SOLANO Resource Conservation District

Nurturing Groundwater : The Environmental Benefits of Vegetated Ditches and Ponds

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SOLANO
Resource
Conservation
District

- Our Goals

- **Restore** Solano County watersheds and natural resources to health

- **Protect** natural resources through vibrant partnerships, strategic restoration, and effective education programs

- **Educate** children and adults about watershed science and effective stewardship

- **Enhance** our watersheds and their habitats to better serve all beneficial purposes

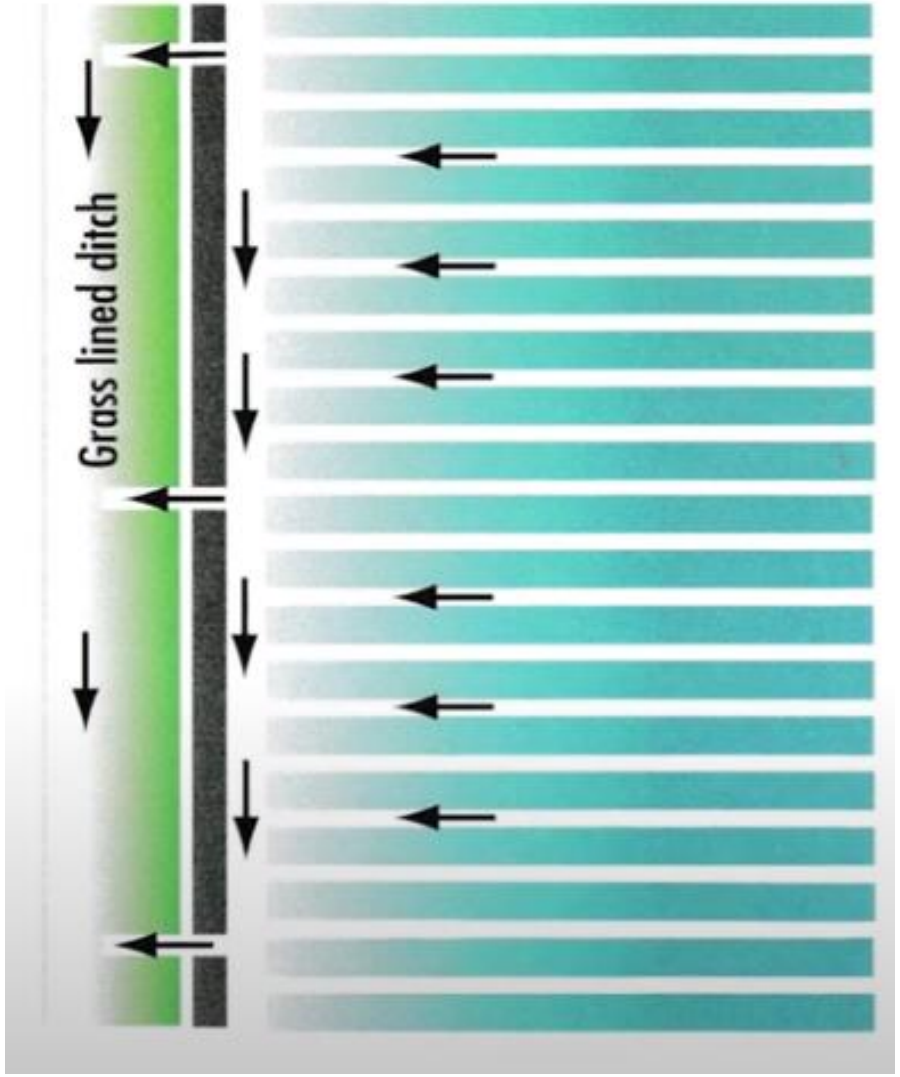
- **Slow It**
  - Provide a rougher, more vegetated surface that slows down water flow.
- **Spread It**
  - Prevent flow accumulation by widening the flow path.
- **Sink It**
  - Create a soil surface that allows water infiltration into unconfined shallow and/or deep aquifers.
- **Store It**
  - Create a healthy, biologically active soil profile with organic matter that acts more as a sponge.

