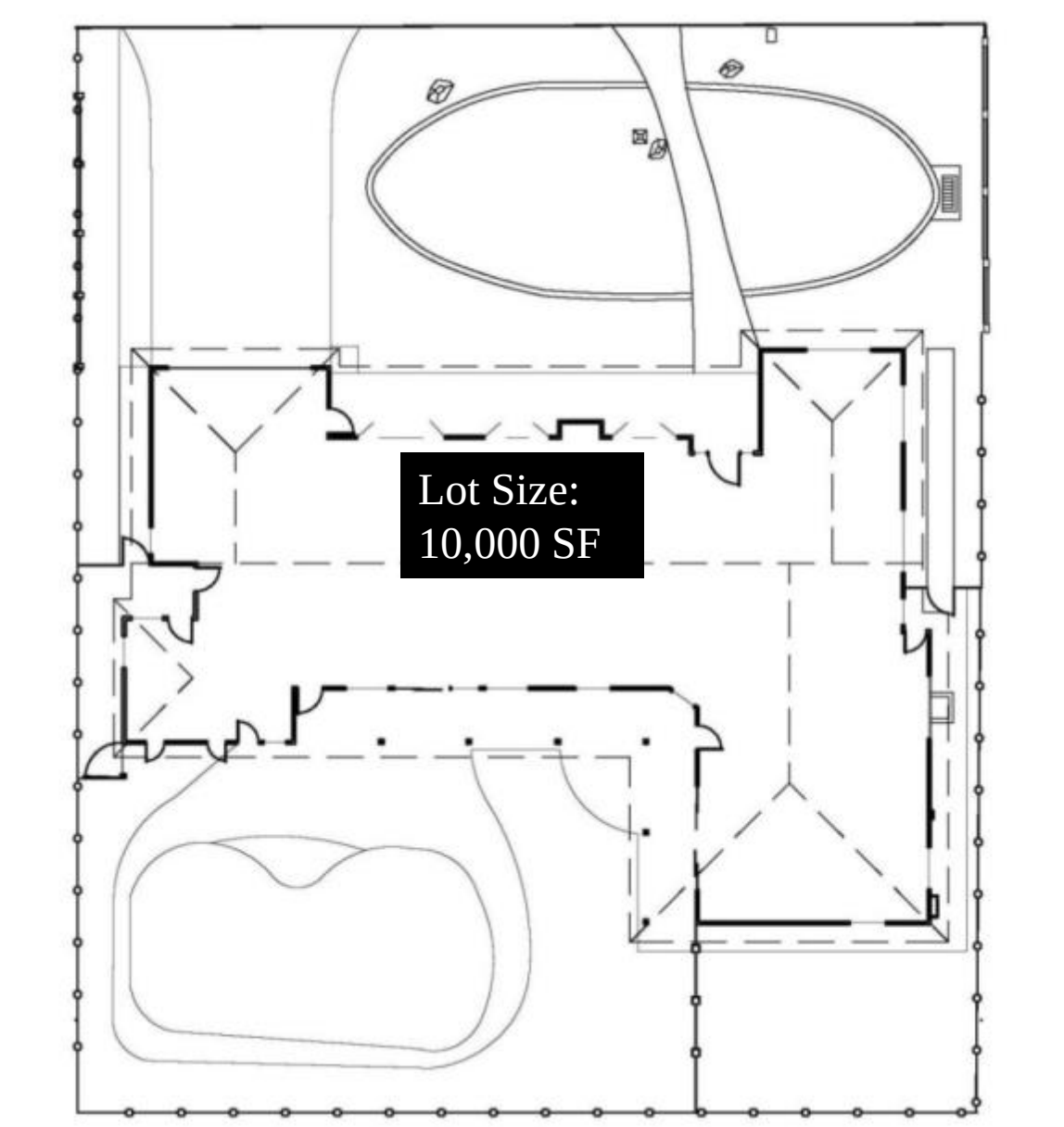
Top Tip for Saving Water in the Garden

Keep Water Onsite

Calculating rainwater amount on your lot

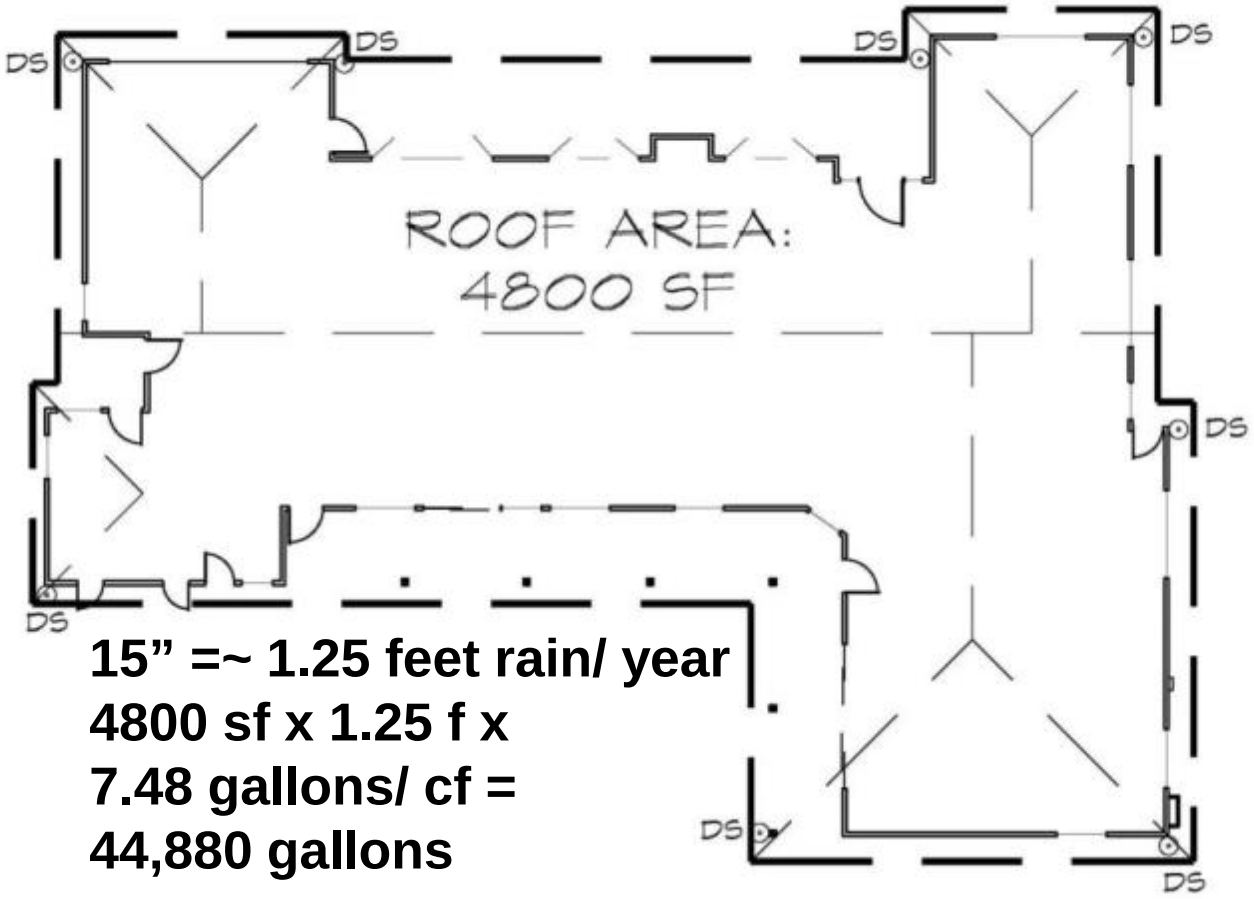
10,000 sf x 1.25 f
X 7.48 gallons/ cf
= 93,500 gallons

