

APPENDIX B

Basis of Design

Prospect Island Habitat Restoration

Solano County, California

Revegetation / Bio-Engineering Design Office Report

**Landscape Architectural Unit
Structural Design Section (CW)**



**US ARMY CORPS OF ENGINEERS
Sacramento District**

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PROSPECT ISLAND HABITAT RESTORATION
Restoration / Bio-Engineering Design Office Report

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Prospect Island Habitat Restoration Restoration / Bio-Engineering Design Office Report

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A. Design Alternative

1. Alternative: The original direction for this office report was to further design and analyze the selected alternative plan 1B from the reconnaissance report (April 1995). Subsequent discussions and recent meetings with local and federal agencies have amended that plan to reflect current conditions and policies. A new modified alternative designated Alternative #5 was created for this report. This alternative has two breaches located at the southern end of the project with re-configured berms and islands (See Plan: L1.0 and C2.0).

2. Design Focus and Direction: The project's limited funding has necessitated the focus of the earthwork design and revegetation efforts to the protection & stabilization (bio-engineering) of the proposed flooded interior faces of the existing levees. Secondary consideration was given for riparian habitat creation on the islands and benches.

2.1 Revegetation: Project funds and scope have limited the amount, type, and method of bio-engineering efforts that can be achieved in the initial restoration and bio-engineering effort. Selected upland areas will be planted for riparian habitat.

2.2 Earthwork: Island configuration and placement were designed for cost effectiveness, efficiency, and fetch protection; berm configuration and placement were located at interior levee areas exposed to wind wave erosion.

3. Assumptions: Several design and project assumptions were agreed upon during team meetings and incorporated into the preparation of this report:

3.1 All flood damage will be repaired to pre-winter 1996/97 conditions. (Miner Slough breach was repaired in fall of 1997, Port breach and cross levee breach were repaired by winter of 1999)

3.2 The project will be constructed in the dry. (Construction logistics and costs were determined prohibitive for wet construction methods)

3.3 Powerline utilities will be removed from project site. Electrical service for the Stringer property only needs to be restored if the property is not purchased by the non-Federal sponsor.

3.4 Construction will be scheduled for a two-year time frame.

3.5 Future soils investigation will not impose unanticipated limits or conditions to construction. (Flooded condition of site prohibited soils explorations from being finalized).

3.6 An offer will be made for the Stringer property located along Miner Slough. If purchased, maintenance for land access and utilities would no longer be necessary. (Private property along Miner Slough requires land and utility access through project site)

B. Field Observations & Existing Conditions

1. Active farming operations took place up to the fall of 1995. The project site flooded in the 1996/1997 winter and remains flooded with two breaks in the levees at the southern Miner Slough levee (one of which was repaired Fall 1997) and at the cross levee separating the Port of Sacramento property. The Port's levee breach from the winter floods of 1997 have been repaired. The dewatering of the island began October of 1998 and the repair of the cross levee repair was completed by winter of 1999. Plans to resume and complete the dewatering effort of Prospect Island will begin in spring of 1999. (See Photo #1 & 2)

1.1. The flooding event has provided an unique opportunity to observe actual tidal and water level inter-actions along with observations on levee erosion and natural

revegetation processes within the project over a one year period. Additional field investigations and monitoring by various supporting environmental agencies took advantage of this opportunity to generate field data and observations for this project and similar future projects within the Delta.

1.2 Significant damage to both the north and south cross levees occurred during the 1997/1998 winter season. Repair work was completed for the northern cross levee during spring 1998.



Photo #1: Prospect Island View from the North End



Photo #2: The Cross Levee Breach

C. Restoration Habitat Design Criteria

1. The limited project funds necessitated the evaluation and prioritization of the initial earthwork and revegetation efforts. The earthwork created will focus on narrow "barrier" islands and interior levee berms. The revegetation will be on: areas requiring bio-engineering efforts for protection and stabilization of the landforms (islands, benches, and levees) from interior wind generated wave action; selected upland riparian planting areas; and initial control of invasive weed species on newly graded areas through weed control and a cover crop.

2. The overall magnitude of the project areas (over 7 miles of new shoreline and over 150 acres of potential riparian and SRA habitat) required a secondary determination to specifically target and prioritize project work on highly exposed areas where accelerated vegetation protection from wave erosion was warranted. These high erosion impacted areas are planned to be provided with enlarged bench widths and plantings of emergents and pole cuttings along the water/wave interfaces (See L1.0).

3. Bio-Engineering Protection & Stabilization: The primary bio-engineering efforts for this project will encompass three areas of technique: islands, berm structures, and revegetation protection for selected shorelines. "Seed" plantings from live pole cuttings and emergent tuber/plugs will provide accelerated vegetation protection to identified high erosion

vulnerability areas. Other bio-technical methods and techniques will be explored and implemented as site specific situations and budget constraints allow.

3.1. Islands: Two island type configurations were developed for wave protection and habitat creation: a barrier island (40' bench / 60' island / 20' bench) for more exposed open water areas, and a standard island (40' bench / 20' island / 20' bench) for all other areas (See Sections and L1.0). Islands were located to best provide wave protection from northwest wind generated waves and all have 5:1 interface slopes. Island sides with the greatest exposure to wave fetch action, i.e. northwest facing shorelines, will have the expanded benches of 40 feet.

3.2. Benches: Interior levee faces will be protected by existing terrain bench slopes or constructed benches. Some existing levee grades provide sufficient interface protection without additional earthwork and will be left in place. Other levee shorelines will be protected by a graded bench slope of a minimum of 10 feet with a 5:1 slope. Levee areas with greatest exposure to wave fetch action, i.e. northwest facing shorelines, will have expanded benches of 40 feet with 5:1 slopes (See Sections and L1.0).

3.3. Plantings: Initial emergent revegetation efforts will be focused on expediting planting protection with emergent tuber/plug transplanting and pole cuttings along the bench slope water interfaces of the 40 foot benches only. All other water interface areas and benches will be left to vegetate naturally. Plant material will be collected from on-site or surrounding areas to maintain eco-typic adapted plants; species and species numbers will be subject to availability at time of collecting and installation. (See Table 04).

3.4. Other Techniques: Other methods and techniques will be explored and utilized for site specific project situations and if project budget constraints permit. Possible other methods that could be implemented and provide more immediate or a higher level of protection are: organic mats with or without imbedded plantings; coconut or rice straw rolls with or without imbedded plantings; willow bundles; etc.

4. Riparian Plantings: The project will provide riparian plantings for selected areas of the project as "pocket planting" seed source areas (estimated @ 12 acres). Islands and berms will be targeted first for these initial riparian plantings. The project will also provide riparian plantings along the interior of the east side levee along Miner Slough (estimated @ 10 acres) to

provide habitat and to serve as a windbreak to protect the Miner Slough levee. All plantings will be propagated from ecotypic stock and grown in D-Pot or Tree Pot containers. Plantings will be installed roughly 300 plants/acre. Each plant will have mulch, plant screen, and be maintained/established for three years. For proposed plant species to be used see Table 05 plant list.

5. Project Tidal information: The project waters will be tidally influenced. These water tidal stages will direct habitat formation and the grade elevations for constructed landforms within the project basin. The calculated tidal elevations from the hydrology data and Cache Slough/Yolo Bypass Mitigation Area field data are:

Mean high-high	4.1'	msl (Hydraulic models reflect 4.6' msl)
Mean high	3.5'	msl
Mean	2.0	msl
Mean low	0.2'	msl
Mean low-low	-0.3'	msl

5.1 Hydraulic model calculations have predicted tidal flow ranges will be between 4.6' msl and 0.9' msl during the tidal exchange. These figures signify that the lowest tidal elevations possible shall never be realized during the tidal cycles of the project.

6. Habitat Elevation Ranges: Field observation and studies for other similar projects, esp. Cache Slough/Yolo Bypass Mitigation Area field and monitoring data, have provided some regional specific data of habitat elevation formation. The existing project basin elevations itself range from 3.5' msl to -4.5 msl with an over all rough average of around -0.5' msl for the entire basin. This information was used to formulate an expected habitat elevation chart for the project areas (See also Table 03):

Open Water:	<-1.0'	msl (greater than 3' avg. of water cover)
Mudflat:	-1.0' to 0'	msl (tidal fluxes and exposure)
Tule/Emergents:	0' to 3'	msl (submerged w/ up to 3' avg. of water)
Riparian/SRA:	3' to 6'	msl (close to water edge)
Upland:	>6'	msl (away from water edge; levees)

7. Monitoring: Field observations of the project area in its flooded conditions for the last two years since the floods of 1997 has and will provide important ground truth data, esp. for mudflats and tule emergent estimated acreage. The development and support of a monitoring program as developed by the Project Work Team for this project will provide valued data and baseline information for this and future restoration projects.

7.1 Observations: Field observations performed in the summer of 1997 of the flooded project site have revealed some interesting and unanticipated data. Emergent growth of Polygonum coccineum and other species had extensively covered over 40% of the open water basin and along the existing irrigation ditches throughout the site. Salix and Populus species have volunteered along the northern areas of the basin and water interfaces. Significant wave caused erosion was not noted within the basin reaches during the spring and summer of 1997. Further monitoring observations of volunteer emergent plant growth pattern might require the revision of habitat area acreage (See Photo #3).

