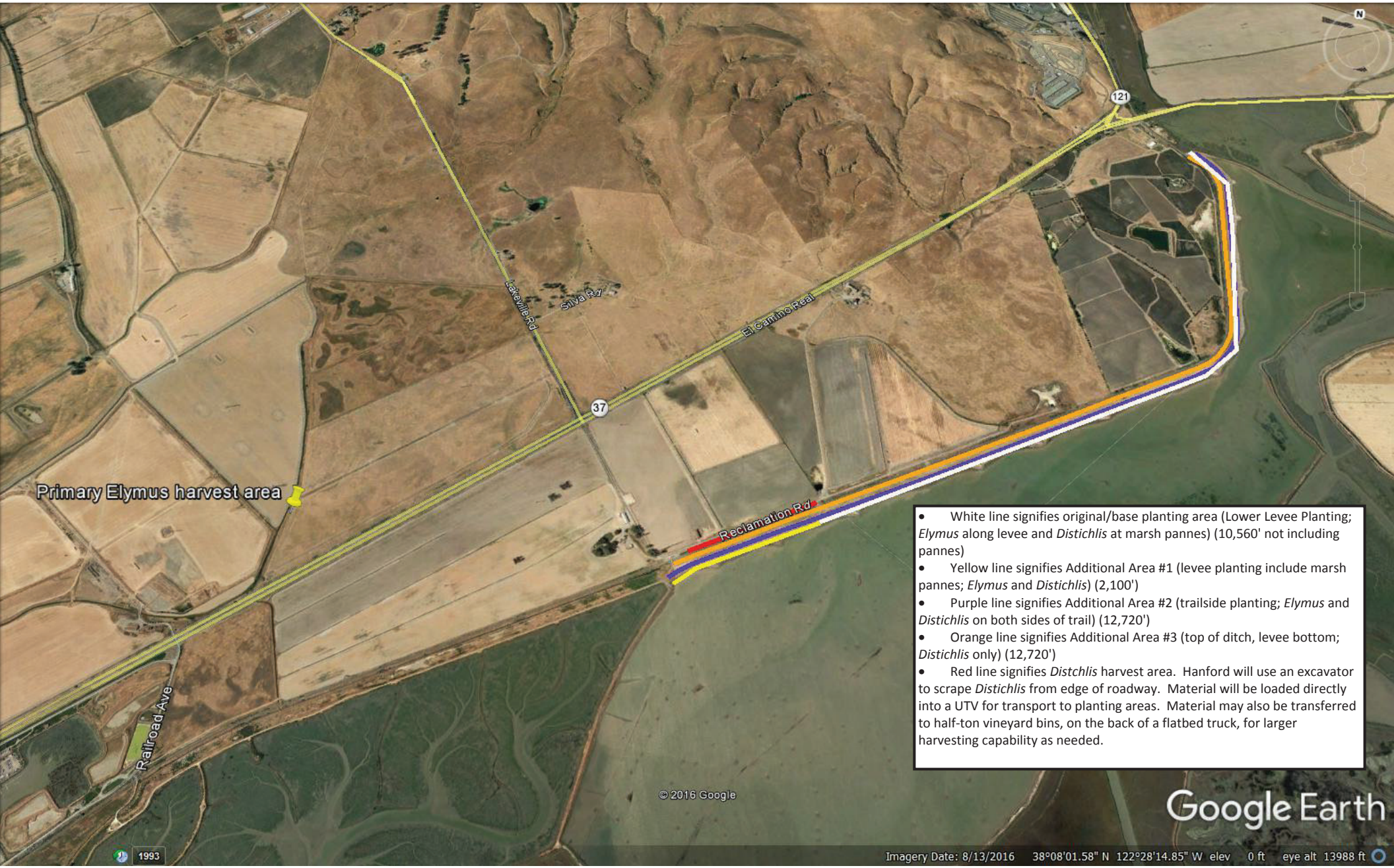
Appendix G. Northern Ecotone Levee Planting

Appendix G

Northern Levee Ecotone Planting

Contents

Appendix G-1
Ecotone Levee Plantings Late 2016/Early 2017



- White line signifies original/base planting area (Lower Levee Planting; *Elymus* along levee and *Distichlis* at marsh pannes) (10,560' not including pannes)
- Yellow line signifies Additional Area #1 (levee planting include marsh pannes; *Elymus* and *Distichlis*) (2,100')
- Purple line signifies Additional Area #2 (trailside planting; *Elymus* and *Distichlis* on both sides of trail) (12,720')
- Orange line signifies Additional Area #3 (top of ditch, levee bottom; *Distichlis* only) (12,720')
- Red line signifies *Distchlis* harvest area. Hanford will use an excavator to scrape *Distichlis* from edge of roadway. Material will be loaded directly into a UTV for transport to planting areas. Material may also be transferred to half-ton vineyard bins, on the back of a flatbed truck, for larger harvesting capability as needed.

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Certified Small Business #49390
GSA Schedule 899 Contract #GS-10F-0244V

March 23, 2018

Sonoma Land Trust
Julian Meisler, Baylands Program Manager
julian@sonomalandtrust.org

Re: Final memo report of work for the **Creeping Wild Rye (*Elymus* triticoides) Levee Planting Project** as part of *Sears Point Wetlands and Watershed Restoration Project*, 2100 Highway 37, Sonoma County, California.

Julian:

Introduction

At your request, the following memo provides a summary of the scope of work, methods, sourcing, and final costs to complete the *Sears Point Wetlands and Watershed Restoration Project*, located at 2100 Highway 37, Sonoma County, California.

Scope of Work

Sonoma Land Trust (SLT) approved Pacific Watershed Associates, Inc. (PWA) proposal dated 10 January 2018 to provide the scope of work (SOW) to implement the **Creeping Wild Rye (*Elymus triticoides*) Levee Planting Project** along approximately 2.5 miles (12,800 feet) of outboard levee within the wetlands restoration area of the *Sears Point Wetlands and Watershed Restoration Project*. Tasks included the following:

1. Conducted a field assessment, identify, and layout harvest area(s).
2. Marked the harvest/planting areas and called USADIG to ensure safety during project excavation.
3. Harvested *Elymus triticoides* sod and Saltgrass (*Distichlis spicata)* from predetermined areas of the property using a backhoe and store materials at pre-determined location.
4. Transported harvested *Elymus* sod and Saltgrass (*Distichlis spicata)* from storage location to the levee using a truck and trailer.
5. Planted over 4,000 four-inch (4") plugs at a spacing of 5' per plug along a predetermined elevation on the outboard face of the habitat levee using PWA staff. Plant rows of *Elymus* plugs along 4,000' of upper levee face in the eastern portion of the project and within sections of lower levee adjacent to the Project's ten constructed marsh pans. The truck and trailer followed the work crew along the levee and supplied sod for planting. Of the over 4,000 plugs, 200 Saltgrass (*Distichlis spicata)* plugs were planted along the inner edges of these 10 marsh pans.
6. Watered plantings 3 times between 1 February and 15 February[1].
7. Flagged all plugs planted along the lower levee.
8. Flagged the top of each row of plantings along the upper levee
9. Prepared a post-project memo report of work.

[1] Watering the entire project took 2 days' time for each watering.

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Methods

Harvesting was conducted on 29 January 2018 by PWA staff Steve Pye and Kyle Spongberg and USFWS staff Jim Griffin. Planting was completed on 1 February 2018 by PWA staff Clay Allison, Kyle Spongberg, and Steve Pye. In all, over 4,000 individual plugs were harvested and planted along the outboard face of the levee, refer to Map 1 for the locations of planting and Appendix A for representative photographs.

Due to the unseasonably warm and dry weather, PWA staff watered the plugs after planting for 2 weeks to promote success. In addition, every plug planted along the lower levee, and the top of each row on the upper levee was flagged to allow for future identification and to monitor for success. Numerous *Elymus triticoides* and *Distichlis spicata* plantings from previous projects during the past several years were observed across the levee, indicating high potential for the success of the PWA plantings. Refer to Map 2 for the location of the previous years' successful plantings.

Soil Conditions

Soil conditions along the levee were variable, but most plantings were installed in soils with substantial moisture content. The *Distichlis spicata* plantings were planted along the outer perimeter of the 10 marsh pannes, where soils were highly saturated. The lower levee soils were moister overall, but there were intermittent areas with very little moisture content. If SLT/USFWS staff has the resources, additional watering(s) during the drier months will help ensure a higher success rate.

Sourcing

All material was harvested from the Lakeville-Highway 37 intersection location and from a drainage ditch north of the railway line near the railroad crossing, which was heavily mulched with seed-free rice straw immediately after harvest was completed to minimize sunlight exposure and limit introduction of non-native, invasive species to the disturbed areas.

Project Administration and Final Costs

Table 1 below summarizes the project costs for the project; this includes in-kind match from Jim Griffin staff from US Fish and Wildlife service (USFWS) and SLT staff. Based on the funding source SLT secured for this project, PWA was required to pay staff prevailing wages for all labor, submit paperwork (certified payroll records), and conduct onsite interviews with Contractor Compliance and Monitoring, Inc. (CCMI) to be compliant with Prevailing Wage requirements under the Prop 84 funding.

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Table 1. Final costs for the *Creeping Wild Rye Levee Planting Project.*

Cost Description	Units	Cost rate	Total Cost
PWA non-prevailing wage services			
PWA Principal Earth Scientist	5	$125.00	$625.00
PWA Senior Geologist	19	$105.00	$1,995.00
PWA Staff Scientist	20	$85.00	$1,700.00
PWA Physical Science Technicians	10.25	$75.00	$768.75
PWA prevailing wage services			
PWA Staff Scientist	97.75	$110.00	$10,752.50
PWA Physical Science Technicians	59	$100.00	$5,900.00
Materials and Operating Expenses			
Field Materials	1	$559.26	$559.26
Prevailing wage subcontracted expenses	1	$455.10	$455.10
Water Tank Rental ($100/day)	6	$100.00	$600.00
Mileage	479	0.65	$311.35
PWA Overhead		20%	$4,733.39
US Fish and Wildlife In-Kind/Match Services			
USFWS Equipment operator	5	$225.00	$1,125.00
Backhoe (1 day rental)	1	$500.00	$500.00
		PWA Subtotal	$28,400.35
		USFWS In-Kind Match Subtotal	$1,625.00
		FINAL PROJECT TOTAL	**$30,025.35**

We assume this meets your needs at this time. If you have any questions or wish to discuss any elements of the final memo report, please feel free to contact us by email or phone at (707) 773-1385.

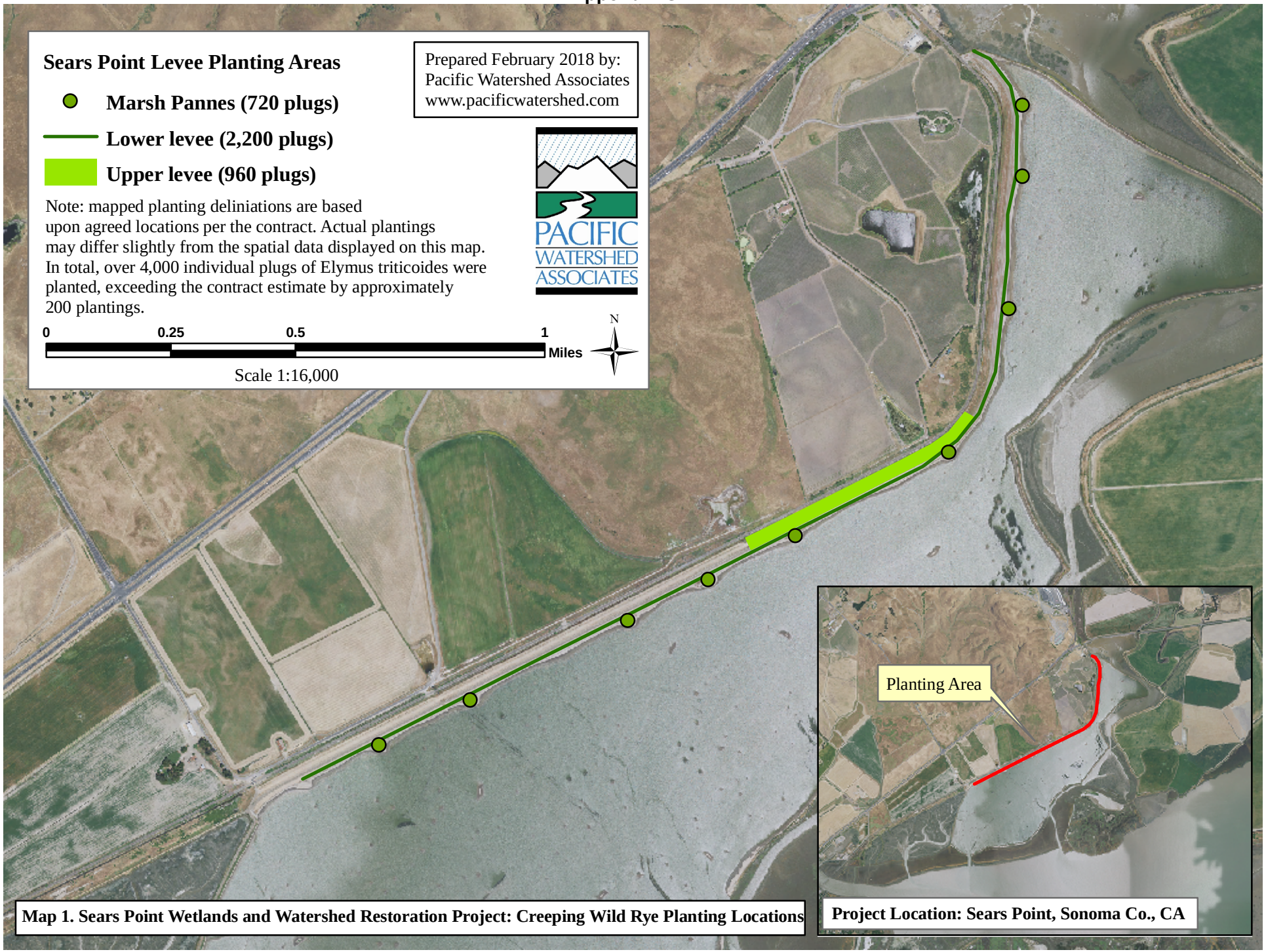
Sincerely,
PACIFIC WATERSHED ASSOCIATES INC.