sf = square feet
f = feet
cf = cubic feet



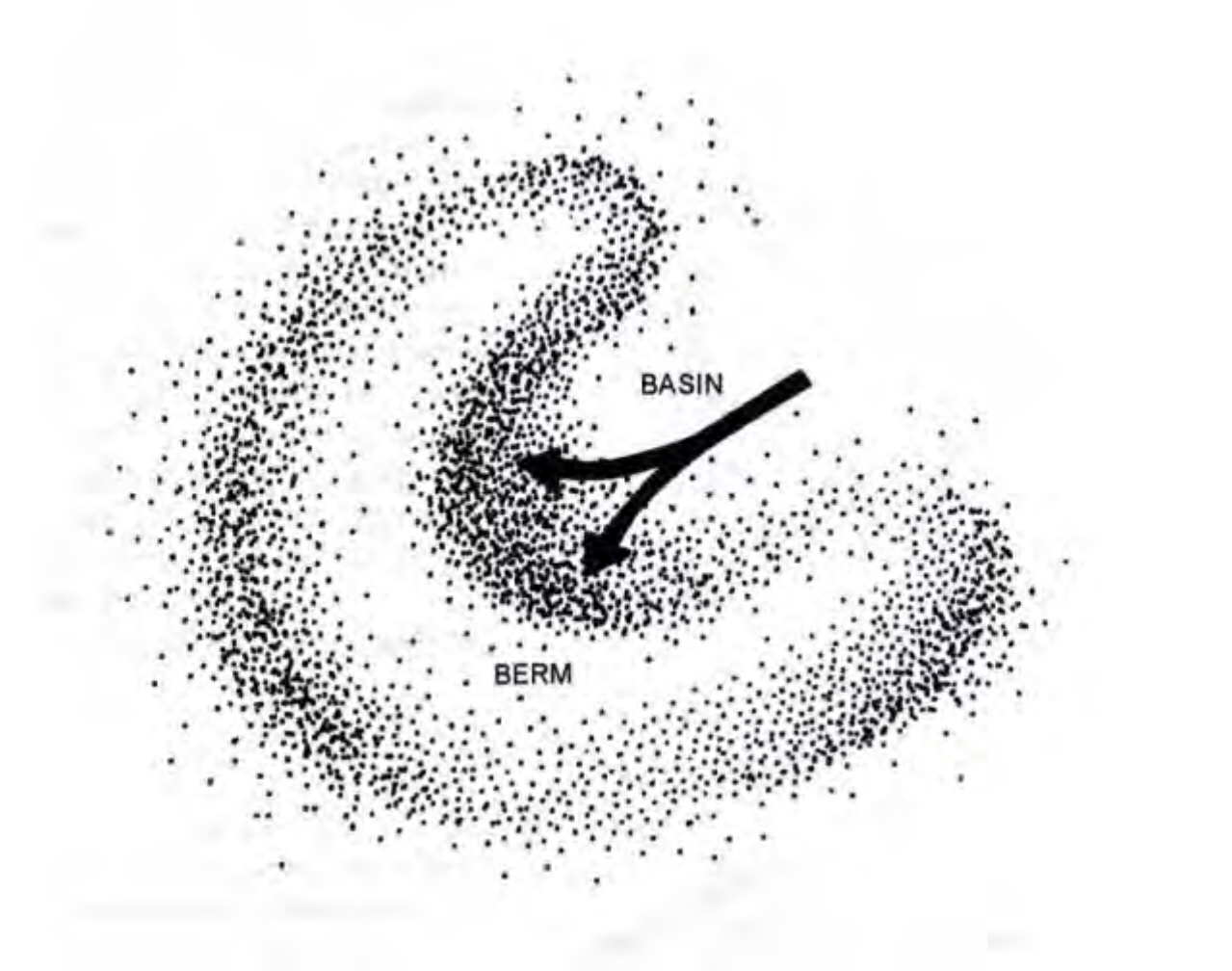
Calculating rainwater amount on your roof

sf = square feet, f = feet, cf = cubic feet



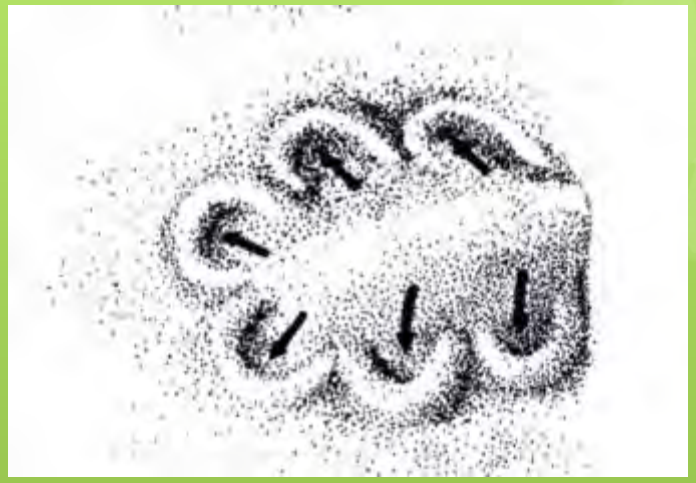
15” =~ 1.25 feet rain/ year
4800 sf x 1.25 f x
7.48 gallons/ cf =
44,880 gallons

