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Development and Interim Management Plan for the Twitchell Island Wetland Enhancement and Restoration Project, Sacramento County, California



PREPARED FOR

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Cover photo: The Twitchell Island Wetland Enhancement and Restoration Project existing site conditions for livestock grazing (October 2, 2023; Stillwater Sciences).

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1 INTRODUCTION

1.1 Project Overview

The California Department of Water Resources (DWR), through a contract with Reclamation District 1601 (RD 1601) and in consultation with the California Department of Fish and Wildlife (CDFW), is proposing to restore and enhance wetland and riparian habitat on Twitchell Island in Sacramento County, California. RD 1601, formed in 1914, is responsible for operation and maintenance of the levees around the perimeter of Twitchell Island. Much of the island has been farmed since the early 1900s and the levees have continued to be built up as the associated farmland subsidies. In the early 1990s, DWR purchased approximately 90 percent of Twitchell Island to benefit water quality and create wildlife habitat.

The Twitchell Island Wetland Enhancement and Restoration Project (Project) proposes to create approximately 40 acres of wetland habitat (enhancement) and approximately 80 acres of Riparian Forest and Scrub-shrub habitat (advance mitigation) within a 180-acre Project area footprint on Twitchell Island, with approximately 60 acres remaining under the current grazing/agricultural use. The Project would plant native riparian tree and shrub species with a native grass understory, as well as redistribute onsite soil to create a mosaic of shallow open-water habitat, habitat islands, and emergent wetland communities. Additionally, the Project would construct shallow swales, incorporate water control structures for water delivery, and include management within the improved wetland units. Once complete, the Project would result in a net increase in wetland acreage, resulting in improved aquatic resource functions and services onsite.

The purpose of the Project is to provide high-quality and cost-effective habitat for Delta Levees Special Flood Control Projects Program (Delta Levees Program or “DLP”) participants. Reclamation districts responsible for maintenance of levees throughout the Delta participate in the DLP. Reclamation districts that receive funding from DLP for levee maintenance and improvement work are required to have nonet long-term loss of riparian habitat and a net long-term habitat improvement for that work. CDFW oversees those mandates outlined in the California Water Code (CWC), and along with DWR, sees an advantage in addressing them programmatically. The Project would offset future impacts associated with levee maintenance and improvement work implemented through DLP and, thereby, help satisfy the no net loss of riparian habitat mandate provided in CWC Sections 12314(c) and 12987(c) and the net long-term habitat improvement mandate provided in CWC Sections 12314(d) and 12987(d).

This Development and Interim Management Plan (Plan) summarizes the goals and objectives for developing enhancement and advance mitigation acreage at the site; provides planting and irrigation plans with details on materials and implementation methods; outlines maintenance activities; and includes a monitoring plan to track Project success throughout the estimated three-year interim management period. Following completion of the interim management period, the site will enter long-term maintenance under a Long-term Management Plan, to be developed.

1.2 Project Location and Existing Conditions

The Project is located on Twitchell Island approximately three miles southeast of Rio Vista in the San Joaquin-Sacramento Delta in southern Sacramento County (Figure 1). The Project area encompasses approximately 180 acres, located on two parcels (APN #s 157-0130-022-0000 and 157-0130-006-0000) owned by DWR. This area forms part of the northern boundary of the 3,500-acre Twitchell Island. The Project area is bounded on the north by Twitchell Island Road and Seven Mile Slough and on the east by Twitchell Island Ferry Road (a.k.a., Center Road). The latitude and longitude of the approximate center of the site are 38.114785, -121.657261.



Figure 1. Overview of the Project area.

1.2.1 Historical and current land use

Historically, what is now Twitchell Island was primarily tule marsh with some Riparian Forest. In approximately 1869, levees were constructed that ultimately formed Twitchell Island. Much of the island has been farmed since the early 1900s and the levees have continued to be built up as the associated farmland subsided. The island's hydrology has been heavily altered, divided by a network of irrigation canals used for flood irrigation of agricultural lands. The Project area was farmed for corn and sunflowers for many years prior to becoming primarily pastureland. In the early 1990s, DWR purchased approximately 90 percent of Twitchell Island, including the Project area, to benefit water quality and create wildlife habitat. The Project area has been and continues to be used for agriculture and grazing for cattle and sheep, often flood-irrigated via a siphon pump drawing water from Seven Mile Slough. Other historic uses that continue today are natural gas production from gas wells located on the island and recreation based out of Owl Harbor marina along Seven Mile Slough.

Part of the Project area is in conservation under the Williamson Act (Williamson Land Conservation Agreement 72-AP-092). The Board of Supervisors of Sacramento County has recorded receipt of DWR's application to remove the parcels from Williamson Act conservation.

1.2.2 Topography and soils

The Project area is generally below sea level due to land subsidence following levee construction and maintenance. Elevations within the Project area range from approximately -5 feet along portions of the northern border to approximately -20 feet along the southern border (elevations are relative to the National Geodetic Vertical Datum 29 [NGVD29]). A V-ditch runs east and west along the northern border of the Project area and was historically used for flood-irrigating the land to support livestock grazing. Minor ridges are oriented north-south within the Project area to confine flood irrigation within narrower strips. A drainage canal runs along the south and western borders (Figure 2).

Soils on Twitchell Island generally consist of approximately 70 feet of unconsolidated material, with the upper 10–35 feet being organic-rich silts, clays, and/or peatlands, with an underlying sand layer at least five feet thick (Applied Water Resources 2015). Soils on more than half of the Project area are classified as Scribner clay loam, approximately one-quarter is classified as Gazwell mucky clay, just under one-quarter is classified as Rindge mucky silt loam, and a small area near the northwest corner is classified as Sailboat silty clay loam (USDA 2023) (Figure 2).

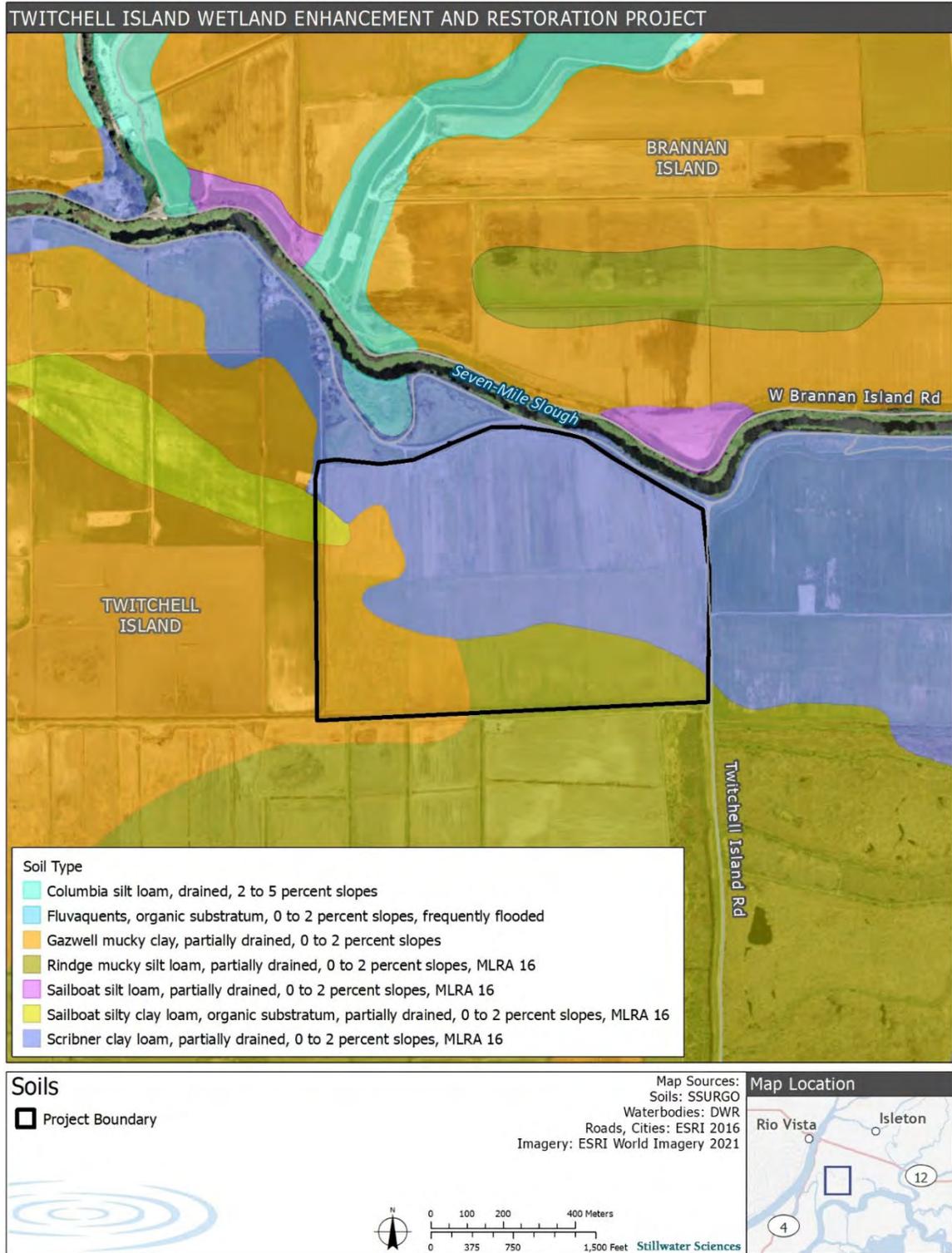


Figure 2. Soil types in the Project area.

Scribner clay loam is classified as a hydric soil based on the criteria that it is “frequently flooded for long or very long durations during the growing season” (USDA 2023). According to the USDA soil survey reports, Scribner clay loam soil pH is neutral to slightly alkaline, at 7.0 to 7.8 in the upper 12 inches, and 8.0 to 8.2 in the lower portion of the profile; salinity in the upper 20 inches is 0 decisiemens per meter, but 0.020 decisiemens per meter below 20 inches depth. Below 8 inches, the saturated hydraulic conductivity is estimated at 0.42 to 1.40 micromols per second, which is analogous to a very low permeability class (USDA 2023). The vertical profile for this soil type includes clay loam soils (0-51 inches) above sandy clay loam subsoils.

Gazwell mucky clay is classified as a hydric soil based on the criteria that it is “tidally-influenced, freshwater” (USDA 2023). According to the USDA soil survey reports, Gazwell mucky clay soil pH is moderately acidic, with a pH of 6.0 in the upper 30 inches, and 5.0 to 6.0 in the lower portion of the profile. The vertical profile for this soil type includes mucky clay soils (0–36 inches) above broken face sapric material.

Rindge mucky silt loam is classified as a hydric soil based on the criteria that it is “tidally-influenced, freshwater” (USDA 2023). According to the USDA soil survey reports, Rindge mucky silt loam soil pH is slightly acidic, at 5.8 to 6.2 throughout the profile. The vertical profile for this soil type includes black muck soils (0–8 inches) above black mucky peat subsoils.

Sailboat silty clay loam is classified as a hydric soil based on the criteria that it is “freshwater” (USDA 2023). According to the USDA soil survey reports, Sailboat silty clay loam soil pH varies from acidic to alkaline (pH of 6.5 to 7.8) in the upper 28 inches, and moderately alkaline (pH of 8.2 to 8.4) in the lower portion of the profile. The vertical profile for this soil type includes silt loam soils (0–28 inches) above clay loam and loam subsoils.

1.2.3 Hydrology

Twitchell Island is located approximately two miles east of the Sacramento River and is surrounded by levees that separate it from Sevenmile Slough, Threemile Slough, and the San Joaquin River. These rivers and sloughs are the primary source of groundwater recharge and surface water on the island. Precipitation, irrigation water, and surface water from nearby rivers and sloughs all contribute to the shallow groundwater table, which is heavily managed by pumping stations, drainage ditches, and siphons (Applied Water Resources 2015).

Within the Project area, there are approximately 2.53 acres of wetlands of the U.S./State (DWR 2014). Plant species that are indicative of wetland conditions are dominant in parts of the Project area that are subject to flooding for extended periods of time during the growing season. Common plants in those areas include tall flatsedge (*Cyperus eragrostis*), pale smartweed (*Persicaria lapathifolia*), spotted lady’s thumb (*Persicaria maculosa*), Italian ryegrass (*Festuca perennis*), knotgrass (*Paspalum distichum*), rabbits foot grass (*Polypogon monspeliensis*), and cursed buttercup (*Ranunculus sceleratus*) (DWR 2014).

1.2.4 Vegetation

The dominant vegetation type within the Project area is Pastures and Crop Agriculture that has been primarily utilized for cattle grazing (Figure 3). Vegetation within the grazed areas is generally dominated by non-native grass and forb species and includes Bermuda grass (*Cynodon dactylon*), foxtail (*Hordeum murinum* subsp. *glaucum*), Johnson grass (*Sorghum halepense*) bluegrass (*Poa secunda*), milk thistle (*Silybum murinum*), yellow star thistle (*Centaurea solstitialis*), Italian thistle (*Carduus pycnocephalus*), bull thistle (*Cirsium vulgare*), clovers

(*Trifolium* spp.), red-stemmed filaree (*Erodium cicutarium*), docks (*Rumex* spp.), and knotweeds (*Persicaria* spp.). Cattle graze the site and maintain the vegetation to a short lawn-like stature, but do not graze various spiny thistles that grow up to five feet tall in areas. Cattle fencing surrounds the site, and a ditch on the western border is dominated by Himalayan blackberry (*Rubus armeniacus*).

A narrow strip on the eastern border of the Project area is outside of the grazing land and is classified as Annual Grasses and Forbs. Species composition is similar to that in Pastures and Crop Agriculture but given that this area does not receive flood irrigation, there is low to no cover of some of the more mesic species (e.g., Bermudagrass, Johnson grass, bluegrass, docks, and knotweeds).

No special-status plant species were identified during botanical surveys (DWR 2015).

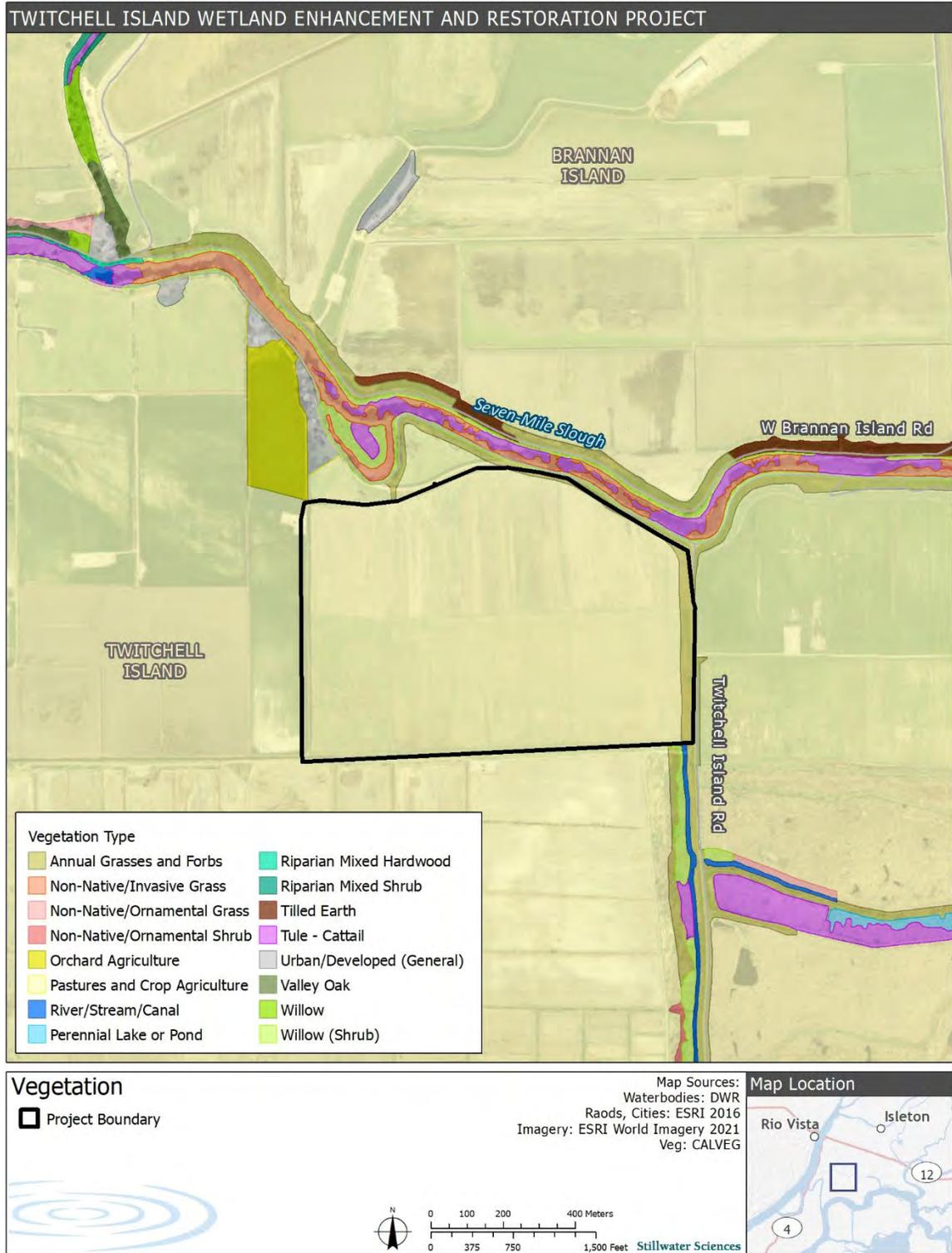


Figure 3. Existing vegetation types in the Project area.

1.3 Opportunities and Constraints

1.3.1 Landscape context

Twitchell Island is situated at the southwestern extent of Sacramento County and is shown on the Jersey Island and Bouldin Island USGS topographic quadrangle (T3N, R3E, un-sectionalized portion of Twitchell Island). The Island is on the western end of the Delta, approximately 3.5 miles south of the City of Isleton, southeast of the city of Rio Vista, and very close to the San Joaquin-Sacramento River confluence. Parks and open agricultural lands occupy most of the surrounding islands. Since the majority of Twitchell Island is state-owned, many if not all the parcels surrounding the Project area would be managed as natural lands. Thus, this project is located in a larger landscape context that offers patches of diverse natural habitat. Immediately adjacent to the Project area is a recent restoration of Riparian Forest and Scrub-shrub habitat along Seven Mile Slough and several other recently restored or enhanced sites on Twitchell Island are close by. These lands surrounding the Project area are wetland, pasture, agriculture, Riparian Forest, Scrub-shrub, and fallow.

There are many other open and natural lands within a 5-mile radius of the Project area, including upland ruderal grasslands (e.g., upland open space at Brannan Island State Recreation Area); Riparian Forest (e.g., the Bradford Island 50-acre mitigation site, with the adjacent scour pond and Riparian Forest); tidal and intertidal wetlands (e.g., the Sherman Island Waterfowl Management Area, Big Break, Franks Tract); wetlands (e.g., those formed from the levee setback on the southwest end of Twitchell Island and along Mayberry Slough on the southwestern shore of Sherman Island); carbon capture wetlands in subsided island interiors (e.g., existing and planned wetlands on Twitchell Island, Mayberry Wetland on Sherman Island, and the ‘Whale’s Mouth’ wetland on Sherman Island). This density of Riparian Forest, Scrub-shrub, and Freshwater Marsh habitats at landscape scale in the vicinity of the Project help support native riparian and migratory birds as well as other wildlife species.

1.3.2 Integration with Twitchell Enhancement Project

The Project would be the continuation of a series of habitat restoration and enhancement projects on Twitchell Island. The additional habitat the Project would provide would increase connectivity to immediately adjacent sites that have been previously restored as part of the Twitchell Island Habitat Enhancement Project (which entered long-term management at the end of 2021), including:

- the approximately 9.5-acre Levee Cut-off site (i.e., Elderberry site) immediately to the north from the Project area;
- the approximately 8.5-acre 8-Acre Mitigation site (i.e., Willow Canal site) immediately south of the Project area along the central drainage canal; and
- the approximately 19.5-acre Twitchell Meadow site that is also immediately south of the Project area and parallel to the 8-Acre Mitigation site.

Creating this contiguous, diverse, native riparian habitat would further enhance native Riparian Forest communities in the Delta, which currently occupy approximately 23% of their estimated pre-European extent (Whipple et al. 2012). These sites collectively would also host a greater number of wildlife species and increased avian movement between Twitchell Island and neighboring islands. Roughly one-third of the seventeen Central Valley and Delta riparian focal bird species depend on healthy, mid- to upper-canopy conditions for nesting, where mid- and upper-canopies are defined as vegetation occupying space from 2 to 15 feet (ft) and greater than 15 ft in height, respectively (RHJV 2004). Thus, this Riparian Forest and Scrub-shrub design

attempts to build a diversity of habitat types that are expected to support a wide range of riparian dependent bird species (RHJV 2004).

1.3.3 Integration with Twitchell Island East End Habitat Project

In 2014, the Twitchell Island East End Habitat Project restored 740 acres of agricultural land to palustrine emergent wetlands on the eastern side of Twitchell Island. It created a permanent wetland that provides a great diversity of habitat, including four wetland units that create a mosaic of water channels and emergent vegetation year-round. More recently, the area has been the focus of giant garter snake (GGS) monitoring surveys meant to determine if the area is being utilized by GGS and assess the area's mitigation potential for GGS habitat. This Project would increase connectivity to the restoration efforts on the eastern side of Twitchell Island and potentially increase the suitable habitat available to GGS and other wetland species. The wetlands that would be created by the Project would assist in creating a broader network of enhanced wetlands and open water channels on Twitchell Island.

