

Framing the Low- water Garden: *A Watershed Approach to Hardscape*

Karrie Reid
Environmental Horticulture Advisor
San Joaquin Co. Cooperative Extension

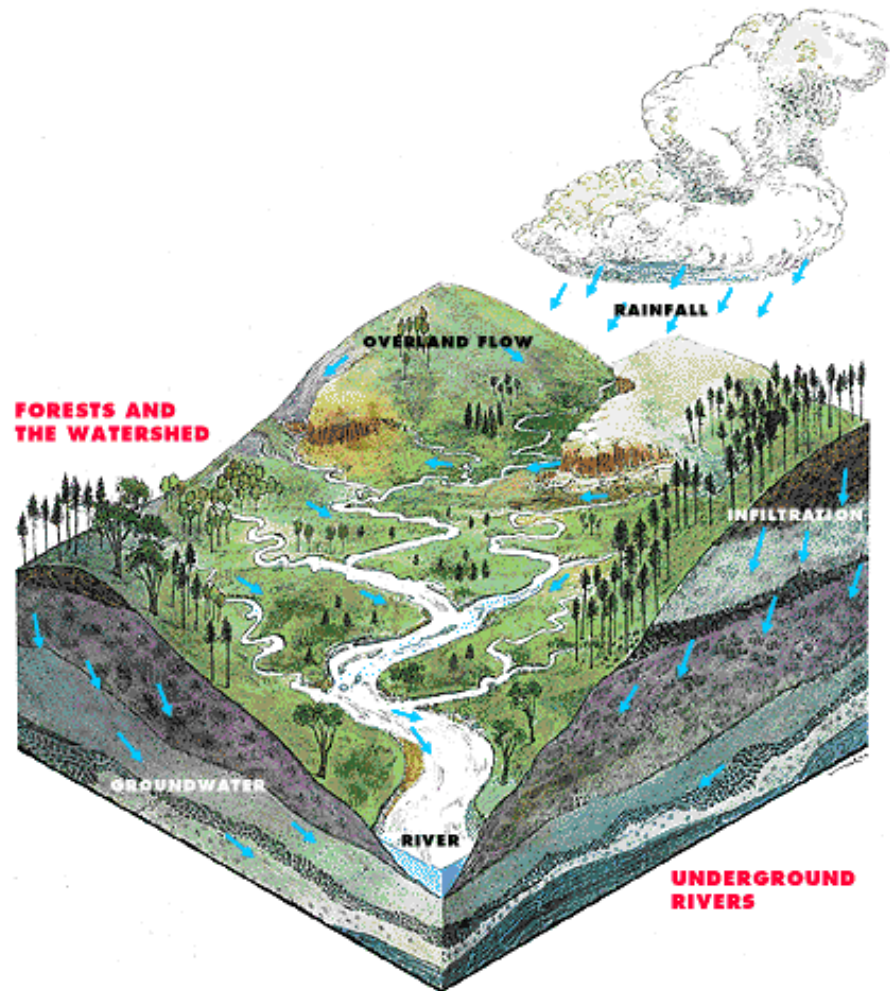




What is a watershed?

- *the geographic area through which water flows across the land and below the surface and drains into a common body of water, whether a stream, river, lake, or ocean*

Syn: drainage basin



Why should we pay attention to runoff?