Photo #3: Emergent Growth in Northeast Open Water Areas (Fall 1998)



D. Civil Engineering Criteria

1. Civil Design Criteria

The civil design criteria concentrated on the grading and earthwork required for the formation of the proposed islands and berms of the project. The civil design work will also include utility relocations and the two project breaches.

1.1. Topography: Existing topography information was used for this study. The topographical data was developed by Corps of Engineers, Survey Section from aerial surveys (See C1.0 thru C.4.). Flood conditions and water movement may have affected the site topography, particularly at and around where the levees breached during the flood.

1.2. Soils: No updated soils explorations or data has been provided for this report, due to flooded conditions of the project site. Field work is anticipated to commence upon repair and pumping out of the project site.

1.2.1 The exposed top soil after grubbing will be stockpiled and saved for last 1 ft. of grading requirements of islands and berms.

1.3. No Excavation Zone: In consideration for the continuing Ryer Island studies, Soils Section recommended a 1,000 foot setback zone of "no excavation" from the toe of the interior Miner Slough levee. Very minor excavation will be allowed to take place in this zone for grubbing, breach, and channel grading.

1.4. Earthwork Equipment: Soils Section has recommended that special equipment considerations need to be addressed for earthwork due to soil and water table factors. Wide track excavation equipment may be required to compensate for unstable or saturated soils in the area. Wide track dozers, loaders, and bottom dumpers will probably be required. Spreading, mixing, moisture conditioning and compaction will have to be accomplished with relatively small equipment or with wide track or multiple-tire farm type equipment. For example, compaction would be accomplished using a procedural specification such as applying 4 coverages of a D-4 caterpillar dozer and restricting the loose lift thickness to 6 inches.

1.5. Earthwork Consolidation: Soils explorations have not been performed. It is not known whether soils will be a significant factor in project construction efforts. The consolidation of the material is of concern due to the need to establish specific elevations for the island and berms within one construction period. For this report, an assumption of 2 feet settling of earthwork will be incorporated. The phased earthwork will allow for settlement and soil consolidation.

1.6. Geo-technical: Initial reconnaissance concerns of soils structure stability and settlement have been noted. Fills of no greater than 5 feet above existing grade have been recommended; on areas of greater than 5 feet fill, a 2-staged construction schedule will be implemented. Construction will be phased over two years. Project discussions have directed the grades for the islands to be overbuilt 2 feet above initial desired elevations, and 1 foot of overbuilt on the berms. These overbuilt factors will allow for slumping and settling of earthwork materials.

1.7. Disposal Areas: No disposal area is necessary. All cut and fill earthwork will be balanced on site.

1.8. Ground Water: The initial reconnaissance studies have shown that groundwater is consistently within 4 feet of the existing surface. Soils investigations will confirm.

2. Earthwork

2.1. Grubbing & Clearing: The minimal amount of area at the benches, island, channel locations, and haul routes will be grubbed and cleared to minimize disturbance to the site and reduce construction costs. Top soil stockpiling of the first 12 inches of soil after grubbing and clearing within the excavation areas will be done where practical.

2.2. Surveying & Staking: This will be done previous to or concurrently with grubbing and clearing to verify earthwork area locations and existing conditions.

2.3. Utilities: Electrical is the only identified utility service and easements located within the Prospect Island site. PG&E electrical power crosses the Prospect Island from Ryer Island to provide service capabilities to Liberty Island, the Prospect Island Bureau of Reclamation pumps, and the Stringer Property. The existing poles and Deep Water Ship Channel aerial lines will need to be removed and/or relocated before island flooding. If not

purchased prior to construction of the project, the Stringer Property will have to have their power lines rerouted along the Miner Sough levee or over Miner Slough and serviced from Ryer Island.

2.3.1. PG&E Removal Service: Service for Liberty Island and the Reclamation pumps at Prospect Island have been discontinued, and are planned to be removed by PG&E in the near future. No service relocation or reconnection for these areas is planned.

2.3.2. Abandoned Poles: The existing wood and unneeded aerial electrical poles will be removed by PG&E. The possible re-use of the wood poles for perch or nest sites was considered, but was eventually dismissed due to their instability and unknown material composition.

2.4. Grading (See C2.0 thru C4.0)

2.4.1. Islands: The primary function of the islands is to protect the levee areas from wave action. The configurations and locations of the islands are dedicated to protect the NW facing levee areas from wave fetch forces (See Table 01).

2.4.1.1. Standard Island: The standard island configuration consists of (See Detail: Standard Island Section):

- a 50 foot no excavation zone from base of island benches for island stability.
- a 20 foot bench @ 4.0' msl w/ 5:1 transition slope (leeward side SE)
- a 20 foot island core @ 7.0' msl w/ 5:1 transition slopes
- a 40 foot bench @ 4.0' msl w/ 5:1 transition slope (windward side NW)

2.4.1.2. Barrier Island: The barrier island configuration is utilized in the most exposed open water locations. These islands are provided additional island widths. The barrier island configuration is as follows (See Detail: Barrier Island Section):

- a 50 foot no excavation zone from base of island benches for island stability.
- a 20 foot bench @ 4.0' msl w/ 5:1 transition slopes (leeward side SE)
- a 60 foot island core @ 7.0' msl w/ 5:1 transition slopes
- a 40 foot bench @ 4.0' msl w/ 5:1 transition slope (windward side NW)

Table 01: Island Configurations*

Island #	Configuration	Island Length: l.f.	Island Area: ac.
1	Barrier Island (40' Bench / 60' Island / 20' Bench)	2,100	6.17
2	Standard Island (40' Bench / 20' Island / 20' Bench)	931	1.88
3	Standard Island	1,801	3.64
4	Barrier Island	517	1.52
5	Barrier Island	928	2.73
6	Standard Islands	511	1.03
7	Standard Island	1,024	2.07
8	Barrier Island	622	1.83
9	Standard Island	456	0.92
	Totals Barrier Island:	4,167 l.f.	12.24 ac
	Totals Standard Island:	4,723 l.f.	9.54 ac

*: Estimated configurations and linear feet

2.4.2 Levee/Island Benches: All interior landforms will be protected by an existing or graded bench and transition slope from wave action. Areas that will receive heavy wave forces will be protected by wider 40' bench areas. Benches could also serve as habitat areas for SRA and riparian (See Table 02).

2.4.2.1 Existing Bench: Existing elevations and grades of some areas along the levees are configured to require no additional excavation for wave protection (See Detail: Existing Levee Section / No Grading).

2.4.2.2 10' width bench w/ 10:1 transition slope: Areas determined to have minimal wave exposure will be graded with 10' foot wide benches @ 4.0' msl (See Detail: Typical Abandoned Levee/Bench Section).

2.4.2.3 40' width bench w/ 5:1 transition slope: Water interface areas that will have maximum exposure to wave forces will be graded with 40' wide benches @ 4.0 msl. (See Detail: Typical Abandoned Levee/Bench Section).

Table 02: Interior Levee Benches

Description	I.f.
Existing Grades to Remain	7,925
40' Wide Bench w/ 5:1 Slope Transition	11,316
10' Wide Bench w/ 10:1 Slope Transition	16,232

2.4.3. Channels: All excavation materials for grading work will be generated from channel excavation. All channels will have a maximum depth of -5.0' msl where possible for fishery concerns. Main channel width will be determined by the fill demands of the project. Channel sides will be set at 5:1 slopes. Top soil after grubbing will be stockpiled and saved for last 1 ft. of finish grading requirements of islands and berms (See C2.0).

2.4.3.1. Main Channel: (\pm 60-100' wide set @ -5.0 msl) Channel meanders through center of project from southern breach areas to the northern section.

2.4.3.2. Dead End Channel Sloughs: (\pm 60' wide @ -5.0 msl): Channels branch from main channel and dead-end.

2.4.4 Breaches: Two breaches will be constructed utilizing the same proven design as built at the Cache Slough / Yolo Bypass Mitigation project. Both breaches are located at the southern end of the project at the Miner Slough and Ship Channel levees. Each breach will be 300' wide and set at 0.0' msl and will be armored with rock riprap for stability.

2.4.4.1 Miner Slough Breach: Located where natural breach occurred during the 1996/97 flood. The southern location negates the need to provide a bridge access to the Stringer property. (See Selected Plan, Alternative #5 and Photo #4)

2.4.4.2 Ship Channel Breach: Located opposite the Miner Slough breach along the riprapped ship channel levee section. This area is devoid of vegetation so existing habitat disturbance will be minimal. (See Selected Plan, Alternative #5 and Photo #5)

2.5. Finish Grading: The finish grades for the islands and benches shall be "rough" graded to produce varied and undulated surface texture that provides micro-habitat finish grade for plant colonization and growth. Compaction of earthwork will be targeted not to exceed 85%. Discing of earthwork will be implemented to breakup surface compaction and slicking from grading operations before planting.