1.4 Roles and Responsibilities

The District is responsible for: (1) developing this Plan; (2) implementing the Project; (3) conducting maintenance (e.g., non-native plant control, irrigation), monitoring, and reporting; and (4) implementation of remedial measures if the performance standards are not met at the end of the interim management period.

DWR is responsible for providing funds to develop, implement, maintain, and monitor the enhancement acreage during the interim maintenance period, as well as providing funds to support the long-term maintenance of the area. These responsibilities are detailed in work agreements between the District and DWR.

CDFW is responsible for ensuring that the requirements of AB 360 are met, including: (1) approval of this Plan; (2) oversight of installation, maintenance, and monitoring; and (3) determination that the performance standards have been met.

2 ENHANCEMENT PLAN

2.1 Goals and Objectives

To help DLP participants meet the mandate for no net loss of riparian habitat and a net long-term habitat improvement (Section 1.1), the Project aims to create habitat that could be utilized to offset future impacts.

This Plan is intended to guide habitat development, restoration efforts, and post-implementation maintenance and monitoring such that the Project area would be relatively self-sustaining at the conclusion of the establishment phase before entering long-term management.

The overarching objectives of the Project are as follows:

- Create Riparian Forest¹, Scrub-shrub², and Freshwater Marsh³ acreage that can be utilized to offset future impacts to these California Assembly Bill 360 habitat types;
- Develop a restoration approach that would work within the bounds of physical (e.g., soils, depth to ground water, and geographic range) and biological (e.g., invasive plants, sources of propagules for natural recruitment) constraints of the site to maximize the likelihood of successful establishment and long-term persistence of native vegetation;
- Create higher quality and higher diversity habitat that is less fragmented and supports wildlife native to this geographic area to a greater extent than current conditions; and
- Attain the performance standards (Section 5.1) within the interim management period of habitat establishment, maintenance, monitoring, and potential remedial planting.

2.2 Planting Plan

The full planting design (Appendix A) is based on the following: (1) existing physical (topography, soils, hydrology) and biological (plant and wildlife species) opportunities and constraints within and near the Project; (2) consideration for the types and acreage of habitats impacted by Delta levee maintenance; (3) discussions between CDFW, Solano County RCD, DWR, Ducks Unlimited, and the District; and (4) professional experience and published research of natural, disturbed, and restored plant communities in the Delta (Moore et al. 2011, River Partners 2024, Stillwater Sciences 2015, Stillwater Sciences 2019, Stillwater Sciences 2021, Viers et al. 2012, Whipple et al. 2012).

Three habitat types are proposed as part of the Project: Riparian (including 17 Riparian Forest and Scrub-shrub planting units), Wetland (one planting unit), and Grassland (one planting unit). The distribution of these habitat types (Appendix A) are based on topography, vegetation mapping conducted by CDFW, and soils (USDA 2023).

The following sections describe the revegetation design for each vegetation type; specifics on species distributions and densities within each planting unit are provided in the Planting Plan (Appendix A).

2.2.1 Riparian

The clay soils within the parcel must be considered in developing the planting design. Willows (*Salix* spp.), California button willow (*Cephalanthus occidentalis*), and Fremont cottonwood (*Populus fremontii* subsp. *fremontii*) are adapted to grow in clay-rich soils. Despite the overall low elevation of the Project area and its proximity to water sources, areas at higher elevations are relatively dry throughout much of the year due to the continued presence of the levees. With this,

¹ Assembly Bill (AB) 360 Definition for Riparian Forest habitat includes woody vegetation (including isolated trees or shrubs) greater than 20 ft in height that may or may not overhang the water's edge. Often there is a dense, shrubby understory. The most common trees in the Delta include cottonwood, sycamore, alder, Oregon ash, willows, box elder, black walnut and various oaks.

² The AB 360 Definition for Scrub-shrub habitat includes stands of woody vegetation predominantly less than 20 ft in height. The various tree and shrub species that make up Scrub-shrub are generally the same as for Riparian Forest, although in most instances alders and or willows are the dominant plants.

³ The AB 360 definition for Freshwater Marsh habitat includes tidal and non-tidal areas near levees, either on the waterside or landside where there are seeps or toe ditches. Common plant species include cattails and tules.

various types of Scrub-shrub can be planted on the higher elevations. At lower elevations, Riparian Forest would be planted, though those species would primarily access groundwater. The planting plan follows guidance from CDFW on density of woody stems for Riparian Forest and Scrub-shrub habitat types (Table 1).

Table 1. Minimum habitat requirements for enhancement, from CDFW.

Habitat type	Maximum average spacing	Minimum average stems per acre	Acreage within Project area
Riparian Forest	20' x 20'	109	51.18
Scrub-shrub	10' x 10'	436	24.03

2.2.1.1 Riparian Forest

Stands of Riparian Forest would be planted across a range of parcel elevations (-3 to -15 feet) along drainages and bordering canals/ditches throughout the southern, eastern and western borders, with some planting units extending into interior portions of the Project area (Appendix A). Tree plantings would be spaced on 20-foot centers and would include a broad selection of riparian species native to the Delta, but with concentrations of certain species to achieve a diversity of vegetation types. Depending on the target vegetation type, dominant species would include Goodding's black willow (*Salix gooddingii*), Fremont cottonwood, western sycamore (*Platanus racemosa*), valley oak (*Quercus lobata*), and coast live oak (*Quercus agrifolia*). Associated native riparian tree species would include box elder (*Acer negundo*), red willow (*Salix laevigata*), Pacific willow (*Salix lasiandra*), and Oregon ash (*Fraxinus latifolia*). Target vegetation types within Riparian Forest habitats include:

- Black willow forest
- Cottonwood forest
- Oak sycamore woodland

2.2.1.2 Scrub-shrub

Stands of Scrub-shrub would be planted at the higher elevations (-2.5 to -7 feet) throughout the northern and central portions of the Project area (Appendix A), where these species are most likely to successfully establish and survive under a range of soil moisture conditions. Shrub plantings would be spaced on 10-foot centers and would include a broad selection of riparian species native to the Delta, but with concentrations of certain species to achieve a diversity of vegetation types. Depending on the target vegetation type, dominant species would include coyote brush (*Baccharis pilularis*), mule fat (*Baccharis salicifolia* subsp. *salicifolia*), California rose (*Rosa californica*), and scrub willows (e.g., narrowleaf willow [*Salix exigua*] and arroyo willow [*Salix lasiolepis*]). Associated native shrub species would include California button willow, California grape (*Vitis californica*), California blackberry (*Rubus ursinus*), and blue elderberry (*Sambucus mexicana*). Target vegetation types within Scrub-shrub habitats include:

- Coyote brush
- Mule fat
- Rose briar
- Willow scrub

2.2.2 Wetland

The Project would establish enhancement wetlands in the southwest corner of the Project area (Appendix A). The wetlands are designed as GGS habitat, with meandering low-grade channels of deeper water intended to inhibit the growth of emergent vegetation and shallower benches on which tules (*Schoenoplectus* spp.) would grow, resulting in a matrix of open water and emergent vegetation that is ideal GGS habitat. The wetlands would be filled with water seasonally via a pipe to be installed from the siphon at the northern border of the Project area, drawing water from Sevenmile Slough to the wetlands. The water level would fluctuate seasonally such that open water is available during the GGS active periods, and drawn down in other seasons to inhibit the growth of undesirable non-native plant species (e.g., water hyacinth [*Eichhornia crassipes*] and water primrose [*Ludwigia* spp.]). To increase the likelihood of the establishment of native emergent vegetation that may outcompete non-native emergent plant species, tule bulbs would be installed in the wetlands. Several berm islands would be constructed within the wetlands for wildlife refugia. These berms and the narrow margins around the wetlands would not be submerged, and would be broadcast seeded with native graminoids, potentially allowing the use of a broadleaf herbicide, if feasible, during periods in which the water is drawn down and impacts to GGS would be avoided.

2.2.3 Grassland

The Project would establish a grassland unit along the northern portion of the Project area that is between the levee road and the Riparian planting units. Given that this portion of the Project area is within the footprint of a potential future levee re-sloping/rehabilitation effort, the grassland unit would not be eligible for mitigation acreage. As such, there are no associated performance standards for this habitat type. The grassland unit would be maintained as part of the Project by the implementation contractor.

2.3 Irrigation Plan

Under existing conditions, ground and surface water supplies are not adequate during the growing season to promote establishment of the planting palette; therefore, plantings would receive watering for a minimum of two years following installation. An irrigation system would be constructed onsite by the implementation contractor, utilizing existing siphons from Sevenmile Slough and with the addition of a sand-filter system and generator-powered pump, per the irrigation plan (Appendix A).

3 IMPLEMENTATION

3.1 Mobilization and Demobilization

This task includes the supply and transport of implementation equipment, materials, supplies, appurtenances, and other items necessary to perform the work at the Project site. Upon completion of the work, this task also includes removal of all equipment, implementation waste, storage facilities, and incidentals such that the Project is cleaned to the satisfaction of the District or their designee.

3.2 Site Preparation

The District or their designee would prepare the site as necessary to increase the success of plant establishment and decrease the cost of long-term habitat management. Throughout 2022–2025, the Project area was herbicided repeatedly, disced and rolled, seeded with native grasses, and maintained with the goal of promoting native grass establishment. Prior to initiation of Project activities, the District would further prepare the site for planting, including additional herbicide applications and mowing, as necessary.

3.3 Plant Procurement and Installation

Planting materials for the Project would include a combination of nursery-grown container plants, stem cuttings, tule bulb propagules, and a seed mix. To the extent possible, local plant propagules and source material from within 50 miles of the Sacramento-San Joaquin Delta (Delta) and growing under similar ecological conditions (e.g., soils, depth to ground water, etc.) shall be utilized to revegetate the Project area.

3.3.1 Riparian

The Riparian planting units will be revegetated with nursery-grown container stock and stem cuttings, depending on the species. Details on procurement and installation are provided below. Following installation, plant protectors (e.g., Tubex tree shelters) and mulch (e.g., wood chips) will be installed to support survival and establishment. Wood chip mulch shall be placed to a depth of approximately three inches and a radius of 18 inches around the base of plants to suppress surrounding herbaceous growth and support retention of soil moisture.

3.3.1.1 Container stock

The District contracted a nursery to prepare container plants based on the quantities in Appendix A. The contracted nursery collected propagation material during the appropriate time of year from other sites on Twitchell Island and may have supplemented that material with existing in-stock material already collected from within the Delta. The contracted nursery follows best management practices for minimizing the spread of sudden oak death (*Phytophthora* spp.; Swiecki and Bernhardt 2016a, 2016b, or more current guidance).

Installation of container plants will occur during late fall to early winter (after the onset of the first rains that saturate the soil profile, which is also typically during plant dormancy) to maximize success of plant establishment and to minimize initial irrigation demands. The location, quantity, and spacing for plantings will be implemented as specified in Appendix A, following any adjustments made by the nursery and/or Restoration Contractor and agreed upon by the District. For each vegetation type, the implementation crew shall use color-coded flagging to lay out a sample patch of approximately 1,000 square feet in the field for review and approval by the District.

Planting will follow guidelines developed by the California Department of Conservation (Newton and Claassen 2003), as summarized below:

- Planting shall minimize disturbance of the root system and avoid air pockets in the planting hole. This shall generally include the following steps:
 - A hole shall be excavated to approximately twice the size of the plant's root ball.
 - The planting hole shall be partially back-filled with loose, native soil.

- The plant shall be carefully removed from the container, keeping the roots intact to the extent possible.
- Any plants not exhibiting a healthy root system shall be discarded.
- The plant shall be placed into the planting hole and the soil firmed around the plant to raise the soil surface level to slightly above the root crown.
- Plants shall be placed in soil depressions or collection basins to increase the amount of precipitation intercepted by the plant and “watered-in” at the time of planting. On slopes, a four-inch high, hand-compacted earth berm will be constructed along the forward edge of the planting terrace for a watering basin.
- Unless soil moisture is very high throughout the root zone at the time of planting, plants shall be irrigated immediately and thoroughly after installation to settle the soil around the plant. If the roots become exposed, additional soil shall be placed around the root crown.

3.3.1.2 Stem cuttings

Cuttings shall be procured by the implementation contractor. Established stands of native woody riparian species on other DWR-owned enhancement sites on Twitchell Island are available for collecting stem cuttings for Goodding's willow, red willow, arroyo willow, sandbar willow, Fremont cottonwood, and mule fat. Collection of cuttings at DWR-owned parcels shall be coordinated with DWR. The implementation contractor shall review the sites prior to bid to determine the adequacy of the stock on site for use on the Project. If sufficient cuttings cannot be procured from these areas, they shall be obtained from other suitable locations within the Delta. Cuttings shall be procured and installed as follows:

- Cuttings shall be taken during mid-winter during the species' dormant periods (i.e., December–February) from vigorous, mature, healthy trees and shrubs, and conducted in alignment with best management practices such that intact native habitats are not significantly impacted.
- Willow and cottonwood poles shall be approximately 3–4 feet long and at least approximately 0.5 inches in diameter at the base, but no larger than approximately three inches in diameter.
- The rooting end shall be cut at a 45-degree angle, and the meristem end will be cut at a 90-degree angle, if necessary. Cuttings shall be bundled in lots of 25–50, with all rooting ends oriented in the same direction to aid in proper installation, and shall be identified to species with color-coded flagging tape, spray paint, or other distinguishing method.
- Most auxiliary branches and leaves shall be removed upon collection of cuttings.
- Cuttings shall be kept moist, will not be left in the sun, and will be transported in covered vehicles to protect them from desiccation, shall be stored with the rooting ends submerged in water (if not installed within 48 hours of collection), and installed within three weeks of collection if water is changed every 48 hours and the meristem ends are kept cool and shaded (e.g., with wet burlap).
- Cuttings shall be planted such that approximately six inches of the cutting remains above the ground. Planting holes may require pre-drilling to accomplish the desired planting depth without damaging the cuttings.
- The planting hole shall be closed with loose soil and firmed around the plant (e.g., with a tamper or the heel of the boot) to close the hole completely. No airspace shall remain.
- The cuttings shall be watered immediately after planting to settle the soil and eliminate air pockets.

3.3.2 Wetland

The Wetland planting unit will be revegetated with tule bulb propagules (within submerged and bank edge areas) and a native grassland seed mix (within above-water areas). Details on procurement and installation are provided below. Coinciding with or following installation, the wetland areas will be flooded up to support establishment of wetland emergent vegetation. Procurement and installation guidelines include the following:

- Tule bulb propagules shall be procured by the implementation contractor. Established stands of tule species on other DWR-owned enhancement sites near Twitchell Island are available for source material. Collection from any DWR-owned sites shall be coordinated with DWR. The implementation contractor shall review the sites prior to bid to determine the adequacy of the stock on site for use on the Project. If sufficient propagules cannot be procured from these areas, they shall be obtained from other suitable locations within the Delta. Following collection, tule bulbs shall be kept moist and shaded (e.g., with wet burlap) until installation, which shall be within two weeks of collection.
- Native seeds for the non-inundated portions of the wetlands shall be procured by the implementation contractor from one or several qualified nurseries or seed sources. The appropriate seed quantities by weight and species are provided in Appendix A. Seeds shall be broadcast upon the onset of fall rains and gently raked in to ensure soil contact and reduce predation by birds.

3.3.3 Grassland

The Grassland unit would not be planted further than what has already been done as described in site preparation (Section 3.2), but would be maintained by the implementation contractor as part of the Project.

3.4 Irrigation

There are two existing irrigation siphons within the Project area, which would be left in place. A pipeline extension would be installed by the implementation contractor at an existing siphon in the north end of the Project area and would follow along the northern perimeter, then turn south at the western boundary to connect to the southern half of the parcel. This would provide water from Sevenmile Slough to the wetland units and agricultural areas within the southern portion of the Project area.

To facilitate efficient irrigation, the irrigation system would be divided into independent zones that would be watered on a rotating schedule, one zone per day or otherwise as necessary to ensure saturation of soil throughout the root zone. The independent irrigation zones and rotational watering schedule would allow for isolation of each zone, enhancing the integrity of the pressure-dependent system. If feasible, watering would occur overnight to reduce evapotranspiration losses, and watering duration shall be adjusted to maintain a constant instantaneous flow rate for the irrigation system. Watering amounts and duration would decrease after the first year to ensure the plants become sustainably established and not dependent on irrigation water availability at the soil surface.

Once the plantings have established for two years—and assuming no remedial planting is necessary that would require irrigation—the irrigation system components would be removed, respooled, and recycled.

4 MAINTENANCE PLAN

After initial Project implementation, various maintenance activities would be performed in each of the three habitat types (i.e., Riparian, Wetland, and Grassland) for the interim management period of three to five years (with Year 1 being the first growing season following plant installation). During this period, when possible, plant management treatments would occur between September 1 and January 31 to avoid avian nesting times. If invasive plant management activities occur outside of this period, the relevant Mitigation Measures in the Project's IS/MND (RD 1601 2023) would be implemented.

Water levels in the wetland areas are intended to fluctuate seasonally and would be managed through a system of pipelines, swales, and water control structures. Water level fluctuation would provide some level of minimizing invasive plant establishment (e.g., aquatic invasive vegetation may desiccate during periods when water levels are drawn down, and establishment of terrestrial invasive plant species would be inhibited by sustained flooding). The wetlands shall be flooded up throughout the GGS active period (i.e., approximately mid-April to mid-October) and drawn down during brumation periods (i.e., approximately mid-October to mid-April). The implementation contractor shall be responsible for maintaining the correct water level schedule, as advised by the District.

4.1 Irrigation

Following plant installation, the District or its designated contractor would monitor the planting areas and provide general guidance to the implementation contractor as to the appropriate amount and frequency of water based on site-specific conditions to achieve the quantity and frequency of watering necessary to establish and maintain plant health and vigor. The implementation contractor would continue watering within the planted area on a schedule to be determined by weather and local site conditions (typically spring through fall). In the case that rainfall amounts are higher or lower than ideal, the frequency of watering would be adjusted. Ideally, watering would be tapered off once plants become established in preparation for the cessation of watering after two years. If it is found that the plants are sufficiently established so as to be self-sustaining, further watering would be curtailed. The implementation contractor would maintain the irrigation system in functional order throughout the interim management period as necessary.

4.2 Non-native Plant Control

Controlling invasive plant species is key to successful restoration at the site, and therefore qualitative monitoring of the site would be conducted regularly by the District or its designated representative to determine the presence and growth stages of such plants and develop recommended actions. Invasive plants include all those with a California Invasive Plant Council (Cal-IPC) rating of "High" as well as broad-leaved plants (herbaceous and woody) rated "Moderate" (Cal-IPC 2024 or more current). On-going maintenance during the interim management period would focus on non-native plant species—including invasive aquatic vegetation—and would address populations as quickly as possible. Non-native plant control would typically be conducted throughout the growing season (generally early spring through early fall) and could involve manual removal techniques, mowing, and herbicide, as outlined below.

4.2.1 Manual removal

To reduce the use of large gas-powered equipment (e.g., mowers) and herbicides, manual removal techniques such as hand-grubbing, raking, and string-line trimming would be the preferred methods for controlling non-native plant populations, whenever practical.

4.2.2 Mowing

Mowing shall be timed carefully such that a majority of the cover of non-native plant species (e.g., annual grasses) are beginning to bloom but before viable seed can be formed. Mowing height would be limited to a minimum of six inches. Fuel efficient mowers are preferred, and idling time would be minimized to avoid unnecessary emissions. If necessary based on season, Mitigation Measures in the Project's IS/MND (RD 1601 2023) may need to be implemented.

4.2.3 Herbicide

Herbicide would be used to control invasive plants that are not manageable using manual removal, mowing, or other techniques. If conditions are not conducive to herbicide application (e.g., strong winds), mechanical methods will be used. The District or its designated contractor would use herbicides approved in coordination with an agricultural pest control adviser (PCA). Approved herbicides include those under the National Pollutant Discharge Elimination System General Permit No. CAG990005, registered for use as aquatic herbicide, and classified as practically nontoxic to freshwater and estuarine/marine fish and invertebrates, birds, and bees (RD 1601 2023).

The application of herbicide would be performed by a Qualified Applicator, or under the supervision of the Qualified Applicator, following the herbicide manufacturer's recommendations for application and use in aquatic areas. Application techniques would include the use of backpack sprayers, wick applicators, or spray equipment mounted on vehicles. Cones, or spray hoods, would be used to reduce drift. Where feasible, spot applications would be used preferentially to broadcast spraying to reduce impacts to native vegetation, wildlife, and water quality. If weeding in previous years has been successful in reducing the cover of invasive plants significantly below the performance standard threshold, the District would proceed with spot treatment as necessary.

4.3 Remedial Actions

To ensure revegetation of the site progresses as anticipated, the District will conduct routine site visits throughout the year to make qualitative observations and provide management recommendations, in addition to the more significant annual performance monitoring assessments (Section 5). Between the routine site visits and the performance monitoring assessments, the Project area would be visited approximately every-other month. During the routine site visits, observations will be recorded for a number of factors such as overall plant survival and health, soil moisture, invasive and non-native plant cover, herbivory damage, etc. If any factors are negatively affecting the plantings, the District would develop recommended actions for the implementation contractor to implement.

If the District determines through annual performance monitoring (Section 5) that the Project is not on a trajectory to meet the performance standards (Section 5.1), the District would seek CDFW's approval to conduct more significant remedial actions, potentially including additional planting, irrigation, seeding, maintenance, plant protection, invasive plant management, and/or

monitoring, as required, to meet the standards as specified in this Plan. Any remedial plantings would be installed in the same manner described in Section 3 and Appendix A, unless modifications to these protocols are indicated from observations or monitoring data and agreed upon by the District, CDFW, and the implementation contractor. Where necessary (e.g., following any remedial planting), the District would ensure plants continue to receive regular watering, either through the irrigation system or by a watering truck to help meet the performance standards (Section 5.1).

