APPENDIX A-C FOR THE DRAFT MECOX BAY MANAGEMENT PLAN

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APPENDIX A

1986 Stony Brook Study

StonyBrook

Office of Research Administration
State University of New York at Stony Brook
Stony Brook, New York 11794-4466
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January 7, 1986

Mr. David Emilita
Town Planner
Town of Southampton
116 Hampton Road
Southampton, New York 11968

RE: Southampton Town Resolution # 746
(local file # 431-2413a)

Dear Mr. Emilita:

Enclosed please find the final written project report for the project entitled: "Dynamics of Mecox Inlet". This completes Dr. Zarillo's obligations under the agreement.

Please forward final payment on the grant to:

Mr. Robert G. Parr
Secretary-Treasurer
P.O. Box 9
Albany, New York 12201

Sincerely,

Marie Murphy

Marie Murphy
Associate for Sponsored Programs

Enclosures

xc: Dr. G. Zarillo
Dr. J. Schubel
Ms. R. Tompkins
file

DYNAMICS OF MECOX INLET AND RESULTING EFFECTS ON ADJACENT BEACHES

Final Report to the Town of Southampton

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and

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Marine Sciences Research Center
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Introduction

Physical and geological processes controlling tidal inlet dynamics include tidal currents, wave action, wave-generated nearshore currents, sediment transport and shoaling patterns, and episodic storms. These processes interact to not only control inlet hydraulics, but also can exert significant influence over adjacent beach and nearshore areas. The combined effect of these processes is additionally complicated due to their variability on time scales from hours to months.

In addition to processes, which determine inlet dynamics on a relatively short time scale, other factors such as the long-term rate of sea-level rise, long-term rate of shoreline, recession and rate of sediment supply determine how an inlet-bay system and surrounding beaches will evolve with time. Therefore, in order to successfully develop a management plan for the Mecox Inlet-Bay system it is necessary to understand both the effects of processes operating on a short to intermediate basis (days to months) and the effects of factors controlling the longer-term (years) trends of shoreline change. It is particularly important to make a clear distinction between short-term variability of the beach, inlet and bay and long-term permanent changes. A single episode of beach erosion or accretion does not imply a permanent change or long-term trend. This distinction is particularly important for inlet-influenced shorelines, which are usually subject to greater variability than shorelines where no inlets exist. Permanent change to a shoreline can only be viewed as a long-term average of many short-term fluctuations.

The overall goal of the work completed for the Town of Southampton has three parts: 1) to provide a basic understanding of hydraulic and sediment transport processes operating at the Mecox Inlet-Bay system and to assess the immediate effects of these processes on adjacent beach areas, 2) to determine whether short-term effects of the inlet on adjacent beaches have led to any long-term impacts which are resolvable from long-term changes of nearby shoreline areas, that are not immediately influenced by an inlet, 3) and to develop a set of guidelines for controlling man-made openings of Mecox Inlet that will minimize adverse impacts on the adjacent beach areas. Within the context of these goals the management of Mecox Bay is also considered in terms of reducing bay water levels and promoting adequate flushing of the bay to enhance water quality.

Scope of Work

In order to meet the goals outlined above work completed for the Town of Southampton was completed in three areas. Firstly, a program of field measurements was designed to determine how the Mecox Inlet-Bay system functions on a short to intermediate term basis. This part of the study has two components. A network of beach profiles extending from the dune face to the mean low water line was established and monitored for an eight-month period. The beach profiles were used to determine the magnitude of the seasonal beach cycle due to the varying frequency of storms between winter and summer. The second component of the field program consisted of a week-long process-response study corresponding with a man-made inlet opening at Mecox Bay (Sept. 10 to 17, 1985). This part of the study, including measurements of inlet hydraulics and beach volume change was designed to determine the immediate effects of Mecox Inlet on the adjacent shoreline.

The second area of work includes the use of an analytical and numerical model of inlet-bay hydraulics. Both models were used to simulate tidal flow in the inlet and tide-level fluctuations in Mecox Bay under open-inlet conditions. The goal of this part of the study is to develop a predictive tool that could be used to test different inlet configurations for potential impact on the beach and potential for enhanced flushing of Mecox Bay. The analytical model was used as a preliminary step to assess overal hydraulic conditions of Mecox Inlet and to select possible alternative configurations to be tested with the more comprehensive numerical model. The numerical model provides much more detail on flow conditions within the inlet and was therefore coupled with a sediment transport model. The sediment transport model was used to assess whether Mecox Inlet under several different inlet configurations would tend to export or import sand from the littoral zone. In this way the impact of each proposed inlet configuration could be ranked according to potential for accelerating beach erosion.

The third phase of the work includes a study of long-term rates of shoreline changes in Southampton. Shoreline changes that take place over a number of years cannot be predicted from shorter-term variations measured with beach profile. The only way to establish such changes is by comparing shorelines from aerial photographs and maps widely separated in time. In order for the results to be meaningful, however, the change in shoreline position must be greater than measurement errors associated with using photographs and maps. Despite the difficulty in determining long term shoreline changes, this part of the study provides important information regarding the long-term impact of inlets on the beach. In addition there has been no attempt at a quantitative study of shoreline change in the Southampton area or other sections of Long Island's south shore since Taney's (1961) report twenty-five years ago.

Seasonal Beach Changes

Seasonal variation of beach in the vicinity of Mecox Inlet was measured using a network of thirteen beach profiles (Fig. 1). The network includes approximately 1.5 kms (0.9 miles) of beach centered on the area where the inlet is frequently cut. The profiles are spaced approximately 100 m (330 ft) apart and extend from the seaward dune face to the mean low water line. The landward position of each beach profile was located with a temporary bench mark established using rod and transit surveying methods. The elevation of each temporary profile bench mark was determined from a permanent Suffolk County tidal bench mark in the edge of Dune Road on the east side of the inlet (Fig. 1).

