

*Suffolk County Vector Control  
and Wetlands Management Long Term Plan  
and Generic Environmental Impact Statement  
Task 12*

*For the:*

**Wertheim National Wildlife Refuge  
Open Marsh Water Management Demonstration Project  
Data Report 2003**



Submitted to:  
Suffolk County Department of Public Works  
Suffolk County Department of Health Services

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**TABLE OF CONTENTS**

**I. INTRODUCTION ..... 1**  
 1.1. STATION SELECTION ..... 3

**II. BIOLOGICAL PARAMETERS..... 5**  
 2.1 MOSQUITO BREEDING CONCENTRATION AREAS ..... 5  
 2.2 MOSQUITO DIP TRANSECTS..... 5  
 2.3 VEGETATION QUADRATS..... 28  
 2.4 NEKTON SAMPLING ..... 34  
 2.5 INVERTEBRATES ..... 45  
 2.6 INVERTEBRATE ANALYSIS ..... 46  
 2.7 VEGETATION BIOMASS..... 63  
 2.8 BIRD OBSERVATIONS ..... 67

**III. PHYSICAL PARAMTERS ..... 68**  
 3.1 DITCH QUALITIES ..... 68  
 3.2 SEDIMENTATION..... 82  
 3.3 WATER TABLE HEIGHT ..... 82

**IV. CHEMICAL PARAMTERS ..... 82**  
 4.1 WATER QUALITY MONITORING IN DITCHES..... 83  
 4.2 DITCH SALINITY SURVEYS ..... 83  
 4.3 WATER TABLE/PORE WATER SALINITY..... 95  
 4.4 CARMAN’S RIVER WATER QUALITY ..... 97

**TABLE OF TABLES**

Table 2-1 - Mosquito Sampling ..... 6  
 Table 2-2 - Vegetation Quadrats ..... 29  
 Table 2-3 - Nekton Sampling ..... 35  
 Table 2-4 - Nekton Measurements ..... 39  
 Table 2-5 - Vegetation Invertebrate Identification ..... 47  
 Table 2-6 - Water Column Invertebrate Identification ..... 53  
 Table 2-7 - Benthic Invertebrate Identification ..... 57  
 Table 2-8 - Vegetation Biomass - Live Vegetation Clippings ..... 64  
 Table 2-9 - Vegetation Biomass - Soil Core Samples ..... 65  
 Table 2-10- Vegetation Biomass - Soil Core Clippings ..... 66  
 Table 3-1 - Ditch Qualities ..... 69  
 Table 4-1 - Chemical Parameters ..... 84  
 Table 4-2 - Water Quality Monitoring in Ditches ..... 85  
 Table 4-3 - Ditch Salinities ..... 90  
 Table 4-4 - Salinity & Water Table Measurements ..... 96  
 Table 4-5 - Carman's River Water Quality ..... 110  
 Table 4-6 - Estuarine Water Quality Detections ..... 111  
 Table 4-7 - Estuarine Water Quality Analytes and Standard Values ..... 112

**TABLE OF FIGURES**

Fig. 1-1 Site Location Map  
 Fig. 1-2 Overall Area  
 Fig. 1-3 Area 1  
 Fig. 1-4 Area 2  
 Fig. 1-5 Area 3  
 Fig. 1-6 Area 4

## List of Abbreviations and Acronyms

CA	Cashin Associates
DU	Ducks Unlimited
LTP	Long Term Plan (the Suffolk County Vector Control and Wetlands Management Long-Term Plan and Generic Environmental Impact Statement)
MSRC	Marine Sciences Research Center, University at Stony Brook
OMWM	Open Marsh Water Management
PEHL	Suffolk County Department of Health Services Public and Environmental Health Laboratory
SCDHS	Suffolk County Department of Health Services
SCVC	Suffolk County Vector Control
USFWS	US Fish and Wildlife Service
USGS	US Geological Survey
WNWR	Wertheim National Wildlife Refuge

## **I. Introduction**

As part of the development of a Long-Term Plan (LTP) for Vector Control and Wetlands Management, Suffolk County has determined that local demonstration projects of various kinds are in order. It is widely believed that the most effective, economical, and potentially environmentally benign means of control for salt marsh mosquitoes is to manage their habitat so as to minimize breeding of larvae and so minimize the development of adult populations. Open Marsh Water Management (OMWM) is a guild of techniques that has been developed with the intention of controlling mosquito production but avoiding environmental impacts associated with traditional grid or parallel ditch maintenance. OMWM is intended to enhance habitat for the fish that consume mosquito larvae and to increase access for these fish to potential breeding sites. OMWM is intended to at least partially restore water levels to pre-ditching variability. OMWM is therefore often classified as a means of salt marsh restoration.

There have been several projects that have used OMWM principles or OMWM-like techniques in certain wetlands on Long Island. However, none of these projects have constituted a comprehensive demonstration project of standard OMWM, especially with the overt intention of demonstrating mosquito control feasibility.

Therefore, as part of the development of its LTP for vector control, Suffolk County would like to institute a wide-ranging, long-term, comprehensive demonstration project of several alternatives of OMWM. The US Fish and Wildlife Service (USFWS) has offered to allow portions of the Wertheim National Wildlife Refuge (WNWR), Shirley, to be used for this purpose (see Fig. 1-1).

In order to detect impacts from the OMWM construction projects, pre-project environmental monitoring has been undertaken to establish a data baseline. This report provides the initial round of data collection for the time period August 2003 to January 2004. The data have not been interpreted, and so this is merely a preliminary accounting of the pre-project monitoring to date.

WNWR is comprised of approximately 2,550 acres located on the south shore of Long Island at the mouth of the Carmans River. The project locations (four distinct areas, called Area 1, Area 2,

Area 3, Area 4 [see Figure 1-2]) are along the east bank of the Carmans River in the salt marshes found near its confluence with the bay. Generally, the marshes are ditched, and are comprised of nearly monotonic stands of *S. alterniflora* (low marsh) and *S. S. patens* (high marsh). Invasive *Phragmites australis* stands are found throughout the proposed project region. More *Phragmites* are found in Areas 1 and 4 (see below) along some of the mosquito control ditches, but *Phragmites* stands are also common in higher elevations of the marshes where they appear to be promoted by fresh water inflows.

Most of the mosquito control ditches were plugged at various times in the 1980s and 1990s. Many of the plugs have failed, either due to physical processes (erosion caused by tides or storms) or undermining by muskrats. However, some are still effectively retaining water within the marsh during tidal cycling. A three year monitoring project conducted between Areas 3 and 4 has just been completed by MJ James-Pirri (part of a North-East US project covering 11 different sites, sponsored by USFWS and US Geological Survey [USGS]).

The marsh is an active breeding area for salt marsh mosquitoes, although some other species breed in the refuge as well. Suffolk County Vector Control (SCVC) and USFWS conduct weekly larval monitoring at selected locations. Increases in larval counts result in aerial applications of larvicides (commonly, methoprene). WNWR has also been included in one aerial adulticide application since 1999, intended to prevent West Nile virus infestations in the Bellport-Brookhaven-Mastic-Shirley area.

Sampling has been conducted by a consortium of organizations. These include Cashin Associates (CA), the consultant to the County on the LTP, Ducks Unlimited (DU) (a subconsultant to CA), SCVC, Suffolk County Department of Health Services (SCDHS) including the Public and Environmental Health Laboratory (PEHL), and USFWS staff from WNWR. Researchers from the Goodbred and Cerrato laboratories, Marine Sciences Research Center (MSRC), University at Stony Brook, have also assisted.

It should be noted that the OMWM installations will not be judged solely on the data collected as part of this project. CA intends to incorporate information generated by the James-Pirri project as

well as prior OMWM/OMWM-like efforts conducted on the south shore in Suffolk County such as Seatuck, Sayville, William Floyd, and Fireplace Neck (Brookhaven hamlet), and perhaps use information from similar projects elsewhere on Long Island that may be relevant to understanding impacts and processes at WNWR.

### 1.1. Station Selection

Transects were identified across each Area, using the USFWS/USGS protocols (James-Pirri et al., 2002). Twenty-four stations were established in each of Areas 1 and 2, and 20 stations were established in Areas 3 and 4, for a total of 88 marsh surface stations. In addition, 10 ditch sampling points (“fish stations”) were established, again using the USFWS/USGS protocols. SCDHS also established four permanent Carmans River water quality monitoring stations (one associated with each Area), and two water quality monitoring stations in navigable sections of the major creeks. Station locations are represented in Figures 1-3 – 1-6.

### STATION LOCATIONS

AREA 1	AREA 2	AREA 3	AREA 4
1-00	1-00	1-00	1-00
1-40	1-40	1-40	1-40
1-80	1-80	1-80	1-80
1-120	1-120	1-120	1-120
2-00	1-160	1-160	1-160
2-40	2-00	1-200	2-00
2-80	2-40	2-00	2-40
2-120	2-80	2-40	2-80
3-00	2-120	2-80	2-120
3-40	2-160	2-120	2-160
3-80	2-200	2-160	3-00
3-120	3-00	2-200	3-40
3-160	3-40	3-00	3-80
3-200	3-80	3-40	3-120
4-00	3-120	3-80	3-160
4-40	3-160	3-120	4-00
4-80	3-200	4-00	4-40
4-120	4-00	4-40	4-80
4-160	4-40	4-80	4-120
4-200	4-80	4-120	4-160
4-240	4-120		
5-00	5-00		
5-40	5-40		
5-80	5-80		

## II. Biological Parameters

### 2.1 Mosquito Breeding Concentration Areas

Mosquito breeding concentration areas were identified throughout the four areas of the marsh in September 2003. For a period of four weeks, the areas were visually inspected five times for small pools of stagnant water that might contain mosquito larvae using the USFWS/USGS protocols (James-Pirri et al., 2002). The pools were selected arbitrarily with a mosquito dipper. Each location containing mosquito larvae was flagged and the GPS coordinates were documented. An assessment of the data was made and the locations of concentrated areas of mosquito larvae were estimated.

### 2.2 Mosquito Dip Transects

The following table represents mosquito larvae that were collected during a period of six weeks in September and October. Larvae was sampled every 15-20 m along each transect in all four marsh areas using a mosquito dipper in accordance with USFWS/USGS protocols (James-Pirri et al., 2002). At each sampling location, the nearest standing water within a 3 m radius was noted. If standing water was present within a 3 m radius, the edges of the standing water were sampled with the mosquito dipper. If a full dipper of water was not possible, the volume increments inside the mosquito dipper were used to estimate the water volume collected. The larvae collected in the mosquito dipper were counted and recorded. If there were more than 100 larvae estimated to be in the dipper, the sample was coded into one of four categories (100 to 200 larvae; 200 to 300 larvae; 300 to 500 larvae; or >500 larvae).



*Sampling technique used for mosquito dip samples*



**TABLE 2-1 MOSQUITO SAMPLING**

**AREA 1**

Area	Date	Station #	Total # of Larvae	Dipper Volume (fifths)	Area Dipped
Area 1	9/3/2003	1-00	-	-	dry
Area 1	9/3/2003	1-20	0	1	standing water
Area 1	9/3/2003	1-40	0	3	pool
Area 1	9/3/2003	1-60	0	5	ditch
Area 1	9/3/2003	1-80	-	-	dry
Area 1	9/3/2003	1-100	0	1	standing water
Area 1	9/3/2003	1-120	-	-	dry
Area 1	9/3/2003	2-120	0	5	standing water
Area 1	9/3/2003	2-100	-	-	dry
Area 1	9/3/2003	2-80	0	2	standing water
Area 1	9/3/2003	2-60	0	1	standing water
Area 1	9/3/2003	2-40	1	2	standing water
Area 1	9/3/2003	2-20	-	-	dry
Area 1	9/3/2003	2-00	-	-	dry
Area 1	9/3/2003	3-00	0	2	standing water
Area 1	9/3/2003	3-20	-	-	dry
Area 1	9/3/2003	3-40	6	2	standing water
Area 1	9/3/2003	3-60	-	-	dry
Area 1	9/3/2003	3-80	0	4	standing water
Area 1	9/3/2003	3-100	1	1	standing water
Area 1	9/3/2003	3-120	1	1	standing water
Area 1	9/3/2003	3-140	0	1	standing water
Area 1	9/3/2003	3-160	0	0	standing water
Area 1	9/3/2003	3-180	0	1	standing water
Area 1	9/3/2003	3-200	-	-	dry
Area 1	9/3/2003	4-240	-	-	dry
Area 1	9/3/2003	4-220	10	4	standing water
Area 1	9/3/2003	4-200	-	-	dry
Area 1	9/3/2003	4-180	-	-	dry
Area 1	9/3/2003	4-160	-	-	dry
Area 1	9/3/2003	4-140	0	3	standing water
Area 1	9/3/2003	4-120	-	-	dry
Area 1	9/3/2003	4-100	-	-	dry
Area 1	9/3/2003	4-80	0	2	standing water
Area 1	9/3/2003	4-60	17	4	standing water
Area 1	9/3/2003	4-40	34	4	standing water
Area 1	9/3/2003	4-20	0	2	standing water
Area 1	9/3/2003	4-00	0	1	standing water
Area 1	9/3/2003	5-00	-	-	dry
Area 1	9/3/2003	5-20	30	5	standing water
Area 1	9/3/2003	5-40	0	3	standing water
Area 1	9/3/2003	5-60	6	2	standing water
Area 1	9/3/2003	5-80	0	1	standing water
Area 1	9/17/2003	1-00	-	-	dry

Area 1	9/17/2003	1-20	0	1	standing water
Area 1	9/17/2003	1-40	0	1	little pool
Area 1	9/17/2003	1-60	0	5	plugged ditch
Area 1	9/17/2003	1-80	-	-	dry
Area 1	9/17/2003	1-100	-	-	dry
Area 1	9/17/2003	1-120	-	-	dry
Area 1	9/17/2003	2-120	-	-	dry
Area 1	9/17/2003	2-100	-	-	dry
Area 1	9/17/2003	2-80	-	-	dry
Area 1	9/17/2003	2-60	-	-	dry
Area 1	9/17/2003	2-40	-	-	dry
Area 1	9/17/2003	2-20	-	-	dry
Area 1	9/17/2003	2-00	-	-	dry
Area 1	9/17/2003	3-00	-	-	dry
Area 1	9/17/2003	3-20	-	-	dry
Area 1	9/17/2003	3-40	-	-	dry
Area 1	9/17/2003	3-60	-	-	dry
Area 1	9/17/2003	3-80	-	-	dry
Area 1	9/17/2003	3-100	-	-	dry
Area 1	9/17/2003	3-120	-	-	dry
Area 1	9/17/2003	3-140	-	-	dry
Area 1	9/17/2003	3-160	-	-	dry
Area 1	9/17/2003	3-180	-	-	dry
Area 1	9/17/2003	3-200	-	-	dry
Area 1	9/17/2003	4-240	-	-	dry
Area 1	9/17/2003	4-220	-	-	dry
Area 1	9/17/2003	4-200	-	-	dry
Area 1	9/17/2003	4-180	-	-	dry
Area 1	9/17/2003	4-160	-	-	dry
Area 1	9/17/2003	4-140	-	-	dry
Area 1	9/17/2003	4-120	-	-	dry
Area 1	9/17/2003	4-100	-	-	dry
Area 1	9/17/2003	4-80	-	-	dry
Area 1	9/17/2003	4-60	0	1	standing water
Area 1	9/17/2003	4-40	12	1	standing water
Area 1	9/17/2003	4-20	-	-	dry
Area 1	9/17/2003	4-00	-	-	dry
Area 1	9/17/2003	5-00	-	-	dry
Area 1	9/17/2003	5-20	-	-	dry
Area 1	9/17/2003	5-40	-	-	dry
Area 1	9/17/2003	5-60	1	1	standing water
Area 1	9/17/2003	5-80	-	-	dry
Area 1	9/26/2003	1-00	0	1	standing water
Area 1	9/26/2003	1-20	-	-	dry
Area 1	9/26/2003	1-40	1	3	standing water
Area 1	9/26/2003	1-60	0	2	standing water
Area 1	9/26/2003	1-80	0	1	standing water
Area 1	9/26/2003	1-100	0	2	standing water

Area 1	9/26/2003	1-120	-	-	dry
Area 1	9/26/2003	2-120	0	2	standing water
Area 1	9/26/2003	2-100	0	2	standing water
Area 1	9/26/2003	2-80	0	3	standing water
Area 1	9/26/2003	2-60	3	5	standing water
Area 1	9/26/2003	2-40	0	2	standing water
Area 1	9/26/2003	2-20	0	3	standing water
Area 1	9/26/2003	2-00	-	-	dry
Area 1	9/26/2003	3-00	0	1	standing water
Area 1	9/26/2003	3-20	0	5	standing water
Area 1	9/26/2003	3-40	4	4	standing water
Area 1	9/26/2003	3-60	0	3	standing water
Area 1	9/26/2003	3-80	0	1	standing water
Area 1	9/26/2003	3-100	0	2	standing water
Area 1	9/26/2003	3-120	0	2	standing water
Area 1	9/26/2003	3-140	0	3	standing water
Area 1	9/26/2003	3-160	-	-	dry
Area 1	9/26/2003	3-180	0	2	standing water
Area 1	9/26/2003	3-200	0	2	standing water
Area 1	9/26/2003	4-240	-	-	dry
Area 1	9/26/2003	4-220	-	-	dry
Area 1	9/26/2003	4-200	-	-	dry
Area 1	9/26/2003	4-180	0	3	standing water
Area 1	9/26/2003	4-160	0	1	standing water
Area 1	9/26/2003	4-140	0	5	standing water
Area 1	9/26/2003	4-120	-	-	dry
Area 1	9/26/2003	4-100	-	-	dry
Area 1	9/26/2003	4-80	0	4	standing water
Area 1	9/26/2003	4-60	0	3	standing water
Area 1	9/26/2003	4-40	0	3	standing water
Area 1	9/26/2003	4-20	0	2	standing water
Area 1	9/26/2003	4-00	0	1	standing water
Area 1	9/26/2003	5-00	0	2	standing water
Area 1	9/26/2003	5-20	2	4	standing water
Area 1	9/26/2003	5-40	-	-	dry
Area 1	9/26/2003	5-60	0	3	standing water
Area 1	9/26/2003	5-80	0	2	standing water
Area 1	10/3/2003	1-00	-	-	dry
Area 1	10/3/2003	1-20	0	2	standing water
Area 1	10/3/2003	1-40	0	3	standing water
Area 1	10/3/2003	1-60	0	5	pool
Area 1	10/3/2003	1-80	-	-	dry
Area 1	10/3/2003	1-100	-	-	dry
Area 1	10/3/2003	1-120	-	-	dry
Area 1	10/3/2003	2-120	0	3	standing water
Area 1	10/3/2003	2-100	-	-	dry
Area 1	10/3/2003	2-80	0	4	standing water
Area 1	10/3/2003	2-60	0	2	standing water

Area 1	10/3/2003	2-40	-	-	dry
Area 1	10/3/2003	2-20	-	-	dry
Area 1	10/3/2003	2-00	-	-	dry
Area 1	10/3/2003	3-00	0	3	standing water
Area 1	10/3/2003	3-20	-	-	dry
Area 1	10/3/2003	3-40	0	4	standing water
Area 1	10/3/2003	3-60	-	-	dry
Area 1	10/3/2003	3-80	0	2	standing water
Area 1	10/3/2003	3-100	0	4	standing water
Area 1	10/3/2003	3-120	0	3	standing water
Area 1	10/3/2003	3-140	-	-	dry
Area 1	10/3/2003	3-160	0	3	standing water
Area 1	10/3/2003	3-180	0	4	standing water
Area 1	10/3/2003	3-200	-	-	dry
Area 1	10/3/2003	4-240	-	-	dry
Area 1	10/3/2003	4-220	1	2	standing water
Area 1	10/3/2003	4-200	0	3	standing water
Area 1	10/3/2003	4-180	-	-	dry
Area 1	10/3/2003	4-160	-	-	dry
Area 1	10/3/2003	4-140	0	3	standing water
Area 1	10/3/2003	4-120	-	-	dry
Area 1	10/3/2003	4-100	-	-	dry
Area 1	10/3/2003	4-80	0	4	standing water
Area 1	10/3/2003	4-60	0	3	standing water
Area 1	10/3/2003	4-40	0	2	standing water
Area 1	10/3/2003	4-20	0	2	standing water
Area 1	10/3/2003	4-00	0	3	standing water
Area 1	10/3/2003	5-00	-	-	dry
Area 1	10/3/2003	5-20	0	3	standing water
Area 1	10/3/2003	5-40	0	4	standing water
Area 1	10/3/2003	5-60	0	3	standing water
Area 1	10/3/2003	5-80	0	2	standing water
Area 1	10/9/2003	1-00	0	2	standing water
Area 1	10/9/2003	1-20	0	2	standing water
Area 1	10/9/2003	1-40	0	5	pool
Area 1	10/9/2003	1-60	0	5	ditch
Area 1	10/9/2003	1-80	-	-	dry
Area 1	10/9/2003	1-100	2	3	standing water
Area 1	10/9/2003	1-120	0	4	standing water
Area 1	10/9/2003	2-120	0	4	standing water
Area 1	10/9/2003	2-100	0	5	standing water
Area 1	10/9/2003	2-80	0	3	standing water
Area 1	10/9/2003	2-60	0	4	standing water
Area 1	10/9/2003	2-40	0	2	standing water
Area 1	10/9/2003	2-20	0	3	standing water
Area 1	10/9/2003	2-00	0	4	standing water
Area 1	10/9/2003	3-00	0	3	standing water
Area 1	10/9/2003	3-20	-	-	dry

Area 1	10/9/2003	3-40	0	3	standing water
Area 1	10/9/2003	3-60	-	-	dry
Area 1	10/9/2003	3-80	0	3	standing water
Area 1	10/9/2003	3-100	0	2	standing water
Area 1	10/9/2003	3-120	0	2	standing water
Area 1	10/9/2003	3-140	-	-	dry
Area 1	10/9/2003	3-160	0	1	standing water
Area 1	10/9/2003	3-180	0	2	standing water
Area 1	10/9/2003	3-200	-	-	dry
Area 1	10/9/2003	4-240	0	4	standing water
Area 1	10/9/2003	4-220	0	3	standing water
Area 1	10/9/2003	4-200	0	3	standing water
Area 1	10/9/2003	4-180	-	-	dry
Area 1	10/9/2003	4-160	-	-	dry
Area 1	10/9/2003	4-140	0	3	standing water
Area 1	10/9/2003	4-120	-	-	dry
Area 1	10/9/2003	4-100	2	4	standing water
Area 1	10/9/2003	4-80	0	3	standing water
Area 1	10/9/2003	4-60	0	2	standing water
Area 1	10/9/2003	4-40	0	3	standing water
Area 1	10/9/2003	4-20	0	3	standing water
Area 1	10/9/2003	4-00	0	1	standing water
Area 1	10/9/2003	5-00	-	-	dry
Area 1	10/9/2003	5-20	0	2	standing water
Area 1	10/9/2003	5-40	1	2	standing water
Area 1	10/9/2003	5-60	0	4	standing water
Area 1	10/9/2003	5-80	0	3	standing water
Area 1	10/17/2003	1-00	-	-	dry
Area 1	10/17/2003	1-20	-	-	dry
Area 1	10/17/2003	1-40	0	4	panne
Area 1	10/17/2003	1-60	0	5	ditch
Area 1	10/17/2003	1-80	-	-	dry
Area 1	10/17/2003	1-100	-	-	dry
Area 1	10/17/2003	1-120	-	-	dry
Area 1	10/17/2003	2-120	0	4	standing water
Area 1	10/17/2003	2-100	0	2	standing water
Area 1	10/17/2003	2-80	0	1	standing water
Area 1	10/17/2003	2-60	0	1	standing water
Area 1	10/17/2003	2-40	0	1	standing water
Area 1	10/17/2003	2-20	-	-	dry
Area 1	10/17/2003	2-00	-	-	dry
Area 1	10/17/2003	3-00	0	3	standing water
Area 1	10/17/2003	3-20	0	3	standing water
Area 1	10/17/2003	3-40	0	4	standing water
Area 1	10/17/2003	3-60	0	2	standing water
Area 1	10/17/2003	3-80	0	5	standing water
Area 1	10/17/2003	3-100	0	3	standing water
Area 1	10/17/2003	3-120	0	2	standing water

Area 1	10/17/2003	3-140	-	-	dry
Area 1	10/17/2003	3-160	-	-	dry
Area 1	10/17/2003	3-180	0	1	standing water
Area 1	10/17/2003	3-200	-	-	dry
Area 1	10/17/2003	4-240	-	-	dry
Area 1	10/17/2003	4-220	-	-	dry
Area 1	10/17/2003	4-200	-	-	dry
Area 1	10/17/2003	4-180	-	-	dry
Area 1	10/17/2003	4-160	-	-	dry
Area 1	10/17/2003	4-140	0	2	standing water
Area 1	10/17/2003	4-120	-	-	dry
Area 1	10/17/2003	4-100	0	1	standing water
Area 1	10/17/2003	4-80	0	2	standing water
Area 1	10/17/2003	4-60	0	4	panne
Area 1	10/17/2003	4-40	0	4	standing water
Area 1	10/17/2003	4-20	0	4	standing water
Area 1	10/17/2003	4-00	0	3	standing water
Area 1	10/17/2003	5-00	-	-	dry
Area 1	10/17/2003	5-20	-	-	dry
Area 1	10/17/2003	5-40	0	2	standing water
Area 1	10/17/2003	5-60	0	3	standing water
Area 1	10/17/2003	5-80	0	2	standing water

**AREA 2**

Area	Date	Station #	Total # of Larvae	Dipper Volume (fifths)	Area Dipped
Area 2	9/3/2003	1-00	-	-	dry
Area 2	9/3/2003	1-20	-	-	dry
Area 2	9/3/2003	1-40	-	-	dry
Area 2	9/3/2003	1-60	0	5	plugged ditch
Area 2	9/3/2003	1-80	-	-	dry
Area 2	9/3/2003	1-100	0	1	standing water
Area 2	9/3/2003	1-120	0	1	standing water
Area 2	9/3/2003	1-140	30	4	standing water
Area 2	9/3/2003	1-160	-	-	dry
Area 2	9/3/2003	2-200	-	-	dry
Area 2	9/3/2003	2-180	0	1	standing water
Area 2	9/3/2003	2-160	-	-	dry
Area 2	9/3/2003	2-140	0	1	standing water
Area 2	9/3/2003	2-120	0	3	standing water
Area 2	9/3/2003	2-100	0	1	standing water
Area 2	9/3/2003	2-80	0	5	standing water
Area 2	9/3/2003	2-60	10	3	standing water
Area 2	9/3/2003	2-40	1	5	standing water
Area 2	9/3/2003	2-20	-	-	dry
Area 2	9/3/2003	2-00	10	3	standing water
Area 2	9/3/2003	3-00	0	5	plugged ditch
Area 2	9/3/2003	3-20	0	2	standing water
Area 2	9/3/2003	3-40	0	5	standing water
Area 2	9/3/2003	3-60	0	1	standing water
Area 2	9/3/2003	3-80	0	5	plugged ditch
Area 2	9/3/2003	3-100	0	2	standing water
Area 2	9/3/2003	3-120	-	-	dry
Area 2	9/3/2003	3-140	-	-	dry
Area 2	9/3/2003	3-160	-	-	dry
Area 2	9/3/2003	3-180	-	-	dry
Area 2	9/3/2003	4-120	-	-	dry
Area 2	9/3/2003	4-100	0	1	standing water
Area 2	9/3/2003	4-80	-	-	dry
Area 2	9/3/2003	4-60	-	-	dry
Area 2	9/3/2003	4-40	-	-	dry
Area 2	9/3/2003	4-20	-	-	dry
Area 2	9/3/2003	4-00	-	-	dry
Area 2	9/3/2003	5-00	-	-	dry
Area 2	9/3/2003	5-20	-	-	dry
Area 2	9/3/2003	5-40	-	-	dry
Area 2	9/3/2003	5-60	-	-	dry
Area 2	9/3/2003	5-80	-	-	dry
Area 2	9/16/2003	1-00	-	-	dry
Area 2	9/16/2003	1-20	-	-	dry
Area 2	9/16/2003	1-40	-	-	dry
Area 2	9/16/2003	1-60	0	5	plugged ditch