Steve Pye, Staff Scientist
stevep@pacificwatershed.com

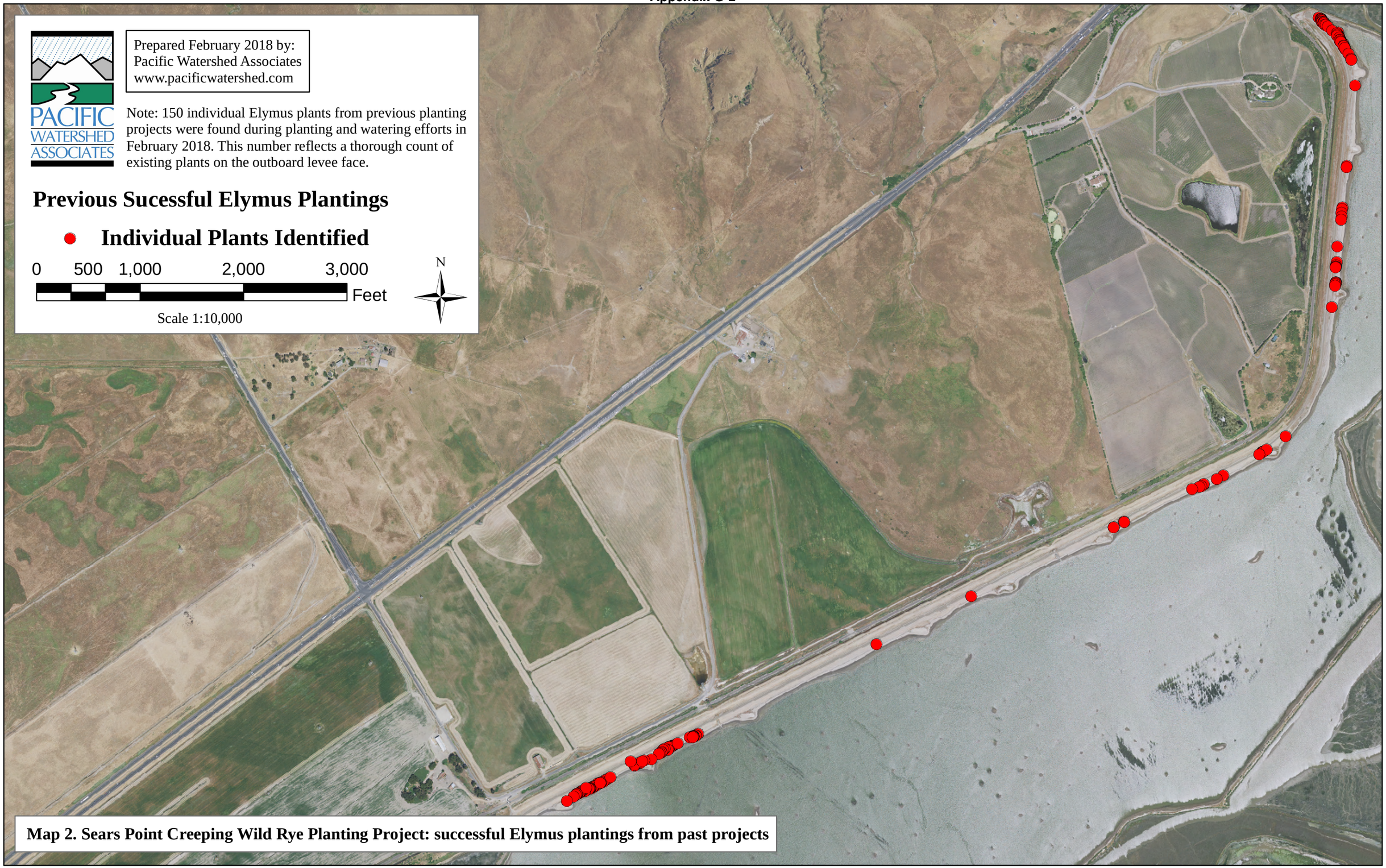
Tara Zuroweste, Professional Geologist #8418
taraz@pacificwatershed.com

Encl:
Map 1. Sears Point Creeping Wetlands and Watershed Restoration Project: Creeping Wild Rye Planting Locations.
Map 2. Sears Point Creeping Wild Rye Planting Project: successful Elymus plantings from past projects.
Appendix A. Representative project photos

cc: Danny Hagans, PWA (dannyh@pacificwatershed.com)



Map 1. Sears Point Wetlands and Watershed Restoration Project: Creeping Wild Rye Planting Locations



Map 2. Sears Point Creeping Wild Rye Planting Project: successful Elymus plantings from past projects

Appendix A

Representative Photos

Creeping Wild Rye (*Elymus triticoides*) Levee Planting Project Sonoma County, California

Photo 1. View to the South-west along the outboard levee face and lower levee plantings.

Photo 2. View Looking North-east along the outboard levee face and lower levee plantings.

Photo 3. PWA's Clay Allison planting *Elymus* plugs along the outboard levee.

Photo 4. PWA's Kyle Spongberg watering plantings during the dry January weather.

Photo 5. PWA's Kyle Spongberg planting *Elymus* plugs along the lower levee.

Photo 6. Planting in progress along the levee.

Photo 7. Flagging along the lower levee indicating the location of *Elymus* plugs.

Photo 8. View looking South-west along the levee face in the upper levee planting section. Note the white flagging, indicating the locations of rows of plugs planted vertically up the levee face.

Photo 9. An Elymus plug along the lower levee approximately 2 weeks after planting. Note the small green leaf in the right portion of the frame; a new sprout that emerged after several waterings.

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January 21, 2019

Sonoma Land Trust
Julian Meisler, Baylands Program Manager
julian@sonomalandtrust.org

Re: Final memo report of work for the **Creeping Wild Rye (*Elymus* triticoides) Levee Planting Project, Phase 2** as part of *Sears Point Wetlands and Watershed Restoration Project*, 2100 Highway 37, Sonoma County, California.

Introduction

At your request, the following memo provides a summary of the scope of work, methods, sourcing, and final costs to complete the *Creeping Wild Rye Levee Planting Project, Phase 2*, located at 2100 Highway 37, Sonoma County, California (Map 1). Included in this memo are representative location and site maps and figures (Maps 1-3; Figure 1), selected photographs (Appendix A), and actual project costs (Table 1). In addition, we've provided a LINK to download the GIS shapefiles for geographic locations of Phase 2 plantings.

Scope of Work

Sonoma Land Trust (SLT) approved Pacific Watershed Associates, Inc. (PWA) proposal dated 9 August 2018 and amendment dated 4 December 2018 to provide the scope of work (SOW) to implement the **Creeping Wild Rye (*Elymus triticoides*) Levee Planting Project, Phase 2** along approximately 2.5 miles (12,800 feet) of outboard levee within the wetlands restoration area of the *Sears Point Wetlands and Watershed Restoration Project*. Tasks included the following:

1. Conducted a field assessment to identify and layout harvest area(s).
2. Harvested *Elymus triticoides* sod and Saltgrass (*Distichlis spicata)* from predetermined areas of the property using a backhoe and mini excavator and stored materials at pre-determined location on Leonard Ranch.
3. Weedwhipped patches on the outboard levee face to remove existing vegetation prior to planting.
4. Transported harvested *Elymus triticoides* sod and *Distichlis spicata* from storage location to the levee using a pickup truck.
5. Planted 7,590 four-inch (4in) plugs of *Elymus triticoides* in clusters of 30 along 2.5 mi of the outboard face of the habitat levee at a predetermined elevation using 2-3 PWA staff. The truck followed the work crew along the levee and supplied sod for planting.
6. Planted 1,700 four-inch (4in) plugs of Saltgrass (*Distichlis spicata)* plugs in clusters of 20 along the highest observable wrackline along approximately 4,400ft of outboard levee face extending eastward from Pump 2.
7. Prepared and implemented an amendment to the original planting plan based on available time, harvested material, and budget to increase planting success and overall survival rate.
8. Mapped (using GPS) and flagged all planting sites following project implementation.
9. Prepared a post-project memo report of work, maps, and appendixes.
10. Project close out communications, prevailing wage documentation, and invoicing.

Methods

Project Purpose, Design, Layout, and Modifications

The purpose of the *Creeping Wild Rye (Elymus triticoides) Levee Planting Project, Phase 2* was to establish a self-sustaining population of *Elymus triticoides* and *Distichlis spicata* on the outboard face of the habitat levee at Sears Point (Maps 1-3). This outboard levee face represents the transitional habitat between tidal wetland areas and the terrestrial uplands that would naturally be found around the perimeter of the bay. Most of the surface of the levee is currently being farmed for oat hay, a strategy which SLT employed to help suppress invasive species colonization while seeking funding for large-scale plantings of native species. A long-term goal of SLT is to establish native vegetation on the entire levee, which PWA has helped implement over the past two planting seasons (Figure 1). *Elymus triticoides* and *Distichlis spicata* are two species commonly found within transitional habitat areas around San Francisco Bay. Both *Elymus* and *Distichlis* and are highly desirable because of their ability to suppress invasive species growth, provide valuable wildlife habitat, and because both grasses spread via rhizomatous growth and colonize areas well outside their original planting location.

PWA and SLT developed a planting scheme that takes advantage of the spreading nature of both grasses by employing a patchwork planting pattern in multiple clumps. This plan assumes that individual plants will spread overtime to create larger, homogenous patches of native grasses. Phase 2 of the *Creeping Wild Rye Levee Planting Project* specified that patches of 30 clumps of *Elymus* would be planted in rectangular patches spaced every 50ft along the outboard face of the levee from Pump 2 to the eastern terminus, and midway between the mean higher high water elevation and the crest of the levee. This would place the patches in the center of the levee, allowing for lateral growth both upslope and downslope from the planting location. The *Distichlis* portion of the planting specify that 20 clumps would be planted in patches spaced every 50ft along the wrackline near the base of the levee. Refer to Maps 2 and 3 and Figure 1 for the location and schematic of relative locations of planting. Under the scope of the original contract, both *Elymus* and *Distichlis* were to be planted from Pump 2 to the eastern terminus of the levee. The contract was amended on 4 December 2018 to include the planting of *Elymus* from Pump 2 to the western terminus of the levee, which would allow for planting along all 2.5 miles of outboard levee face.

As mentioned above, the original scope of the contract entailed planting *Elymus triticoides* and *Distichlis spicata* from Pump 2 to the eastern terminus of the levee. However, upon harvesting the *Distichlis*, it was determined that the rhizomes were less dense than had been estimated, and planting per the contract would have detrimentally affected the source area because more would need to be harvested. Verbal communication with SLT was made regarding this issue, and it was agreed upon that planting would extend as far as the preliminary harvest material reached before running out. Therefore, modifications were made to the extent and location of planting. PWA planted an additional 4,400ft of levee before exhausting the *Distichlis* that was harvested. The original scope of the contract as it relates to *Elymus* was implemented per the contract and was fully completed without issue.

Plant Harvesting

All *Elymus triticoides* and *Distichlis spicata* material was harvested from the open field adjacent to Pump 2 and from a drainage ditch north of the railway line near the railroad crossing, respectively (Maps 2 and 3). Harvesting of local *Elymus triticoides* and *Distichlis spicata* was conducted on 10 December 2018 and 2 January 2019 by PWA staff Steve Pye, Clay Allison, and Kyle Spongberg. United States Fish and Wildlife Service (USFWS) staff Jim Griffin and local farmer Craig Jacobson operated the heavy equipment needed to harvest the grass.

Excavation of *Elymus* sod was done by working the teeth and bucket under the rhizome layer approximately 3in below the ground surface and scraping large (5-6 ft^2) pieces of sod from the surface. The sod mats were approximately 3-4in thick and comprised of a dense combination of clay-rich soil and rhizomes. *Distichlis* was harvested from a drainage ditch along the paved road near the levee access road. A backhoe was used to excavate clumps of saltgrass to a depth of 18", which is where the highest density of rhizomes was observed. All harvest areas were backfilled with approximately 26 cubic yards of imported clay-rich organic soil and covered with a 1ft layer of rice straw to prevent weed growth. These sod mats were then transported to the storage area and kept moist under a tarp in a shaded area. All 1,000 ft^2 of *Elymus* sod was laid out on the ground in a single layer and cut into 4-6in squares (clumps) using machetes and hatchets before being placed in buckets and taken to the levee for planting. This harvesting method ensures rhizomes within the soil are protected from wind and sunlight within the soil and ensures that the sod can be easily identified and placed right-side-up in the planting holes.