Vegetation options:

- Cover crops
- Tree/shrub hedgerows
- Tree/shrub end caps
- Riparian buffer strips
- Grassed swales or vegetated ditches

Tailwater Ditches

- Ditches at end of field that run perpendicular to crop rows
- Can be planted with grasses and forbs to help filter and slow down agricultural runoff and stormwater
- Began in southeastern U.S. but spread to CA and was tested and proven on tomato and alfalfa fields



Source: East San Joaquin Water Quality Coalition

The Role of Vegetation

- ABOVE GROUND
  - Vegetation helps intercept water and reduce its impact on soil
  - Also works to physically remove sediments
  - Helps filter pollutants
- BELOW GROUND
  - Roots help stabilize slopes
  - Improve infiltration
    - Roots create conduits for water to flow
  - Living roots promote microbial activity which breaks down nutrients and other pollutants

Best Management Practice for Water Quality

- 3 main concerns with runoff and surface water
  - 1. Erosion/sediment
  - 2. Nutrients
  - 3. Pest control products

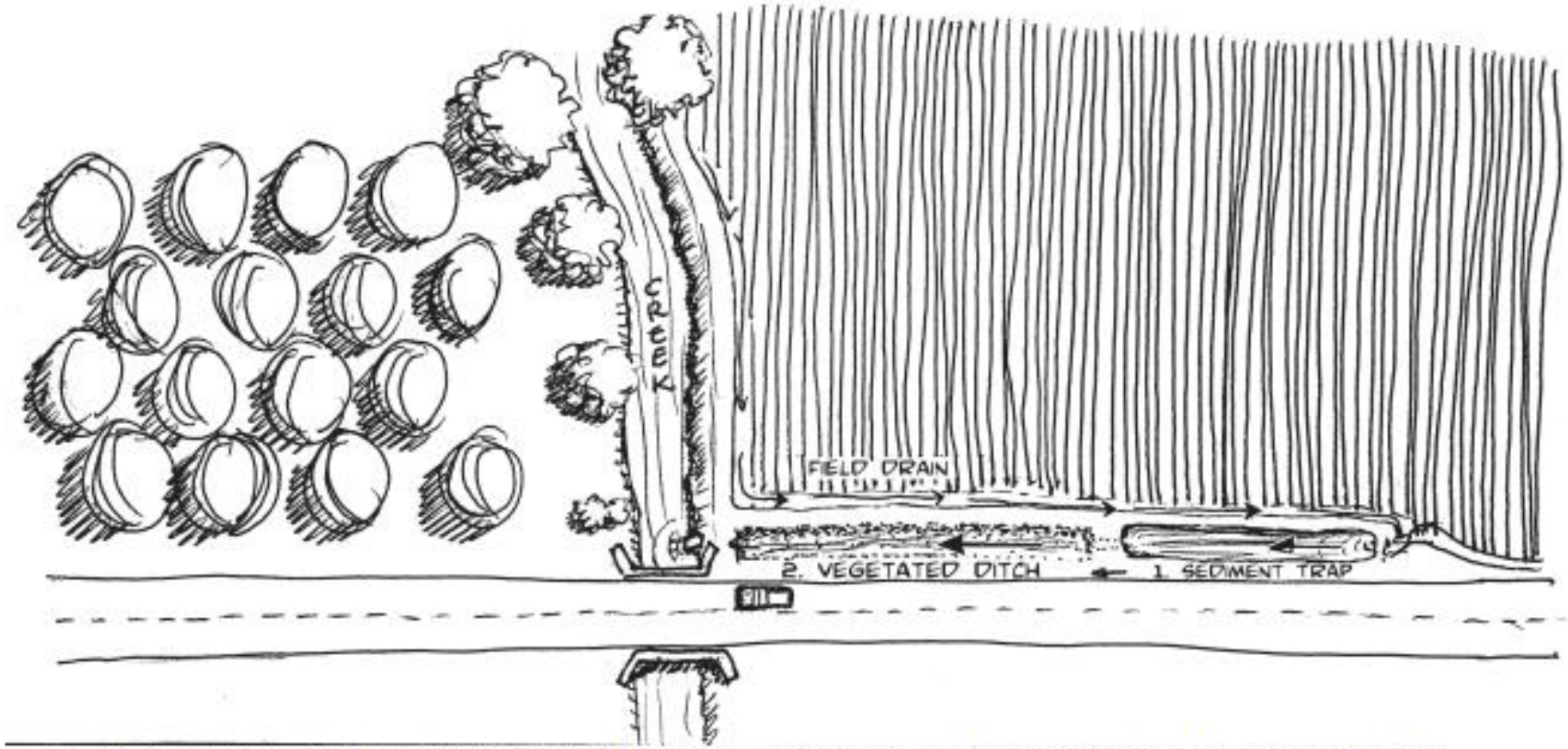
- Vegetated ditches reduce amount of sediment, nutrients and pesticides or herbicides that end up downstream

- One study found a 67% decrease in permethrin concentrations (Moore et al. 2011)

Benefits beyond water quality!

