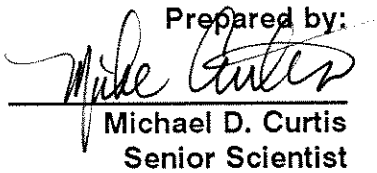
INITIAL EELGRASS SURVEY
CHANNEL SHOALS

MISSION BAY

Prepared for:

City of San Diego
Parks and Recreation Department

Prepared by:



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INITIAL SURVEY OF CHANNEL SHOALS, MISSION BAY EELGRASS TRANSPLANT

INTRODUCTION

On 19 April 1995, MBC Applied Environmental Sciences (MBC) and their subcontractor, Merkel and Associates (M&A), contracted with the City of San Diego Parks and Recreation Department (City) to assist with the Phase 1 and Phase 2 Shoreline Stabilization Projects. To ensure compliance with regulatory provisions, MBC and M&A were to assist the City with monitoring shoreline stabilization construction activities and dredge operations at Mission Bay. Assistance and monitoring was to consist of interacting with the regulatory agencies on behalf of the City, procurement of needed permits, and pre- and post-construction mapping and reporting on the eelgrass resources. After stabilization activities and dredging had been completed, eelgrass (*Zostera marina*) was to be transplanted to those locations impacted by the stabilization construction and dredge operations which resulted in a loss of eelgrass resources.

The City was obligated by regulatory requirements to replace lost eelgrass at a ratio of 1.2 ft^2 transplanted for every 1.0 ft^2 lost. The City had previously negotiated an agreement with the regulatory agencies for the City to set up a banking system whereby any excess eelgrass planted beyond their regulatory requirements (to be calculated at five years post-transplant) could be used to offset the loss of eelgrass from future construction or dredge projects. This banking plan was feasible because some of the area to be utilized for the transplant was previously unvegetated and it was thought construction activities might create a more favorable environment for eelgrass growth. To ensure a safety margin for unforeseen losses and for potential banking credit, the City had determined that all unvegetated areas would be planted. At the end of five years, any coverage of eelgrass in excess of their requirements would be banked.

The Channel Shoals site had been previously surveyed for eelgrass coverage on 28 December 1994. Dredging began at the Channel Shoals site on 19 March 1996 and continued through 15 April 1996. The area that would be impacted by the dredging was initially calculated by City surveyors to be approximately 3.7 acres; however, as a result of an abbreviated dredging schedule, the dredge footprint was smaller than previously calculated. Most of the Channel Shoals site was dredged to a depth of -11.3 ft MSL (-8.5 ft MLLW), a slightly deeper than intermediate depth for subtidal eelgrass in Mission Bay, but deemed adequate to balance navigational needs with eelgrass viability.

Prior to the transplant, a suitable donor site was selected offshore of South Cove with the concurrence of the California Department of Fish and Game, that had dense and healthy eelgrass and was judged capable of supporting a large transplant without unduly affecting the viability of the site.

A reconnaissance survey was conducted on 24 and 25 April 1996 to determine the available area and the amount of eelgrass that was impacted by dredging. Dredging had been conducted along two linear paths that connected at one end forming a vee at approximately 45° angles to each other (Figure 1). During that survey, the two separate paths of the dredged area were located and subsequently outlined and sub-divided into manageable sub-sections to facilitate the transplant and later monitoring. The transplant was conducted over a period of 10 days, commencing on 10 May and continuing until 28 May 1996. During the latter part of the transplant period, all areas of the site were measured and eelgrass coverage was mapped.