Photo #4: Repaired Miner Slough Levee on Reclamation Property & Proposed Breach Location

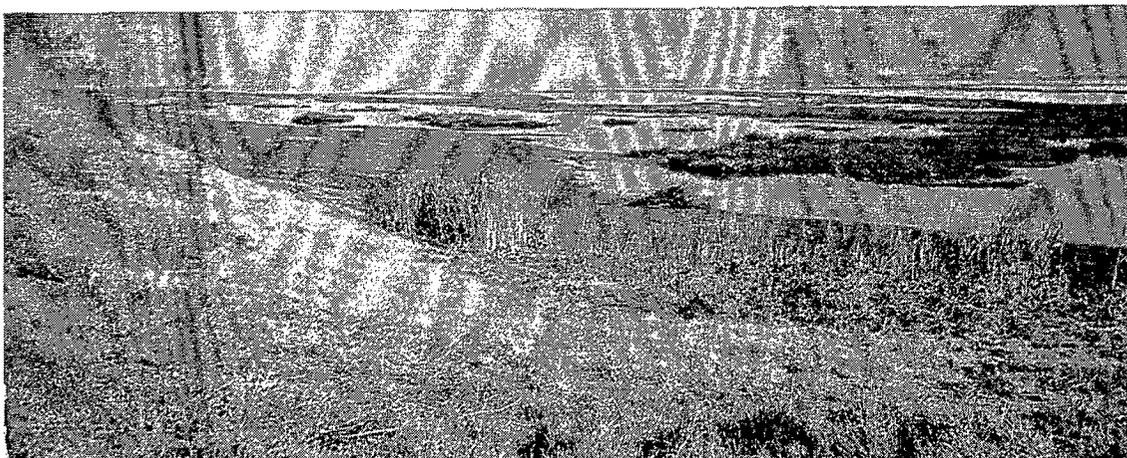


Photo #5: Proposed Breach Location on Ship Channel Levee

Table 03: Estimated Habitat Acreage

Habitat Type	Elevation	Acres
Open Water	<-1.0' msl	594.5
Mudflat*	@ 0.0 msl	4.0
Tule / Emergent	0.0' to 3.0' msl	333.8
Tule/Emergent Potential	-0.5' to 0.0' msl	230.0
SRA / Riparian / Upland	>3.0' msl	150.6
Miscellaneous (roads)	NA	3.1
	Total Acres:	1,316.0

*: Estimated zone of 20' wide along water interface

2.6. Habitat Areas: The estimated habitat acreage from existing project conditions and planned earthwork are shown in Table 03 along with their corresponding elevations. These numbers are estimates and will vary as field and project conditions change. Some habitat numbers vary from Fish and Wildlife Service numbers due to different initial assumptions such as mudflat formations. Subsequent field observations are being reviewed for estimated habitat areas.

E. Construction Scheduling and Sequencing

The following is the anticipated construction schedule for the project for site work and revegetation. This schedule assumes that all soils explorations and design work will be completed by June 1999 and no special construction considerations are required. This schedule is subject to environmental restrictions and conditions. Missing any of the construction windows can cause a minimum of one year delay in project completion.

PLANS AND SPECIFICATIONS

Start:	Apr 99
Complete:	Aug 99

CONSTRUCTION

0.	Site Levees Repaired and Site De-watered	Jan 99
1.	Soils Field Work	May 99
2.	Contract Award / Mobilization of Earthwork Contractor	Oct 99
3.	Utility Relocations	Oct 99
4.	Clearing and Grubbing - first year	Oct 99
5.	Surveying and Staking - first year	Oct 99
6.	Grading: Top Soil Stockpiling - first year	Nov 99
7.	Grading: Islands and Benches - first year	Nov 99
8.	Riparian plant propagation (separate contract)	Nov 00
9.	Clearing and Grubbing - second year	Apr 00
10.	Surveying and Staking - second year	Apr 00
11.	Grading: Top Soil Stockpiling - second year	Apr 00
12.	Grading: Islands and Benches - second year	Apr 00
13.	Finish Grading: Islands and Benches	Sep 00
14.	Breach Excavation and Rip-Rapping	Sep 00
15.	De-Mobilization of Earthwork Contractor	Sep 00

REVEGETATION

10.	Mobilization of Revegetation Contractor	Oct 00
11.	Survey of all collection sites and project site	Oct 00
12.	Emergent plugs/plants collection and preparation	Oct 00

13.	Emergent plugs/plants installation (immediately following collection & timed with breach)	Nov 00
14.	Soil Preparation & Cover Crop Seeding	Oct 00
15.	Riparian plants and irrigation installation	Oct 00
16.	Start plant maintenance period	Nov 00
17.	Pole cuttings collection and preparation	Jan 01
18.	Pole cuttings installation	Mar 01
19.	End of plant maintenance period for project	Nov 04
20.	Project turn over	Nov 04

F. Revegetation Criteria

1. Re-Vegetation Strategy:

Predicted habitat acreage have been calculated (See Table 03) with revegetation anticipated on abandoned levee slopes, benches, and islands and their respective water interface areas. Open water areas will be dynamic with volunteer emergent vegetation minimizing any large expanses of open water (from field observations). Natural revegetation has already occurred within the project's areas and is predicted to readily occur when the project is implemented. Surrounding lands will provide excellent seed source and volunteer recruitment. Mudflat creation is not anticipated to be significant within the site due to the tidal cycle elevations and from field observations of 1998.

1.1. Bio-technical Revegetation: Upon the breaching and flooding of the interior project area, water interface areas determined to be of high risk for wave erosion (areas with 40 foot wide benches) will be immediately planted with plant/plugs and later with pole cuttings. All plant material will be collected on or near site for live plants/plugs and pole cuttings. Exact numbers and species ratios will be determined as per field availability. All materials will be collected, processed, and planted within 24 hrs of each collection. No irrigation will be required, but plantings will be maintained for 3 years, see 1.2.3.

1.1.1. Tubers/Plugs: Plant material from *Juncus* and *Scirpus* species will be collected on site or from surrounding areas. Spacings will be 12 inches O.C. triangular spacing; set at 0 to 1 foot MSL. Add 1 gm of slow release fertilizer per planting. (See Table 04 and Detail) Planting scheduled will be timed with breaching operations.

1.1.2. Pole Cuttings: Various size live pole cuttings of Populus and Salix species will be utilized for material diversity and to ensure material numbers required are available. Cuttings will be collected and planted in December/February window. Cutting sizes will range from 3 to 6 feet in lengths and ½ inch to 1 inch caliper. Planting will be direct burial to depth proportional to cutting size. Spacing will be roughly 2 feet within water elevation and exact locations as determined in field. Half of all cuttings will be fertilized with a 21 gram fertilizer tablet or slow release pellets, and the plant locations noted in as-built drawings. (See Table 04 and Detail)

Table 04: Revegetation & Bio-Engineering Plant List**

	Plant Species	Size	Levee Bench Quantity	Island Quantity
Tree/Shrub	Bench Water Interface			
	Populus fremontii Fremont Cottonwood	Pole Cutting	1,000	1,000
	Salix laevigata Red Willow	Pole Cutting	2,250	2,250
	Salix lasiandra Yellow Willow	Pole Cutting	1,500	1,500
	Salix goodingii Goodings Willow	Pole Cutting	1,250	1,250
		Totals:	6,000	6,000
Emergent	Tidal Zone Interface			
	Scirpus species Tule or Bulrush	Live Plants / Root Plugs	20,000	18,000
	Juncus species Rushes	Live Plants / Root Plugs	14,000	9,000
		Totals:	34,000	27,000
Cover Crop	Graded Benches & Islands			
	Hordeum brachyantherum Meadow Barley	Seed 11.5 lb/ac	-	-

	Leymus triticoides Creeping Wildrye	Seed 4 lb/ac	-	-
	Elymus glaucus Blue Wildrye	Seed 6 lb/ac	-	-
	Muhlenbergia rigens Deer Grass	Seed 0.5 lb/ac	-	-
	Deschampsia caespitosa Tufted Hairgrass	Seed 1 lb/ac	-	-
	(Mix = 23 lbs/ac)	Total Mix:	392 lbs	463 lbs
Riparian Plantings	See Table 05 for species			
	Riparian Trees Various species	Tree Pots D-Pots	2,700	600
	Riparian Shrubs Various species	D-Pots	2,700	600

** : Plant numbers and ratios will vary with availability of each species of plant and proximity of sources.

1.2 Riparian Revegetation: Selected upland areas (12 acres) and the bench along the Miner Slough levee (10 acres) will be targeted to be planted with riparian plant species (see Table 05 for potential plant list) and maintained for three years. Areas to be planted will focus on the constructed islands and berms with planting densities of 300 plants per acre. (See Table 05 and Detail)

1.2.1. Plant Propagation: Cuttings and seeds will be collected within or near the project site where possible. Plants will be grown to D-Pot or Tree Pot sized containers.

1.2.2. Installation: Plants will be field located and each planted with fertilizer, wire mesh screens, and mulch basins. An irrigation system will be installed and applied by drip system from pumped project basin water.

1.2.3. Maintenance: Maintenance for all plantings (riparian, emergents, pole cuttings) will commence immediately after their installation, and consist of the following: regular watering (riparian plants only; April - October), weeding (chemical & hand), pruning,

plant resetting, monitoring, reporting, and replanting.

1.3 Weed Control: Weed control is crucial for planting establishment. Newly graded areas of the berms and islands provide an opportunity to minimize exotic weed species competition, and encourage natural riparian & SRA revegetation to establish. An initial cover crop of native grasses and forbes will be drill seeded and/or hand broadcast seeded in the fall to all new earthwork. *Arundo* will be specifically targeted in these planted areas for maximum control.