Profiles in the network were surveyed on a monthly basis from March to November, 1985, thereby including most of the spring and fall months as well as all the summer months. During September, 1985 most profiles were measured two additional times as well as on the usual monthly basis in order to observe the effects of the opening of Mecox Inlet and Hurricane Gloria. After emplacement of the benchmarks using rod and transet methods, calibrated sighting rods were used to survey the profiles. In this method vertical elevation change along each profile of the beach is determined by sighting on the horizon using the top of one rod and reading the elevation change from the top of a second calibrated rod. The cross-shore distance between each measurement was about 2 m (6 ft). This method is considered to be accurate within ± 1 cm (0.4 inches) in the vertical and 4 cm (1.6 inches) in the horizontal. In addition to accuracy, the advantage of using this method over the rod and transit method is the speed with which measurements can be completed. All thirteen profiles could be completed within two hours.

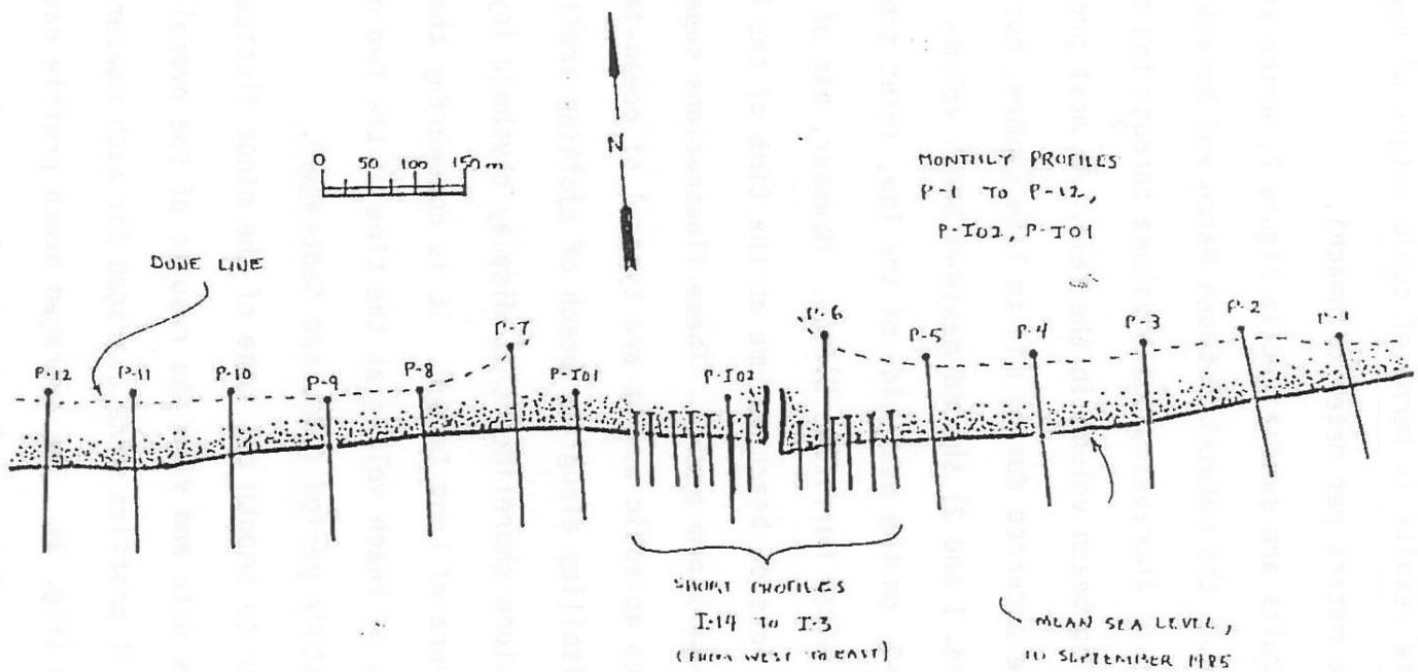


Figure 1. Location of beach profiles surveyed monthly and profiles surveyed daily during the process-response study.

Analysis of volumetric changes of the beach from data collected at each profile loction was completed using a computer program. The program determines the difference in beach area under consecutive profile curves, thus providing the results in terms of cubic meters of beach per linear meter of beach (cubic meters per meter of beach).

The results are summarized in Figure 2, which shows volumetric change at each profile in the network between March and November. Overall, the profiles show a trend of increasing beach volume through the spring and summer months and decreasing beach volume in the fall. At most profile locations maximum beach volume occurred during mid to late summer, but two of the profiles, PF-2 and PF-9 (Fig. 1 and 2) showed maximum beach volume in early November. One profile, PF-6, on the west side of the low, inlet area, acquired maximum volume just after Hurricane Gloria. However, six of the profiles displayed significant loss of beach volume at the time of the hurricane or during the immediate post-storm period. These fluctuations superimposed on the seasonal trends due to episodic events are typical of ocean-facing shorelines. The spatial variability along the beach of ajoining profiles is also common, especially along shorelines that display rhythmic (cycle) topography such as the south shore of Long Island. It is noteworthy that none of the profiles shows a loss of beach volume at the time of the two openings of Mecox Inlet within the study period (June and September).