Any additional container or live cutting plantings will be documented and incorporated into calculations of plant density for subsequent years of monitoring. The District may choose to develop interim progress goals to help determine if the Project is on a trajectory to meet the performance standards by the end of the interim management period.

5 MONITORING PROGRAM

Habitat development in the Project area would be monitored by the District for the duration of the interim management period (e.g., three to five years or until the habitat restoration goals [Section 2.1] and performance standards [Section 5.1] have been met). Monitoring would be conducted during routine site visits (in which qualitative observations are recorded) and annual performance monitoring (in which quantitative data are recorded), both of which would provide information on vegetation establishment and any recommended remedial actions, if necessary. Results of annual performance monitoring will be summarized in an annual monitoring report to be submitted to DWR by November 15th and to CDFW by December 15th of each year.

5.1 Performance Standards

The proposed performance standards are based on the desire that the site be self-sustaining by the end of the interim management period. Standards were developed with consideration for typical CDFW enhancement targets used on other Delta restoration projects (e.g., survival of woody species, vigor, density, and diversity), and on best professional judgment (Delta Stewardship Council 2020, Stillwater Sciences 2015, Stillwater Sciences 2019, Stillwater Sciences 2021). The District, CDFW, and DWR may—through consensus negotiations—choose to modify these standards based on site-specific conditions and the results of annual maintenance and monitoring at the site. If the Project is not on a trajectory to meet performance standards, remedial actions may be recommended (Section 4.3).

The following performance standards (summarized in Table 2) shall be achieved within each vegetation type (e.g., oak sycamore woodland, willow scrub) by the conclusion of the interim management period:

- **Density targets of native woody species are achieved:**
 - The density of native woody stems is equal to or greater than 80% of that originally planted.
 - Native woody trees and shrubs that recruit throughout the interim management period may be included in the density assessment.
- **Vigor of native woody species is high:**
 - At least 80 percent of the native woody plants within each vegetation type will have a rating of Vigor 3 or higher (defined below in Table 3) by the end of the interim management period.

- Native woody trees and shrubs that recruit throughout the interim management period may be included in the vigor assessment.
- **Diversity of native species is maintained:**
 - Three different native species will each account for at least 5% of the plants within each vegetation type.
- **Invasive plant cover is low:**
 - The total percent cover of invasive plants (as calculated by summing the absolute cover of each invasive plant species) will be less than 10 percent in each vegetation type.
 - For the purposes of these performance standards, an “invasive plant” is defined as any species with a “High” rating from Cal-IPC (Cal-IPC 2024 or more current) and any broad-leaved species (including herbaceous and woody species) with a Cal-IPC rating of “Moderate”.

Table 2. Summary of vegetation monitoring performance standards for the Project.

Habitat type	Indicator	Performance standard	Detail
Riparian	Density of woody plants	≥ 80% of that originally planted	Recruitment of native woody trees and shrubs may be included.
	Vigor of woody plants	>80% with Vigor ≥ 3 ^a	Recruitment of native woody trees and shrubs may be included.
	Diversity of woody plants	≥ 3 native species each represent ≥ 5% of plants	Includes all plants, including recruited plants.
Riparian, Wetland, and Grassland	Invasive Plants	<10% cover in all planting areas	Invasive plants are any species rated “High” by Cal-IPC and any broad-leaved species (both herbaceous and woody) with a Cal-IPC rating of “Moderate”.

^a Vigor Rating is defined in Table 3.

Table 3. Vigor categories to be used in monitoring of the Project¹.

Category	Description
1	Less than 25 percent of branches and foliage are estimated to be healthy ²
2	25 to 50 percent of branches and foliage are estimated to be healthy
3	51 to 80 percent of branches and foliage are estimated to be healthy
4	81 percent (or greater) of branches and foliage are estimated to be healthy

¹ Vigor of foliage (i.e., leaf death or stress) that is attributed to normal winter or summer deciduous species is not included.

² Healthy is defined as showing no signs of herbivory, nutrient or water stress, or pathogens on stems, branches, or foliage; unhealthy branches and foliage may show signs of wilting, browning, damage, or death including an apparent reduction in size of the estimated full canopy.

5.2 Methods

Monitoring of progress toward achieving the Project’s performance standards would occur twice annually for the duration of the interim management period following installation. A monitoring event for invasive species cover would occur during peak phenology and growth of most herbaceous species (e.g., late spring) to aid in identification and accurate assessments of percent cover. A second monitoring event would occur toward the end of the growing season (e.g.,

September), to assess woody species density, vigor, and diversity after the dry summer season. An annual report summarizing findings from both the spring and fall monitoring events would be submitted by the District to DWR and CDFW. This would provide the District sufficient time to develop and implement remedial actions in support of meeting the performance standards in a subsequent year.

Performance standards would be assessed using sampling plots that are stratified (i.e., measured separately) by vegetation type (e.g., oak sycamore woodland, willow scrub). Following initial planting, permanent monitoring plots would be randomly established within each vegetation type based on total acreage of those vegetation types. Sampling would occur across a minimum of either three plots/acre of revegetated habitat or four total plots, whichever is greater. Plots for sampling woody species shall be a minimum of 1,000 square feet; plots for sampling invasive plants shall be a minimum of 200 square feet. Plot dimensions may vary based on the shapes and widths of a given vegetation type. If field observations indicate any sampling plot is not representative of the vegetation type, additional plots would be sampled.

Within woody plant sampling plots, each native woody individual would be counted, assessed for vigor, and identified to species. The following sections provide details and calculation methods for analyzing the results compared to the performance standards.

5.2.1 Density of native woody plants

To determine the success of planted woody species and account for natural recruitment, all native woody plants within each plot will be tallied. The quantity of plants in plots within a given vegetation type will be divided by the number of plots within that vegetation type to give an average quantity per 1,000 square feet, which will then be extrapolated to determine the density of native woody plants per acre, stratified by vegetation type. The result will be used to determine if the performance standard is being met.

5.2.2 Vigor of native woody plants

A variety of factors may lead to leaf wilting, damage, branch die-back, and/or death, such as nutrient deficiency, herbivory, fire, water stress, disease, insect infestation, and competition or shading from nearby plants (USDA Forest Service 2017). During annual performance monitoring in the fall, each native woody plant (or stem, if differentiation of individuals is not possible) will be assessed for vigor using the qualitative categories detailed in Table 3. The visual evaluation would be in comparison to an estimated full canopy and—if possible—the cause of any reduced vigor will be noted (e.g., disease, wind damage, water stress, etc.). Vigor assessments will account for seasonally appropriate foliage conditions (e.g., buckeye being summer-deciduous) rather than attribute a low vigor rating. The percentage of all living woody plants with a vigor rating of “3” or higher would be stratified by vegetation type and used to determine if the performance standard is being met.

5.2.3 Diversity of native woody plants

Species diversity shall be evaluated using the number of native woody plants with an average vigor rating of “3” or higher (i.e., the total number of vigorous species), as determined by the vigor assessment (Section 5.2.2). The quantity of vigorous plants of a given species would be summed across plots within a given vegetation type, then divided by the total number of vigorous plants within that vegetation type to obtain the percent composition of that species within that

vegetation type. The number of species with a composition of 5% or greater will be used to determine if the performance standard for diversity of vigorous species is being met.

5.2.4 Cover of invasive plants

To monitor the percent cover of invasive plants, visual estimates of the percent absolute cover of each invasive plant species would be recorded in plots established in each vegetation type, including wetlands and grasslands. The percent absolute cover for each species would then be summed to determine cover of invasive plants within a plot and then averaged across the vegetation type to determine if the performance standard is being met.

5.3 Reporting

The District would be responsible for annual performance reporting to summarize maintenance activities throughout the year, monitoring results as compared to performance standards, and any recommendations for remedial actions. The reports would include the following sections:

- Introduction;
- Maintenance Activities Performed;
- Monitoring Methods;
- Monitoring Results (qualitative and quantitative results compared to baseline information from the original planting, or compared to previous year[s] results);
- Achievement of Performance Standards (and interim guidelines, if developed); and,
- Recommendations (e.g., maintenance actions and/or remedial planting).

The District shall prepare interim and final reports as follows (to DWR by November 15th and to CDFW by December 15th of each year):

- Year 1: prepare an interim monitoring report
- Year 2: prepare an interim monitoring report
- Year 3:
 - If monitoring data indicate that the Project has achieved the performance standards (Section 5.1), the District would prepare a final monitoring report.
 - If monitoring data indicate that the Project has not yet achieved the performance standards (Section 5.1), the District would—based on negotiations with CDFW—initiate any recommended remedial actions and extend the interim management period as necessary. In this case, the District would prepare annual monitoring reports for Year 3 and any subsequent years as necessary, with a final monitoring report at the end of the extended interim management period, as negotiated with CDFW.

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Appendices

Appendix A

Planting and Irrigation Plan for the Project

TWITCHELL ISLAND MITIGATION AND ENHANCEMENT SITES - PLANTING PLAN & IRRIGATION DESIGN

SACRAMENTO COUNTY, CA

TWITCHELL ISLAND MITIGATION AND ENHANCEMENT SITES - DESIGN PROJECT

SACRAMENTO COUNTY, CA

Stillwater Sciences

2855 TELEGRAPH AVENUE, SUITE 400
BERKELEY, CA 94705 P: (510) 848-8098

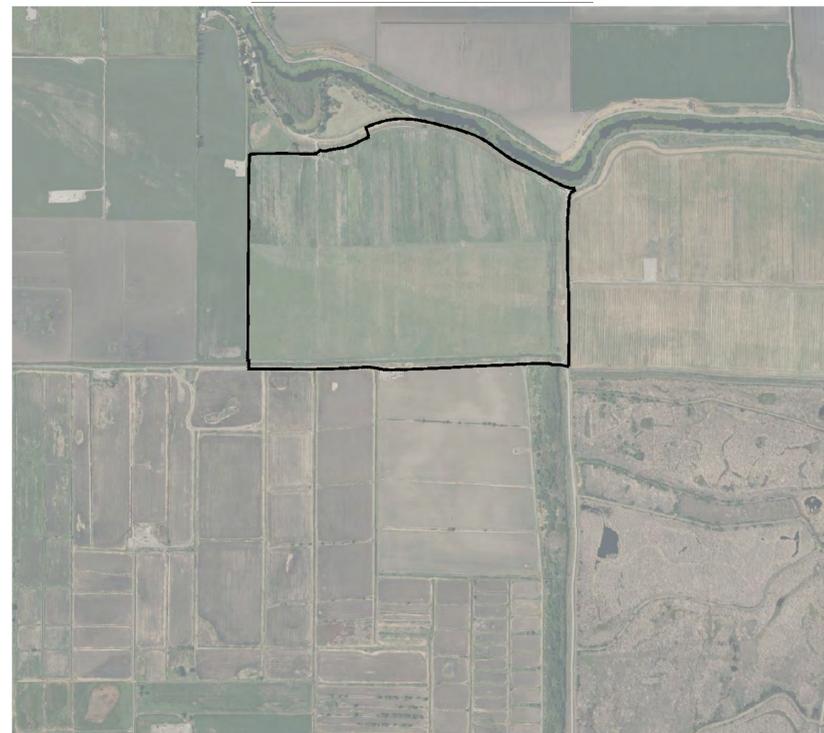
GENERAL NOTES, TERMS, & CONDITIONS:

1. **DESIGN INTENT.** THESE DRAWINGS REPRESENT THE GENERAL DESIGN INTENT TO BE IMPLEMENTED AND CONTRACTOR IS RESPONSIBLE FOR ALL ITEMS SHOWN ON THESE PLANS. CONTRACTOR SHALL BE RESPONSIBLE FOR CONTACTING THE PROJECT MANAGER FOR ANY CLARIFICATIONS OR FURTHER DETAILS NECESSARY TO ACCOMMODATE ACTUAL SITE CONDITIONS. ANY DEVIATION FROM THESE PLANS WITHOUT THE LANDOWNER'S REPRESENTATIVE APPROVAL ARE AT THE CONTRACTOR'S OWN RISK AND EXPENSE. NOTIFY PROJECT MANAGER IMMEDIATELY OF ANY UNEXPECTED AND CHANGED CONDITIONS, SAFETY HAZARDS, AND ENVIRONMENTAL PROBLEMS ENCOUNTERED.
2. **JOB SITE CONDITIONS AND CONTRACTOR RESPONSIBILITY.** CONTRACTOR SHALL ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR SITE CONDITIONS DURING THE COURSE OF THE CONSTRUCTION OF THIS PROJECT, INCLUDING THE SAFETY OF ALL PERSONS AND PROPERTY, AND ALL ENVIRONMENTAL PROTECTION ELEMENTS, WHETHER SHOWN ON THESE DRAWINGS OR NOT. CONTRACTOR SHALL FOLLOW ALL APPLICABLE CONSTRUCTION AND SAFETY REGULATIONS. THESE REQUIREMENTS SHALL APPLY CONTINUOUSLY AND WILL NOT BE LIMITED TO NORMAL WORKING HOURS. THE CONTRACTOR SHALL DEFEND, INDEMNIFY, AND HOLD THE LANDOWNER OR THE ENGINEER (STILLWATER SCIENCES) HARMLESS FROM ANY AND ALL LIABILITY, REAL OR ALLEGED, IN CONNECTION WITH THE PERFORMANCE OF WORK ON THIS PROJECT, EXCEPT FROM LIABILITY ARISING FROM THE SOLE NEGLIGENCE OF THE LANDOWNER OR ENGINEER.
3. **DAMAGE.** CONTRACTOR SHALL EXERCISE CARE TO AVOID DAMAGE TO EXISTING PUBLIC AND PRIVATE PROPERTY, INCLUDING NATIVE TREES AND SHRUBS, AND OTHER PROPERTY IMPROVEMENTS. IF CONTRACTOR CAUSES DAMAGES TO SUCH ITEMS, HE SHALL BE RESPONSIBLE FOR REPAIR OR REPLACEMENT IN LIKE NUMBER, KIND, CONDITION, AND SIZE. ANY SUCH COST MAY BE DEDUCTED BY OWNER FROM MONIES DUE CONTRACTOR UNDER THIS CONTRACT.
4. **LIMITS OF WORK, ACCESS, STAGING AND MOBILIZATION AREAS.** THE APPROXIMATE LIMITS OF WORK ARE SHOWN ON THE DRAWINGS. EXACT LIMITS OF WORK, POINTS OF INGRESS-EGRESS, CREEK CHANNEL ACCESS, MOBILIZATION, STAGING, AND WORK AREAS WILL BE FLAGGED IN THE FIELD BY THE ENGINEER. EQUIPMENT MAINTENANCE AND FUELING MUST OCCUR OUTSIDE OF THE CHANNEL AREA AS DESCRIBED IN THE ENVIRONMENTAL PERMITS FOR THE PROJECT.
5. **WORK IN STREAM CHANNELS AND STREAM DIVERSIONS.** ALL WORK INVOLVING USE OF HEAVY EQUIPMENT MUST BE COMPLETED FROM TOP OF BANK UNLESS A SPECIFIC POINT OF CREEK CHANNEL ACCESS HAS BEEN APPROVED AND IS SHOWN ON THE PLANS, AND THEN ONLY IN NON-LIVE WATER AS DEFINED BY CDFW. THE CONTRACTOR SHALL BE RESPONSIBLE FOR IMPLEMENTING THE DEWATERING PLAN DEPICTED IN THIS PLAN SET.
 - 5.1. CONTRACTOR IS RESPONSIBLE FOR REMOVAL AND DISPOSING OF ALL WATER CONTROL STRUCTURES AND EQUIPMENT.
 - 5.2. THE CONTRACTOR SHALL FURNISH, INSTALL, AND OPERATE ALL OTHER NECESSARY MACHINERY, APPLIANCES, AND EQUIPMENT TO DIVERT FLOWING WATER AROUND WORK AREAS, AND TO KEEP EXCAVATIONS AND TRENCHES REASONABLY FREE FROM WATER DURING CONSTRUCTION. CONTRACTOR SHALL DISPOSE OF THE WATER SO AS NOT TO CAUSE INJURY TO PUBLIC OR PRIVATE PROPERTY, OR TO CAUSE A NUISANCE OR A MENACE TO THE PUBLIC, OR TO DEGRADE WATER QUALITY. HE SHALL AT ALL TIMES HAVE ON HAND SUFFICIENT PUMPING EQUIPMENT AND MACHINERY IN GOOD WORKING CONDITION FOR ALL ORDINARY EMERGENCIES AND SHALL HAVE AVAILABLE AT ALL TIMES COMPETENT MECHANICS FOR THE OPERATION OF ALL PUMPING EQUIPMENT. IF THE CONTRACTOR CHOOSES TO USE A PUMPING SYSTEM FOR ANY PORTION OF THE WATER CONTROL WORK, HE SHALL HAVE ADEQUATE BACK-UP EQUIPMENT TO INSURE THE CONTINUOUS OPERATION OF THE EQUIPMENT.
 - 5.3. THE CONTRACTOR SHALL AT ALL TIMES PROVIDE FOR THE ADEQUATE RETURN FLOW OF DIVERSIONS BELOW THE PROJECT SITE. THE CONTRACTOR MAY TEMPORARILY DIVERT WATER DURING CONSTRUCTION, AS OUTLINED IN THE APPROVED STREAM DIVERSION AND WATER CONTROL PLAN. THIS MAY INCLUDE FOR INSTANCE, VISQUEEN AND STRAW BALE OR SAND BAG DIVERSION DIKES AND PIPING SYSTEMS. RETURN FLOW SHALL BE FILTERED THROUGH FILTER CLOTH, STRAW BALES AND/OR THROUGH A SERIES OF STILLING BASINS WHEN REQUIRED.
 - 5.4. TURBID DEWATERING FLOWS SHALL BE PUMPED INTO A HOLDING FACILITY OR SPRAYED OVER A LARGE AREA OUTSIDE THE STREAM CHANNEL TO ALLOW FOR NATURAL FILTRATION OF SEDIMENTS. AT NO TIME SHALL TURBID WATER FROM THE HOLDING FACILITY BE ALLOWED BACK INTO THE STREAM CHANNEL UNTIL WATER IS CLEAR OF SILT.
 - 5.5. ALL HEAVY EQUIPMENT MUST HAVE A SUPPLY OF SORBENT PADS AVAILABLE TO CLEAN-UP GREASE, OIL, OR FUEL THAT DRIPS OR SPILLS INTO THE STREAM CHANNEL. SORBENT BOOMS MUST BE PLACED DOWNSTREAM FROM LOCATIONS WHERE MACHINERY IS EXPECTED TO CROSS THE STREAM CHANNEL. USED PADS AND BOOMS ARE TO BE DISPOSED OF PROPERLY AT CONTRACTOR'S EXPENSE.
6. **EARTHWORK QUANTITIES.** CONTRACTOR IS RESPONSIBLE FOR ALL EARTHWORK, INCLUDING GRADING, PROVISION AND PLACEMENT OF ROCK MEETING SIZE LIMITS, AS SHOWN ON DRAWINGS, AND DISPOSAL OF ALL EXCESS SOIL AND RUBBLE. EARTHWORK QUANTITIES, INCLUDING GRADING, PLACED ROCK RIP-RAP AND OFF-HAUL QUANTITY ESTIMATES PROVIDED BY THE ENGINEER ARE ESTIMATES ONLY. LANDOWNER AND ENGINEER DO NOT, EXPRESSLY OR OTHERWISE BY IMPLICATION, EXTEND ANY WARRANTY TO EARTHWORK CALCULATIONS
7. **THE FOLLOWING PERMITS ARE REQUIRED FOR THIS PROJECT, THE CONTRACTOR SHALL BE GIVEN COPIES OF ALL THE PERMITS, SHALL BECOME FAMILIAR WITH THE PERMIT REQUIREMENTS, AND SHALL BE RESPONSIBLE FOR ADHERENCE TO AND CONFORMANCE WITH ALL PERMIT CONDITIONS.**
 - SEC. 404 PERMIT ISSUED BY US ARMY CORPS OF ENGINEERS
 - 1601/1603 STREAMBED ALTERATION AGREEMENT ISSUED BY CA DEPT. FISH & WILDLIFE
 - WATER QUALITY CERTIFICATION, BY REGIONAL WATER QUALITY CONTROL BOARD
 - US FISH AND WILDLIFE SERVICE CONSULTATION AND IMPLEMENTATION RECOMMENDATIONS
 - NATIONAL MARINE FISHERIES SERVICE CONSULTATION AND IMPLEMENTATION RECOMMENDATIONS.
8. AREAS TO BE GRADED SHALL BE CLEARED OF ALL VEGETATION INCLUDING ROOTS AND OTHER UNSUITABLE MATERIAL FOR A STRUCTURAL FILL, THEN SCARIFIED TO A DEPTH OF 6 INCHES PRIOR TO PLACING OF ANY FILL.
9. AREAS WITH EXISTING SLOPES WHICH ARE TO RECEIVE FILL MATERIAL SHALL BE KEYED AND BENCHED.
10. FILL MATERIAL SHALL BE SPREAD IN LIFTS NOT EXCEEDING 6 INCHES IN COMPACTED THICKNESS, MOISTENED OR DRIED AS NECESSARY TO NEAR OPTIMUM MOISTURE CONTENT AND COMPACTED BY AN APPROVED METHOD. FILL MATERIAL SHALL BE COMPACTED TO A MINIMUM OF 90% MAXIMUM DENSITY AS DETERMINED BY 1957 ASTM D - 1557 - 91 MODIFIED PROCTOR (AASHO) TEST OR SIMILAR APPROVED METHODS.
11. CUT SLOPES SHALL NOT EXCEED A GRADE OF 1.5 HORIZONTAL TO 1 VERTICAL. FILL AND COMBINATION FILL AND CUT SLOPES SHALL NOT EXCEED 2 HORIZONTAL TO 1 VERTICAL. SLOPES OVER THREE FEET IN VERTICAL HEIGHT SHALL BE PLANTED WITH APPROVED PERENNIAL OR TREATED WITH EQUALLY APPROVED EROSION CONTROL MEASURES PRIOR TO FINAL INSPECTION.
12. BEST MANAGEMENT PRACTICES FOR CONSTRUCTION ACTIVITIES: ERODED SEDIMENTS AND OTHER POLLUTANTS MUST BE RETAINED ONSITE AND MAY NOT BE TRANSPORTED FROM THE SITE VIA SHEET FLOW, SWALES, AREA DRAINS, NATURAL DRAINAGE COURSES, OR WIND. STOCKPILES OF EARTH AND OTHER CONSTRUCTION RELATED MATERIALS MUST BE PROTECTED FROM BEING TRANSPORTED FROM THE SITE BY THE FORCES OF WIND OR WATER. FUELS, OILS, SOLVENTS, AND OTHER TOXIC MATERIALS MUST BE STORED IN ACCORDANCE WITH THEIR LISTING AND ARE NOT TO CONTAMINATE THE SOIL AND SURFACE WATERS. ALL APPROVED STORAGE CONTAINERS ARE TO BE PROTECTED FROM THE WEATHER. SPILLS MAY NOT BE WASHED INTO THE DRAINAGE SYSTEM. EXCESS OR WASTE CONCRETE MAY NOT BE WASHED INTO PUBLIC WAY OR ANY OTHER DRAINAGE SYSTEM. PROVISIONS MUST BE MADE TO RETAIN CONCRETE WASTES ON SITE UNTIL THEY CAN BE DISPOSED AS A SOLID WASTE. TRASH AND CONSTRUCTION RELATED SOLID WASTE MUST BE DEPOSITED INTO A COVERED WASTE RECEPTACLE TO PREVENT CONTAMINATION OF RAINWATER AND DISPERSAL BY WIND. SEDIMENTS AND OTHER MATERIAL MAY NOT BE TRACKED FROM TO THE SITE BY VEHICLE TRAFFIC.