1.4 Natural Revegetation: The existing project areas and surrounding lands have extensive mature riparian and emergent vegetation groves and patches on the Miner Slough and Ship Channel sides. It is anticipated and has been observed that natural revegetation and volunteers will occur quickly with this close seed source proximity and project conditions (See Table 05 for anticipated plant volunteer species).

Table 05: Proposed Plant Species for Re-vegetation and Re-naturalizing

Botanical/Common Name

TREES:

Acer negundo californicum / Box Elder
Alnus rhombifolia / White Alder
Juglans californica var. *hindsii* / California Black Walnut
Platanus racemosa / California Sycamore
Populus fremontii / Fremont Cottonwood
Quercus lobata / Valley Oak
Sambucus mexicana / Blue Elderberry
Salix goodingii / Gooddings Willow
Salix laevigata / Red Willow
Salix lasiandra / Yellow Willow
Salix lasiolepis / Arroyo Willow

SHRUBS:

Artemisia douglasiana / Mugwort
Baccharis douglassii / Marsh Baccharis
Baccharis pil. pilularis / Coyote Brush
Clematis ligusticifolia / California Clematis
Rosa californica / California Wild Rose
Rubus discolor / Himalayas Blackberry
Rubus ursinus / California Blackberry
Salix exigua / Sandbar Willow

EMERGENTS:

Scirpus spp. / Tule or Bulrush

Juncus spp. / Rush

Typha latifolia / Cattail

1.4.1. Natural revegetation of Populus and Salix species volunteers was and is continuing within the project site, esp. along the Northwest and North areas and the irrigation ditches. With the flooding of the project area more aggressive revegetation has been observed and is predicted until repairs and pumping occurs.

1.4.2. The heavy rip rap areas on the ship channel levee (channel side) are to be left in place to provide additional stability to those areas; revegetation will occur more slowly in these areas, but is anticipated to provide some stability and valued riparian and shaded riverine aquatic vegetation.

G. Establishment/Maintenance

1.1. The maintenance period for establishing the plantings is scheduled for three years. Maintenance items will include: weed control, irrigating riparian plantings, planting upkeep, and some minor re-planting efforts. No irrigation is planned for emergents and pole cuttings, since plantings will be within the groundwater zones of the bench and water interface zones. Natural revegetation of native riparian volunteers will be targeted as a goal. Monitoring and reporting of the project will be required for each year along with three yearly reports. Monitoring and reports will be coordinated with the Interagency Ecological Project Work Team.

H. Goal and Success Criteria

1.1. The goal for the revegetation and bio-engineering work after one year will be to initiate the stabilization and protection of the interior levee and island water interfaces from wind caused wave action, and establishment of 22 acres of riparian plantings. The success criteria is targeted to:

- 80% of the shorelines stabilized and/or protected
- Establishment of 60% of emergent and willow/cottonwood plantings
- Volunteer planting growth along shorelines and bench areas.
- 80% of the riparian plants established

I. Conclusion

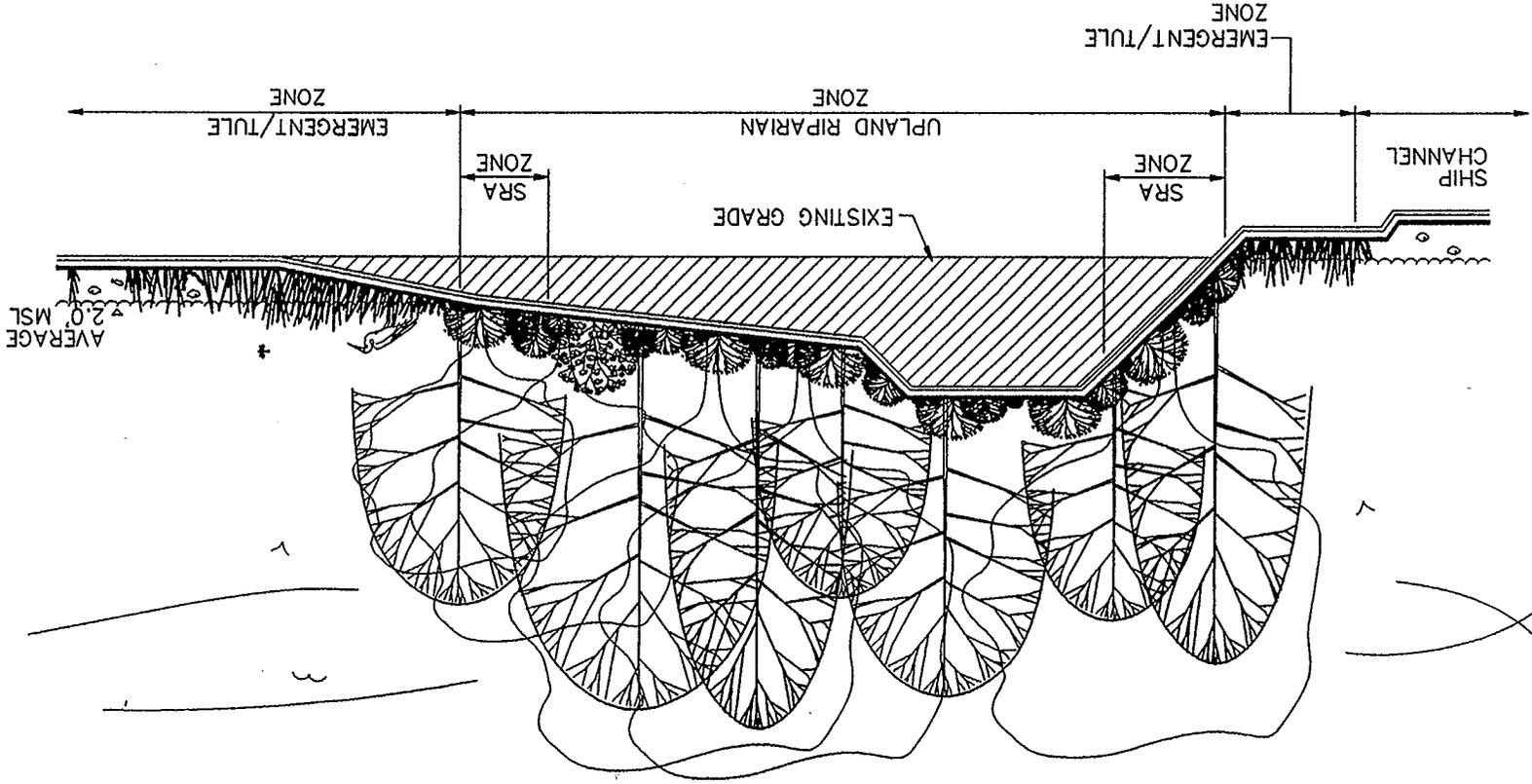
1.1. Prospect Island provides an important opportunity to restore valued and varied wildlife habitats within the region. The flooding of the island in 1997 has provided valuable insight of the hydraulic and vegetative processes that will influence the site's future. Limited funds and the focus on the stabilization and protection of the island levees has directed the design process and efforts to their protection, but ensures the long term survival of the project site's inherent qualities that provide a diverse landscape and range of habitats.

