CS-11b

Sweet/Willow Lake Hydrologic Restoration Summary Data and Graphics

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Sweet/Willow Lake Hydrologic Restoration (CS-11b)

Project Overview:

The Sweet Lake/Willow Lake shoreline protection project is composed of approximately 6,000 ac (2,428 ha) of open water and freshwater wetlands surrounding Sweet Lake and Willow Lake in northeastern Cameron Parish (figure 1). The project area is bounded on the south and west by the Gulf Intracoastal Waterway (GIWW), and on the north and east by Pleistocene prairie formations along La. Hwy. 384 and La. Hwy. 27.

Three soil types occur in the project area (U. S. Department of Agriculture, Soil Conservation Service [USDA/SCS] 1995; USDA/Natural Resources Conservation Service [USDA/NRCS] 1997). Allemands muck, a very poorly drained organic soil found in freshwater marshes, makes up 90% of the area. The remaining 10% consists of frequently flooded Aquents Series (6.0%) and Udifluvents Series (3.6%) soils that comprise the dredged spoil along the GIWW.

The plant community in the project area is fresh marsh consisting mainly of *Sagittaria lancifolia* (bulltongue), with lesser amounts of *Panicum hemitomon* (maiden cane), *Scirpus californicus* (California bullwhip), *Spartina patens* (marshhay cordgrass), *Typha* sp. (cattail), *Phragmites australis* (common reed), *Colocasia esculenta* (elephant ears), and *Alternanthera philoxeroides* (alligator weed). A canopy layer of *Sesbania drummondii* (rattlebox), *Salix nigra* (black willow), *Sapium sebiferum* (Chinese tallow tree), and *Cephalanthus occidentalis* (buttonbush) is present on higher ground in the marsh and on the remains of ridges formed by old levees and spoil banks in the area. Shallow open water areas support a number of aquatic plants, with stands of *Nelumbo lutea* (American lotus) and *Potamogeton diversifolius* (common pondweed) being the most conspicuous.

Project Overview continued:

Eichhornia crassipes (water hyacinth) is also prevalent, with large floating mats often developing in open water areas by the summer and fall seasons.

When the GIWW was constructed in the early 1900's, its route lay just south of the southern shorelines of both lakes, but the high energy associated with the navigation channel has and continues to impact the lakes and surrounding marshes. Erosion of the banks of the GIWW, caused by the water level drawdown effect and wave wash from the wakes created by passing boats and barges (Good et al. 1995), along with the widening and deepening of the channel from its original dimensions of 40 ft (12.2 m) wide x 5 ft (1.5 m) deep to 125 ft (38 m) wide x 12 ft (3.7 m) deep in the 1940's (United States Army Corps of Engineers [USACE] 1978) and subsequent erosion of its banks, has resulted in the breaching of the narrow strip of marsh and spoil bank between the canal and the southern shoreline of both lakes.

These hydrological connections have led to increased mechanical erosion of the lake shorelines and the surrounding organic marsh soils, followed by the suspension and transport of organic and mineral sediments from the lakes and surrounding marshes into the deeper water of the GIWW channel, resulting in a significant loss of fresh marsh in the project area. Such "blowouts," where direct connections between a channel and inland water body form, exposing fragile organic marsh soils to high energy and increased erosion, are a common problem along navigation channels in coastal Louisiana (Good et al. 1995).

Land loss studies by Britsch (1994) indicate that in 1956, approximately 39 percent of the project area was classified as open water, and 61 percent was classified as fresh emergent marsh. By 1993, approximately 74 percent of the project area was classified as open water, and only 26 percent as fresh emergent marsh, most of which was deteriorated and converting to open water (Britsch 1994).

Project Overview continued:

Between 1952 and 1975, the average shoreline erosion rate was 3.8 ft/yr (1.2 m/yr) at Willow Lake and 2.6 ft/yr (0.8 m/yr) at Sweet Lake (Adams et al. 1978). Between 1978 and 1990, this rate increased to 11 ft/yr (3.4 m/yr) along the northern and eastern shorelines of Willow Lake, and averaged 22 ft/yr (6.7 m/yr) along the Sweet Lake shoreline (Brown & Root 1992). Erosion rates for the GIWW shoreline are not available for this area. A major concern today is that the remaining marshes surrounding Sweet Lake and Willow Lake will eventually erode away, creating one large open water body, which could exacerbate shoreline erosion of the adjacent south bank of the GIWW and the Cameron-Creole estuary marshes to the south (Louisiana Coastal Wetlands Conservation and Restoration Task Force [LCWCRTF] 1993).