Microbasins



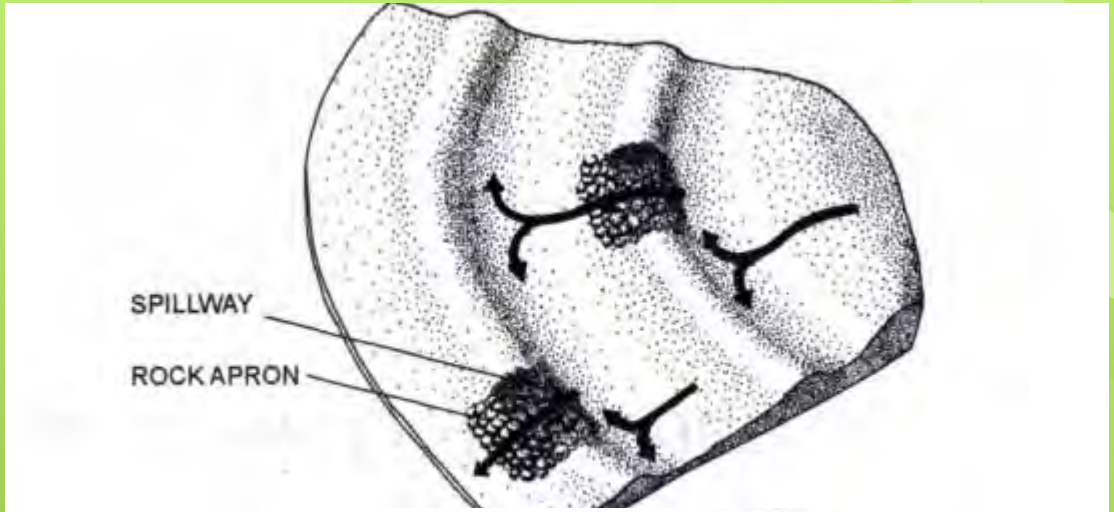
Drawing from “City of Tucson Water Harvesting Guidance Manual”

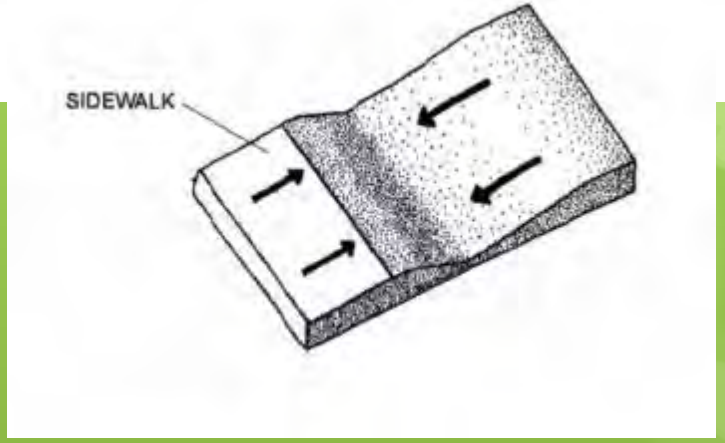
Microbasins



Drawings from “City of Tucson Water Harvesting Guidance Manual”

Swales





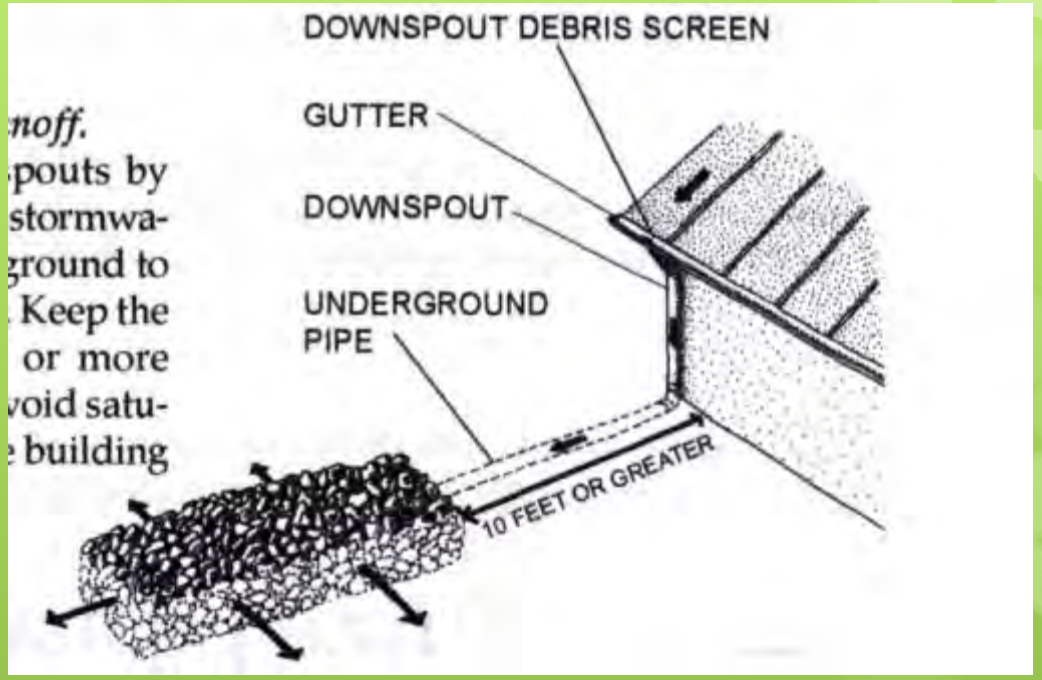
Drawings from “City of Tucson Water Harvesting Guidance Manual”