Miki Fujitsubo
Landscape Architect
Landscape Architectural Unit



EXISTING LEVEL SECTION/NO GRADING

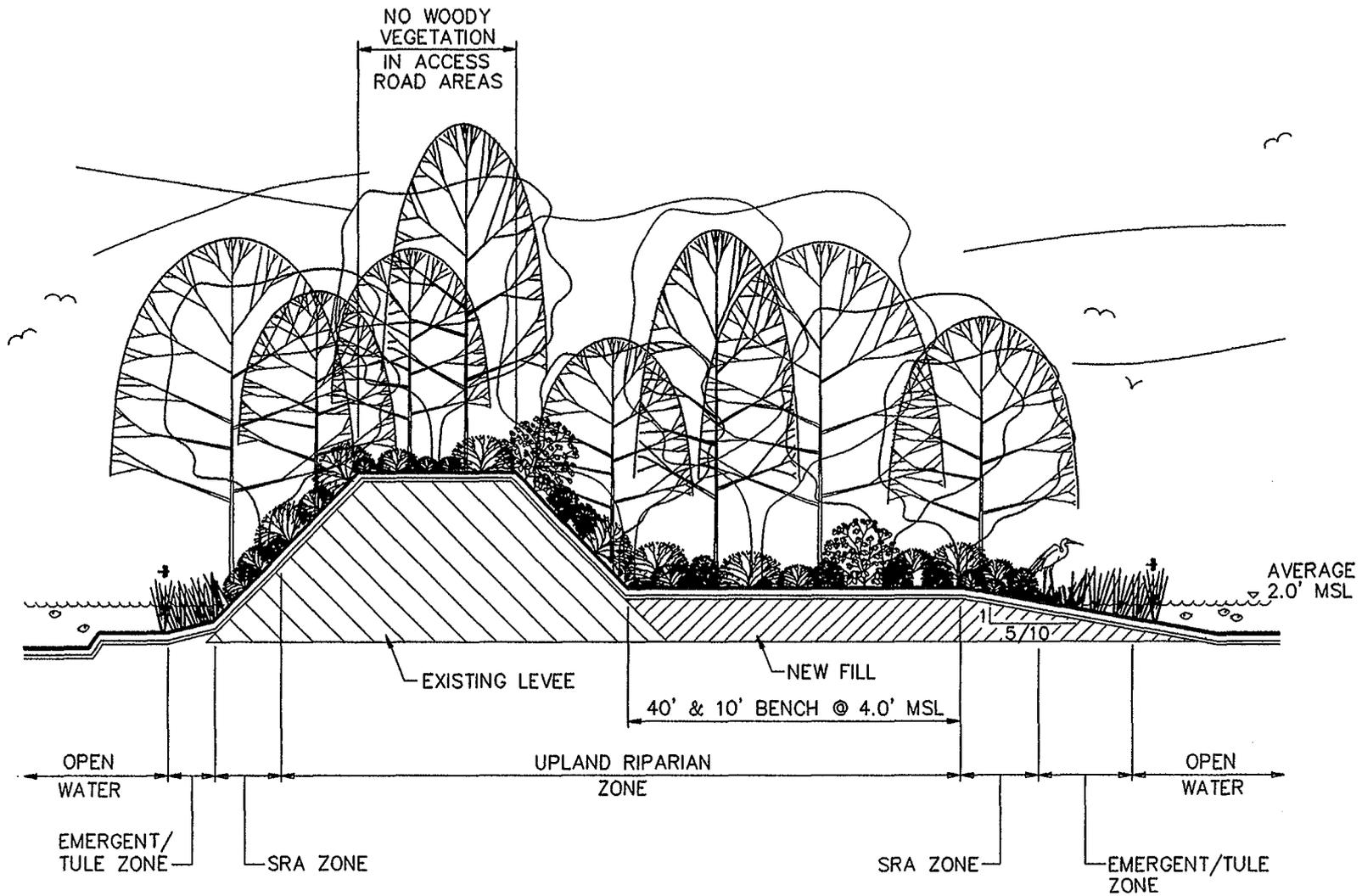
NOT TO SCALE



PA-MESG.DWG/PL01 1=250/9-9-97

C-088910

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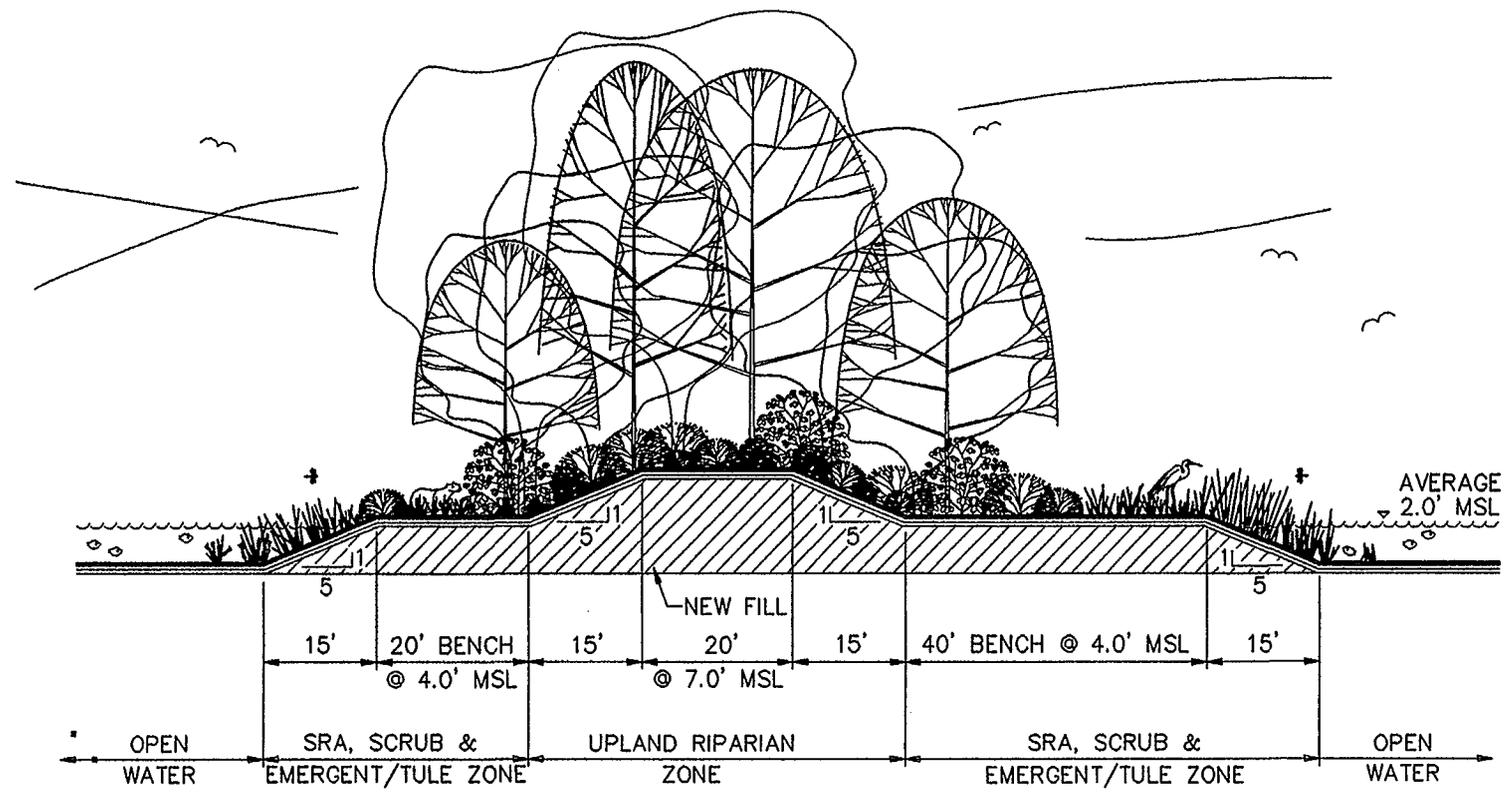