VICINITY MAP



PROJECT LOCATION MAP

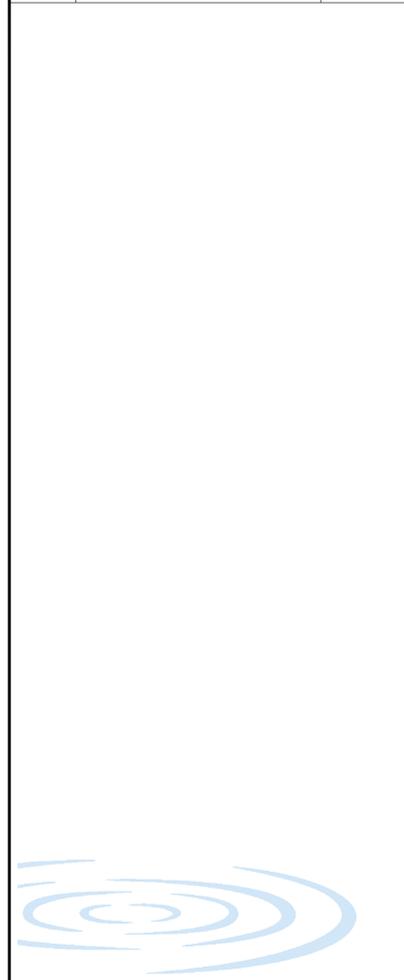


Sheet List Table	
Sheet Number	Sheet Title
1	TITLE SHEET
2	OVERVIEW
3	PLAN VIEW
4	PLANTING PLAN 1 - WEST SIDE
5	PLANTING PLAN 2 - CENTER
6	PLANTING PLAN 3 - EAST SIDE
7	PLANTING TABLES - WOODLAND
8	PLANTING TABLES - BLACK WILLOW FOREST
9	PLANTING TABLES - COTTONWOOD
10	PLANTING TABLES - COYOTE BRUSH
11	PLANTING TABLES - MULEFAT
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14	INFRASTRUCTURE PLANVIEW DETAILS
15	WEST-EAST TYPICAL SECTIONS
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17	DITCH FLOWLINE PROFILES 1
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19	IRRIGATION LAYOUT
20	IRRIGATION DETAILS
21	PLANTING DETAILS
22	PLANTING DETAILS (2)

ABBREVIATIONS AND SYMBOLS:

- <E> EXISTING
- <P> PROPOSED
- EXISTING TREE (SURVEYED)
- EXISTING TREE (APPROXIMATE LOCATION)
- EXISTING POOL (APPROXIMATE LOCATION)
- 1 LARGE WOOD FEATURE NUMBER
- a INDIVIDUAL LOG OR ROOTWAD DESIGNATION
- 3 8 DETAIL # ON SHEET
- 8 SHEET #

REVISIONS		
NO.	DESCRIPTION	DATE



PROJECT NUMBER: 1013.00
SCALE: AS NOTED
DATE: 4/8/24

DESIGN: EE/RT
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CHECKED: JB
APPROVED: RT

TITLE SHEET

SHEET 1 OF 22

DRAWING IS NOT TO SCALE - QUANTITY APPROXIMATE
LAST SAVE: 12/17/2023 PLOT DATE: 4/8/2024 PLOT STYLE: STILLWATER-GRASSSCALE-225
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**TWITCHELL ISLAND
MITIGATION AND
ENHANCEMENT SITES -
DESIGN PROJECT**

SACRAMENTO COUNTY, CA

Stillwater Sciences

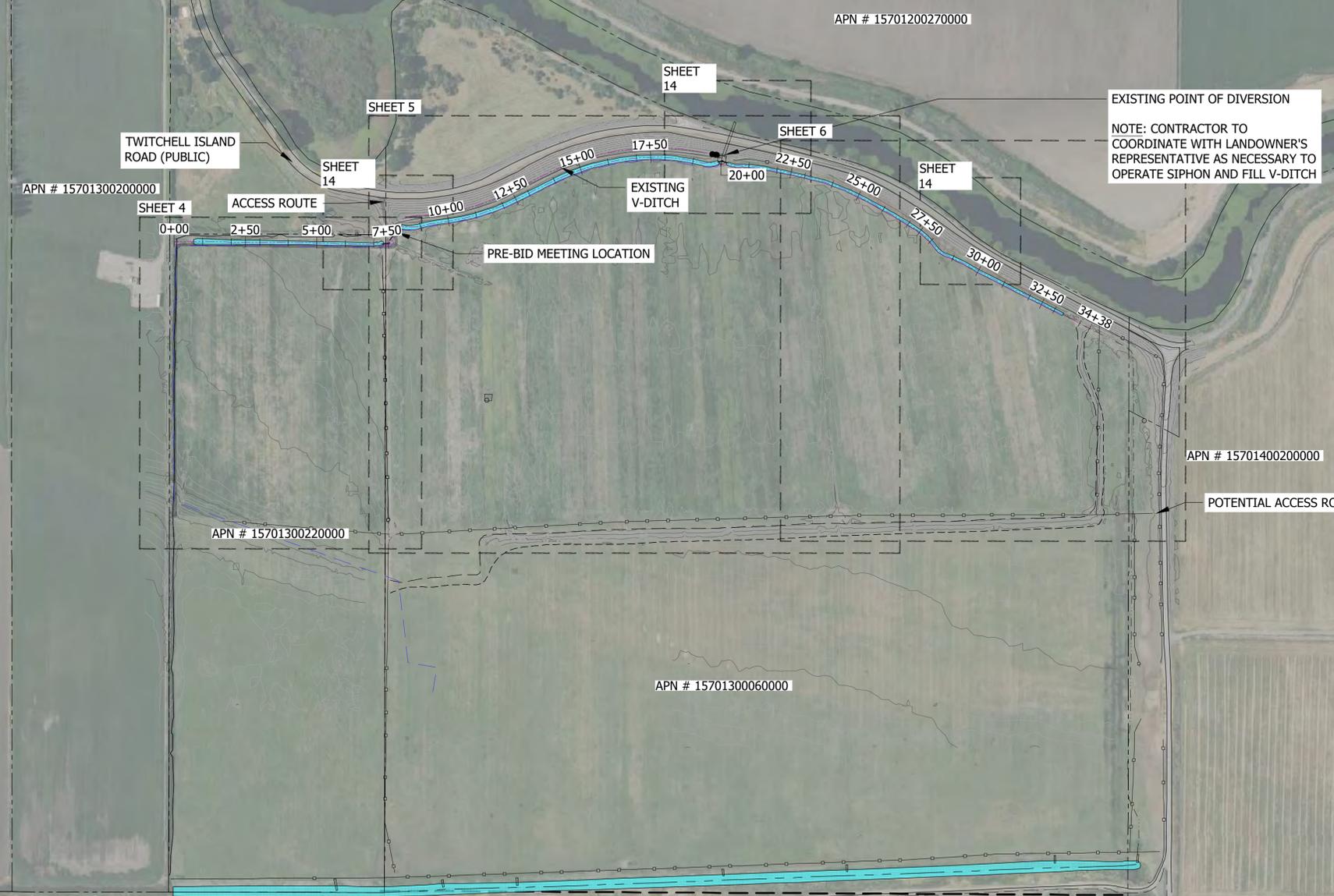
2855 TELEGRAPH AVENUE, SUITE 400
BERKELEY, CA 94705 P: (510) 848-8098

REVISIONS

NO.	DESCRIPTION	DATE

LEGEND

- ####+00 STATIONING IN FEET
-  PROFILE LINE
-  PARCEL BOUNDARY
-  WATER SURFACE ELEVATION
-  EXISTING ROAD
-  HEAD DITCH
-  WATER LINE
-  EXISTING FENCE LINE



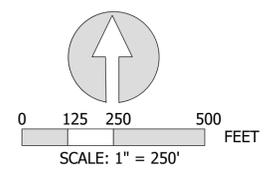
EXISTING POINT OF DIVERSION
NOTE: CONTRACTOR TO COORDINATE WITH LANDOWNER'S REPRESENTATIVE AS NECESSARY TO OPERATE SIPHON AND FILL V-DITCH



PROJECT NUMBER: 1013.00
SCALE: AS NOTED
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APPROVED: RT

OVERVIEW



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REVISIONS

NO.	DESCRIPTION	DATE

LEGEND

- ####+00 STATIONING IN FEET
- ⊕---⊕ PROFILE LINE
- PARCEL BOUNDARY
- WATER SURFACE ELEVATION
- /// EXISTING ROAD
- ▬ HEAD DITCH
- ▬ OAK SYCAMORE WOODLAND
- ▬ BLACK WILLOW FOREST
- ▬ COTTONWOOD
- ▬ COYOTE BRUSH
- ▬ MULEFAT
- ▬ ROSE BRIAR
- ▬ WILLOW SCRUB
- ▬ HERBACEOUS
- WATER LINE
- EXISTING FENCE LINE



EXISTING POINT OF DIVERSION
NOTE: CONTRACTOR TO COORDINATE WITH LANDOWNER'S REPRESENTATIVE AS NECESSARY TO OPERATE SIPHON AND FILL V-DITCH

HERBACEOUS
4.5 AC
*NO INITIAL PLANTING;
ONLY MAINTENANCE

POTENTIAL ACCESS ROUTE

<E>
CORRAL
0.2 AC



0 75 150 300
FEET
SCALE: 1" = 150'

PROJECT NUMBER: 1013.00
SCALE: AS NOTED
DATE: 12/20/24

DESIGN: EE/RT
DRAWN: BW/HG/JB
CHECKED: JB
APPROVED: RT

PLAN VIEW

SHEET 3 OF 22

LAST SAVED: 12/20/2024 PLOT DATE: 12/20/2024 PLOT STYLE: STILLWATER-GRAYSCALE-255
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LEGEND

- ###+00 STATIONING IN FEET
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- EXISTING FENCE LINE

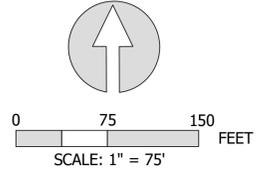
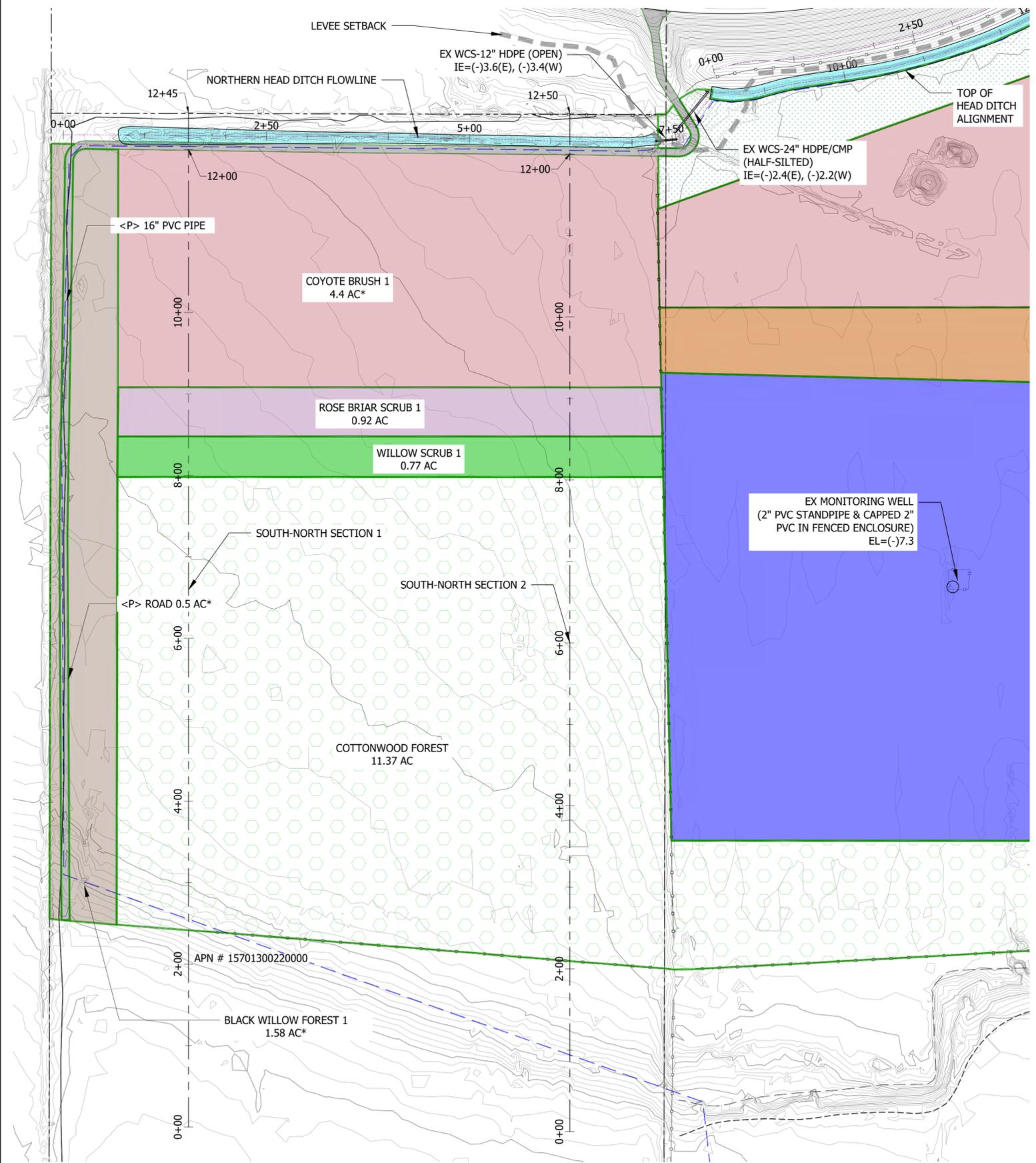


PROJECT NUMBER: 1013.00
SCALE: AS NOTED
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DESIGN: EE/RT
DRAWN: BW/HG/JB
CHECKED: JB
APPROVED: RT

**PLANTING PLAN 1 - WEST
SIDE**

SHEET 4 OF 22



LAST SAVED: 12/20/2024 PLOT DATE: 12/20/2024 PLOT STYLE: STILLWATER-GRAYSCALE.dwt
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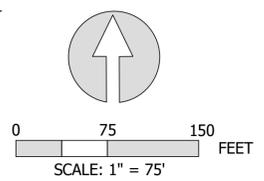
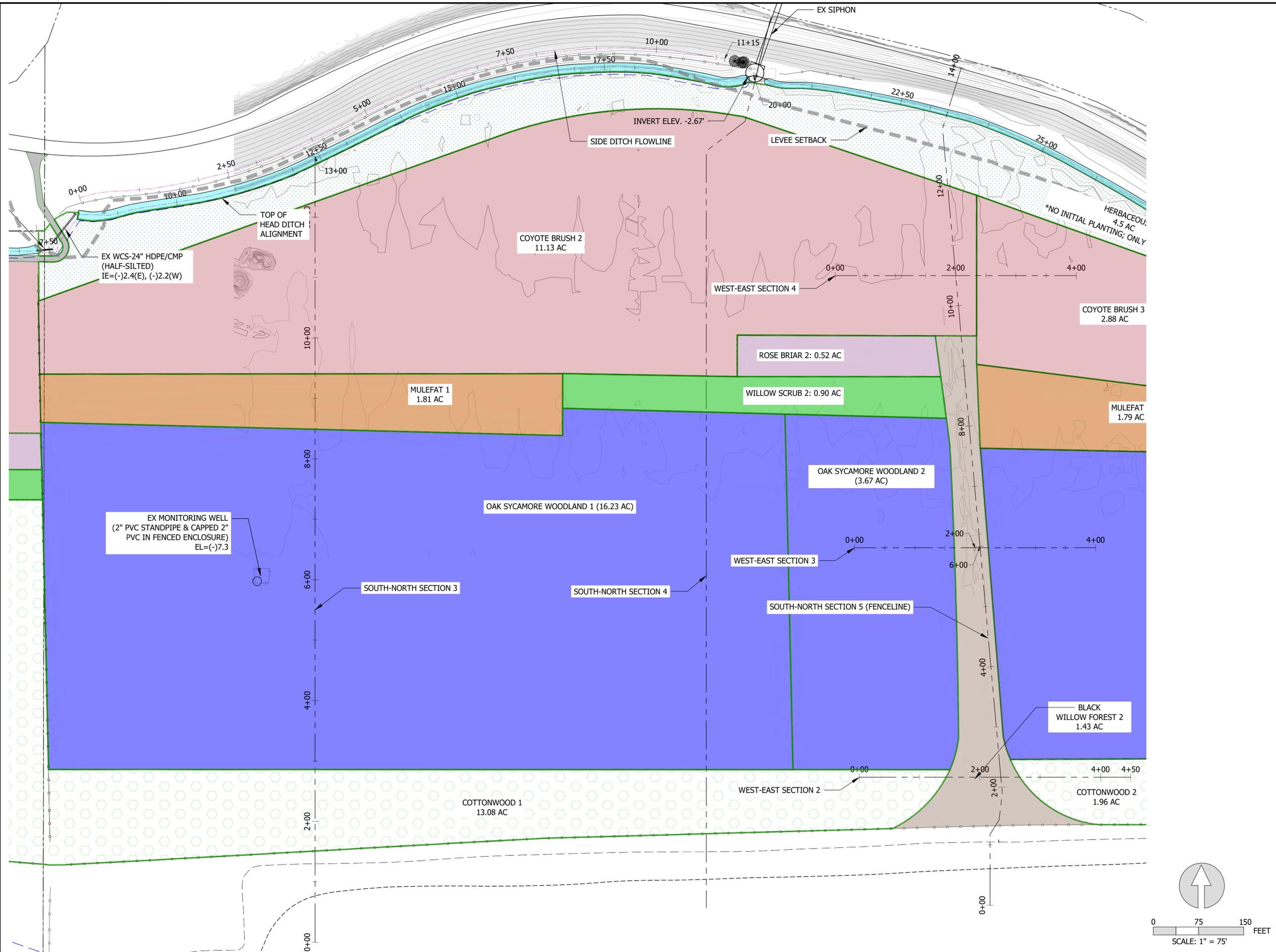
2855 TELEGRAPH AVENUE, SUITE 400
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REVISIONS

NO.	DESCRIPTION	DATE

LEGEND

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- WATER SURFACE ELEVATION
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PROJECT NUMBER: 1013.00
SCALE: AS NOTED
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DESIGN: EE/RT
DRAWN: BW/HG/JB
CHECKED: JB
APPROVED: RT

**PLANTING PLAN 2 -
CENTER**

SHEET 5 OF 22

LAST SAVED: 12/20/2024 - PLOT DATE: 12/20/2024 - PLOT STYLE: STILLWATER-GRAYSCALE-255
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DESIGN PROJECT**