In order to smooth out some of the minor fluctuations indicated by the beach profile data and view the results of the overall data set, volume changes at all profiles were averaged for each measurement period and plotted against time (Fig. 3). The averaged beach profile data set clearly shows the seasonal trends of increasing beach volume during the Summer and decreasing beach volume during the Fall. In the data set smoothed by averaging, only the

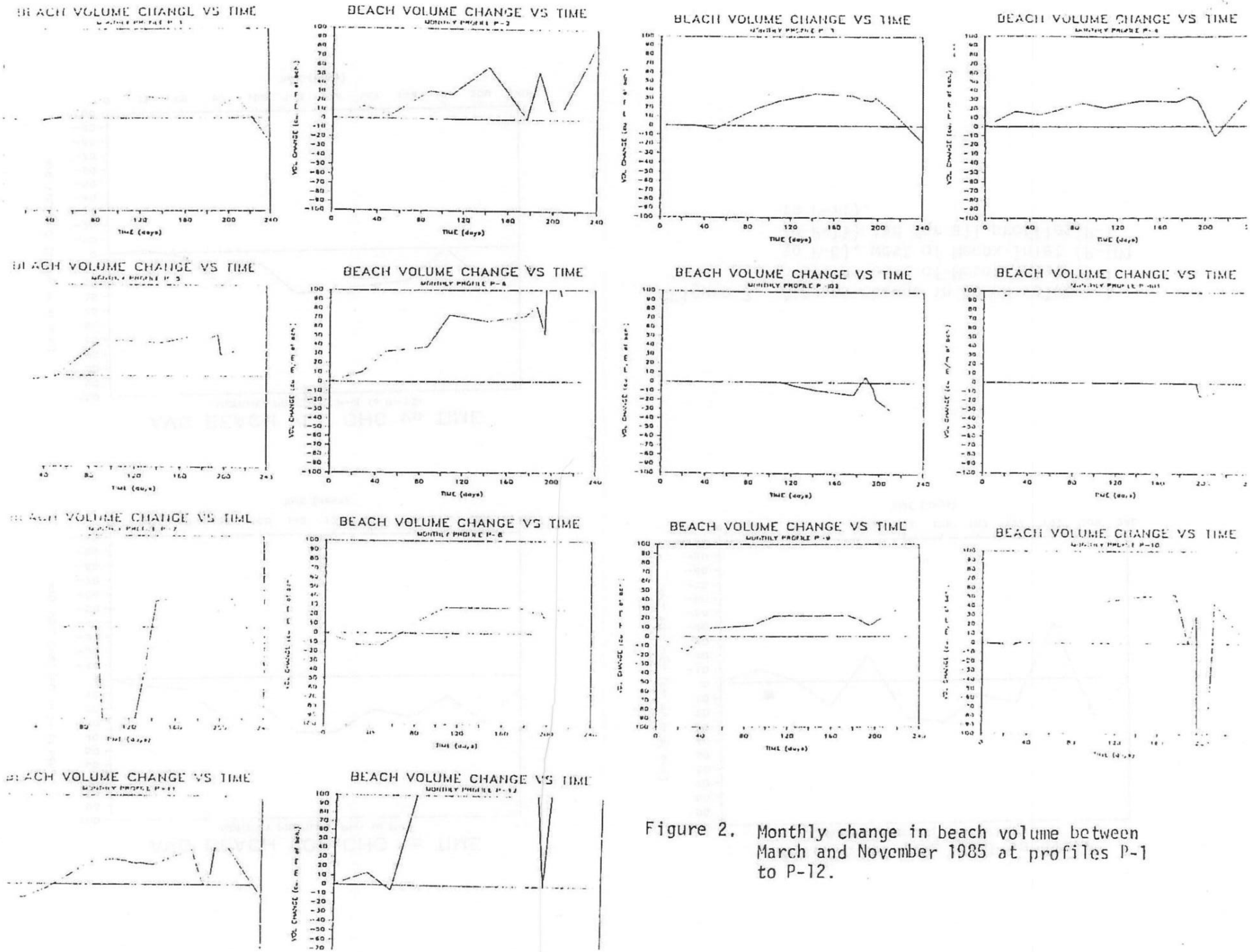


Figure 2. Monthly change in beach volume between March and November 1985 at profiles P-1 to P-12.