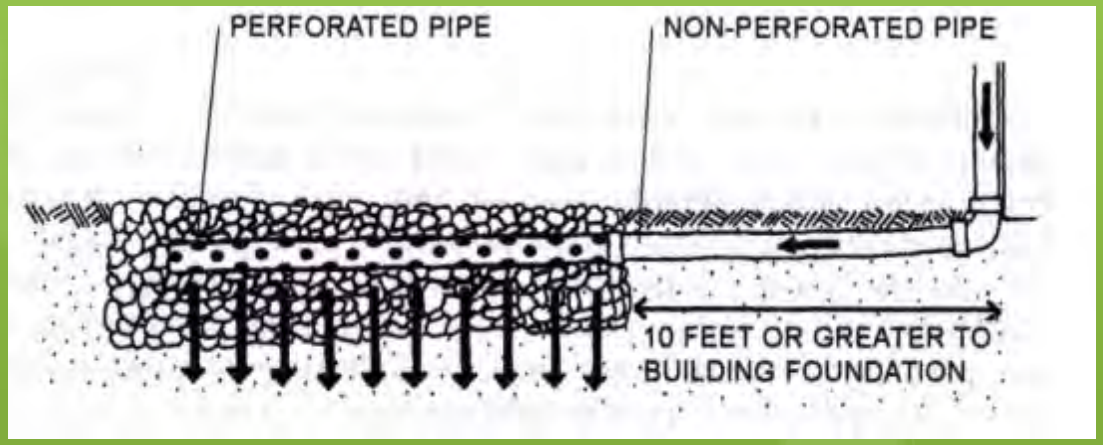
Terraces

Recycled concrete terrace designed by Deva Luna, EarthCare Landscaping

Terraces in the Andes

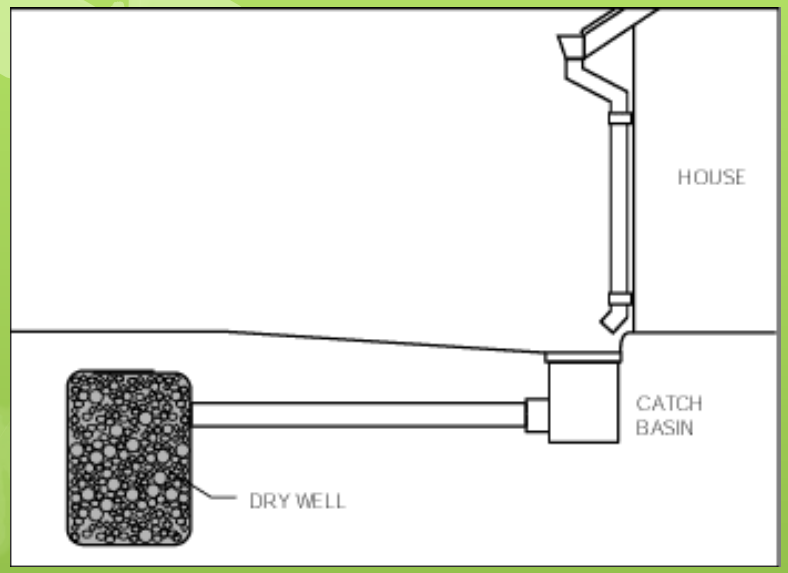
French drains

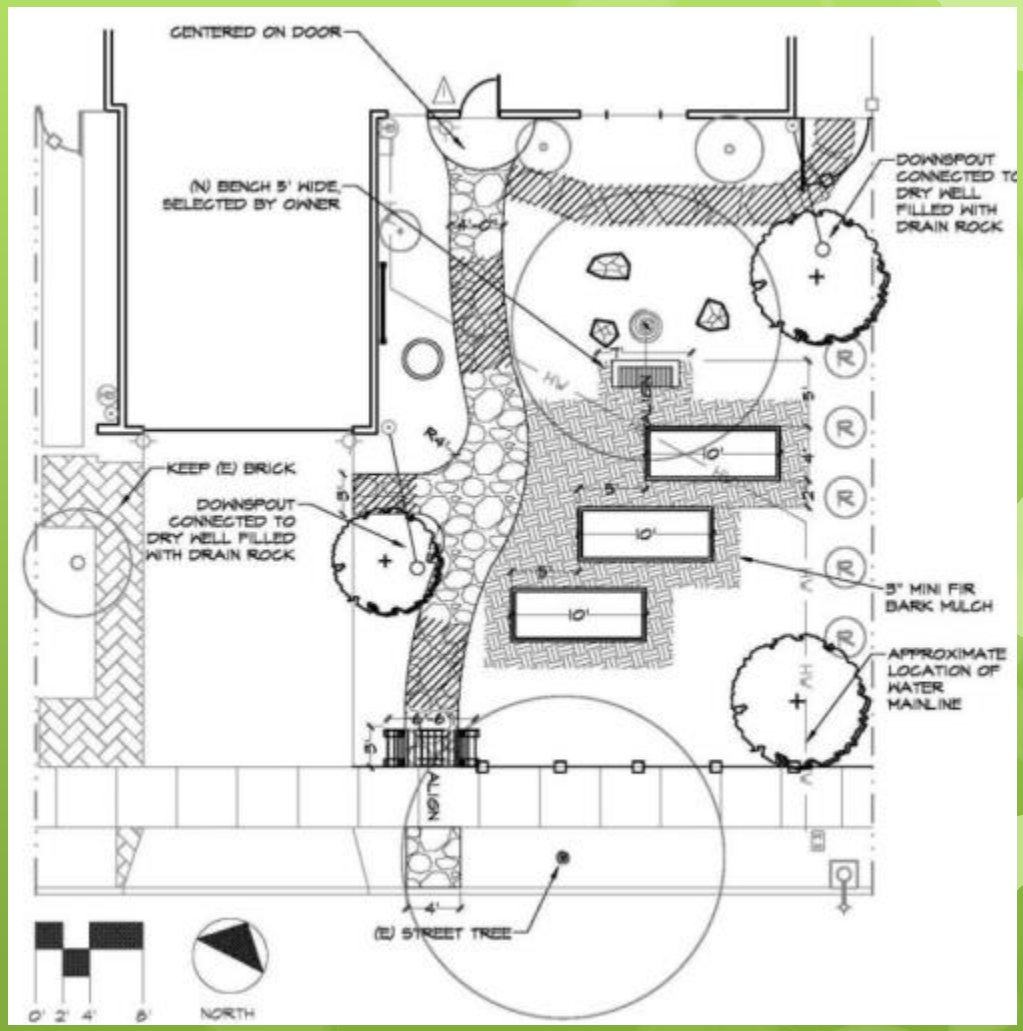




Drawing from "City of Tucson Water Harvesting Guidance Manual"