Area 2	9/16/2003	1-80	0	5	plugged ditch
Area 2	9/16/2003	1-100	-	-	dry
Area 2	9/16/2003	1-120	-	-	dry
Area 2	9/16/2003	1-140	-	-	dry
Area 2	9/16/2003	1-160	-	-	dry
Area 2	9/16/2003	2-200	-	-	dry
Area 2	9/16/2003	2-180	-	-	dry
Area 2	9/16/2003	2-160	-	-	dry
Area 2	9/16/2003	2-140	0	5	plugged ditch
Area 2	9/16/2003	2-120	0	1	standing water
Area 2	9/16/2003	2-100	-	-	dry
Area 2	9/16/2003	2-80	0	1	standing water
Area 2	9/16/2003	2-60	-	-	dry
Area 2	9/16/2003	2-40	12	1	standing water
Area 2	9/16/2003	2-20	9	3	standing water
Area 2	9/16/2003	2-00	3	2	standing water
Area 2	9/16/2003	3-00	0	5	tidal creek
Area 2	9/16/2003	3-20	11	2	standing water
Area 2	9/16/2003	3-40	8	3	standing water
Area 2	9/16/2003	3-60	-	-	dry
Area 2	9/16/2003	3-80	0	5	plugged ditch
Area 2	9/16/2003	3-100	-	-	dry
Area 2	9/16/2003	3-120	-	-	dry
Area 2	9/16/2003	3-140	-	-	dry
Area 2	9/16/2003	3-160	0	5	plugged ditch
Area 2	9/16/2003	3-180	-	-	dry
Area 2	9/16/2003	4-120	-	-	dry
Area 2	9/16/2003	4-100	-	-	dry
Area 2	9/16/2003	4-80	-	-	dry
Area 2	9/16/2003	4-60	0	5	plugged ditch
Area 2	9/16/2003	4-40	-	-	dry
Area 2	9/16/2003	4-20	-	-	dry
Area 2	9/16/2003	4-00	-	-	dry
Area 2	9/16/2003	5-00	-	-	dry
Area 2	9/16/2003	5-20	-	-	dry
Area 2	9/16/2003	5-40	-	-	dry
Area 2	9/16/2003	5-60	0	5	plugged ditch
Area 2	9/16/2003	5-80	-	-	dry
Area 2	9/26/2003	1-00	0	3	standing water
Area 2	9/26/2003	1-20	0	2	standing water
Area 2	9/26/2003	1-40	0	3	standing water
Area 2	9/26/2003	1-60	0	4	standing water
Area 2	9/26/2003	1-80	0	5	pool
Area 2	9/26/2003	1-100	0	4	standing water
Area 2	9/26/2003	1-120	0	2	standing water
Area 2	9/26/2003	1-140	0	3	standing water
Area 2	9/26/2003	1-160	0	2	standing water
Area 2	9/26/2003	2-200	0	3	standing water



Area 2	9/26/2003	2-180	0	5	standing water
Area 2	9/26/2003	2-160	0	5	standing water
Area 2	9/26/2003	2-140	-	-	dry
Area 2	9/26/2003	2-120	0	4	standing water
Area 2	9/26/2003	2-100	0	3	standing water
Area 2	9/26/2003	2-80	0	1	standing water
Area 2	9/26/2003	2-60	0	2	standing water
Area 2	9/26/2003	2-40	0	2	standing water
Area 2	9/26/2003	2-20	0	2	standing water
Area 2	9/26/2003	2-00	0	3	standing water
Area 2	9/26/2003	3-00	0	4	standing water
Area 2	9/26/2003	3-20	0	1	standing water
Area 2	9/26/2003	3-40	0	5	pool
Area 2	9/26/2003	3-60	0	2	standing water
Area 2	9/26/2003	3-80	0	3	standing water
Area 2	9/26/2003	3-100	0	2	standing water
Area 2	9/26/2003	3-120	0	3	standing water
Area 2	9/26/2003	3-140	0	3	standing water
Area 2	9/26/2003	3-160	0	2	standing water
Area 2	9/26/2003	3-180	0	3	standing water
Area 2	9/26/2003	4-120	0	2	standing water
Area 2	9/26/2003	4-100	0	3	standing water
Area 2	9/26/2003	4-80	0	3	standing water
Area 2	9/26/2003	4-60	0	4	standing water
Area 2	9/26/2003	4-40	0	2	standing water
Area 2	9/26/2003	4-20	0	1	standing water
Area 2	9/26/2003	4-00	0	3	standing water
Area 2	9/26/2003	5-00	0	2	standing water
Area 2	9/26/2003	5-20	0	2	standing water
Area 2	9/26/2003	5-40	0	3	standing water
Area 2	9/26/2003	5-60	0	4	standing water
Area 2	9/26/2003	5-80	0	5	pool
Area 2	10/3/2003	1-00	0	3	standing water
Area 2	10/3/2003	1-20	0	2	standing water
Area 2	10/3/2003	1-40	0	3	standing water
Area 2	10/3/2003	1-60	0	2	standing water
Area 2	10/3/2003	1-80	0	5	pool
Area 2	10/3/2003	1-100	0	4	standing water
Area 2	10/3/2003	1-120	0	2	standing water
Area 2	10/3/2003	1-140	0	3	standing water
Area 2	10/3/2003	1-160	0	4	standing water
Area 2	10/3/2003	2-200	0	3	standing water
Area 2	10/3/2003	2-180	0	5	standing water
Area 2	10/3/2003	2-160	0	3	standing water
Area 2	10/3/2003	2-140	-	-	dry
Area 2	10/3/2003	2-120	0	4	standing water
Area 2	10/3/2003	2-100	0	2	standing water
Area 2	10/3/2003	2-80	0	1	standing water

Area 2	10/3/2003	2-60	0	2	standing water
Area 2	10/3/2003	2-40	0	2	standing water
Area 2	10/3/2003	2-20	0	2	standing water
Area 2	10/3/2003	2-00	0	3	standing water
Area 2	10/3/2003	3-00	0	4	standing water
Area 2	10/3/2003	3-20	0	1	standing water
Area 2	10/3/2003	3-40	0	5	pool
Area 2	10/3/2003	3-60	0	2	standing water
Area 2	10/3/2003	3-80	0	3	standing water
Area 2	10/3/2003	3-100	0	2	standing water
Area 2	10/3/2003	3-120	0	3	standing water
Area 2	10/3/2003	3-140	0	4	standing water
Area 2	10/3/2003	3-160	0	2	standing water
Area 2	10/3/2003	3-180	0	3	standing water
Area 2	10/3/2003	4-120	0	1	standing water
Area 2	10/3/2003	4-100	0	3	standing water
Area 2	10/3/2003	4-80	0	3	standing water
Area 2	10/3/2003	4-60	0	2	standing water
Area 2	10/3/2003	4-40	0	2	standing water
Area 2	10/3/2003	4-20	0	1	standing water
Area 2	10/3/2003	4-00	0	4	standing water
Area 2	10/3/2003	5-00	0	2	standing water
Area 2	10/3/2003	5-20	0	2	standing water
Area 2	10/3/2003	5-40	0	2	standing water
Area 2	10/3/2003	5-60	0	4	standing water
Area 2	10/3/2003	5-80	0	5	pool
Area 2	10/9/2003	1-00	0	2	standing water
Area 2	10/9/2003	1-20	0	2	standing water
Area 2	10/9/2003	1-40	0	3	standing water
Area 2	10/9/2003	1-60	0	3	standing water
Area 2	10/9/2003	1-80	0	5	pool
Area 2	10/9/2003	1-100	0	4	standing water
Area 2	10/9/2003	1-120	0	3	standing water
Area 2	10/9/2003	1-140	0	3	standing water
Area 2	10/9/2003	1-160	0	2	standing water
Area 2	10/9/2003	2-200	0	3	standing water
Area 2	10/9/2003	2-180	0	5	standing water
Area 2	10/9/2003	2-160	0	3	standing water
Area 2	10/9/2003	2-140	-	-	dry
Area 2	10/9/2003	2-120	-	-	dry
Area 2	10/9/2003	2-100	0	3	standing water
Area 2	10/9/2003	2-80	0	1	standing water
Area 2	10/9/2003	2-60	0	2	standing water
Area 2	10/9/2003	2-40	0	2	standing water
Area 2	10/9/2003	2-20	0	4	standing water
Area 2	10/9/2003	2-00	0	3	standing water
Area 2	10/9/2003	3-00	0	4	standing water
Area 2	10/9/2003	3-20	0	2	standing water

Area 2	10/9/2003	3-40	0	5	pool
Area 2	10/9/2003	3-60	0	2	standing water
Area 2	10/9/2003	3-80	0	3	standing water
Area 2	10/9/2003	3-100	0	2	standing water
Area 2	10/9/2003	3-120	0	3	standing water
Area 2	10/9/2003	3-140	0	3	standing water
Area 2	10/9/2003	3-160	0	2	standing water
Area 2	10/9/2003	3-180	0	3	standing water
Area 2	10/9/2003	4-120	0	2	standing water
Area 2	10/9/2003	4-100	0	3	standing water
Area 2	10/9/2003	4-80	0	3	standing water
Area 2	10/9/2003	4-60	0	4	standing water
Area 2	10/9/2003	4-40	0	3	standing water
Area 2	10/9/2003	4-20	0	1	standing water
Area 2	10/9/2003	4-00	0	3	standing water
Area 2	10/9/2003	5-00	0	3	standing water
Area 2	10/9/2003	5-20	0	3	standing water
Area 2	10/9/2003	5-40	0	3	standing water
Area 2	10/9/2003	5-60	0	3	standing water
Area 2	10/9/2003	5-80	0	5	pool
Area 2	10/16/2003	1-00	0	3	standing water
Area 2	10/16/2003	1-20	0	3	standing water
Area 2	10/16/2003	1-40	0	3	standing water
Area 2	10/16/2003	1-60	0	4	standing water
Area 2	10/16/2003	1-80	0	5	pool
Area 2	10/16/2003	1-100	0	4	standing water
Area 2	10/16/2003	1-120	0	2	standing water
Area 2	10/16/2003	1-140	0	3	standing water
Area 2	10/16/2003	1-160	0	2	standing water
Area 2	10/16/2003	2-200	0	3	standing water
Area 2	10/16/2003	2-180	0	2	standing water
Area 2	10/16/2003	2-160	0	5	standing water
Area 2	10/16/2003	2-140	-	-	dry
Area 2	10/16/2003	2-120	0	4	standing water
Area 2	10/16/2003	2-100	-	-	dry
Area 2	10/16/2003	2-80	0	1	standing water
Area 2	10/16/2003	2-60	0	2	standing water
Area 2	10/16/2003	2-40	0	2	standing water
Area 2	10/16/2003	2-20	0	2	standing water
Area 2	10/16/2003	2-00	0	3	standing water
Area 2	10/16/2003	3-00	0	4	standing water
Area 2	10/16/2003	3-20	0	1	standing water
Area 2	10/16/2003	3-40	0	5	pool
Area 2	10/16/2003	3-60	0	2	standing water
Area 2	10/16/2003	3-80	0	3	standing water
Area 2	10/16/2003	3-100	0	2	standing water
Area 2	10/16/2003	3-120	0	3	standing water
Area 2	10/16/2003	3-140	0	3	standing water

Area 2	10/16/2003	3-160	0	2	standing water
Area 2	10/16/2003	3-180	0	3	standing water
Area 2	10/16/2003	4-120	0	2	standing water
Area 2	10/16/2003	4-100	0	3	standing water
Area 2	10/16/2003	4-80	0	3	standing water
Area 2	10/16/2003	4-60	0	4	standing water
Area 2	10/16/2003	4-40	0	2	standing water
Area 2	10/16/2003	4-20	0	1	standing water
Area 2	10/16/2003	4-00	0	3	standing water
Area 2	10/16/2003	5-00	0	2	standing water
Area 2	10/16/2003	5-20	0	2	standing water
Area 2	10/16/2003	5-40	0	3	standing water
Area 2	10/16/2003	5-60	0	2	standing water
Area 2	10/16/2003	5-80	0	5	pool

**AREA 3**

Area	Date	Station #	Total # of Larvae	Dipper Volume (fifths)	Area Dipped
Area 3	9/3/2003	4-00	-	-	dry
Area 3	9/3/2003	4-20	-	-	dry
Area 3	9/3/2003	4-40	-	-	dry
Area 3	9/3/2003	4-60	-	-	dry
Area 3	9/3/2003	4-80	-	-	dry
Area 3	9/3/2003	4-100	-	-	dry
Area 3	9/3/2003	4-120	-	-	dry
Area 3	9/3/2003	3-120	-	-	dry
Area 3	9/3/2003	3-100	-	-	dry
Area 3	9/3/2003	3-80	-	-	dry
Area 3	9/3/2003	3-60	-	-	dry
Area 3	9/3/2003	3-40	-	-	dry
Area 3	9/3/2003	3-20	-	-	dry
Area 3	9/3/2003	3-00	-	-	dry
Area 3	9/3/2003	2-00	0	5	plugged ditch
Area 3	9/3/2003	2-20	-	-	dry
Area 3	9/3/2003	2-40	0	3	standing water
Area 3	9/3/2003	2-60	-	-	dry
Area 3	9/3/2003	2-80	0	1	pool
Area 3	9/3/2003	2-100	0	0	ditch
Area 3	9/3/2003	2-120	0	4	ditch
Area 3	9/3/2003	2-140	-	-	dry
Area 3	9/3/2003	2-160	-	-	dry
Area 3	9/3/2003	2-180	25	5	standing water
Area 3	9/3/2003	2-200	-	-	dry
Area 3	9/3/2003	1-200	0	1	standing water
Area 3	9/3/2003	1-180	0	1	standing water
Area 3	9/3/2003	1-160	0	1	standing water
Area 3	9/3/2003	1-140	0	1	standing water
Area 3	9/3/2003	1-120	0	2	standing water
Area 3	9/3/2003	1-100	-	-	dry
Area 3	9/3/2003	1-80	0	5	plugged ditch
Area 3	9/3/2003	1-60	-	-	dry
Area 3	9/3/2003	1-40	0	2	standing water
Area 3	9/3/2003	1-20	30	5	standing water
Area 3	9/3/2003	1-00	-	-	dry
Area 3	9/15/2003	4-00	-	-	dry
Area 3	9/15/2003	4-20	0	5	tidal creek
Area 3	9/15/2003	4-40	-	-	dry
Area 3	9/15/2003	4-60	0	5	tidal creek
Area 3	9/15/2003	4-80	-	-	dry
Area 3	9/15/2003	4-100	-	-	dry
Area 3	9/15/2003	4-120	-	-	dry
Area 3	9/15/2003	3-120	-	-	dry
Area 3	9/15/2003	3-100	-	-	dry
Area 3	9/15/2003	3-80	-	-	dry

Area 3	9/15/2003	3-60	-	-	dry
Area 3	9/15/2003	3-40	-	-	dry
Area 3	9/15/2003	3-20	-	-	dry
Area 3	9/15/2003	3-00	-	-	dry
Area 3	9/15/2003	2-00	0	5	plugged ditch
Area 3	9/15/2003	2-20	-	-	dry
Area 3	9/15/2003	2-40	-	-	dry
Area 3	9/15/2003	2-60	-	-	dry
Area 3	9/15/2003	2-80	0	5	panne
Area 3	9/15/2003	2-100	-	-	dry
Area 3	9/15/2003	2-120	0	5	plugged ditch
Area 3	9/15/2003	2-140	-	-	dry
Area 3	9/15/2003	2-160	-	-	dry
Area 3	9/15/2003	2-180	-	-	dry
Area 3	9/15/2003	2-200	-	-	dry
Area 3	9/15/2003	1-200	-	-	dry
Area 3	9/15/2003	1-180	-	-	dry
Area 3	9/15/2003	1-160	-	-	dry
Area 3	9/15/2003	1-140	-	-	dry
Area 3	9/15/2003	1-120	-	-	dry
Area 3	9/15/2003	1-100	-	-	dry
Area 3	9/15/2003	1-80	0	5	plugged ditch
Area 3	9/15/2003	1-60	-	-	dry
Area 3	9/15/2003	1-40	-	-	dry
Area 3	9/15/2003	1-20	4	2	standing water
Area 3	9/15/2003	1-00	-	-	dry
Area 3	9/26/2003	4-00	0	3	standing water
Area 3	9/26/2003	4-20	0	2	standing water
Area 3	9/26/2003	4-40	0	3	standing water
Area 3	9/26/2003	4-60	0	4	standing water
Area 3	9/26/2003	4-80	0	5	pool
Area 3	9/26/2003	4-100	0	4	standing water
Area 3	9/26/2003	4-120	0	4	standing water
Area 3	9/26/2003	3-120	0	3	standing water
Area 3	9/26/2003	3-100	0	3	standing water
Area 3	9/26/2003	3-80	0	5	pool
Area 3	9/26/2003	3-60	-	-	dry
Area 3	9/26/2003	3-40	0	4	standing water
Area 3	9/26/2003	3-20	0	3	standing water
Area 3	9/26/2003	3-00	0	5	pool
Area 3	9/26/2003	2-00	-	-	dry
Area 3	9/26/2003	2-20	-	-	dry
Area 3	9/26/2003	2-40	0	1	standing water
Area 3	9/26/2003	2-60	0	1	standing water
Area 3	9/26/2003	2-80	-	-	dry
Area 3	9/26/2003	2-100	0	2	standing water
Area 3	9/26/2003	2-120	-	-	dry
Area 3	9/26/2003	2-140	-	-	dry

Area 3	9/26/2003	2-160	0	5	standing water
Area 3	9/26/2003	2-180	0	5	standing water
Area 3	9/26/2003	2-200	0	3	standing water
Area 3	9/26/2003	1-200	0	3	standing water
Area 3	9/26/2003	1-180	0	2	standing water
Area 3	9/26/2003	1-160	0	2	standing water
Area 3	9/26/2003	1-140	0	3	standing water
Area 3	9/26/2003	1-120	-	-	dry
Area 3	9/26/2003	1-100	-	-	dry
Area 3	9/26/2003	1-80	0	3	standing water
Area 3	9/26/2003	1-60	0	3	standing water
Area 3	9/26/2003	1-40	0	2	standing water
Area 3	9/26/2003	1-20	0	3	standing water
Area 3	9/26/2003	1-00	0	4	standing water
Area 3	10/3/2003	4-00	0	4	standing water
Area 3	10/3/2003	4-20	0	3	standing water
Area 3	10/3/2003	4-40	0	2	standing water
Area 3	10/3/2003	4-60	0	3	standing water
Area 3	10/3/2003	4-80	0	3	standing water
Area 3	10/3/2003	4-100	-	-	dry
Area 3	10/3/2003	4-120	-	-	dry
Area 3	10/3/2003	3-120	-	-	dry
Area 3	10/3/2003	3-100	0	2	standing water
Area 3	10/3/2003	3-80	-	-	dry
Area 3	10/3/2003	3-60	0	1	standing water
Area 3	10/3/2003	3-40	0	1	standing water
Area 3	10/3/2003	3-20	-	-	dry
Area 3	10/3/2003	3-00	-	-	dry
Area 3	10/3/2003	2-00	0	5	pool
Area 3	10/3/2003	2-20	0	3	standing water
Area 3	10/3/2003	2-40	0	4	standing water
Area 3	10/3/2003	2-60	-	-	dry
Area 3	10/3/2003	2-80	0	5	pool
Area 3	10/3/2003	2-100	0	3	standing water
Area 3	10/3/2003	2-120	0	3	standing water
Area 3	10/3/2003	2-140	-	-	dry
Area 3	10/3/2003	2-160	0	5	standing water
Area 3	10/3/2003	2-180	0	5	standing water
Area 3	10/3/2003	2-200	0	3	standing water
Area 3	10/3/2003	1-200	0	3	standing water
Area 3	10/3/2003	1-180	0	2	standing water
Area 3	10/3/2003	1-160	0	2	standing water
Area 3	10/3/2003	1-140	0	3	standing water
Area 3	10/3/2003	1-120	-	-	dry
Area 3	10/3/2003	1-100	-	-	dry
Area 3	10/3/2003	1-80	0	3	standing water
Area 3	10/3/2003	1-60	0	3	standing water
Area 3	10/3/2003	1-40	0	2	standing water

Area 3	10/3/2003	1-20	0	3	standing water
Area 3	10/3/2003	1-00	0	4	standing water
Area 3	10/9/2003	4-00	0	4	standing water
Area 3	10/9/2003	4-20	0	3	standing water
Area 3	10/9/2003	4-40	0	2	standing water
Area 3	10/9/2003	4-60	0	3	standing water
Area 3	10/9/2003	4-80	0	3	standing water
Area 3	10/9/2003	4-100	-	-	dry
Area 3	10/9/2003	4-120	-	-	dry
Area 3	10/9/2003	3-120	-	-	dry
Area 3	10/9/2003	3-100	0	2	standing water
Area 3	10/9/2003	3-80	-	-	dry
Area 3	10/9/2003	3-60	0	1	standing water
Area 3	10/9/2003	3-40	0	1	standing water
Area 3	10/9/2003	3-20	-	-	dry
Area 3	10/9/2003	3-00	-	-	dry
Area 3	10/9/2003	2-00	0	5	pool
Area 3	10/9/2003	2-20	0	3	standing water
Area 3	10/9/2003	2-40	0	4	standing water
Area 3	10/9/2003	2-60	-	-	dry
Area 3	10/9/2003	2-80	0	5	pool
Area 3	10/9/2003	2-100	0	3	standing water
Area 3	10/9/2003	2-120	0	3	standing water
Area 3	10/9/2003	2-140	-	-	dry
Area 3	10/9/2003	2-160	0	5	standing water
Area 3	10/9/2003	2-180	0	5	standing water
Area 3	10/9/2003	2-200	0	3	standing water
Area 3	10/9/2003	1-200	0	3	standing water
Area 3	10/9/2003	1-180	0	2	standing water
Area 3	10/9/2003	1-160	0	2	standing water
Area 3	10/9/2003	1-140	0	3	standing water
Area 3	10/9/2003	1-120	-	-	dry
Area 3	10/9/2003	1-100	-	-	dry
Area 3	10/9/2003	1-80	0	3	standing water
Area 3	10/9/2003	1-60	0	3	standing water
Area 3	10/9/2003	1-40	0	2	standing water
Area 3	10/9/2003	1-20	0	3	standing water
Area 3	10/9/2003	1-00	0	4	standing water
Area 3	10/16/2003	4-00	0	4	standing water
Area 3	10/16/2003	4-20	0	3	standing water
Area 3	10/16/2003	4-40	0	2	standing water
Area 3	10/16/2003	4-60	0	3	standing water
Area 3	10/16/2003	4-80	0	3	standing water
Area 3	10/16/2003	4-100	-	-	dry
Area 3	10/16/2003	4-120	-	-	dry
Area 3	10/16/2003	3-120	-	-	dry
Area 3	10/16/2003	3-100	0	2	standing water
Area 3	10/16/2003	3-80	-	-	dry



Area 3	10/16/2003	3-60	0	1	standing water
Area 3	10/16/2003	3-40	0	1	standing water
Area 3	10/16/2003	3-20	-	-	dry
Area 3	10/16/2003	3-00	-	-	dry
Area 3	10/16/2003	2-00	0	5	pool
Area 3	10/16/2003	2-20	0	3	standing water
Area 3	10/16/2003	2-40	0	4	standing water
Area 3	10/16/2003	2-60	-	-	dry
Area 3	10/16/2003	2-80	0	5	pool
Area 3	10/16/2003	2-100	0	3	standing water
Area 3	10/16/2003	2-120	0	3	standing water
Area 3	10/16/2003	2-140	-	-	dry
Area 3	10/16/2003	2-160	0	5	standing water
Area 3	10/16/2003	2-180	0	5	standing water
Area 3	10/16/2003	2-200	0	3	standing water
Area 3	10/16/2003	1-200	0	3	standing water
Area 3	10/16/2003	1-180	0	2	standing water
Area 3	10/16/2003	1-160	0	2	standing water
Area 3	10/16/2003	1-140	0	3	standing water
Area 3	10/16/2003	1-120	-	-	dry
Area 3	10/16/2003	1-100	-	-	dry
Area 3	10/16/2003	1-80	0	3	standing water
Area 3	10/16/2003	1-60	0	3	standing water
Area 3	10/16/2003	1-40	0	2	standing water
Area 3	10/16/2003	1-20	0	3	standing water
Area 3	10/16/2003	1-00	0	4	standing water

**AREA 4**

Area	Date	Station #	Total # of Larvae	Dipper Volume (fifths)	Area Dipped
Area 4	9/3/2003	1-00	-	-	dry
Area 4	9/3/2003	1-20	-	-	dry
Area 4	9/3/2003	1-40	30	4	standing water
Area 4	9/3/2003	1-60	10	4	standing water
Area 4	9/3/2003	1-80	-	2	standing water
Area 4	9/3/2003	1-100	-	-	dry
Area 4	9/3/2003	1-120	-	5	plugged ditch
Area 4	9/3/2003	1-140	-	-	dry
Area 4	9/3/2003	1-160	-	1	standing water
Area 4	9/3/2003	2-160	5	2	standing water
Area 4	9/3/2003	2-140	-	3	ditch
Area 4	9/3/2003	2-120	-	1	standing water
Area 4	9/3/2003	2-100	-	1	ditch
Area 4	9/3/2003	2-80	-	-	ditch
Area 4	9/3/2003	2-60	1	2	standing water
Area 4	9/3/2003	2-40	-	-	dry
Area 4	9/3/2003	2-20	-	-	dry
Area 4	9/3/2003	2-00	-	-	dry
Area 4	9/3/2003	3-00	0	2	standing water
Area 4	9/3/2003	3-20	0	5	ditch
Area 4	9/3/2003	3-40	0	2	standing water
Area 4	9/3/2003	3-60	-	-	dry
Area 4	9/3/2003	3-80	0	3	standing water
Area 4	9/3/2003	3-100	7	2	standing water
Area 4	9/3/2003	3-120	0	4	ditch
Area 4	9/3/2003	3-140	0	1	standing water
Area 4	9/3/2003	3-160	0	4	panne
Area 4	9/3/2003	4-160	-	-	dry
Area 4	9/3/2003	4-140	0	5	ditch
Area 4	9/3/2003	4-120	0	1	standing water
Area 4	9/3/2003	4-100	0	5	ditch
Area 4	9/3/2003	4-80	0	2	standing water
Area 4	9/3/2003	4-60	15	2	standing water
Area 4	9/3/2003	4-40	-	-	dry
Area 4	9/3/2003	4-20	-	-	dry
Area 4	9/3/2003	4-00	0	1	standing water
Area 4	9/15/2003	1-00	0	0	dry
Area 4	9/15/2003	1-20	0	5	plugged ditch
Area 4	9/15/2003	1-40	-	-	dry
Area 4	9/15/2003	1-60	-	-	dry
Area 4	9/15/2003	1-80	-	-	dry
Area 4	9/15/2003	1-100	0	5	plugged ditch
Area 4	9/15/2003	1-120	0	5	plugged ditch
Area 4	9/15/2003	1-140	-	-	dry
Area 4	9/15/2003	1-160	0	3	standing water
Area 4	9/15/2003	2-160	-	-	dry