1. Filtration
2. Flood attenuation in winter
3. Living roots stabilize ditch banks & fight erosion
4. Can reduce invasion by weeds
5. Wildlife habitat

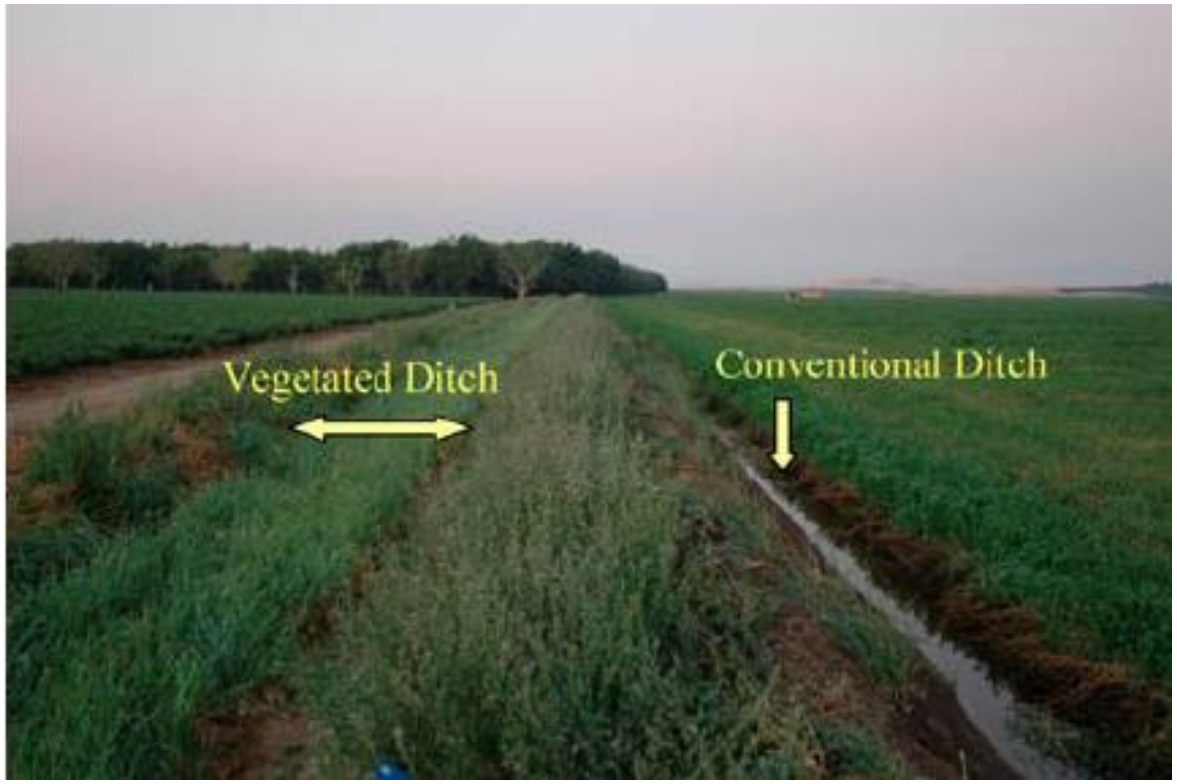
Potential Layout



In this field, furrows drain from top to bottom of the picture. Water is captured in the tail ditch and passes through an up-stream sediment trap from right to left before enering the vegetated ditch enroute to the stream (see arrows).

Possible Designs

- “V” ditches
  - Easiest to excavate and most compact
  - More susceptible to erosion
- Flat bottom or “U”-shaped ditches
  - Most effective
  - Slow water down and increase area over which water can percolate
  - 2 ft bottom width allows for use of lawn mower



Gill, Sheryl & Spurlock, Frank & Goh, Kean & Ganapathy, Carissa. (2007). Vegetated ditches as a management practice in irrigated alfalfa. Environmental monitoring and assessment. 144. 261-7. 10.1007/s10661-007-9988-

Establishing Vegetated Ditches

- New ditches can be excavated with a ditcher, scraper or road grader
- Gentle 3:1 or 2:1 slopes work best for plant establishment
- Ideal time is in the fall
  - Once irrigation season has ended but before start of winter rains
- Ensure blank canvas if seeding natives
  - Allow first flush of weeds to come up and kill them before planting

Species for Perennial vs Annual Ditch

Perennial

- Native plants that can tolerate periods of drought
- Deeper roots of perennials allow more infiltration
  - Red fescue (less attractive to rodents)
  - Creeping wild rye and lupines
  - Sedge and rush species
    - Can be drill seeded (if ditch is wide enough) or plug planted, ideally in mid winter
    - Dense planting: 6-12 inches apart

Annual

- Annual species
  - Barley or annual rye
    - Fast growing grasses that can provide cover in the winter months