1. Waste
2. Contaminants end up downstream
 - Fertilizers
 - Pesticides
 - Sediments
 - Organics



Longitudinal Runoff Study

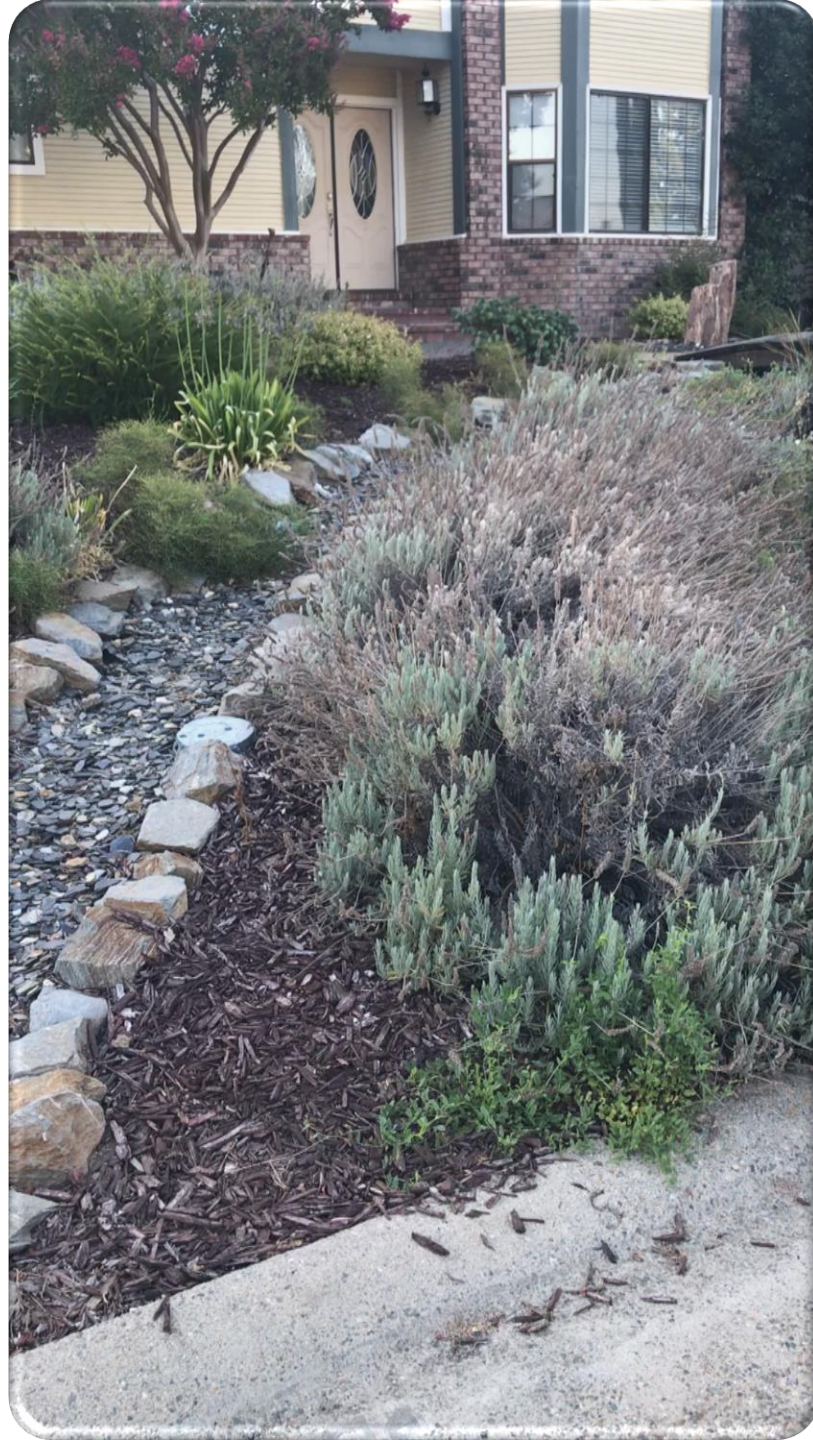
- 2 Sites in Folsom, Natomas, 4 in SoCal
- Collected samples of runoff for years
- Measured flows



Results

- **All samples polluted:**
 - ant control products, fertilizers, coliform bacteria (pet waste)
- **Summer flows > winter**
- 1 year of runoff would fill Lake Oroville







This is where your runoff ends up!



SUSTAINABILITY GOALS

- Manage landscape as a watershed
- Conserve and ***optimize*** water use
- Retain rain and irrigation on site
- Focus HIGH water use on Edibles



The Watershed Approach

Landscape as a Drainage Basin

□ Ask:

- Where does water come from?
- Where does it flow to?
- Where can I slow it?
- Can I retain any of it?
- Where does it empty?
- Can I filter it before it leaves?