Area 4	9/15/2003	2-140	-	-	dry
Area 4	9/15/2003	2-120	-	-	dry
Area 4	9/15/2003	2-100	-	-	dry
Area 4	9/15/2003	2-80	-	-	dry
Area 4	9/15/2003	2-60	-	-	dry
Area 4	9/15/2003	2-40	0	2	plugged ditch
Area 4	9/15/2003	2-20	-	-	dry
Area 4	9/15/2003	2-00	0	4	standing water
Area 4	9/15/2003	3-00	-	-	dry
Area 4	9/15/2003	3-20	0	3	plugged ditch
Area 4	9/15/2003	3-40	-	-	dry
Area 4	9/15/2003	3-60	0	4	standing water
Area 4	9/15/2003	3-80	0	3	standing water
Area 4	9/15/2003	3-100	-	-	dry
Area 4	9/15/2003	3-120	0	3	standing water
Area 4	9/15/2003	3-140	-	-	dry
Area 4	9/15/2003	3-160	-	-	dry
Area 4	9/15/2003	4-160	0	2	standing water
Area 4	9/15/2003	4-140	0	0	dry
Area 4	9/15/2003	4-120	0	0	dry
Area 4	9/15/2003	4-100	0	5	plugged ditch
Area 4	9/15/2003	4-80	-	-	dry
Area 4	9/15/2003	4-60	-	-	dry
Area 4	9/15/2003	4-40	-	-	dry
Area 4	9/15/2003	4-20	0	1	standing water
Area 4	9/15/2003	4-00	-	-	dry
Area 4	9/26/2003	1-00	0	4	standing water
Area 4	9/26/2003	1-20	0	5	standing water
Area 4	9/26/2003	1-40	0	5	standing water
Area 4	9/26/2003	1-60	-	-	dry
Area 4	9/26/2003	1-80	0	5	standing water
Area 4	9/26/2003	1-100	0	3	standing water
Area 4	9/26/2003	1-120	0	5	standing water
Area 4	9/26/2003	1-140	0	5	standing water
Area 4	9/26/2003	1-160	0	5	pool
Area 4	9/26/2003	2-160	0	3	standing water
Area 4	9/26/2003	2-140	-	-	dry
Area 4	9/26/2003	2-120	0	3	standing water
Area 4	9/26/2003	2-100	0	5	pool
Area 4	9/26/2003	2-80	-	-	dry
Area 4	9/26/2003	2-60	0	4	standing water
Area 4	9/26/2003	2-40	0	5	standing water
Area 4	9/26/2003	2-20	0	3	standing water
Area 4	9/26/2003	2-00	0	5	standing water
Area 4	9/26/2003	3-00	0	3	standing water
Area 4	9/26/2003	3-20	0	5	pool
Area 4	9/26/2003	3-40	0	5	standing water
Area 4	9/26/2003	3-60	0	5	pool

Area 4	9/26/2003	3-80	0	3	standing water
Area 4	9/26/2003	3-100	0	3	standing water
Area 4	9/26/2003	3-120	0	5	pool
Area 4	9/26/2003	3-140	0	1	standing water
Area 4	9/26/2003	3-160	0	5	panne
Area 4	9/26/2003	4-160	0	5	pool
Area 4	9/26/2003	4-140	0	5	pool
Area 4	9/26/2003	4-120	0	1	standing water
Area 4	9/26/2003	4-100	0	5	pool
Area 4	9/26/2003	4-80	0	4	standing water
Area 4	9/26/2003	4-60	0	5	standing water
Area 4	9/26/2003	4-40	0	5	pool
Area 4	9/26/2003	4-20	0	5	pool
Area 4	9/26/2003	4-00	0	1	standing water
Area 4	10/3/2003	1-00	-	-	dry
Area 4	10/3/2003	1-20	0	5	ditch
Area 4	10/3/2003	1-40	0	3	standing water
Area 4	10/3/2003	1-60	0	2	standing water
Area 4	10/3/2003	1-80	-	-	dry
Area 4	10/3/2003	1-100	-	-	dry
Area 4	10/3/2003	1-120	-	-	dry
Area 4	10/3/2003	1-140	0	1	standing water
Area 4	10/3/2003	1-160	0	1	standing water
Area 4	10/3/2003	2-160	0	3	standing water
Area 4	10/3/2003	2-140	0	2	standing water
Area 4	10/3/2003	2-120	-	-	dry
Area 4	10/3/2003	2-100	-	-	dry
Area 4	10/3/2003	2-80	0	2	standing water
Area 4	10/3/2003	2-60	0	2	standing water
Area 4	10/3/2003	2-40	-	-	dry
Area 4	10/3/2003	2-20	-	-	dry
Area 4	10/3/2003	2-00	-	-	dry
Area 4	10/3/2003	3-00	0	2	standing water
Area 4	10/3/2003	3-20	0	3	standing water
Area 4	10/3/2003	3-40	0	4	standing water
Area 4	10/3/2003	3-60	0	5	pool
Area 4	10/3/2003	3-80	0	2	standing water
Area 4	10/3/2003	3-100	-	-	dry
Area 4	10/3/2003	3-120	0	5	ditch
Area 4	10/3/2003	3-140	0	3	standing water
Area 4	10/3/2003	3-160	0	2	panne
Area 4	10/3/2003	4-160	0	3	standing water
Area 4	10/3/2003	4-140	0	4	standing water
Area 4	10/3/2003	4-120	0	3	standing water
Area 4	10/3/2003	4-100	0	5	ditch
Area 4	10/3/2003	4-80	0	2	standing water
Area 4	10/3/2003	4-60	0	3	standing water
Area 4	10/3/2003	4-40	-	-	dry

Area 4	10/3/2003	4-20	-	-	dry
Area 4	10/3/2003	4-00	-	-	dry
Area 4	10/9/2003	1-00	-	-	dry
Area 4	10/9/2003	1-20	0	5	ditch
Area 4	10/9/2003	1-40	0	3	standing water
Area 4	10/9/2003	1-60	0	4	standing water
Area 4	10/9/2003	1-80	-	-	dry
Area 4	10/9/2003	1-100	-	-	dry
Area 4	10/9/2003	1-120	-	-	dry
Area 4	10/9/2003	1-140	-	-	dry
Area 4	10/9/2003	1-160	-	-	dry
Area 4	10/9/2003	2-160	0	3	standing water
Area 4	10/9/2003	2-140	0	2	standing water
Area 4	10/9/2003	2-120	-	-	dry
Area 4	10/9/2003	2-100	-	-	dry
Area 4	10/9/2003	2-80	-	-	dry
Area 4	10/9/2003	2-60	0	3	standing water
Area 4	10/9/2003	2-40	-	-	dry
Area 4	10/9/2003	2-20	-	-	dry
Area 4	10/9/2003	2-00	-	-	dry
Area 4	10/9/2003	3-00	0	2	standing water
Area 4	10/9/2003	3-20	0	1	standing water
Area 4	10/9/2003	3-40	0	3	standing water
Area 4	10/9/2003	3-60	0	4	pool
Area 4	10/9/2003	3-80	0	2	standing water
Area 4	10/9/2003	3-100	-	-	dry
Area 4	10/9/2003	3-120	0	5	ditch
Area 4	10/9/2003	3-140	0	3	standing water
Area 4	10/9/2003	3-160	0	2	panne
Area 4	10/9/2003	4-160	0	2	standing water
Area 4	10/9/2003	4-140	0	2	standing water
Area 4	10/9/2003	4-120	0	3	standing water
Area 4	10/9/2003	4-100	0	4	ditch
Area 4	10/9/2003	4-80	0	2	standing water
Area 4	10/9/2003	4-60	0	3	standing water
Area 4	10/9/2003	4-40	-	-	dry
Area 4	10/9/2003	4-20	-	-	dry
Area 4	10/9/2003	4-00	-	-	dry
Area 4	10/17/2003	1-00	-	-	dry
Area 4	10/17/2003	1-20	0	5	ditch
Area 4	10/17/2003	1-40	0	4	standing water
Area 4	10/17/2003	1-60	0	2	standing water
Area 4	10/17/2003	1-80	-	-	dry
Area 4	10/17/2003	1-100	-	-	dry
Area 4	10/17/2003	1-120	-	-	dry
Area 4	10/17/2003	1-140	-	-	dry
Area 4	10/17/2003	1-160	-	-	dry
Area 4	10/17/2003	2-160	0	3	standing water

Area 4	10/17/2003	2-140	0	1	standing water
Area 4	10/17/2003	2-120	-	-	dry
Area 4	10/17/2003	2-100	-	-	dry
Area 4	10/17/2003	2-80	-	-	dry
Area 4	10/17/2003	2-60	0	2	standing water
Area 4	10/17/2003	2-40	-	-	dry
Area 4	10/17/2003	2-20	-	-	dry
Area 4	10/17/2003	2-00	-	-	dry
Area 4	10/17/2003	3-00	0	3	standing water
Area 4	10/17/2003	3-20	0	4	standing water
Area 4	10/17/2003	3-40	0	2	standing water
Area 4	10/17/2003	3-60	0	2	pool
Area 4	10/17/2003	3-80	0	3	standing water
Area 4	10/17/2003	3-100	-	-	dry
Area 4	10/17/2003	3-120	0	3	ditch
Area 4	10/17/2003	3-140	0	1	standing water
Area 4	10/17/2003	3-160	0	3	panne
Area 4	10/17/2003	4-160	0	3	standing water
Area 4	10/17/2003	4-140	0	3	standing water
Area 4	10/17/2003	4-120	0	3	standing water
Area 4	10/17/2003	4-100	0	3	ditch
Area 4	10/17/2003	4-80	0	3	standing water
Area 4	10/17/2003	4-60	0	3	standing water
Area 4	10/17/2003	4-40	-	-	dry
Area 4	10/17/2003	4-20	-	-	dry
Area 4	10/17/2003	4-00	-	-	dry

### 2.3 Vegetation Quadrats

In order to detect differences in the vegetative community composition and abundance, vegetation quadrats were placed at 88 stations in all four areas of the marsh, following USFWS/USGS protocols (James-Pirri et al., 2002). The vegetation was sampled once towards the end of the growing season in October, when plants were easily identifiable. The quadrats measured 1 m<sup>2</sup> and consisted of a meter stick and dowels ( $\leq 3$  mm in diameter). The dowels were placed perpendicular to the meter stick at 0, 25, 50, 75 and 100 cm. Each dowel was one meter in length with a total of ten marks, each spaced 11.1 cm apart. Thus, the 1 m<sup>2</sup> quadrant is divided into a grid of 50 evenly spaced points. A thin rod, approximately 3 mm in diameter, was placed vertically to the first sampling point and lowered through the vegetation canopy to the sampling point on the ground. All vegetation species that came in contact with the rod were recorded. Categories other than plant species, such as “water,” “bare ground,” and “wrack and litter” were also recorded. This process was repeated for all remaining points on the sampling quadrat until all 50 points had been sampled. The total number of times each species was recorded was tallied for each quadrat. All vegetation quadrats were sampled within one to two weeks and during a period when the marsh surface was not flooded.



*Mixed vegetative community in Area 3*

**TABLE 2-2 VEGETATION QUADRATS**

**AREA 1**

**10/22/03**

Plot ID	Bare Ground	Distichlis spicata	Dis_spic (dead)	Iva frutescens	Iva_fruit young <2 in	Iva frutescens (Dead)	Salidago_spp	Limonium carolinianum	Spartina_sp	Phragmites aust (dead)	Phragmites australis	Pluchea purpurascens	Sci_olne	Sci_olne (Dead)	Spartina alterniflora	Spa_alterniflora (dead)	Spartina patens	Spartina patens (dead)	Water	Ditch	Wrack Line
1-00	50									50	50		50								
1-40																	50				
1-80	2												34				50	16			
1-120	8	28								27	2	7	34				50	18			
2-120	23						3	8		13	18		34				50				
2-80	5	31	1				2										50	20			
2-40	8	5															50	13			
2-00	50									50	50	5	43								
3-00	14	33											50								
3-40	20	5									37						50				
3-80	2	18		3													50	1			
3-120	1	4															50				
3-160	1	5										6					50				
3-200	7			17				4		50	50										
4-240				1											2		50				
4-200	8	37										4	39	4			50				
4-160				9									34				34	10			
4-120	3	19		3				1					20				50				
4-80	9	39		5							12		8				50				
4-40	2	5											7				50				
4-00	4									18	38		40	18							
5-00	4									21	26		5				50	4			
5-40	6																50				
5-80	4																50	16			



**AREA 2**

**10/20/03**

Plot ID	Bare Ground	Distichlis spicata	Dis_spic (dead)	Iva frutescens	Iva_frut young <2 in	Iva frutescens (Dead)	Salidago_spp	Limonium carolinianum	Spartina_sp	Phragmites aust (dead)	Phragmites australis	Pluchea purpurascens	Sci_olne	Sci_olne (Dead)	Spartina alterniflora	Spa_alterniflora (dead)	Spartina patens	Spartina patens (dead)	Water	Ditch	Wrack Line
5-00				1						6	2				5		50				
5-40																	50				
5-80	11			4						43	29	18					50				3
4-120	13			17						48	49		43				45				
4-80																	50	41			
4-40	23											4			50	13	50	36			
4-00																	50	32			
3-00	41											24			50						
3-40	1														8		50				
3-80	38											6			50		50				
3-120	11														29		50	1			
3-160	4											10			50	1	50	22			
3-200	25			1								9			50	8					
2-200										4	9						50	13			
2-160	10											3			36	2	50	26			
2-120																	50	37			
2-80	5																50	9			
2-40																	50	11			
2-00																	50				
1-00										46	30		43				50				8
1-40															23		50	16			
1-80																	50				
1-120	6														37		50	27			
1-160	9																50	10			

**AREA 3**

**10/17/03**

Plot ID	Bare Ground	Distichlis spicata	Dis_spic (dead)	Iva frutescens	Iva_frut young <2 in	Iva frutescens (Dead)	Salidago_spp	Limonium carolinianum	Spartina_sp	Phragmites aust (dead)	Phragmites australis	Pluhea purpurascens	Sci_olne	Sci_olne (Dead)	Spartina alterniflora	Spa_alterniflora (dead)	Spartina patens	Spartina patens (dead)	Water	Ditch	Wrack Line
4-00	13														50	19					
4-40																	50	19			
4-80															25		50				
4-120	16														44		36	4			
3-120				12					16	50	50				12						
3-80	46														50	10					
3-40																	50				
3-00															38		50				
2-00									18			2			6		44			15	
2-40																	50				
2-80										2	21	6					8		47		
2-120	8											5			34	7	50				
2-160	2																50	10			
2-200															23		50				
1-200												1			23		50				
1-160	5											1			30		50				
1-120		2											16	14			50	5			
1-80					1					16	26	7	34	3	7		50				
1-40		7															50	23			
1-00	4	18								16	23	2	38				50				

**AREA 4**

**9/9/03**

Plot ID	Bare Ground	Distichlis spicata	Dis_spic (dead)	Iva frutescens	Iva_frut young <2 in	Iva frutescens (Dead)	Salidago_spp	Limonium carolinianum	Spartina_sp	Phragmites aust (dead)	Phragmites australis	Pluchea purpurascens	Sci_olne	Sci_olne (Dead)	Spartina alterniflora	Spa_alterniflora (dead)	Spartina patens	Spartina patens (dead)	Water	Ditch	Wrack Line
1-00	41									29	20				13		50				
1-40																	50	38			
1-80	3																50				
1-120	25														45	34	40	10			
1-160	20									4	22				44	12	47	10			
2-00																	50				
2-40	1				1												50				
2-80											1						50				
2-120	4	12									2				46	10	31	2			
2-160	5									29	12				50	6					
3-00																	50				
3-40	2	9													21		50				
3-80																	50				
3-120		41	5		1					6	11						50				
3-160						1											31		33		
4-00	6									41	21		50	50			27				
4-40										24	28				2		50				
4-80		27	3														50				
4-120		2															50	24			
4-160	41									50	50	7									



## 2.4 Nekton Sampling

Nekton sampling was conducted in accordance with USFWS/USGS protocols (James-Pirri et al., 2002) at all fish stations located throughout the four marsh areas in October. A total of 40 samples were collected using a ditch net. The ditch net consisted of nylon netting (1.8 in. mesh). The center of the net was placed along the sides and bottom of 1 linear meter of ditch. The nets were placed in the ditches at the station locations at least 30 minutes before sampling to minimize any disturbance to the fish caused by placing the net in the ditch. Two doors located on the open ends of the net were pulled to close the net after 30 minutes. Once closed, the ditch net enclosed an area of water 1 m long and as wide as the ditch. The net was quickly removed from the water onto the marsh surface where the fish were identified, counted and measured. Water quality parameters were also conducted and recorded at each sampling location.



*Fish net set up for nekton sampling*

**TABLE 2-3 NEKTON SAMPLING**

<b>AREA 1 Station</b>	<b>D-1</b>	<b>D-2</b>	<b>D-3</b>	<b>D-4</b>	<b>D-5</b>	<b>D-6</b>	<b>D-7</b>	<b>D-8</b>	<b>D-9</b>	<b>D-10</b>
<b>Water Depth (cm)</b>	11	9.4	15	41	10	22	5	24	13	36
<b>Creek Depth (cm)</b>	11	9.4	15	41	10	28	5	32	17	52
<b>Tide</b>	ebb	ebb	ebb	ebb	ebb	ebb	ebb	ebb	ebb	ebb
<b>Habitat</b>	plugged ditch	plugged ditch	plugged ditch	plugged ditch	plugged ditch	open ditch	open ditch	open ditch	open ditch	open ditch
<b>Area (m<sup>2</sup>)</b>	0.7718	0.8259	0.7224	0.5698	0.8336	0.7407	0.5426	0.9696	0.6433	0.4719
<b>Water Temp (C)</b>	15.8	15.2	12.9	14.7	16.3	14	17	12.6	15.9	14.9
<b>Salinity (ppt)</b>	8.9	3.3	5.5	11.1	6.2	9.3	11.2	10.6	12.6	11
<b>DO (mg/L)</b>	0.1	0.44	0.33	1.29	0.1	0.61	9.3	0.56	1.09	0.55
<i>Fundulus heteroclitus</i>	-	1	-	5	-	-	-	-	-	-
<i>Lucania parva</i>	-	-	-	41	-	-	-	-	2	-
<i>Fundulus luciae</i>	-	-	-	-	-	-	-	-	-	-
<i>Palaemonetes</i> spp.	-	-	-	-	-	-	-	-	-	-
Juvenile Unknown	-	-	-	-	-	-	-	-	-	-
<i>Cyprinodon variegatus</i>	-	-	-	-	-	-	-	-	-	-
<i>Pandalus montagui</i>	-	-	-	-	-	-	-	-	-	-
<i>Fundulus majalis</i>	-	-	-	-	-	-	-	-	-	-
<i>Clupea harengus</i>	-	-	-	-	-	-	-	-	-	-
<i>Uca</i> spp.	-	-	-	-	-	-	-	-	-	-
<i>Fundulus diaphanus</i>	-	-	-	-	-	-	-	-	-	-
<i>Menidia</i>	-	-	-	-	-	-	-	-	-	-
<i>Anguilla rostrata</i>	-	-	-	-	-	-	-	-	-	-
<i>Callinectes</i> spp.	-	-	-	-	-	-	-	-	-	-
<i>Pandelet</i> spp.	-	-	-	-	-	-	-	-	-	-

<b>AREA 2 Station</b>	<b>D-1</b>	<b>D-2</b>	<b>D-3</b>	<b>D-4</b>	<b>D-5</b>	<b>D-6</b>	<b>D-7</b>	<b>D-8</b>	<b>D-9</b>	<b>D-10</b>
<b>Water Depth (cm)</b>	33	28	30	10	21	20	13	14	23	36
<b>Creek Depth (cm)</b>	40	42	37	15	30	20	13	14	23	36
<b>Tide</b>	ebb	ebb	ebb	ebb	ebb	ebb	ebb	ebb	ebb	ebb
<b>Habitat</b>	plugged ditch	plugged ditch	plugged ditch	plugged ditch	plugged ditch	plugged ditch	plugged ditch	plugged ditch	plugged ditch	plugged ditch
<b>Area (m<sup>2</sup>)</b>	0.6923	0.8532	0.9919	0.8725	0.8557	0.8403	0.7401	0.8699	0.6574	1.1447
<b>Water Temp (C)</b>	14	14.2	13.1	14.2	14.8	14.3	16.7	15.3	13.7	14.3
<b>Salinity (ppt)</b>	13.8	14.4	15.1	11.2	10.8	14.7	18	16.7	16.7	
<b>DO (mg/L)</b>	0.37	0.24	0.06	0.36	0.16	0.21	0.38	4.1	5.75	1.69
<i>Fundulus heteroclitus</i>	-	-	9	-	-	-	-	44	15	7
<i>Lucania parva</i>	5	2	3	-	2	-	-	2	-	4
<i>Fundulus luciae</i>	-	-	-	-	-	-	-	-	-	-
<i>Palaemonetes spp.</i>	-	1	-	-	-	-	-	-	60	8
Juvenile Unknown	-	-	-	-	-	-	-	-	-	-
<i>Cyprinodon variegatus</i>	-	-	-	-	-	-	-	-	-	-
<i>Pandalus montagui</i>	-	-	-	-	-	-	-	-	2	-
<i>Fundulus majalis</i>	-	-	-	-	-	-	-	-	-	-
<i>Clupea harengus</i>	-	-	-	-	-	-	-	-	-	-
<i>Uca spp.</i>	-	-	-	-	-	-	-	-	-	-
<i>Fundulus diaphanus</i>	-	-	-	-	-	-	-	-	-	-
<i>Menidia</i>	-	-	-	-	-	-	-	-	-	-
<i>Anguilla rostrata</i>	-	-	-	-	-	-	-	-	-	-
<i>Callinectes spp.</i>	-	-	-	-	-	-	-	-	-	-
<i>Pandelelet spp.</i>	-	-	-	-	-	-	-	-	-	-

AREA 3 Station	D-1	D-2	D-3	D-4	D-5	D-6	D-7	D-8	D-9	D-10
Water Depth (cm)	21	17	10	5	22	18	25	26	14	38
Creek Depth (cm)	21	17	10	5	22	18	25	26	14	38
Tide	ebb	ebb	ebb	Ebb	ebb	ebb	ebb	ebb	ebb	ebb
Habitat	plugged ditch	plugged ditch	plugged ditch	plugged ditch	plugged ditch	plugged ditch	plugged ditch	plugged ditch	plugged ditch	plugged ditch
Area (m <sup>2</sup> )	0.8507	0.7641	0.8109	0.6234	0.8852	0.8195	0.9213	0.6323	0.8591	1.0365
Water Temp (C)	17.3	16.4	17.4	19	16.7	17.9	16.6	19.2	18.8	14.4
Salinity (ppt)	10.2	7.1	8.7	10.5	5.4	11	12.2	7.6	13.8	21.1
DO (mg/L)	0.8	0.09	0.81	0.31	1.32	0.17	0.73	5.6	1.4	5.15
<i>Fundulus heteroclitus</i>	1	1	-	-	-	-	37	1	-	5
<i>Lucania parva</i>	4	9	-	4	3	-	8	-	-	2
<i>Fundulus luciae</i>	-	-	-	-	-	-	-	-	-	-
<i>Palaemonetes spp.</i>	-	-	-	-	7	-	-	-	-	62
Juvenile Unknown	-	-	-	-	-	-	-	-	-	-
<i>Cyprinodon variegatus</i>	-	-	-	-	-	-	-	-	-	-
<i>Pandalus montagu</i>	-	-	-	-	-	-	-	-	-	-
<i>Fundulus majalis</i>	-	-	-	-	-	-	-	-	-	-
<i>Clupea harengus</i>	-	-	-	-	-	-	-	-	-	-
<i>Uca spp.</i>	-	-	-	-	-	-	-	-	-	-
<i>Fundulus diaphanus</i>	-	-	-	-	-	-	-	-	-	-
<i>Menidia</i>	-	-	-	-	-	-	-	-	-	-
<i>Anguilla rostrata</i>	-	-	-	-	-	-	-	-	-	-
<i>Callinectes spp.</i>	-	-	-	-	-	-	-	-	-	-
<i>Pandeleet spp.</i>	-	-	-	-	-	-	-	-	-	-



AREA 4 Station	D-1	D-2	D-3	D-4	D-5	D-6	D-7	D-8	D-9	D-10
Water Depth (cm)	8.5	20	70	15	14	37.5	13	27.5	7	30
Creek Depth (cm)	20	26	83	15	14	37.5	13	27.5	12	35
Tide	flood	flood	flood	ebb	ebb	ebb	ebb	ebb	flood	flood
Habitat	plugged ditch	plugged ditch	plugged ditch	plugged ditch	plugged ditch	open ditch	open ditch	open ditch	plugged ditch	plugged ditch
Area (m <sup>2</sup> )	0.4373	0.3633	0.6787	0.6489	0.8036	0.6998	0.7771	0.7687	0.4532	0.7702
Water Temp (C)	10.9	11.3	14.6	10.5	11.5	9.9	11	10.3	14	11.8
Salinity (ppt)	20.7	15.7	22.7	8	3.4	1.7	0.8	2.1	20.8	8.2
DO (mg/L)	5.15	0.53	4.67	1.3	1.05	3.75	2.46	2.23	0.45	1.93
<i>Fundulus heteroclitus</i>	-	-	7	3	-	7	-	-	-	3
<i>Lucania parva</i>	-	3	1	-	-	-	-	-	1	1
<i>Fundulus luciae</i>	-	-	-	-	-	-	-	-	-	-
<i>Palaemonetes spp.</i>	-	-	89	-	-	-	-	-	-	-
Juvenile Unknown	-	-	-	-	-	-	-	-	-	-
<i>Cyprinodon variegatus</i>	-	-	-	-	-	-	-	-	-	-
<i>Pandalus montagu</i>	-	-	-	-	-	-	-	-	-	-
<i>Fundulus majalis</i>	-	-	-	-	-	-	-	-	-	-
<i>Clupea harengus</i>	-	-	-	-	-	-	-	-	-	-
<i>Uca spp.</i>	-	-	-	-	-	-	-	-	-	-
<i>Fundulus diaphanus</i>	-	-	-	-	-	-	-	-	-	-
<i>Menidia</i>	-	-	-	-	-	-	-	-	-	-
<i>Anguilla rostrata</i>	-	-	-	-	-	-	-	-	-	-
<i>Callinectes spp.</i>	-	-	-	-	-	-	-	-	-	-
<i>Pandeleet spp.</i>	-	-	-	-	-	-	-	-	-	-

**TABLE 2-4 NEKTON MEASUREMENTS**

<b>Station</b>	<b>Species</b>	<b>Length (mm)</b>
<b>AREA 1</b>		
D-2	<i>Fundulus heteroclitus</i>	21
D-4	<i>Fundulus heteroclitus</i>	34
D-4	<i>Fundulus heteroclitus</i>	25
D-4	<i>Fundulus heteroclitus</i>	31
D-4	<i>Fundulus heteroclitus</i>	28
D-4	<i>Fundulus heteroclitus</i>	34
D-4	<i>Lucania parva</i>	47
D-4	<i>Lucania parva</i>	35
D-4	<i>Lucania parva</i>	37
D-4	<i>Lucania parva</i>	28
D-4	<i>Lucania parva</i>	34
D-4	<i>Lucania parva</i>	24
D-4	<i>Lucania parva</i>	28
D-4	<i>Lucania parva</i>	35
D-4	<i>Lucania parva</i>	31
D-4	<i>Lucania parva</i>	28
D-4	<i>Lucania parva</i>	35
D-4	<i>Lucania parva</i>	27
D-4	<i>Lucania parva</i>	24
D-4	<i>Lucania parva</i>	26
D-4	<i>Lucania parva</i>	27
D-9	<i>Lucania parva</i>	20
D-9	<i>Lucania parva</i>	28
<b>AREA 2</b>		
D-1	<i>Lucania parva</i>	24
D-1	<i>Lucania parva</i>	21
D-1	<i>Lucania parva</i>	20
D-1	<i>Lucania parva</i>	18
D-1	<i>Lucania parva</i>	28
D-2	<i>Lucania parva</i>	21
D-2	<i>Lucania parva</i>	24
D-2	<i>Palaemonetes spp.</i>	33
D-3	<i>Fundulus heteroclitus</i>	57
D-3	<i>Fundulus heteroclitus</i>	14
D-3	<i>Fundulus heteroclitus</i>	20
D-3	<i>Fundulus heteroclitus</i>	18
D-3	<i>Fundulus heteroclitus</i>	37
D-3	<i>Fundulus heteroclitus</i>	17
D-3	<i>Fundulus heteroclitus</i>	17