Planting

Planting was conducted between 11 December 2018 and 8 January 2019 by PWA staff Clay Allison, Kyle Spongberg, and Steve Pye. Elymus planting on all 2.5 miles of outboard levee face was completed on 8 January 2019. Planting locations were delineated using a Keson measuring wheel to identify and flag locations every 50ft along the entire length of the levee. Weedwhips were then employed to remove existing annual grasses from the planting plot locations in 10ft x 20ft rectangles (i.e. "plot") centered around each 50ft flag marker, with the longer side of each plot running parallel to the length of the levee. A team of two PWA employees executed the planting scheme at each plot using a truck loaded with rhizome clumps and two trenching shovels. At each designated patch, 30 shallow holes were made for *Elymus* and 20 for *Distichlis*. A single clump of *Elymus* or *Distichlis* was then planted in each hole and backfilled with excavated soil (Photos 2, 8, and 9; Appendix A).

In all, exactly 7,590 individual plugs of *Elymus triticoides* were harvested and planted along 2.5 mi of the outboard face of the levee (Map 2). *Elymus* planting required approximately 121 labor hours (not including travel, field prep, etc.) and was completed using two PWA staff. A total of 1,700 plugs of *Distichlis spicata* were planted along the outboard levee face, beginning at Pump 2 and ending approximately 4,400ft to the east near the "Fish Tail" (Map 3). *Distichlis* planting required approximately 20 labor hours (not including travel, field prep, etc.) and was completed using two PWA staff.

Planting Conditions

Soil conditions along the levee were variable during project implementation; however, most plantings were installed in soils with substantial moisture content. Soil moisture overall was higher than during the previous Phase 1 planting project.

The project site received approximately 3.23 inches of rainfall[1] between 10 December 2018 and 8 January 2019 and soils along the levee west of Pump 2 reached total saturation. Ponding water was observed in many holes while planting, and standing water was present in many of these locations following the completion of planting. Soils along the eastern half of the levee east of Pump 2 were significantly more dry and heavy clays were present throughout many of the planting patches. Despite significant rainfall, survival and soil saturation will likely be lower in these eastern areas.

[1] http://cdec.water.ca.gov/jspplot/jspPlotServlet.jsp?sensor_no=7887&end=01%2F8%2F2019+10%3A16&geom=huge&interval=28&cookies=cdec01

Final Results, Mapping and Photo Documentation

In total, 9,290 plugs (7,590 *Elymus triticoides* and 1,700 *Distichlis spicata*) were planted on the outboard levee face during the implementation of this project (Maps 1-3). All patches of both *Elymus triticoides* and *Distichlis spicata* were marked using a Garmin handheld GPS unit. Geospatial data (GPS data) has been provided to the client as shapefiles and delivered via email[2]. In addition, yellow flagging was utilized to mark planting patches for both *Elymus triticoides* and *Distichlis spicata.* Planting patches west of Pump 2 were flagged both within the patch and at the top of the levee along the roadway to prevent sites from being lost in the event that the levee face is mowed or disced for vegetation management purposes. Along the remaining section of levee, flagging was only placed within the planting patches as the possibility of mowing or discing is less likely. Maps 1-3 provide general project location and site maps depicting locations of the harvest site, storage, site, and planting locations. Appendix A provides representative photos from the project and Figure 1 is a schematic of the Levee, which illustrates the relative locations of plantings on the outboard levee face and relative elevations for Phase 1 and Phase 2 planting.

Recommended Inspections, Maintenance, and Monitoring

PWA recommends SLT move forward with conducting post-planting monitoring to determine survival rates of the Phase 2 project, which may have a higher success rate than the Phase 1 project based upon planting locations and higher soil moisture and rainfall than was observed during Phase 1. This information may be valuable in determining the viability of the methods and specific levee planting locations utilized during the Phase 2 planting project.

As part of the post project monitoring, we recommend all planting locations (individual plugs) be visually inspected to determine the percentage of plants that have sprouted following the planting project. In addition, we recommend representative photos be taken and the locations of surviving plants be marked using a handheld GPS device with a horizontal accuracy of approximately 10ft. The sum total of these points could then be used to generate a total number of surviving plants and compared to the total number of plants installed during the winter of 2018-2019 to generate survival rates and overall project effectiveness for Year 1 of Phase 2. This data may then be compared to the survival rates identified during Year 1 monitoring of Phase 1 planting and utilized for the upcoming SERCAL [3]conference in April 2019.

Project Administration and Project Costs

The funding secured by SLT to implement this project, required compliance with Davis-Bacon Act and prevailing wage requirements. As the primary contractor, PWA (DIR#1000027167) was required to maintain compliance with Prevailing Wage requirements as dictated by Proposition 84 grant allocated funds. Additional project administration included, but was not limited to: (1) notify Contractor Compliance and Monitoring, Inc. (CCMI) prior to project initiation, submit contract award information, and complete the *General Prevailing Wage Checklist*; (2) pay staff prevailing wages for all labor tasks; (3) generate certified payroll records and provide copies to CCMI; (4) submit schedule of availability, notify California Apprenticeship Council, and pay apprentice fees; (5) schedule onsite

[2] PWA provided GIS shapefiles as an email Link to download GPS dataset for the Phase 2 project.

[3] Steve Pye from PWA submitted an abstract to present this project at the 2019 California Society for Ecological Restoration (SERCAL) Conference in Santa Barbara (http://www.sercal.org/sercal-2019-welcome)

interviews with CCMI and labor staff as requested; (6) supply proof of required paperwork to DIR and CCMI to verify compliance; and (7) be available for a project audit if requested.

Table 1 below summarizes total costs for the project. Actual costs include but may not be limited to in-kind match from Jim Griffin (USFWS) and local farmer Craig Jacobson; PWA prevailing and non-prevailing staff time, mileage, field materials, and overhead; equipment rental fees, and material costs. SLT in-kind match and/or other costs not specified above are not included.

Table 1. Final costs for the *Creeping Wild Rye Levee Phase II Planting Project*[1].

Cost Description	Units	Cost rate	Total Cost
PWA non-prevailing wage services			
PWA Principal Earth Scientist	2	$140.00	$280.00
PWA Senior Geologist	34.5	$115.00	$3,967.00
PWA Staff Scientist	70.5	$95.00	$6,697.50
PWA Physical Science Technicians	26	$85.00	$2,210.00
PWA prevailing wage services			
PWA Staff Scientist	106	$115.00	$12,190.00
PWA Physical Science Technicians	88.25	$105.00	$9,266.25
Materials and Operating Expenses			
Field materials (rice straw, Top Soil, tarps) includes delivery	1	$559.26	$3,229.98
Rental Equipment (weedwhps, pump)	1	$455.10	$648.00
Subcontracted Administrative Services/Apprenticeship Fees	6	$100.00	$531.99
Mileage	801	0.65	$520.65
PWA Overhead	-	20%	$7,908.37
US Fish and Wildlife In-Kind/Match Services			
USFWS Equipment operator	5	$225.00	$1,125.00
Backhoe (1 day rental)	1	$500.00	$500.00
		PWA Subtotal	$47,450.24
		USFWS In-Kind Match Subtotal	$1,625.00
		FINAL PROJECT TOTAL	**$49,075.24**

[1] Actual project costs do not include any SLT staff time (in-kind or other).

We assume this meets your needs at this time. If you have any questions or wish to discuss any elements of the final memo report, please feel free to contact us by email or phone at (707) 773-1385.

Sincerely,
PACIFIC WATERSHED ASSOCIATES INC.

Steve Pye, Staff Scientist
stevep@pacificwatershed.com

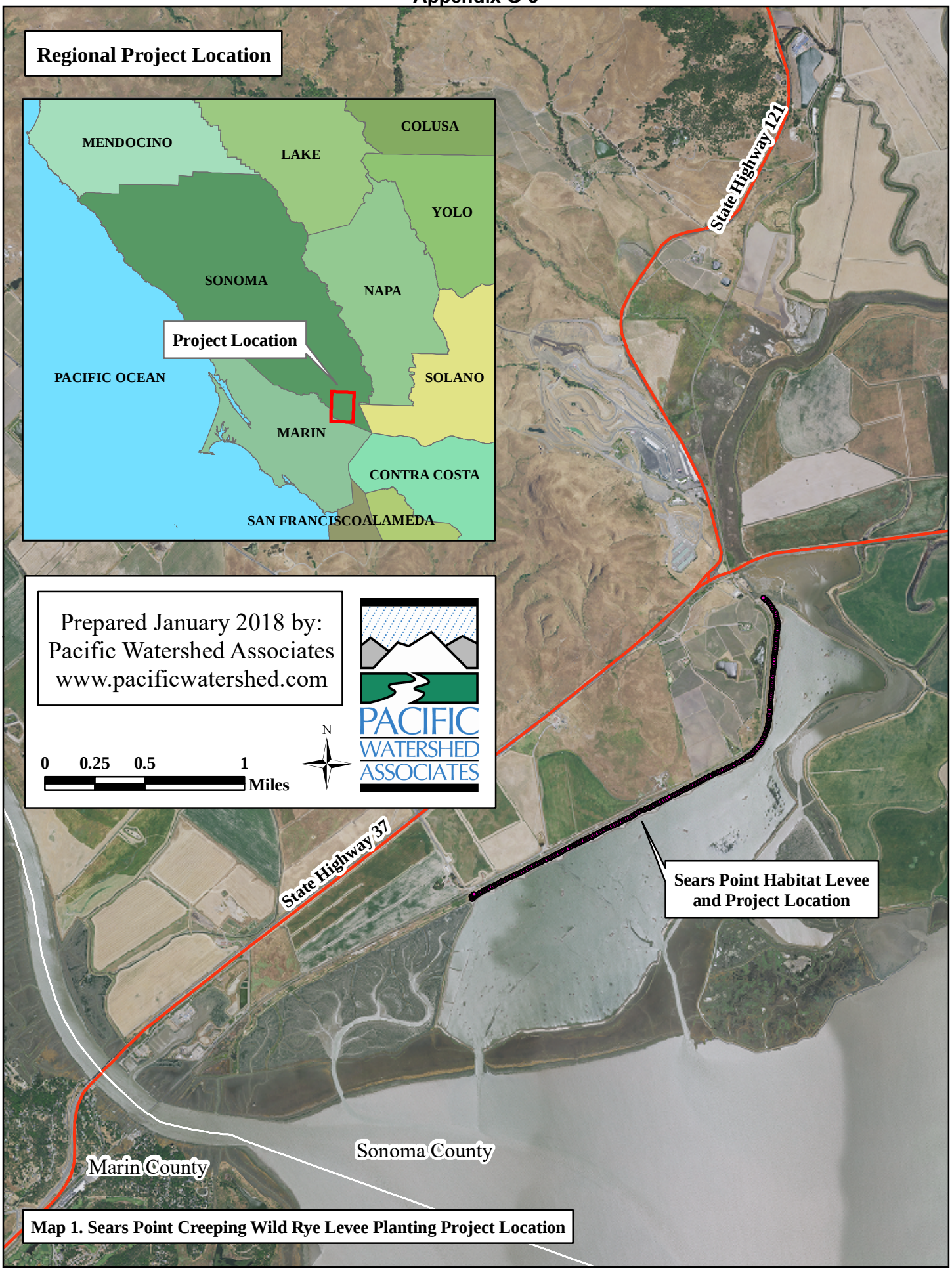
Tara Zuroweste, Professional Geologist #8418
taraz@pacificwatershed.com

Encl:

Map 1.	Sears Point Creeping Wetlands and Watershed Restoration Project: Regional Project location.
Map 2.	Sears Point Creeping Wetlands and Watershed Restoration Project: *Elymus triticoides* harvest, storage, and planting locations.
Map 3.	Sears Point Creeping Wetlands and Watershed Restoration Project: *Distichlis spicata* harvest, storage, and planting locations.
Figure 1	Sears Point Creeping Wild Rye Planting Project: Schematic of Levee Section and Planting Locations for Phase 1 and Phase 2 Projects.
Appendix A.	Representative project photos
GIS dataset.	Geographic locations of plantings (Email link provided to download shapefiles)

cc:

Danny Hagans, PWA Principal Earth Scientist (dannyh@pacificwatershed.com)



Map 1. Sears Point Creeping Wild Rye Levee Planting Project Location

Sears Point Levee Planting, Phase 2 Elymus Planting Locations

- **Elymus Planting Patches**

Note: each point on this map represents one planting patch, equal to 30 individual plugs. Planting locations depicted on this map are based upon field surveys of actual planting locations as distributed across the levee. In total, 7,590 Elymus plugs were installed on the outboard face of the levee, with 30 plugs in each patch.