TRADITIONAL WATERSHED

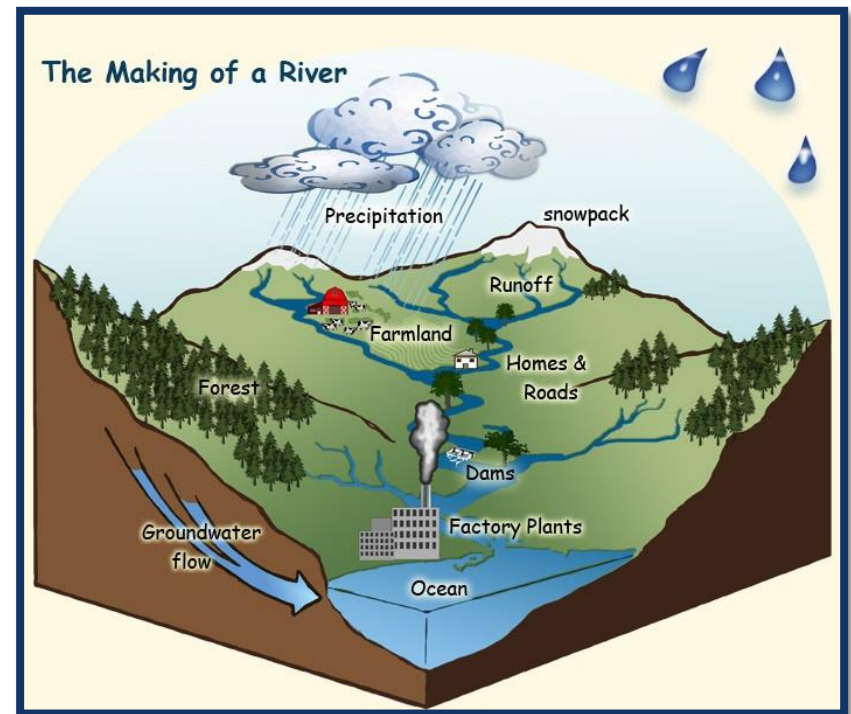


Image courtesy of A. Vicente, USFS

Landscape Components

HARDSCAPE

Driveway
Pathways
Patios
Dry riverbeds
Play areas
Bed borders



IRRIGATION SYSTEMS

Controller
Stations/Valves
Delivery type

- Drip
- Bubblers
- Sprays



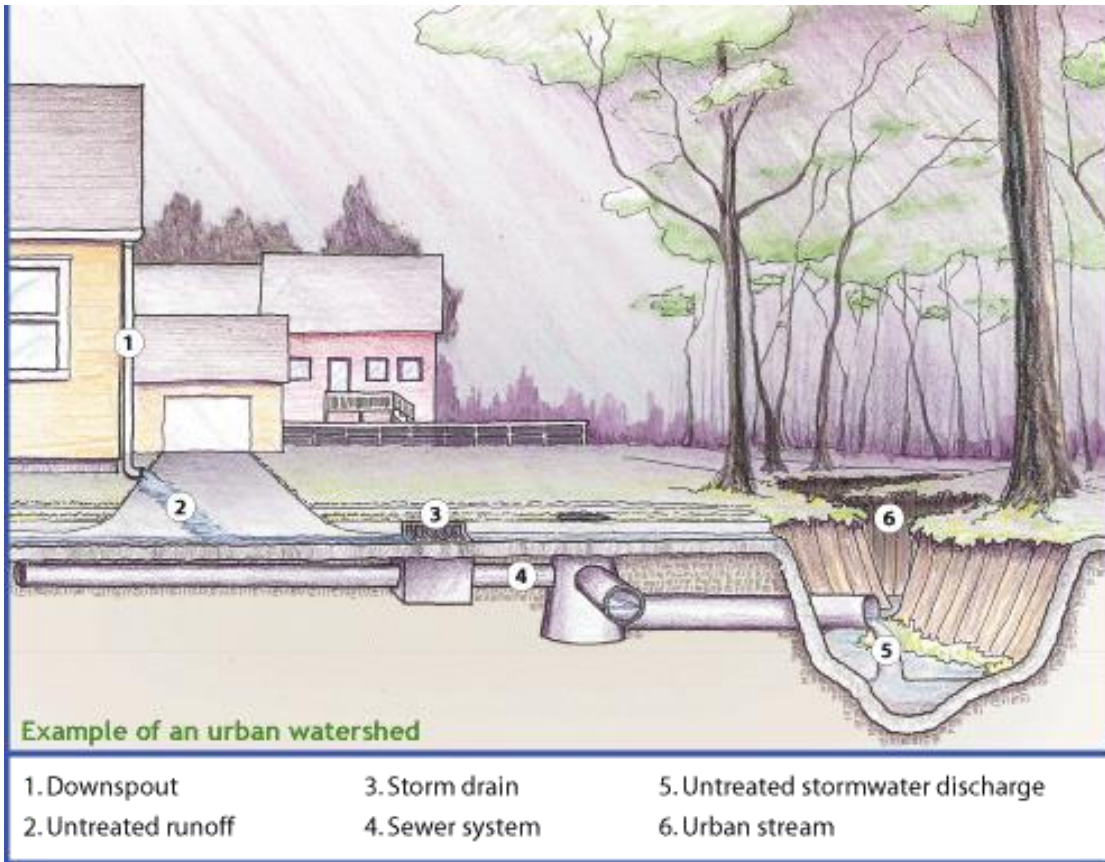
PLANTS

Trees
Shrubs
Perennials
Groundcovers
Edibles



SERVICES

Shade/cooling
Decoration
Play surface
Food for us/wildlife



RAINWATER HARVESTING

8 Principles of Successful Rainwater Harvesting
borrowed from Brad Lancaster
Rainwater Harvesting for Drylands and Beyond Vol. 1

1. Thoughtful observation
2. Start at the top of your watershed and work your way down
3. Think simple fixes
4. Spread and infiltrate the flow of water

“Harvesting” Rainwater cnt’d.



5. Manage rain as a resource

6. Maximize living and organic groundcover

7. “Stack functions” e.g.

- berms as paths
- vegetation as cooling
- driveway as catchment

8. Continually reassess





RAINWATER COLLECTION

- **Not a total solution in CA climates**
- **May defer spring irrigation- use for pots**
- **Some creative solutions are available; e.g. pool conversion to cistern**



Downspout to flower garden





Downspout to Barrel

Key Watershed Principles

- **DIRECT**
- **SLOW**
- **INFILTRATE/ FILTER**
- **Plan for overflow**



Mechanisms

- Vegetated Swales
- Retention basins
- Terraces
- Dry stream beds
- Permeable paths, patios, and driveways

*Some or all used
interconnectedly to
accomplish goals.*



VEGETATED SWALES

- **DEFINITION:**
 - Shallow landscaped areas designed to capture, convey, and potentially infiltrate stormwater runoff as it moves downstream
- **CAUTION**
 - Plants must tolerate both inundation and drought or low water



SLOW IT. SPREAD IT. SINK IT.

- Hard surfaces graded to planted areas.
- Water spreads through vegetated land.
- Plants filter sediments.
- Plants filter pollutants.
- Water infiltrates soil.
 - May recharge groundwater.