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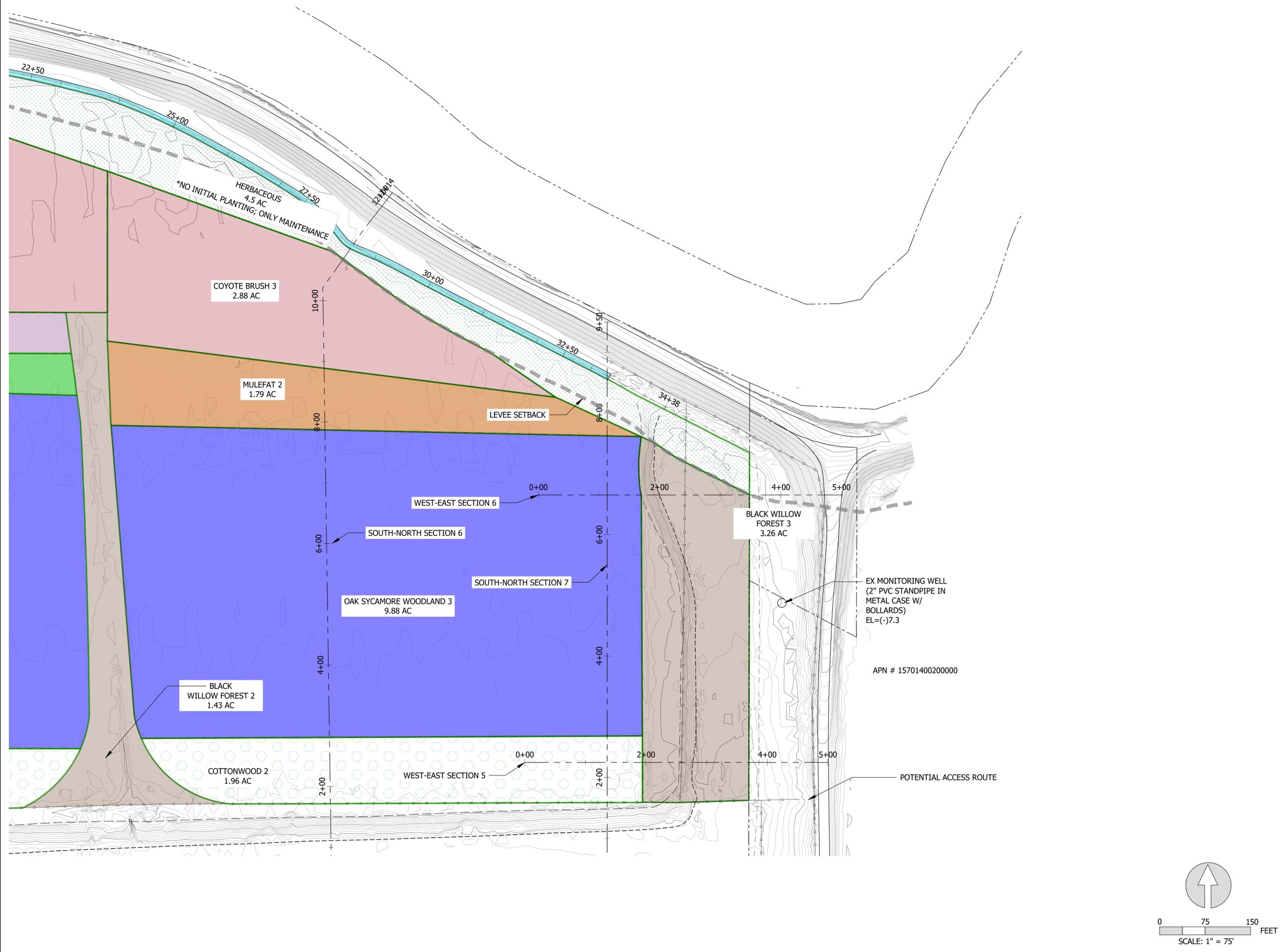
2855 TELEGRAPH AVENUE, SUITE 400
BERKELEY, CA 94705 P: (510) 848-8098

REVISIONS

NO.	DESCRIPTION	DATE

LEGEND

- ####+00 STATIONING IN FEET
- PROFILE LINE
- PARCEL BOUNDARY
- WATER SURFACE ELEVATION
- EXISTING ROAD
- HEAD DITCH
- OAK SYCAMORE WOODLAND
- BLACK WILLOW FOREST
- COTTONWOOD
- COYOTE BRUSH
- MULEFAT
- ROSE BRIAR
- WILLOW SCRUB
- HERBACEOUS
- WATER LINE
- EXISTING FENCE LINE

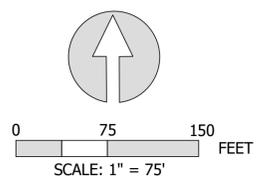


PROJECT NUMBER: 1013.00
SCALE: AS NOTED
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DESIGN: EE/RT
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**PLANTING PLAN 3 - EAST
SIDE**

SHEET 6 OF 22



LAST SAVED: 12/20/2024 PLOT DATE: 12/20/2024 PLOT STYLE: STILLWATER-GRAYSCALE-255
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**TWITCHELL ISLAND
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SACRAMENTO COUNTY, CA

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REVISIONS

NO.	DESCRIPTION	DATE

Riparian Forest: Oak Sycamore Woodland1						
Scientific name	Common name	Form	Acres	Spacing (feet)	Fill	Quantity
Acer negundo	box elder	tree	16.23	20	8%	142
Baccharis pilularis	coyote brush	shrub	16.23	10	4%	283
Baccharis salicifolia subsp. salicifolia	mule fat	shrub	16.23	10	1%	71
Cephalanthus occidentalis	California button willow	shrub	16.23	10	2%	142
Fraxinus latifolia	Oregon ash	tree	16.23	20	8%	142
Platanus racemosa	western sycamore	tree	16.23	20	30%	531
Populus fremontii subsp. fremontii	Fremont cottonwood	tree	16.23	20	3%	54
Quercus agrifolia	coast live oak	tree	16.23	20	20%	354
Quercus lobata	valley oak	tree	16.23	20	10%	177
Rosa californica	California rose	shrub	16.23	10	1%	71
Rubus ursinus	California blackberry	shrub	16.23	10	1%	71
Salix exigua	narrowleaf willow	shrub	16.23	10	2%	142
Salix gooddingii	Goodding's black willow	tree	16.23	20	2%	36
Salix laevigata	red willow	tree	16.23	20	2%	36
Salix lasiandra	Pacific willow	tree	16.23	20	2%	36
Salix lasiolepis	arroyo willow	shrub	16.23	10	2%	142
Sambucus mexicana	blue elderberry	shrub	16.23	10	1%	71
Vitis californica	California wild grape	shrub	16.23	10	1%	71
				Total percent fill:	100%	
				Total number of plants:		2,572
				Shrubs/trees per acre:		158

Riparian Forest: Oak Sycamore Woodland2						
Scientific name	Common name	Form	Acres	Spacing (feet)	Fill	Quantity
Acer negundo	box elder	tree	3.69	20	3%	33
Baccharis pilularis	coyote brush	shrub	3.69	10	4%	65
Baccharis salicifolia subsp. salicifolia	mule fat	shrub	3.69	10	1%	17
Cephalanthus occidentalis	California button willow	shrub	3.69	10	2%	33
Fraxinus latifolia	Oregon ash	tree	3.69	20	3%	33
Platanus racemosa	western sycamore	tree	3.69	20	30%	121
Populus fremontii subsp. fremontii	Fremont cottonwood	tree	3.69	20	3%	13
Quercus agrifolia	coast live oak	tree	3.69	20	20%	81
Quercus lobata	valley oak	tree	3.69	20	10%	41
Rosa californica	California rose	shrub	3.69	10	1%	17
Rubus ursinus	California blackberry	shrub	3.69	10	1%	17
Salix exigua	narrowleaf willow	shrub	3.69	10	2%	33
Salix gooddingii	Goodding's black willow	tree	3.69	20	2%	9
Salix laevigata	red willow	tree	3.69	20	2%	9
Salix lasiandra	Pacific willow	tree	3.69	20	2%	9
Salix lasiolepis	arroyo willow	shrub	3.69	10	2%	33
Sambucus mexicana	blue elderberry	shrub	3.69	10	1%	17
Vitis californica	California wild grape	shrub	3.69	10	1%	17
				Total percent fill:	100%	
				Total number of plants:		598
				Shrubs/trees per acre:		162

Riparian Forest: Oak Sycamore Woodland3						
Scientific name	Common name	Form	Acres	Spacing (feet)	Fill	Quantity
Acer negundo	box elder	tree	9.88	20	3%	87
Baccharis pilularis	coyote brush	shrub	9.88	10	4%	173
Baccharis salicifolia subsp. salicifolia	mule fat	shrub	9.88	10	1%	44
Cephalanthus occidentalis	California button willow	shrub	9.88	10	2%	87
Fraxinus latifolia	Oregon ash	tree	9.88	20	3%	87
Platanus racemosa	western sycamore	tree	9.88	20	30%	323
Populus fremontii subsp. fremontii	Fremont cottonwood	tree	9.88	20	3%	33
Quercus agrifolia	coast live oak	tree	9.88	20	20%	216
Quercus lobata	valley oak	tree	9.88	20	10%	108
Rosa californica	California rose	shrub	9.88	10	1%	44
Rubus ursinus	California blackberry	shrub	9.88	10	1%	44
Salix exigua	narrowleaf willow	shrub	9.88	10	2%	87
Salix gooddingii	Goodding's black willow	tree	9.88	20	2%	22
Salix laevigata	red willow	tree	9.88	20	2%	22
Salix lasiandra	Pacific willow	tree	9.88	20	2%	22
Salix lasiolepis	arroyo willow	shrub	9.88	10	2%	87
Sambucus mexicana	blue elderberry	shrub	9.88	10	1%	44
Vitis californica	California wild grape	shrub	9.88	10	1%	44
				Total percent fill:	100%	
				Total number of plants:		1,574
				Shrubs/trees per acre:		159



PROJECT NUMBER: 1013.00
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DESIGN: EE/RT
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**PLANTING TABLES -
WOODLAND**

SHEET 7 OF 22

CIVILS@STILLWATER-SCIENCES.COM TWITCHELL ISLAND MITIGATION AND ENHANCEMENT SITES - DOCUMENTS\GIS - TECHNICAL STUDIES-TASKS\1_DMP\2_PLANTING PLAN\WCD\1_SHEETS\18_PLANTING TABLES - WILLOW_SCRUB.DWG
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 IF BAK DOES NOT MEASURE 1" DRAWING IS NOT TO SCALE - ADJUST ACCORDINGLY

**TWITCHELL ISLAND
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ENHANCEMENT SITES -
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SACRAMENTO COUNTY, CA

Stillwater Sciences

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REVISIONS

NO.	DESCRIPTION	DATE

Riparian Forest: BlackWillow1						
Scientific name	Common name	Form	Acres	Spacing (feet)	Fill	Quantity
Acer negundo	box elder	tree	1.58	20	5%	17
Baccharis salicifolia subsp. salicifolia	mule fat	shrub	1.58	10	4%	14
Cephalanthus occidentalis	California button willow	shrub	1.58	10	7%	21
Fraxinus latifolia	Oregon ash	tree	1.58	20	5%	17
Platanus racemosa	western sycamore	tree	1.58	20	9%	28
Populus fremontii subsp. fremontii	Fremont cottonwood	tree	1.58	20	7%	22
Rubus ursinus	California blackberry	shrub	1.58	10	2%	7
Salix exigua	narrowleaf willow	shrub	1.58	10	11%	35
Salix gooddingii	Goodding's black willow	tree	1.58	20	17%	53
Salix laevigata	red willow	tree	1.58	20	7%	22
Salix lasiandra	Pacific willow	tree	1.58	20	4%	13
Salix lasiolepis	arroyo willow	shrub	1.58	10	13%	42
Sambucus mexicana	blue elderberry	shrub	1.58	10	4%	14
Vitis californica	California wild grape	shrub	1.58	10	2%	7
				Total percent fill:	100%	
				Total number of plants:		312
				Shrubs/trees per acre:		197

Riparian Forest: BlackWillow2						
Scientific name	Common name	Form	Acres	Spacing (feet)	Fill	Quantity
Acer negundo	box elder	tree	1.43	20	6%	16
Baccharis salicifolia subsp. salicifolia	mule fat	shrub	1.43	10	5%	13
Cephalanthus occidentalis	California button willow	shrub	1.43	10	7%	19
Fraxinus latifolia	Oregon ash	tree	1.43	20	6%	16
Platanus racemosa	western sycamore	tree	1.43	20	9%	26
Populus fremontii subsp. fremontii	Fremont cottonwood	tree	1.43	20	7%	19
Rubus ursinus	California blackberry	shrub	1.43	10	2%	7
Salix exigua	narrowleaf willow	shrub	1.43	10	11%	32
Salix gooddingii	Goodding's black willow	tree	1.43	20	17%	48
Salix laevigata	red willow	tree	1.43	20	7%	19
Salix lasiandra	Pacific willow	tree	1.43	20	4%	12
Salix lasiolepis	arroyo willow	shrub	1.43	10	13%	38
Sambucus mexicana	blue elderberry	shrub	1.43	10	5%	13
Vitis californica	California wild grape	shrub	1.43	10	2%	7
				Total percent fill:	100%	
				Total number of plants:		285
				Shrubs/trees per acre:		200

Riparian Forest: BlackWillow3						
Scientific name	Common name	Form	Acres	Spacing (feet)	Fill	Quantity
Acer negundo	box elder	tree	2.25	20	5%	23
Baccharis salicifolia subsp. salicifolia	mule fat	shrub	2.25	10	5%	20
Cephalanthus occidentalis	California button willow	shrub	2.25	10	7%	30
Fraxinus latifolia	Oregon ash	tree	2.25	20	5%	23
Platanus racemosa	western sycamore	tree	2.25	20	9%	37
Populus fremontii subsp. fremontii	Fremont cottonwooc	tree	2.25	20	7%	29
Rubus ursinus	California blackberry	shrub	2.25	10	2%	10
Salix exigua	narrowleaf willow	shrub	2.25	10	11%	49
Salix gooddingii	Goodding's black willow	tree	2.25	20	17%	71
Salix laevigata	red willow	tree	2.25	20	7%	29
Salix lasiandra	Pacific willow	tree	2.25	20	4%	18
Salix lasiolepis	arroyo willow	shrub	2.25	10	14%	59
Sambucus mexicana	blue elderberry	shrub	2.25	10	5%	20
Vitis californica	California wild grape	shrub	2.25	10	2%	10
				Total percent fill:	100%	
				Total number of plants:		428
				Shrubs/trees per acre:		190



PROJECT NUMBER: 1013.00

SCALE: AS NOTED

DATE: 12/20/24

DESIGN: EE/RT
DRAWN: BW/HG/JB
CHECKED: JB
APPROVED: RT

**PLANTING TABLES -
BLACK WILLOW FOREST**

SHEET 8 OF 22

LAST-SAVED: 12/20/2024 - PLOT DATE: 12/20/2024 - PLOT STYLE: STILLWATER-GRAYSCALE-255
 C:\USERS\BIBSON\STILLWATER SCIENCES\1013.00 TWITCHELL ISLAND MITIGATION AND ENHANCEMENT SITES - DOCUMENTS\AS- TECHNICAL STUDIES-TASKS\1. DMP\2. PLANTING PLAN\ACQ\1...SHEET\18 PLANTING TABLES - WILLOW SCRUB.DWG

Riparian Forest: Cottonwood1						
Scientific name	Common name	Form	Acres	Spacing (feet)	Fill	Quantity
Acer negundo	box elder	tree	13.08	20	12%	171
Baccharis salicifolia subsp. salicifolia	mule fat	shrub	13.08	10	2%	114
Cephalanthus occidentalis	California button willow	shrub	13.08	10	4%	228
Fraxinus latifolia	Oregon ash	tree	13.08	20	10%	143
Platanus racemosa	western sycamore	tree	13.08	20	10%	143
Populus fremontii subsp. fremontii	Fremont cottonwood	tree	13.08	20	36%	513
Quercus agrifolia	coast live oak	tree	13.08	20	5%	72
Quercus lobata	valley oak	tree	13.08	20	4%	57
Rosa californica	California rose	shrub	13.08	10	1%	57
Rubus ursinus	California blackberry	shrub	13.08	10	1%	57
Salix exigua	narrowleaf willow	shrub	13.08	10	2%	114
Salix gooddingii	Goodding's black willow	tree	13.08	20	4%	57
Salix laevigata	red willow	tree	13.08	20	2%	29
Salix lasiandra	Pacific willow	tree	13.08	20	2%	29
Salix lasiolepis	arroyo willow	shrub	13.08	10	2%	114
Sambucus mexicana	blue elderberry	shrub	13.08	10	2%	114
Vitis californica	California wild grape	shrub	13.08	10	1%	57
				Total percent fill:	100%	
				Total number of plants:		2,069
				Shrubs/trees per acre:		158

Riparian Forest: Cottonwood2						
Scientific name	Common name	Form	Acres	Spacing (feet)	Fill	Quantity
Acer negundo	box elder	tree	1.96	20	12%	26
Baccharis salicifolia subsp. salicifolia	mule fat	shrub	1.96	10	2%	18
Cephalanthus occidentalis	California button willow	shrub	1.96	10	4%	35
Fraxinus latifolia	Oregon ash	tree	1.96	20	10%	22
Platanus racemosa	western sycamore	tree	1.96	20	10%	22
Populus fremontii subsp. fremontii	Fremont cottonwood	tree	1.96	20	36%	77
Quercus agrifolia	coast live oak	tree	1.96	20	5%	11
Quercus lobata	valley oak	tree	1.96	20	4%	9
Rosa californica	California rose	shrub	1.96	10	1%	9
Rubus ursinus	California blackberry	shrub	1.96	10	1%	9
Salix exigua	narrowleaf willow	shrub	1.96	10	2%	18
Salix gooddingii	Goodding's black willow	tree	1.96	20	4%	9
Salix laevigata	red willow	tree	1.96	20	2%	5
Salix lasiandra	Pacific willow	tree	1.96	20	2%	5
Salix lasiolepis	arroyo willow	shrub	1.96	10	2%	18
Sambucus mexicana	blue elderberry	shrub	1.96	10	2%	18
Vitis californica	California wild grape	shrub	1.96	10	1%	9
				Total percent fill:	100%	
				Total number of plants:		320
				Shrubs/trees per acre:		164

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SACRAMENTO COUNTY, CA

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PROJECT NUMBER: 1013.00
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PLANTING TABLES -
COTTONWOOD

SHEET 9 OF 22

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 C:\USERS\BRIANSON\STILLWATER SCIENCES\1013.00 TWITCHELL ISLAND MITIGATION AND ENHANCEMENT SITES - DOCUMENTS\AS5 TECHNICAL STUDIES-TASKS\1 DMP\2 PLANTING PLAN\AC01_1_SHEETS\18 PLANTING TABLES - WILLOW SCRUB.DWG

Scrub-Shrub: Coyote1						
Scientific name	Common name	Form	Acres	Spacing (feet)	Fill	Quantity
Baccharis pilularis	coyote brush	shrub	4.40	10	45%	867
Baccharis salicifolia subsp. salicifolia	mule fat	shrub	4.40	10	12%	230
Cephalanthus occidentalis	California button willow	shrub	4.40	10	6%	120
Rosa californica	California rose	shrub	4.40	10	9%	173
Rubus ursinus	California blackberry	shrub	4.40	10	2%	41
Salix exigua	narrowleaf willow	shrub	4.40	10	8%	154
Salix lasiolepis	arroyo willow	shrub	4.40	10	5%	96
Sambucus mexicana	blue elderberry	shrub	4.40	10	13%	250
				Total percent fill:	100%	
				Total number of plants:		1,931
				Shrubs/trees per acre:		439

Scrub-Shrub: Coyote2						
Scientific name	Common name	Form	Acres	Spacing (feet)	Fill	Quantity
Baccharis pilularis	coyote brush	shrub	11.13	10	45%	2,186
Baccharis salicifolia subsp. salicifolia	mule fat	shrub	11.13	10	12%	582
Cephalanthus occidentalis	California button willow	shrub	11.13	10	6%	291
Rosa californica	California rose	shrub	11.13	10	9%	437
Rubus ursinus	California blackberry	shrub	11.13	10	2%	99
Salix exigua	narrowleaf willow	shrub	11.13	10	8%	388
Salix lasiolepis	arroyo willow	shrub	11.13	10	5%	243
Sambucus mexicana	blue elderberry	shrub	11.13	10	13%	631
				Total percent fill:	100%	
				Total number of plants:		4,857
				Shrubs/trees per acre:		437

Scrub-Shrub: Coyote3						
Scientific name	Common name	Form	Acres	Spacing (feet)	Fill	Quantity
Baccharis pilularis	coyote brush	shrub	2.82	10	45%	553
Baccharis salicifolia subsp. salicifolia	mule fat	shrub	2.82	10	12%	148
Cephalanthus occidentalis	California button willow	shrub	2.82	10	6%	74
Rosa californica	California rose	shrub	2.82	10	9%	111
Rubus ursinus	California blackberry	shrub	2.82	10	2%	27
Salix exigua	narrowleaf willow	shrub	2.82	10	8%	104
Salix lasiolepis	arroyo willow	shrub	2.82	10	5%	62
Sambucus mexicana	blue elderberry	shrub	2.82	10	13%	160
				Total percent fill:	100%	
				Total number of plants:		1,239
				Shrubs/trees per acre:		439

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PLANTING TABLES -
COYOTE BRUSH

SHEET 10 OF 22

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 LAST SAVED: 12/20/2024 PLOT DATE: 12/20/2024 PLOT STYLE: STILLWATER-GRAVSCALE - 255
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Scrub-Shrub: Mulefat1						
Scientific name	Common name	Form	Acres	Spacing (feet)	Fill	Quantity
Baccharis pilularis	coyote brush	shrub	1.81	10	10%	81
Baccharis salicifolia subsp. salicifolia	mule fat	shrub	1.81	10	44%	356
Cephalanthus occidentalis	California button willow	shrub	1.81	10	2%	16
Rosa californica	California rose	shrub	1.81	10	8%	64
Rubus ursinus	California blackberry	shrub	1.81	10	2%	16
Salix exigua	narrowleaf willow	shrub	1.81	10	8%	64
Salix lasiolepis	arroyo willow	shrub	1.81	10	9%	69
Sambucus mexicana	blue elderberry	shrub	1.81	10	15%	119
Vitis californica	California wild grape	shrub	1.81	10	2%	19
				Total percent fill:	100%	
				Total number of plants:		804
				Shrubs/trees per acre:		443