Prepared January 2019 by:
Pacific Watershed Associates
www.pacificwatershed.com

PACIFIC WATERSHED ASSOCIATES

0 0.25 0.5 1 Miles

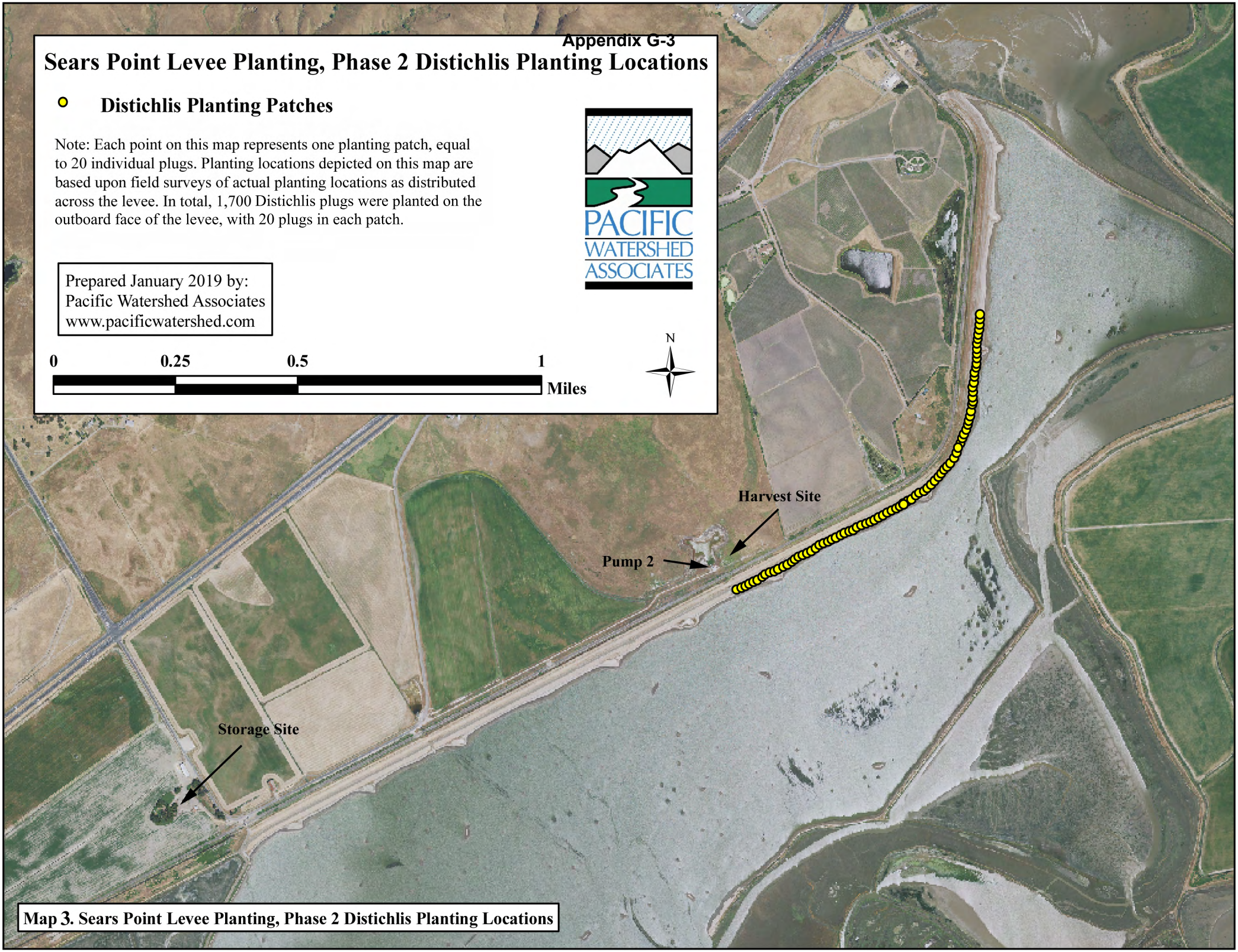
N

Harvest Site

Pump 2

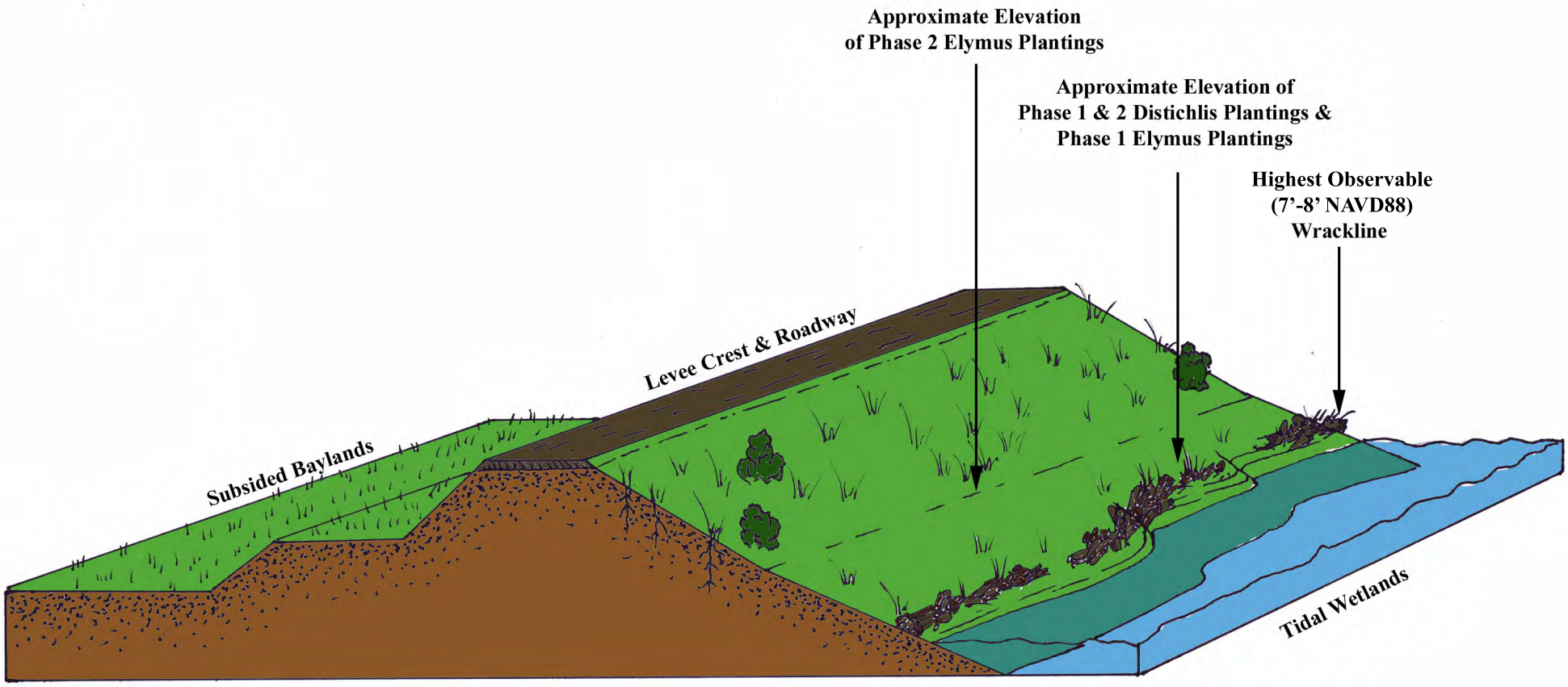
Storage Site

Map 2. Sears Point Levee Planting, Phase 2 Elymus Planting Locations



Map 3. Sears Point Levee Planting, Phase 2 Distichlis Planting Locations

Figure 1. Schematic of Levee Section and Planting Locations for the Creeping Wild Rye Levee Planting Project, Phases 1 & 2



Appendix A

Representative Photos

Creeping Wild Rye (*Elymus triticoides*) Levee Planting Project, Phase 2 Sonoma County, California

Photo 1. View to the east along the outboard levee face and planting area during week 1 of implementation.

Photo 2. View Looking Southwest along the outboard levee face and an unplanted patch.

Photo 3. View Looking Southwest along the outboard levee face and the truck loaded with rhizome clumps and planting buckets.

Photo 4. View looking east over the levee and the weed whipped planting patches.

Photo 5. View looking west over the levee and the planting patches.

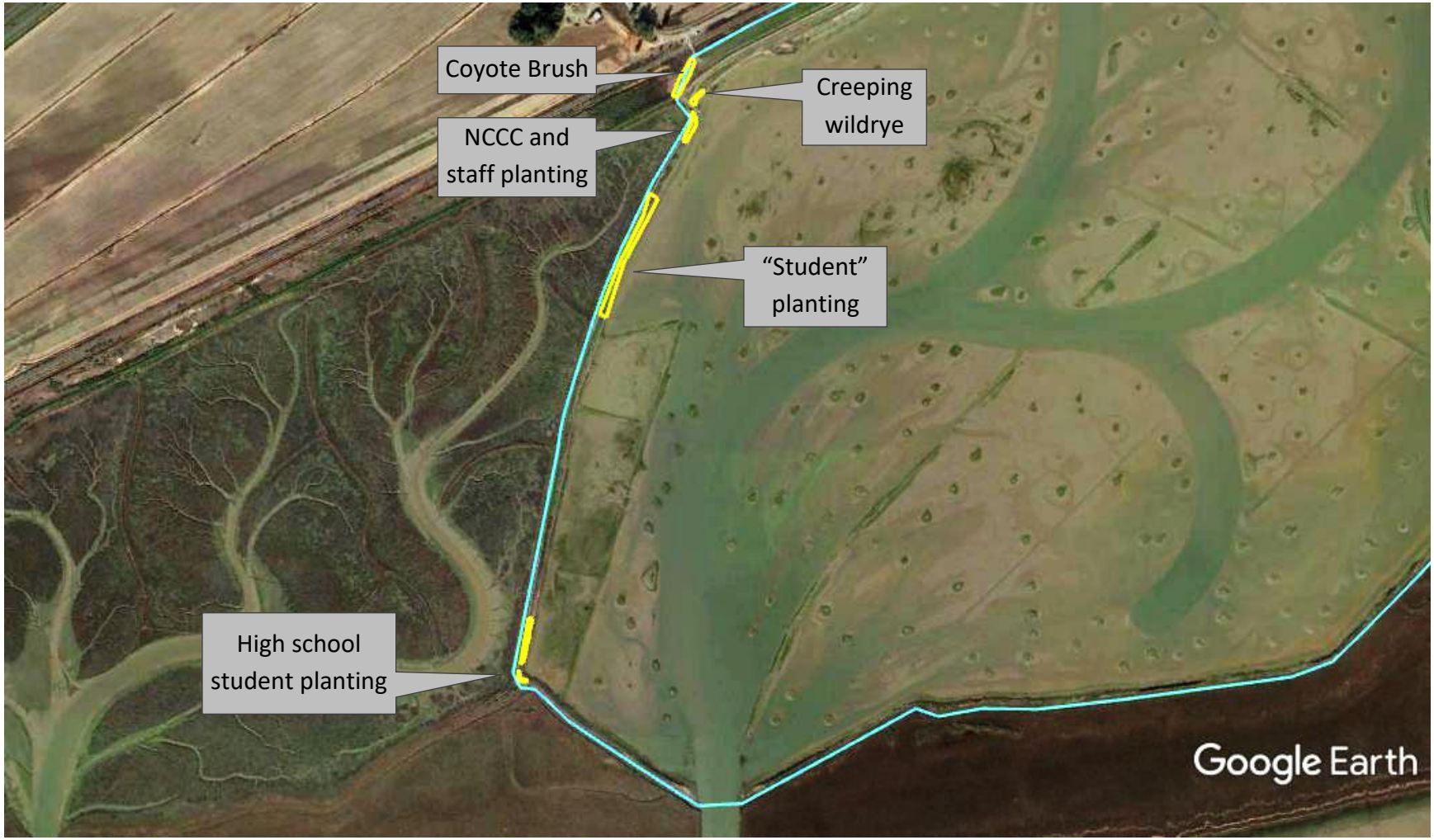
Photo 6. View looking down through the fog at a section of levee containing both *Elymus* and *Distichli*s patches.

Photo 7. Planting *Elymus* patches along the levee.

Photo 8. A representative photo of *Elymus* spouting out of a planting hole two weeks after planting.

Photo 9. A representative photo of *Elymus* spouting out an additional planting hole two weeks after planting.

Locations of STRAW Plantings, 2018 and 2019



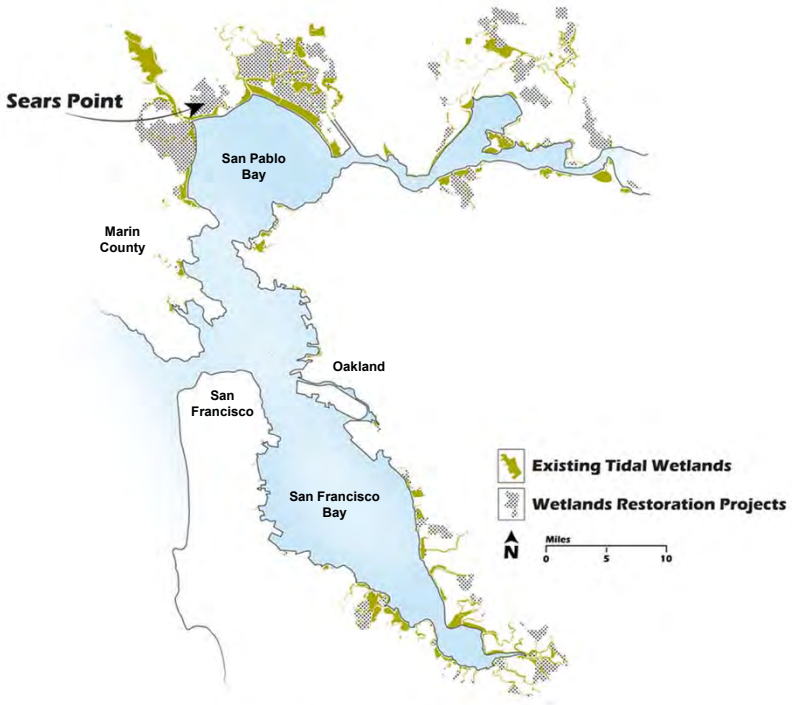
Rapid, Large-scale Rhizomatous Grass Plantings in San Francisco Bay Tidal Wetlands

Steve Pye

- **Owner of Spye General Engineering, *Professional Habitat Enhancement and Landscape Construction Services***