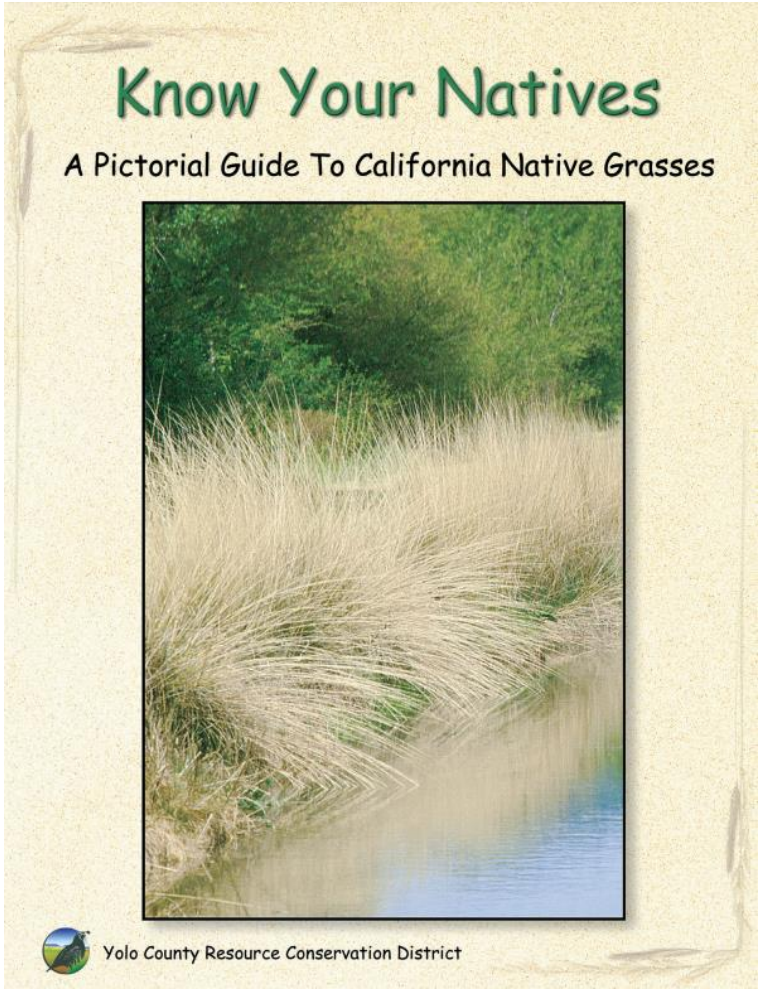
Root Systems of Recommended Species

Figure 10.4. Root systems of four grass cover crops at early stages of growth (two months in a greenhouse). From left: annual ryegrass, barley, triticale (winter biennials) and sorghum-sudangrass (summer annuals). Photos by Joseph Amsili.

Magdoff, F. and Van Es, H. (2021). Building Soils for Better Crops. Sustainable Agriculture Research and Education (SARE) Program, National Institute of Food and Agriculture, U.S. Department of Agriculture.

What Species Should I Choose?

- Know Your Natives handbook from Yolo RCD
- We can also do a site visit and provide you with a recommended species list