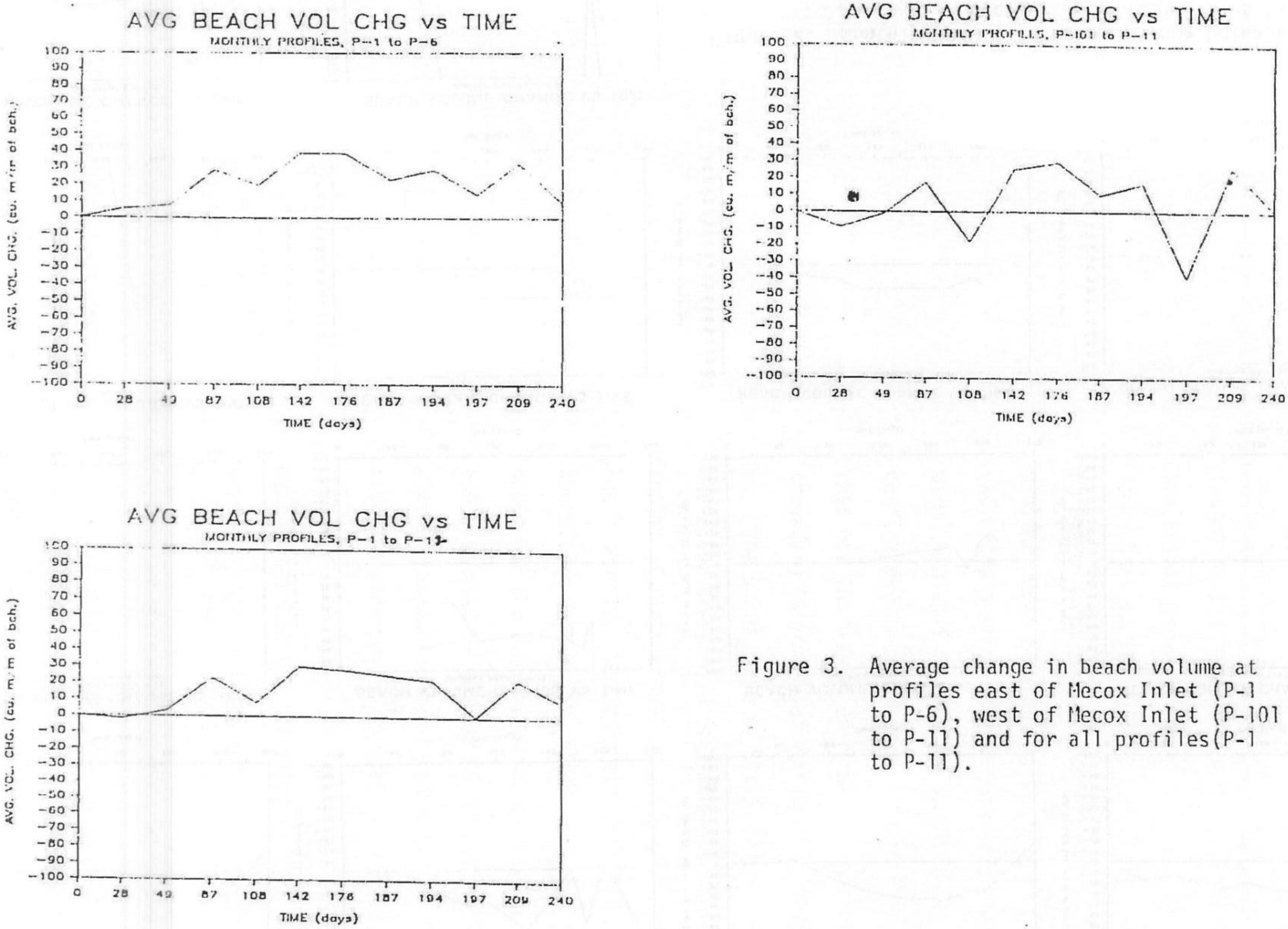


Figure 3. Average change in beach volume at profiles east of Mecox Inlet (P-1 to P-6), west of Mecox Inlet (P-101 to P-11) and for all profiles(P-1 to P-11).

effects of major events can be seen. Significant loss of beach volume is indicated by the July and late September data set.

Figure 4 indicates the net volumetric change at all profiles between the beginning of the study period (March, 1985) and October, 1985. In general, most profiles underwent a small net gain of beach sand with the exception of profiles 4, I01 and I02. The net loss at profile 4, located approximately 250 m (820 ft) to the east of the inlet (Fig. 1) was very small. Profiles I01 and I02 are located in the immediate vicinity of the inlet and were surveyed only during the final four months of the study (July to November, 1985). The individual plots of each of these profiles (Fig. 2) shows that beach volume loss in the inlet area was largely due to the effects of Hurricane Gloria in late September rather than opening the Mecox Inlet in early September. Profile I02, just west of the inlet (Fig. 2) underwent a small volume loss just before and just after opening of the inlet, but more than regained this loss in the period between closing of the inlet and the hurricane (Fig. 3). The largest net gain of beach sand during the study period occurred at profile 6 located just east of the inlet (Fig. 2). More than half of this gain took place between the end of September and the middle of October, 1985 (Fig. 3). Some of this gain can probably be attributed to recovery of the beach after the storm. Overall, net changes in the profiles over the study period tended to be smaller than episodic gains or losses on a month to month basis. This pattern is typical of open ocean beaches, which respond rapidly to episodic storm events but display more gradual changes when considered on a seasonal or longer term basis.

