



Large transition-zone, large equipment: Employing heavy farming equipment as one of the many tools to revegetate high acreage transition-zone slopes

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Overview

- Save The Bay's habitat restoration program
- Overview of Ravenswood revegetation project
- Planting process
- Early monitoring results and site status
- Lessons learned

Evolution of our restoration projects



Evolution of our restoration projects

Oro Loma Horizontal Levee Demonstration Project

- Onsite division bed nursery
- 70,000 plants in an abbreviated timeline
- Locally collected wetland and transition-zone species
- Rhizomatous perennial species
- Seed mix cover crop



Ravenswood

- Two HTZ sites
 - R4 Levee adjacent to Bedwell Bayfront Park - 9 acres
 - All American Canal - 16 acres
- Constructed on-site nursery
- Project partners include: USFWS, Ducks Unlimited, State Coastal Conservancy, West Bay Sanitary District, South Bay Salt Pond Project

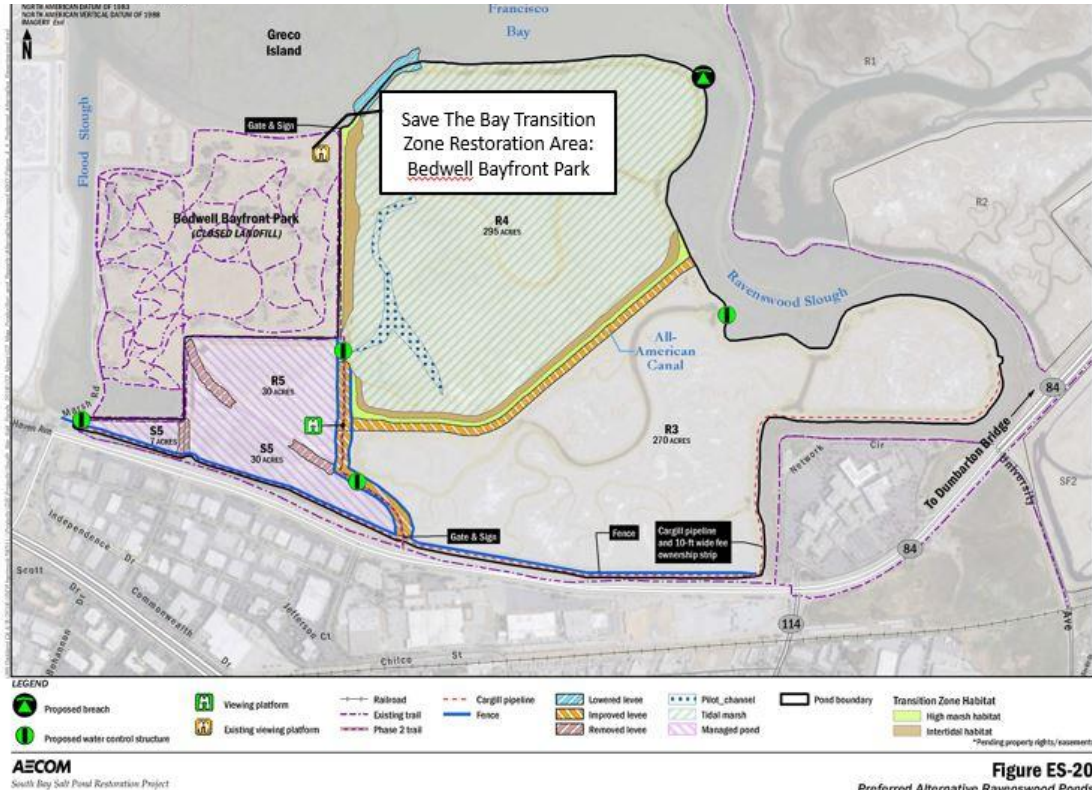


Figure ES-20
Preferred Alternative Ravenswood Ponds

Ravenswood Onsite Nursery

- 84 division beds
- Rhizomatous perennial species
- Adjacent to the project site
- Locally collected seed and vegetative material
- Minimal maintenance



Species

- **Clonal meadow species**
 - Abundant, stress tolerant
 - Mechanized equipment planting method
- **Diversity patch species**
 - Less stress tolerant, perennial species critical for pollinator habitat, cover, and biodiversity
 - Hand-planted
- **Refuge patch species**
 - Provide dense, shrubby high tide refugia
 - Hand-planted
- **Annual cover crop species**
 - Functionally competitive native annual species
 - Hand-broadcast



Planting process

- **October - November**
 - Site preparation
 - Prepare sod planting material
- **November**
 - Translocate to slope
 - Disc in using farming equipment
 - Broadcast annual seed mix
- **November- January**
 - Diversity patch planting
- **January**
 - Refuge species planting/infill planting
- **February-April**
 - Supplemental irrigation and targeted weeding