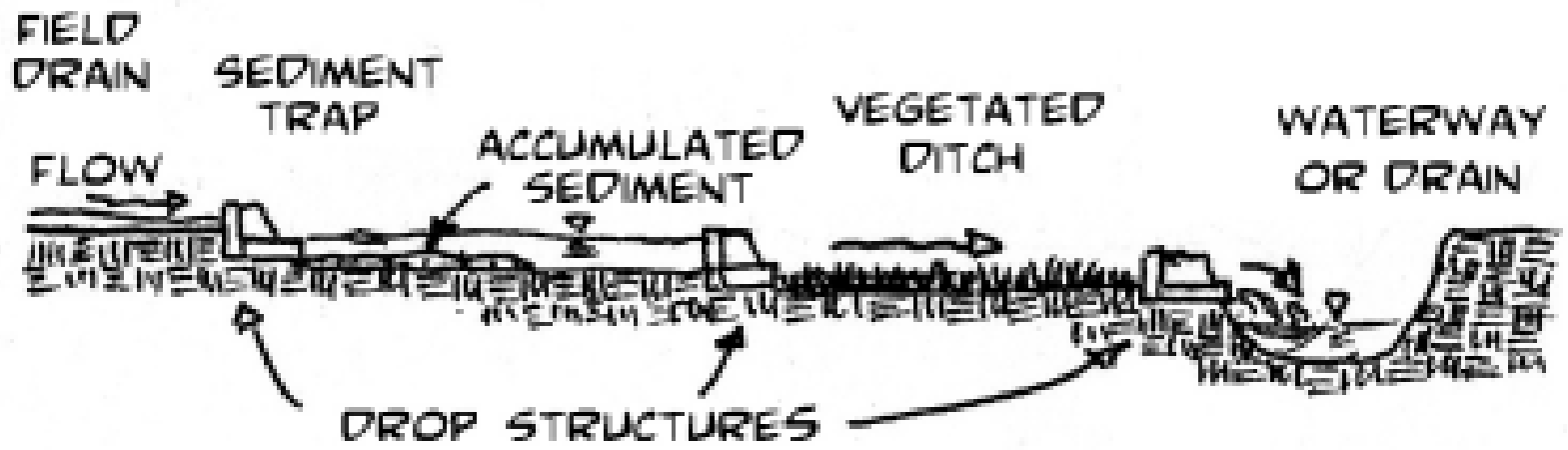


Maintenance

- Periodic excavation or scraping
- Weed control
  - Mowing, spraying and/ or burning
- Reseeding vegetation to repair damage from machinery or erosion
- For mosquito control, limit the length of time there is standing water
  - Reach out to Solano County Mosquito Abatement District (https://www.solanomosquito.com/)

Sediment Traps

- Capture eroded particles from runoff
  - Prevent clogging of vegetated ditches
  - Shallow basin, 2-3 ft deep
  - Upstream of vegetated ditch
  - Can add check dam at end of sediment trap