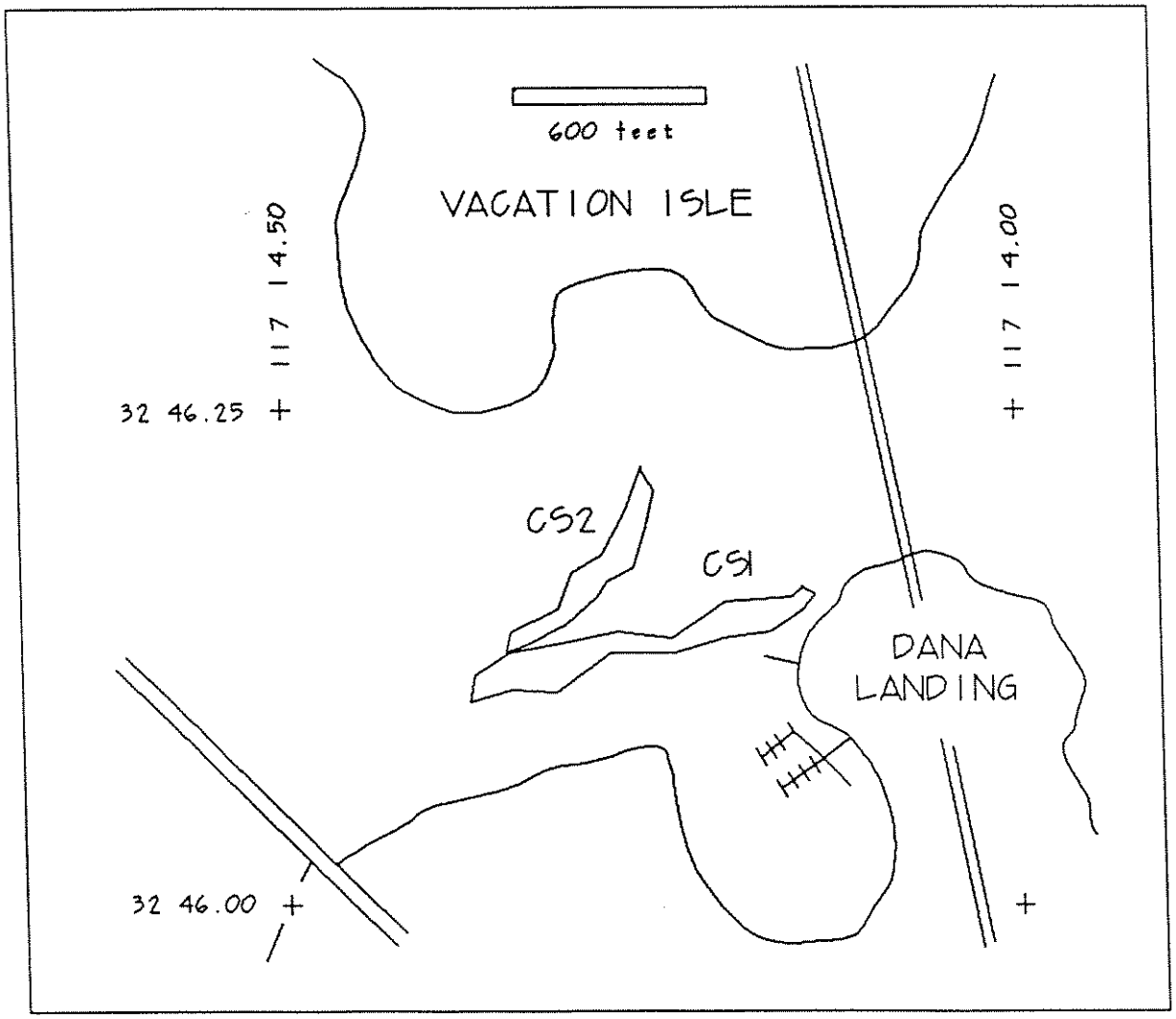

Figure 1. Location of Channel Shoals eelgrass mitigation transplant site.

METHODS

Biologist-divers located the dredge areas of Channel Shoals and secured 0.25-inch diameter yellow polypropylene reference lines to the bottom at the outer perimeter of each dredge path. These lines outlined 25 sections on one path (Channel Shoals 1 = CS1) and

16 on the other path (Channel Shoals 2 = CS2) for a total of 41 separate sections, each upon the footprint of the dredge area (Figure 2). The reference lines were used to facilitate the transplant and would be used to exactly relocate the site during subsequent surveys.