Plants for Bioswales- in zones

- Inundation zone
- Lower slopes
- Higher edges
- Overflow should be above the lower level



More info for the keen

https://www.casqa.org/sites/default/files/downloads/central_coast_bioretention_plant_guidance_press.pdf

https://www.waterboards.ca.gov/rwqcb3/water_issues/programs/stormwater/docs/salinas/appndx_g.pdf



Terraces for Slopes

WHY?

- Reduce runoff (winter)
- Increase irrigation efficiency (summer)

HOW?

- Cut slopes
- Install small “walls”
- Level each terrace





Each section now irrigated without runoff!

Boulders create terraces that mimic “outcroppings”





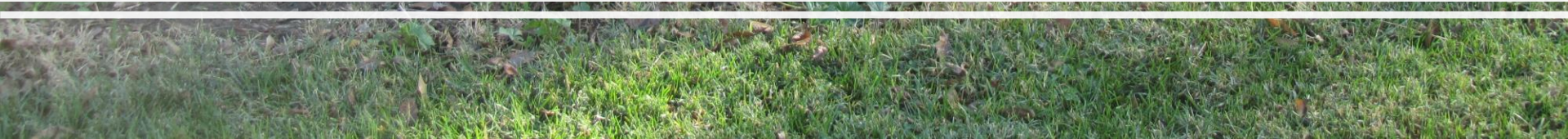
Using local stone gives sense of place







Repurposed concrete- urbanite!



Dry Stream Beds

- Act as catchment for heavy rainfall events
- Use permeable geotextile fabric base
- Vary rock sizes for most naturalistic look
- Creating planting pockets helps uptake water



Right Idea, Wrong Execution





Pathway Design

- Follow the natural flow of traffic
- Cut through very large beds (plant access)
- Consider
 - Destination
 - Focal points: bench, birdbath, sculpture, specimen plant
 - Mystery

Mystery?



Hardscape Materials- *permeable*

ORGANIC

- Walk-on bark
- Wood chips
- Pros: infiltrates well, improves soil (slowly)
- Cons: *Must be replenished, hard to roll carts or wheelchairs over*

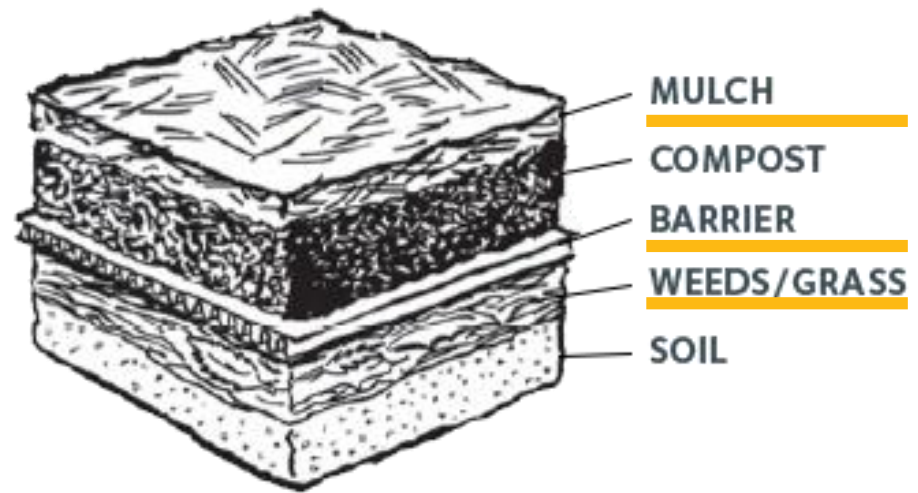


**Create a barrier between
organics and direct access to
stormdrains!**

Sheet Mulching Option

Grass to Path

- If grass - scalp lawn
 - You *can* cut and flip
 - You *can* spray with glyphosate
- Cut out below grade at edges of hardscape
- Lay overlapping cardboard layers
- Cover with mulch or compost & mulch





Cut below grade next to hardscape





Sheeting rolls over
scalped grass

Permeable Materials

INORGANIC:

- Concrete w/slot drains
- Pervious concrete
- Pavers/Flagstones
- Brick
- Crushed rock