Photo by Steve Pye

Project Location

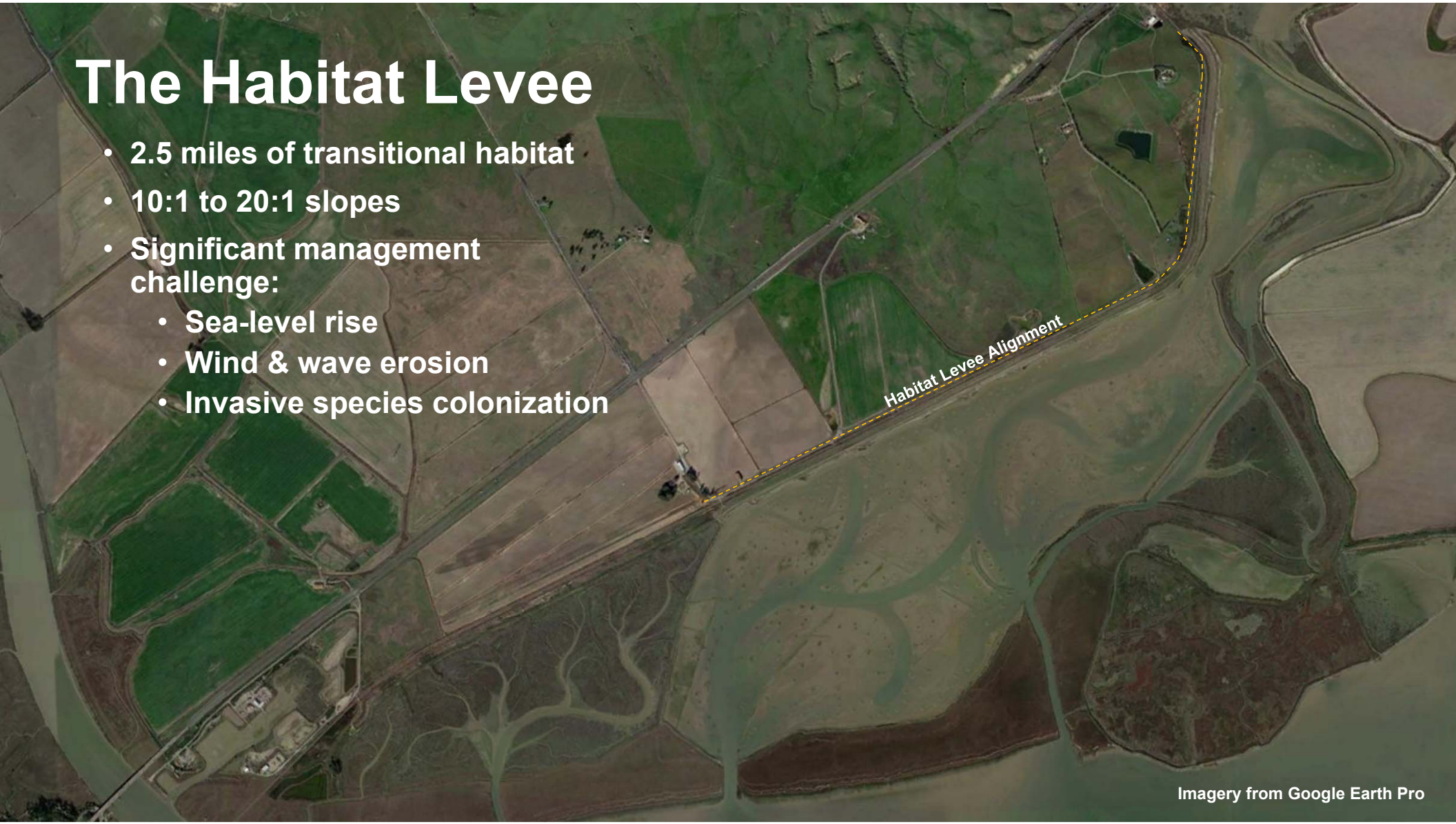


(Wetlands Spatial Data From CalAtlas Project Tracker)

Graphics by Steve Pye

Sears Point Wetlands and Watershed Restoration Project

- 2,300 Total acres
- Purchased by Sonoma Land Trust in 2005
- Includes a 960 acre tidal wetlands restoration project
- Owned by San Pablo Bay National Wildlife Refuge (SPBNWR)
- Managed by Sonoma Land Trust (SLT) & SPBNWR
- One of the largest tidal wetlands restoration projects in San Francisco Bay Region


The Habitat Levee
• 2.5 miles of transitional habitat
• 10:1 to 20:1 slopes
• Significant management challenge:
  • Sea-level rise
  • Wind & wave erosion
  • Invasive species colonization
Habitat Levee Alignment
Imagery from Google Earth Pro

SLT and SPBNWR's Management Strategy

- Interim oat hay farming
- Seeding of native grasses and forbs
- Natural recruitment of upland and intertidal native species
- Targeted broadleaf herbicide treatments in conjunction with…
- native grass plantings of Elymus triticoides and Distichlis spicata


Photo by Steve Pye

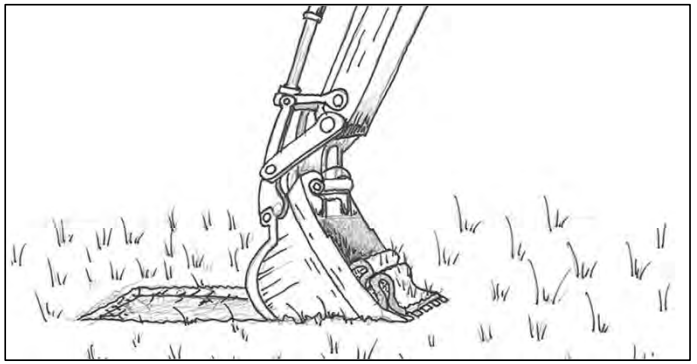
Elymus & Distichlis Plantings

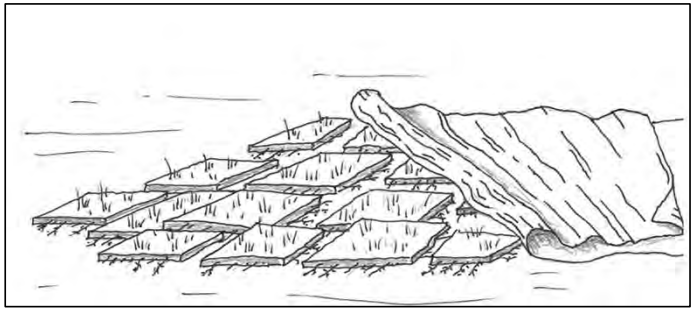
- **Project site has multiple large populations of both Elymus triticoides and Distichlis spicata**
- **Both species valued for their spreading growth habit, tolerance of high soil salinity, periodic inundation, habitat value, and ability to suppress invasive species colonization**
- **SLT & SPBNWR partnered with Pacific Watershed Associates for 2 seasons to implement 2 phases of plantings of *E. triticoides* and *D. spicata* along all 2.5 miles of the habitat levee**

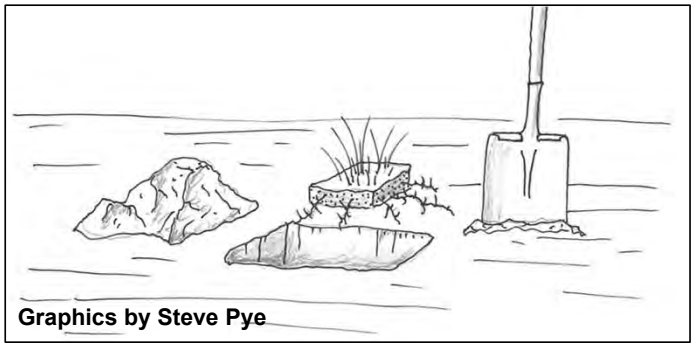
1

Planting Strategies

- **Harvest:**
  - **Mowing of source populations**
  - **Shallow excavation of sod mats**
  - **Soil backfill and weed prevention**
- **Storage:**
  - **Heavily shaded, cool, damp**
  - **Single layer sod under a large tarp**
  - **Weekly watering of sod mat**
- **Planting:**
  - **Processing of sod into clumps**
  - **Transportation to levee**
  - **Predetermined planting patches**
  - **Planting of 1 clump per hole**







Graphics by Steve Pye

Planting Phases 1 & 2 (2018 & 2019)

Phase 1

- Locations: Upper levee, lower levee and marsh pannes
- 4,000 Elymus clumps
- 200 Distichlis clumps
- Planting completed over 6 days
- Watered clumps 3 times after planting due to drought conditions

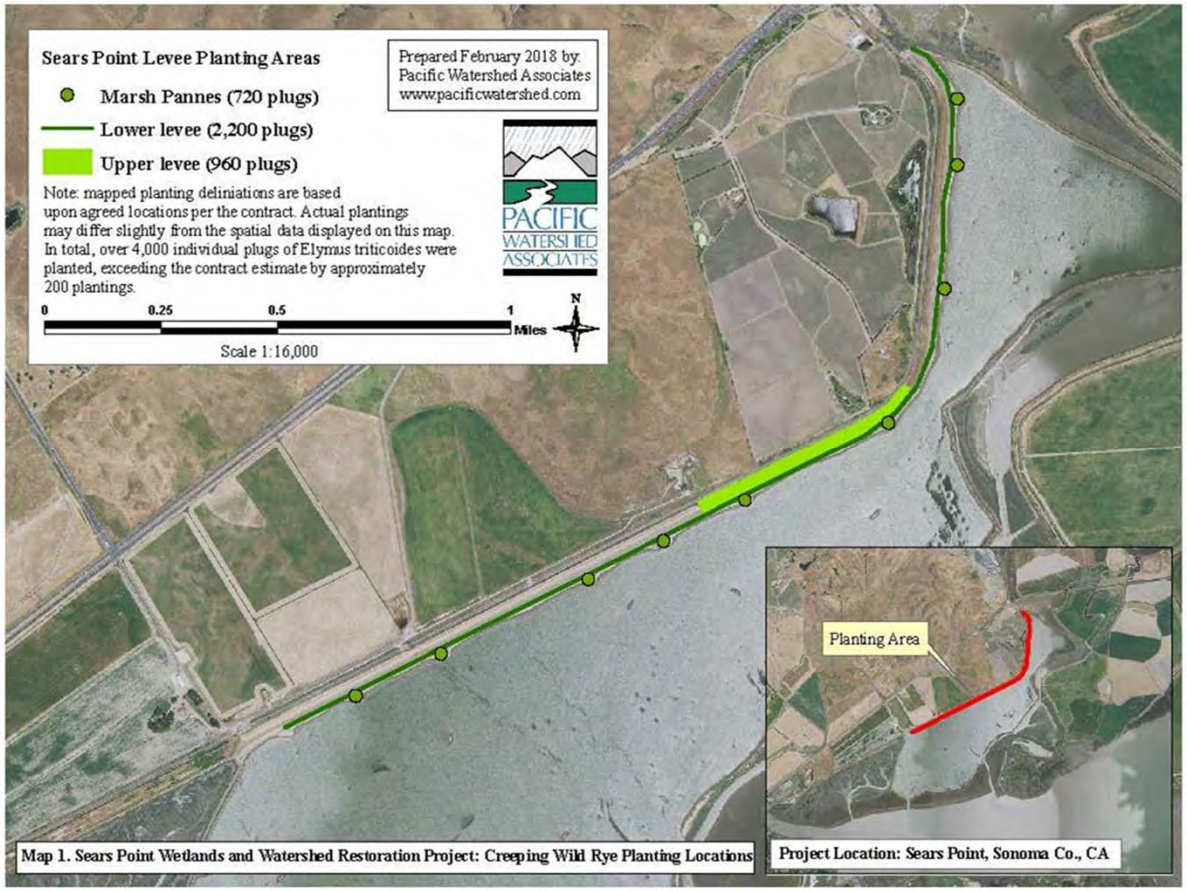

Photo by Steve Pye

Phase 2

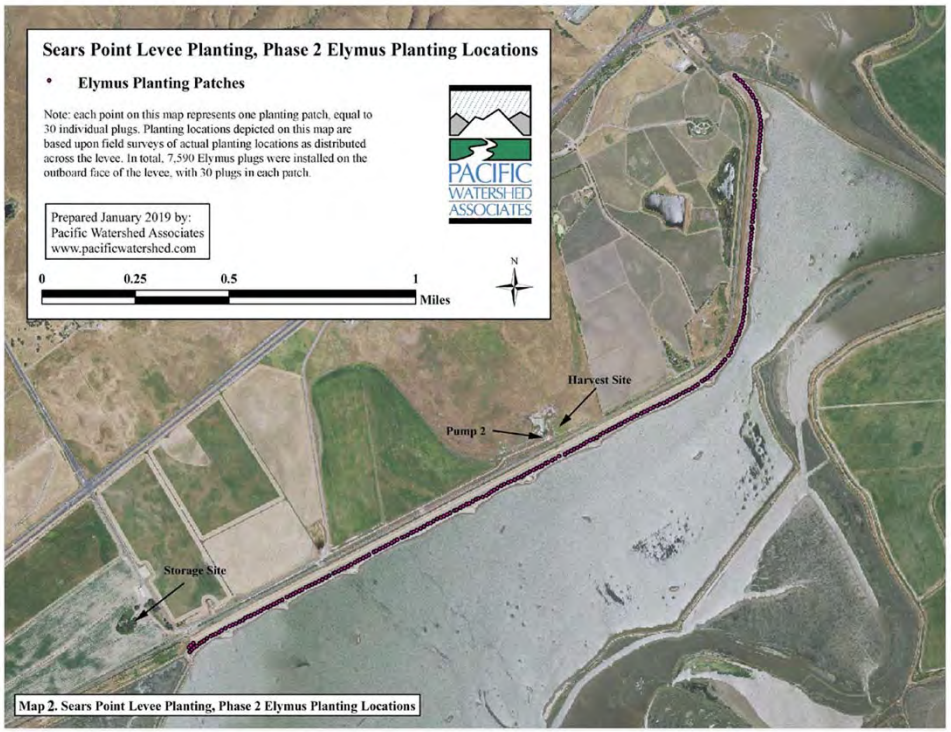
- Location: Mid-levee
- 7,590 Elymus clumps
- 1,700 Distichlis clumps
- 9,290 total individual plants
- Planting completed over 14 days
- Labor force of two to three staff
- Up to 1,000 plants per day