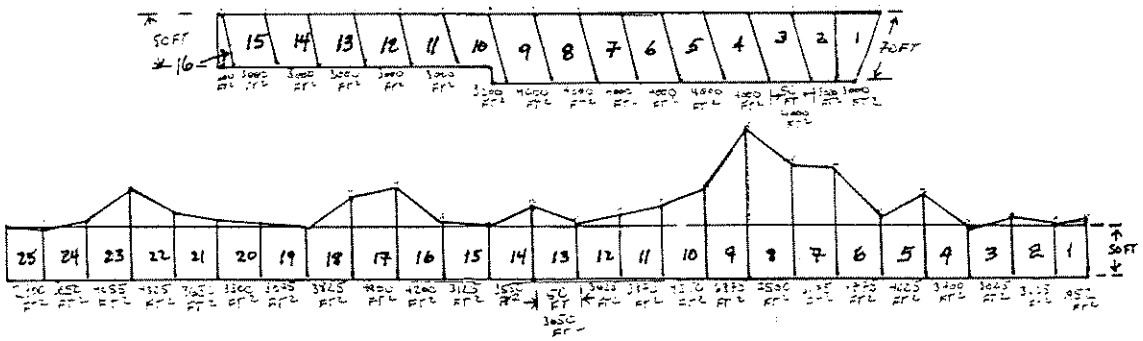

Figure 2. Diagrammatic representation of Channel Shoals eelgrass mitigation transplant site showing planting sections.

A control eelgrass bed located adjacent and parallel to the transplant site was selected for comparison of any fluctuations (caused by changing environmental conditions) in the status of the transplanted bed.

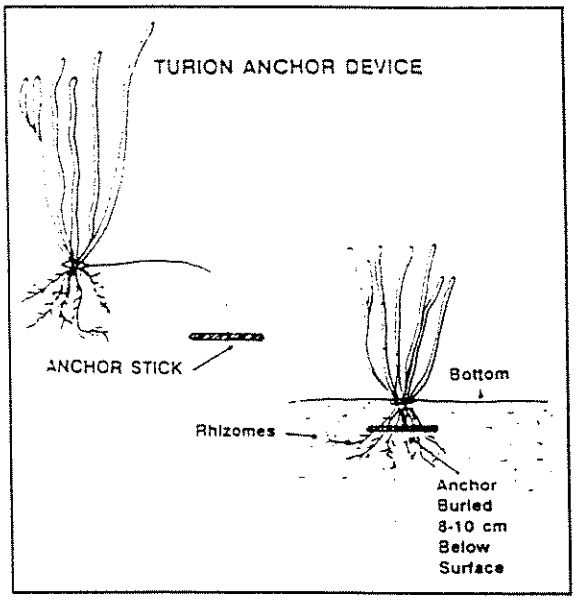

Figure 3. Diagrammatic representation of eelgrass turion anchor device.

Eelgrass was collected by divers from the designated donor site offshore of South Cove and was fabricated into bundles composed of 8 to 15 turions using the bare-root turion and anchor method (Figure 3). Depending on the type of carrying device, either 25 or 50 bundles were attached to each device to allow the biologist-divers to carry large numbers of bundles for rapid deployment underwater (Figure 4). The eelgrass bundles were transplanted at a density of one per square meter in the open areas of each section of the mitigation site.

Immediately following the transplant, biologist-divers used tape measures, grid lines, and writing slates to map the extent of the transplant and the impact of the dredging on the existing eelgrass resources.

RESULTS

During the pre-transplant siting survey, the Channel Shoals area was arbitrarily divided into two sites and designated CS1 and CS2 (Figure 1). It was determined that the outlined area of CS1 totaled 52,820 ft^2 (1.21 acres) and CS2 totaled 100,607 ft^2 (2.31 acres) for a total of 153,427 ft^2 or 3.52 acres = 1.42 hectares (Table 1). The initial monitoring survey (0-Month) determined that no existing eelgrass was present within the gridded area.

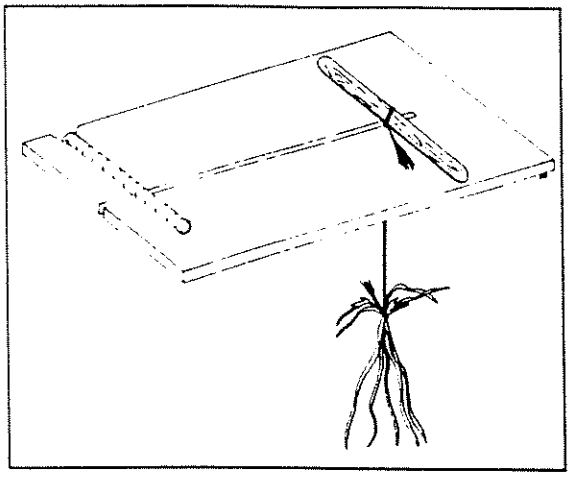

Figure 4. Board used to transport eelgrass turion bundles.