Vegetated Ditch in Woodland

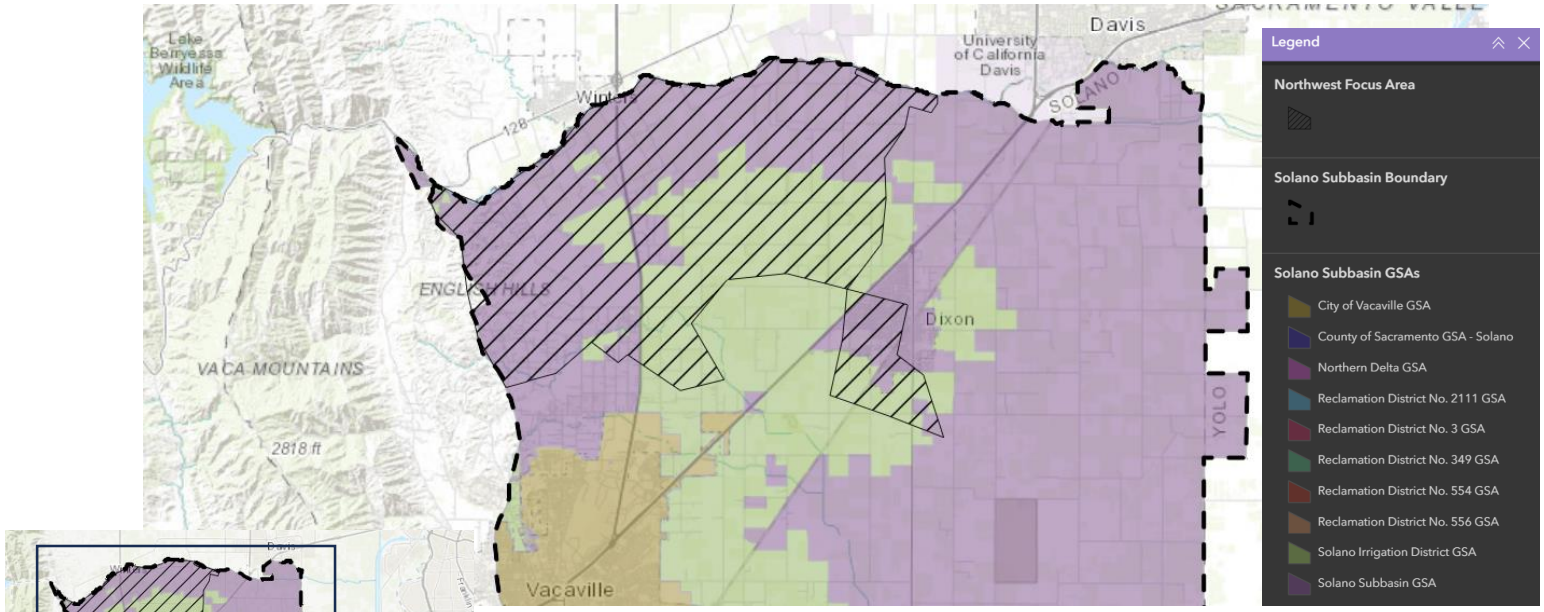
Vegetated Ditch in Woodland

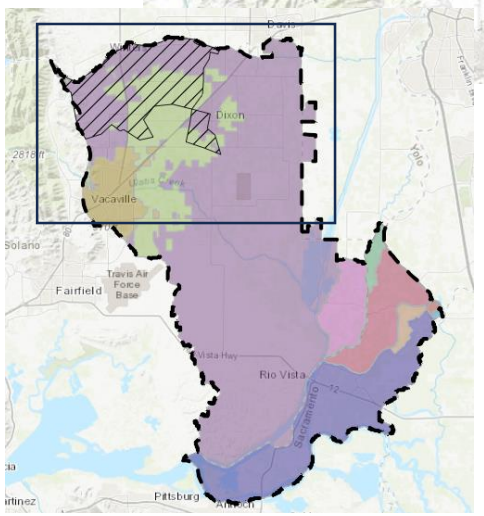
- Lupines in March

Planning for a Pond

2022 Dixon RCD Survey of Landowners in NW Focus Area

- Area where wells have gone dry and where topography creates runoff that floods other areas
- Interest in establishing seasonal ponds





Interactive Solano Subbasin map
solanogsp.com

Preliminary Questions

1. Water Source

2. Soil & Underlying Geology
   - Web Soil Survey is sometimes limited to top 60 inches

3. Topography

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1. Water Source

2. Soil & Underlying Geology
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3. Topography

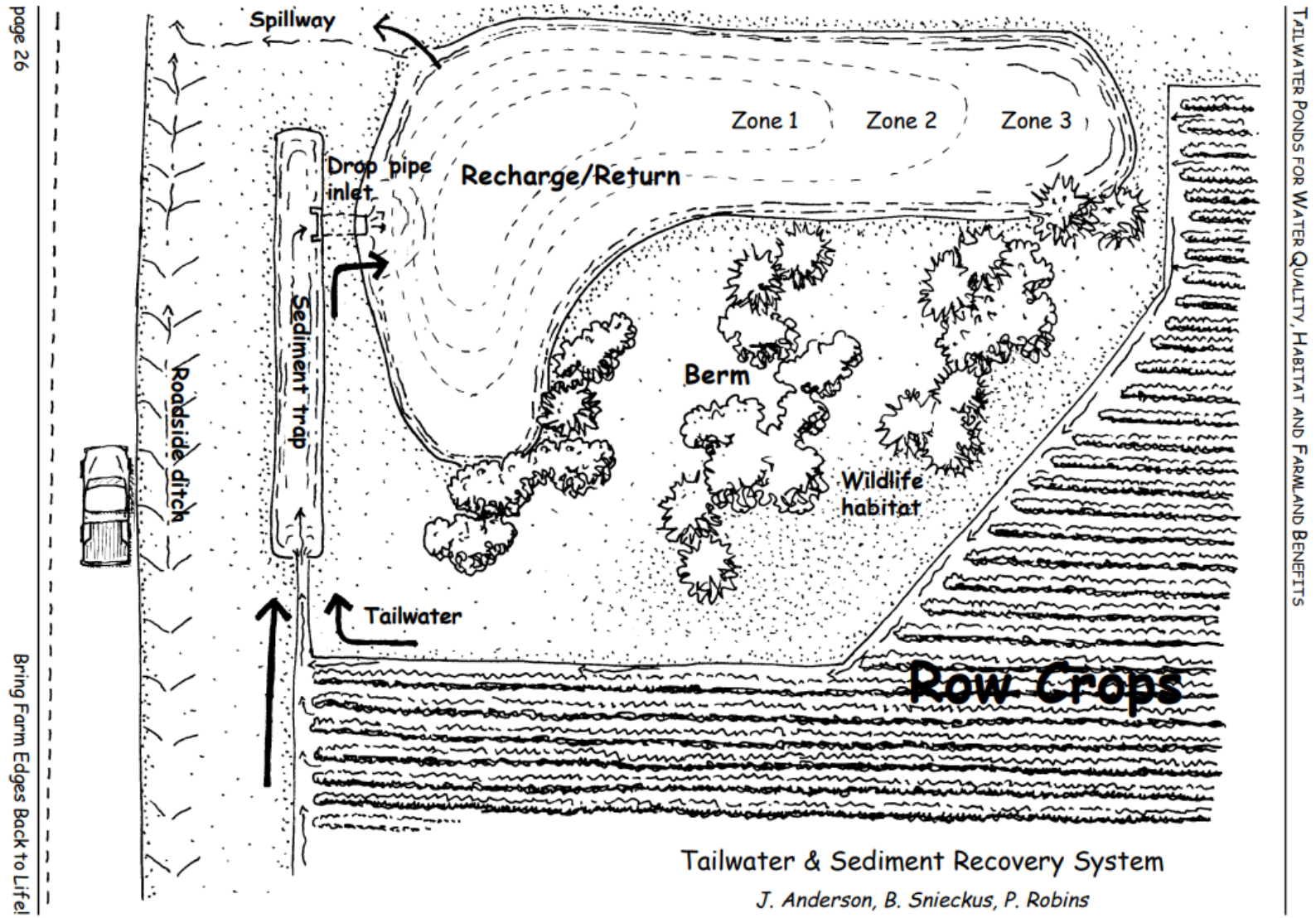
Solano RCD can help recommend a consultant to determine feasibility and design.