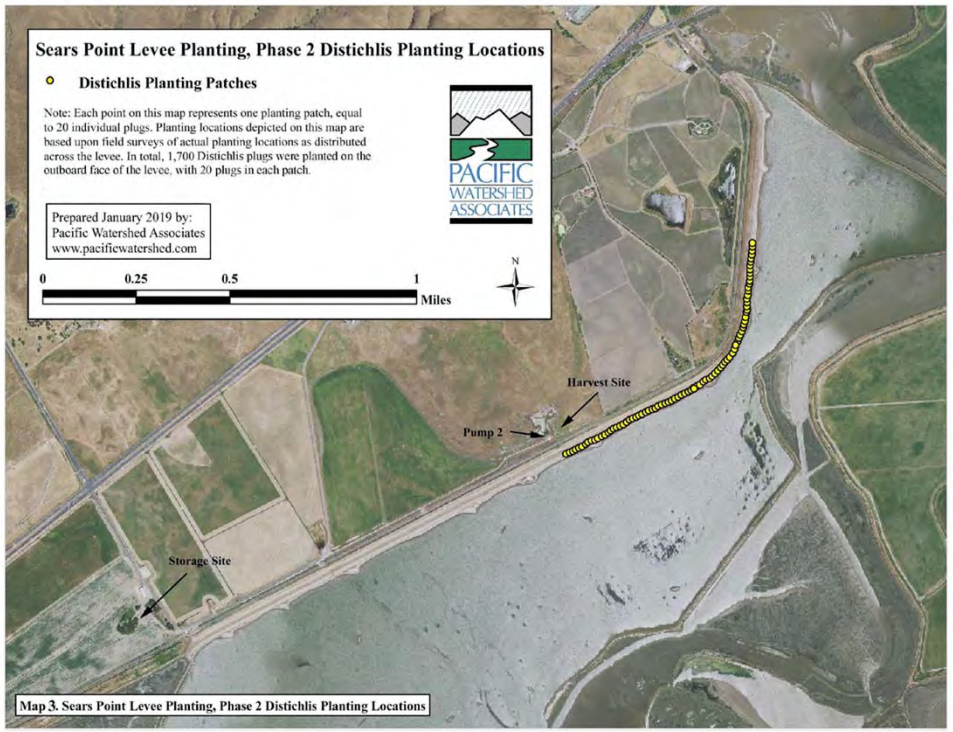

Photo by Steve Pye

Phase 1 Plantings



Phase 2 Plantings





Planting Results

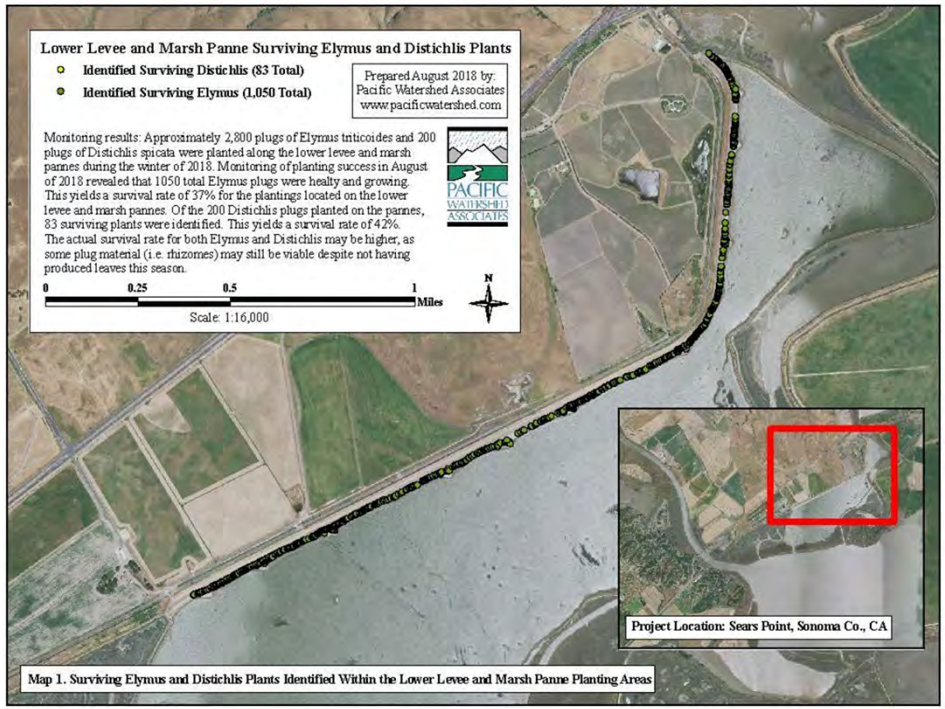
- **Phase 1 Planting**
- **Elymus survival rate of 32%**
- **Distichlis survival rate of 42%**

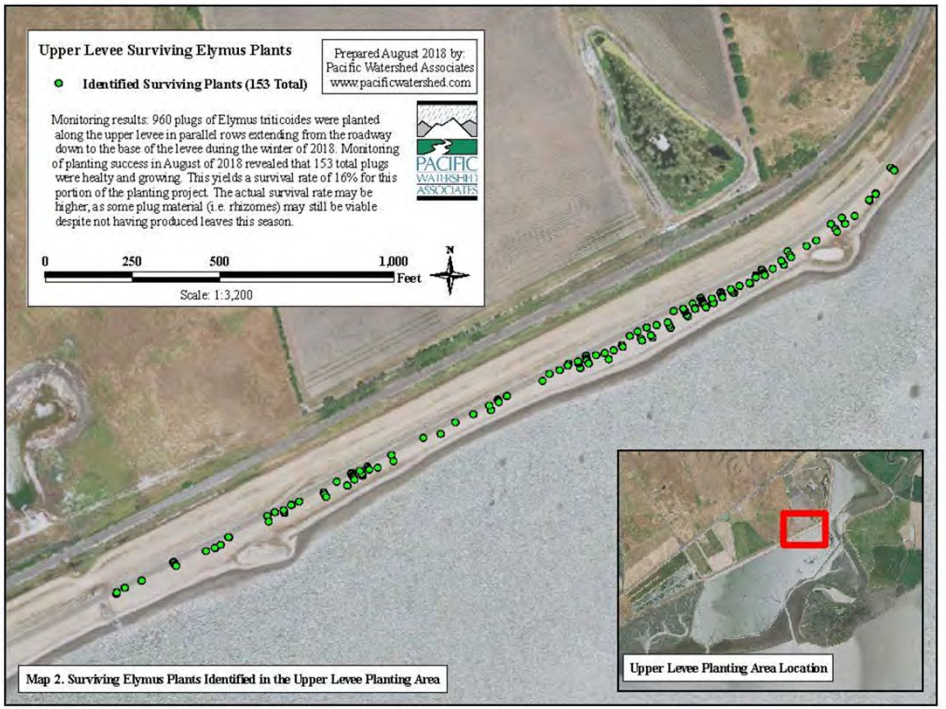

Photo by Steve Pye

- **Phase 2 Planting**
- **Preliminary Monitoring of 54 Elymus patches revealed a survival rate of 90%**
- **All surveyed patches had at least 20 plants growing**
- **Still to early to assess Distichlis success…**

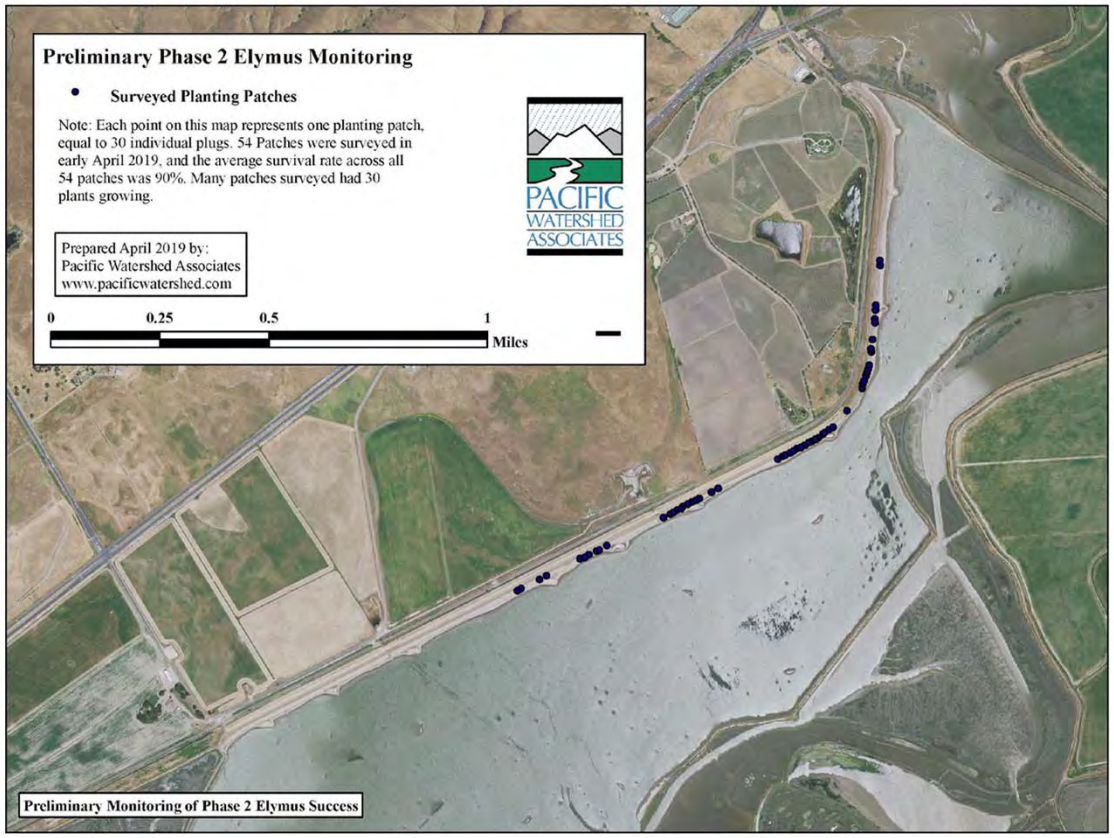

Photo by Steve Pye

Results: Phase 1 Success Monitoring





Results: Phase 2 Success Monitoring



Synopsis

- The key to planting efficiently and effectively was in the details
- Methods honed to save time, reduce cost, and ensure rhizome viability
- Methods allowed two people to plant nearly 10,000 plugs on 2.5 miles of levee in 2 weeks

Thank you!

Steve Pye

Owner, Spye General Engineering

Class A & C-27 Licensed Contractor

SPYE
GENERAL ENGINEERING
LIC # 1043953

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Photo by Steve Pye

Photo by Steve Pye

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January 17, 2020

Julian Meisler
Baylands Program Manager
Sonoma Land Trust
822 Fifth Street, Santa Rosa, CA

Subject: Sears Point Creeping Wild Rye Levee Planting Project, Phase III

Dear Julian Meisler,

Spye General Engineering (SGE) is pleased to provide the following report, which has has been compiled following the completion of work on the habitat levee within the Sears Point Wetlands (Dickson Unit). On January 15, 2020, Spye General Engineering's crew successfully completed the planting of 7,470 Elymus triticoides plants in predetermined areas between the Phase II patch locations on the full 2.5 miles of the levee. Additionally, a total of 2,595 Elymus triticoides were planted in vertical rows along to top of the levee extending from Pump 2 westward to the end of the habitat levee. This report documents the methodology and techniques used to complete these plantings, provides information regarding pertiment field observations and project metrics, and includes photographs, planting schematics, and basic maps to show the work that was done.

Please feel free to contact Steve Pye, Owner of Spye General Engineering, should you have any questions. You may contact me anytime by phone at (707) 666-5550, or by email at spyegeneralengineering@gmail.com.

Sincerely,

Steve Pye

Steve Pye
Owner of Spye General Engineering

Post-Project Report: Sears Point Creeping Wild Rye Levee Planting Project

Overview

In January of 2020, Sonoma Land Trust (SLT) hired Spye General Engineering to perform excavation and planting of rhizomatous Elymus triticoides on the bayward face of the habitat levee within the Sears Point wetlands (Dickson Unit). Harvest and Planting methodology during this project was the same as the methods employed during the Phase I and Phase II plantings conducted in 2017 and 2018. Planting for Phase III was performed between January 2nd and January 15th, 2020, during which time a total of 10,066 Elymus clumps were planted on the levee. 7,470 plants were planted in patches between the Phase II planting areas, and an additional 2,595 plants were installed along the upper levee in vertical rows extending from Pump 2 westward to the terminus of the habitat levee. These vertical rows were not a component of the Phase III proposal, but were installed as extra plantings in addition to the proposed plantings.