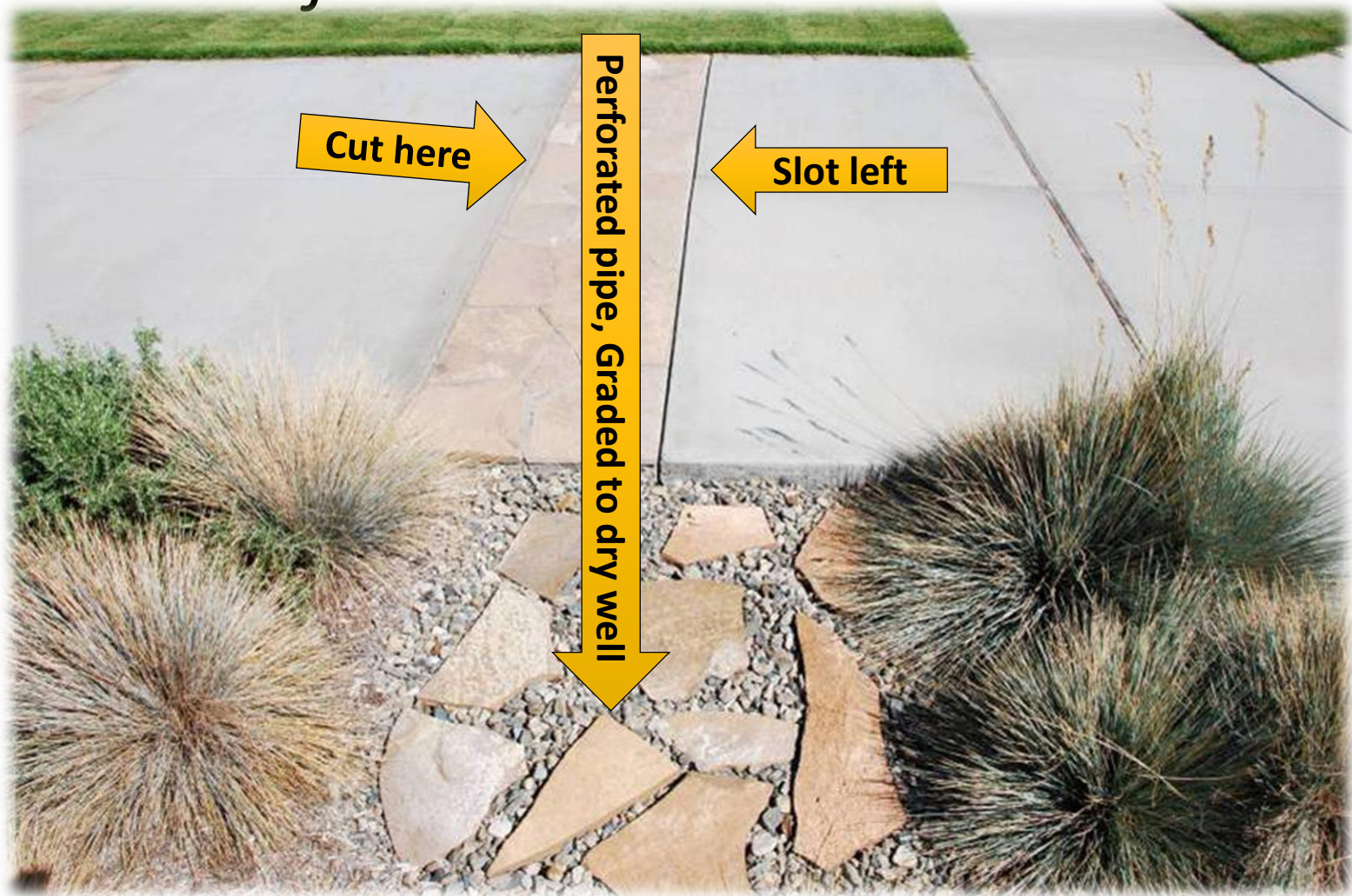
COMBO Org/Inorg:

- Planted paving



Mixed Media

Concrete with Slot Drains- *either retrofitted or new install*



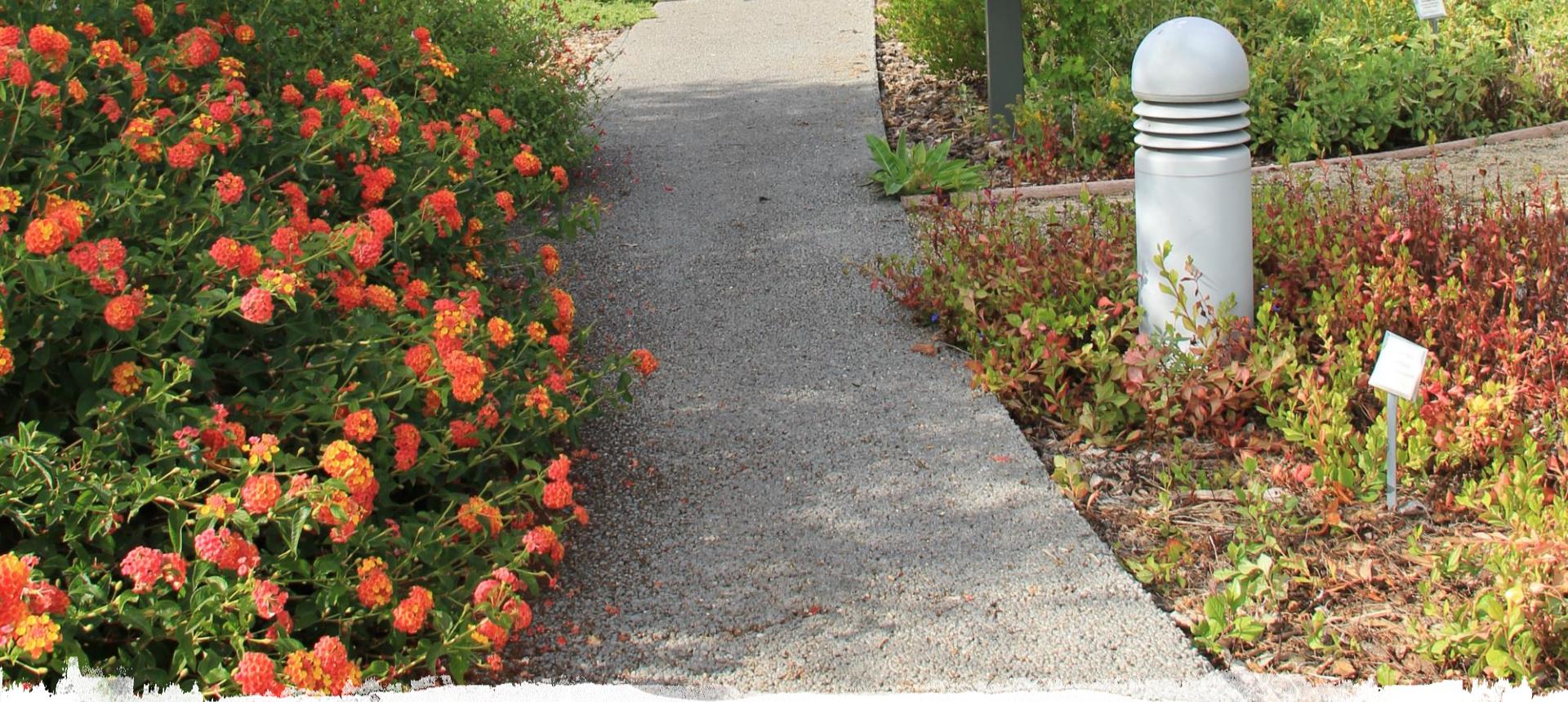
Concrete with slot drains

- Superior runoff capture to pervious concrete
- Superior pesticide runoff reduction
- Professional installation required



Porous/Permeable Concrete





Porous/Permeable Concrete

- Combines stability and permeability
- 3/8" crushed rock w/no fines held together with cement or asphalt
- May be called "popcorn mix", "open-graded mix", or "porous friction coat"
- Laid on top of rock base of 2" crush



NOTES

- Professional install required
- May require power washing to retain porosity

Pavers, Brick, ICPs, & Flagstones

- Excavate 4-6 inches below final desired height
- Install edging (optional)
- Base *must* be prepared
 - 4-6" coarse crushed rock
 - 1- 1½" coarse sharp sand



Manufactured artificial flagstone

Pavers, Brick, ICPs, & Flagstones

- Do *NOT* excessively pack either base or completed surface
- Measure your square footage and add 5-10% (more cuts, use 10%)



Manufactured artificial flagstone

Pavers, Brick, ICPs, & Flagstones

- Joints up to ¼" – smaller w/ smaller pavers
 - ICPs have inset spacers
- Use thicker pavers where rigidity is required
- Coarse, sharp sand for joint filler- brushed in with stiff broom



Interlocking concrete pavers w/spacers

Pavers, Brick, ICPs, & Flagstones

- Water in initial filler
- After initial settling, add more filler (otherwise fines settle in and reduce porosity)



Interlocking concrete pavers w/spacers

Pavers, Brick, ICPs, & Flagstones

- NOTES

- Initial height of finished surface $\frac{1}{8}$ " – $\frac{1}{4}$ " above grade for settling
- Can use a bitumen binder w/coarse sharp sand filler
- Leave joint filler lower than surface for best drainage



Crushed Rock- Decomposed Granite (DG)



Patios/Seating Areas



Pathways



Road base (large coarse crush) as pathway

Installing Crushed Rock

- Excavate if necessary- layer should be at least 2-3" thick
- Install geotextile fabric beneath
- If clay beneath – poke holes with soil corer or aerator





Installing Crushed Rock

- Spray with water and roll with turf-roller filled with water
- 1X for coarse rock
- Spray and repeat 2X for DG

Binder not needed!





Grassed pavers/Paved grass

Light Duty/Occasional Traffic

- Blocks, plastic forms, or commercially poured as slabs
- Planted with grass or other groundcover
- Can be used unplanted w/ gravel between
 - Same basic install principles



Plants for paver installations

FULL SUN

- Mother-of-thyme/ creeping thyme (L)
 - *Thymus praecox*
- Silver carpet (L)
 - *Dymondia margaretae*
- Roman chamomile (M)
 - *Chamaemelum nobile*
- Blue star creeper (M)
 - *Isotoma fluviatilis*
- Dragon's blood sedum (L)
 - *Sedum spurium*

SHADE

- Dwarf mondo grass (M)
 - *Ophiopogon japonicus 'Nanus'*









For all Permeable Surfaces

- Pay attention to grading
- Edging prevents material erosion- *especially with mild slopes*
- Some maintenance may be required
 - Refilling surfaces or filler as it packs
 - Cleaning
 - Weeding – pre-emergent herbicides can help

Questions?