TYPICAL ABANDONED LEVEE/BENCH SECTION

NOT TO SCALE

PL-ABLSC.DWG/PLOT 1-230/12-22-87



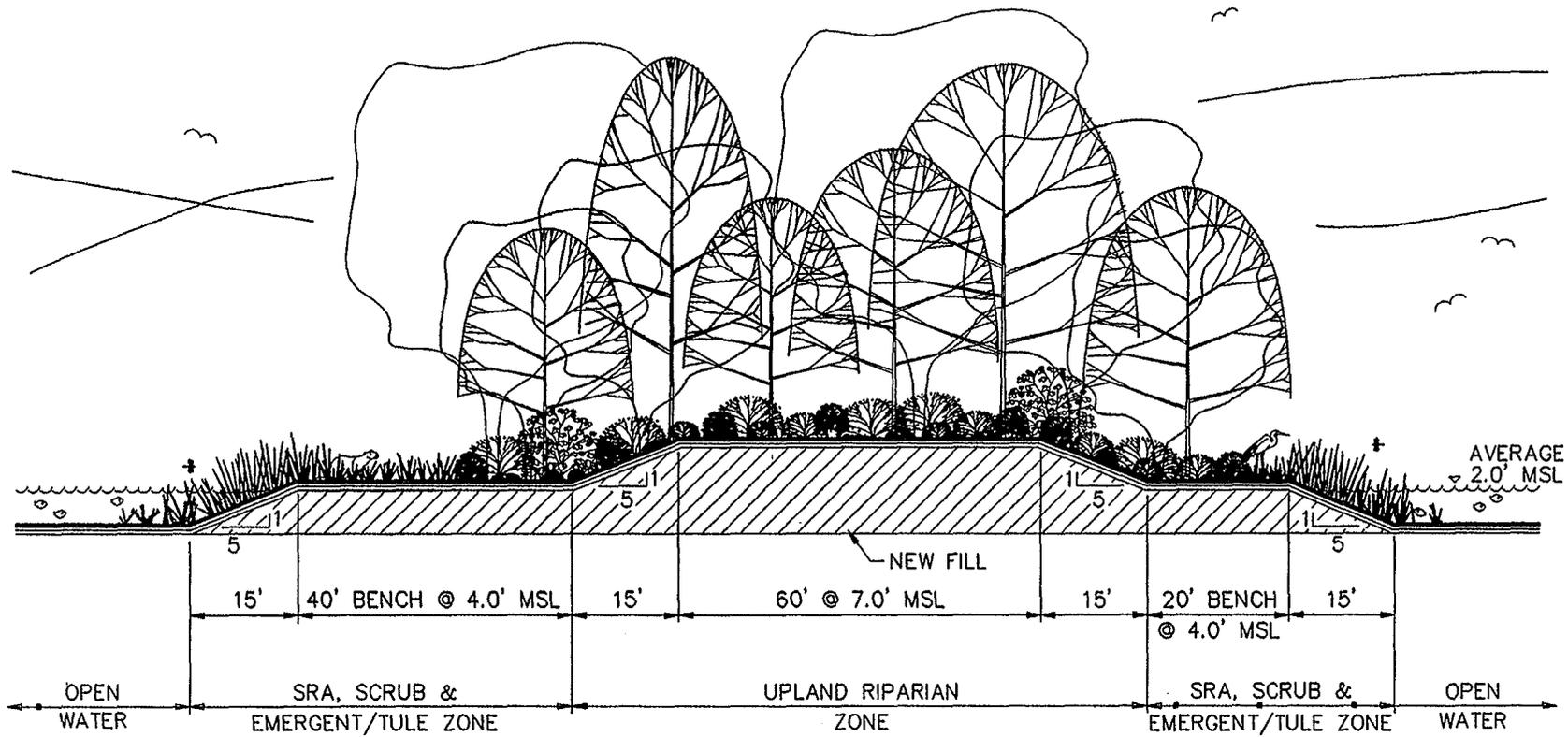


STANDARD ISLAND SECTION

NOT TO SCALE

PI-ISLSC.DWG/PL01 I=260/12-22-97



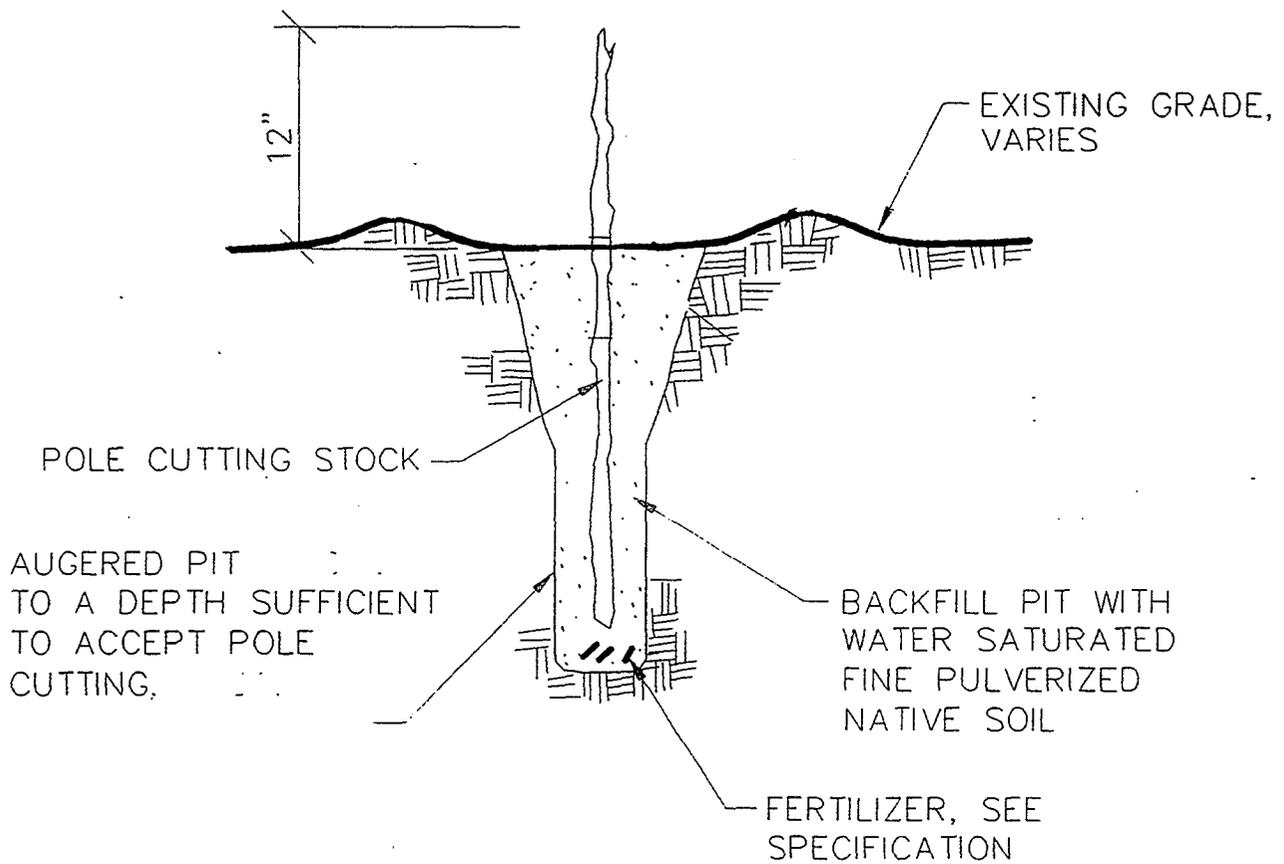


BARRIER ISLAND SECTION

NOT TO SCALE

PI-BISSC.DWG/PLAT 1-250/12-22-97



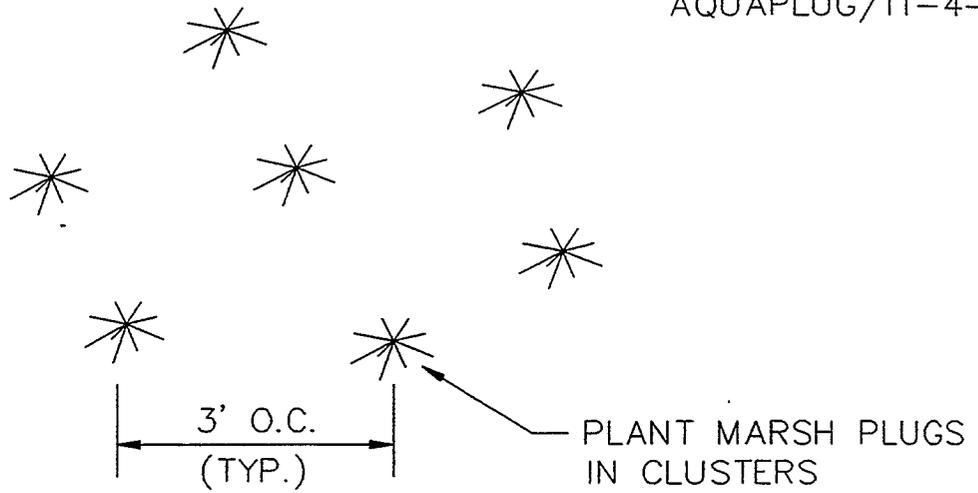


NOTE:

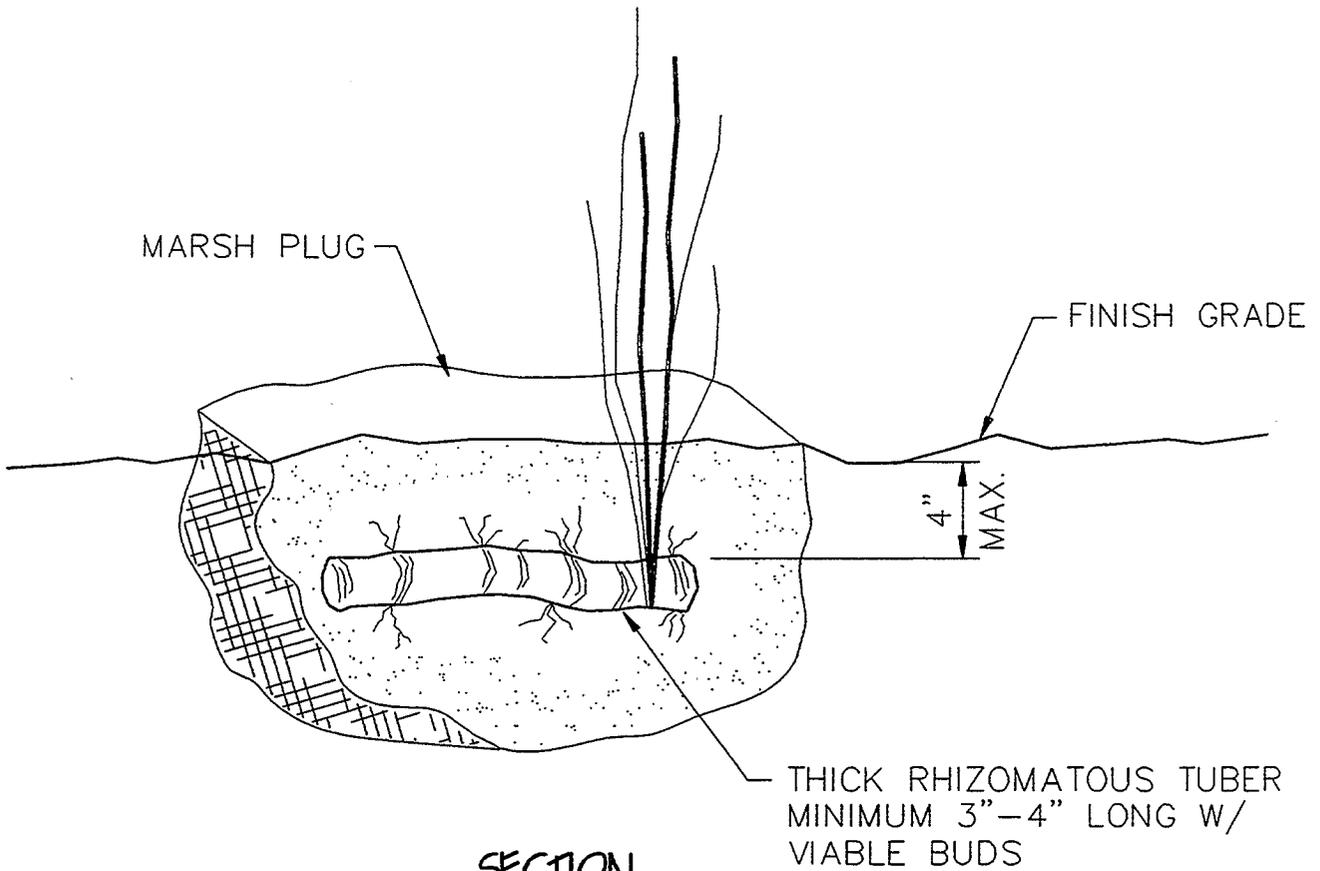
1. PLANTING STOCK; POLE CUTTING. SIZE AS PER SPECS.