Elymus triticoides Harvest

Prior to planting, Elymus Triticoides rhizome material was harvested from the Pump 2 source population. United States Fish and Wildlife Service (USFWS) personnel mowed the standing grass and thatch within the harvest area prior to harvesting operations to make harvesting more efficient. A mini hydraulic excavator was used to excavate rhizome material (sod mats) and load the mats onto a trailer for transport to the storage area on Leonard Ranch that was used during the Phase I and II plantings. Shallow trenches that were created in the harvest area were backfilled with clay-rich organic potting soil and covered with 6”-8” of rice straw to reduce potential for colonization by invasive species. Material harvested at a later date for the extra plantings previously mentioned was done by hand using trench shovels. Sod mat perimeters were cut to a depth of 4”-6” using shovels, and then pried up using shovels and carried to a flat area where they could be processed into clumps for individual plantings. The excavation areas from these extra plantings were similarly backfilled and covered with rice straw.

Elymus triticoides Planting

7,470 Elymus triticoides plants (clumps of soil and rhizome derived from harvested sod) were planted in predetermined areas along the habitat levee between the patches planted during Phase II in 2018. These mid-levee plantings were done in the same convention as the levee plantings done in Phase II, for which patches of 30 plants were installed in patches spaced at fifty-foot intervals along the length of the levee. The phase III planting patches were installed between the patches planted in Phase II to effectively create a belt of continuous Elymus along the entire length of the levee.

Prior to planting, the precise planting locations were flagged using orange irrigation flags. Specific planting locations were determined by locating to mid point between the phase II planting patches and were identified by the yellow irrigation flags placed within each patch

during that project. Once planting patch locations were determined, all patches were weed whipped to remove thatch and existing grass. Patch sizes vary, but were made to be approximately 8’ wide (from base of levee to crest) and approximately 15’ long (east to west along the levee face).

Within each patch, 30 shallow holes were made using trench shovels. 3 rows of 10 holes were made in each patch. A single 4-inch clump of soil and rhizome was then placed in each hole and lightly covered with 1”-2” of soil to complete the planting. A total of 249 patches were successfully planted with 30 plants per patch, totaling 7,470 plants across the 2.5 miles of levee.

SGE’s crew completed the project planting ahead of schedule, and the decision was made between SGE, SLT, and USFWS to plant extra vertical rows along the upper portion of the levee in a similar manner plantings done in Phase I. These Phase I plantings were done in rows spaced every 25’ along the length of the levee from Pump 2 to to the “Fish tail.” 10 plants were installed in these rows during Phase I. The additional plants installed during Phase III were planted extending westward from Pump 2 to the terminus of the habitat levee. Instead of planting in single rows of 10 plants, SGE planted 3 rows of 5 plants every 25’ along the levee, or 15 total plants every 25’ along the levee. A total of 2,595 plants were installed using this planting scheme. These plantings were marked with an orange flag placed at the crest of the levee adjacent to the pathway. SGE ran out of orange flags during the planting and used green flags for several dozen of these rows near the separator levee.

Maps 1 and 2, attached, show the distribution of plantings completed during Phase III. Each patch, both mid-levee and the extra patches planted at the top of the levee, was marked using a Garmin handheld GPS. Map 1 shows the Upper Levee patches as white points, where as Map 2 shows the mid-levee patches across the entire levee.

Project Metrics & Planting Conditions

The 7,470 plants installed in patches of 30 between the phase II plantings were successfully planted in just 4.5 days with a crew of 3 laborers. A crew of 3 weed whipped and flagged all 249 patches over a 2 day period before planting began.

Planting began on Monday January 6th and was completed on Friday, January 10. An average of 58 patches were planted per day (1,740 plants), with each planting day requiring approximately 2 hours of processing time to break up sod mats into plantable clumps and load the 5-gallon buckets used to plant out each patch.

Soil conditions during the planting were notably more consistent than observed during the Phase I and II plantings. Soil moisture levels, especially along the upper levee, were observed to be more uniform and higher overall than observed during either of the previous years of planting. Weather during the plantings was largely sunny and dry, although several small rain events did occur during the project.

Many of the Phase I and II plantings were observed during the Phase II project, and it appears that survival overall for Phases I and II may be higher than was observed during recent monitoring efforts in 2019. Phase II patches containing surviving plants were

especially identifiable during the project. Numerous surviving rows of 10 plants were visible in many Phase II patches, as well as the Phase I vertical rows that were planted extending down from the crest of the levee.

Phase I, II, and III planting Overview

Over the past 3 years, a number of different planting patterns (spatial schemes) have been utilized. The following Figures provide a simple visual representation of how the habitat levee has been planted in Phases I, II, and III. Figure 1 shows a schematic of the levee, which has been divided into three sections based upon the specific planting patterns that define them.

During Phase 1, Elymus was installed along the base of the levee where 1 plant was installed every 5' for the entire length of the levee. Additionally, Elymus and Distichlis were planted along the perimeter of the marsh Pannes. Elymus was also planted in vertical rows extending from the top of the levee to the high water line for a short distance between Pump 2 and the "Fish Tail." Figure 3 shows each of these three planting schemes.

During Phase II, Elymus was planted in patches of 30 plants along the mid-elevation area of the levee. This planting pattern was done on all 2.5 miles of the levee. Distichlis was planted in the same manner during Phase II as well, although only 20 plants were installed per patch and these patches were only installed from Pump 2 to the "Fish Tail." The distichlis plantings were placed immediately below the Phase II Elymus plantings as shown in Figure 3.

During Phase III, Elymus was planted in the same convention as in Phase II, but shifted slightly along the length of the levee such that the gaps between the Phase II Elymus were closed by the Phase III plantings. This planting was done on all 2.5 miles of the levee as well. The additional Elymus plantings completed during Phase III were installed from Pump 2 to the separator levee in a similar convention to the vertical rows planted in Phase I. Figure 2 shows the section of levee that contains each of these Phase III planting layouts. Figure 4 is a representation of the eastern portion of the levee past the "Fish Tail" referred to as Section 3 in Figure 1. This portion of the levee does not have any plantings above the Phase II and Phase III patches of 30 plants. Sections 1 and 2 of the levee as shown in Figure 1, 2, and 3 have the highest density of plantings across the outboard face of the habitat levee. Section 2 of the levee is the most densely planted.

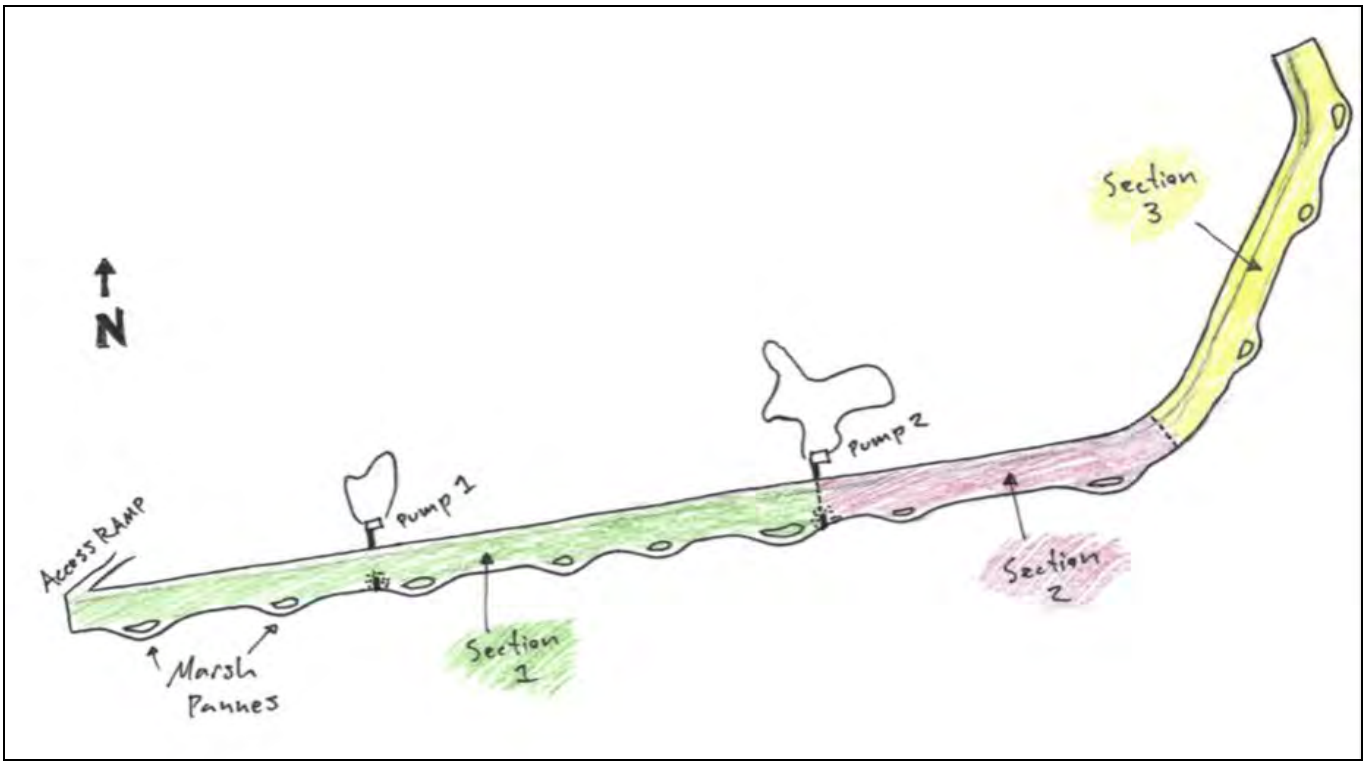


Figure 1: Schematic of the levee sections based upon different planting patterns.

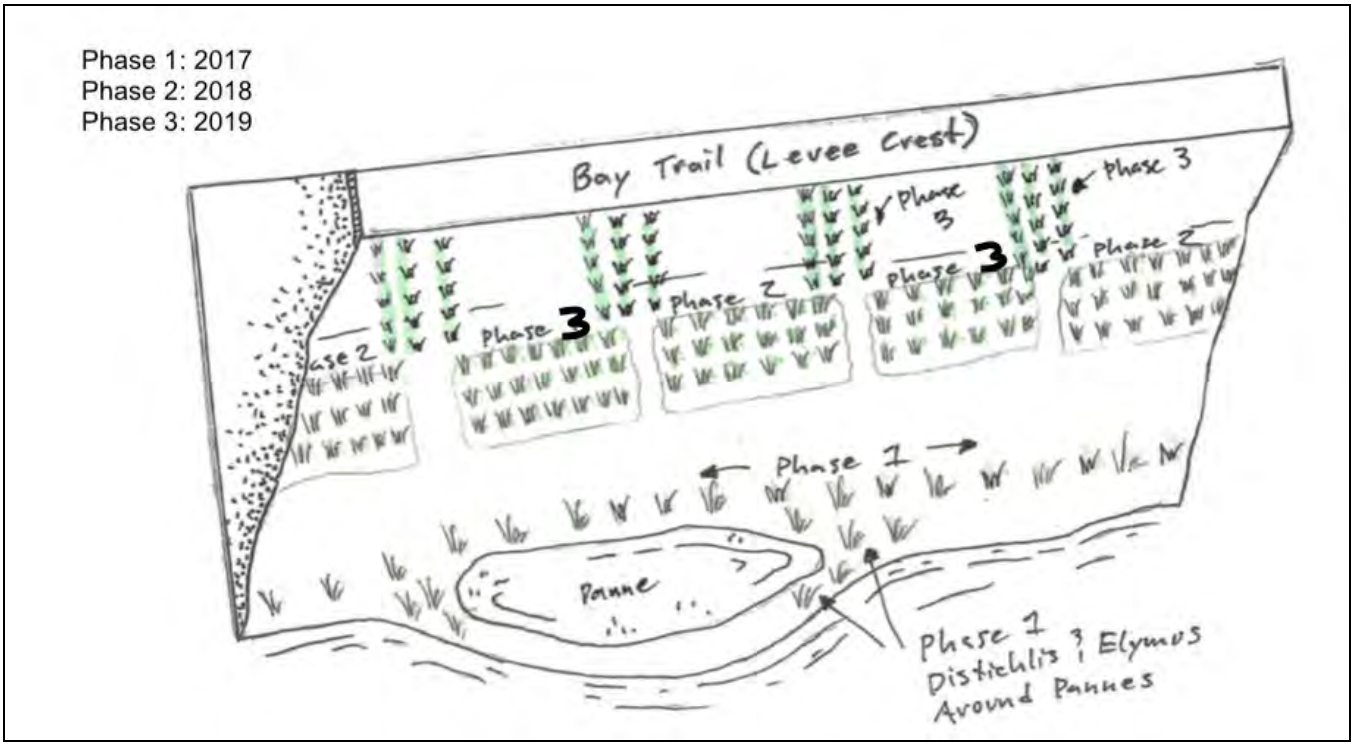


Figure 2: Levee Section 1 and associated planting patterns.