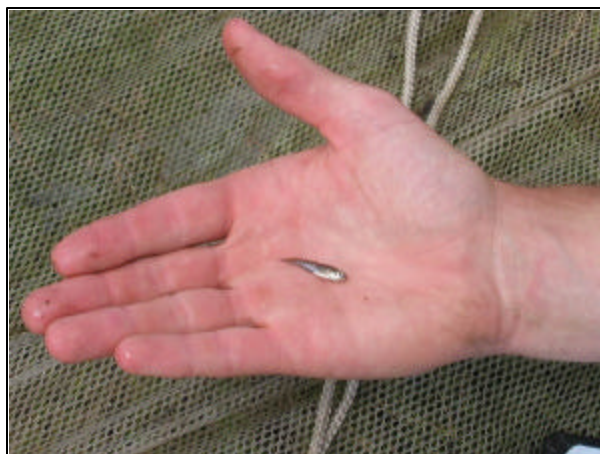
D-3	<i>Fundulus heteroclitus</i>	36
D-3	<i>Fundulus heteroclitus</i>	34
D-3	<i>Lucania parva</i>	35
D-3	<i>Lucania parva</i>	25
D-3	<i>Lucania parva</i>	29
D-5	<i>Lucania parva</i>	32
D-5	<i>Lucania parva</i>	33
D-8	<i>Fundulus heteroclitus</i>	31
D-8	<i>Fundulus heteroclitus</i>	35
D-8	<i>Fundulus heteroclitus</i>	33
D-8	<i>Fundulus heteroclitus</i>	36
D-8	<i>Fundulus heteroclitus</i>	38
D-8	<i>Fundulus heteroclitus</i>	31
D-8	<i>Fundulus heteroclitus</i>	33
D-8	<i>Fundulus heteroclitus</i>	35
D-8	<i>Fundulus heteroclitus</i>	33
D-8	<i>Fundulus heteroclitus</i>	32
D-8	<i>Fundulus heteroclitus</i>	32
D-8	<i>Fundulus heteroclitus</i>	31
D-8	<i>Fundulus heteroclitus</i>	32
D-8	<i>Fundulus heteroclitus</i>	29
D-8	<i>Fundulus heteroclitus</i>	26
D-8	<i>Lucania parva</i>	24
D-8	<i>Lucania parva</i>	29
D-9	<i>Cyprinodon variegatus</i>	46
D-9	<i>Cyprinodon variegatus</i>	35
D-9	<i>Palaemonetes spp.</i>	38
D-9	<i>Palaemonetes spp.</i>	33
D-9	<i>Palaemonetes spp.</i>	32
D-9	<i>Palaemonetes spp.</i>	36
D-9	<i>Palaemonetes spp.</i>	27
D-9	<i>Palaemonetes spp.</i>	30
D-9	<i>Palaemonetes spp.</i>	33
D-9	<i>Palaemonetes spp.</i>	33
D-9	<i>Palaemonetes spp.</i>	30
D-9	<i>Palaemonetes spp.</i>	36
D-9	<i>Palaemonetes spp.</i>	31
D-9	<i>Palaemonetes spp.</i>	27
D-9	<i>Palaemonetes spp.</i>	30
D-9	<i>Palaemonetes spp.</i>	30
D-9	<i>Palaemonetes spp.</i>	32
D-9	<i>Fundulus heteroclitus</i>	46
D-9	<i>Fundulus heteroclitus</i>	54

D-9	<i>Fundulus heteroclitus</i>	50
D-9	<i>Fundulus heteroclitus</i>	44
D-9	<i>Fundulus heteroclitus</i>	55
D-9	<i>Fundulus heteroclitus</i>	39
D-9	<i>Fundulus heteroclitus</i>	42
D-9	<i>Fundulus heteroclitus</i>	34
D-9	<i>Fundulus heteroclitus</i>	36
D-9	<i>Fundulus heteroclitus</i>	35
D-9	<i>Fundulus heteroclitus</i>	30
D-9	<i>Fundulus heteroclitus</i>	32
D-9	<i>Fundulus heteroclitus</i>	24
D-9	<i>Fundulus heteroclitus</i>	25
D-9	<i>Fundulus heteroclitus</i>	37
D-10	<i>Fundulus heteroclitus</i>	42
D-10	<i>Fundulus heteroclitus</i>	25
D-10	<i>Fundulus heteroclitus</i>	30
D-10	<i>Fundulus heteroclitus</i>	36
D-10	<i>Fundulus heteroclitus</i>	25
D-10	<i>Fundulus heteroclitus</i>	26
D-10	<i>Fundulus heteroclitus</i>	22
D-10	<i>Palaemonetes spp.</i>	32
D-10	<i>Palaemonetes spp.</i>	29
D-10	<i>Palaemonetes spp.</i>	32
D-10	<i>Palaemonetes spp.</i>	35
D-10	<i>Palaemonetes spp.</i>	37
D-10	<i>Palaemonetes spp.</i>	27
D-10	<i>Palaemonetes spp.</i>	34
D-10	<i>Palaemonetes spp.</i>	36
D-10	<i>Lucania parva</i>	49
D-10	<i>Lucania parva</i>	44
D-10	<i>Lucania parva</i>	31
D-10	<i>Lucania parva</i>	26
<b>AREA 3</b>		
D-1	<i>Lucania parva</i>	18
D-1	<i>Lucania parva</i>	22
D-1	<i>Lucania parva</i>	20
D-1	<i>Lucania parva</i>	24
D-1	<i>Fundulus heteroclitus</i>	47
D-2	<i>Lucania parva</i>	24
D-2	<i>Lucania parva</i>	20
D-2	<i>Lucania parva</i>	20
D-2	<i>Lucania parva</i>	21
D-2	<i>Lucania parva</i>	32

D-2	<i>Lucania parva</i>	30
D-2	<i>Lucania parva</i>	20
D-2	<i>Lucania parva</i>	24
D-2	<i>Lucania parva</i>	23
D-2	<i>Fundulus heteroclitus</i>	32
D-4	<i>Lucania parva</i>	23
D-4	<i>Lucania parva</i>	29
D-4	<i>Lucania parva</i>	31
D-4	<i>Lucania parva</i>	18
D-5	<i>Lucania parva</i>	29
D-5	<i>Lucania parva</i>	21
D-5	<i>Lucania parva</i>	22
D-5	<i>Palaemonetes spp.</i>	32
D-5	<i>Palaemonetes spp.</i>	28
D-5	<i>Palaemonetes spp.</i>	32
D-5	<i>Palaemonetes spp.</i>	27
D-5	<i>Palaemonetes spp.</i>	34
D-5	<i>Palaemonetes spp.</i>	25
D-5	<i>Palaemonetes spp.</i>	36
D-7	<i>Lucania parva</i>	44
D-7	<i>Lucania parva</i>	52
D-7	<i>Lucania parva</i>	40
D-7	<i>Lucania parva</i>	46
D-7	<i>Lucania parva</i>	36
D-7	<i>Lucania parva</i>	34
D-7	<i>Lucania parva</i>	41
D-7	<i>Lucania parva</i>	32
D-7	<i>Fundulus heteroclitus</i>	45
D-7	<i>Fundulus heteroclitus</i>	50
D-7	<i>Fundulus heteroclitus</i>	40
D-7	<i>Fundulus heteroclitus</i>	44
D-7	<i>Fundulus heteroclitus</i>	31
D-7	<i>Fundulus heteroclitus</i>	33
D-7	<i>Fundulus heteroclitus</i>	42
D-7	<i>Fundulus heteroclitus</i>	31
D-7	<i>Fundulus heteroclitus</i>	41
D-7	<i>Fundulus heteroclitus</i>	34
D-7	<i>Fundulus heteroclitus</i>	36
D-7	<i>Fundulus heteroclitus</i>	37
D-7	<i>Fundulus heteroclitus</i>	39
D-8	<i>Fundulus heteroclitus</i>	31
D-10	<i>Palaemonetes spp.</i>	34
D-10	<i>Palaemonetes spp.</i>	32

D-10	<i>Palaemonetes spp.</i>	26
D-10	<i>Palaemonetes spp.</i>	32
D-10	<i>Palaemonetes spp.</i>	40
D-10	<i>Palaemonetes spp.</i>	29
D-10	<i>Palaemonetes spp.</i>	46
D-10	<i>Palaemonetes spp.</i>	27
D-10	<i>Palaemonetes spp.</i>	30
D-10	<i>Palaemonetes spp.</i>	27
D-10	<i>Palaemonetes spp.</i>	32
D-10	<i>Palaemonetes spp.</i>	31
D-10	<i>Palaemonetes spp.</i>	29
D-10	<i>Palaemonetes spp.</i>	15
D-10	<i>Palaemonetes spp.</i>	31
D-10	<i>Fundulus heteroclitus</i>	39
D-10	<i>Fundulus heteroclitus</i>	31
D-10	<i>Fundulus heteroclitus</i>	28
D-10	<i>Fundulus heteroclitus</i>	29
D-10	<i>Fundulus heteroclitus</i>	29
D-10	<i>Lucania parva</i>	37
D-10	<i>Lucania parva</i>	30
<b>AREA 4</b>		
D-2	<i>Lucania parva</i>	20
D-2	<i>Lucania parva</i>	28
D-2	<i>Lucania parva</i>	30
D-3	<i>Palaemonetes spp.</i>	35
D-3	<i>Palaemonetes spp.</i>	17
D-3	<i>Palaemonetes spp.</i>	28
D-3	<i>Palaemonetes spp.</i>	26
D-3	<i>Palaemonetes spp.</i>	23
D-3	<i>Palaemonetes spp.</i>	32
D-3	<i>Palaemonetes spp.</i>	35
D-3	<i>Palaemonetes spp.</i>	34
D-3	<i>Palaemonetes spp.</i>	33
D-3	<i>Palaemonetes spp.</i>	38
D-3	<i>Palaemonetes spp.</i>	27
D-3	<i>Palaemonetes spp.</i>	23
D-3	<i>Palaemonetes spp.</i>	32
D-3	<i>Palaemonetes spp.</i>	31
D-3	<i>Palaemonetes spp.</i>	30
D-3	<i>Fundulus heteroclitus</i>	34
D-3	<i>Fundulus heteroclitus</i>	35
D-3	<i>Fundulus heteroclitus</i>	25
D-3	<i>Fundulus heteroclitus</i>	28

D-3	<i>Fundulus heteroclitus</i>	22
D-3	<i>Fundulus heteroclitus</i>	40
D-3	<i>Fundulus heteroclitus</i>	28
D-3	<i>Lucania parva</i>	24
D-4	<i>Fundulus heteroclitus</i>	32
D-4	<i>Fundulus heteroclitus</i>	49
D-4	<i>Fundulus heteroclitus</i>	62
D-6	<i>Fundulus heteroclitus</i>	47
D-6	<i>Fundulus heteroclitus</i>	36
D-6	<i>Fundulus heteroclitus</i>	39
D-6	<i>Fundulus heteroclitus</i>	39
D-6	<i>Fundulus heteroclitus</i>	37
D-6	<i>Fundulus heteroclitus</i>	20
D-6	<i>Fundulus heteroclitus</i>	26
D-9	<i>Lucania parva</i>	13
D-10	<i>Lucania parva</i>	25
D-10	<i>Fundulus heteroclitus</i>	52
D-10	<i>Fundulus heteroclitus</i>	43
D-10	<i>Fundulus heteroclitus</i>	25



*Cyprinodon variegatus* and *Lucania parva* caught in fish nets

## 2.5 Invertebrates

Invertebrates commonly used as a measure of overall habitat function and health. Invertebrate samples were collected from three different areas: marsh surface; mosquito ditches (water column samples); and mosquito ditch sediments (benthic samples).

Twenty-six marsh surface samples were collected at randomly selected stations in October (the stations were stratified by area, and then again by vegetation type: *Phragmites*, low marsh (LM), high marsh (HM), with one *Phragmites* and two samples each from high marsh and low marsh taken from Areas 2 and 3, and two *Phragmites* and three samples each from high and low marsh taken in Areas 1 and 4). A circular metal frame, 30 cm in diameter, was used to define the sampling area. Mobile insects were trapped in the plastic bag attached to the frame. The frame was inserted into the surface of the marsh to a depth of approximately 5 cm. Soil and root mass within the frame were excavated using a machete, and the mass was collected in the plastic bag. Each marsh surface sample was initially processed in a sorting tray. Plant detritus material was examined to ensure that sessile species were included in the sample. Samples were then rinsed and sieved through a 0.5 mm screen to further separate invertebrates. All specimens caught were preserved in 91% alcohol for later identification.

The water column was sampled at 28 fish stations in November (seven randomly selected stations in each area). Samples were collected using a D-frame sweep net (500 micron mesh) using the USFWS/USGS protocols (James-Pirri et al., 2002). Twelve net-sweeps were performed along a one-meter length segment above the benthos at each sampling station. The contents of the net were emptied individually into five-gallon buckets and transported to a lab where they were processed in sorting trays. Dense samples were split in half or thirds. Each sorting tray was examined under light and dense matter was searched and separated from the tray. The trays were examined for a minimum of 15 minutes if no organisms were observed. The invertebrates that had been observed were captured and stored in 91% alcohol.





*Water column sampling at fish stations*

Benthic samples were collected from the same 28 fish stations in early December. A screened dipper, 10 cm in diameter (0.5 mm mesh), was used to collect samples at the top 5 cm of benthos. Three replicate samples were taken from every station and stored in individual plastic bags. The samples were taken to a lab where they were processed in sorting trays. Concentrated sugar water (one five-pound bag of sugar per gallon of water) was poured into each sorting tray containing the sample, for better identification (Lewis 2000). Organic material in the tray floated to the surface of the sugar water. All invertebrates observed were removed and preserved in 91% alcohol for later identification.

## 2.6 Invertebrate Analysis

Specimens collected from each invertebrate sample (marsh surface, water column, and benthos) were identified by a taxonomist with the use of a dissecting microscope and magnifying glass. Each invertebrate was identified to the family level using various reference guides (Weiss 1995; Borrer and White, 1970; Emerton, 1961). Assistance was also received from the Cerrato Laboratory, MSRC. The identification of water column and benthic invertebrates has not yet been completed.

**TABLE 2-5 VEGETATION INVERTEBRATE IDENTIFICATION**

<b>AREA 1</b>				
<b>Station</b>	<b>Class</b>	<b>Order</b>	<b>Family</b>	<b>Quantity</b>
T2-40-HM	Gastropoda		Melampodidae	1
	Gastropoda	Stylommatophora	Succineidae	17
	Crustacea	Isopoda	Oniscidae	33
	Crustacea	Amphipoda	Talitridae	5
	Arachnida	Ananeae	Lycosidae	7
	Arachnida	Ananeae	Clubionidae	1
	Arachnida	Ananeae	Micryphantidae	1
	Insecta	Hemiptera	Hebridae	1
T3-160-HM	Crustacea	Isopoda	Oniscidae	12
	Crustacea	Amphipoda	Talitridae	18
	Arachnida	Ananeae	Lycosidae	4
	Arachnida	Ananeae	Clubionidae	2
	Insecta	Hemiptera	Hebridae	1
	Insecta	Diptera	Tabindae (larva)	1
T5-40-HM	Gastropoda	Stylommatophora	Succineidae	5
	Crustacea	Isopoda	Oniscidae	66
	Crustacea	Amphipoda	Talitridae	24
	Arachnida	Ananeae	Lycosidae	24
	Arachnida	Ananeae	Clubionidae	9
	Arachnida	Ananeae	Salticidae	1
	Insecta	Hemiptera	Hebridae	6
	Insecta	Coleoptera	Anthicidae	2
	Insecta	Coleoptera	Chrysomelidae	1
	Insecta	Lepidoptera	Pyralidae (larva)	1
	Insecta	Coleoptera	Heteroceridae (larva)	1
	T1-80-LM	Gastropoda		Melampodidae
Gastropoda		Stylommatophora	Succineidae	23
Crustacea		Isopoda	Oniscidae	62
Crustacea		Amphipoda	Talitridae	71
Crustacea			Nematoda	2
Arachnida		Ananeae	Lycosidae	17
Arachnida		Ananeae	Clubionidae	10
Insecta		Hemiptera	Hebridae	2
Insecta		Hymenoptera	Formicidae	8
Insecta		Diptera	Tabanidae (larva)	2
Insecta		Diptera	Dolichopodidae (larva)	1
Insecta		Coleoptera	Chrysomelidae (larva)	1

T4-160-LM	Gastropoda		Melampodidae	1
	Gastropoda	Stylommatophora	Succineidae	7
	Crustacea	Isopoda	Oniscidae	64
	Crustacea	Amphipoda	Talitridae	13
	Arachnida	Ananeae	Lycosidae	11
	Arachnida	Ananeae	Clubionidae	2
	Insecta	Hemiptera	Hebridae	1
T1-120-LM	Gastropoda	Stylommatophora	Succineidae	3
	Crustacea	Isopoda	Oniscidae	16
	Crustacea	Amphipoda	Talitridae	4
	Arachnida	Ananeae	Lycosidae	3
	Arachnida	Ananeae	Clubionidae	1
	Insecta	Diptera	Tabanidae (larva)	1
T3-200-Phrag	Crustacea	Isopoda	Oniscidae	24
	Crustacea	Amphipoda	Talitridae	24
	Gastropoda		Melampodidae	2
	Gastropoda	Stylommatophora	Succineidae	1
T4-00-Phrag	Crustacea	Isopoda	Oniscidae	3
	Crustacea	Amphipoda	Talitridae	1
	Arachnida	Ananeae	Clubionidae	1
	Arachnida	Ananeae	Micryphantidae	2
	Insecta	Lepidoptera	Pyralidae (larva)	1
	Insecta	Diptera	Sciomyzidae	1

<b>AREA 2</b>				
<b>Station</b>	<b>Class</b>	<b>Order</b>	<b>Family</b>	<b>Quantity</b>
T3-40-HM	Crustacea	Isopoda	Oniscidae	2
	Arachnida	Ananeae	Lycosidae	6
	Arachnida	Ananeae	Clubionidae	3
	Insecta	Hemiptera	Hebridae	2
	Insecta	Diptera	Tabanidae (larva)	1
T2-40-HM	Gastropoda	Stylommatophora	Succineidae	9
	Crustacea	Isopoda	Oniscidae	4
	Crustacea	Amphipoda	Talitridae	7
	Arachnida	Ananeae	Lycosidae	9
	Arachnida	Ananeae	Clubionidae	1
	Arachnida	Ananeae	Tetragnathidae	1
	Insecta	Hemiptera	Hebridae	5
T4-80-LM	Crustacea	Isopoda	Oniscidae	1
	Crustacea	Amphipoda	Talitridae	7
	Arachnida	Ananeae	Lycosidae	8
	Arachnida	Ananeae	Micryphantidae	2
	Arachnida	Ananeae	Salticidae	1
T3-120-LM	Crustacea	Isopoda	Oniscidae	25
	Crustacea	Amphipoda	Talitridae	26
	Arachnida	Ananeae	Lycosidae	3
	Arachnida	Ananeae	Clubionidae	1
	Arachnida	Ananeae	Micryphantidae	1
	Insecta	Coleoptera	Staphylinidae	4
	Insecta	Hymenoptera	Formicidae	1
	Insecta	Coleoptera	Cantharidae	1
	Insecta	Diptera	Tabanidae (larva)	1
T1-80-Phrag	Gastropoda		Melampodidae	1
	Gastropoda	Stylommatophora	Succineidae	1
	Crustacea	Isopoda	Oniscidae	1
	Crustacea	Amphipoda	Talitridae	4
	Arachnida	Ananeae	Lycosidae	1
	Arachnida	Ananeae	Clubionidae	1

<b>AREA 3</b>				
<b>Station</b>	<b>Class</b>	<b>Order</b>	<b>Family</b>	<b>Quantity</b>
T3-40-HM	Gastropoda	Stylommatophora	Succineidae	6
	Crustacea	Isopoda	Oniscidae	3
	Crustacea	Amphipoda	Talitridae	9
	Arachnida	Ananeae	Lycosidae	22
	Arachnida	Ananeae	Clubionidae	2
	Arachnida	Ananeae	Tetragnathidae	1
	Insecta	Diptera	Tabanidae (larva)	2
T3-120-HM	Crustacea	Isopoda	Oniscidae	4
	Crustacea	Amphipoda	Talitridae	11
	Arachnida	Ananeae	Lycosidae	5
	Insecta	Diptera	Tabanidae (larvae)	2
	Insecta	Coleoptera	Carabidae	1
	Insecta	Coleoptera	Heteroceridae (larva)	1
T3-160-LM	Gastropoda		Melampodidae	3
	Crustacea	Isopoda	Oniscidae	24
	Crustacea	Amphipoda	Talitridae	9
	Arachnida	Ananeae	Lycosidae	17
	Arachnida	Ananeae	Clubionidae	2
	Insecta	Hemiptera	Hebridae	4
	Insecta	Diptera	Tabanidae (larva)	1
	Insecta	Lepidoptera	Pyralidae (larva)	1
	Insecta	Diptera	Dolichopodidae (larva)	1
T4-40-LM	Gastropoda		Melampodidae	1
	Crustacea	Isopoda	Oniscidae	2
	Arachnida	Ananeae	Lycosidae	4
	Arachnida	Ananeae	Clubionidae	1
	Insecta	Hemiptera	Hebridae	5
T5-80-Phrag	Crustacea	Isopoda	Oniscidae	4
	Arachnida	Ananeae	Micryphantidae	1
	Insecta	Lepidoptera	Pyralidae (larva)	1

<b>AREA 4</b>				
<b>Station</b>	<b>Class</b>	<b>Order</b>	<b>Family</b>	<b>Quantity</b>
T4-80-HM	Gastropoda		Melampodidae	1
	Gastropoda	Stylommatophora	Succineidae	20
	Crustacea	Isopoda	Oniscidae	43
	Crustacea	Amphipoda	Talitridae	6
	Arachnida	Ananeae	Lycosidae	10
	Arachnida	Ananeae	Clubionidae	3
	Arachnida	Ananeae	Tetragnathidae	1
	Insecta	Hemiptera	Hebridae	1
	Insecta	Diptera	Tabanidae (larva)	1
	Insecta	Coleoptera	Heteroceridae (larva)	1
	Insecta	Hymenoptera	Formicidae	1
T3-80-HM	Gastropoda	Stylommatophora	Succineidae	16
	Crustacea	Isopoda	Oniscidae	2
	Crustacea	Amphipoda	Talitridae	1
	Arachnida	Ananeae	Lycosidae	6
	Arachnida	Ananeae	Micryphantidae	1
	Insecta	Coleoptera	Chrysomelidae	2
	Insecta	Hymenoptera	Formicidae	1
T3-00-HM	Gastropoda	Stylommatophora	Succineidae	2
	Crustacea	Isopoda	Oniscidae	16
	Crustacea	Amphipoda	Talitridae	37
	Arachnida	Acarina	Suborder Trombidiformes	1
	Arachnida	Ananeae	Lycosidae	4
	Arachnida	Ananeae	Tetragnathidae	1
T1-120-LM	Gastropoda		Melampodidae	3
	Gastropoda	Stylommatophora	Succineidae	4
	Crustacea	Isopoda	Oniscidae	29
	Crustacea	Amphipoda	Talitridae	4
	Arachnida	Acarina	Sub order Trombidiformes	1
	Arachnida	Ananeae	Lycosidae	6
	Arachnida	Ananeae	Clubionidae	5
	Insecta	Coleoptera	Chrysomelidae	1
	Insecta	Diptera	Tabanidae (larva)	1
	Insecta	Coleoptera	Curcolionidae	1
T2-00-LM	Gastropoda		Melampodidae	9
	Gastropoda	Stylommatophora	Succineidae	2
	Crustacea	Isopoda	Oniscidae	172
	Crustacea	Amphipoda	Talitridae	8
	Arachnida	Acarina	Suborder Trombidiformes	2
	Arachnida	Ananeae	Lycosidae	14

	Arachnida	Ananeae	Clubionidae	5
	Arachnida	Ananeae	Micryphantidae	4
	Arachnida	Ananeae	Tetragnathidae	2
	Insecta	Hemiptera	Hebridae	3
	Insecta	Coleoptera	Chrysomelidae	1
	Insecta	Coleoptera	Heteroceridae (larva)	1
T1-160-LM	Gastropoda		Melampodidae	8
	Gastropoda	Stylommatophora	Succineidae	3
	Crustacea	Amphipoda	Talitridae	5
	Arachnida	Ananeae	Lycosidae	7
	Arachnida	Ananeae	Clubionidae	5
T2-120-Phrag	Gastropoda		Melampodidae	1
	Crustacea	Isopoda	Oniscidae	33
	Crustacea	Amphipoda	Talitridae	8
	Arachnida	Ananeae	Lycosidae	4
	Arachnida	Ananeae	Clubionidae	4
	Arachnida	Ananeae	Micryphantidae	1
	Insecta	Diptera	Tabanidae (larvae)	3
T4-00-Phrag	Crustacea	Amphipoda	Talitridae	1
	Insecta	Coleoptera	Chrysomelidae	1

**TABLE 2-6 WATER COLUMN INVERTEBRATE IDENTIFICATION**

<b>AREA 1</b>				
<b>Station</b>	<b>Class</b>	<b>Order</b>	<b>Family</b>	<b>Quantity</b>
D-1	Oligochaeta		Megascolecidae	6
	Amphipoda		Gammaridae	2
	Amphipoda		Talitridae	1
	Insecta	Hymenoptera	Formicidae	1
D-3	Ostracoda			1
	Oligochaeta		Naididae	1
	Amphipoda		Talitridae	4
D-4	Polychaeta		Ampharetidae	5
	Insecta	Diptera	Chironomidae	1
D-6	Polychaeta		Ampharetidae	1
	Ostracoda			1
	Insecta	Diptera	Ceratopogonidae	1
D-8	Ostracoda			2
	Oligochaeta		Megascolecidae	1
	Amphipoda		Gammaridae	1
	Arachnida		Clubionidae	1
	Insecta		Chironomidae	2
D-9	Insecta	Hemiptera	Corixidae	6
D-10	Insecta	Hemiptera	Corixidae	3



<b>AREA 2</b>				
<b>Station</b>	<b>Class</b>	<b>Order</b>	<b>Family</b>	<b>Quantity</b>
D-1	Oligochaeta		Naididae	2
	Amphipoda		Aoridae	1
D-2	Amphipoda		Gammaridae	2
D-3	Insecta	Hemiptera	Corixidae	4
	Insecta	Diptera	Tabanidae	1
	Insecta	Diptera	Chironomidae	1
D-5	Oligochaeta		Naididae	1
D-6	Polychaeta		Ampharetidae	3
	Oligochaeta		Megascolecidae	2
	Arachnida		Lycosidae	1
D-7	Polychaeta		Ampharetidae	44
	Amphipoda		Gammaridae	1
	Arachnida		Clubionidae	1
	Insecta	Diptera	Chironomidae	1
D-8	Polychaeta		Ampharetidae	1
	Amphipoda		Gammaridae	12
	Isopoda		Idoteidae	1