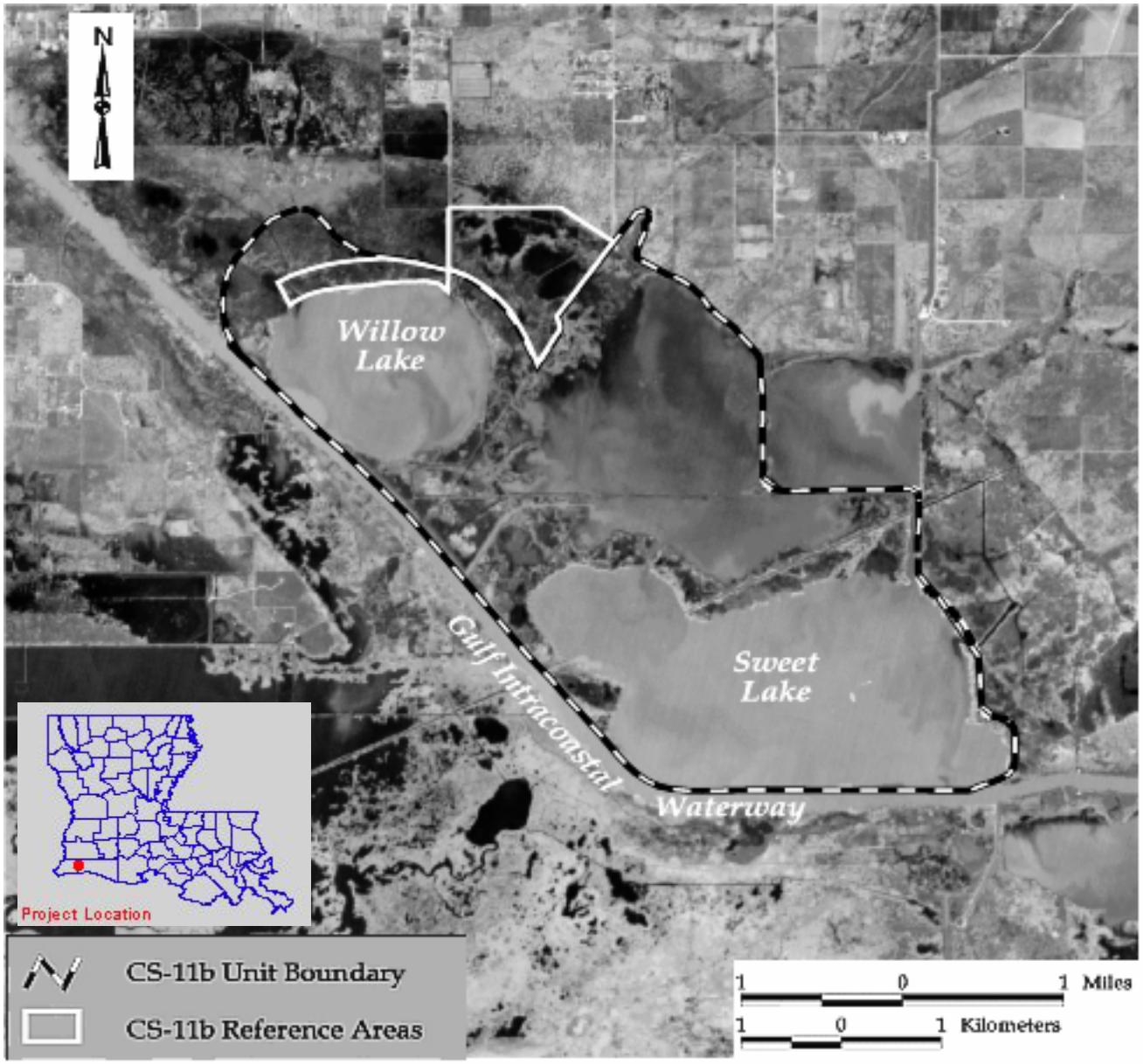

Figure 1. 1994 Sweet/Willow Lake Hydrologic Restoration (CS-11b) project and reference features.

Sweet/Willow Lake Hydrologic Restoration (CS-11b)

Project Objectives

1. Protect emergent marsh in the project area by reducing shoreline erosion.

2. Increase the acreage of emergent and submerged aquatic vegetation (SAV) within the project area.

Specific Goals

The following goals will contribute to the evaluation of the above objectives:

1. Reduce the erosion rate along the Sweet Lake shoreline adjacent to the vegetative plantings of *S. californicus* (California bulrush).

2. Decrease the rate of marsh loss in the terracing/vegetative planting section of the project area.

3. Increase the coverage of emergent wetland vegetation and submerged aquatic vegetation (SAV) in the shallow open water areas in the terracing/vegetative planting section of the project.

Sweet/Willow Lake Hydrologic Restoration (CS-11b)

Monitoring Elements:

The following monitoring elements will provide the information necessary to evaluate the specific goals listed above:

Aerial Photography: To document land and open water areas, and marsh loss/gain rates in the terracing/planting section of the project area and the terracing reference area, near-vertical, color-infrared aerial photography (1:12,000 scale) was obtained in 1998 prior to construction, and will be obtained, postconstruction during 2009 and 2016. The photography will be processed by National Wetlands Research Center (NWRC) personnel using standard operating procedures documented in Steyer et al. (1995) for determining land-to-water ratios and corresponding acreage through GIS analysis. In addition, the length of the shoreline of Sweet Lake adjacent to the vegetation plantings will be determined using the most current aerial photography available at the time of construction. Shoreline length will be used to estimate marsh loss/gains along the Sweet Lake shoreline over time using shoreline erosion rates determined through Global Position System (GPS) shoreline surveys, as described below.

Shoreline Change: To document shoreline movement along the Sweet Lake shoreline, GPS surveys of unobstructed sections of shoreline adjacent to the *S. californicus* plantings were conducted in 2001 at the vegetative edge of the bank to document the position of the shoreline. Future shoreline surveys will be conducted, post-construction in 2004, 2009, and 2016. A similar survey will be conducted concurrently along a 1-mi (1.6 km) long section of the north shoreline of Willow Lake in reference area 1 (figure 1) for use as a reference.

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Shoreline Change continued: A survey monument was established in the vicinity of the rock dike for construction purposes will be used to establish a GPS control point at the beginning and end of each day of surveying. GPS readings taken at this control point will be used as an accuracy check and for determining error associated with each GPS shoreline survey. GPS shoreline positions will be mapped and used to measure shoreline movement over the life of the project.

Vegetation Plantings: The survival and general condition of the *S. californicus* plantings along the Sweet Lake shoreline were documented by monitoring a 5% subsample of the plantings randomly selected from areas where GPS surveys were conducted. Each sampling plot consists of 16 plantings. The locations were marked with a labeled post and a GPS reading. Within each sampling plot, survival was determined as a percentage of the number of live plants to the number planted (percent survival = no. plants/no. planted x 100), after Mendelssohn and Hester (1988) and Mendelssohn et al. (1991). Survival was monitored at 1 month postplanting in 2001 and 2002. Future survivals will be collected in 2004, 2009, and 2016, or until the individual plantings become indistinguishable. These data will be used to determine if the plantings have an effect on the Sweet Lake shoreline erosion rate, as compared with rates similarly estimated along Willow Lake shoreline in reference area 1, as described above. In order to determine planting success, and to estimate the amount (acreage) of emergent vegetation that becomes established on the terraces, random sampling plots were established to include a 3% subsample of the *S. californicus* plantings on the terraces constructed in the open water area north of Sweet Lake.

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Vegetation Plantings continued: Plots were selected by numbering the plantings and randomly selecting plots based on these numbers. Each plot includes 16 plants, and consist of a rectangular section of terrace with eight plantings along each long side of the terrace section. The area of each plot was determined by measuring the length and width of the terrace for each plot. Ocular estimates of percent canopy cover were recorded for each plot. The percent cover for each plot was broken down into the percent cover provided by the *S. californicus* plantings, by other wetland species, and by upland species. The terracing plantings will also be monitored postplanting in 2004, 2009, and 2016.

Submerged Aquatic Vegetation: The rake method (Chabreck and Hoffpauir 1962; Nyman and Chabreck 1996) will be used to document changes in the relative frequency of SAV in the project and reference areas. Transects will be established in the shallow open water area north of Sweet Lake where the terraces and plantings will be installed. For comparison and use as a reference, transects will be similarly established in an open water area in the marsh northeast of Willow Lake. Open water areas will be sampled for presence or absence of SAV at 25 to100 random points along each transect line, depending on the size of the water body. Species composition and relative frequency of occurrence (frequency = number of occurrences/number of samples taken x 100) will be determined. Because extensive colonies of *Eichhornia crassipes* are likely to be present in the open water areas during the fall season, SAV was monitored during May in 2000 pre- construction and will be monitored post-construction in 2004, 2009, and 2016.

Sweet/Willow Lake Hydrologic Restoration (CS-11b)

Aerial photography

Photography was collected Pre-construction in November 1998, and will also be collected in 2009 and 2016 post-construction.

Figures:

Figure 2. 1998 Land :Water Analysis of the Sweet/Willow Lake Hydrologic Restoration project and reference areas.