GRAYWATER

Emerging as part of the landscape solution



Source: Sunset.com

Complex systems

High volume
($>250\text{G/day}$)

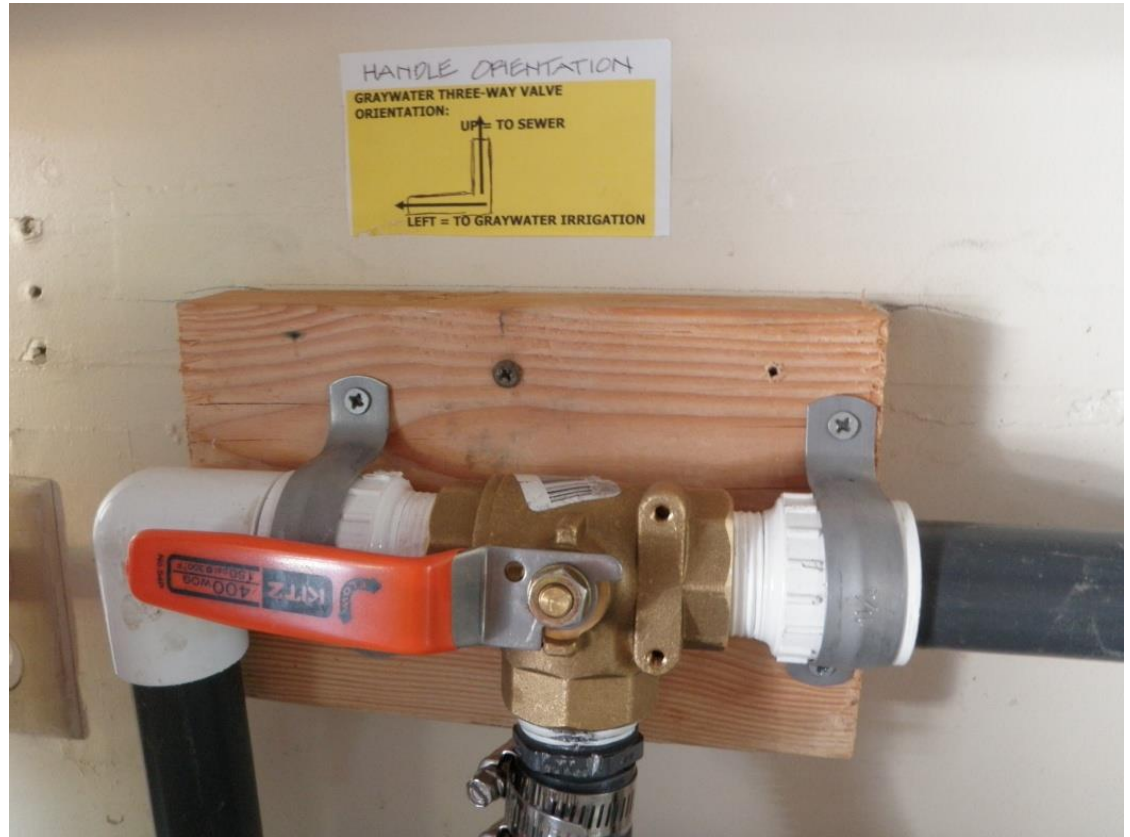
Multiple drains,
plumbed from inside

Multiple houses or units

Require building permits

GRAYWATER- Simple systems

- Low volume (<250G/day)
- Single or 2/family units
- Retrofitted from laundry to landscape
- May not require permits



GRAYWATER

SOME BENEFITS



- reduced potable water to landscapes
- reduced energy load required for pumping and treating potable water
- a sustainable, steady, and reliable water source in areas of the state with low rainfall

GRAYWATER

SOME RISKS



- May cause salt build-up and plant damage
 - *special cleaning products must be used*
- if used with drip, filtration will be required
- may not be used for food plants
- should not be used on lawns or groundcovers
- direct human/animal contact poses health risks
 - **MUST DRAIN TO MULCH BASIN- NOT OPEN TANK!**

GRAYWATER

Do your homework!



- For workshops:
 - <https://greywateraction.org/business-directory/>
- For design manual:
 - <http://sfwater.org/modules/showdocument.aspx?documentid=55>
- For design and install ideas and information:
 - oasisdesign.net

Look up regulations for your area!