<b>AREA 3</b>				
<b>Station</b>	<b>Class</b>	<b>Order</b>	<b>Family</b>	<b>Quantity</b>
D-1	Insecta	Trichoptera	Limnephilidae	3
	Insecta	Hemiptera	Corixidae	5
	Insecta	Diptera	Culicidae	1
D-2	Crustacea	Decapoda	Palaemonidae	6
D-3	Polychaeta		Ampharetidae	20
	Oligochaeta		Megascolecidae	22
	Arachnida		Lycosidae	2
	Insecta	Hemiptera	Belostomatidae	1
	Insecta	Diptera	Chironomidae	1
	Insecta	Coleoptera	Staphylinidae	1
D-5	Oligochaeta		Naididae	3
	Arachnida		Lycosidae	1
	Insecta		Chironomidae	2
D-6	Polychaeta		Ampharetidae	19
	Oligochaeta		Naididae	13
	Oligochaeta		Megascolecidae	1
	Ostracoda			3
	Gastropoda		Succineidae	1
	Arachnida		Clubionidae	2
	Insecta	Diptera	Chironomidae	17
	Insecta		Ceratopogonidae	3
	Insecta	Coleoptera	Hydrophilidae	1
	Insecta	Odonata	Libellulidae	1
D-7	Polychaeta		Ampharetidae	21
	Oligochaeta		Megascolecidae	5
	Anthozoa	Ceriantharia		3
	Amphipoda		Gammaridae	2
	Insecta	Hemiptera	Corixidae	3
D-8	Polychaeta		Ampharetidae	3
	Polychaeta		Ampharetidae	3
	Oligochaeta		Megascolecidae	4
	Ostracoda			2
	Amphipoda		Gammaridae	1
	Insecta	Odonata	Coenagrionidae	1
	Insecta	Diptera	Chironomidae	6

<b>AREA 4</b>				
<b>Station</b>	<b>Class</b>	<b>Order</b>	<b>Family</b>	<b>Quantity</b>
D-1	Anthozoa	Ceriantharia		4
	Amphipoda		Gammaridae	1
	Amphipoda		Talitridae	2
	Crustacea	Decapoda	Palaemonidae	1
	Insecta	Hemiptera	Corixidae	7
	Insecta	Diptera	Culicidae	1
	Insecta	Odonata	Libellulidae	2
	Insecta	Coleoptera	Hydrophilidae	1
D-2	Gastropoda		Succineidae	1
	Insecta	Hemiptera	Corixidae	2
	Insecta	Diptera	Syrphidae	1
D-3	Amphipoda		Gammaridae	5
	Insecta	Diptera	Chironomidae	5
D-4	Anthozoa	Ceriantharia		1
	Amphipoda		Talitridae	1
D-6	Polychaeta		Ampharetidae	6
	Oligochaeta		Naididae	1
	Insecta	Diptera	Tipulidae	3
D-7	Polychaeta		Ampharetidae	2
	Entognatha		Poduridae	1
	Insecta	Trichoptera	Polycentropodidae	1
D-8	Isopoda		Asellidae	2
	Insecta	Coleoptera	Staphilinidae	1
	Insecta	Coleoptera	Dysticidae	2
	Insecta	Odonata	Libellulidae	1

**TABLE 2-7 BENTHIC INVERTEBRATE IDENTIFICATION**

<b>AREA 1</b>						
<b>Station</b>	<b>Sample</b>	<b>Class</b>	<b>Sub Class</b>	<b>Order</b>	<b>Family</b>	<b>Quantity</b>
D-1	R-1	Polychaeta			Ampharetidae	1
	R-2	-				-
	R-3	-				-
D-3	R-1	Polychaeta			Ampharetidae	1
	R-2	Polychaeta			Ampharetidae	1
	R-3	-				-
D-8	R-1	Crustacea	Ostracoda			1
	R-2	Crustacea	Ostracoda			9
		Insecta		Diptera	Ceratopogonidae	1
		Polychaeta			Ampharetidae	22
		Oligochaeta			Naididae	3
		Oligochaeta			Megascolecidae	1
		Crustacea		Amphipoda	Gammaridae	1
	R-3	Crustacea	Ostracoda			2
		Insecta		Diptera	Ceratopogonidae	5
		Polychaeta			Ampharetidae	12
		Oligochaeta			Naididae	5
		Oligochaeta			Megascolecidae	2
D-10	R-1	Polychaeta			Ampharetidae	1
		Oligochaeta			Naididae	2
	R-2	-				-
	R-3	Oligochaeta			Naididae	1
D-4	R-1	Polychaeta			Ampharetidae	3
	R-2	Polychaeta			Ampharetidae	17
		Oligochaeta			Naididae	2
		Insecta		Diptera	Ceratopogonidae	1
	R-3	Polychaeta			Ampharetidae	2
		Oligochaeta			Naididae	1
		Oligochaeta			Megascolecidae	1
		Insecta		Diptera	Ceratopogonidae	1
		Insecta		Coleoptera	Hydrophilidae	1
D-6	R-1	Polychaeta			Ampharetidae	4
		Polychaeta			Ampharetidae	1

		Oligochaeta			Megascolecidae	1
	R-2	Polychaeta			Ampharetidae	3
		Oligochaeta			Naididae	4
		Insecta		Diptera	Ceratopogonidae	1
	R-3	Oligochaeta			Naididae	8
D-9	R-1	Polychaeta			Ampharetidae	4
		Oligochaeta			Megascolecidae	1
		Crustacea		Amphipoda	Gammaridae	1
		Crustacea		Isopoda	Idoteidae	3
		Insecta		Diptera	Ceratopogonidae	2
	R-2	Crustacea	Ostracoda			1
		Polychaeta			Ampharetidae	3
		Crustacea		Isopoda	Idoteidae	4
		Insecta		Diptera	Ceratopogonidae	1
	R-3	Crustacea		Isopoda	Idoteidae	3
		Crustacea		Amphipoda	Gammaridae	2
		Insecta		Hemiptera	Corixidae	2

<b>AREA 2</b>						
<b>Station</b>	<b>Sample</b>	<b>Class</b>	<b>Sub Class</b>	<b>Order</b>	<b>Family</b>	<b>Quantity</b>
D-1	R-1	-				-
	R-2	-				-
	R-3	Polychaeta			Ampharetidae	3
		Oligochaeta			Naididae	2
D-2	R-1	-				-
	R-2	-				-
	R-3	-				-
D-3	R-1	-				-
	R-2	Ostracoda				2
		Oligochaeta			Naididae	2
		Insecta		Diptera	Ceratopogonidae	3
		Insecta		Diptera	Chironomidae	1
	R-3	Polychaeta			Ampharetidae	3
D-5	R-1	Polychaeta			Ampharetidae	2
		Oligochaeta			Naididae	1
	R-2	-				-
	R-3	-				-
D-6	R-1	-				-
	R-2	-				-
	R-3	-				-
D-8	R-1	-				-
	R-2	Crustacea		Amphipoda	Gammaridae	1
		Crustacea		Decapoda	Palaemonidae	1
	R-3	Insecta		Diptera	Ceratopogonidae	1

<b>AREA 3</b>						
<b>Station</b>	<b>Sample</b>	<b>Class</b>	<b>Sub Class</b>	<b>Order</b>	<b>Family</b>	<b>Quantity</b>
D-1	R-1	-				-
	R-2	Amphipoda			Aoridae	1
		Insecta		Diptera	Chironomidae	1
	R-3	-				-
D-3	R-1	Polychaeta			Ampharetidae	9
		Oligochaeta			Megascolecidae	2
		Insecta		Diptera	Chironomidae	1
		Insecta		Diptera	Ceratopogonidae	1
	R-2	Polychaeta			Ampharetidae	3
	R-3	Polychaeta			Ampharetidae	2
		Insecta		Diptera	Chironomidae	1
D-5	R-1	-				-
	R-2	Polychaeta			Ampharetidae	3
		Oligochaeta			Megascolecidae	3
		Oligochaeta			Naididae	1
	R-3	-				-
D-6	R-1	Polychaeta			Ampharetidae	29
	R-2	Polychaeta			Ampharetidae	8
		Oligochaeta			Megascolecidae	1
	R-3	Polychaeta			Ampharetidae	1
		Ostracoda				1
D-7	R-1	Oligochaeta			Megascolecidae	1
	R-2	-				-
	R-3	-				-
D-8	R-1	Polychaeta			Ampharetidae	1
	R-2	-				-
	R-3	-				-

<b>AREA 4</b>						
<b>Station</b>	<b>Sample</b>	<b>Class</b>	<b>Sub Class</b>	<b>Order</b>	<b>Family</b>	<b>Quantity</b>
D-1	R-1	-				-
	R-2	Anthozoa		Cerlantharia		1
		Insecta		Diptera	Tabanidae	1
	R-3	-				-
D-2	R-1	-				-
	R-2	Crustacea	Ostracoda			5
		Oligochaeta			Naididae	3
		Insecta		Diptera	Ceratopogonidae	6
	R-3	Oligonchaeta			Naididae	1
		Crustacea	Ostracoda			1
		Insecta		Diptera	Ceratopogonidae	13
D-3	R-1	Polychaeta			Ampharetidae	11
		Polychaeta			Nephthydae	2
		Oligochaeta			Naididae	6
		Crustacea		Isopoda	Anthuridae	1
	R-2	Oligochaeta			Naididae	4
		Crustacea		Tanaidacea	Tanaidae	1
	R-3	Crustacea		Tanaidacea	Tanaidae	6
D-4	R-1	Polychaeta			Ampharetidae	1
		Insecta		Diptera	Ceratopogonidae	1
	R-2	Crustacea	Ostracoda			2
		Polychaeta			Ampharetidae	7
		Oligochaeta			Megascolecidae	2
		Insecta		Diptera	Ceratopogonidae	1
	R-3	-				-
D-6	R-1	Polychaeta			Ampharetidae	5
		Insecta		Diptera	Ceratopogonidae	2
	R-2	Polychaeta			Ampharetidae	15
		Insecta		Diptera	Ceratopogonidae	2
	R-3	Polychaeta			Ampharetidae	64
		Oligonchaeta			Naididae	16
		Oligonchaeta			Megascolecidae	2
		Insecta		Diptera	Tipulidae	3
		Amphipoda			Gammaridae	1
D-7	R-1	Oligochaeta			Naididae	1



		Decapoda			Palaemonidae	1
	R-2	Polychaeta			Ampharetidae	1
		Oligonchaeta			Megascolecidae	6
		Decapoda			Palaemonidae	1
	R-3	-				-
D-8	R-1	-				-
	R-2	-				-
	R-3	-				-

## 2.7 Vegetation Biomass

As an extension of the vegetation speciation effort described above, vegetation biomass sampling was also conducted. Half of the stations were sampled for above-ground vegetation mass, and a quarter were sampled for above-ground and root mass. The samples were selected randomly (stratified by area).

A 27 cm ring was placed at each above-ground biomass station to determine the vegetation plot to be sampled. The vegetation within the plot was clipped at ground level and bagged separate from dead vegetation. The samples were weighed and dried in an oven at 105 degrees Celsius. The samples were removed after a period of 12 hours and re-weighed. The sample weight after drying was subtracted from the initial weight to obtain the biomass of the vegetation.

Soil biomass samples were collected using a 5 cm core sampler. Prior to obtaining a soil core, the live vegetation above the plot to be sampled was clipped at ground level and stored in individual bags. These samples were analyzed as above. The core sampler was driven into the marsh surface to a depth of 30 cm below ground surface (method adopted from Allison 1996). The soil was extracted from the core and placed in individual labeled bags. The soil core samples were weighed and dried in an oven at 105 degrees Celsius. After 24 hours, the samples were removed and re-weighed to obtain the biomass of the soil core.

**TABLE 2-8 VEGETATION BIOMASS - LIVE VEGETATION CLIPPINGS**

	<b>Station</b>	<b>Sample Weight (g)</b>	<b>Vegetation Description</b>
<b>Area 1</b>	2-00	40.4	<i>Phragmites, Pluchea purpurascens, Scirpus americanus, Iva frutescens</i>
	2-40	47.3	<i>S. patens</i>
	2-80	43.4	<i>S. patens</i>
	2-120	14.8	<i>Phragmites, Scirpus americanus, Solidago sempervirens, S. patens</i>
	3-00	28.4	<i>Scirpus americanus, S. patens, Distichlis D. spicata</i>
	3-80	54.6	<i>S. patens</i>
	3-120	14.9	<i>S. patens</i>
	3-160	44.9	<i>S. patens</i>
	4-80	43.6	<i>Spartina, Scirpus americanus</i>
	4-120	24.0	<i>Iva frutescens, S. patens, Scirpus americanus, Distichlis D. spicata</i>
	4-160	38.4	<i>Scirpus americanus, Pluchea purpurascens, S. patens</i>
	5-00	56.3	<i>Phragmites, Scirpus americanus, S. patens</i>
<b>Area 2</b>	1-40	21.2	<i>S. patens, S. alterniflora</i>
	1-120	38.7	<i>S. patens, S. alterniflora, Iva frutescens</i>
	1-160	29.0	<i>S. patens</i>
	2-40	40.9	<i>S. patens</i>
	2-80	67.5	<i>S. patens</i>
	3-40	32.1	<i>S. patens, S. alterniflora</i>
	3-80	26.1	<i>S. patens, S. alterniflora</i>
	3-120	41.4	<i>S. patens</i>
	4-40	28.3	<i>S. patens, S. alterniflora, Pluchea purpurascens</i>
	4-80	42.9	<i>S. patens</i>
	5-00	73.5	<i>S. patens, Iva frutescens</i>
	5-40	53.3	<i>S. patens, Iva frutescens</i>
	5-80	36.0	<i>S. patens, S. alterniflora</i>
<b>Area 3</b>	1-00	18.2	<i>S. patens, Scirpus americanus, Phragmites</i>
	1-80	12.0	<i>Phragmites, Scirpus americanus, S. patens</i>
	1-200	30.2	<i>S. patens</i>
	2-80	24.6	<i>S. patens</i>
	2-120	35.5	<i>S. patens, S. alterniflora</i>
	2-160	32.5	<i>S. patens, S. alterniflora</i>
	2-200	20.5	<i>S. alterniflora, S. patens, Pluchea purpurascens</i>
	3-40	27.4	<i>S. patens</i>
	3-120	9.0	<i>Phragmites</i>
4-80	46.1	<i>S. alterniflora</i>	
<b>Area 4</b>	1-40	28.6	<i>S. patens</i>
	1-60	68.0	<i>S. patens</i>
	1-100	33.7	<i>S. patens, S. alterniflora</i>
	2-00	19.6	<i>S. patens</i>
	2-40	36.1	<i>S. patens</i>
	3-00	36.9	<i>S. patens</i>
	3-80	41.0	<i>S. patens</i>
	3-120	48.8	<i>S. patens, Phragmites</i>
	4-00	2.0	<i>Phragmites</i>
4-80	67.8	<i>S. patens, Scirpus americanus</i>	

**TABLE 2-9 VEGETATION BIOMASS  
 SOIL CORE SAMPLES**

	<b>Station</b>	<b>Sample Weight (g)</b>
<b>Area 1</b>	3-200	33.1
	4-80	14.1
	4-160	16.2
	4-200	22.6
	4-240	26.4
	5-00	11.0
<b>Area 2</b>	1-00	26.4
	1-40	30.6
	1-80	37.2
	2-00	26.4
	2-40	20.2
	2-80	31.6
	5-40	31.5
<b>Area 3</b>	1-00	15.1
	1-80	9.6
	1-120	43.7
	1-160	19.6
	1-200	18.8
<b>Area 4</b>	1-40	20.7
	2-80	15.9
	3-00	8.1
	3-40	9.2
	4-80	19.8
	4-120	16.3

**TABLE 2-10 VEGETATION BIOMASS  
 SOIL CORE CLIPPINGS**

	<b>Station</b>	<b>Sample Weight (g)</b>	<b>Vegetation Description</b>
<b>Area 1</b>	3-200	2.7	<i>Phragmites</i>
	4-80	1.3	<i>S. patens, Scirpus americanus</i>
	4-160	1.2	<i>Scirpus americanus, S. patens</i>
	4-200	-	No vegetation apparent
	4-240	0.3	<i>Scirpus americanus, S. patens</i>
	5-00	-	No vegetation apparent
<b>Area 2</b>	1-00	3.4	<i>Phragmites</i>
	1-40	1.1	<i>S. patens, S. alterniflora</i>
	1-80	1.0	<i>S. patens</i>
	2-00	5.8	<i>S. patens</i>
	2-40	10.7	<i>S. patens</i>
	2-80	11.3	<i>S. patens</i>
	5-40	6.4	<i>S. patens</i>
<b>Area 3</b>	1-00	1.9	<i>S. patens, Scirpus americanus</i>
	1-80	0.9	<i>S. patens, Scirpus americanus, Phragmites</i>
	1-120	2.5	<i>S. patens</i>
	1-160	5.4	<i>S. patens, S. alterniflora</i>
	1-200	0.7	<i>S. patens</i>
<b>Area 4</b>	1-40	4.8	<i>S. patens</i>
	2-80	5.7	<i>S. patens</i>
	3-00	-	No vegetation apparent
	3-40	-	No vegetation apparent
	4-80	0.4	<i>S. patens, Scirpus americanus</i>
	4-120	7.1	<i>Phragmites, S. patens</i>

## 2.8 Bird Observations

The bird fauna within the refuge have been continuously observed and documented. The marsh lies along migration corridors used by shorebirds, raptors and songbirds. In addition, the refuge supports nine federal and/or New York State designated endangered/threatened avian species. Through anecdotal observations, approximately 22 species of birds have been observed in the marsh. The most abundant species observed include black duck, Northern harrier, and a variety of wading birds. Tree and barn swallows are very common during migrating season. During September and October, swallows were observed in swarms of hundreds. An immature bald eagle has wintered at the Refuge the past several years.

Anecdotal observations in all four marsh areas have shown the following list of positive identified bird species.

Black-Crowned Night Heron	Mallard
Black Ducks	Northern Harrier
Bufflehead	Osprey
Canada Geese	Red-Wing Blackbird
Great Blue Heron	Seaside Sparrow
Great Egret	Sedge Wren
Great Heron	Sharp-tailed Sparrow
Gulls – Heron	Snipe
– Black-back	Snowy Egret
Hooded Mergansers	Swallow – Barn
Kingfisher	– Tree

### III. Physical Parameters

#### 3.1 Ditch Qualities

There are 43 delineated mosquito ditches within the four Areas. The ditches vary in width, but are constructed uniformly parallel east to west in all areas, except in Area 4 which contains a grid ditch network. A visual inspection of all the mosquito ditches was performed in January, and general characteristics of the ditches were documented. These included accounts of the plugs, which were classified as “working” (retaining water), “moderate,” or “failed.” A photo-log of the ditches was also compiled. Major features were recorded by GPS coordinates. It should be noted that most of the plugs in Area 4 were determined to have failed; most of the plugs in Area 1 were characterized as moderate; and most of the plugs in Area 3 were listed as working. Of other interest, Ditches 4 and 5 in Area 2 contain an additional plug in the mid-portion of the ditch, and Ditch 6 contains two additional mid-section plugs.

<b>Area</b>	<b># of Plugs Installed</b>	<b># of Plugs Working</b>	<b># of Plugs Moderately Working</b>	<b># of Plugs Failed</b>	<b># of Plugs Missing</b>
1	14	2	7	3	2
2	24	20	4	-	-
3	10	8	1	1	-
4	17	3	2	9	3

**TABLE 3-1 DITCH QUALITIES**

**AREA 1**

Ditch 1A	Starting at the easternmost end:
	<ul style="list-style-type: none"> <li>◆ Plug 5 feet wide, heavy <i>Phragmites</i></li> <li>◆ Ditch difficult to follow; wanders, shallow through thick <i>Phragmites</i>; no distinct ditch</li> </ul>
Ditch 1	Starting at the westernmost end:
	<ul style="list-style-type: none"> <li>◆ Distinct end to ditch; 50 feet from tree line; approximately 2.5 ft in width</li> <li>◆ <i>Phragmites</i> on edges of ditch; 75 ft west of terminus</li> <li>◆ Ditch is straight and shallow at high tide</li> <li>◆ Width varies from 1.5 ft – 2.5 ft</li> <li>◆ <i>Phragmites</i> become heavy west of intersecting of Ditch 1 and ditch running south to Ditch 2</li> <li>◆ Plug 80 ft from mouth, in good condition, overgrown with <i>Phragmites</i>; water level at high tide was 10 ft below top of plug.</li> </ul>
Ditch 2	Starting at the easternmost end:
	<ul style="list-style-type: none"> <li>◆ Muskrat mound in small ditches between Ditch 2 and Ditch 3</li> <li>◆ Ditch 6 ft wide at mouth, heavy <i>Phragmites</i> on edges</li> <li>◆ Second plug in poor condition</li> <li>◆ Looking east from second plug, the ditch is straight and edges are dominated by heavy <i>Phragmites</i>; no berm</li> <li>◆ Ditch is 4 ft wide at point of intersection with north-south ditch from Ditch 1</li> <li>◆ Ditch ends 100 ft east of intersection; no distinct end, it trails off into <i>Phragmites</i>, approximately 300 ft from the tree line</li> </ul>
Ditch 3	Starting at the westernmost end:
	<ul style="list-style-type: none"> <li>◆ Terminus in heavy <i>Phragmites</i></li> <li>◆ Ditch is straight; no berm, filled with dead <i>Phragmites</i></li> <li>◆ Water flow heading east; visible from 50 ft from the eastern terminus</li> <li>◆ Ditch widens 10 ft at fish station D-2 with no distinct bank; <i>Phragmites</i> on the western portion</li> <li>◆ Ditch then narrows to 3 ft with <i>Phragmites</i> on both sides</li> <li>◆ Plug 20 ft east of D-2</li> <li>◆ Area beyond (east) plug is totally overgrown &amp; ditch is choked off</li> </ul>



Ditch 4	Starting at the easternmost end:
	<ul style="list-style-type: none"> <li>◆ Soil plug 30 ft from mouth</li> <li>◆ No berm, low banks</li> <li>◆ Water flowing towards the west during falling tide</li> <li>◆ Ditch branches out over low areas 60 ft east of plug; light <i>Phragmites</i>, <i>Distichlis spicata</i> and <i>Spartina patens</i></li> <li>◆ Terminus in <i>Phragmites</i>, approximately 70 ft from tree line</li> </ul>
Ditch 5	Starting at the westernmost end:
	<ul style="list-style-type: none"> <li>◆ Terminus distinct, trails off into heavy <i>Phragmites</i> and <i>Iva frutescens</i> 300 ft west of the tree line</li> <li>◆ Tide visibly running west</li> <li>◆ Mid section of ditch contains light <i>Phragmites</i> and <i>Iva frutescens</i> on banks</li> <li>◆ Ditch is approximately 4 ft wide</li> <li>◆ Mouth is approximately 12-15 ft wide with <i>Phragmites</i> and <i>Iva frutescens</i> on banks</li> <li>◆ No plug visible at mouth, but shrub and <i>Phragmites</i> are growing in the center of the ditch 60 ft from the mouth.</li> </ul>
Ditch 6	Starting at the easternmost end:
	<ul style="list-style-type: none"> <li>◆ Mouth is 6-7 ft in width, in heavy <i>Phragmites</i></li> <li>◆ Plug in good condition located 30 ft from mouth with <i>Phragmites</i> and <i>Iva frutescens</i> growing behind it</li> <li>◆ 120 ft east of mouth has low banks, light <i>Phragmites</i>, <i>S. patens</i> and <i>Iva frutescens</i>; ditch is 2-3 ft in width</li> <li>◆ Water flowing west</li> <li>◆ <i>Phragmites</i>, <i>S. patens</i> and <i>Iva frutescens</i> near fish station D-6; ditch is 2-3 ft wide</li> <li>◆ Terminus of ditch at fish station D-7; trails off into <i>Phragmites</i> and <i>Scirpus americanus</i></li> </ul>
Ditch 7	Starting at the westernmost end:
	<ul style="list-style-type: none"> <li>◆ Terminus of ditch in <i>Phragmites</i>, <i>S. patens</i> and <i>S. americanus</i></li> <li>◆ Water flowing west, visible 20 ft from terminus at fish station D-9</li> <li>◆ Moderate <i>Phragmites</i> cover on banks 100 ft from terminus; ditch is approximately 3 ft wide</li> <li>◆ No <i>Phragmites</i> from D-8 to 70 ft west; <i>S. patens</i>, <i>S. americanus</i>, <i>D. spicata</i> and <i>S. alterniflora</i></li> <li>◆ Heavy <i>Phragmites</i> 7- ft west of D-8; ditch is straight and approximately 4-5 ft in width</li> <li>◆ Ditch varies in width heading west as <i>Phragmites</i> density changes</li> <li>◆ Plug in moderate condition 60 ft east of mouth, approximately 3.5 ft wide,</li> </ul>

	<p>covered with <i>Phragmites</i></p> <ul style="list-style-type: none"><li>◆ Mouth of ditch is 4-5 ft wide, banks are lined with heavy <i>Phragmites</i></li></ul>
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Ditch 8	Starting at the easternmost end:
	<ul style="list-style-type: none"> <li>◆ Ditch is 10 ft wide at mouth, surrounded by heavy <i>Phragmites</i></li> <li>◆ Plug located 50 ft east of mouth; poor condition, <i>Phragmites</i> growing behind plug; evidence of muskrats</li> <li>◆ Ditch choked with <i>Phragmites</i> 100 ft southeast of T4-200; ditch is approximately 1 foot wide</li> <li>◆ Mid length of ditch there is a heavy area of <i>S. americanus</i> on north side, water flowing west</li> <li>◆ Moderate <i>Phragmites</i> on banks near mid-length of ditch; banks low</li> <li>◆ Heavy <i>Phragmites</i> near terminus; ditch is approximately 3-4 ft wide; merges with ditch running NW/SE</li> </ul>
Ditch 9	Starting at the westernmost end:
	<ul style="list-style-type: none"> <li>◆ Terminus is approximately 500 ft from the tree line, choked with <i>Phragmites</i></li> <li>◆ Water flow visible; flowing west with tide</li> <li>◆ Light <i>Phragmites</i> and <i>S. patens</i> at fish station D-10 for 80 ft on each side; no berm; ditch 1-3 ft wide</li> <li>◆ Ditch surrounded and choked by <i>Phragmites</i> from mouth to approximately 400-500 ft inland</li> <li>◆ Very narrow at points; less than 1 ft wide</li> <li>◆ Plug with board and soil 100 ft west from river; very little water (1 ½ hours before low tide)</li> <li>◆ Mouth is 2 ft wide at mouth with very low water</li> <li>◆</li> </ul>
Ditch 10	Starting from the easternmost end:
	<ul style="list-style-type: none"> <li>◆ Eastern plug in poor shape; moderately holding water 60 ft from junction with small pool 10 ft in diameter</li> <li>◆ Ditch turns south towards D-10; surrounded by dense <i>Phragmites</i></li> <li>◆ Light <i>Phragmites</i> with <i>S. patens</i> and <i>S. alterniflora</i> from plug to 300 ft east; ditch narrows to 2-3 ft wide</li> <li>◆ Ditch becomes choked with <i>Phragmites</i></li> <li>◆ D-10 exits <i>Phragmites</i> to east out of Area 1</li> </ul>
Ditch 11	Starting at the easternmost end:
	<ul style="list-style-type: none"> <li>◆ Mouth to plug is 25 yards; ditch is approximately 3 ft wide</li> <li>◆ Approximately 75 yards west <i>Iva frutescens</i> and <i>Phragmites</i> dominate both sides of the ditch</li> <li>◆ Small ditch connects Ditch 11 to southern portion of tidal creek 100 yards west</li> <li>◆ Short <i>Phragmites</i> and <i>S. americanus</i> between D-11 and tidal creek</li> </ul>