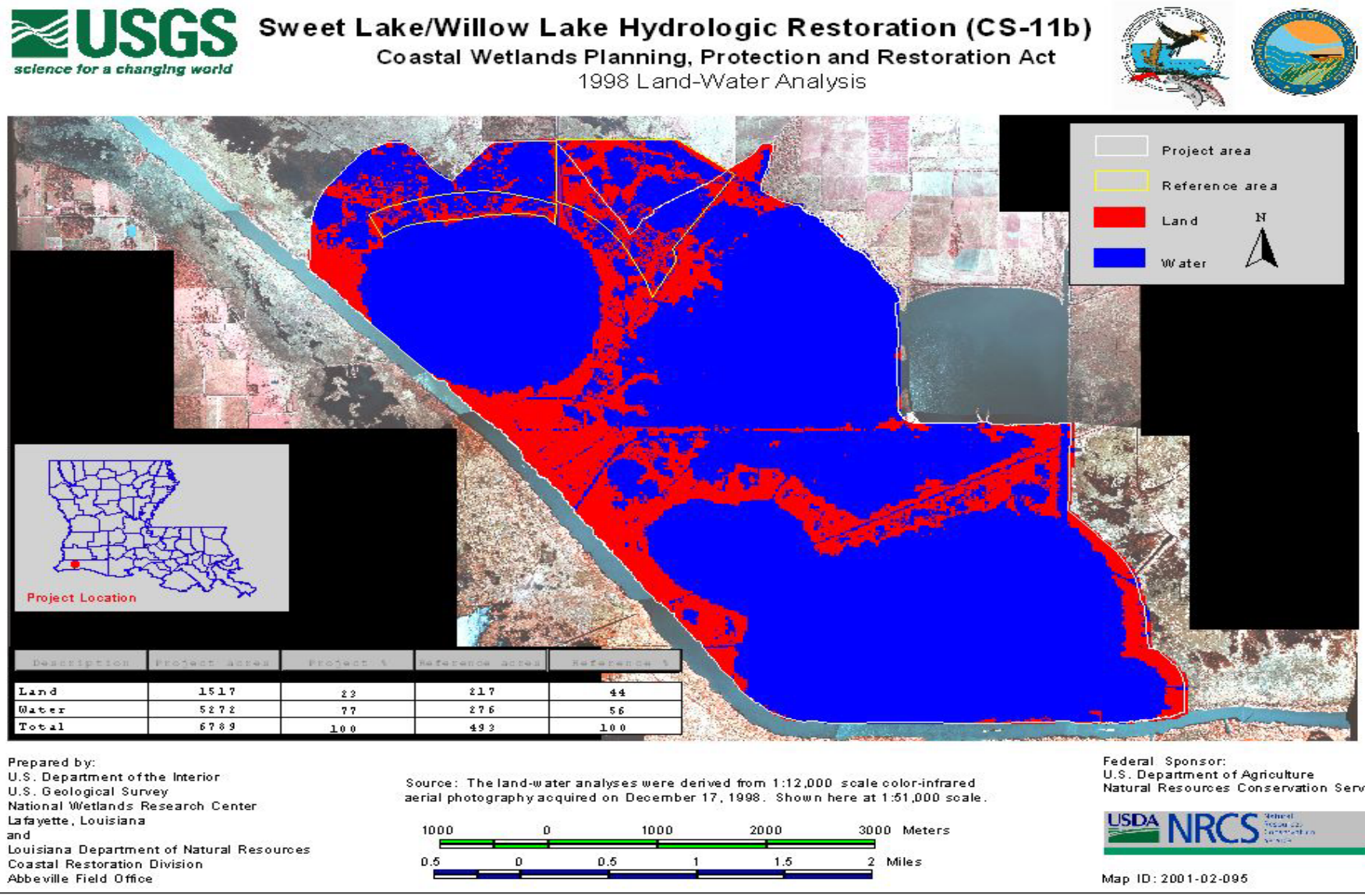

Figure 2. 1998 land to water analysis of the Sweet/Willow Lake Hydrologic Restoration (CS-11b) project area.

Sweet/Willow Lake Hydrologic Restoration (CS-11b)

Shoreline Change

Shoreline position using a Global Positioning System (GPS) was documented in 2001 along the Sweet/Willow Lake shoreline.

Figures:

Figure 3. 2001 preconstruction DGPS survey of shoreline position in the Sweet/Willow Lake Hydrologic Restoration project area.

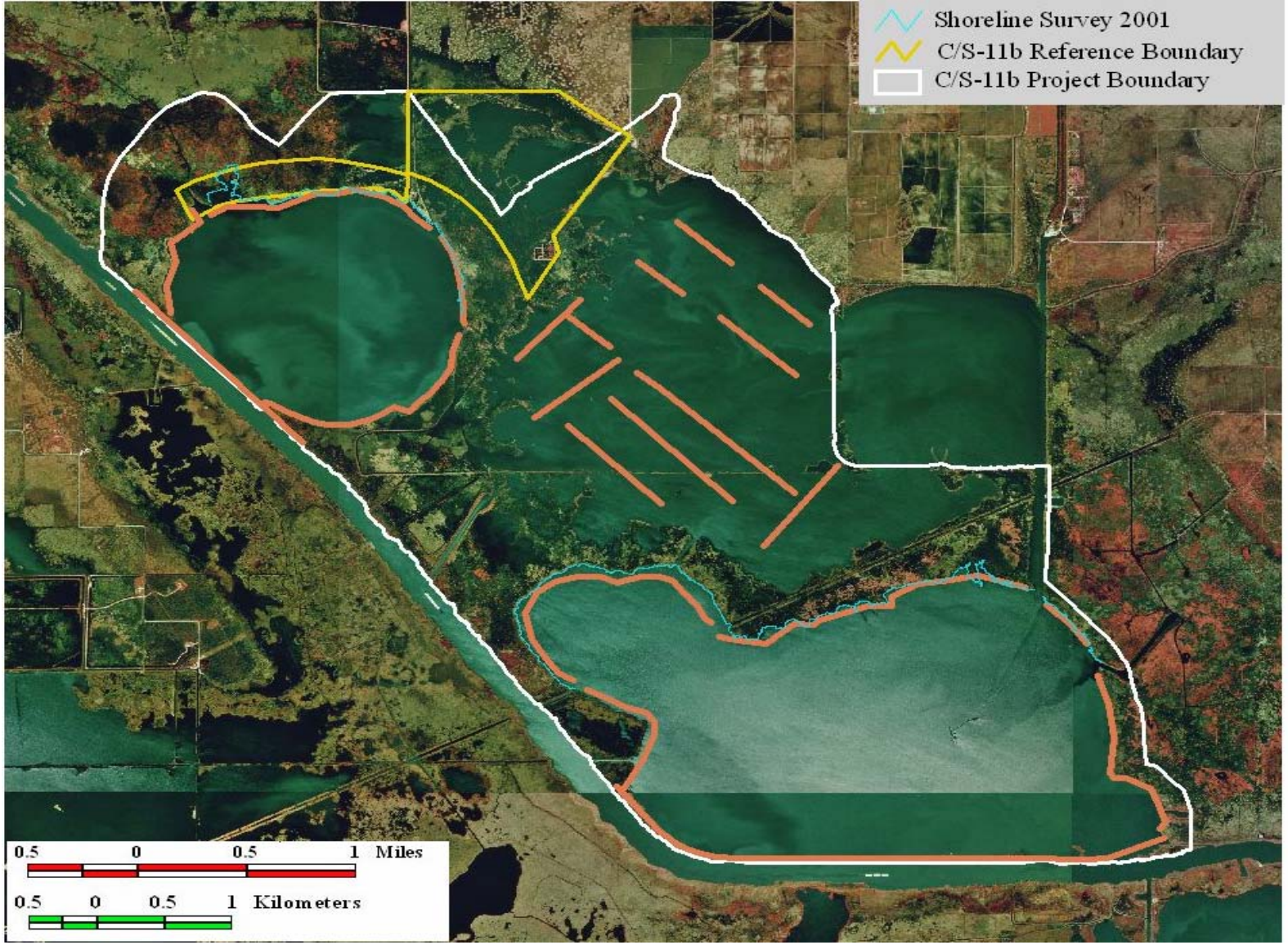

Figure 3. 2001 DGPS Shoreline survey of the Sweet/Willow Lake Hydrologic Restoration (CS-11b) project area and proposed location of the earthen terraces within the project area.