As the dredge paths were both linear and did not impact all the existing eelgrass in the Channel Shoals area, the total area of previously existing eelgrass impacted by the dredge footprint was 23,680 ft^2 (0.54 acres = 0.22 hectares) (Figure 5). The additional area transplanted over that lost to dredging was 129,747 ft^2 (2.98 acres = 1.21 hectares). The regulatory agencies required ratio of planting area to impacted area mandated a minimum transplant of 28,416 ft^2 (0.65 acres = 0.26 hectares). The net area available for banking purposes, should all the area be viable at the end of five years, is 125,011 ft^2 or 2.87 acres = 1.16 hectares.

Table 1. Channel Shoals eelgrass transplant area, percent survival, density, and other survey parameters.

Parameter	Date: / Survey Type: / Area:	July 1996 Initial acres	(hectares)	September 1996 3 month acres	(hectares)	November 1996 6 month acres	(hectares)
Transplanted area		3.52	(1.42)				
Survey coverage		3.52	(1.42)				
Loss of coverage		0	(0)				
Percent survival (%)		100					
Transplant turion density (m^2)		12.1					
Areal loss of eelgrass coverage due to construction		0.54	(0.22)				
Required mitigation area		0.65	(0.26)				
Area available for banking		2.87	(1.16)				
Average control bed density (m^2)		219					
Average control bed coverage (%)		84					

Although only 14,245 turion bundles were required to be planted at the 3.52 acre site, 14,354 turion bundles were actually transplanted. The slightly greater density of turion bundles was due to poor visibility which resulted in variability in the interval distances; also, the desire to enhance marginal habitat areas resulted in extra bundles being placed into those areas.

In terms of individual turions, 172,248 turions (approximately 12 per bundle) were planted in the transplant site resulting in an average turion density of 12.1 turions per m^2 or approximately 1.5 turions per 0.125 m^2. Thus, the average density was slightly greater than the specified density of 8 to 12 (average 10) turions per m^2 or 1.3 turions per 0.125 m^2.