Dry Wells


HOUSE
CATCH BASIN
DRY WELL


CENTERED ON DOOR
(N) BENCH 5' WIDE SELECTED BY OWNER
DOWNSPOUT CONNECTED TO DRY WELL FILLED WITH DRAIN ROCK
KEEP (E) BRICK
DOWNSPOUT CONNECTED TO DRY WELL FILLED WITH DRAIN ROCK
3" MINI FIR BARK MULCH
APPROXIMATE LOCATION OF WATER MAINLINE
(E) STREET TREE
ALIGN
0' 2' 4' 8'
NORTH

Pervious Paving

Pervious Concrete with Brick Bands

Design by Sherri Osaka, Installation by Earthcare Landscaping

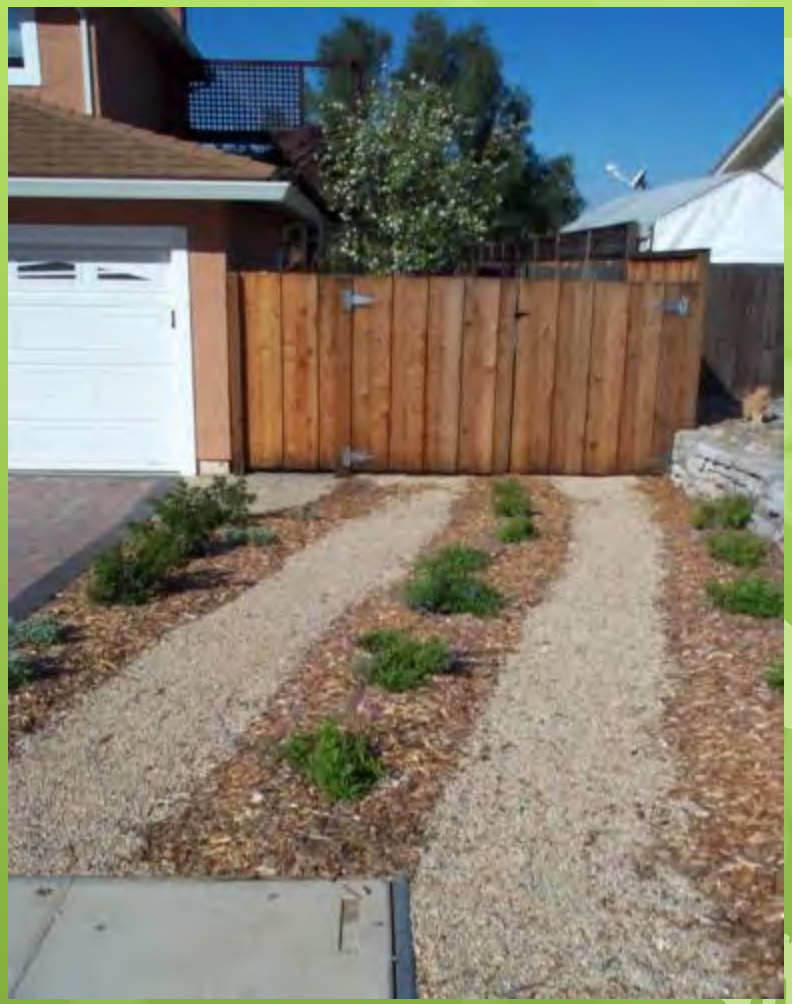
Pervious Concrete with Urbanite Step Stones

Design: Agi Kehoe, Installation: Earthcare Landscaping

Guadalupe Gardens in San Jose
Designed by Sherri Osaka

Pervious Pavers

Pervious GravelPave, planting and mulch for trailer access



Design: Sherri Osaka; Installation EarthCare Landscaping

Gravel Pave Driveway - Design Stephanie Morris, Landscape Architect

Permeable Paving

Permeable Quarry Stone by Calstone

Flagstone with gravel

Designs by Sherri Osaka, Sustainable Landscape Designs

Rain Gardens, Bioswales, etc.