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Emergent Vegetation Data

Collected in December 2001 at 20 replicate open water stations

Collected in October/November 2002 at 20 replicate open water stations, 24 replicate Willow Lake stations and 38 replicate Sweet Lake stations.

Figures:

Figure 4. As-built project maps of Sweet Lake showing location of vegetative terraces.

Figure 5. As-built project maps of Willow Lake showing location of vegetative terraces.

Figure 6. 2001 % survival and % cover of vegetative plantings along open water terraces.

Figure 7. 2002 % survival and % cover of vegetative plantings along open water terraces.

Figure 8. 2002 % survival and % cover of vegetative plantings along the Sweet Lake shoreline.

Figure 9. 2002 % survival and % cover of vegetative plantings along the Willow Lake shoreline.

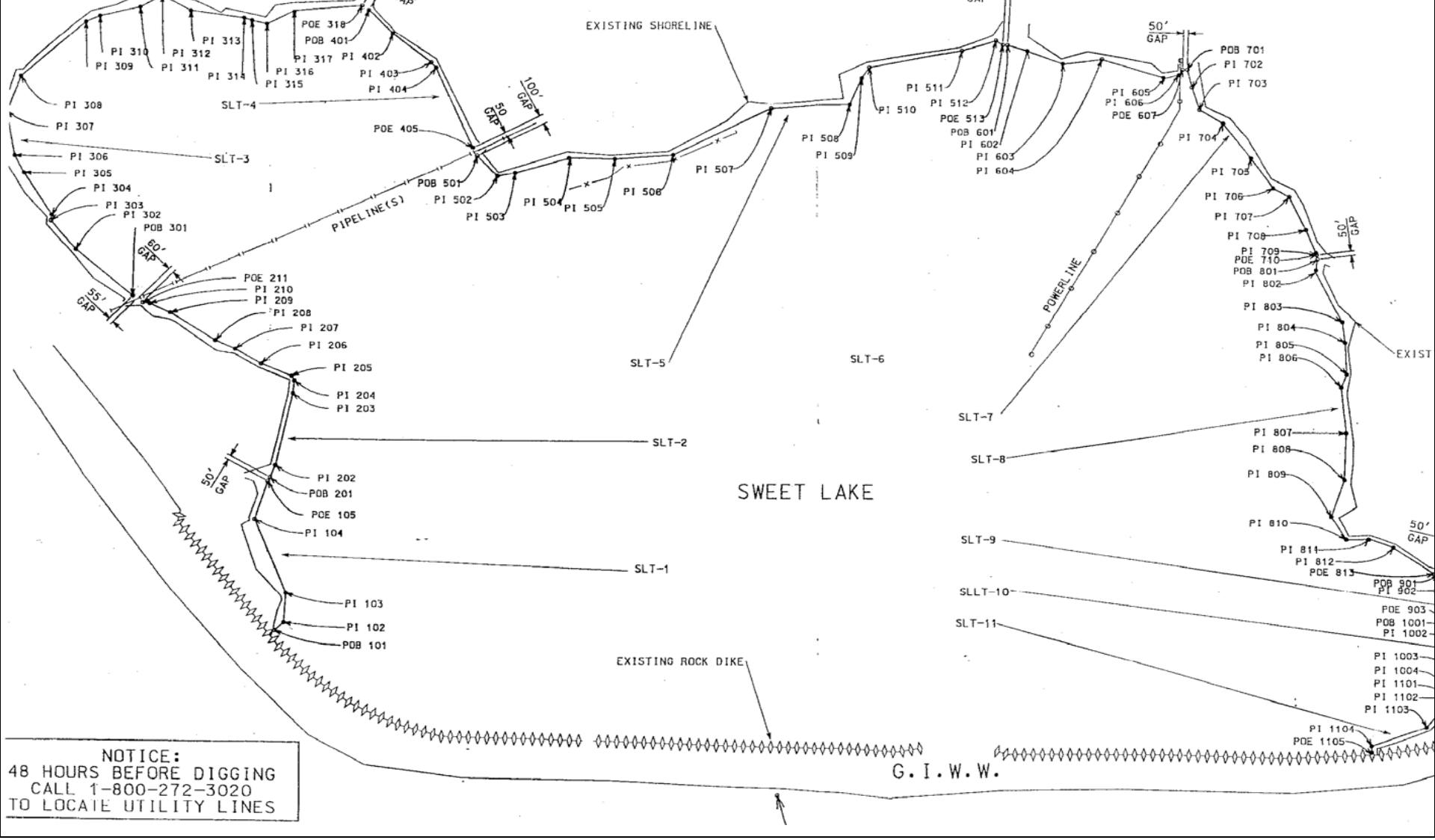

Figure 4. As-built location of earthen terraces within the Sweet Lake area of the Sweet/Willow Lake Hydrologic Restoration (CS-11b) project area.