POLE CUTTING

NOT TO SCALE



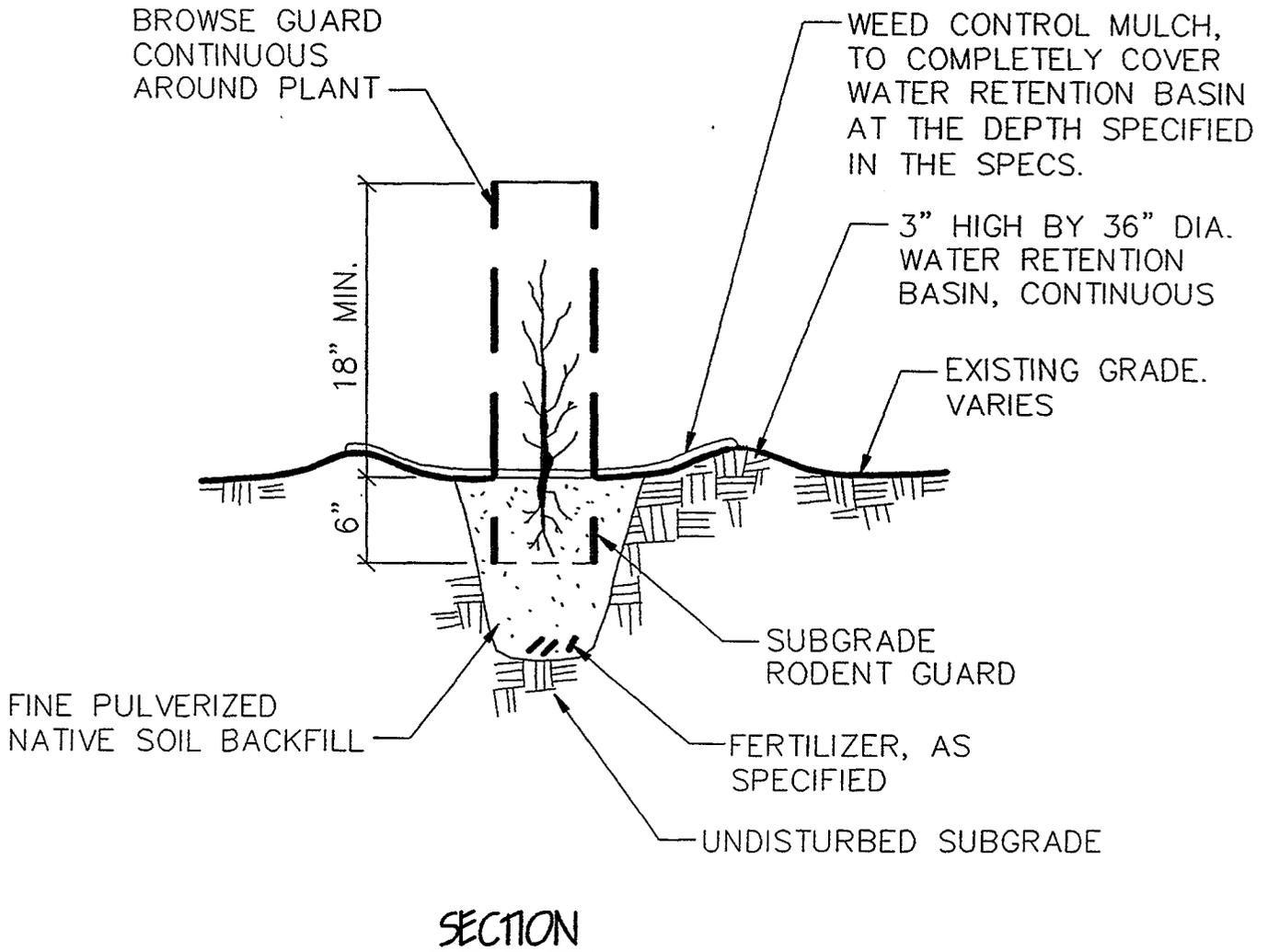
PLAN VIEW



SECTION

AQUATIC PLUG PLANTING

NOT TO SCALE

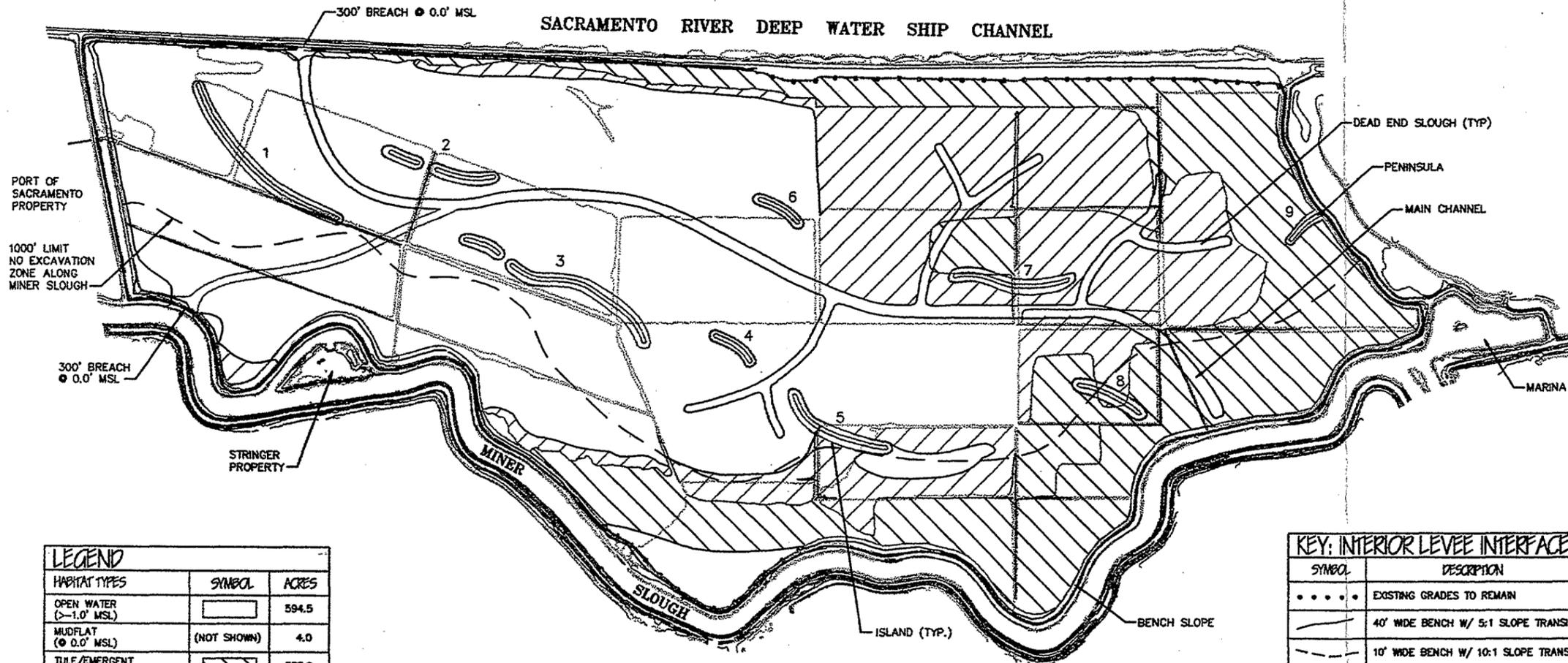


NOTES:

1. SET PLANTS ROOF CROWN 1/2" ABOVE EXISTING GRADE.
2. PLANTING STOCK, UP TO ONE GALLON SIZE.
3. PLANTING PIT A MINIMUM OF TWO TIMES DIAMETER AND TWO TIMES DEPTH OF ROOTBALL. SCARIFY EDGES.

SEEDLING

NOT TO SCALE



LEGEND

HABITAT TYPES	SYMBOL	ACRES
OPEN WATER (>-1.0' MSL)	[Empty Box]	594.5
MUDFLAT (0.0' MSL)	(NOT SHOWN)	4.0
TULE/EMERGENT (0.0' MSL TO 3.0' MSL)	[Diagonal Lines]	333.8
POTENTIAL TULE/EMERGENT (-0.5' MSL TO 0.0' MSL)	[Cross-hatch]	230.0
SRA/RIPARIAN/UPLAND (>3.0' MSL)	[Empty Box]	153.7
TOTAL ACREAGE:		1316.0

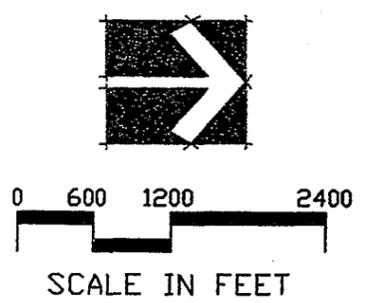
KEY: INTERIOR LEVEL INTERFACE

SYMBOL	DESCRIPTION	ESTIMATED L.F.
.....	EXISTING GRADES TO REMAIN	7,925
———	40' WIDE BENCH W/ 5:1 SLOPE TRANSITION	11,316
- - - -	10' WIDE BENCH W/ 10:1 SLOPE TRANSITION	16,232