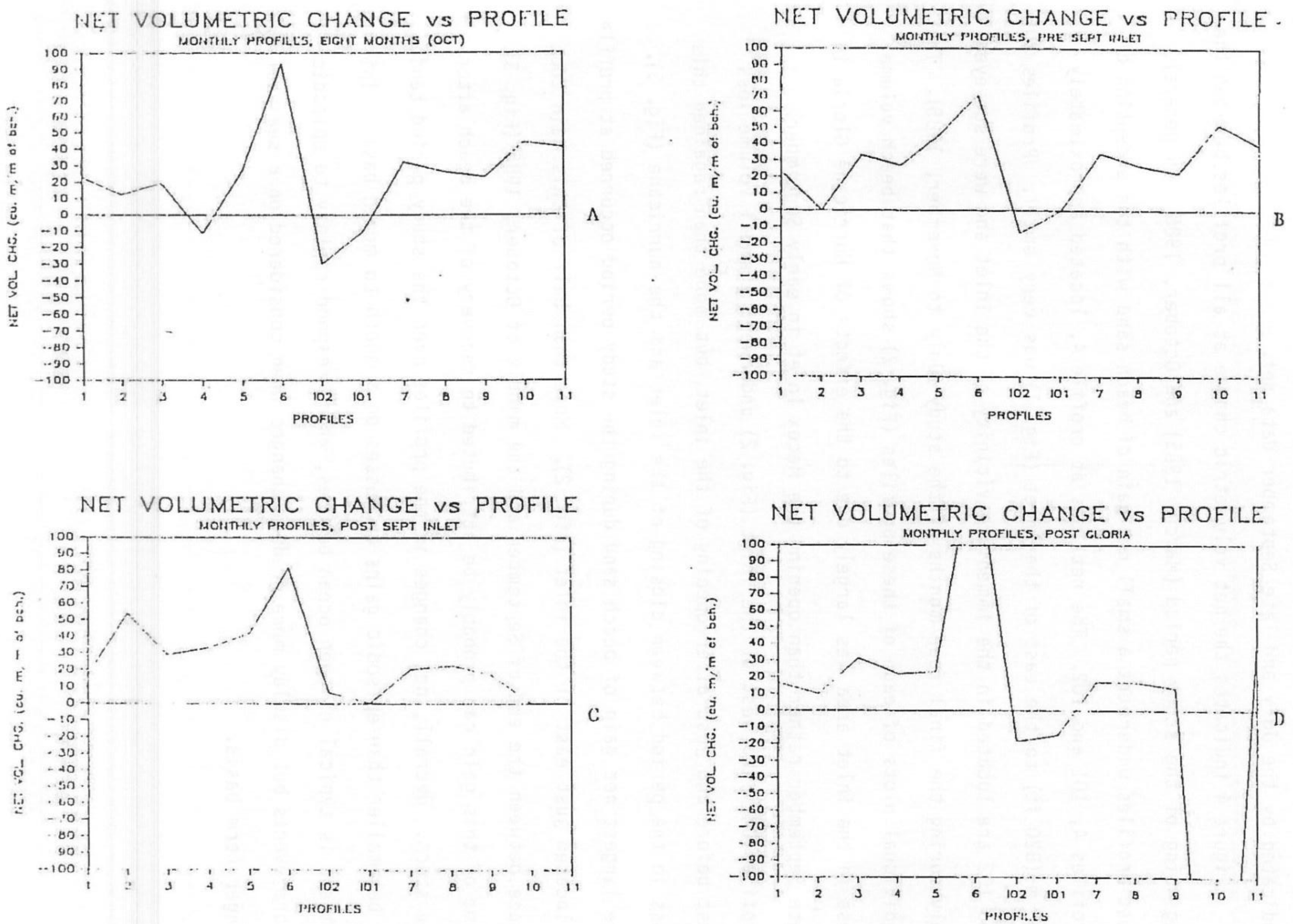


Figure 4. Net change in beach volume A) at all profiles for the first eight months of the study, B) for the period up to the September inlet opening, C) for the period ending just after September inlet closing and D) for the period ending just after hurricane Gloria.

Processs-Response Study

In order to determine the hydraulic properties of Mecox Inlet and to assess the immediate effects of the inlet on the surrounding beach a week long observational study was conducted in September, 1985. The study period corresponded to the opening of the inlet on September 10 to closing of the inlet on September 17. The overall goal of the process-response study was to provide a continuous record of conditions at the inlet. Therefore, the observational program was designed to collect data 24 hours a day as long as the inlet remained open. From a temporary field station established on the beach measurements of inlet currents, wave parameters and associated longshore currents and wind patterns were measured at 3-hour intervals over the entire eight day period the inlet was open. The response of the surrounding beach was monitored by surveying fourteen closely spaced beach profiles in the vicinity of the inlet on a daily basis. The configuration of the inlet channel and associated shoals within the inlet throat were also surveyed on a daily basis.

Tidal currents in the inlet were determined over a measured course along the throat of the inlet (narrowest and deepest section) using a surface float. Changes in configuration (depth and width) and orientation of the inlet were determined using standard surveying methods as well as with tape measures and calibrated staffs to provide detail.

In the surfzone, just seaward of the inlet entrance, breaking wave heights were measured using a hand-held calibrated staff. Wave periods were determined as the average of eleven waves passing a fixed point in the surfzone. The angle of breaking waves with respect to the beach was estimated by sighting along the crests of shoaling waves with a hand-held compass. Longshore currents generated by breaking waves were measured in a similar way as tidal currents in the inlet. The alongshore movement of a float over the surfzone was timed over a 20-meter distance four times to provide an average speed of the longshore current. Wind speed and direction was also measured using a hand-held anemometer.

Fourteen beach profiles surveyed on a daily basis during the process-response study were spaced approximately 50 m (165 ft) apart and extended for 150 m (500 ft) to the east and west of the inlet (Fig. 2). The survey method was identical to that used for the seasonal beach profiles, but only the lower portion of the beach (berm crest to Mean Low Water) was surveyed during the process-response study in order to allow each daily survey to be completed at low tide.

Results of Process-Response Study

Throughout the Process-Response study from September 10 to September 17, 1985, both weather conditions and surfzone conditions were fairly uniform. Winds were generally from northeasterly to southeasterly quadrants during the week-long study (Fig. 5). During the first day of the study strong northerly winds (up to 20 mph) dominated the wind pattern (Fig. 5). During the middle part of the study (days 2 to 5) northerly winds were no greater than 10 mph. During the last 3 days of the study winds remained at about 5 mph but shifted to the southeast (Fig. 5).

Breaker heights in the surfzone were less than 1 m (3.28 ft) during the first half of the study (Day 1 to 4) (Fig. 6). Associated wave periods during this time varied between 5 seconds and 10 seconds. Maximum breaker height increased to greater than 1 m in the second half of the study. Wave periods were also generally longer (7 to 11 seconds) during this time. During the final day of the study the maximum breaker height increased to nearly 2 m.