Irrigation in the Low-water Garden



Irrigation with the Watershed Approach

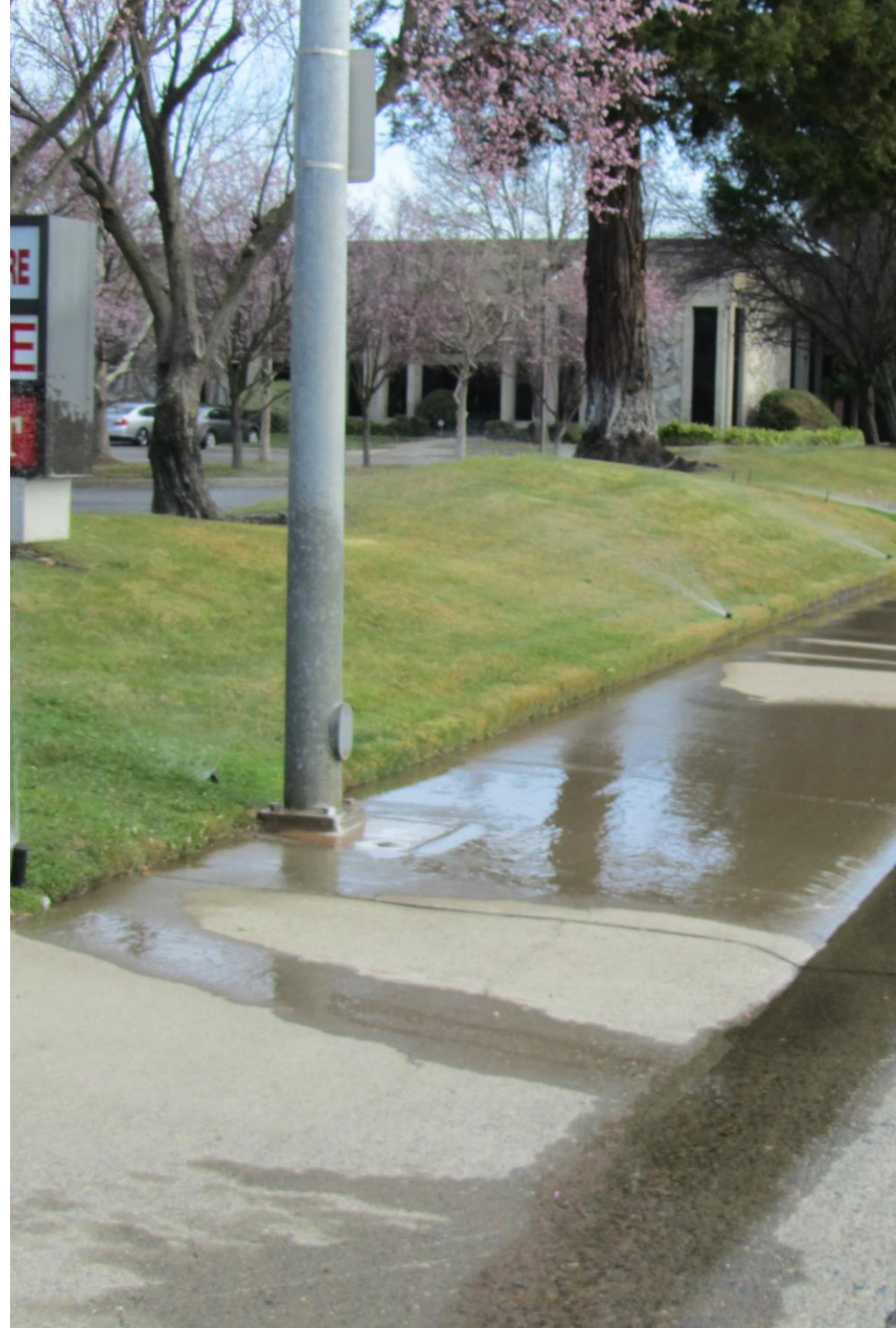
GOALS:

1. Optimize water SYSTEMS
 - Convert to the most efficient for the planting
2. Make every drop count
3. NO OVERSPRAY
4. NO RUNOFF



ASSESS YOUR SITE

- **Assess the soil type**
- **Assess compaction**
 - **Affects infiltration rate**
- **Observe current runoff**
- **Where can you improve?**



MATCH DELIVERY SYSTEM TO PLANTS

Rotary streams best for

- Turf
- Some groundcovers
- Some dense shrubs (when retrofitting)
- Low delivery rate
- Less loss to wind (large droplet size)



MATCH DELIVERY SYSTEM TO PLANTS

- **DRIP is best for**
 - Shrubs
 - Trees
 - Perennial beds
 - Borders
 - Vegetables
 - Groundcovers



Drip Systems

Inline drip tubing



Point source drip



Drip Rings

- $\frac{1}{4}$ " inline emitter tubing
- Attached to $\frac{1}{2}$ " delivery line
- Avoid long $\frac{1}{4}$ " lines- pressure loss
- Only good for smaller plants for limited time (2 years?)
- Larger plants/trees will need more in future





Buttons vs. In-line



BUTTONS

- Spotty coverage to root zones
- Lines have to be added for new plants
- Add'l line should be added as plants grow
- Emitters need replacement
- Leaks and blowouts

INLINE

- Even soil coverage
- Water use easily calculated in in. or gals
- No need to add lines for new plants/growing plants
- Pressure-regulated emitters with check valves mean less waste

Infiltration Rates

SOIL TEXTURE	0-5% slope		5-8% Slope	
	Cover	Bare	Cover	Bare
Coarse sandy	2.0	2.0	2.0	1.5
Sandy loam	1.75	1.0	1.25	0.8
Silt loam	1.0	0.5	0.8	0.4
Clay or Clay loam	0.2	0.15	0.15	0.1

*Application rate **MUST NOT EXCEED THIS** for your soil type or you will have runoff - Check the Design Guide*

You CAN waste water with drip!

Design & Scheduling Specifications

	Clay			Loam			Sandy		
Rate (gph)	0.26			0.4			0.6-0.9		
Emitter spacing (in)	18			18			12		
Row spacing	18	21	24	18	21	24	16	18	20
App. Rate (in/hr)	.19	.16	.14	.3	.26	.23	.7-1.1	.65-1	.6-.9
Minutes to apply ¼ "	80	96	106	50	58	66	13-20	15-23	17-26

Download: Hunter Drip Irrigation Design Guide
Netafim Techline CV Design Guide

Watch for runoff!!!

- Divide your runtimes
- Add additional cycles