	<ul style="list-style-type: none"> <li>◆ 200 yards off from Carmans a berm begins on the northern side of the ditch</li> <li>◆ 300 yards west <i>Phragmites</i> is on the both sides; large strand of <i>Phragmites</i> on south side with small berm</li> <li>◆ East plug is approximately 25 yards from east tidal creek; about 8 ft in length</li> </ul>
Ditch 12	Starting from the westernmost end:
	<ul style="list-style-type: none"> <li>◆ Ditch is 2-3 ft wide</li> <li>◆ Areas of <i>S. alterniflora</i> and <i>S. americanus</i> vegetation community surrounded by <i>Phragmites</i></li> <li>◆ Ditch trails off into heavy <i>Phragmites</i>; 120 ft west of tree line</li> </ul>



Photographs of various ditches in Area 1

**AREA 2**

Ditch 1	<p>Starting at easternmost end:</p> <ul style="list-style-type: none"> <li>◆ Terminus at tidal creek; 50 ft in diameter</li> <li>◆ Large plug approximately 100 ft from terminus; 25 ft long; good condition</li> <li>◆ Ditch width is 18-24 in, with clumps of <i>S. patens</i> vegetation</li> <li>◆ Berm on north side of ditch from tidal creek heading west</li> <li>◆ Ditch opens up to a 10 ft wide, 30 ft long pool with vegetation clumps; 40 yd from D-1, 100 yd from tidal creek</li> <li>◆ <i>Phragmites</i> on east end of ditch for 30 yd</li> <li>◆ <i>Phragmites</i> on south side of ditch, 120 yd east of tidal creek; <i>S. americanus</i> and <i>S. patens</i> on north side of ditch for 40 yd; berm on south side</li> <li>◆ Vegetation turns to <i>S. patens</i> on north side, 35 yd from <i>S. americanus</i> edge; <i>Phragmites</i> thinning out on south side</li> <li>◆ Light <i>Phragmites</i> on both sides; ditch width is 2-3 ft wide</li> <li>◆ Berm on south side; <i>Iva frutescens</i> present</li> <li>◆ Edges become more winding</li> <li>◆ <i>Phragmites</i> ends on both sides; 40 yd west of mouth on south side becomes mostly <i>S. patens</i>; 20 yd west of mouth on north side mostly <i>S. americanus</i></li> <li>◆ Failed plug 10 yd east of mouth</li> <li>◆ Small <i>Phragmites</i> community on north side 10-15 yd east of mouth; intermix vegetative community on south side</li> </ul>
Ditch 2	<p>Starting at the westernmost end:</p> <ul style="list-style-type: none"> <li>◆ Very wide mouth</li> <li>◆ <i>Phragmites</i> on south side of mouth; north side is tall-form <i>S. alterniflora</i>, leading into <i>Phragmites</i></li> <li>◆ <i>Phragmites</i> ends 30 yd west of mouth</li> <li>◆ <i>S. patens</i>, <i>S. alterniflora</i> and <i>Pluchea purpurascens</i> on both sides; ditch width is 2-3 ft wide</li> <li>◆ Ditch curves toward north</li> <li>◆ Berm on north side</li> <li>◆ Plug 30 yd from mouth near D-2; good condition</li> <li>◆ Ditch curving towards the south</li> <li>◆ Ditch width increases after plug to 35 in for approximately 50 yd (hour-glass shape)</li> <li>◆ <i>Phragmites</i> choked off ditch west of eastern plug</li> <li>◆ Plug 30 yd from tidal creek; <i>S. alterniflora</i>, <i>S. americanus</i> and <i>Iva frutescens</i></li> </ul>

Ditch 3	Starting at the easternmost end:
	<ul style="list-style-type: none"> <li>◆ Western plug 5 ft long 20 yd from tidal creek; <i>S. patens</i> and <i>S. alterniflora</i> from plug to tidal creek; no linear ditch</li> <li>◆ <i>Phragmites</i> on both sides 30 yd west of tidal creek for 20 yd</li> <li>◆ Water flowing from east to west</li> <li>◆ Berms on south side 100 yd from <i>Phragmites</i> heading west</li> <li>◆ Western plug 30 yd from Carmans River; moderately working; ditch width at 48 in east of plug</li> <li>◆ Ditch opens up to a pool on the north and south side surrounded by <i>Phragmites</i> 10 yd west of the plug</li> </ul>
Ditch 4	Starting at the westernmost end:
	<ul style="list-style-type: none"> <li>◆ Mouth 10 yd wide; cone shaped, narrowing down to 36 in ditch</li> <li>◆ Western plug 30 yd from mouth; moderately working</li> <li>◆ 10 in diameter pool 5 yd west of plug</li> <li>◆ 2 small pools 50 yd east of mouth; 5 ft in diameter</li> <li>◆ Ditch opens up to 5 ft diameter pool 75 yd east of mouth</li> <li>◆ Monotypic <i>Phragmites</i> stand on both sides of ditch; 175 yd east of mouth</li> <li>◆ <i>S. patens</i> and <i>S. alterniflora</i> on both sides of ditch for a distance of 165 yd heading east</li> <li>◆ Plug 50 yd from end of <i>Phragmites</i> stand</li> <li>◆ Ditch width east of plug is 36 in for 15 yd, then tapering off to 24 in wide</li> <li>◆ East plug 15 yd west of tidal creek in <i>Phragmites</i>; 10 yd long; working; small pool on east end</li> <li>◆ Berm on south side</li> </ul>
Ditch 5	Starting at the easternmost end:
	<ul style="list-style-type: none"> <li>◆ Eastern plug 18 yd from tidal creek; 4 ft x 4 ft; failed</li> <li>◆ Mouth opens up and branches out naturally; short form <i>S. alterniflora</i> vegetation</li> <li>◆ Water flow from west to east</li> <li>◆ West side of plug opens up to a small pool</li> <li>◆ Ditch width is 48 in</li> <li>◆ Monoculture of short form <i>S. alterniflora</i> on both sides of ditch, 50 yd west of plug</li> <li>◆ Ditch tapers off from 36 in to 48 in</li> <li>◆ <i>S. alterniflora</i> and <i>S. patens</i> mix 150 yd west of plug; <i>S. patens</i> dominating south side; <i>S. alterniflora</i> on north side of ditch</li> <li>◆ Middle plug 200 yd from previous plug; 6 ft long; working</li> <li>◆ Ditch 18 in wide</li> </ul>

	<ul style="list-style-type: none"> <li>◆ 100 yd west of plug water flow is from east to west</li> <li>◆ North edge of ditch becomes <i>S. americanus</i> and <i>S. alterniflora</i> mix into <i>Phragmites</i></li> <li>◆ 135 yd from middle plug, <i>Phragmites</i> dominates both sides of ditch</li> <li>◆ Ditch linear; width from 18 in to 5 ft</li> <li>◆ Western plug; failed</li> <li>◆ Water flow near plug is from east to west</li> <li>◆ Mouth is 25 yd wide</li> </ul>
Ditch 6	Starting at the westernmost end:
	<ul style="list-style-type: none"> <li>◆ Mouth 15 yd wide; tapers off to a 20 in ditch 25 yd east of mouth</li> <li>◆ <i>S. alterniflora</i> on the north and south sides of ditch</li> <li>◆ Tall and short form <i>S. alterniflora</i> with <i>Iva frutescens</i> on the north side of ditch, approximately 25 yd east of mouth; south side is short form <i>S. alterniflora</i></li> <li>◆ Western plug is 45 yd east of mouth; 6 ft long, 30 in wide; working</li> <li>◆ Second plug 125 yd east of mouth, 5 ft long, 30 in wide</li> <li>◆ <i>S. patens</i> on north side for 30 yd</li> <li>◆ Small <i>Phragmites</i> stand with <i>S. americanus</i>, <i>S. patens</i> and short form <i>S. alterniflora</i> 220 yd east of mouth</li> <li>◆ Plug 240 yd east of mouth; 10 ft long; working</li> <li>◆ Eastern plug 270 yd from western plug; working; evidence of muskrats</li> <li>◆ Ditch width 4-5 ft; water flow from west to east</li> <li>◆ Tidal creek 20 yd from eastern plug</li> </ul>
Ditch 7	Starting at the easternmost end:
	<ul style="list-style-type: none"> <li>◆ 10 yd west of tidal creek <i>Iva frutescens</i> on north side, <i>Phragmites</i> on south side</li> <li>◆ Eastern plug 6 ft wide, 10 ft long covered with <i>Iva frutescens</i></li> <li>◆ Short form <i>S. alterniflora</i> and <i>S. patens</i> mix on both sides 40 yd west of plug</li> <li>◆ Ditch width is 30 in wide; water flowing from west to east</li> <li>◆ 15 yd stand of <i>Phragmites</i> on both sides 80 yd west of tidal creek</li> <li>◆ 20 yd of <i>S. patens</i> west of <i>Phragmites</i> stand</li> <li>◆ 20 yd of <i>Phragmites</i> west of <i>S. patens</i></li> <li>◆ Ditch linear; 24 in wide for most of ditch length</li> <li>◆ Western plug 190 yd west from tidal creek</li> <li>◆ Mouth 10 ft wide; 15 yd from western plug</li> </ul>

Ditch 8	Starting at the westernmost end:
	<ul style="list-style-type: none"><li>◆ Mouth of ditch is 7 yd wide, tapering off to a 3 ft ditch</li><li>◆ Western plug is 20 yd east of mouth; 4 ft long x 30 in wide; working</li><li>◆ <i>S. patens</i> and <i>S. alterniflora</i> mix on both sides of ditch 50 yd east of plug</li><li>◆ Eastern plug is 3 yd west of tidal creek; 8 ft long x 24 in wide</li></ul>



Ditch 9	Starting at the easternmost end:
	<ul style="list-style-type: none"> <li>◆ Eastern plug is 5 yd from tidal creek; 8 ft long, blends into marsh surface</li> <li>◆ Ditch width is 30 in</li> <li>◆ Short form <i>S. alterniflora</i> and <i>S. patens</i> mix on both sides of ditch</li> <li>◆ Western plug is 6 ft long x 30 in wide; 15 yd from mouth</li> <li>◆ Mouth is 12 ft wide</li> </ul>
Ditch 10	Starting at the westernmost end:
	<ul style="list-style-type: none"> <li>◆ Mouth is 8 ft wide</li> <li>◆ Western plug is 10 yd east of mouth</li> <li>◆ <i>S. patens</i> and <i>S. alterniflora</i> on north and south sides of ditch</li> <li>◆ Western plug is 4 ft long x 5 ft wide; 25 yd west of tidal creek</li> </ul>
Ditch 11	Starting at the easternmost end:
	<ul style="list-style-type: none"> <li>◆ Eastern plug is 5 yd west of tidal creek; 5 ft long x 30 in wide</li> <li>◆ Ditch width is 30 in</li> <li>◆ Western plug is 20 yd west of eastern plug; 5 ft long x 30 in wide</li> <li>◆ Short form <i>S. alterniflora</i> and <i>S. patens</i> mix on north and south sides of ditch</li> <li>◆ Mouth is 11 ft wide</li> </ul>



Photographs of various ditches in Area 2

**AREA 3**

Ditch 1	Starting at easternmost end:
	<ul style="list-style-type: none"> <li>◆ Terminus of ditch is 70 ft east of fish station D-1; heavy <i>Phragmites</i> on south side; <i>Iva frutescens</i>, <i>S. alterniflora</i> and <i>S. americanus</i> on north side</li> <li>◆ Ditch 2.5 ft wide</li> <li>◆ <i>Phragmites</i> on both sides west of D-1</li> <li>◆ Ditch narrows to less than 1 ft wide 60 ft west of D-1; <i>Phragmites</i> choking off ditch</li> <li>◆ <i>S. alterniflora</i> and <i>S. americanus</i> for 180 ft</li> <li>◆ Ditch curves slightly and varies between 2-4 ft wide with <i>Phragmites</i> on the north side and <i>S. patens</i>, <i>S. alterniflora</i> and <i>Iva frutescens</i> on the south side for 60 ft</li> <li>◆ Vegetation changes to <i>Phragmites</i> on both sides of ditch; ditch curves slightly south</li> <li>◆ Plug 30 ft east of mouth; 4 ft wide; moderately working</li> <li>◆ Mouth in heavy <i>Phragmites</i>; 60 ft west of fish station D-2; ditch width is 1 ft wide</li> </ul>
Ditch 2	Starting at the westernmost end:
	<ul style="list-style-type: none"> <li>◆ Mouth of ditch is 4-5 ft wide; <i>S. alterniflora</i> and <i>S. patens</i> mix on both sides with some light <i>Phragmites</i> and <i>P. purpurascens</i> for a length of 150 ft</li> <li>◆ Plug 50 ft east of mouth</li> <li>◆ Water flowing from east to west</li> <li>◆ Vegetation changes to <i>Phragmites</i> on both sides with <i>Iva frutescens</i>; ditch narrows to 3 ft wide for a distance of 45 ft to D-3, <i>Phragmites</i> choking ditch</li> <li>◆ Ditch is 2.5 ft wide at D-3 with <i>S. patens</i>, <i>S. americanus</i> and <i>Phragmites</i> on both sides for 180 ft (between D-3 and D-4)</li> <li>◆ <i>Phragmites</i> choking ditch east of D-3 for 300 ft</li> <li>◆ Ditch opens up to a small panne (dry at low tide) with vegetation clumps of <i>S. patens</i>, <i>Phragmites</i>, <i>Iva frutescens</i> and <i>P. purpurascens</i>; 30 ft wide</li> <li>◆ Terminus of ditch is 10 ft wide ending at eastern tidal creek; <i>Phragmites</i> on both sides</li> </ul>
Ditch 3	Starting at the easternmost end:
	<ul style="list-style-type: none"> <li>◆ Mouth of ditch is 15 ft wide</li> <li>◆ Ditch branches off to the south 50 ft west of mouth</li> <li>◆ Plug 30 ft west of mouth; 5 ft wide, covered with <i>Iva frutescens</i> and <i>Phragmites</i></li> <li>◆ <i>Iva frutescens</i>, <i>Phragmites</i>, <i>S. patens</i> on north side of ditch; <i>S. patens</i>, <i>Iva frutescens</i> and <i>P. purpurascens</i> on south side; east of fish station D-5</li> <li>◆ Ditch width is 3 ft</li> <li>◆ Between D-5 and D-6 <i>S. patens</i>, <i>S. americanus</i>, <i>P. purpurascens</i> and tall-</li> </ul>

	<p>form <i>S. alterniflora</i> on both sides of ditch; berm on south side</p> <ul style="list-style-type: none"> <li>◆ Berm on north side of ditch west of T2-00; ditch width is 1 ft</li> <li>◆ <i>Iva frutescens</i> on both sides west of D-6; ditch width is 3 ft</li> <li>◆ Plug 60 ft west of D-6; 4ft x 10 ft; working</li> <li>◆ Ditch width is 5 ft east of plug</li> </ul>
Ditch 4	Starting at the westernmost end:
	<ul style="list-style-type: none"> <li>◆ Mouth of ditch is 5 ft wide</li> <li>◆ Plug 30 ft west of mouth; 4 ft x 10 ft; working</li> <li>◆ Ditch width east of plug is 3 ft wide</li> <li>◆ Ditch intersects small ditch on north side, 360 ft east of plug (between D-7 and D-8)</li> <li>◆ <i>S. patens</i>, <i>P. purpurascens</i>, and <i>S. americanus</i> on both sides of ditch; berm on south side</li> <li>◆ <i>Phragmites</i> 480 ft east of plug on south side</li> <li>◆ <i>Phragmites</i> on both sides east of D-8</li> <li>◆ Changing to <i>Phragmites</i> and <i>Iva frutescens</i> community on the south side; ditch becoming choked off by <i>Phragmites</i></li> <li>◆ Water flowing from west to east</li> <li>◆ Ditch opens up to 20 ft wide towards the south side for 15 ft long, narrowing back down to 2 ft wide</li> <li>◆ Heavy <i>Phragmites</i> 100 ft west of mouth</li> <li>◆ Plug 40 ft west of mouth; 4 ft x 10 ft; widening to 6 ft; evidence of muskrats</li> <li>◆ Mouth of ditch is 6 ft wide</li> </ul>
Ditch 5	Starting at the easternmost end:
	<ul style="list-style-type: none"> <li>◆ Eastern terminus of ditch is 5 ft wide</li> <li>◆ Plug 40 ft west of mouth; 4 ft x 10 ft; working</li> <li>◆ <i>Iva frutescens</i> and <i>Phragmites</i> on both sides for 150 ft west of mouth</li> <li>◆ Vegetation changes to <i>S. patens</i>, <i>P. purpurascens</i>, <i>S. alterniflora</i> and <i>S. americanus</i> 200 ft west of mouth; berm on south side; ditch width is 3 ft</li> <li>◆ Ditch widens to 4 ft wide 300 ft west of <i>Iva frutescens</i> and <i>Phragmites</i> stand</li> <li>◆ Plug 50 ft east of mouth; 5 ft x 10 ft</li> <li>◆ Ditch widens to 5-10 ft wide east of plug</li> <li>◆ <i>Iva frutescens</i> and tall-form <i>S. alterniflora</i> west of plug</li> <li>◆ Mouth of ditch is 4 ft wide</li> </ul>

Ditch 6	Starting at the westernmost end:
	<ul style="list-style-type: none"> <li>◆ Mouth of ditch is 6 ft wide</li> <li>◆ Plug 40 ft east of mouth; 10 ft x 2 ft; covered with tall-form <i>S. alterniflora</i>, <i>Phragmites</i> and <i>Iva frutescens</i></li> <li>◆ Ditch width is 2.5 ft east of plug</li> <li>◆ Short-form <i>S. alterniflora</i> vegetation for the length of the ditch; berm on south side; ditch width is 5 ft</li> <li>◆ Plug 40 ft west of terminus; 3 ft x 4 ft; covered with <i>Iva frutescens</i></li> <li>◆ Eastern terminus is 5 ft wide</li> </ul>



Photographs of various ditches in Area 3

### 3.2 Sedimentation

To quantify surface deposition on the marsh surface, marker horizons were established. Feldspar clay was chosen for the marker in this project because it is easily distinguishable from the surrounding sediment and forms a cohesive layer once wetted.

In October, marker horizons were placed at the 88 stations on the marsh surface. The marker horizons were positioned 2 m southeast from the monitoring well at each station. This location relative to the wells was chosen because it was generally away from station-to-station pathways, and yet close enough to a defined point that the horizon should be locatable in the future. Each marker horizon plot was arranged using a 30 cm circular frame. Feldspar was sprinkled directly on the marsh surface until the area within the frame was completely covered, approximately 2 cm in depth. All marker horizon locations were documented and flagged. Assistance with the marker horizons was provided by Steve Goodbred's Laboratory, MSRC.

### 3.3 Water Table Height

Water table measurements have been collected using the 88 temporary groundwater monitoring wells in all four marsh areas, following USFWS/USGS protocols (James-Pirri et al., 2002). The monitoring wells are constructed of 4 cm PVC pipes, 70 cm in length. 60 cm of the wells are installed below the marsh surface. Holes were drilled into the pipe to allow water to percolate into the well. The top 10 cm of the pipe was left intact to prevent surface water from entering the well. The wells were capped with PVC caps.

When measuring the height of the water table, a meter stick was inserted into the well until the stick came into contact with the water in the well. The measurement from the top of the meter stick was recorded. The height of the well from the marsh surface was also recorded to determine if the well had moved from the previous sampling period. The height of the well from the marsh surface was subtracted from the total distance of the top of the well casing to the water level and recorded (Water Table Depth). These measurements are recorded in the Salinity & Water Table Measurements table on page 84.

#### **IV. Chemical Parameters**

##### **4.1 Water Quality Monitoring in Ditches**

At each of the fish stations, beginning in October, hand-held YSI multi-parameter and pH meters were used to collect salinity, temperature, conductivity, pH, and dissolved oxygen concentrations measurements using the USFWS/USGS protocols (James-Pirri et al., 2002).

##### **4.2 Ditch Salinity Surveys**

Salinity was measured along the mosquito ditches in November using a YSI meter in accordance with USFWS/USGS protocols (James-Pirri et al., 2002). Measurements were taken every 30 to 50 m, depending on the length of the ditch. They will be repeated at intervals throughout the winter. These measurements may also help identify fresh water influxes. Ditch salinity measurements were completed for Areas 1, 2, and 3.



**TABLE 4.1 CHEMICAL PARAMETERS**

<b>Parameter</b>	<b>Responsible Party</b>	<b>Assisting Parties</b>	<b>Locations</b>	<b>Frequency</b>	<b>Technique</b>	<b>Actions to Date</b>
Carmans River WQ	SCDHS		4 stations	Quarterly (not before Oct)	Std.; full SCDHS parameter list	3 rounds completed
Salinity, T, Cond., pH, DO	SCDHS	DU	Deep portions of ditches	Rotate on bi-weekly basis	YSI continuous sondes (may deploy several)	Not completed; discussed moving to river edge
Ditch salinity surveys	DU	SCDHS	All ditches	At least once, more is better	Every 50 m or so, measure salinity in ditch	Areas 1 ,2, 3 completed
Water table/pore water salinity	DU		All transect stations (88)	every 10-14 days	YSI meter	6 rounds completed in Areas 1 & 4; 5 rounds completed in Areas 2 & 3
WQ parameters (Sal, T, Cond, pH, DO)	SCDHS	DU	All fish stations (40)	~ Bi-weekly but rotate through tidal cycles	YSI meter plus pH meter	5 rounds completed
Larvicide presence/time series	DU	SCDHS	1 puddle per area, 1 close ditch point	Once	SCDHS SVOCs; take one sample before application, 1 sample w/i 1-2 hrs, 1 sample 2 days later	Not achieved

**TABLE 4-3 WATER QUALITY MONITORING IN DITCHES**

AREA	DATE	TIME	STATION	pH	TEMP C	DO	SALINITY	TIDAL STAGE/REMARKS
AREA 1	10/16/2003	1155	D-1	6.5	15.6	2.6	14.8	Low, Beginning of flood
	10/16/2003	1150	D-2	6.6	14.6	0.5	14.0	
	10/16/2003	1145	D-3	6.4	13.9	0.2	12.4	
	10/16/2003	1140	D-4	6.7	15.4	7.4	16.0	
	10/16/2003	1130	D-5	6.5	14.7	1.3	4.9	
	10/16/2003	1143	D-6	6.4	15.8	1.1	15.9	
	10/16/2003	1150	D-7	6.0	16.1	7	17.6	
	10/16/2003	1137	D-8	6.4	14.3	2.2	16.6	
	10/16/2003	1155	D-9	6.1	15.4	5.2	16.9	
	10/16/2003	1130	D-10	6.4	13.9	4.7	18.7	
AREA 2	10/16/2003	1235	D-1	6.1	13.6	3.8	19.6	
	10/16/2003	1240	D-2	6.6	13.3	4.5	20.2	
	10/16/2003	1230	D-3	6.6	14	3.9	18.6	
	10/16/2003	1250	D-4	6.0	14.5	5.2	19.9	
	10/16/2003	1252	D-5	5.9	16.4	3.2	20.5	
	10/16/2003	1255	D-6	6.0	14.5	too shallow	22.6	
	10/16/2003	1300	D-7	5.9	13.9	0.9	23.6	
	10/16/2003	1303	D-8	5.9	16.6	2.4	25.1	
	10/16/2003	1306	D-9	5.9	13.9	4.9	25.6	
	10/16/2003	1310	D-10	5.8	14.9	5.7	25.3	
AREA 3	10/16/2003	1220	D-1	6.4	13.6	5.3	14.6	
	10/16/2003	1225	D-2	6.3	13.6	5.5	9.1	
	10/16/2003	1235	D-3	6.5	14.3	4.1	15.9	
	10/16/2003	1240	D-4	6.4	14.6	4.6	16.2	
	10/16/2003	1245	D-5	6.4	14.5	1.9	17.5	
	10/16/2003	1230	D-6	6.5	15.5	3.7	19.9	
	10/16/2003	1253	D-7	6.5	14.4	2.5	22.4	
	10/16/2003	1250	D-8	6.5	15.3	5	19.9	
	10/16/2003	1255	D-9	6.6	15.6	0.2	18.2	
	10/16/2003	1300	D-10	6.9	12.8	4.5	26.4	
AREA 4	10/16/2003	1040	D-1	6.6	12.0	4.0	25.8	
	10/16/2003	1030	D-2	6.9	14.1	3.8	21.5	
	10/16/2003	1047	D-3	6.5	13.1	4.9	20.4	
	10/16/2003	1020	D-4	6.4	12.5	5.3	19.0	
	10/16/2003	1025	D-5	6.0	12.6	1.1	14.7	
	10/16/2003	1015	D-6	5.9	12.9	2.3	14.2	
	10/16/2003	1040	D-7	5.5	13.0	1.3	11.1	
	10/16/2003	1035	D-8	6.3	12.7	3.8	10.6	
	10/16/2003	1015	D-9	6.8	13.3	7.7	20.3	
	10/16/2003	1100	D-10	6.4	13.8	5.6	22.9	



AREA	DATE	TIME	STATION	pH	TEMP C	DO	SALINITY	TIDAL STAGE/REMARKS
AREA 1	10/27/2003	1445	D-1	6.8	15.5	5.7	6.5	High, Beginning of ebb
	10/27/2003	1440	D-2	7.0	14.7	6.9	8.0	
	10/27/2003	1435	D-3	7.0	14.6	6.9	9.6	
	10/27/2003	1430	D-4	6.9	15.5	6.7	8.5	
	10/27/2003	1425	D-5	6.9	14.9	6.7	10.0	
	10/27/2003	1430	D-6	7.1	15.2	6.6	11.0	
	10/27/2003	1424	D-7	7.2	15.5	4.9	7.0	
	10/27/2003	1432	D-8	7.1	14.6	7.2	11.4	
	10/27/2003	1420	D-9	6.9	14.8	6.9	11.6	
	10/27/2003	1436	D-10	6.9	15.2	3.3	7.3	
AREA 2	10/27/2003	1240	D-1	6.9	14.8	4.5	9.9	water flowing up-ditch (away from river)
	10/27/2003	1230	D-2	7.3	14.8	7.5	9.2	
	10/27/2003	1242	D-3	6.9	13.0	2.6	14.9	
	10/27/2003	1220	D-4	7.0	14.9	8.2	10.3	
	10/27/2003	1216	D-5	7.1	14.8	9.5	9.7	
	10/27/2003	1215	D-6	7.2	14.9	8.7	11.0	
	10/27/2003	1210	D-7	7.4	14.8	9.4	11.4	
	10/27/2003	1205	D-8	7.1	14.6	5.5	15.8	
	10/27/2003	1200	D-9	7.0	14.3	4.7	17.5	
	10/27/2003	1155	D-10	7.1	14.8	7.7	16.5	
AREA 3	10/27/2003	1140	D-1	6.6	15.3	2.0	7.6	
	10/27/2003	1145	D-2	7.1	14.4	8.4	10.1	
	10/27/2003	1150	D-3	7.1	14.7	8.3	9.3	
	10/27/2003	1225	D-4	7.0	15.0	7.1	5.6	
	10/27/2003	1220	D-5	7.4	14.8	9.1	10.5	
	10/27/2003	1155	D-6	6.7	14.9	7.4	10.7	
	10/27/2003	1200	D-7	6.7	14.6	3.8	11.5	
	10/27/2003	1215	D-8	7.2	14.8	7.7	9.6	
	10/27/2003	1205	D-9	6.8	15.0	6.5	10.3	
	10/27/2003	1210	D-10	6.9	14.7	4.4	17.4	
AREA 4	10/27/2003	1335	D-1	6.8	15.3	1.9	17.7	
	10/27/2003	1331	D-2	6.9	15.0	3.3	17.8	
	10/27/2003	1326	D-3	7.5	14.0	7.4	23.4	
	10/27/2003	1325	D-4	7.2	14.4	6.6	19.8	
	10/27/2003	1330	D-5	7.1	14.0	6.5	19.7	
	10/27/2003	1320	D-6	6.8	14.4	6.2	18.3	
	10/27/2003	1340	D-7	5.9	14.8	0.6	2.5	
	10/27/2003	1335	D-8	7.1	14.2	5.7	16.5	
	10/27/2003	1325	D-9	7.1	15.0	6.4	21.6	
	10/27/2003	1341	D-10	7.0	15.0	4.5	17.5	