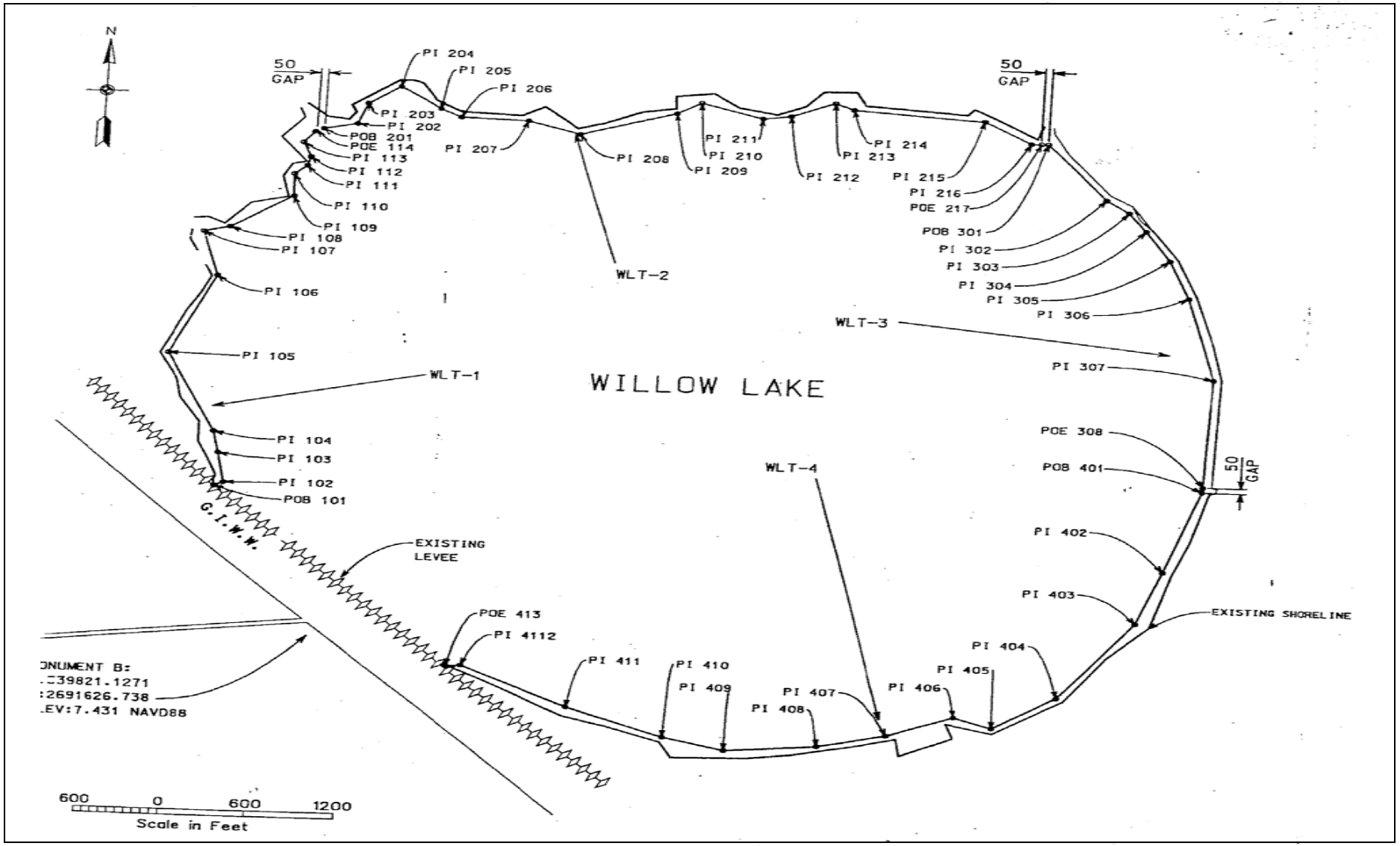

Figure 5. As-built location of earthen terraces within the Willow Lake area of the Sweet/Willow Lake Hydrologic Restoration (CS-11b) project area.

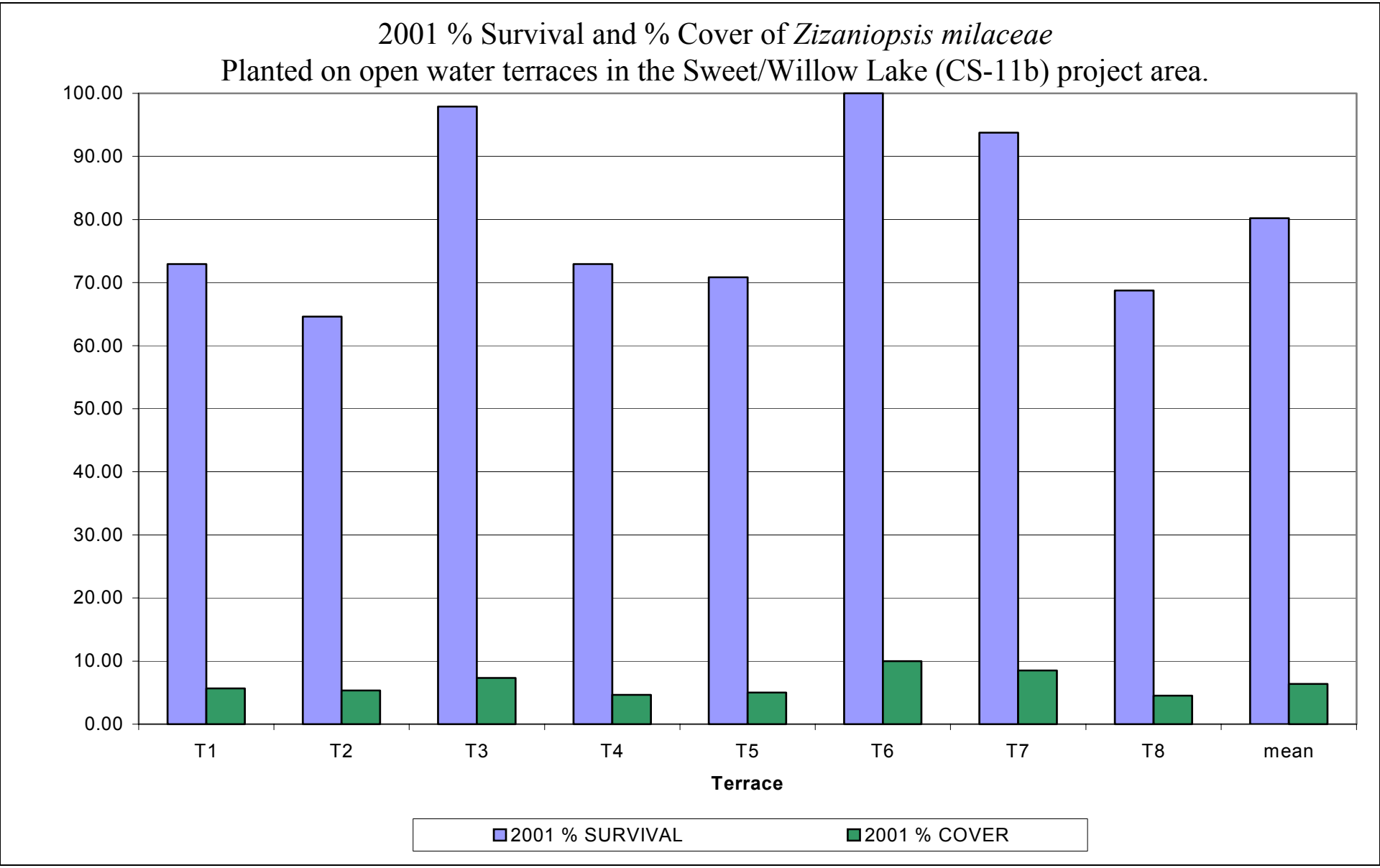

Figure 6. 2001 percent survival and percent cover of vegetative plantings on the open water terraces located in the Sweet/Willow Lake Hydrologic Restoration (CS-11b) project area.