Scrub-Shrub: Mulefat2						
Scientific name	Common name	Form	Acres	Spacing (feet)	Fill	Quantity
Baccharis pilularis	coyote brush	shrub	1.79	10	10%	80
Baccharis salicifolia subsp. salicifolia	mule fat	shrub	1.79	10	44%	351
Cephalanthus occidentalis	California button willow	shrub	1.79	10	2%	16
Rosa californica	California rose	shrub	1.79	10	8%	63
Rubus ursinus	California blackberry	shrub	1.79	10	2%	16
Salix exigua	narrowleaf willow	shrub	1.79	10	8%	63
Salix lasiolepis	arroyo willow	shrub	1.79	10	9%	68
Sambucus mexicana	blue elderberry	shrub	1.79	10	15%	117
Vitis californica	California wild grape	shrub	1.79	10	2%	18
				Total percent fill:	100%	
				Total number of plants:		792
				Shrubs/trees per acre:		443

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**PLANTING TABLES -
MULEFAT**

SHEET 11 OF 22

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 LAST SAVED: 12/20/2024 PLOT DATE: 12/20/2024 PLOT STYLE: STILLWATER-GRAYSCALE.ctb
 IF BAK DOES NOT MEASURE 1" DRAWING IS NOT TO SCALE - ADJUST ACCORDINGLY

Scrub-Shrub: Rose1						
Scientific Name	Common name	Form	Acres	Spacing (feet)	Fill	Quantity
Baccharis pilularis	coyote brush	shrub	0.92	10	14%	61
Baccharis salicifolia subsp. salicifolia	mule fat	shrub	0.92	10	8%	35
Cephalanthus occidentalis	California button willow	shrub	0.92	10	7%	30
Rosa californica	California rose	shrub	0.92	10	46%	195
Rubus ursinus	California blackberry	shrub	0.92	10	2%	9
Salix exigua	narrowleaf willow	shrub	0.92	10	10%	41
Sambucus mexicana	blue elderberry	shrub	0.92	10	13%	56
				Total percent fill:	100%	
				Total number of plants:		427
				Shrubs/trees per acre:		462

Scrub-Shrub: Rose2						
Scientific Name	Common name	Form	Acres	Spacing (feet)	Fill	Quantity
Baccharis pilularis	coyote brush	shrub	0.52	10	14%	34
Baccharis salicifolia subsp. salicifolia	mule fat	shrub	0.52	10	9%	22
Cephalanthus occidentalis	California button willow	shrub	0.52	10	8%	19
Rosa californica	California rose	shrub	0.52	10	45%	110
Rubus ursinus	California blackberry	shrub	0.52	10	2%	5
Salix exigua	narrowleaf willow	shrub	0.52	10	9%	23
Sambucus mexicana	blue elderberry	shrub	0.52	10	14%	34
				Total percent fill:	100%	
				Total number of plants:		247
				Shrubs/trees per acre:		475

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**PLANTING TABLES - ROSE
BRIAR**

SHEET 12 OF 22

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 LAST SAVED: 12/20/2024 PLOT DATE: 12/20/2024 PLOT STYLE: STILLWATER-GRAYSCALE.ctb
 IF BAK DOES NOT MEASURE 1" DRAWING IS NOT TO SCALE - ADJUST ACCORDINGLY

Scrub-Shrub: Scrubwillow2						
Scientific Name	Common name	Form	Acres	Spacing (feet)	Fill	Quantity
Baccharis salicifolia subsp. salicifolia	mule fat	shrub	0.90	10	19%	79
Cephalanthus occidentalis	California button willow	shrub	0.90	10	6%	24
Rosa californica	California rose	shrub	0.90	10	8%	32
Rubus ursinus	California blackberry	shrub	0.90	10	2%	8
Salix exigua	narrowleaf willow	shrub	0.90	10	24%	100
Salix lasiolepis	arroyo willow	shrub	0.90	10	25%	103
Sambucus mexicana	blue elderberry	shrub	0.90	10	14%	59
Vitis californica	California wild grape	shrub	0.90	10	2%	8
				Total percent fill:	100%	
				Total number of plants:		413
				Shrubs/trees per acre:		461

Scrub-Shrub: Scrubwillow2						
Scientific Name	Common name	Form	Acres	Spacing (feet)	Fill	Quantity
Baccharis salicifolia subsp. salicifolia	mule fat	shrub	0.90	10	19%	79
Cephalanthus occidentalis	California button willow	shrub	0.90	10	6%	24
Rosa californica	California rose	shrub	0.90	10	8%	32
Rubus ursinus	California blackberry	shrub	0.90	10	2%	8
Salix exigua	narrowleaf willow	shrub	0.90	10	24%	100
Salix lasiolepis	arroyo willow	shrub	0.90	10	25%	103
Sambucus mexicana	blue elderberry	shrub	0.90	10	14%	59
Vitis californica	California wild grape	shrub	0.90	10	2%	8
				Total percent fill:	100%	
				Total number of plants:		413
				Shrubs/trees per acre:		461

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**PLANTING TABLES -
WILLOW SCRUB**

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 LAST SAVED: 12/20/2024 PLOT DATE: 12/20/2024 PLOT STYLE: STILLWATER-GRAVSCALE -255
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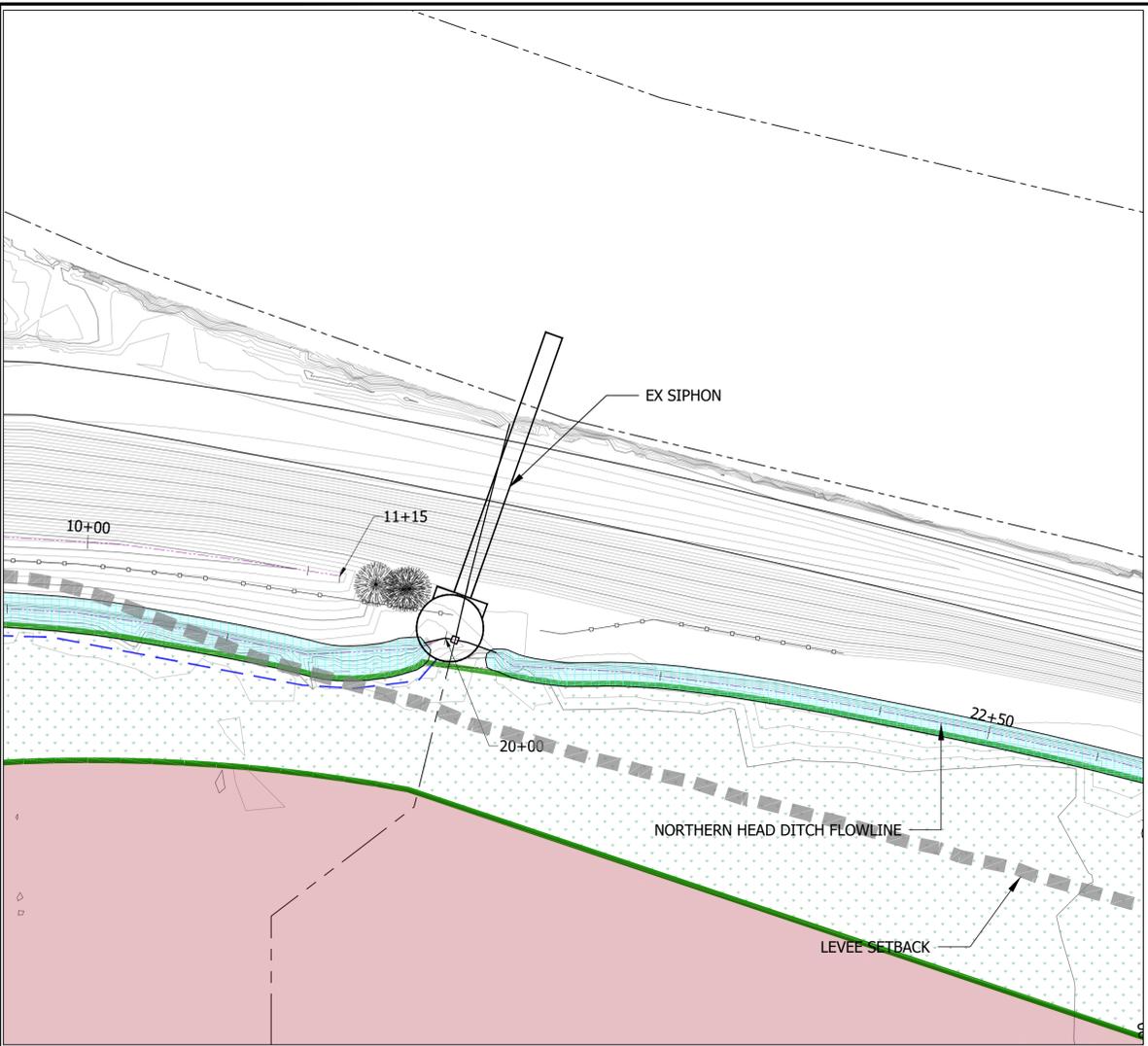
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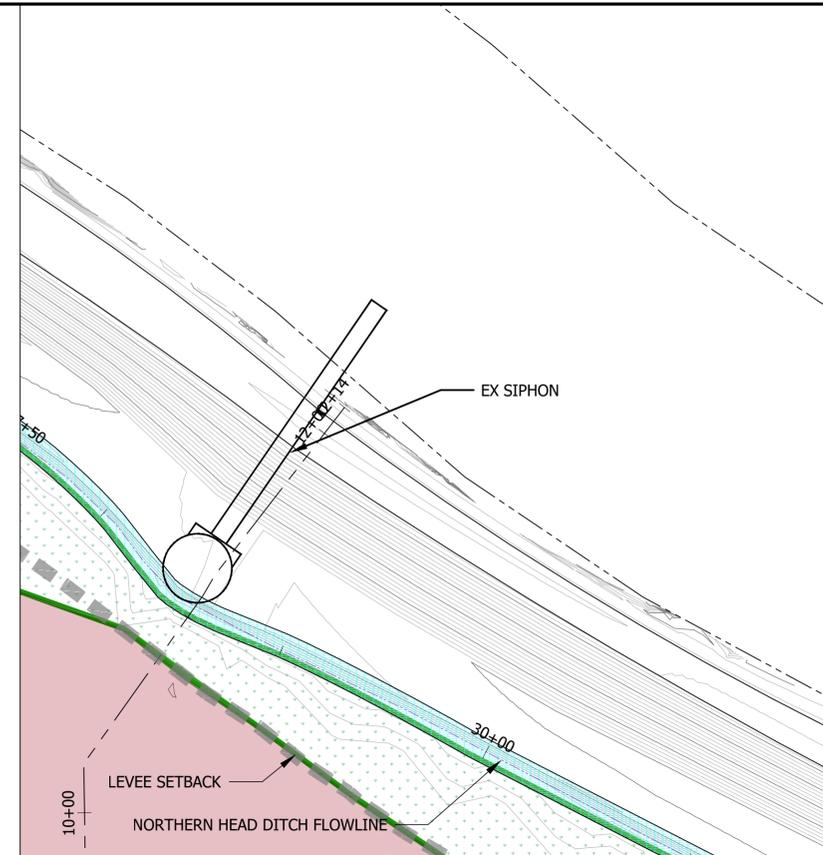
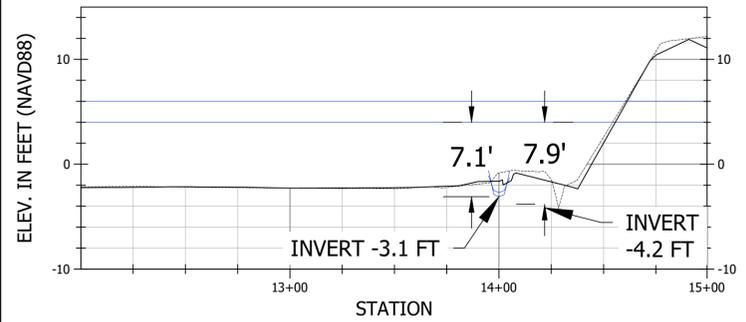
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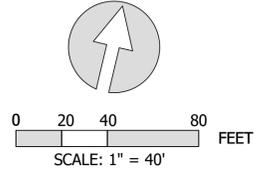
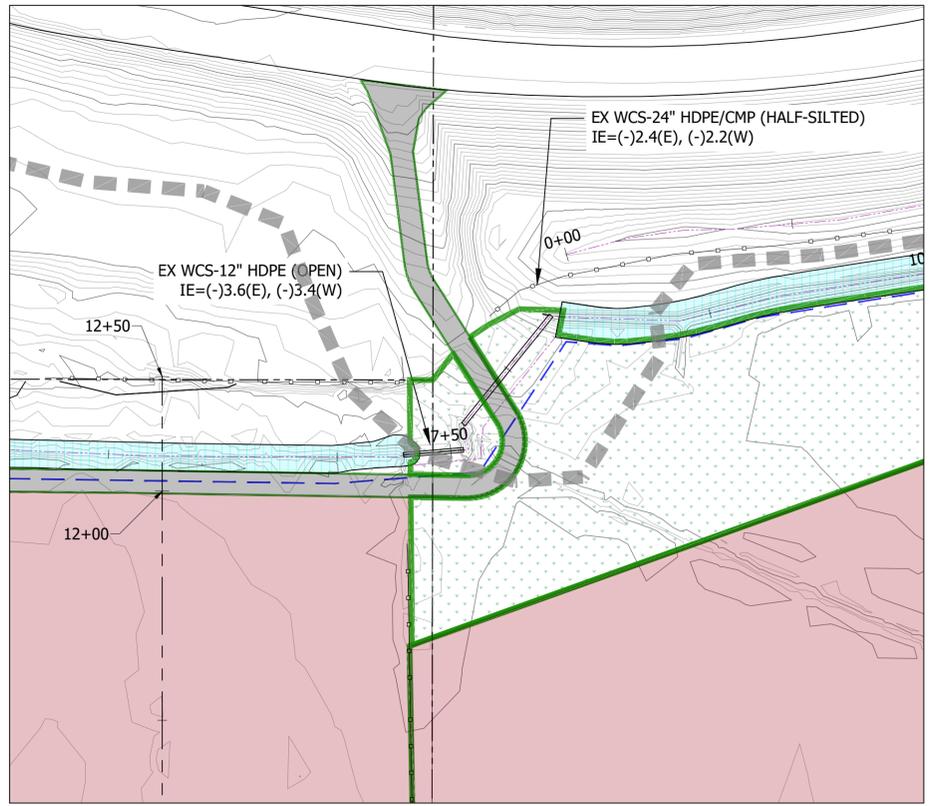
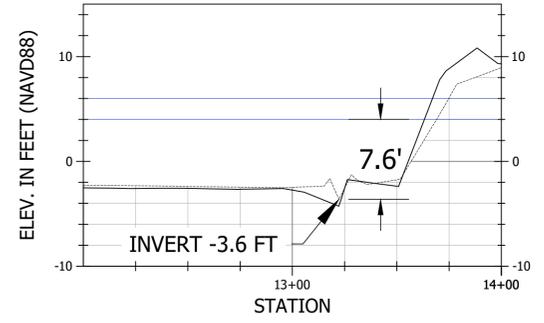
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- ⊕---⊕ PROFILE LINE
- PARCEL BOUNDARY
- WATER SURFACE ELEVATION
- /// EXISTING ROAD
- █ HEAD DITCH
- █ COYOTE BRUSH
- █ HERBACEOUS
- WATER LINE
- EXISTING FENCE LINE



SIPHON - WEST



SIPHON - EAST



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**INFRASTRUCTURE
PLANVIEW DETAILS**

SHEET 14 OF 22

LAST SAVED: 12/20/2024 PLOT DATE: 12/20/2024 PLOT STYLE: STILLWATER-GRAYSCALE.ctb
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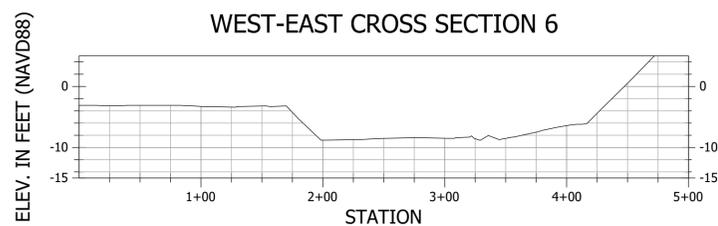
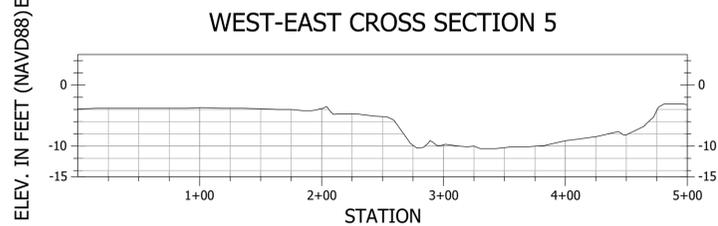
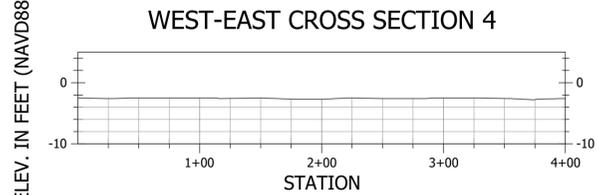
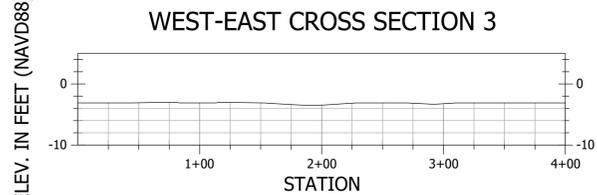
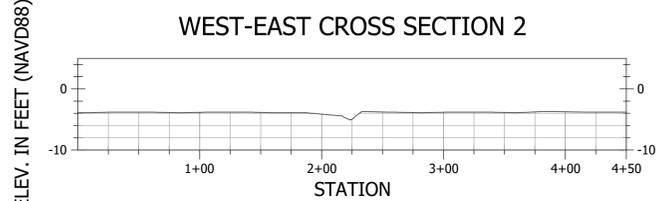
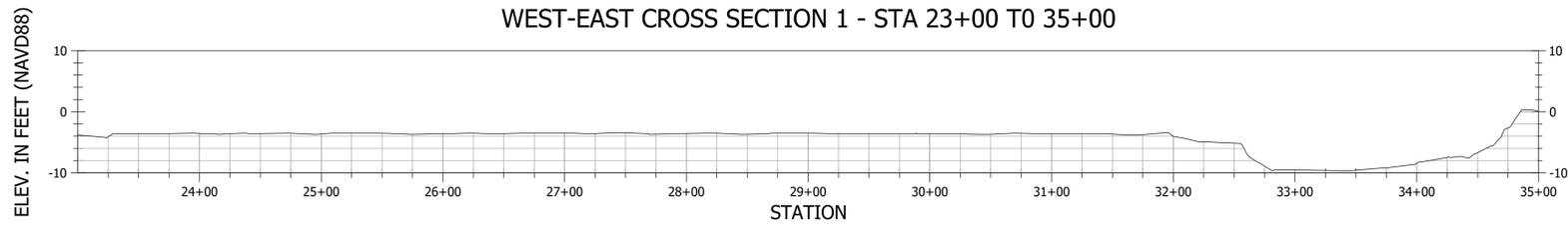
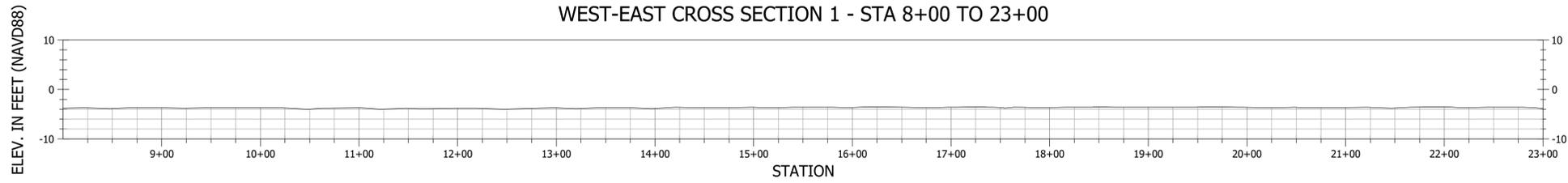
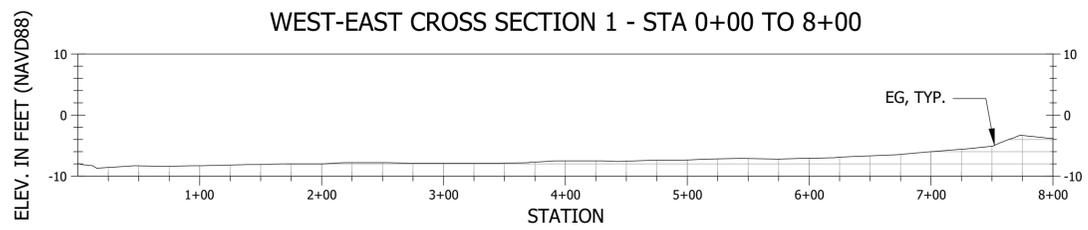
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**WEST-EAST TYPICAL
SECTIONS**