AREA	DATE	TIME	STATION	pH	TEMP C	DO	SALINITY	TIDAL STAGE/REMARKS
AREA 1	11/24/2003	1220	D-1	7.4	8.6	8.9	14.5	End of flood
	11/24/2003	1215	D-2	7.5	9.7	8.5	20.3	
	11/24/2003	1210	D-3	7.6	10.0	8.4	24.0	
	11/24/2003	1205	D-4	7.5	10.1	9.6	20.4	
	11/24/2003	1200	D-5	7.7	10.0	8.9	24.2	
	11/24/2003	1152	D-6	6.3	9.9	8.9	26.3	
	11/24/2003	1154	D-7	6.2	8.4	8.2	18.0	
	11/24/2003	1156	D-8	7.0	9.8	8.8	23.5	
	11/24/2003	1210	D-9	6.2	10.0	8.6	24.1	
	11/24/2003	1150	D-10	7.2	8.3	8.4	17.8	
AREA 2	11/24/2003	1115	D-1	6.8	8.9	8.8	24.1	
	11/24/2003	1118	D-2	6.9	9.5	8.5	23.5	
	11/24/2003	1120	D-3	6.7	9.6	5.8	23.4	
	11/24/2003	1108	D-4	6.4	9.8	8.8	25.5	
	11/24/2003	1058	D-5	6.5	9.4	8.8	24.8	
	11/24/2003	1056	D-6	6.3	8.5	9.1	25.7	
	11/24/2003	1051	D-7	6.5	10.2	9.1	26.6	
	11/24/2003	1046	D-8	8.6	10.2	8.7	26.6	
	11/24/2003	1041	D-9	8.7	10.0	9.0	26.6	
	11/24/2003	1035	D-10	8.9	10.1	8.9	26.6	
AREA 3	11/24/2003	1105	D-1	7	6.6	4.3	11.0	
	11/24/2003	1100	D-2	7.5	9.7	8.7	24.3	
	11/24/2003	1035	D-3	7.4	9.3	8.0	22.8	
	11/24/2003	1015	D-4	6.7	8.6	5.4	14.2	
	11/24/2003	1020	D-5	7.3	9.3	8.0	21.7	
	11/24/2003	1050	D-6	7.7	9.9	8.8	24.6	
	11/24/2003	1045	D-7	7.6	9.7	8.7	24.4	
	11/24/2003	1025	D-8	7.3	7.9	7.4	18.0	
	11/24/2003	1030	D-9	7.3	9.2	8.4	23.3	
	11/24/2003	1035	D-10	7.7	9.4	9.1	24.2	
AREA 4	11/24/2003	0936	D-1	7.7	6.0	7.1	20.1	
	11/24/2003	0943	D-2	7.9	8.7	7.6	23.9	
	11/24/2003	0950	D-3	8.3	9.8	8.3	26.3	
	11/24/2003	0950	D-4	7.3	9.5	8.2	24.0	
	11/24/2003	0955	D-5	7.3	8.6	7.6	21.7	
	11/24/2003	0930	D-6	6.5	6.3	6.4	3.3	
	11/24/2003	0940	D-7	6.7	6.1	4.2	9.5	
	11/24/2003	0955	D-8	6.6	7.6	1.4	1.9	
	11/24/2003	0930	D-9	7.6	6.8	1.6	23.2	
	11/24/2003	0955	D-10	7.8	8.0	8.0	21.8	

AREA	DATE	TIME	STATION	pH	TEMP C	DO	SALINITY	TIDAL STAGE/REMARKS
AREA 1	12/12/2003	1135	D-1	6.6	4.4	3.9	14.6	Middle of flood
	12/12/2003	1140	D-2	6.7	4.7	5.2	10.9	
	12/12/2003	1145	D-3	7.0	4.5	10.3	4.1	
	12/12/2003	1150	D-4	6.8	4.8	8.7	12.3	
	12/12/2003	1155	D-5	6.8	4.8	6.2	14.5	
	12/12/2003	1140	D-6	6.8	4.0	5.3	16.5	
	12/12/2003	1143	D-7	6.8	5.0	4.2	15.6	
	12/12/2003	1148	D-8	6.9	4.3	8.0	12.1	
	12/12/2003	1150	D-9	6.9	5.6	7.8	11.7	
	12/12/2003	1135	D-10	6.9	4.1	7.8	13.0	
AREA 2	12/12/2003	1055	D-1	7.0	3.4	5.2	18.9	
	12/12/2003	1050	D-2	6.9	3.5	6.7	17.3	
	12/12/2003	1100	D-3	6.9	3.9	4.4	15.3	
	12/12/2003	1045	D-4	7.0	3.6	7.5	17.8	
	12/12/2003	1040	D-5	7.0	3.4	8.4	23.6	
	12/12/2003	1035	D-6	6.7	3.0	5.0	23.7	
	12/12/2003	1030	D-7	6.8	3.0	too shallow	24.9	
	12/12/2003	1025	D-8	7.3	2.3	8.3	24.2	
	12/12/2003	1020	D-9	7.8	2.5	9.8	24.3	
	12/12/2003	1015	D-10	7.3	3.8	9.9	23.8	
AREA 3	12/12/2003	1045	D-1	6.9	3.7	5.5	10.1	
	12/12/2003	1040	D-2	7.1	3.7	8.0	10.3	
	12/12/2003	1035	D-3	7.0	3.7	6.9	14.7	
	12/12/2003	1000	D-4	6.9	3.2	7.6	14.8	
	12/12/2003	1005	D-5	7.0	3.4	7.6	17.8	
	12/12/2003	1030	D-6	7.1	3.6	6.0	17.4	
	12/12/2003	1025	D-7	7.2	3.1	9.1	23.3	
	12/12/2003	1010	D-8	7.0	2.9	9.1	22.9	
	12/12/2003	1015	D-9	6.8	2.8	3.9	21.2	
	12/12/2003	1020	D-10	7.1	2.8	8.9	24.3	
AREA 4	12/12/2003	0925	D-1	7.0	3.4	6.0	26.4	
	12/12/2003	0930	D-2	7.3	3.3	9.4	24.5	
	12/12/2003	0938	D-3	7.2	3.4	7.4	16.7	
	12/12/2003	0935	D-4	6.9	2.9	7.6	13.8	
	12/12/2003	0940	D-5	6.9	3.2	6.9	12.2	
	12/12/2003	0925	D-6	6.6	3.2	6.5	10.8	
	12/12/2003	0930	D-7	6.8	2.8	7.6	10.3	
	12/12/2003	0945	D-8	6.7	4.0	4.6	7.0	
	12/12/2003	0920	D-9	7.7	3.3	8.5	15.0	
	12/12/2003	0945	D-10	6.9	3.7	7.5	24.2	

AREA	DATE	TIME	STATION	pH	TEMP C	DO	SALINITY	TIDAL STAGE/REMARKS
AREA 1	12/29/2003	1122	D-1	7.2	1.5	6.2	11.7	End of ebb
	12/29/2003	1115	D-2	7.1	5.5	0.4	6.8	
	12/29/2003	1110	D-3	7.0	6.3	1.0	7.3	
	12/29/2003	1105	D-4	7.3	3.3	0.4	11.3	
	12/29/2003	1101	D-5	7.1	6.5	1.7	6.0	
	12/29/2003	1058	D-6		4.6	3.0	11.5	skim layer of ice atop
	12/29/2003	1054	D-7		1.5	too shallow	15.5	skim layer of ice atop
	12/29/2003	1050	D-8		3.9	too shallow	10.7	
	12/29/2003	1100	D-9		5.1	5.2	10.1	
	12/29/2003	1045	D-10		3.8	1.2	12.5	skim layer of ice atop
AREA 2	12/29/2003	1010	D-1		3.6	1.1	12.6	
	12/29/2003	1015	D-2		0.9	1.8	14.2	skim layer of ice atop
	12/29/2003	1020	D-3		1.9	7.3	15.3	skim layer of ice atop
	12/29/2003	1005	D-4		2.8	too shallow	15.8	
	12/29/2003	1000	D-5		1.6	1.8	14.4	
	12/29/2003	0955	D-6		1.7	0.6	17.2	skim layer of ice atop
	12/29/2003	0950	D-7		1.4	1.7	17.1	skim layer of ice atop
	12/29/2003	0945	D-8		0.8	>12	11.7	
	12/29/2003	0940	D-9		1.9	11.4	15.3	skim layer of ice atop
	12/29/2003	0935	D-10		1.8	6.2	16.7	skim layer of ice atop
AREA 3	12/29/2003	1011	D-1	7.1	0.9	1.3	11.2	
	12/29/2003	1008	D-2	7.1	4.8	5.1	7.3	
	12/29/2003	1004	D-3	7.1	2.2	2.0	10.5	
	12/29/2003	0928	D-4	7.2	0.7	3.8	11.6	
	12/29/2003	0935	D-5	7.2	3.4	0.5	9.1	
	12/29/2003	1000	D-6	7.2	4.3	1.2	12.7	
	12/29/2003	0955	D-7	7.1	2.7	0.4	14.1	
	12/29/2003	0940	D-8	7.3	1.1	0.4	12.3	
	12/29/2003	0945	D-9	7.2	1.0	0.8	14.3	
	12/29/2003	0950	D-10	7.6	2.2	14.1	14.4	
AREA 4	12/29/2003	0852	D-1		1.0	0.3	20.6	sheet of ice atop
	12/29/2003	0847	D-2		1.1	0.8	15.4	sheet of ice atop
	12/29/2003	0840	D-3		1.8	3.8	6.4	
	12/29/2003	0855	D-4	7.0	4.9	2.2	8.1	
	12/29/2003	0908	D-5	6.7	5.8	1.3	2.7	
	12/29/2003	0835	D-6	6.1	3.8	3.0	2.6	
	12/29/2003	0842	D-7	7.1	1.4	8.9	2.1	
	12/29/2003	0830	D-8	5.6	5.1	2.0	2.3	
	12/29/2003	0830	D-9		1.0	1.0	20.5	sheet of ice atop
	12/29/2003	0900	D-10		2.7	1.6	12.3	skim layer of ice atop

**TABLE 4-3 DITCH SALINITIES**

<b>AREA 1</b>	<b>Date</b>	<b>Station</b>	<b>Salinity (ppt)</b>
	11/10/2003	1-E-0	1.4
	11/10/2003	1-30	3.1
	11/10/2003	1-60	4.2
	11/10/2003	1-90	3.1
	11/10/2003	1-120	3
	11/10/2003	1-150	2.6
	11/10/2003	2-W-0	1.2
	11/10/2003	2-30	0
	11/10/2003	2-60	2.4
	11/10/2003	2-90	1.9
	11/10/2003	3-E-0	0
	11/10/2003	3-30	4.3
	11/10/2003	3-60	6.5
	11/10/2003	3-90	8.5
	11/10/2003	3-120	7.2
	11/10/2003	3-150	1.8
	11/10/2003	4-E-0	3.2
	11/10/2003	4-30	6.5
	11/10/2003	4-60	7.3
	11/10/2003	4-90	9.6
	11/10/2003	4-120	10.1
	11/10/2003	4-150	6.4
	11/10/2003	5-E-0	4.7
	11/10/2003	5-30	7.9
	11/10/2003	5-60	8.3
	11/10/2003	5-90	5.3
	11/10/2003	6-E-0	6.2
	11/10/2003	6-50	9.4
	11/10/2003	6-100	7.8
	11/10/2003	6-150	8.2
	11/10/2003	6-200	5.6
	11/10/2003	7-E-0	2.2
	11/10/2003	7-50	6.7
	11/10/2003	7-100	8.3
	11/10/2003	7-150	8
	11/10/2003	7-200	6.2
	11/10/2003	7-250	4.2
	11/10/2003	8-W-0	16
	11/10/2003	8-50	5.4
	11/10/2003	8-100	7
	11/10/2003	8-150	8.3
	11/10/2003	8-200	10.3
	11/10/2003	8-250	7.3
	11/10/2003	8-300	6.4
	11/10/2003	8-350	5.8

**AREA 1  
(cont'd)**

Date	Station	Salinity (ppt)
11/10/2003	9-W-0	4.7
11/10/2003	9-50	10.6
11/10/2003	9-100	8.1
11/10/2003	9-150	8.6
11/10/2003	9-200	8
11/10/2003	9-250	9.6
11/10/2003	9-300	10.2
11/10/2003	9-350	6.6
11/10/2003	9-365	4.9
11/10/2003	10-E-0	6.2
11/10/2003	10-15	6.9
11/10/2003	10-65	7.7
11/10/2003	10-110	9.5
11/10/2003	10-160	10.7
11/10/2003	10-210	8.8
11/10/2003	10-260	11.3
11/10/2003	10-310	5.4
11/10/2003	10-350	5.4
11/10/2003	11-W-0	13.5
11/10/2003	11-30	14.9
11/10/2003	11-80	11.3
11/10/2003	11-130	12.1
11/10/2003	11-180	12.6
11/10/2003	11-230	8
11/10/2003	11-280	5.1

<b>AREA 2</b>	<b>Date</b>	<b>Station</b>	<b>Salinity (ppt)</b>
	11/17/2003	1-E-0	11.3
	11/17/2003	1-50	11.8
	11/17/2003	1-100	11.9
	11/17/2003	1-150	12.2
	11/17/2003	1-200	12
	11/17/2003	1-250	12.5
	11/17/2003	1-300	12.6
	11/17/2003	1-350	12.8
	11/17/2003	3-375	7.7
	11/17/2003	2-W-0	7.3
	11/17/2003	2-50	15.2
	11/17/2003	2-70	14.3
	11/17/2003	2-120	14.9
	11/17/2003	2-170	13.6
	11/17/2003	2-220	12.9
	11/17/2003	2-270	12.2
	11/17/2003	2-330	13.5
	11/17/2003	3-E-0	13.2
	11/17/2003	3-10	11.9
	11/17/2003	3-60	8.4
	11/17/2003	3-110	9.4
	11/17/2003	3-160	9.5
	11/17/2003	3-210	9.9
	11/17/2003	3-260	10.5
	11/17/2003	3-310	10.9
	11/17/2003	3-370	6.6
	11/17/2003	4-W-30	14.1
	11/17/2003	4-80	14.1
	11/17/2003	4-130	13.9
	11/17/2003	4-180	14.2
	11/17/2003	4-230	14.8
	11/17/2003	4-280	15.1
	11/17/2003	4-330	14.9
	11/17/2003	4-380	14.9
	11/17/2003	4-430	12.7
	11/17/2003	5-E-0	13.9
	11/17/2003	5-50	13.8
	11/17/2003	5-100	13.7
	11/17/2003	5-160	14
	11/17/2003	5-220	15.6
	11/17/2003	5-280	14.5
	11/17/2003	5-340	14.5
	11/17/2003	5-400	14
	11/17/2003	5-460	13.5
	11/17/2003	6-W-0	15.5
	11/17/2003	6-60	15.3

AREA 2 (cont'd)	Date	Station	Salinity (ppt)
	11/17/2003	6-130	18.6
11/17/2003	6-200	22	
11/17/2003	6-270	21.1	
11/17/2003	6-340	19.1	
11/17/2003	6-410	17.6	
11/17/2003	6-480	15.4	
11/17/2003	6-550	15.1	
11/17/2003	7-W-0	17.9	
11/17/2003	7-30	16	
11/17/2003	7-60	16.4	
11/17/2003	7-90	19.1	
11/17/2003	7-120	19.9	
11/17/2003	7-150	19.1	
11/17/2003	7-190	21.3	
11/17/2003	8-W-0	23.4	
11/17/2003	8-15	20.4	
11/17/2003	8-25	20.4	
11/17/2003	8-35	20.2	
11/17/2003	8-45	19.2	
11/17/2003	8-55	18.9	
11/17/2003	8-65	18.9	
11/17/2003	9-E-0	22.3	
11/17/2003	9-10	22.4	
11/17/2003	9-20	22.3	
11/17/2003	9-30	22.3	
11/17/2003	9-40	22.5	
11/17/2003	9-50	24	
11/17/2003	10-W-0	25.9	
11/17/2003	10-10	22.2	
11/17/2003	10-20	22	
11/17/2003	10-30	22	
11/17/2003	10-40	22	
11/17/2003	11-E-0	19.1	
11/17/2003	11-10	19.2	
11/17/2003	11-20	19.3	
11/17/2003	11-30	24.2	



<b>AREA 3</b>	<b>Date</b>	<b>Station</b>	<b>Salinity (ppt)</b>
	11/10/2003	1-E-0	4.4
	11/10/2003	1-50	5.2
	11/10/2003	1-100	6.1
	11/10/2003	1-150	3.9
	11/10/2003	1-180	2.9
	11/10/2003	2-E-0	6
	11/10/2003	2-50	6.1
	11/10/2003	2-100	6.9
	11/10/2003	2-150	3.1
	11/10/2003	3-E-0	6.1
	11/10/2003	3-30	4.9
	11/10/2003	3-60	5.4
	11/10/2003	3-90	5.6
	11/10/2003	3-120	6.8
	11/10/2003	3-150	7.3
	11/10/2003	3-180	6.4
	11/10/2003	3-200	8
	11/10/2003	4-W-0	14.3
	11/10/2003	4-30	8.5
	11/10/2003	4-60	8.2
	11/10/2003	4-90	4.7
	11/10/2003	4-120	6.6
	11/10/2003	4-150	5.7
	11/10/2003	4-180	6.7
	11/10/2003	5-W-0	9.6
	11/10/2003	5-25	16.7
	11/10/2003	5-50	15.4
	11/10/2003	5-75	14.5
	11/10/2003	5-105	12
	11/10/2003	5-135	13.5
	11/10/2003	5-165	14.3
	11/10/2003	5-200	15
	11/10/2003	5-230	14.4
	11/10/2003	5-250	9.9
	11/10/2003	6-W-0	9.9
	11/10/2003	6-15	15.8
	11/10/2003	6-55	16.3
	11/10/2003	6-85	17.8
	11/10/2003	6-105	17.4
	11/10/2003	6-120	16
	11/10/2003	6-130	10.7

#### 4.3 Water Table/Pore Water Salinity

Soil water salinity was measured at all 88 stations every 10-14 days in September, October and November 2003, following the USFWS/USGS protocol (James-Pirri et al., 2002). A soil probe was used to extract water from 15 cm below the marsh surface. The soil probe is constructed of a stainless steel tubing (0.065 in inner diameter), 70 cm in length, with one end crimped and slotted to allow the entry of water. A short length of plastic tubing was attached to the opposite end of the probe. Water was drawn up through the probe by a syringe attached to the plastic tubing. Once several millimeters of water had been extracted with the probe, the depth of which the water was collected was recorded. Salinity readings were recorded by passing the extracted water through a piece of filter paper placed over the syringe nozzle onto the glass plate of a refractometer.

**TABLE 4-4 SALINITY & WATER TABLE MEASUREMENTS**

**AREA 1**

Date	Station #	Water Table Depth (cm)	Soil Salinity (ppt)	Depth of Soil Salinity (cm)
10/3/2003	1-00	1.5	14	15
10/3/2003	1-40	5.8	11	15
10/3/2003	1-80	-6.1	9	15
10/3/2003	1-120	-0.3	12	15
10/3/2003	2-120	0.7	2	15
10/3/2003	2-80	0.8	4	15
10/3/2003	2-40	-1.3	10	15
10/3/2003	2-00	-3.1	9	15
10/3/2003	3-00	5.2	5	15
10/3/2003	3-40	0.9	5	15
10/3/2003	3-80	0.8	13	15
10/3/2003	3-120	0.5	14	15
10/3/2003	3-160	-1.6	13	15
10/3/2003	3-200	-2.9	19	15
10/3/2003	4-240	-6.2	10	15
10/3/2003	4-200	-7.8	10	15
10/3/2003	4-160	-1.8	15	15
10/3/2003	4-120	-1.1	10	15
10/3/2003	4-80	-1	9	15
10/3/2003	4-40	2.6	14	15
10/3/2003	4-00	-3.3	12	15
10/3/2003	5-00	-2.3	12	15
10/3/2003	5-40	10.1	9	15
10/3/2003	5-80	-0.7	10	15
10/17/2003	1-00	0	7	15
10/17/2003	1-40	6.8	11	15
10/17/2003	1-80	-7.7	12	15
10/17/2003	1-120	-2.2	13	15
10/17/2003	2-120	1.7	14	15
10/17/2003	2-80	2.6	11	15
10/17/2003	2-40	-0.9	11	15
10/17/2003	2-00	-5.4	9	30
10/17/2003	3-00	6.2	16	15
10/17/2003	3-40	1.3	14	15
10/17/2003	3-80	1.3	13	15
10/17/2003	3-120	-0.2	15	15
10/17/2003	3-160	-1.3	12	15
10/17/2003	3-200	-1.1	12	15
10/17/2003	4-240	-5.3	14	15
10/17/2003	4-200	-4.2	15	15
10/17/2003	4-160	-1.4	14	15
10/17/2003	4-120	-2	9	15
10/17/2003	4-80	-0.8	14	15

10/17/2003	4-40	2.3	16	15
10/17/2003	4-00	0.5	13	15
10/17/2003	5-00	-1.4	15	15
10/17/2003	5-40	8.1	13	15
10/17/2003	5-80	0.2	18	15
10/31/2003	1-00	1.2	4	15
10/31/2003	1-40	-1.9	15	15
10/31/2003	1-80	-5.1	20	15
10/31/2003	1-120	-1.8	21	15
10/31/2003	2-120	4.2	17	15
10/31/2003	2-80	4.3	14	15
10/31/2003	2-40	-1.3	15	15
10/31/2003	2-00	-3.3	2	15
10/31/2003	3-00	4.6	3	15
10/31/2003	3-40	1.3	4	15
10/31/2003	3-80	1.3	16	15
10/31/2003	3-120	-0.7	14	15
10/31/2003	3-160	-1.8	18	15
10/31/2003	3-200	-6.8	8	15
10/31/2003	4-240	-4.9	10	15
10/31/2003	4-200	-5.2	11	15
10/31/2003	4-160	-2.2	13	15
10/31/2003	4-120	-0.8	14	15
10/31/2003	4-80	-1.3	11	15
10/31/2003	4-40	3.8	16	15
10/31/2003	4-00	-4.2	12	15
10/31/2003	5-00	-4.3	14	15
10/31/2003	5-40	5.9	10	15
10/31/2003	5-80	1.4	8	15
11/14/2003	1-00	1.1	6	15
11/14/2003	1-40	1.2	12	15
11/14/2003	1-80	-	14	15
11/14/2003	1-120	-0.1	11	15
11/14/2003	2-120	3.6	10	15
11/14/2003	2-80	2.8	8	15
11/14/2003	2-40	-1.1	7	15
11/14/2003	2-00	-3.3	4	15
11/14/2003	3-00	3.7	5	15
11/14/2003	3-40	-	6	15
11/14/2003	3-80	-	11	15
11/14/2003	3-120	-0.7	15	15
11/14/2003	3-160	-1.3	14	15
11/14/2003	3-200	-2.6	8	15
11/14/2003	4-240	-	9	15
11/14/2003	4-200	-3.6	13	15
11/14/2003	4-160	-2	15	15
11/14/2003	4-120	-1.3	11	15
11/14/2003	4-80	-1.2	11	15
11/14/2003	4-40	-	16	15

11/14/2003	4-00	-2.5	12	15
11/14/2003	5-00	-3.1	14	15
11/14/2003	5-40	7.4	10	15
11/14/2003	5-80	-0.5	8	15
11/24/2003	1-00	-1.3	9	15
11/24/2003	1-40	3.1	20	15
11/24/2003	1-80	4.2	13	15
11/24/2003	1-120	1.5	12	15
11/24/2003	2-120	-3.5	12	15
11/24/2003	2-80	-3.9	12	15
11/24/2003	2-40	0	13	15
11/24/2003	2-00	1.5	14	15
11/24/2003	3-00	-6.9	13	15
11/24/2003	3-40	-4.6	14	15
11/24/2003	3-80	-2.3	16	15
11/24/2003	3-120	-0.1	14	15
11/24/2003	3-160	1.2	13	15
11/24/2003	3-200	-1.1	11	15
11/24/2003	4-240	6.7	12	15
11/24/2003	4-200	3.7	14	15
11/24/2003	4-160	2.6	16	15
11/24/2003	4-120	0.9	15	15
11/24/2003	4-80	-0.2	11	15
11/24/2003	4-40	-4.9	16	15
11/24/2003	4-00	-1.2	14	15
11/24/2003	5-00	-0.2	20	15
11/24/2003	5-40	-8	14	15
11/24/2003	5-80	-0.8	5	15
12/9/2003	1-00	2.1	10	15
12/9/2003	1-40	2.5	5	15
12/9/2003	1-80	-1.4	15	15
12/9/2003	1-120	0.4	15	15
12/9/2003	2-120	6.7	14	15
12/9/2003	2-80	3	14	15
12/9/2003	2-40	0.8	12	15
12/9/2003	2-00	1.7	11	15
12/9/2003	3-00	6	14	15
12/9/2003	3-40	-4.9	12	15
12/9/2003	3-80	2.8	13	15
12/9/2003	3-120	2.3	9	15
12/9/2003	3-160	0.6	14	15
12/9/2003	3-200	0.4	10	15
12/9/2003	4-240	-0.5	13	15
12/9/2003	4-200	1	9	15
12/9/2003	4-160	1.2	11	15
12/9/2003	4-120	1.1	11	15
12/9/2003	4-80	3.1	13	15
12/9/2003	4-40	7.5	17	15
12/9/2003	4-00	4.3	13	15

12/9/2003	5-00	5.6	20	15
12/9/2003	5-40	12.9	16	15
12/9/2003	5-80	4.6	9	15

\* a negative water table depth measurement denotes the water table height is below the marsh surface

**AREA 2**

Date	Station #	Water Table Depth (cm)	Soil Salinity (ppt)	Depth of Soil Salinity (cm)
10/1/2003	5-00	-10.7	23	45
10/1/2003	5-40	-6.4	14	15
10/1/2003	5-80	-1.6	10	15
10/1/2003	4-120	-4.7	15	15
10/1/2003	4-80	0.2	11	15
10/1/2003	4-40	-1.8	11	15
10/1/2003	4-00	-0.9	10	15
10/1/2003	3-00	-3.9	8	15
10/1/2003	3-40	5.5	12	15
10/1/2003	3-80	-6.9	13	15
10/1/2003	3-120	1.1	10	15
10/1/2003	3-160	-4.5	7	15
10/1/2003	3-200	-3.5	18	15
10/1/2003	2-200	-1.6	4	15
10/1/2003	2-160	-0.4	7	15
10/1/2003	2-120	4	14	15
10/1/2003	2-80	1.5	8	15
10/1/2003	2-40	7.9	12	15
10/1/2003	2-00	-1	6	15
10/1/2003	1-00	-1.1	8	15
10/1/2003	1-40	-4.4	5	15
10/1/2003	1-80	-5.8	-	15
10/1/2003	1-120	0.9	10	15
10/1/2003	1-160	-1.3	8	15
10/17/2003	5-00	-7.9	11	15
10/17/2003	5-40	-4.1	10	15
10/17/2003	5-80	-0.7	10	15
10/17/2003	4-120	-7.8	10	15
10/17/2003	4-80	-0.4	13	15
10/17/2003	4-40	-2.9	13	15
10/17/2003	4-00	-0.6	18	15
10/17/2003	3-00	-5.2	10	30
10/17/2003	3-40	5.4	17	15
10/17/2003	3-80	-6.6	8	15
10/17/2003	3-120	1.3	14	15
10/17/2003	3-160	-3.2	13	30
10/17/2003	3-200	-3.6	20	15
10/17/2003	2-200	-0.1	10	15
10/17/2003	2-160	-1.3	13	15
10/17/2003	2-120	4	15	15
10/17/2003	2-80	2.3	13	15
10/17/2003	2-40	7.3	13	15
10/17/2003	2-00	1.1	10	15
10/17/2003	1-00	0.8	4	15
10/17/2003	1-40	-3.8	16	15
10/17/2003	1-80	-4.9	13	15
10/17/2003	1-120	-0.6	11	15