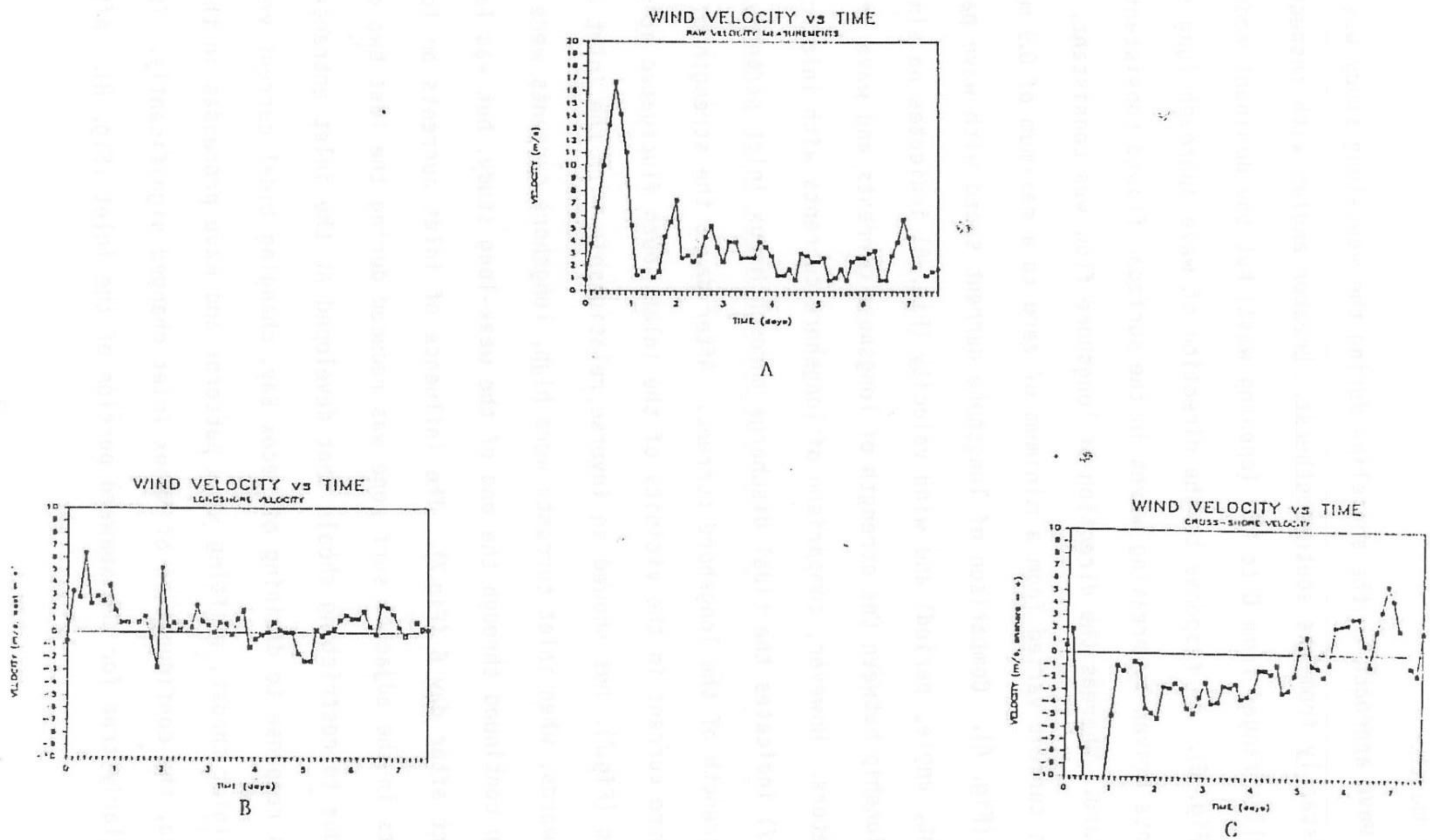


Figure 5. Wind speed during the week-long process-response study including A) raw wind speed, B) longshore component and C) cross-shore component.

This long period swell (9 seconds) is thought to be largely responsible for finally closing the inlet by transporting sand onshore that shoaled in the inlet mouth.

Wave approach to the shoreline during the week-long study was consistantly from the south-southeast. Breaker angles with respect to the shoreline ranged from 0 to 20° (opening west) but the dominant mode was about 10° (Fig. 6). In response to the direction of wave approach long shore currents driven by breaking waves in the surfzone flowed consistantly westward. Whereas the direction of longshore flow was consistant, the speed of the current varied from a minimum of zero to a maximum of 0.9 m/s (2.9 ft/s) (Fig. 6). Comparison of longshore current speed with wave parameters (height, angle, period) and wind velocity (Fig. 6) indicates no simple relationship between the strength of longshore currents and wave or wind parameters. However, comparison of longshore currents with inlet currents (Fig. 7) indicates the tidal discharge through Mecox Inlet strongly influences the strength of the longshore current. After day 3 the strength of the longshore current in the vicinity of the inlet mouth fluctuated at tidal periods (Fig.7), but showed an inverse relationship with the inlet current. In other words, when inlet currents were high, longshore currents were low. This pattern continued through the end of the week-long study, but was less distinct after day 6 (Fig.7). The influence of inlet currents on longshore currents in the adjacent surf zone was reduced during the last two days of the study due to restricting shoals that developed at the inlet entrance.

In response to draining of Mecox Bay, changing tidal current velocities in the inlet throat, shifting wind patterns and wave processes in the adjacent surfzone, the configuration of Mecox Inlet changed significantly. This was particularly true for the seaward portion of the inlet (Fig. 8). After opening