SHEET 15 OF 22

LAST SAVED: 9/30/2023 PLOT DATE: 4/8/2024 PLOT STYLE: STILLWATER-GRAYSCALE-255
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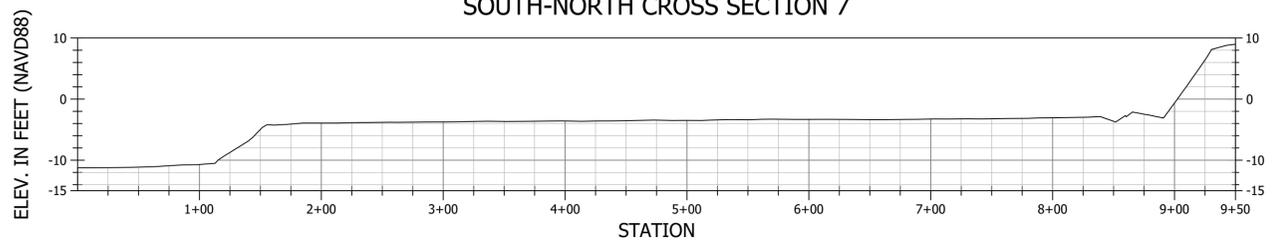
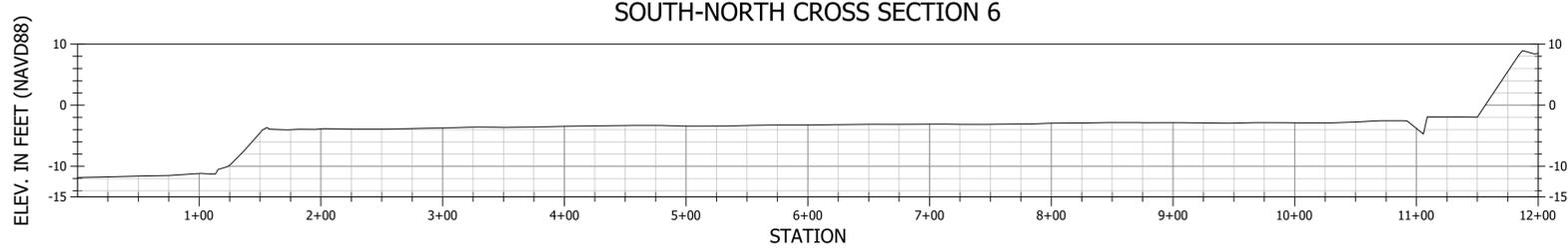
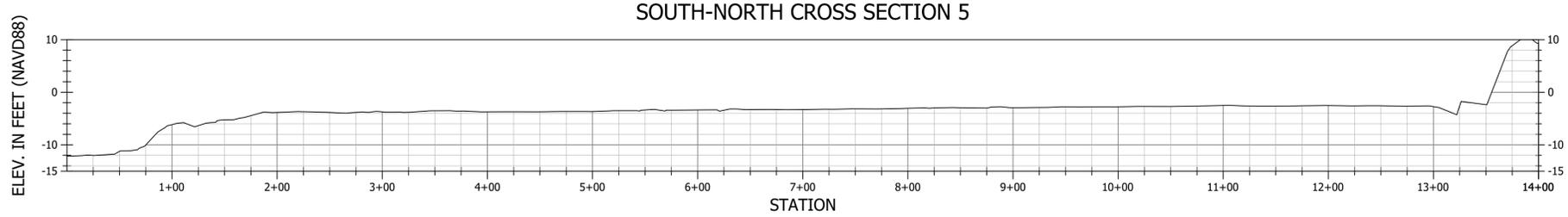
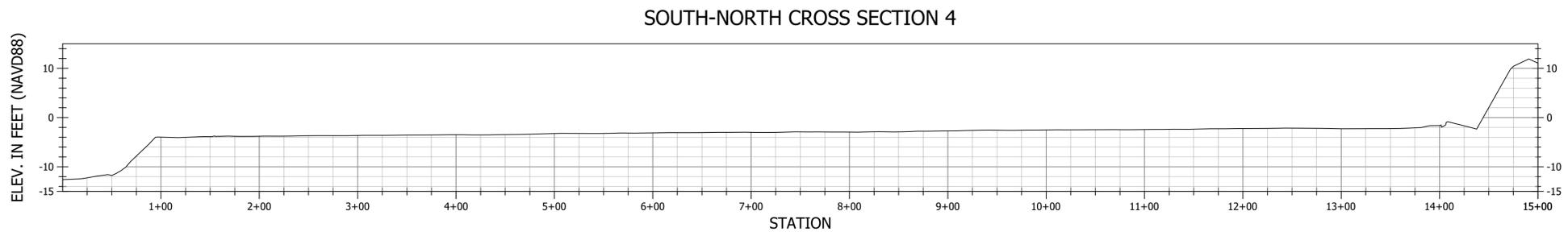
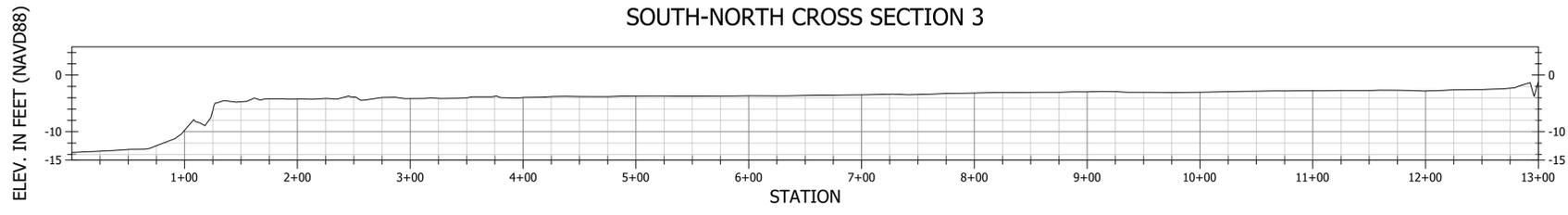
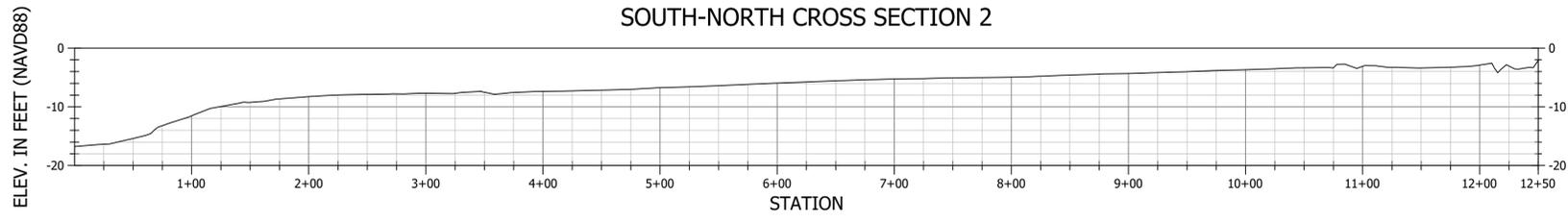
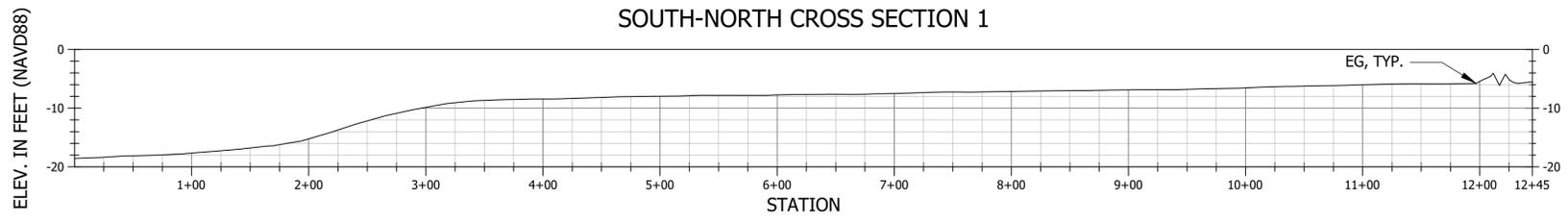
SACRAMENTO COUNTY, CA

Stillwater Sciences

2855 TELEGRAPH AVENUE, SUITE 400
BERKELEY, CA 94705 P: (510) 848-8098

REVISIONS

NO.	DESCRIPTION	DATE



PROJECT NUMBER: 1013.00
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DATE: 4/8/24

DESIGN: EE/RT
DRAWN: BW/HG/JB
CHECKED: JB
APPROVED: RT

**SOUTH-NORTH TYPICAL
SECTIONS**

LAST SAVED: 9/20/2023 PLOT DATE: 4/8/2024 PLOT STYLE: STILLWATER-GRAYSCALE.ctb
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TWITCHELL ISLAND
MITIGATION AND
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DESIGN PROJECT

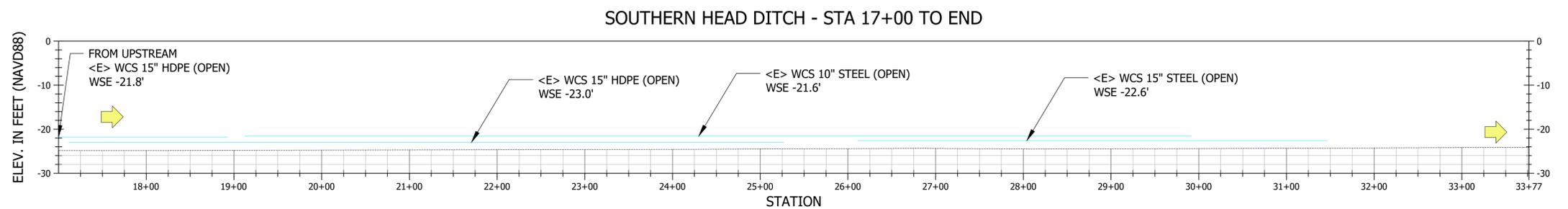
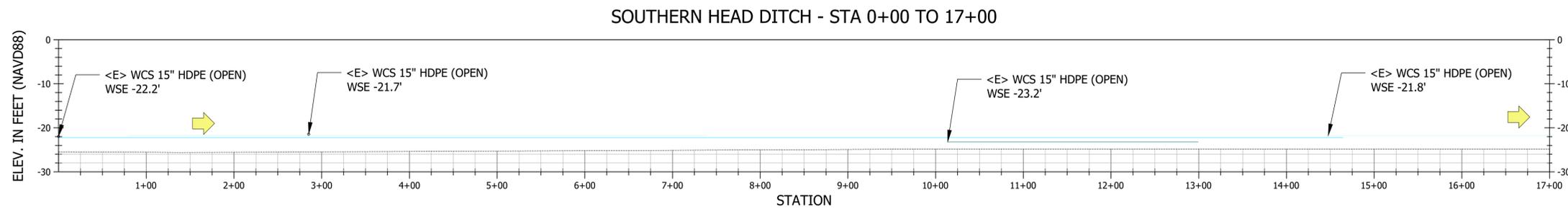
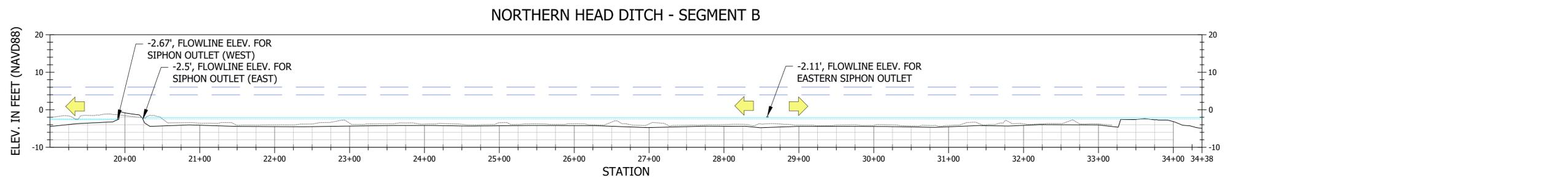
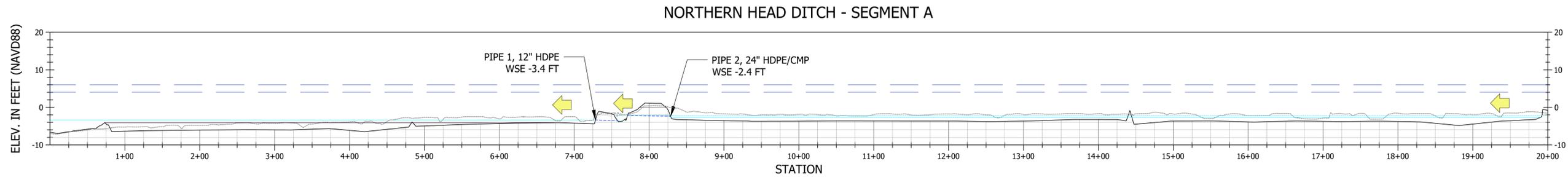
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BERKELEY, CA 94705 P: (510) 848-8098

REVISIONS

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PROJECT NUMBER: 1013.00
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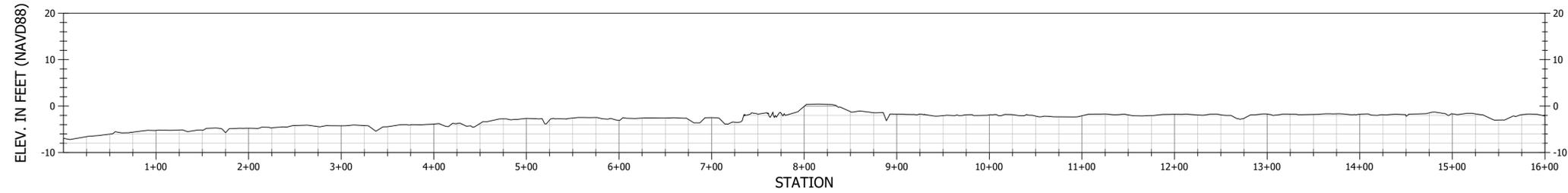
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DRAWN: BW/HG/JB
CHECKED: JB
APPROVED: RT

DITCH FLOWLINE
PROFILES 1

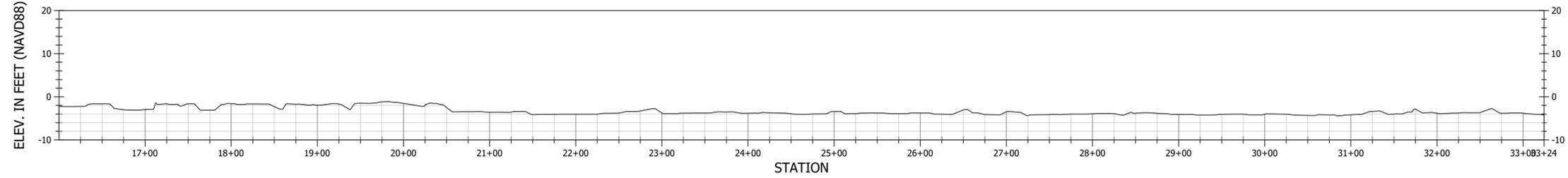
SHEET 17 OF 22

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NORTHERN HEAD DITCH - TOP OF DITCH - SEGMENT A



NORTHERN HEAD DITCH - TOP OF DITCH - SEGMENT B



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SACRAMENTO COUNTY, CA

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DITCH FLOWLINE
PROFILES 2

SHEET 18 OF 22

IF BAK DOES NOT MEASURE 1" DRAWING IS NOT TO SCALE - ADJUST ACCORDINGLY
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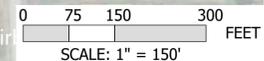
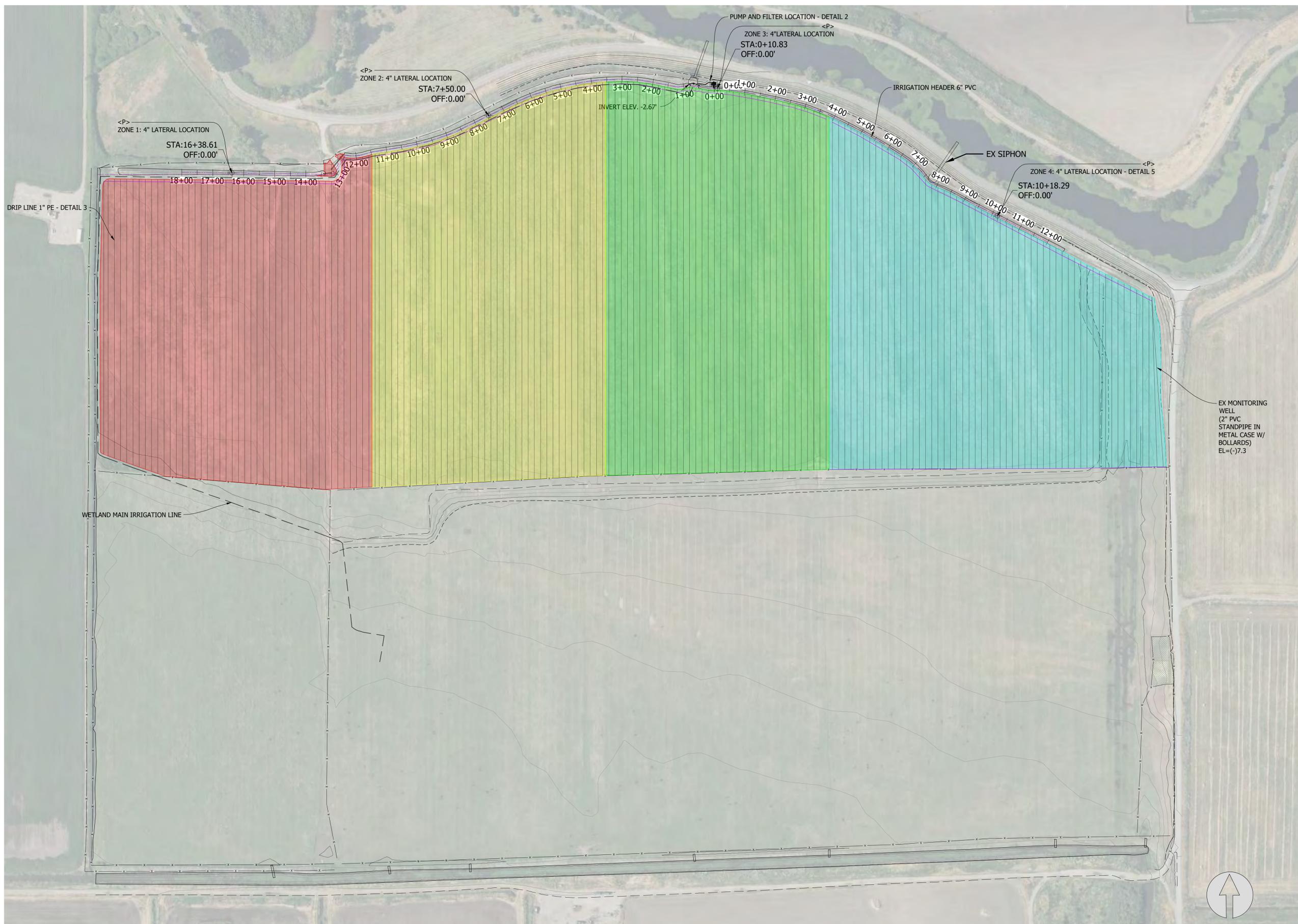
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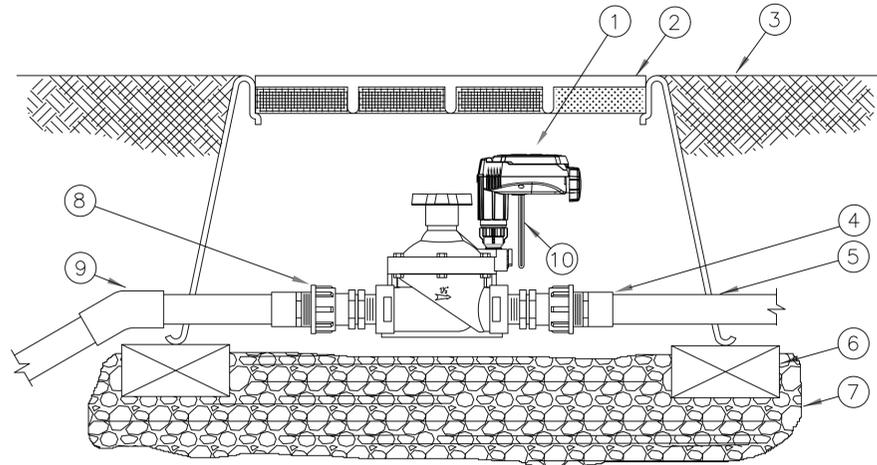
IRRIGATION LAYOUT

P: (510) 848-8098
 PLOT DATE: 4/8/2024
 PLOT STYLE: STILLWATER-GRAYSCALE.ctb
 LAST SAVED: 12/19/2023
 STUDIES-FABR03_3_IMPLEMENTATION_2_PLANTING_PLAN_V020_2_MODEL_IRRIGATION.DWG

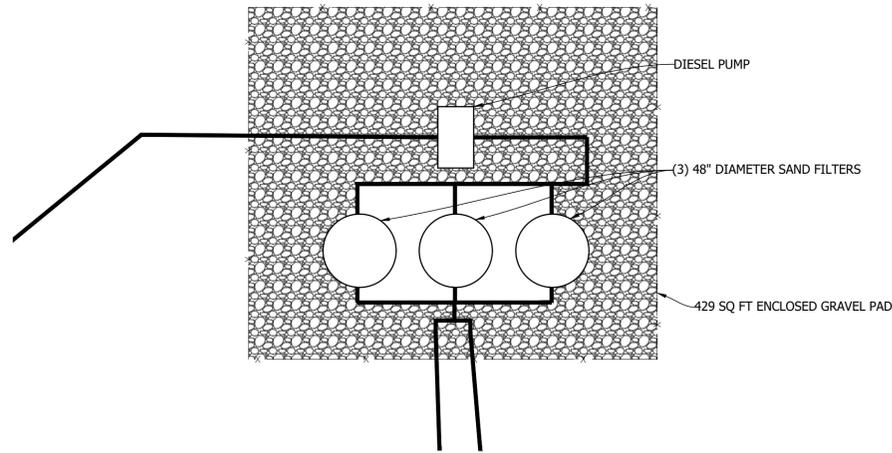
SOLENOID VALVE

LEGEND

- ① SINGLE STATION BATTERY OPERATED CONTROLLER WITH RAIN SENSOR CONNECTION AND INLINE VALVE (IP68) DIG MODEL 400A-150 WITH 1 1/2" INLINE VALVE DIG MODEL 400A-200 WITH 2" INLINE VALVE INCLUDING VALVE ADAPTER MODEL: 30-920
- ② VALVE BOX WITH COVER 12" SIZE
- ③ FINISH GRADE TOP
- ④ PVC SCH 40 MALE ADAPTER
- ⑤ PVC MAIN LINE
- ⑥ BRICK SUPPORT AT EACH CORNER
- ⑦ PEA GRAVEL SUMP MINIMUM 3"
- ⑧ SWIVEL FITTING FOR EASY CONNECTION MODEL: 23-152 1.5" MODEL: 23-202 2"
- ⑨ PVC SCH 40 45 DEGREE ELL
- ⑩ RAIN SENSOR WIRE CONNECTION

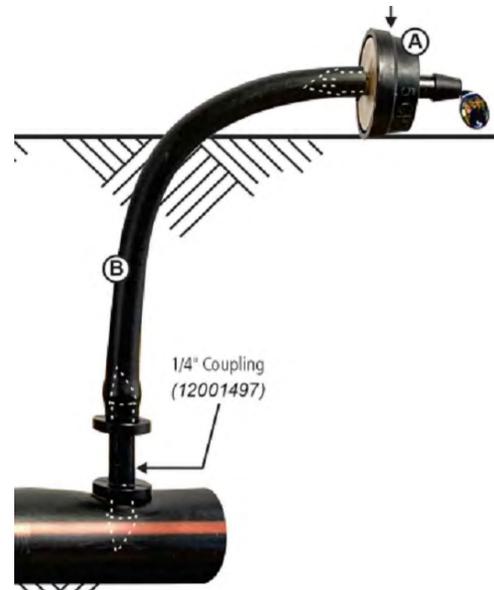


1 TYPICAL BATTERY POWERED SOLENOID VALVE
NTS



2 DIESEL PUMP WITH FILTERS - PLAN
Scale: 1" = 5'

0.5 GPH EMITTER WITH 0.25" COUPLING TO DRIP-LINE



3 DRIP LINE EMITTER - DETAIL
NTS

0.5 GPH EMITTER

CETA® PC Dropper

A take apart pressure compensating dropper incorporating a turbulent flow path and diaphragm for uniform flow rates over a wide range of operating pressure.