Rain gardens, bioswales

Parking lot near Diridon CalTrain Station in San Jose

www.treepeople.com

Rain Garden

Starbucks off Coleman & 87

Dry Streams


Alan Hackler design and installation


Alan Hackler design and installation


Alan Hackler design and installation

Native Plants for Rain Gardens & Dry Stream Beds - Perennials

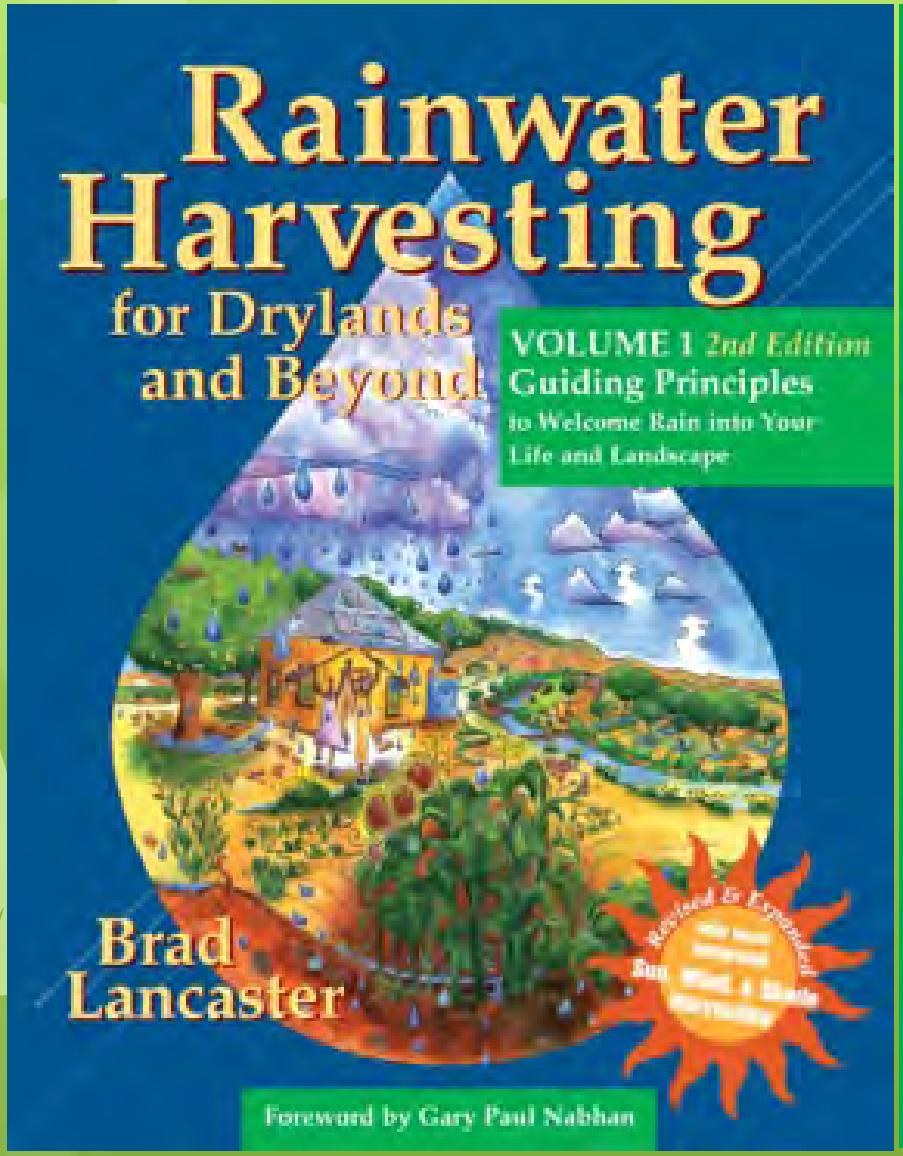
•Western Columbine	*Aquilegia formosa*	
•Mugwort	*Artemisia douglasiana*	
•Wild Ginger	*Asarum caudatum*	
•Sedge	*Carex* (all)	
•Stream Orchid	*Epipactis gigantea*	Summer decidous
•Horsetail	*Equisetum*	
•Wire Grass, Rush	*Juncus* (all)	
•Scarlet Monkeyflower	*Mimulus cardinalis*	
•Seep Monkeyflower	*Mimulus guttatus*	
•Hooker Evening Primrose	*Oenothera elata*	
•Redwood Sorrel	*Oxalis oregana*	
•Monkeyflower Savory	*Satureja mimuloides*	
•Point Reyes Checkerbloom	*Sidalcea calycosa ssp. rhizomata*	
•Blue-eyed Grass	*Sisyrinchium bellum*	
•Goldenrod	*Solidago* (all except *californica*)	