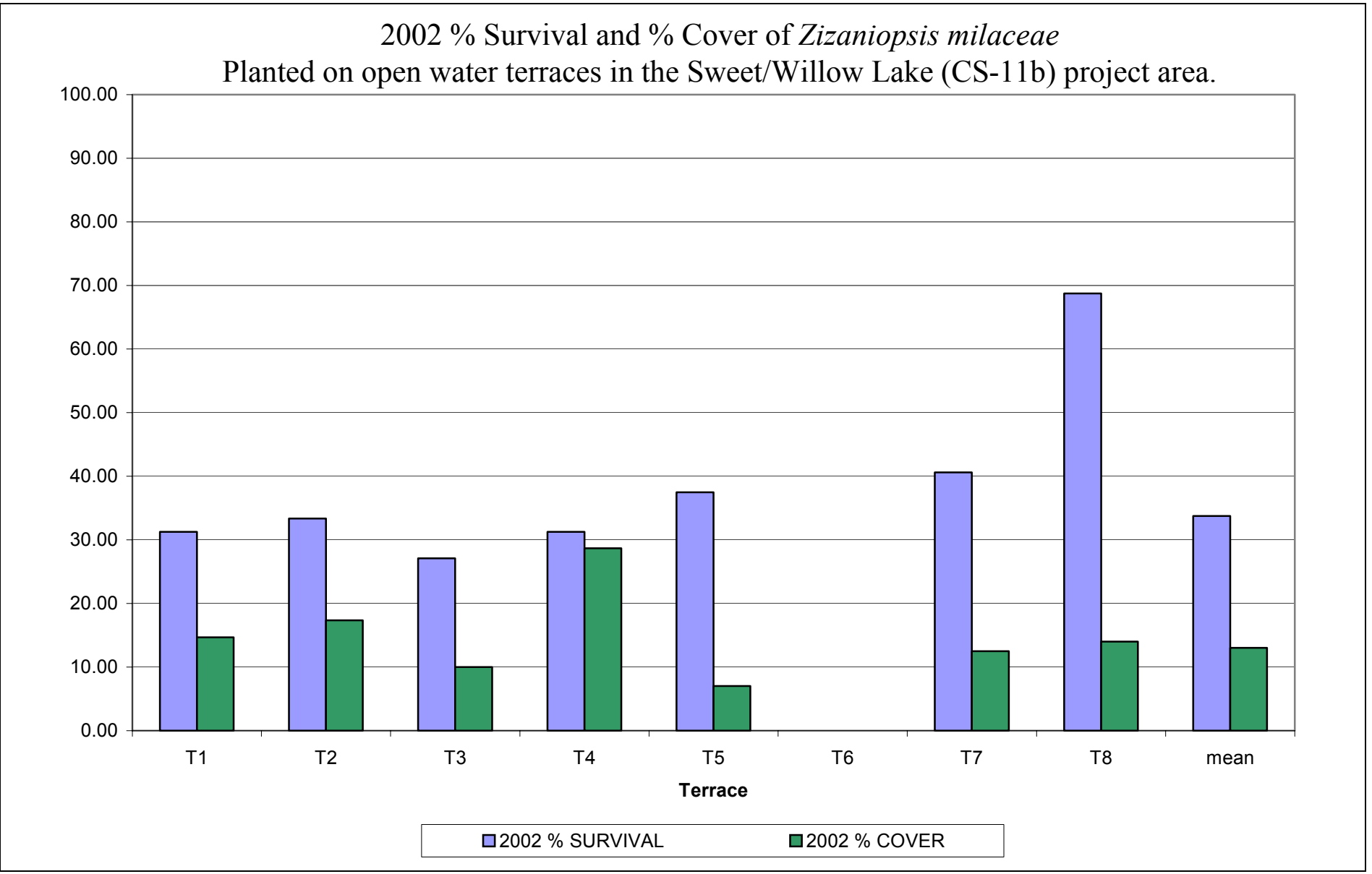

Figure 7. 2002 percent survival and percent cover of vegetative plantings on the open water terraces located in the Sweet/Willow Lake Hydrologic Restoration (CS-11b) project area.

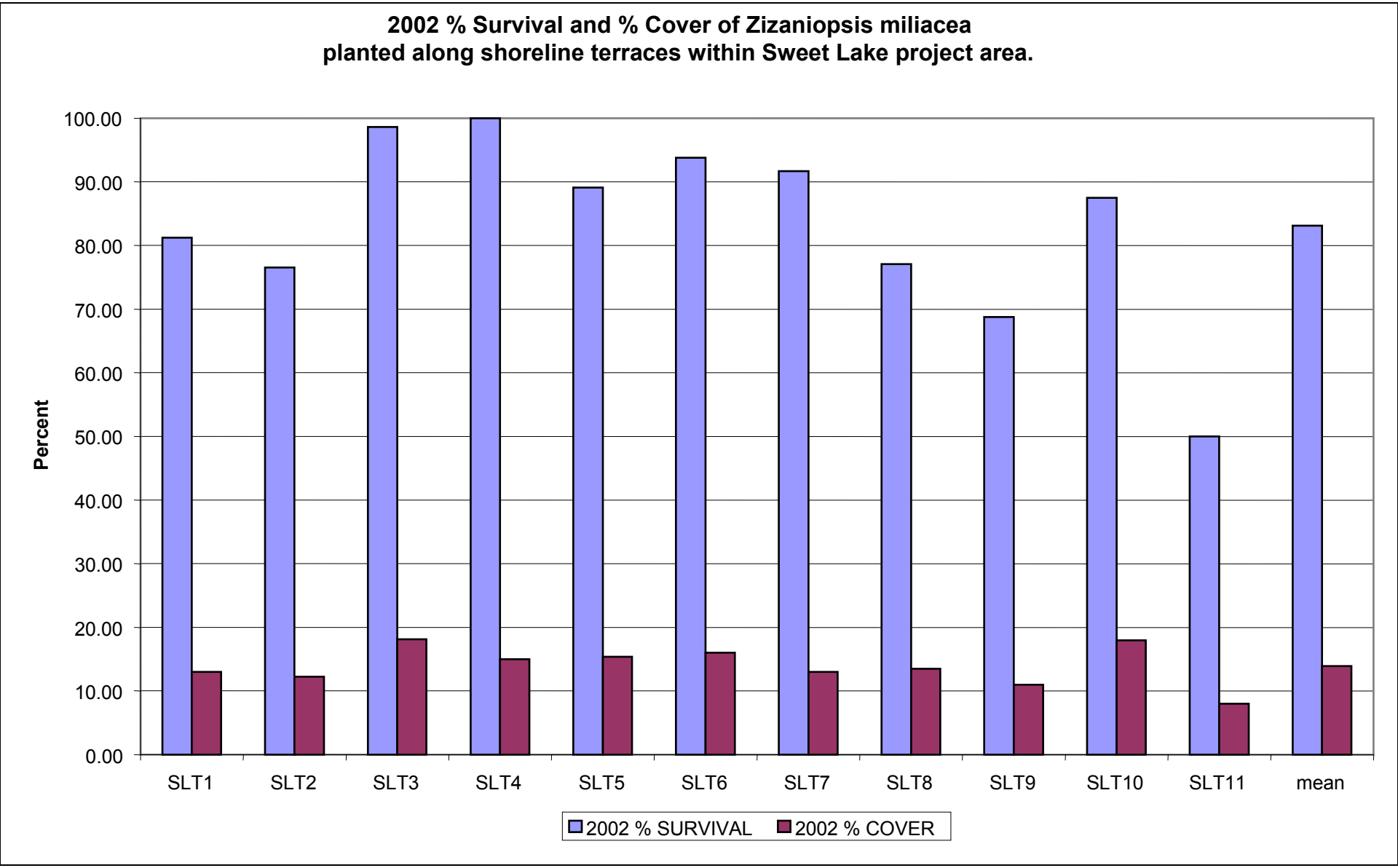

Figure 8. 2002 percent survival and percent cover of vegetative plantings along the Sweet Lake shoreline terraces located in the Sweet/Willow Lake Hydrologic Restoration (CS-11b) project area.