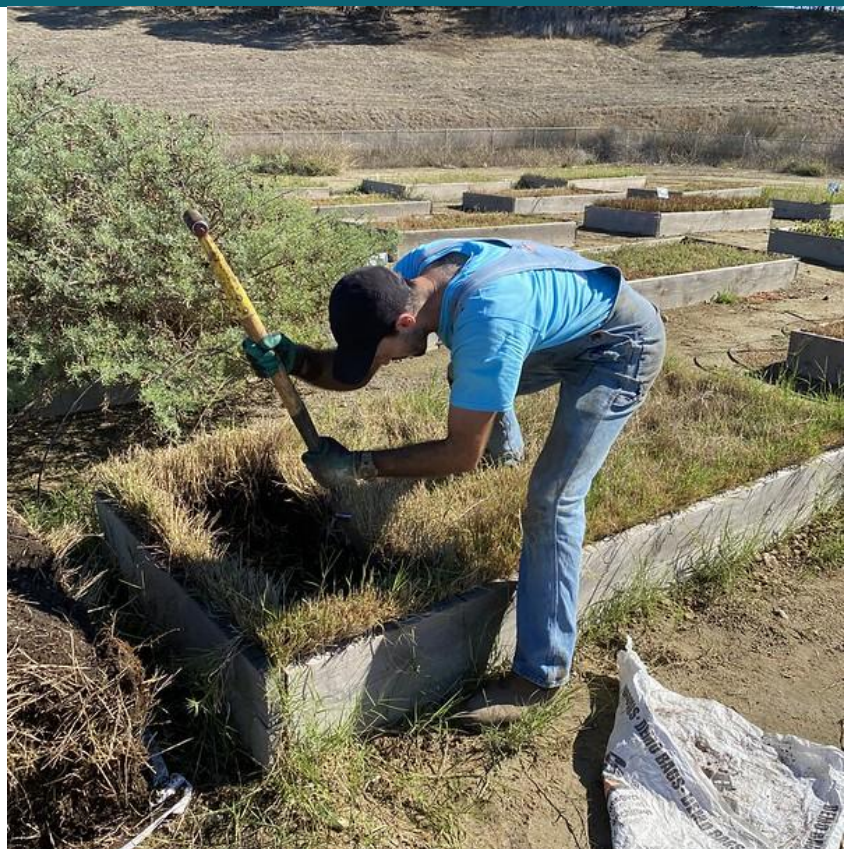
Site preparation

- Prior to planting, the slope was disked to eliminate invasive species cover and reduce compaction from grading
- The site was divided into four transects to test two methods of mechanized planting



Sod material preparation

- Gradually reduce irrigation over the summer and early fall to promote natural seasonal dormancy
- Hand-harvested from the beds into 6" by 18" sod pieces
- Clonal meadow - four species - creeping wildrye (*Elymus triticoides*), Western ragweed (*Ambrosia psilostachya*), salt grass (*Distichlis spicata*), and alkali heath (*Frankenia salina*)



Translocation to slope

- Translocation to slope
- Load sod pieces into trailer and stage on slope
- Counted # of sod pieces of each species per transect



Mechanized, clonal meadow species planting

- Sloped divided into four transects
 - Each ~150 meters long
 - Alternating between the two methods
- **First method:** Sod fed into a hay blower and dispersed across the slope; slope then disked
 - Issues with hay blower
- **Second:** sod hand-placed on the slope; slope then disked



Discing into slope: methods



Annual seed mix



Annual seed mix

- Seed mix progress in April 2022
 - Spring annuals setting seed
 - Dense summer and fall annuals cover the slope



Diversity patch planting

- Species not included in the mechanized planting method
 - Less abundant and stress tolerant provide additional ecosystem services, including vital pollinator habitat and biodiversity
- 3,860 sod pieces harvested from the nursery beds
 - Equivalent to 15,440 container plants

Species	Common Name	# of patches	# of sod pieces	Total across slope
<i>Artemisia douglasiana</i>	Mugwort	4	25	400
<i>Achillea millefolium</i>	Yarrow	5	25	500
<i>Iva axillaris</i>	Povertyweed	2	25	200
<i>Symphyotrichum chilense</i>	California aster	4	25	400
<i>Baccharis glutinosa</i>	Marsh baccharis	10	25	1000
<i>Euthamia occidentalis</i>	Western goldenrod	10	25	1000
<i>Carex barbarae</i>	Santa Barbara sedge	4	15	240
<i>Juncus xiphiodes</i>	Iris leafed rush	2	15	120
Total:		41	965	3,860



Refuge patch planting



- Provide dense, shrubby high tide refugia adjacent to the tidal marsh
- Ssp. like CA rose (*Rosa californica*), CA blackberry (*Rubus ursinus*), and marsh gumplant (*Grindelia stricta*)
- 3,800 container plants
- Likely require backfilling after the breach



Preliminary monitoring

- Determine success for two installation methods - hay blower broadcasting and disking
- Total population census of four clonal meadow species
 - Transect broken into parallel lines and walked by staff, clicker counting present individuals with active growth
- Different process than STB's annual monitoring which is a random stratified sample approach



Preliminary monitoring



Preliminary monitoring



Clonal meadow species establishment	Sod pieces/ transect		Transect 1 (hay blower)	Transect 2 (disked sod)	Transect 3 (both methods)	Transect 4 (disked sod)
Western ragweed (<i>Ambrosia psilostachya</i>)	44	Total	10	110	11	29
		% Est.	23%	250%	25%	66%
Salt grass (<i>Distichlis spicata</i>)	96	Total	19	51	34	22
		% Est.	20%	53%	35%	23%
Creeping wildrye (<i>Elymus triticoides</i>)	184	Total	26	195	310	174
		% Est.	14%	106%	168%	95%
Alkali heath (<i>Frankenia salina</i>)	53	Total	8	76	15	29
		% Est.	15%	143%	28%	55%

Maintenance and Volunteer Engagement

- Corporate and community-based programs contribute to targeted weeding efforts
- Opportunity to get people on the shoreline and educate them about the larger SBSPRP



Lessons Learned



- **Successes**
 - Broad and dense coverage from annual seed mix
 - Survivorship of the perennial rhizomatous sod species planted via the disking process
 - Hardworking and methodical team
- **Constraints**
 - Labor associated with preparing and translocating sod pieces to the slope
 - Lack of volunteer engagement - Covid
 - Invasive and non-native seed bank in the soil
 - Limited irrigation across the slope



Thank you to project partners
and to the Habitat
Restoration Team and
volunteers!