KEY: ISLAND CONFIGURATIONS

ISLAND NO.	CONFIGURATION*	ISLAND LENGTH*
1	BARRIER ISLAND (40' BENCH/ 60' ISLAND/ 20' BENCH)	2,100
2	STANDARD ISLAND (40' BENCH/ 20' ISLAND/ 20' BENCH)	931
3	STANDARD ISLAND	1,801
4	BARRIER ISLAND	517
5	BARRIER ISLAND	928
6	STANDARD ISLAND	511
7	STANDARD ISLAND	1,024
8	BARRIER ISLAND	622
9	STANDARD ISLAND	456

* ESTIMATED CONFIGURATIONS AND LINEAR FEET



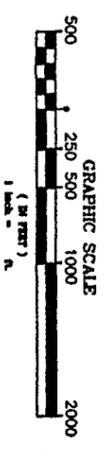
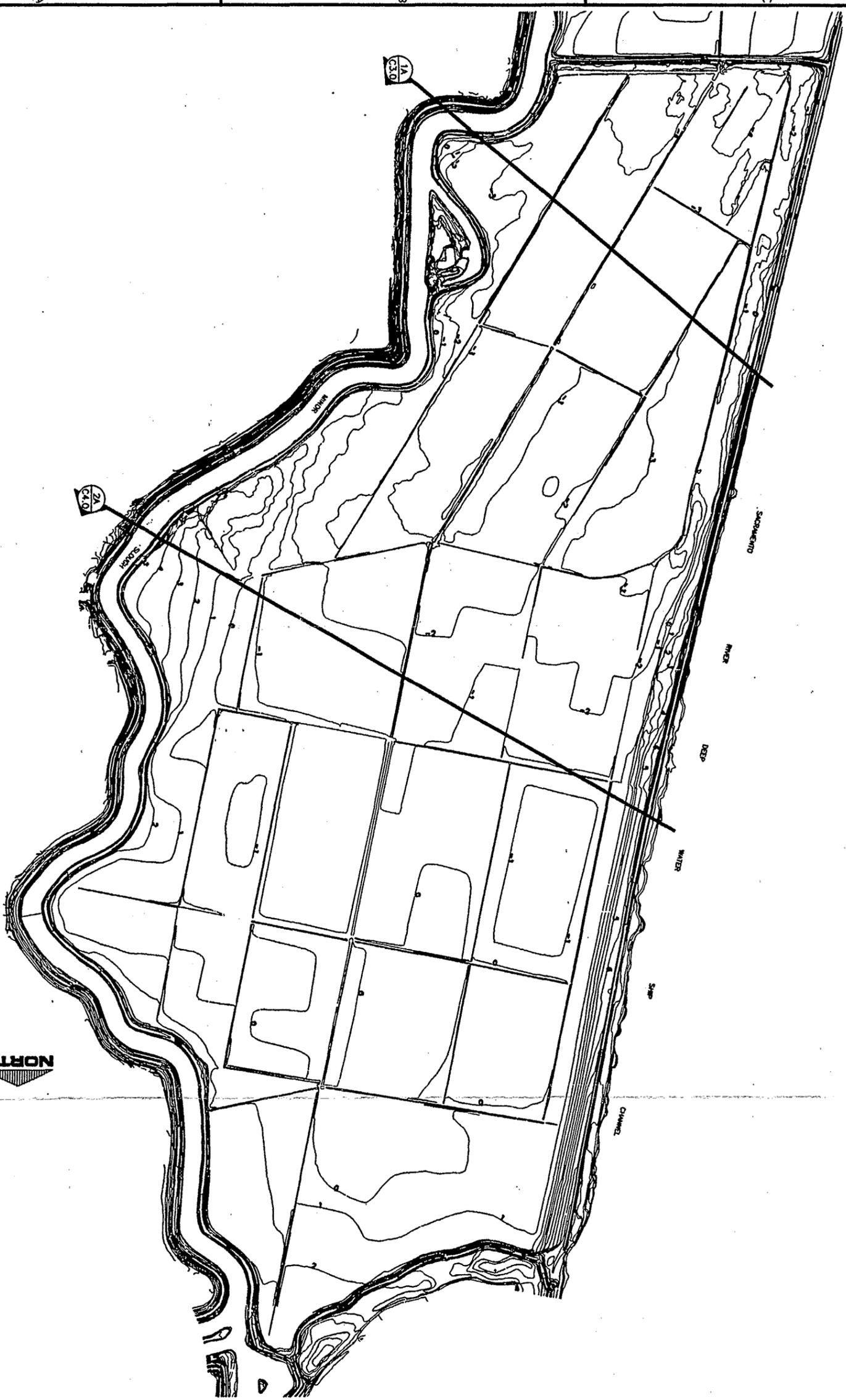
PROSPECT ISLAND

FISH & WILDLIFE HABITAT RESTORATION STUDY ALTERNATIVE 5



CORPS OF ENGINEERS, SACRAMENTO DISTRICT





NORTH

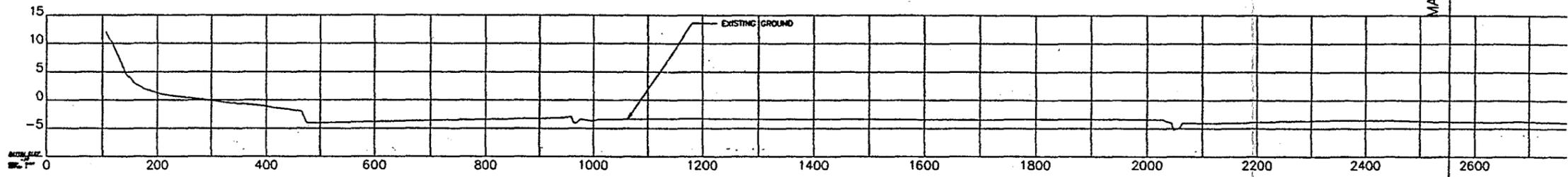
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C1.0
Sheet of

SOLANO COUNTY CALIFORNIA
PROSPECT ISLAND
1125 RESTORATION
EXISTING TOPOGRAPHY

DEPARTMENT OF THE ARMY CORPS OF ENGINEERS SACRAMENTO, CALIFORNIA		Designed by R. SMITH	Date 	Rev.
Drawn by R. SMITH	Ckd by R. SMITH	Design file no. 		
Reviewed by 		SPEC. No. 		
Submitted by Chief, Civ. Des. Sec.		File name ENR2323NS		
		Plot scale 1" = 1000'		

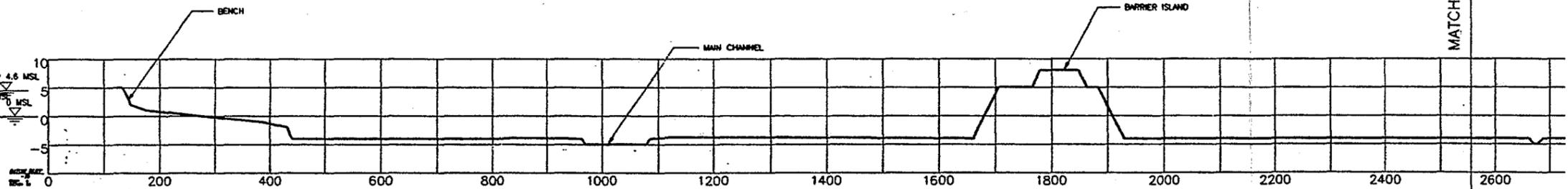
Symbol	Description	Date Approved	Symbol	Description	Date Approved



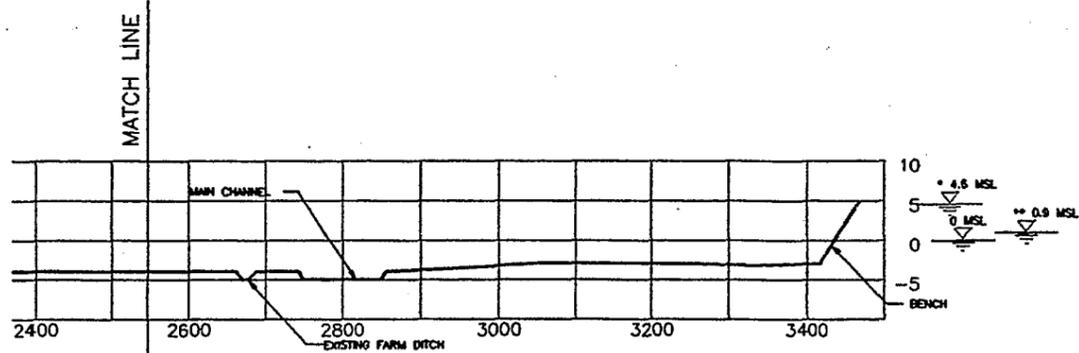


EXISTING SECTION

1A
C3.0



* CALCULATED PROJECT HIGH TIDAL CYCLE
 ** CALCULATED PROJECT LOW TIDAL CYCLE



PROJECT SECTION

1B
C3.0



DATE	DESCRIPTION	DATE APPROVED	BY

DESIGNED BY	DATE	REV.
DRAWN BY		
CHECKED BY		

CALIFORNIA
 ISLAND COUNTY
 PROSPECT ISLAND
 TIDAL RESTORATION
 SECTION 1

Sheet reference number:
C3.0
 Sheet of

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