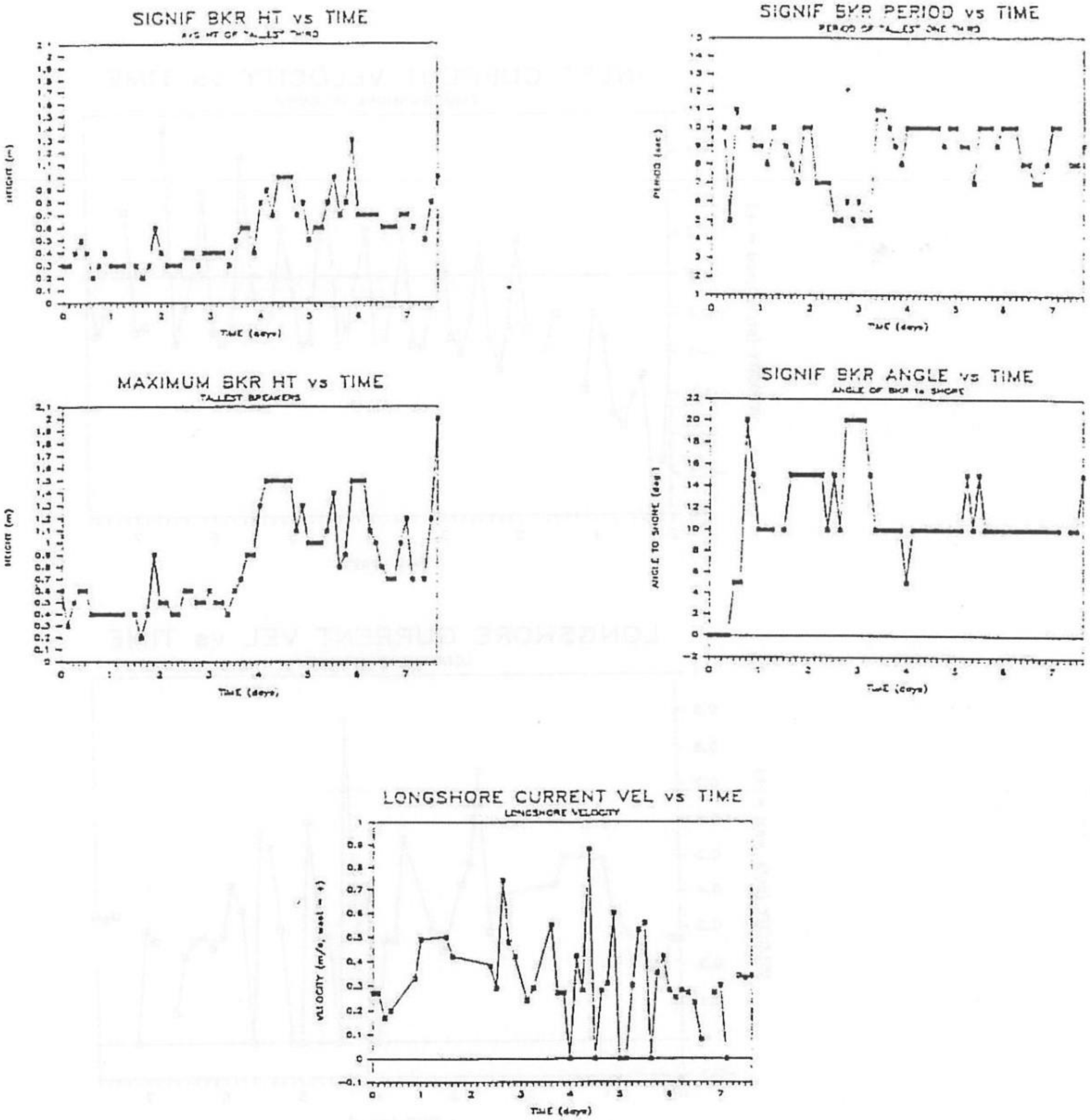


Figure 6. Surf zone parameters during the week-long process-response study including breaker height, breaker period, breaker angle and longshore current velocity.

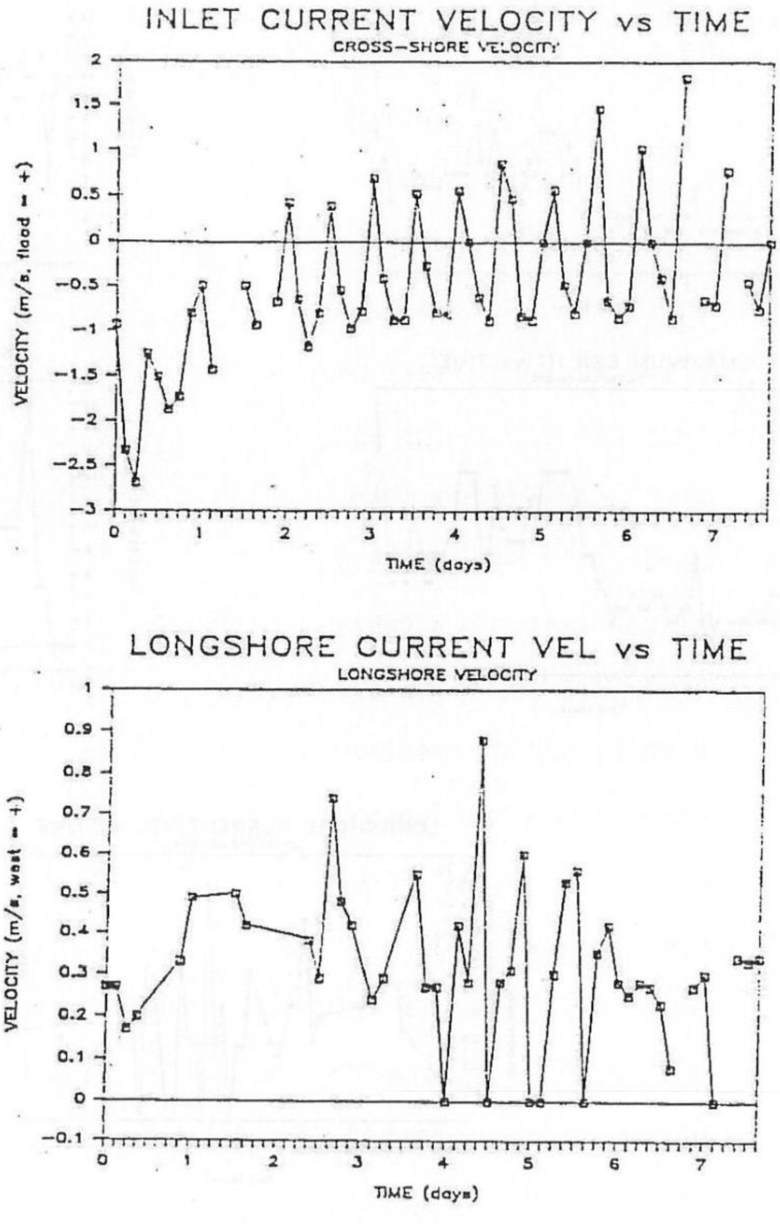


Figure 7. Inlet current velocity and longshore current velocity during the process-response study.