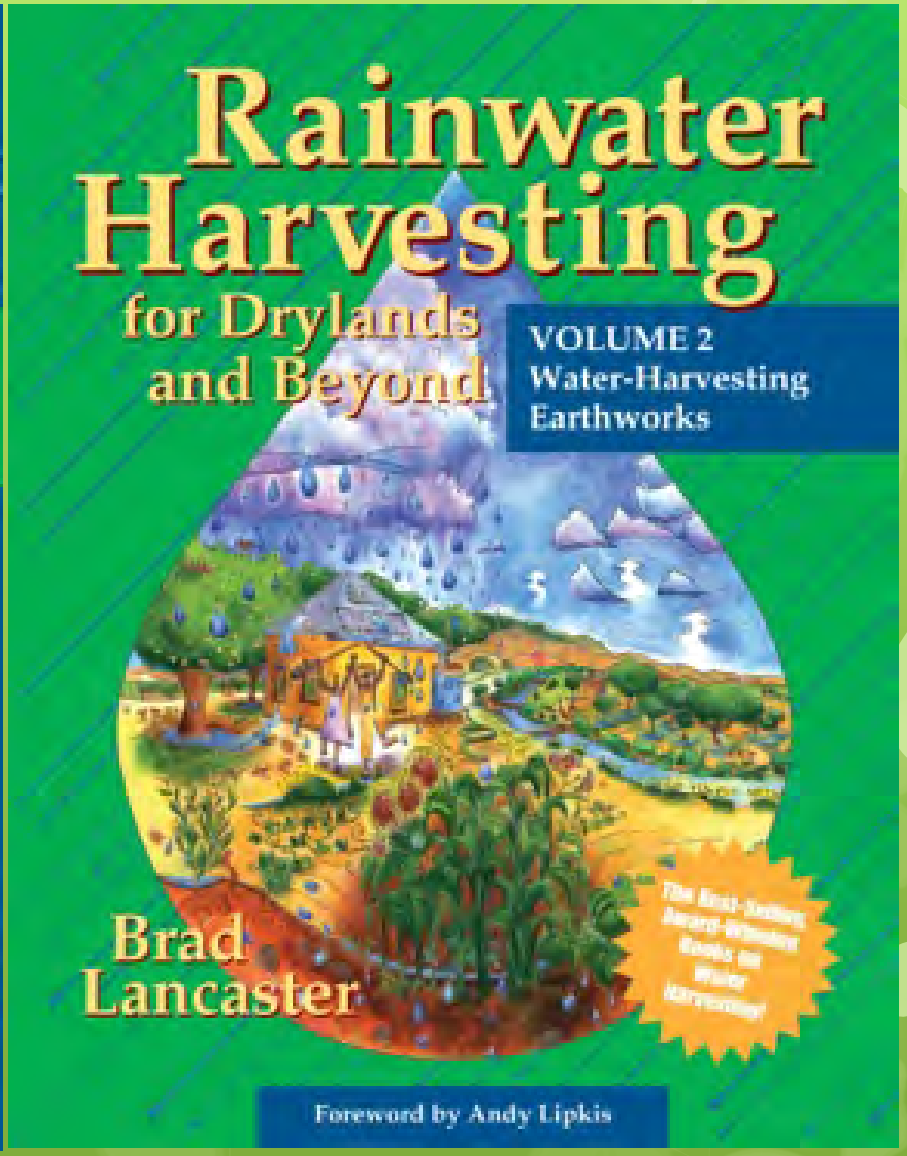
Stream orchid – Epipactis gigantea

Common Rush - Juncus patens

Checkerbloom – Sidalcea malvaeflora

Leopard lily – Lilium pardalinum


Rainwater Harvesting
for Drylands and Beyond
VOLUME 1 2nd Edition
Guiding Principles
to Welcome Rain into Your Life and Landscape
Brad Lancaster
Foreword by Gary Paul Nabhan

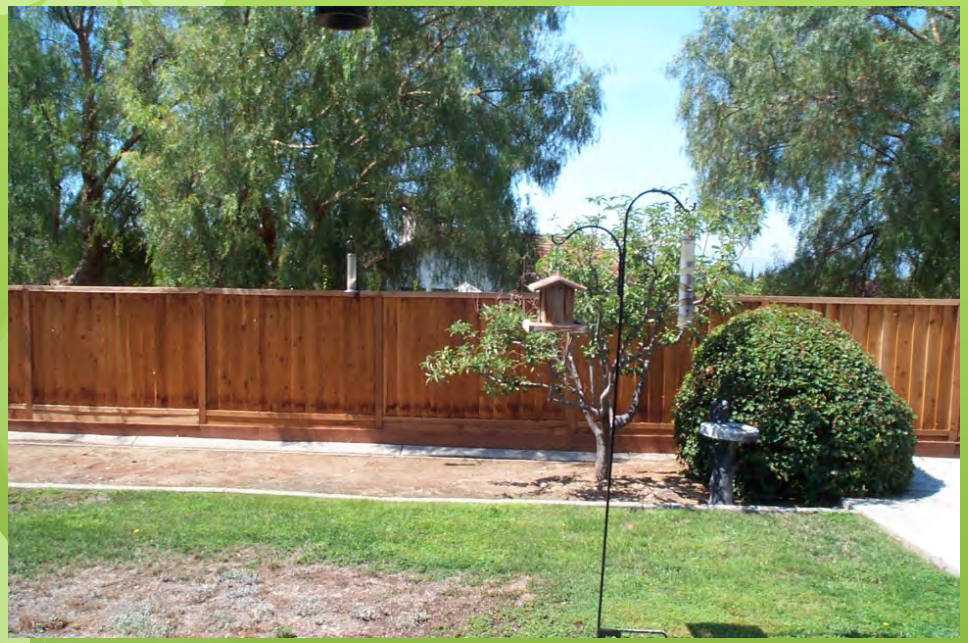

Rainwater Harvesting
for Drylands and Beyond
VOLUME 2
Water-Harvesting Earthworks
Brad Lancaster
Foreword by Andy Lipkis