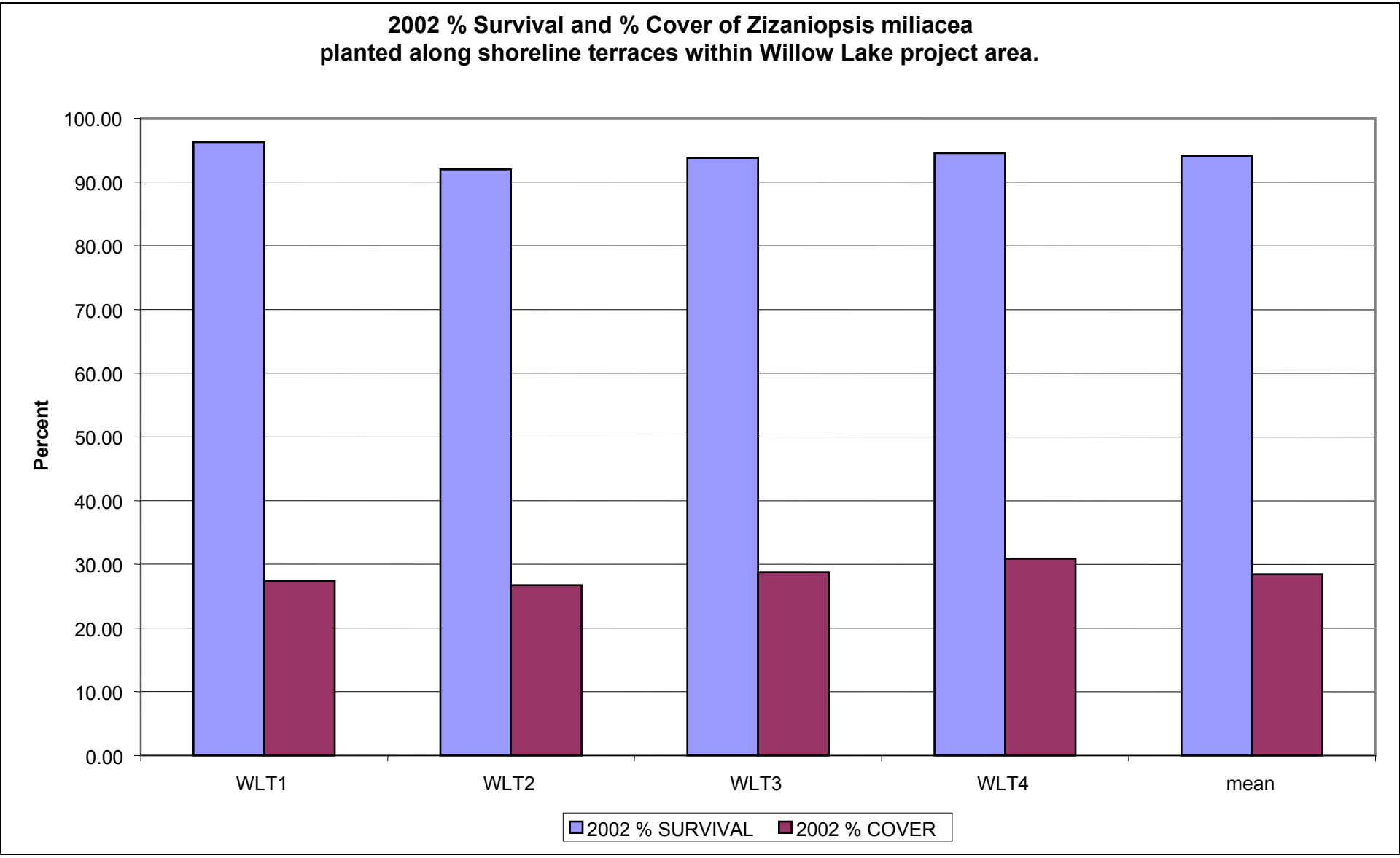

Figure 9. 2002 percent survival and percent cover of vegetative plantings along the Willow Lake shoreline terraces located in the Sweet/Willow Lake Hydrologic Restoration (CS-11b) project area.

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Submerged Aquatic Vegetation Data

Figures:

Figure 10. Number of Occurrence of SAV within the project and reference area from May 2000
Figure 11. Percent Occurrence of SAV within the project and reference area from May 2000

Frequency of Occurrences of SAV within the CS-11b Project and Reference areas from 05/2000.