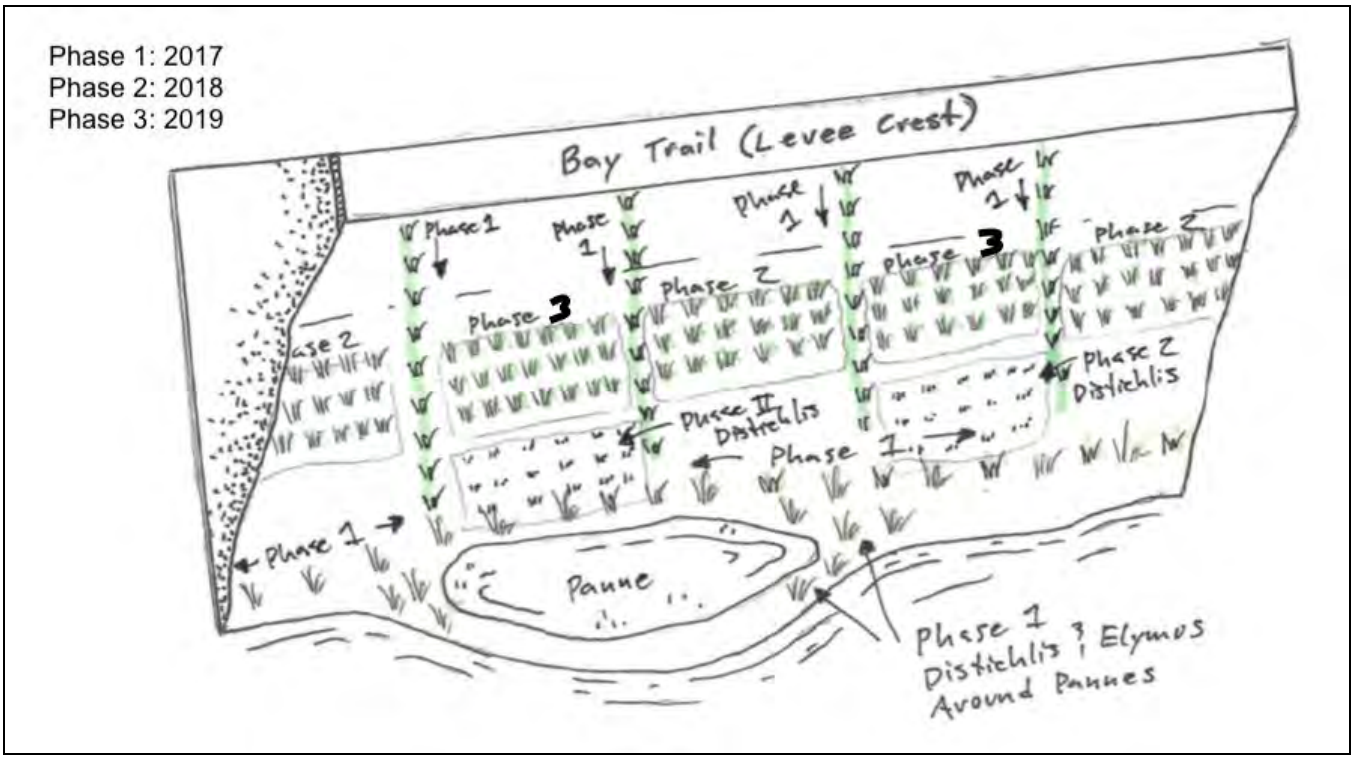


Figure 3: Levee Section 2 and associated planting patterns.

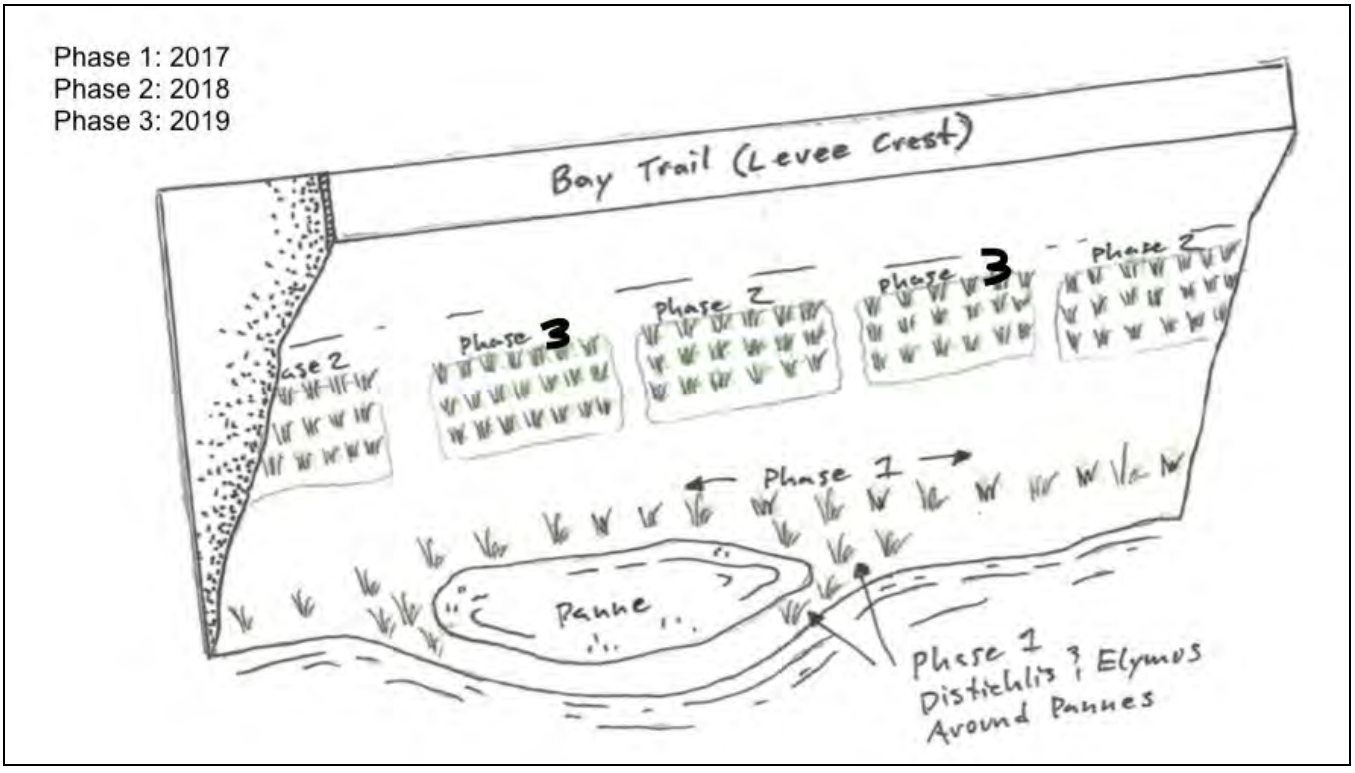


Figure 4: Levee Section 3 and associated planting patterns.

Photo 1. Harvest site after backfilling and prior to straw mulching.

Photo 2. Straw mulch application following soil backfill.

Photo 3. Weed whipping standing grass and thatch prior to planting.

Photo 4. Digging shallow holes in a planting patch ahead of the planting crew.

Photo 5. Planting of the mid-levee patches during a break between rain events.

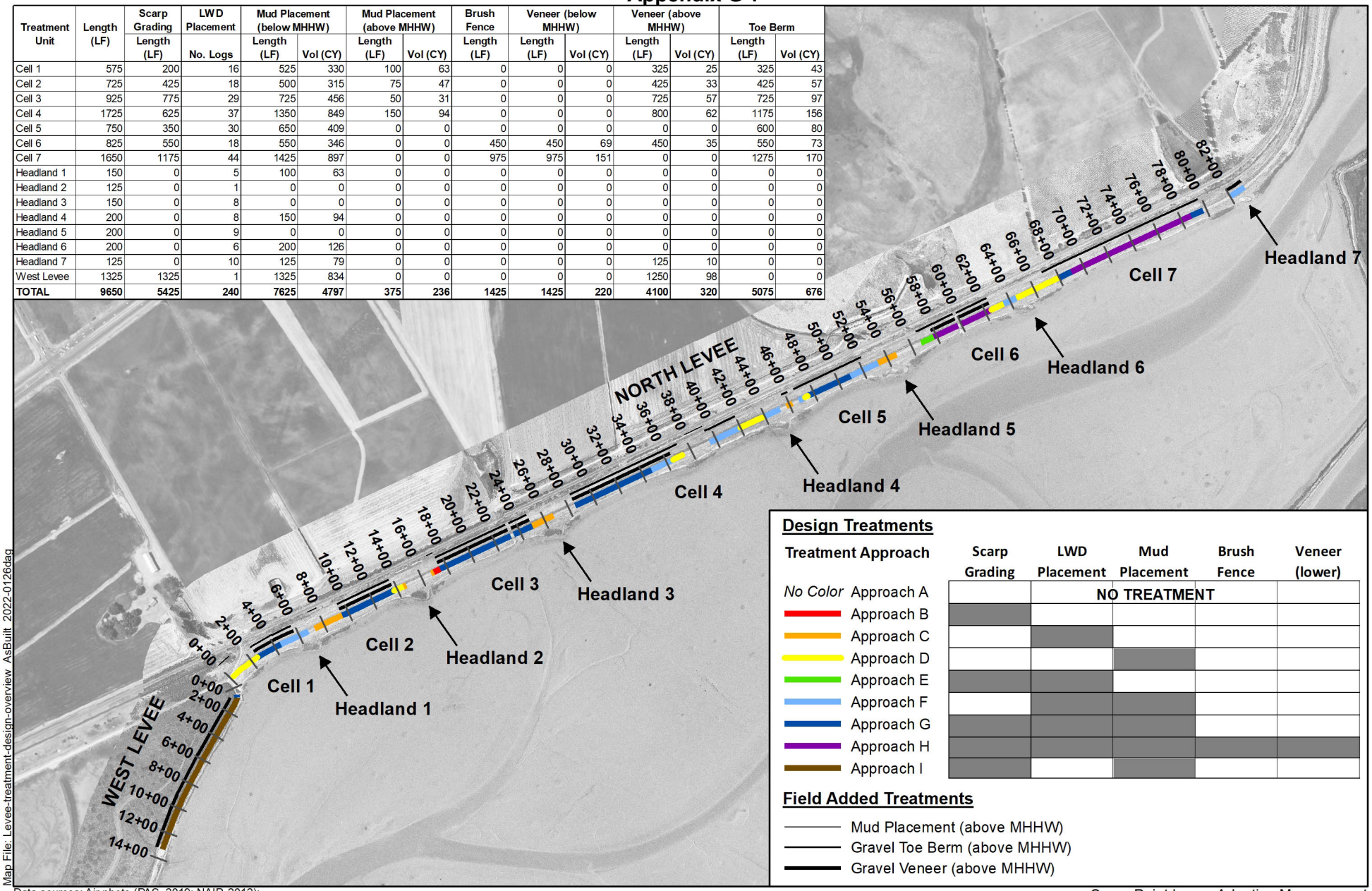
Photo 6. A Phase I Elymus plant inside a Phase III planting patch.

Photo 7. A representative planting patch post-planting.

Photo 8. A representative planting patch post-planting.

Appendix G-7

Treatment Unit	Length (LF)	Scarp Grading	LWD Placement	Mud Placement (below MHHW)		Mud Placement (above MHHW)		Brush Fence	Veneer (below MHHW)		Veneer (above MHHW)		Toe Berm	
		Length (LF)	No. Logs	Length (LF)	Vol (CY)	Length (LF)	Vol (CY)	Length (LF)	Length (LF)	Vol (CY)	Length (LF)	Vol (CY)	Length (LF)	Vol (CY)
Cell 1	575	200	16	525	330	100	63	0	0	0	325	25	325	43
Cell 2	725	425	18	500	315	75	47	0	0	0	425	33	425	57
Cell 3	925	775	29	725	456	50	31	0	0	0	725	57	725	97
Cell 4	1725	625	37	1350	849	150	94	0	0	0	800	62	1175	156
Cell 5	750	350	30	650	409	0	0	0	0	0	0	0	600	80
Cell 6	825	550	18	550	346	0	0	450	450	69	450	35	550	73
Cell 7	1650	1175	44	1425	897	0	0	975	975	151	0	0	1275	170
Headland 1	150	0	5	100	63	0	0	0	0	0	0	0	0	0
Headland 2	125	0	1	0	0	0	0	0	0	0	0	0	0	0
Headland 3	150	0	8	0	0	0	0	0	0	0	0	0	0	0
Headland 4	200	0	8	150	94	0	0	0	0	0	0	0	0	0
Headland 5	200	0	9	0	0	0	0	0	0	0	0	0	0	0
Headland 6	200	0	6	200	126	0	0	0	0	0	0	0	0	0
Headland 7	125	0	10	125	79	0	0	0	0	0	125	10	0	0
West Levee	1325	1325	1	1325	834	0	0	0	0	0	1250	98	0	0
TOTAL	**9650**	**5425**	**240**	**7625**	**4797**	**375**	**236**	**1425**	**1425**	**220**	**4100**	**320**	**5075**	**676**



Design Treatments

Treatment Approach	Scarp Grading	LWD Placement	Mud Placement	Brush Fence	Veneer (lower)
No Color Approach A		NO TREATMENT			
Approach B	■				
Approach C		■			
Approach D			■		
Approach E	■	■			
Approach F		■	■		
Approach G	■	■	■		
Approach H	■	■	■	■	■
Approach I	■		■		

Field Added Treatments

- Mud Placement (above MHHW)
- Gravel Toe Berm (above MHHW)
- Gravel Veneer (above MHHW)

Map File: Levee-treatment-design-overview_AsBuilt_2022-0126dag

Data sources: Air photo (PAS, 2019; NAIP, 2012);
Design data (SE, 2022)

1:12,000 (1" = 1,000' at letter size)

0 500 1,000 Ft

0 150 300 M

Sears Point Levee Adaptive Management

Figure 9

Adaptive Management Treatment Overview