Case Study – East San Jose

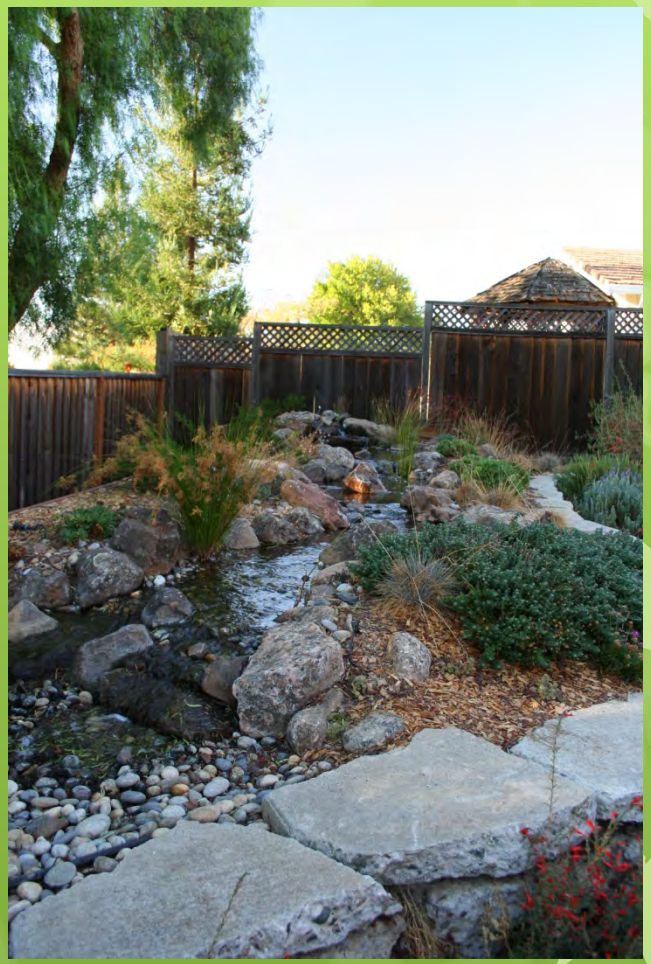
After

Before

Drought tolerant landscapes – Case study bird sanctuary



Before



Pondless waterfall on timer for birds

After

Before

Case Study -- Craftsman Remodel

Drought-tolerant landscape
Case study lawn replacement

Before

After: 18 species of native plants

Pervious Concrete with Brick Bands

200

Design by Sherri Osaka, Installation by Earthcare Landscaping


201

Very low water – Western redbud

Cercis occidentalis

Drought-tolerant landscapes Case study front yard

Case Study – Willow Glen

205

Case Study – Sunnyvale

Case Study – Sunnyvale

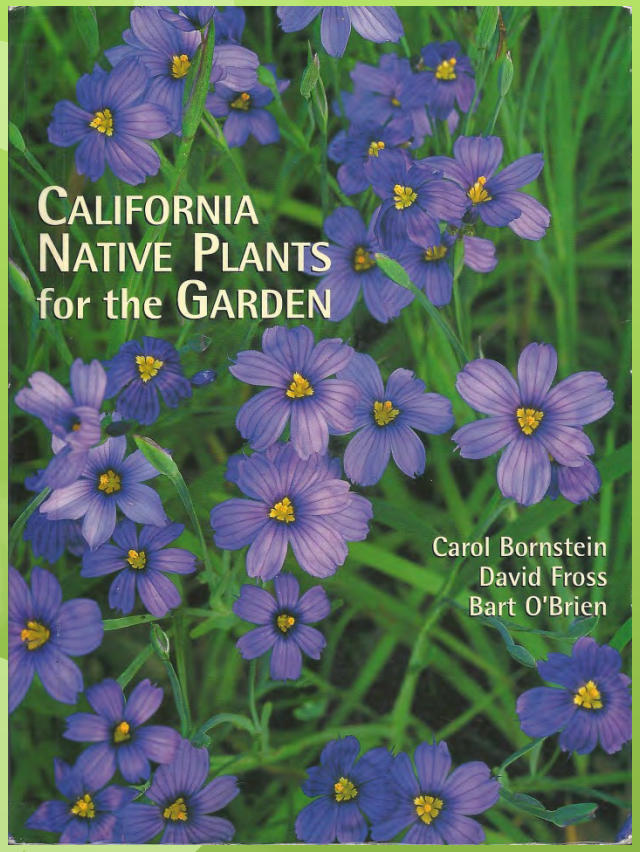
Case Study – Sunnyvale

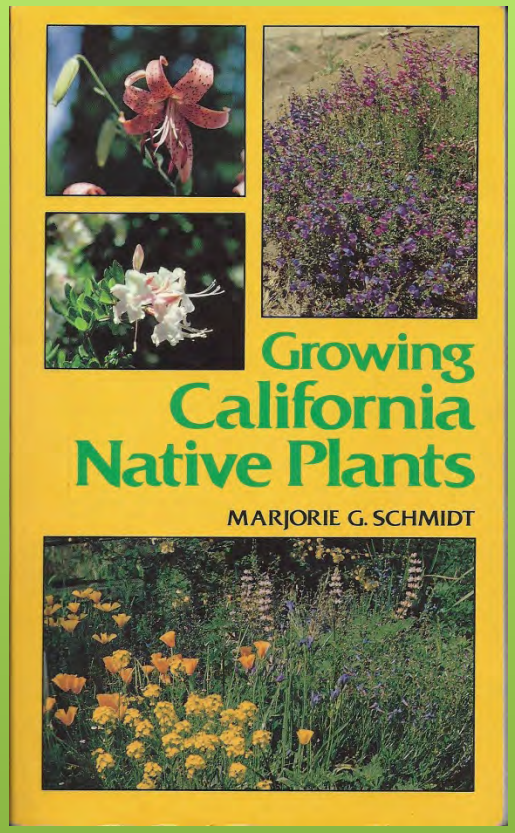
Before circa 1994

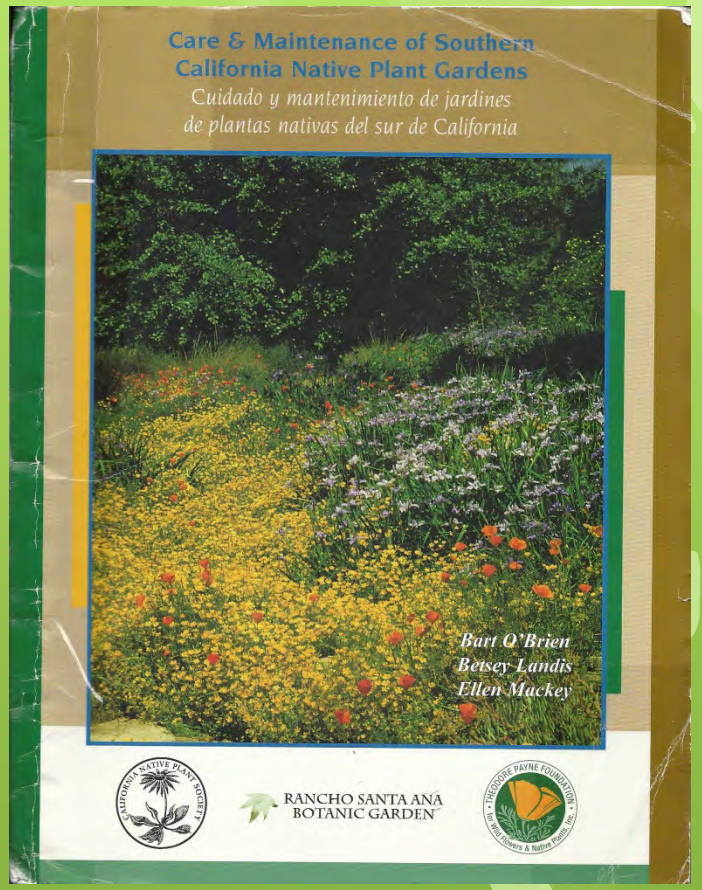
Before circa 2007


LITHOCHROME
COLOR HARDENER

Native Plant References







- "Plants and Landscapes for Summer-Dry Climates" by East Bay MUD
- "Landscape Plants for California Gardens" by Bob Perry

Native Nurseries

- Summerwinds, Palo Alto, Campbell, etc
- Payless Rockery, San Jose (S. King Road)
- Yerba Buena Nursery, Half Moon Bay
- Native Revival Nursery, Aptos
- Larner Seeds, mail order seeds
- Annie Annuals, Richmond and online
- Las Pilitas online

Upcoming Talks

See www.sustainable-landscape.com for more information or Facebook: Bay Area Sustainable Landscape Designs

- **Saturday, October 25: Planting and Sheet Mulching, a Hands-On Workshop** - BAWSCA Sunnyvale, FREE

THE CALIFORNIA NATIVE PLANT SOCIETY
SANTA CLARA VALLEY CHAPTER AND ACTERRA

FALL NATIVE PLANT SALE


Asclepias speciosa

HIDDEN VILLA RANCH

SATURDAY
OCT 18, 2014
10 AM - 3 PM

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- Thank you!