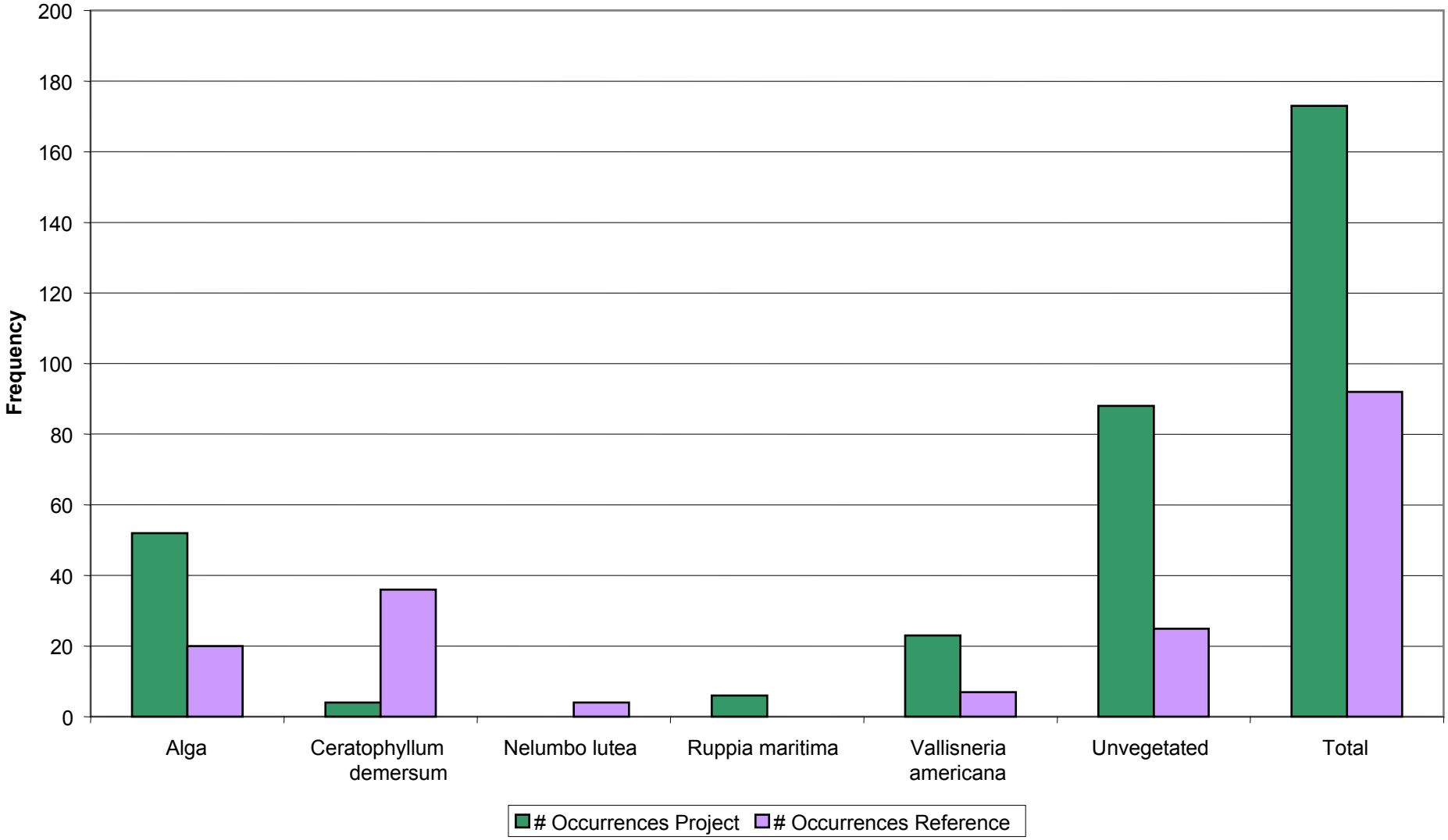

Figure 10. 2000 preconstruction data for number of occurrences of submerged aquatic vegetation within the Sweet/Willow Lake Hydrologic Restoration (CS-11b) project and reference areas.

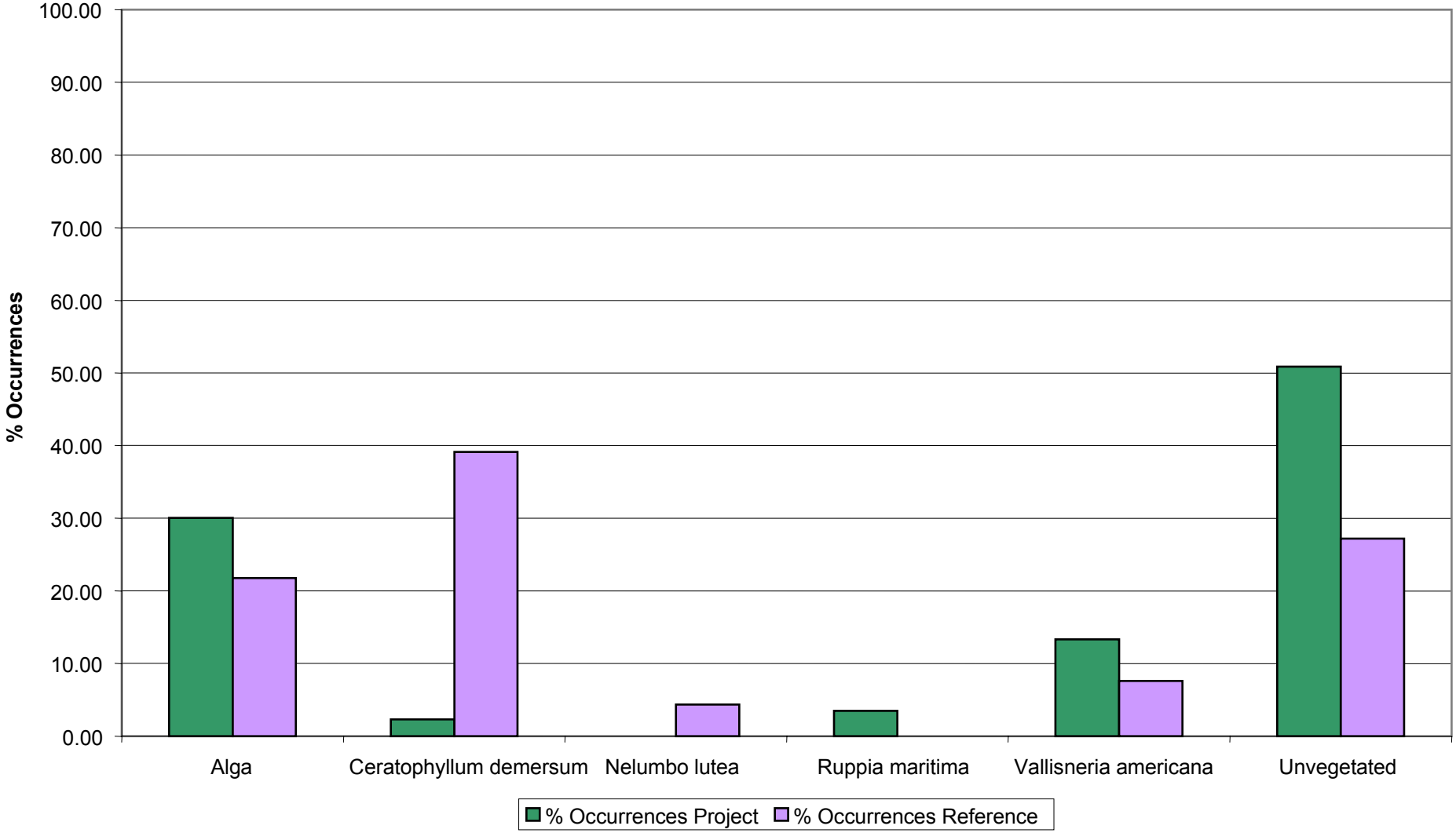

Figure 11. 2000 preconstruction data for percent occurrences of submerged aquatic vegetation within the Sweet/Willow Lake Hydrologic Restoration (CS-11b) project and reference areas.

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Preliminary Findings

Aerial Photography

- Pre-construction (1998) land:water classification indicate 23.0% land and 77.0% water within the project area versus 44.0% land and 56.0% water within reference area.

Shoreline Position

- Data were collected in August 2001 pre-construction. The data will be used to verify shoreline position over time.

Vegetative Plantings

- Data collected in December 2001 and November 2002 on open water terraces indicate that mean % survival has decreased from 80.21 to 33.72 percent.
- Data were collected in October 2002 on shoreline terraces along the Sweet Lake and Willow Lake perimeters. Sweet Lake and Willow Lake terraces had initial mean % survivals of 83.40 and 94.12 respectively.

Submerged Aquatic Vegetation (SAV)

- Data were collected in May 2000 pre-construction. Initial data indicated that unvegetated areas within the project and reference areas were 50.87 and 27.17 percent respectively.