Features

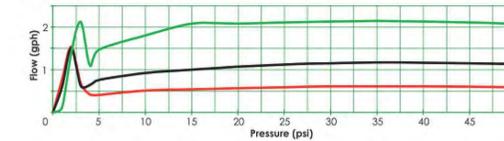
- Low manufacturing coefficient of variation (Cv) provides high performance (conforms to ISO 9261).
- Three color coded and stamped flow rates: 1/2 gph (Red), 1 gph (Black) & 2 gph (Green).
- Large clog resistant turbulent flow path.
- The CETA® dropper is able to be taken apart for inspection and cleaning.
- Anti-insect baffle to deter insect entry.
- Constructed of high quality UV and chemical resistant materials.

Applications
Vineyards, orchards, row crops and landscape applications.

Performance Chart

Pressure (psi)	Flow (gph)		
	1/2 gph	1 gph	2 gph
5	0.41	0.76	1.47
10	0.51	0.92	1.80
15	0.54	1.00	2.08
20	0.57	1.07	2.08
25	0.59	1.12	2.11
30	0.61	1.15	2.13
35	0.61	1.17	2.14
40	0.61	1.16	2.13
45	0.60	1.15	2.11
50	0.59	1.13	2.07

Flow Rate vs. Pressure



Ordering Information - CETA® PC Barb

Flow	Part Number	Pack Quantity	Packs Per Carton	Carton (lbs)
1/2 gph	30425	100	50	15.6
1 gph	30445	100	50	15.6
2 gph	30485	100	50	15.6

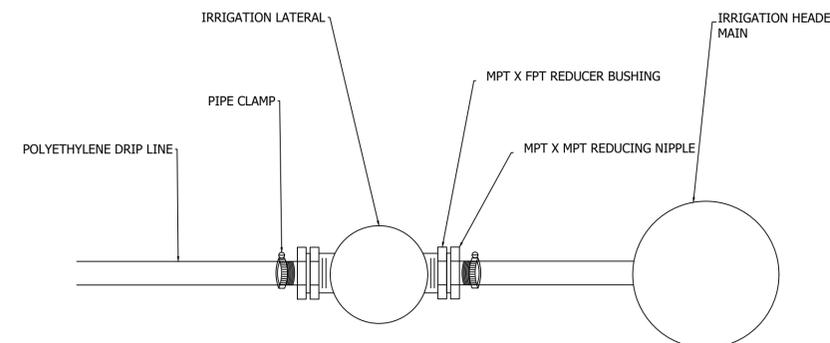
Specifications

Dimensions Assembled	CETA® PC
HEIGHT	1.0"
WIDTH	0.8"
DEPTH	0.6"
WEIGHT (approx.)	0.06 oz
UV STABILIZED MATERIALS	BASE polypropylene CAP polypropylene DIAPHRAGM silicone rubber
CONNECTION TYPE:	Inlet BARB 0.16" Outlet SPOUT 0.16"



4 EMITTER - DETAIL
NTS

PVC TO PE CONNECTION (TYP. SECTION)



NTS

5 MAIN CONNECTION TO DRIP LINE - SECTION

TWITCHELL ISLAND MITIGATION AND ENHANCEMENT SITES - DESIGN PROJECT

SACRAMENTO COUNTY, CA

Stillwater Sciences

2855 TELEGRAPH AVENUE, SUITE 400
BERKELEY, CA 94705 P: (510) 848-8098

REVISIONS

NO.	DESCRIPTION	DATE

PROJECT NUMBER: 1013.00
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APPROVED: RT

IRRIGATION DETAILS

LAST SAVED: 12/19/2023 PLOT DATE: 4/8/2024 PLOT STYLE: STILLWATER-GRAVSCALE-255
C:\USERS\BUBBINA\STILLWATER SCIENCES\1013.00 TWITCHELL ISLAND MITIGATION AND ENHANCEMENT SITES - 08 TECHNICAL STUDIES-TASKS_3 IMPLEMENTATION_2 PLANTING PLAN\ACAD\2_MODEL\IRRIGATION.DWG

**TWITCHELL ISLAND
MITIGATION AND
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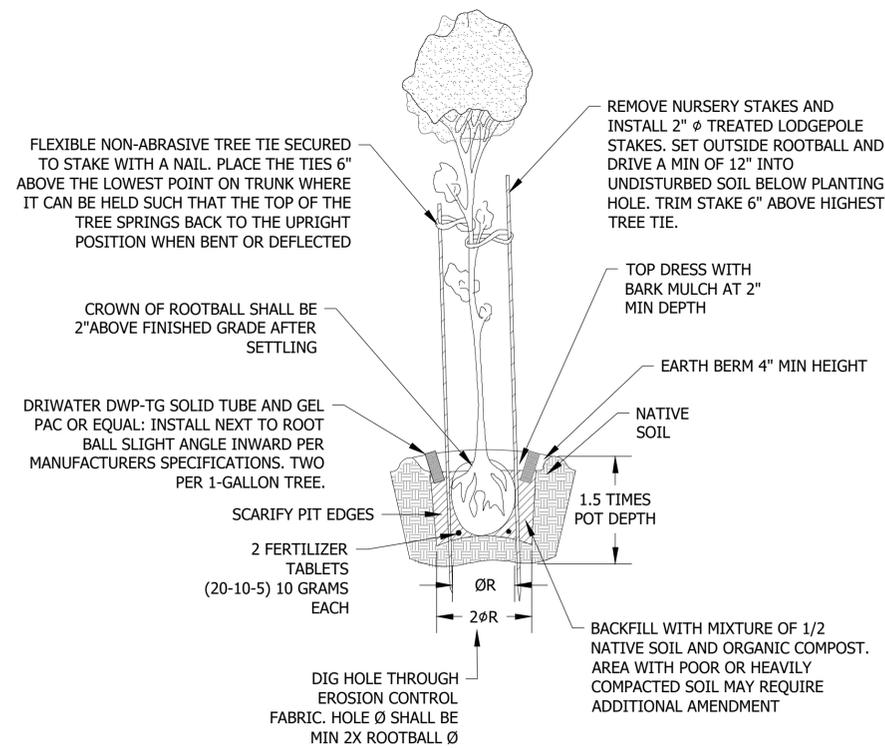
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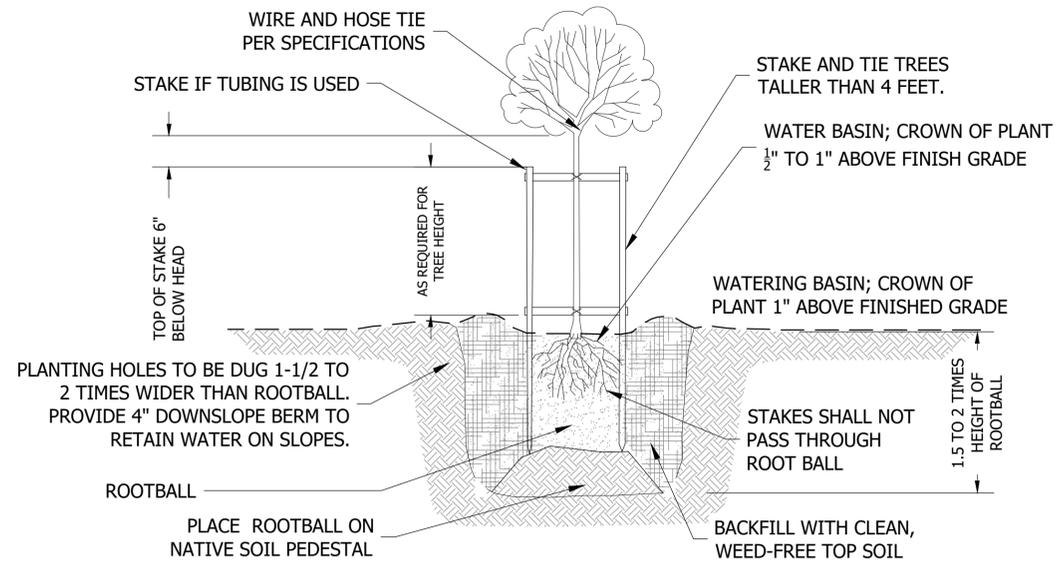
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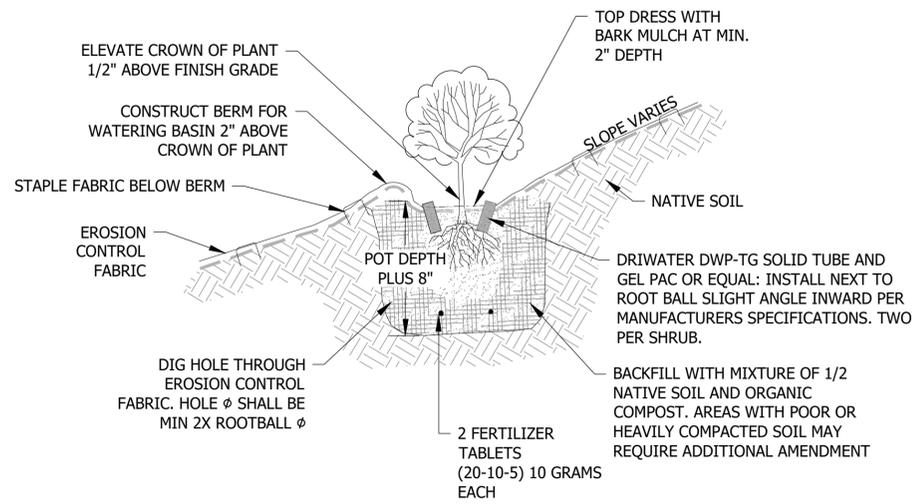
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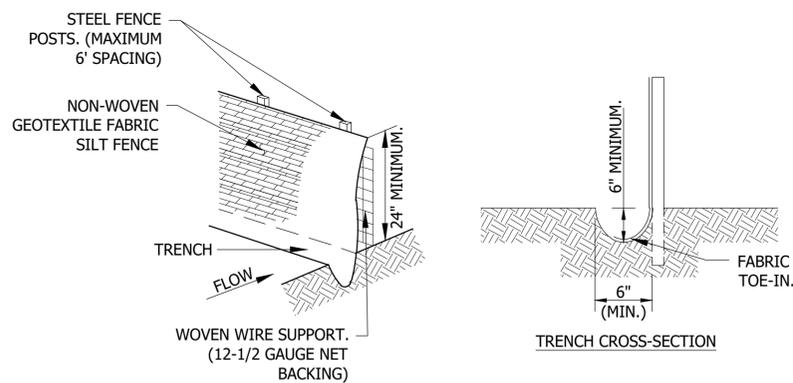
1 TREE PLANTING
NTS



2 TREE PROTECTION
NTS



3 SHRUB PLANTING
NTS



4 SILT FENCE DETAIL
NTS

- NOTES:**
1. STEEL POSTS WHICH SUPPORT THE SILT FENCE SHALL BE INSTALLED ON A SLIGHT ANGLE TOWARD THE ANTICIPATED RUNOFF SOURCE. POST MUST BE EMBEDDED A MIN. OF ONE (1') FOOT.
 2. THE TOE OF THE SILT FENCE SHALL BE TRENCHED IN WITH A SPADE OR MECHANICAL TRENCHER, SO THAT THE DOWNSLOPE FACE OF THE TRENCH IS FLAT AND PERPENDICULAR TO THE LINE OF FLOW. WHERE FENCE CANNOT BE TRENCHED IN (E.G. PAVEMENT) WEIGHT FABRIC FLAP WITH WASHED GRAVEL ON UPHILL SIDE TO PREVENT FLOW UNDER FENCE.
 3. THE TRENCH MUST BE A MINIMUM OF 6 INCHES DEEP AND 6 INCHES WIDE TO ALLOW FOR THE SILT FENCE FABRIC TO BE LAID IN THE GROUND AND BACKFILLED WITH COMPACTED MATERIAL.
 4. SILT FENCE SHALL BE SECURELY FASTENED TO EACH STEEL SUPPORT POST OR TO WOVEN WIRE, WHICH IN TURN IS SECURELY FASTENED TO THE STEEL FENCE POSTS.
 5. INSPECTION SHALL BE MADE WEEKLY OR AFTER EACH RAINFALL EVENT AND REPAIR OR REPLACEMENT SHALL BE MADE PROMPTLY AS NEEDED.
 6. SILT FENCE SHALL BE REMOVED WHEN THE SITE IS COMPLETELY STABILIZED SO AS NOT TO BLOCK OR IMPEDE STORM FLOW OR DRAINAGE.
 7. ACCUMULATED SILT SHALL BE REMOVED WHEN IT REACHES A DEPTH OF 6 INCHES. THE SILT SHALL BE DISPOSED OF IN AN APPROVED SITE AND IN SUCH A MANNER AS TO NOT CONTRIBUTE TO ADDITIONAL SILTATION.



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PLANTING DETAILS

LAST SAVED: 12/13/2023 PLOT DATE: 4/8/2024 PLOT STYLE: STILLWATER-GRayscale-255 SAVES: \\BURNS\STILLWATER_SCIENCES\101300_TWITCHELL_ISLAND_MITIGATION_AND_ENHANCEMENT_SITES\08_TECHNICAL_STUDIES-FRSP03_3_IMPLEMENTATION_2_PLANTING_PLAN\CA01_1_SHEETS_3_OVERVIEW.DWG

**TWITCHELL ISLAND
MITIGATION AND
ENHANCEMENT SITES -
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SACRAMENTO COUNTY, CA

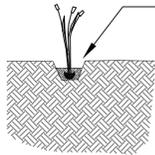
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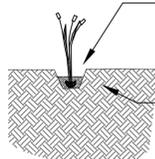
REVISIONS

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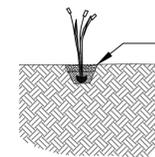
OPEN PLANTING HOLES IN SOIL SLIGHTLY DEEPER THAN LENGTH OF ROOTBALL WITH SHOVEL, TROWEL OR OTHER TOOL



INSERT SALVAGED PLANTS DEEPLY INTO HOLES SO THAT TOP OF ROOTBALL IS AT LEAST 1/2" BELOW ADJACENT NATIVE SOIL



FIRM SOILS AROUND SALVAGED PLANTS, SOIL & ROOTS WITH BLOWS FROM SMALL SLEDGE OR MALLET



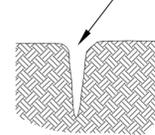
COMPLETELY COVER ALL SALVAGED PLANT ROOTBALLS WITH 1/2" NATIVE SOIL & TOPPED WITH 2-3" OF MULCH

NOTES:

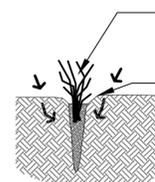
1. LEAVES MAY BE CLIPPED; HOWEVER, EACH UNIT SHALL INCLUDE AERIAL STEMS THAT ARE A MINIMUM OF 18" TO 36" TALL AND ROOTBALLS SHALL BE NO SMALLER THAN 2.4" X 2.4", WITH HEALTHY RHIZOMES AND TOPS.
2. HOLE SHALL BE EQUAL IN DEPTH TO THE ROOTBALL AND 1 TO 1.5 TIMES THE WIDTH OF THE ROOTBALL (ROOTBALL IS FLUSH OR SLIGHTLY BELOW FINISHED GRADE)
3. BACKFILL WITH CLEAN, WEED-FREE TOP SOIL, TAMP SOIL TO REMOVE AIR POCKETS
4. CONSTRUCT A BERM ON THE DOWNSLOPE SIDE THAT IS A HALF-CIRCLE 2" TO 3" ABOVE GRADE

5 SALVAGED PLANTS
NTS

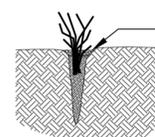
OPEN PLANTING HOLES IN SOIL SLIGHTLY DEEPER THAN LENGTH OF PLUGS WITH SHOVEL, TROWEL OR OTHER TOOL



INSERT PLUGS DEEPLY INTO HOLES SO THAT TOP OF PLUG SOIL IS AT LEAST 1/2" BELOW ADJACENT NATIVE SOIL

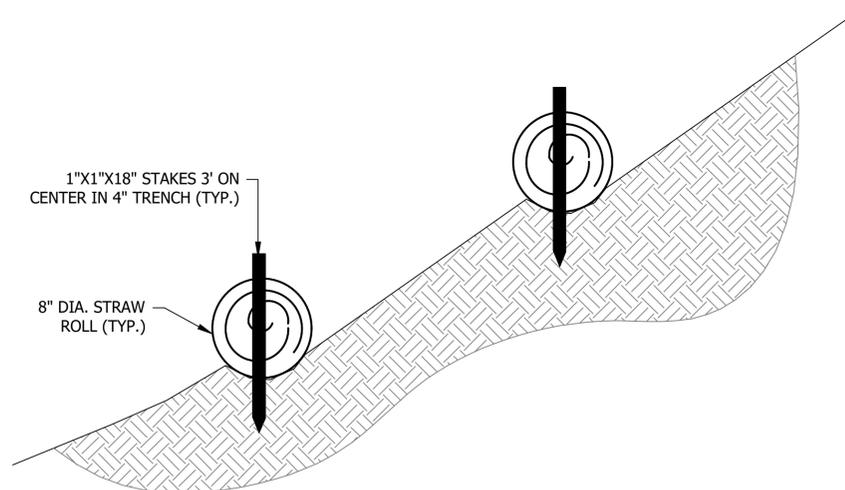


FIRM SOILS AROUND PLUGS, SOIL & ROOTS WITH BLOWS FROM SMALL SLEDGE OR MALLET



COMPLETELY COVER ALL PLUG NURSERY SOIL WITH 1/2" CLEAN, WEED-FREE TOPSOIL

6 PLUG INSTALLATION
NTS



NOTE:

PLACE THE LOOSE EDGE OF THE FIBER ROLLS INTO A 4-INCH DEEP TRENCH AND SECURE WITH A SINGLE ROW OF STAPLES INSTALLED ON 12-INCH CENTERS. THEN PROCEED TO POSITION THE FIBER ROLLS INTO THE TRENCH ADJACENT TO THE SIDEWALK/BACK OF CURB/BACK OF V-DITCH. DRIVE WOODEN 18-INCH STAKES THROUGH THE ROLL ON APPROXIMATELY 3-FOOT CENTERS TO SECURE IN PLACE. CONSTRUCTION OF THE TRENCH AND PROPER STAPLE PLACEMENT IS NECESSARY TO PREVENT WATER AND SEDIMENT FROM FLOWING DIRECTLY UNDER THE SEDIMENT CONTROL ROLL. WITH THIS TYPE OF INSTALLATION, WATER WILL ACCUMULATE BEHIND THE ROLL, ALLOWING SEDIMENT LADEN WATER TO BE FILTERED THROUGH THE ROLL WHILE DEPOSITION OF SEDIMENT OCCURS BEHIND THE ROLL.

7 STRAW ROLL INSTALLATION
NTS



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PLANTING DETAILS (2)

LAST SAVED: 12/13/2023 11:58:00 AM PLOT DATE: 4/8/2024 PLOT STYLE: STILLWATER-GRAYSCALE-255 CAL:\ASSETS\BURNES\STILLWATER_SCIENCES\1013.00_TWITCHELL_ISLAND_MITIGATION_AND_ENHANCEMENT_SITES\DB_TECHNICAL_STUDIES-TASKS_3_IMPLEMENTATION\2_PLANTING_PLAN\CA01\1_SHEETS_3_OVERVIEW.DWG