Permitting

1. **CA Fish and Wildlife** must be consulted to determine habitat connectivity
2. Make sure to call 811 dig!
3. Active ag operations have exemptions, but grading permit may still be needed
   - Only need a grading permit with the County
     - < 50 cubic yards – No permit required.
   - Grading@solanocounty.com

Two Stage Pond Design

- First small pond works as a sediment trap
- Second, larger pond can be used for infiltration, water storage, water return and for wildlife habitat.
  - Gradual 3:1 or 4:1 slope with deep center
  - Deep center portion (> 5 ft)
- No woody species on embankments



Pond Planting Zones

- No woody species on embankments
- Zone 1
  - deep water, rarely dry
- Zone 2 and 3
  - Moist soil, intermittently under water

Suggested Plant Materials for Tailwater Ponds

Moist Soil Vegetation Zone 1 and 2

Spikerush (*Eleocharis macrostachya*)
Sedges (*Cyperus* species)
Rushes (*Scirpus americanus, Juncus effusus and J. balticus*)

(Establishing short-statured rushes and sedges will keep out unwanted species such as cattails and bulrushes which will dominate a small wetland if allowed to proliferate.)

Moist Soil Vegetation Zone 3

Species listed in Zones 1 and 2
White-root sedge (*Carex barbarae*)
Clustered field sedge (*C. praegracilis)*
Meadow barley (*Hordeum brachyantherum*)
Hairgrass (*Deschampsia caespitosa*)
Bentgrass (*Agrostis exarata*)

Pond Edge

Meadow barley
Bentgrass (*Agrostis exerata*)
Hairgrass
Slender wheatgrass (*Elymus trachycaulus majus*)
Creeping wildrye (*Leymus triticoides*)
Clustered field sedge
White-root Sedge

Dryland Native Grass Mixture

Blue wildrye (*Elymus glaucus*)
Purple needlegrass (*Nassella pulchra*)
Oniongrass (*Melica californica*)
Pine bluegrass (*Poa secunda*)

Trees

Willows (*Salix* spp.)
Valley Oak (*Quercus lobata*)
Sycamore (*Platanus racemosa*)
Black Walnut (*Juglans californica* var. *hindsii*)
Cottonwood (*Populus fremontii*)
Interior Live Oak (*Quercus wislizenii*)
Buckeye *(Aesculus californica*)

Shrubs

Button Willow (*Cephalanthus occidentalis)*
Coyote Brush (*Baccharis pilularis*)
Wild Rose (*Rosa californica*)
California Lilac (*Ceanothus* spp.)
Mulefat (*Baccharis viminea*)
Elderberry (*Sambucus mexicana*)
Toyon (*Heteromeles arbutifolia*)
Redbud (*Cercis occidentalis*)

Source: Yolo County RCD -Bring Farm Edges Back to Life!

Native Plant Lists Available

- Will require irrigation first 2-3 years
- More drought tolerant than non-natives