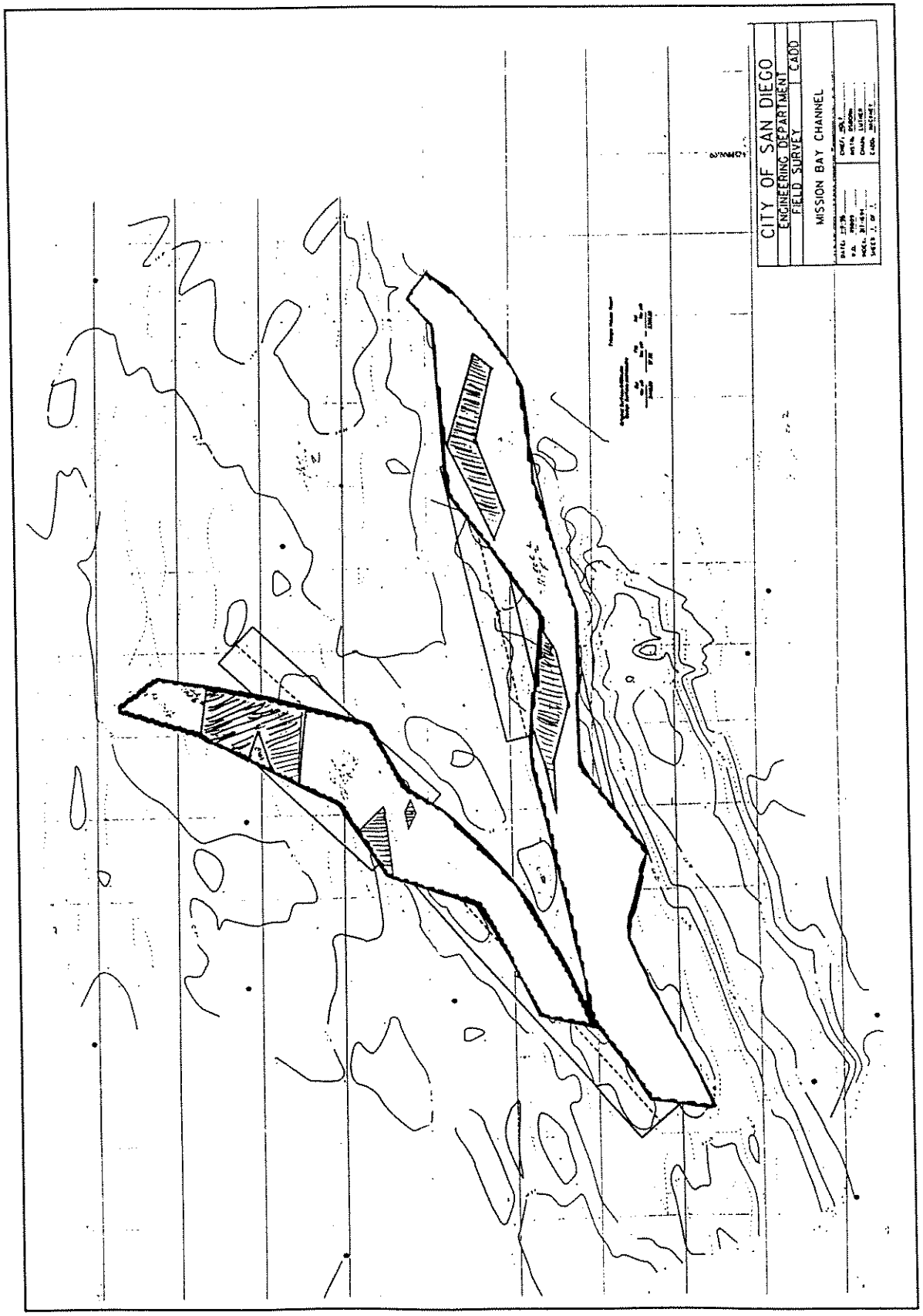

Figure 5. Actual dredge path overlayed on proposed dredge path showing eelgrass beds impacted by dredge operations.

Table 2. Control bed turion densities per transect per 0.125m², July 1996.

Control Bed Density (0.125m²)				
1	2	3	4	Mean
37	28	18	33	
22	24	29	46	
34	33	17	30	
30	25	24	49	
23	27	9	37	
26	31	8	18	
				27.4
Length of 50 m transect vegetated (m)				
46.5	46.5	32.5	41.8	41.81

Control eelgrass bed turion densities averaged 27.4 and ranged from 8 to 49 turions per 0.125 m^2 (Table 2). Coverage ranged between 32.5 m per 50 m transect to 46.5 m and averaged 41.8 m per 50 m transect.

DISCUSSION

Subtidal elevations throughout most of the site should allow adequate light penetration for growth and expansion of the transplanted turion bundles. A large portion (approximately 50%) of the area transplanted had coarse sandy soil, while the remainder of the area was fine sand. The coarse, sandy soil is loose and is indicative of high current regimes; despite this, eelgrass continues to grow vigorously under these conditions on isolated banks within and fringing the channel, indicating that the area can support eelgrass beds.

The single greatest obstacle to a successful transplant may be the intensity of the tidal currents. During the several days of the transplant operations, a number of plants were noted to have been loosened by the currents winnowing sand from around the anchor systems in the coarse, sandy soil areas; occasionally plants were missing and were replaced. By the end of the transplant, 5 to 10% of the plants had noticeable erosion of the substrate around the base of the turion bundle. The turion anchor need to hold the eelgrass turions in place during the strong tidal swings to ensure a successful transplant. If the plants are unable to establish a root system quickly, they may be swept away. Although the coarse sandy area may present some problems, once established, eelgrass should propagate rapidly.

Another potential problem is that large kelp rafts are carried in and out on the tidal currents. As these kelp rafts pass over the bottom the area below is scoured clean by the kelp dragging along the bottom; this may seriously impede the establishment of eelgrass. Round stingrays (*Urolophus halleri*) were also present in large aggregations at the site. These rays create many holes in the eelgrass beds and could potentially affect the survival of the eelgrass turion bundles, especially as even a partial dislodgement of a bundle would be disastrous considering the currents encountered in the area.