10/17/2003	1-160	-4	14	15
11/3/2003	5-00	-12.3	dry	15
11/3/2003	5-40	-15.7	14	15
11/3/2003	5-80	-6.4	15	15
11/3/2003	4-120	-6	19	15
11/3/2003	4-80	-6.1	16	15
11/3/2003	4-40	-7.6	16	15
11/3/2003	4-00	-4.9	17	15
11/3/2003	3-00	-	15	15
11/3/2003	3-40	4.4	14	15
11/3/2003	3-80	-12.1	15	15
11/3/2003	3-120	-1.1	17	15
11/3/2003	3-160	-6.1	16	15
11/3/2003	3-200	-5.2	24	15
11/3/2003	2-200	-4.3	15	15
11/3/2003	2-160	-4.6	14	15
11/3/2003	2-120	3.5	18	15
11/3/2003	2-80	-0.9	19	15
11/3/2003	2-40	6.6	9	15
11/3/2003	2-00	-1	15	15
11/3/2003	1-00	-4.5	12	15
11/3/2003	1-40	-8.7	8	15
11/3/2003	1-80	-12	12	15
11/3/2003	1-120	-4.5	11	15
11/3/2003	1-160	-8.2	14	15
11/17/2003	5-00	-	.	
11/17/2003	5-40	-11.3	13	15
11/17/2003	5-80	-5.8	12	15
11/17/2003	4-120	-4.2	11	15
11/17/2003	4-80	-4.6	14	15
11/17/2003	4-40	-	13	15
11/17/2003	4-00	-3.4	9	15
11/17/2003	3-00	-5.1	10	15
11/17/2003	3-40	4.8	12	15
11/17/2003	3-80	-10	16	15
11/17/2003	3-120	-2.5	11	15
11/17/2003	3-160	-6	14	15
11/17/2003	3-200	-	18	15
11/17/2003	2-200	-2.6	15	15
11/17/2003	2-160	-5.7	13	15
11/17/2003	2-120	1.1	12	15
11/17/2003	2-80	-1	15	15
11/17/2003	2-40	5	9	15
11/17/2003	2-00	-0.2	10	15
11/17/2003	1-00	-5.1	13	15
11/17/2003	1-40	-	10	15
11/17/2003	1-80	-10.4	11	15
11/17/2003	1-120	-2.8	12	15
11/17/2003	1-160	-4.3	14	15



12/1/2003	5-00	7.2	25	15
12/1/2003	5-40	5.5	15	15
12/1/2003	5-80	1.7	13	15
12/1/2003	4-120	1	12	30
12/1/2003	4-80	1.5	14	15
12/1/2003	4-40	4.5	11	15
12/1/2003	4-00	0.7	15	15
12/1/2003	3-00	-	10	15
12/1/2003	3-40	-0.7	14	15
12/1/2003	3-80	-1.4	14	15
12/1/2003	3-120	-1.8	16	15
12/1/2003	3-160	4.4	12	15
12/1/2003	3-200	2.1	18	15
12/1/2003	2-200	1.5	13	15
12/1/2003	2-160	2.1	9	15
12/1/2003	2-120	-5.5	12	15
12/1/2003	2-80	-3.6	14	15
12/1/2003	2-40	-3.7	11	15
12/1/2003	2-00	-1.5	9	15
12/1/2003	1-00	-0.1	10	15
12/1/2003	1-40	6.1	14	15
12/1/2003	1-80	8.1	11	15
12/1/2003	1-120	1.2	13	15
12/1/2003	1-160	3.4	11	15

\* a negative water table depth measurement denotes the water table height is below the marsh surface

**AREA 3**

Date	Station #	Water Table Depth (cm)	Soil Salinity (ppt)	Depth of Soil Salinity (cm)
10/1/2003	4-00	-5.6	12	30
10/1/2003	4-40	-10	12	15
10/1/2003	4-80	-0.4	18	15
10/1/2003	4-120	0.2	6	15
10/1/2003	3-120	-10.4	4	15
10/1/2003	3-80	-2.2	9	15
10/1/2003	3-40	-1	9	15
10/1/2003	3-00	-4.5	13	15
10/1/2003	2-00	-11.4	10	15
10/1/2003	2-40	3.4	9	15
10/1/2003	2-80	-16.7	13	15
10/1/2003	2-120	-5	10	15
10/1/2003	2-160	1.9	8	15
10/1/2003	2-200	-2.3	9	15
10/1/2003	1-200	-0.2	15	15
10/1/2003	1-160	0.6	14	15
10/1/2003	1-120	-2.2	10	15
10/1/2003	1-80	-2	9	15
10/1/2003	1-40	3.5	11	15
10/1/2003	1-00	-1.2	9	15
10/16/2003	4-00	-2.5	21	15
10/16/2003	4-40	-4	15	15
10/16/2003	4-80	0.9	21	15
10/16/2003	4-120	-0.2	15	15
10/16/2003	3-120	5.3	24	15
10/16/2003	3-80	-0.4	16	15
10/16/2003	3-40	-3.7	15	15
10/16/2003	3-00	-1.7	20	15
10/16/2003	2-00	-2.1	18	15
10/16/2003	2-40	3.5	9	15
10/16/2003	2-80	9.2	17	15
10/16/2003	2-120	-0.2	13	15
10/16/2003	2-160	2.3	15	15
10/16/2003	2-200	-0.3	14	15
10/16/2003	1-200	-0.3	15	15
10/16/2003	1-160	1.8	18	15
10/16/2003	1-120	-0.6	16	15
10/16/2003	1-80	3.8	12	15
10/16/2003	1-40	3.8	9	15
10/16/2003	1-00	2.8	10	15
10/30/2003	4-00	-2.1	18	15
10/30/2003	4-40	-3.8	dry	15
10/30/2003	4-80	2.4	21	15
10/30/2003	4-120	1.1	16	15
10/30/2003	3-120	-4	22	15
10/30/2003	3-80	0.6	15	15
10/30/2003	3-40	0.6	19	15

10/30/2003	3-00	-1.2	20	15
10/30/2003	2-00	0.1	13	15
10/30/2003	2-40	1.5	14	15
10/30/2003	2-80	-13.2	11	15
10/30/2003	2-120	-1.3	10	15
10/30/2003	2-160	-	19	15
10/30/2003	2-200	-0.3	17	15
10/30/2003	1-200	-1.4	16	15
10/30/2003	1-160	2.5	16	15
10/30/2003	1-120	-0.1	15	15
10/30/2003	1-80	0.2	10	15
10/30/2003	1-40	3.4	13	15
10/30/2003	1-00	1.8	12	15
11/13/2003	4-00	-5.7	16	30
11/13/2003	4-40	-6.1	15	15
11/13/2003	4-80	-	18	15
11/13/2003	4-120	-0.2	12	15
11/13/2003	3-120	-9.5	18	15
11/13/2003	3-80	-	15	15
11/13/2003	3-40	0.4	20	15
11/13/2003	3-00	-3.4	19	15
11/13/2003	2-00	-11	17	15
11/13/2003	2-40	2.5	8	15
11/13/2003	2-80	1.1	13	15
11/13/2003	2-120	-1.5	11	15
11/13/2003	2-160	-	-	-
11/13/2003	2-200	-0.5	16	45
11/13/2003	1-200	0.3	16	15
11/13/2003	1-160	-0.5	13	15
11/13/2003	1-120	-0.3	11	15
11/13/2003	1-80	0.2	12	15
11/13/2003	1-40	-	10	15
11/13/2003	1-00	1.3	16	15
11/25/2003	4-00	-4	21	15
11/25/2003	4-40	0.2	20	15
11/25/2003	4-80	-4.6	21	30
11/25/2003	4-120	-3.1	21	15
11/25/2003	3-120	-2.6	21	15
11/25/2003	3-80	-3.2	16	15
11/25/2003	3-40	-6.3	18	15
11/25/2003	3-00	-2.8	21	15
11/25/2003	2-00	-	15	15
11/25/2003	2-40	-	17	15
11/25/2003	2-80	-7.1	15	15
11/25/2003	2-120	-	15	15
11/25/2003	2-160	-	21	15
11/25/2003	2-200	-5.2	20	15
11/25/2003	1-200	-10.6	21	15
11/25/2003	1-160	11.5	20	15

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11/25/2003	1-120	-10.1	16	15
11/25/2003	1-80	-	16	15
11/25/2003	1-40	-8.7	15	15
11/25/2003	1-00	-5.7	11	15

\* a negative water table depth measurement denotes the water table height is below the marsh surface

**AREA 4**

Date	Station #	Water Table Depth (cm)	Soil Salinity (ppt)	Depth of Soil Salinity (cm)
9/30/2003	1-00	0.7	10	15
9/30/2003	1-40	-2.2	4	15
9/30/2003	1-80	1.6	9	15
9/30/2003	1-120	-2.2	15	15
9/30/2003	1-160	-10.2	18	15
9/30/2003	2-00	-6.7	19	15
9/30/2003	2-40	0.2	17	15
9/30/2003	2-80	0.2	12	15
9/30/2003	2-120	-1.2	11	15
9/30/2003	2-160	2.6	10	15
9/30/2003	3-00	2	12	15
9/30/2003	3-40	0.4	16	15
9/30/2003	3-80	1.1	14	15
9/30/2003	3-120	-10.9	6	15
9/30/2003	3-160	7.2	12	15
9/30/2003	4-00	0.9	15	15
9/30/2003	4-40	3.9	13	15
9/30/2003	4-80	0.2	14	15
9/30/2003	4-120	0.8	3	15
9/30/2003	4-160	-2.4	9	15
10/14/2003	1-00	12	5	15
10/14/2003	1-40	0	0	15
10/14/2003	1-80	-1	14	15
10/14/2003	1-120	-7	19	15
10/14/2003	1-160	-11	21	15
10/14/2003	2-00	10	14	15
10/14/2003	2-40	-1.5	12	15
10/14/2003	2-80	-	12	15
10/14/2003	2-120	-4	29	15
10/14/2003	2-160	-1.5	21	15
10/14/2003	3-00	-0.1	10	15
10/14/2003	3-40	-	12	15
10/14/2003	3-80	-	15	15
10/14/2003	3-120	-16	8	15
10/14/2003	3-160	2.5	24	15
10/14/2003	4-00	-5	14	15
10/14/2003	4-40	0	21	15
10/14/2003	4-80	-0.5	12	15
10/14/2003	4-120	0	5	15
10/14/2003	4-160	-3.9	14	15
10/28/2003	1-00	1.3	8	15
10/28/2003	1-40	2.4	6	15
10/28/2003	1-80	-0.8	4	15
10/28/2003	1-120	-0.1	14	15
10/28/2003	1-160	6.7	13	15
10/28/2003	2-00	-	11	15
10/28/2003	2-40	-	10	30

10/28/2003	2-80	-	15	15
10/28/2003	2-120	0.9	25	15
10/28/2003	2-160	-3.6	21	15
10/28/2003	3-00	-0.5	14	15
10/28/2003	3-40	-0.9	13	15
10/28/2003	3-80	-2.1	17	15
10/28/2003	3-120	-1.9	15	15
10/28/2003	3-160	-7.1	13	15
10/28/2003	4-00	-1.1	11	15
10/28/2003	4-40	-0.6	3	15
10/28/2003	4-80	-0.5	10	15
10/28/2003	4-120	-	13	15
10/28/2003	4-160	0.3	8	15
11/11/2003	1-00	-	-	15
11/11/2003	1-40	-0.8	7	15
11/11/2003	1-80	1.1	8	15
11/11/2003	1-120	-0.2	11	15
11/11/2003	1-160	-	14	15
11/11/2003	2-00	-	19	15
11/11/2003	2-40	-2.3	18	15
11/11/2003	2-80	-	20	15
11/11/2003	2-120	-0.1	21	15
11/11/2003	2-160	0.9	13	30
11/11/2003	3-00	1.7	14	15
11/11/2003	3-40	2.3	12	15
11/11/2003	3-80	1.3	9	15
11/11/2003	3-120	1	12	15
11/11/2003	3-160	5.5	13	15
11/11/2003	4-00	-	11	15
11/11/2003	4-40	1.1	8	15
11/11/2003	4-80	-	6	15
11/11/2003	4-120	0.1	5	15
11/11/2003	4-160	3.2	11	15
11/24/2003	1-00	-0.6	12	15
11/24/2003	1-40	-	10	15
11/24/2003	1-80	-4.5	21	15
11/24/2003	1-120	-6.1	19	15
11/24/2003	1-160	-3.3	15	15
11/24/2003	2-00	-	14	15
11/24/2003	2-40	-	16	15
11/24/2003	2-80	-	19	15
11/24/2003	2-120	1.7	29	15
11/24/2003	2-160	-5	31	15
11/24/2003	3-00	-	21	15
11/24/2003	3-40	-	20	15
11/24/2003	3-80	-	19	15
11/24/2003	3-120	-	27	15
11/24/2003	3-160	-8.3	-	30
11/24/2003	4-00	-4	15	15

11/24/2003	4-40	-	25	15
11/24/2003	4-80	-7.5	14	15
11/24/2003	4-120	-	22	15
11/24/2003	4-160	-	19	15
12/9/2003	1-00	-0.4	10	15
12/9/2003	1-40	-2.2	0	15
12/9/2003	1-80	0.3	15	15
12/9/2003	1-120	1.1	16	15
12/9/2003	1-160	2.1	15	15
12/9/2003	2-00	3.9	26	15
12/9/2003	2-40	-0.4	22	15
12/9/2003	2-80	-	15	15
12/9/2003	2-120	-	14	15
12/9/2003	2-160	-	12	15
12/9/2003	3-00	2.7	20	15
12/9/2003	3-40	.	11	15
12/9/2003	3-80	.	22	15
12/9/2003	3-120	1.3	-	15
12/9/2003	3-160	7.4	25	15
12/9/2003	4-00	11.9	16	15
12/9/2003	4-40	-	20	15
12/9/2003	4-80	-0.7	11	15
12/9/2003	4-120	-	5	15
12/9/2003	4-160	0	14	15

\* a negative water table depth measurement denotes the water table height is below the marsh surface

#### 4.4 Carman's River Water Quality

In July, Suffolk County Department of Health Services (SCDHS) collected two rounds of samples at the four stations on the River. Field parameters were collected (temperature, depth, secchi disk depth, dissolved oxygen, specific conductivity, salinity and flow) in accordance with SCDHS sampling protocols (SCDHS 2003) and the water samples were analyzed for the Department's full parameter suite (water quality indicators, nutrients, metals, and organic compounds including VOCs, SVOCs, and pesticides and metabolites) (Suffolk County 2003). Monitoring will be continued on a quarterly basis.

#### 4.5 Estuarine Water Quality

Following standard SCDHS sampling protocols (SCDHS 2003), water quality samples were collected by SCDHS on July 15<sup>th</sup>, July 29<sup>th</sup>, and October 15<sup>th</sup>, 2003. The samples were analyzed by PEHL, including a standard QA/QC review. Four samples (WWR001 – WWR004) were collected within WNWR. Three samples (WWNR011, WWNR021 and WWNR022) were taken from nearby areas. WWNR011 was collected from the east side of William Floyd Parkway spur between Bayfair Court and Roneck Court; WWNR021 was collected from beach #5 in Mastic, located at the south end of Oceanview Drive; and WWNR022 was collected from the town boat ramp located on the east side of Riviera Drive. Five inorganic compounds were detected above the standard value in the samples collected within the refuge on July 15, 2003 (Table 4-5). The complete list of inorganic compounds analyzed for each sample is listed in Table 4-6.



**TABLE 4-5 CARMAN'S RIVER WATER QUALITY**

Date	Time	Station	Diurnal	Depth	Salinity	Temp	D.O.	T. Coliform	F. Coliform	NH3	NOx	TN	TDN	TP	TDP	o-PO4
				(ft)	(o/oo)	(C)	(mg/L)	(mpn/100 ml)		(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
7/15/03	7:12	WWR001	A	3.0	16.6	24.3	1.0	5,000	500	0.079	0.169	1.30	1.20	0.066	0.037	< 0.005
7/15/03	7:30	WWR002	A	1.5	6.6	21.3	2.5	< 20	9,000	0.199	0.505	1.90	1.70	0.075	0.036	< 0.005
7/15/03	7:53	WWR003	A	1.0	3.3	21.2	3.8	2,800	130	0.058	0.421	1.50	1.20	0.067	0.041	< 0.005
7/15/03	8:07	WWR004	A	1.0	1.1	20.6	5.2	800	300	0.061	< 0.005	1.50	1.40	0.070	0.051	0.028
7/15/03	12:28	WWR001	P	2.5	13.7	25.8	7.9	1,300	500	0.008	0.029	0.46	0.27	0.060	< 0.025	0.015
7/15/03	12:47	WWR002	P	2.5	13.7	26.9	8.6	2,400	2,400	0.067	0.515	0.58	0.75	0.042	< 0.025	0.007
7/15/03	13:02	WWR003	P	2.0	9.7	26.6	9.6	3,000	110	0.010	0.223	0.64	0.40	0.045	< 0.025	< 0.005
7/15/03	13:13	WWR004	P	2.0	7.2	25.3	11.0	800	220	0.005	0.289	0.69	0.46	0.051	< 0.025	0.024
7/29/03	12:26	WWR004	A		3.8	25.8	8.2									
7/29/03	12:34	WWR003	A		6.0	26.4	8.1									
7/29/03	12:42	WWR002	A		11.2	26.8	9.4									
7/29/03	13:07	WWR001	A		17.4	28.3	9.3									
7/29/03	18:00	WWR001	P		16.5	29.5	14.6									
7/29/03	18:18	WWR002	P		6.0	27.6	9.6									
7/29/03	18:40	WWR003	P		4.5	27.0	7.0									
7/29/03	19:00	WWR004	P		1.1	25.0	7.2									
10/15/03	8:37	WWR001	1	4.0	27.9	16.5	7.4	< 200	< 200	0.014	< 0.005	0.26	0.20	< 0.025	< 0.025	< 0.005
10/15/03	9:05	WWR011		3.0	26.6	16.5	6.5	1,700	200	0.016	< 0.005	0.23	0.18	0.117	0.093	0.007
10/15/03	9:35	WWR002		3.0	27.4	16.3	6.8	200	< 200	0.010	0.006	0.29	0.24	0.046	< 0.025	0.009
10/15/03	9:55	WWR021		3.0	26.5	16.3	6.3	5,000	3,000	0.015	0.011	0.30	0.17	0.132	0.109	0.006
10/15/03	10:15	WWR022		3.0	26.6	16.3	6.4	1,300	1,300	0.012	0.008	0.27	0.19	0.118	0.096	< 0.005
10/15/03	10:45	WWR003		3.0	27.9	16.2	7.2	400	200	0.013	< 0.005	0.26	0.23	0.040	< 0.025	< 0.005
10/15/03	10:55	WWR004		3.0	27.1	16.6	6.8	1,700	400	0.018	0.014	0.21	0.20	0.040	0.077	0.006

Note: On 7/29/03, samples were collected for the methoprene analysis only.

**TABLE 4-6 ESTUARINE WATER QUALITY DETECTIONS**

<b>Date</b>	<b>Time</b>	<b>Station</b>	<b>Diurnal</b>	<b>Analyte</b>	<b>Result</b>	<b>Standard</b>
7/15/03	12:28	WWR001	P	Methyl sulfide	0.7	0.5
7/15/03	12:28	WWR001	P	Methyl-tertiary-butyl-ether	4.0	0.5
7/15/03	12:28	WWR001	P	Toluene	1.0	0.5
7/15/03	12:28	WWR001	P	Total Xylene	0.8	0.5
7/15/03	7:53	WWR003	A	Methyl-tertiary-butyl-ether	3.0	0.5
7/15/03	7:53	WWR003	A	tert-Amyl-Methyl-Ether	0.6	0.5
7/15/03	13:02	WWR003	P	Methyl-tertiary-butyl-ether	2.0	0.5
7/15/03	8:07	WWR004	A	Methyl-tertiary-butyl-ether	3.0	0.5
7/15/03	8:07	WWR004	A	tert-Amyl-Methyl-Ether	0.7	0.5
7/15/03	13:13	WWR004	P	Methyl sulfide	0.9	0.5
7/15/03	13:13	WWR004	P	Methyl-tertiary-butyl-ether	3.0	0.5
7/15/03	13:13	WWR004	P	tert-Amyl-Methyl-Ether	0.5	0.5

**TABLE 4-7 ESTUARINE WATER QUALITY ANALYTES AND STANDARD VALUES**

<b>Parameter</b>	<b>Standard</b>
1,1,1,2-Tetrachloroethane	0.5
1,1,1-Trichloroethane	0.5
1,1,2,2-Tetrachloroethane	0.5
1,1,2-Trichloroethane	0.5
1,1-Dichloroethane	0.5
1,1-Dichloroethene	0.5
1,1-Dichloropropene	0.5
1,2,3-Trichlorobenzene	0.5
1,2,3-Trichloropropane	0.5
1,2,4,5-Tetramethylbenzene	0.5
1,2,4-Trichlorobenzene	0.2
1,2,4-Trimethylbenzene	0.5
1,2-dibromo-3-chloropropane	0.02
1,2-dibromoethane	0.02
1,2-Dichlorobenzene (o)	0.5
1,2-Dichloroethane	0.5
1,2-Dichloropropane	0.5
1,3,5-Trimethylbenzene	0.5
1,3-Dichloropropane	0.5
1,4-Dichlorobutane	0.5
1-Bromo-2-chloroethane	0.5
2,2-Dichloropropane	0.5
2,3-Dichloropropene	0.5
2-Bromo-1-chloropropane	0.5
2-Butanone (MEK)	20
2-Chlorotoluene	0.5
3-Chlorotoluene	0.5
4,4 DDD	0.2
4,4 DDE	0.2
4,4 DDT	0.2
4-Chlorotoluene	0.5
Acenaphthene	0.2
Acenaphthylene	0.2
Acetochlor	0.2
Acrylonitrile	0.5
Alachlor	0.5
Aldrin	0.2
Allethrin	0.2
Allyl chloride	0.5
Alpha - BHC	0.2
Anthracene	0.5
Atrazine	0.2
Azoxystrobin	0.5
Benfluralin	0.5
Benzene	0.5
Benzo(a)anthracene	0.5

Benzo(b)fluoranthene	0.2
Benzo(ghi)perylene	0.2
Benzo(k)fluoranthene	0.2
Benzo-a-pyrene	0.2
Benzophenone	0.2
Benzyl butyl phthalate	0.2
Beta - BHC	0.2
bis(2-ethylhexyl) adipate	0.5
bis(2-ethylhexyl) phthalate	2
Bloc	0.2
Bromacil	0.5
Bromobenzene	0.5
Bromochloromethane	0.5
Bromodichloromethane	0.5
Bromoform	0.5
Bromomethane	0.5
Butachlor	0.2
Butylated Hydroxyanisole	0.5
Butylated Hydroxytoluene	0.2
Caffeine	0.5
Carbamazepine	0.2
Carbon disulfide	0.5
Carbon tetrachloride	0.5
Carisoprodol	0.2
Chlordane	1
Chlorobenzene	0.5
Chlorodibromomethane	0.5
Chlorodifluoromethane	0.5
Chloroethane	0.5
Chlorofenvinphos	0.2
Chloroform	0.5
Chloromethane	0.5
Chlorothalonil	1
Chloroxlenol	0.2
Chlorpyrifos	0.2
Chrysene	0.2
cis-1,2-Dichloroethene	0.5
cis-1,3-Dichloropropene	0.5
Cyanazine	0.2
Cyfluthrin	0.2
Cypermethrin	0.5
d-Limonene	0.5
Dacthal	0.2
Delta - BHC	0.2
Deltamethrin	0.5
Diazinon	0.2
Dibenzo(a,h)anthracene	0.2
Dibromomethane	0.5
Dibutyl phthalate	1

Dichlorobenil	0.2
Dichlorodifluoromethane	0.5
Dichlorvos	0.5
Dieldrin	0.2
Diethyl ether	0.5
Diethyl phthalate	1
Diethyltoluamide (DEET)	0.2
Dimethyl phthalate	0.2
Dimethyldisulfide	0.5
Dinoseb	0.5
Diocetyl phthalate	0.2
Disulfoton	0.5
Disulfoton sulfone	0.2
Endosulfan I	0.2
Endosulfan II	0.2
Endosulfan Sulfate	0.2
Endrin	0.2
Endrin aldehyde	0.2
EPTC	0.2
Ethenylbenzene (Styrene)	0.5
Ethofumesate	0.2
Ethyl parathion	0.2
Ethylbenzene	0.5
Ethylmethacrylate	0.5
Fluoranthene	0.2
Fluorene	0.2
Freon 113	0.5
Gamma - BHC	0.2
Gemfibrozil	0.5
Heptachlor	0.2
Heptachlor epoxide	0.2
Hexachlorobenzene	0.2
Hexachlorobutadiene	0.2
Hexachlorocyclopentadiene	1
Ibuprofen	0.2
Indeno(1,2,3-cd)pyrene	0.2
Iodofenphos	0.2
Iprodione	0.5
Isofenphos	0.5
Isopropylbenzene	0.5
Kelthane	0.5
m,p-Dichlorobenzene	0.5
m-Xylene	0.5
Malathion	0.5
Metalaxyl	0.2
Methacrylonitrile	0.5
Methoprene	0.2
Methoxychlor	0.2
Methyl isothiocyanate	2

Methyl parathion	0.2
Methyl sulfide	0.5
Methyl-tertiary-butyl-ether	0.5
Methylene chloride	0.5
Methylmethacrylate	0.5
Metolachlor	0.2
Metribuzin	0.2
n-Butylbenzene	0.5
n-Propylbenzene	0.5
Naled (Dibrom)	0.2
Naphthalene	0.2
Napropamide	0.2
o-Xylene	0.5
p-Diethylbenzene	0.5
p-Isopropyltoluene	0.5
p-Xylene	0.5
Pendimethalin	0.2
Pentachlorobenzene	0.2
Pentachloronitrobenzene	0.2
Permethrin	0.2
Phenanthrene	0.2
Piperonyl butoxide	0.5
Prometon	0.5
Prometryne	0.2
Propachlor	0.2
Propiconazole	0.2
Pyrene	0.5
Resmethrin	0.2
sec-Butylbenzene	0.5
Simazine	0.2
Sumithrin	0.2
Tebuthiuron	0.5
Terbacil	0.5
Terbufos	0.2
tert-Amyl-Methyl-Ether	0.5
tert-Butyl-Ethyl-Ether	0.5
tert-Butylbenzene	0.5
Tetrachloroethene	0.5
Tetrahydrofuran	20
Toluene	0.5
Total Chlorotoluene	0.5
Total Xylene	0.5
trans-1,2-Dichloroethene	0.5
trans-1,3-Dichloropropene	0.5
Triadimefon	0.5
Trichloroethene	0.5
Trichlorofluoromethane	0.5
Triclosan	0.2
Trifluralin	0.5

Vinclozolin	0.5
Vinyl chloride	0.5
1,1,1,2-Tetrachloroethane	0.5

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