Plants native to Solano County that are good for pond plantings

H_2O	Species	Common name	Structure	Water needs	Height (ft)	Flower	Fruit/seed
In water	*Eleocharis macrostachya*	Spike rush	grass/sedge/rush	emergent	1-2	nondescript	
	Juncus balticus	Baltic rush	grass/sedge/rush	emergent/riparian	2-3	nondescript	
	Scirpus spp.	Tule	grass/sedge/rush	emergent	6-8	nondescript	
	Typha spp.	Cattail	grass/sedge/rush	emergent	6	nondescript	
Riparian species (need/tolerate lots of water)	*Artemesia douglasiana*	Mugwort	forb	riparian/upland	3-5	nondescript	
	Grindelia camporum	Gumplant	forb	riparian	2-4	yellow	
	Symphyotrichum chilense	CA aster	forb	riparian	3-5	pale purple	
	Carex barbarae	Sedge, Santa Barbara	grass/sedge/rush	riparian	2	nondescript	
	Carex praegracilis	Sedge, slender	grass/sedge/rush	riparian/emergent	1.5	nondescript	
	Leymus triticoides	Creeping wildrye	grass/sedge/rush	riparian/upland	3	nondescript	
	Muhlenbergia rigens	Deer grass	grass, large	riparian/upland	3-5	nondescript	
	Baccharis salicifolia	Mule fat	shrub, mid-sized	riparian	4-8	white	
	Calycanthus occidentalis	Spice bush	shrub, large	riparian	8-10	red	
	Cephalanthus occidentalis	Buttonbush	shrub, large	riparian/emergent	8-20	white	
	Cornus sericea	Dogwood	shrub, mid-sized	riparian	5-7	white	
	Hibiscus californica	CA hibiscus	shrub, mid-sized	riparian	4-6	pink	
	Rosa californica	CA rose	shrub, mid-sized	riparian/upland	4-6	pink	red hip
	Rubus ursinus	CA blackberry	shrub, small	riparian	2-3	white	black berry
	Acer negundo	Box elder	tree	riparian	30-50	nondescript	
	Fraxinus latifolia	Oregon ash	tree	riparian/emergent	40-60	nondescript	
	Platanus racemosa	Sycamore	tree	riparian/upland	80	nondescript	
	Populus fremontii	Cottonwood	tree	riparian	50-75	nondescript	
	Quercus lobata	Oak, valley	tree	riparian/upland	50-75	nondescript	acorn
	Quercus wislizeni	Oak, interior	tree	riparian/upland	30-75	nondescript	acorn
	Salix laevigata	Willow, red	tree	riparian	20-30	nondescript	
	Salix lucida	Willow, shining	tree	riparian	20	nondescript	
	Aristilochia californica	Pipevine	vine	riparian	4-6	green/purple	
	Clematis ligustifolia	Clematis, Western	vine	riparian	up to 20	white/yellow	fluffy seed head
	Vitis californica	CA grape	vine	riparian	up to 30	nondescript	purple fruit
Upland Species (need/tolerate less water)	*Asclepias fascicularis*	Milkweed, narrow leafed	forb	upland	2	white/pink	
	Asclepias speciosa	Milkweed, showy	forb	upland	3	white/pink	
	Festuca idahoensis	Idaho fescue	grass/sedge/rush	upland	2	nondescript	
	Nassella pulchra	Purple needle grass	grass/sedge/rush	upland	1	nondescript	
	Baccharis pilularis	Coyote bush	shrub, mid-sized	upland/riparian	6-8	white	
	Berberis aquifolium	Oregon grape	shrub, mid-sized	upland	2-6	yellow	blue berry
	Ceanothus cuneatus	Buck brush	shrub, mid-sized	upland	6-10	white, pale blue	
	Ceanothus integerrimus	Deer brush	shrub, mid-sized	upland	6-10	white, blue	
	Cercis occidentalis	Redbud	shrub, large	upland	8-15	pink	purple pods
	Epilobium canum	CA fuchsia	shrub, small	upland	2	red	
	*Eriogonum fasciculatum**	CA buckwheat*	shrub, small	upland	2-3	white	
	Heteromeles arbutifolia	Toyon	shrub, large	upland	6-15	white	red fruit
	Mimulus aurantiacus	Sticky monkey bush	shrub, small	upland	3-4	orange	
	Rhamnus californica	Coffeeberry	shrub, mid-sized	upland	5-7	white	blue berries
	Ribes sanguineum	Red-flowered currant	shrub, mid-sized	upland	6-10	pink, red	
	Sambucus mexicana	Elderberry	shrub, large	upland/riparian	8-15	white	blue fruit
	Aesculus californica	CA Buckeye	tree	upland/riparian	20-30	pink	large nut
	*Ceanothus thyrsiflorus**	Blue blossom*	tree	upland	15-20	blue	
	Juglans californica	CA Walnut	tree	upland/riparian	40-50	nondescript	nut
	Pinus sabiniana	Grey pine	tree	upland	40-80	nondescript	
	Quercus douglasii	Oak, blue	tree	upland	30-50	nondescript	acorn
	Umbellularia californica	CA bay	tree	upland	30-75	nondescript	
	Clematis lasiantha	Clematis, pipestem	vine	upland	up to 15	white/yellow	fluffy seed head

* native to nearby counties, but not Solano County

For More Information

- Bring Farm Edges Back to Life!

Bring Farm Edges Back to Life!

Table of Contents

THANK YOU!

Sources

- https://www.solanorcd.org/images/vegetated-drainage-ditch.pdf
- https://yolorcd.org/wp-content/uploads/Farm-Edges-v5-Full.pdf
- https://agwaterstewards.org/practices/farm-ponds/
- https://www.youtube.com/watch?v=lE8K-Ejhoa4