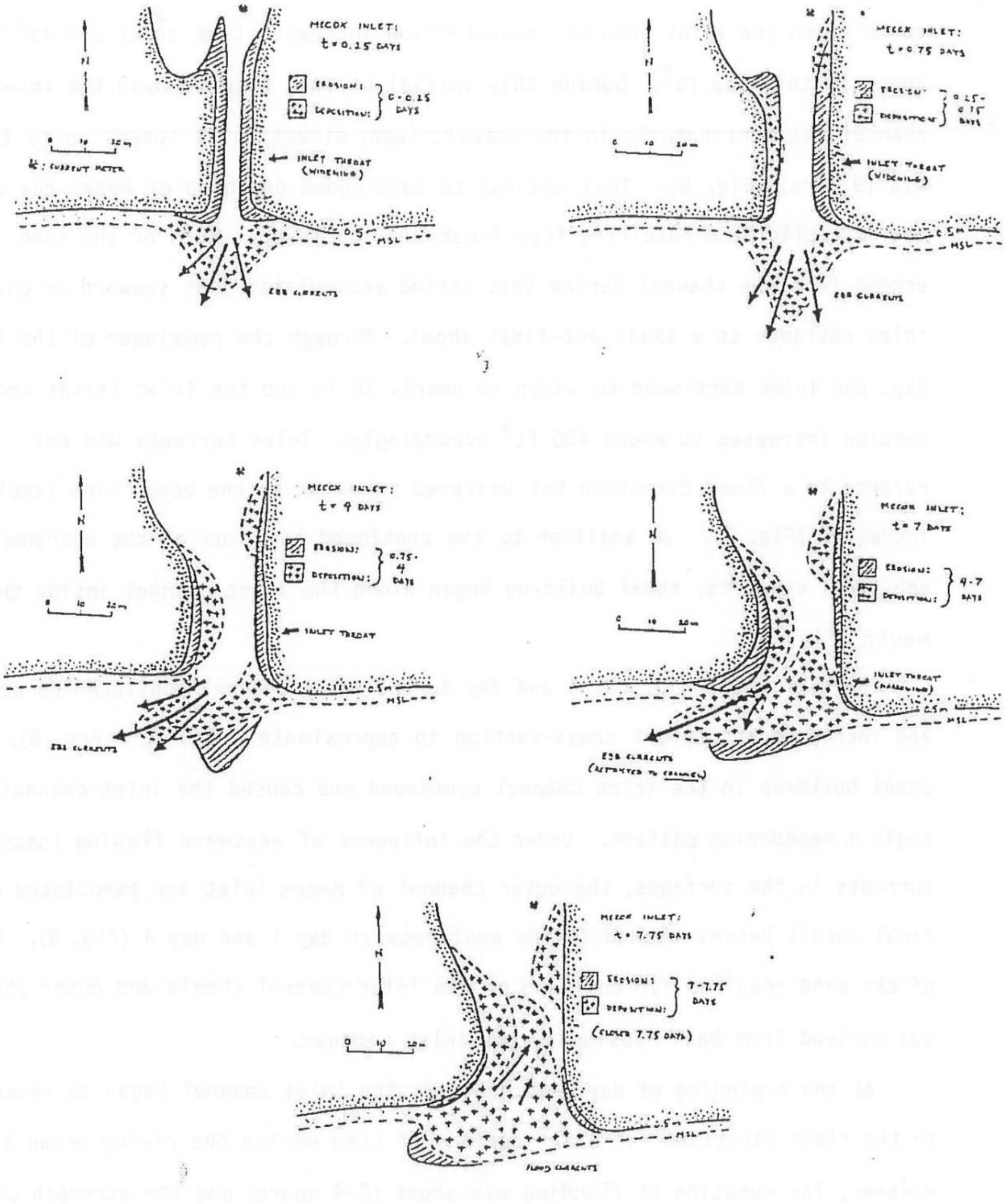


Figure 8. Morphologic changes at Mecox Inlet during the process-response study.

of the inlet on September 10, the inlet throat widened from 10 m (33 ft) to approximately 15 m (50 ft) within a few hours (Fig. 8). At its smallest contriction the inlet channel cross-section increased from about 200 ft^2 to approximately 300 ft^2. During this initial period, flow through the inlet channel was continuously in the seaward (ebb) direction at speeds up to 2.75 m/s (9 ft/s) (Fig. 8). This was due to continuous draining of Mecox Bay under the hydraulic head resulting from freshwater build-up. Much of the sand eroded from the channel during this period accumulated just seaward of the inlet entrance as a small ebb-tidal shoal. Through the remainder of the first day, the inlet continued to widen to nearly 70 ft and the inlet throat cross-section increased to about 400 ft^2 accordingly. Inlet currents did not reverse to a flood direction but weakened somewhat as the ocean tide level increased (Fig. 7). In addition to the continued build-up of the nearshore ebb-tidal deposits, shoal build-up began along the inlet channel inside the mouth (Fig. 8).

Between the end of day 1 and day 4, the inlet channel continued to widen and increased its throat cross-section to approximately 500 ft^2 (Fig. 8). Shoal build-up in the inlet channel continued and caused the inlet channel to begin a meandering pattern. Under the influence of westward flowing longshore currents in the surfzone, the outer channel of Mecox Inlet and associated ebb-tidal shoals became skewed to the west between day 1 and day 4 (Fig. 8). Much of the sand required for build-up of the inlet channel shoals and outer shoals was derived from bank erosion as the inlet widened.

At the beginning of day 2 currents in the inlet channel began to reverse to the flood direction for short periods of time during the rising ocean tide. However, the duration of flooding was short (2-4 hours) and the strength of flooding currents was low, ranging from about 0.4 to 0.6 m/s (1.3-2.0 ft/s).

The ebb dominance of inlet flow was due to the continued draining of Mecox Bay.

From day 4 to day 6 the inlet widened slightly and the channel cross-section reached approximately 550 ft^2. Shoals within the inlet channel reached a quasi-stable configuration as the widening of the inlet slowed and finally ceased (Fig. 8). During this period build-up of the outer shoal also slowed. The ebb-tidal shoal and associated outer inlet channel maintained a westward skewed configuration due to continued westward flowing longshore currents. Tidal currents within the inlet changed from ebb-dominant to flood dominate during this time (Fig. 7). Further reduction of bay level resulted in a decrease in maximu . ebb currents to about 1 m/s (3.3 ft/s) and an increase in maximum flood currents to about 1.5 m/s (5 ft/s).

In the period from day 6 to day 8 of the process-response study the overall configuration of the inlet remained the same. The shoals established earlier in the inlet remained at approximately the same size and shape (Fig. 8). The only modification to the inlet during this period was the build-up of a flood-tidal shoal just inside the inlet entrance. This shoal was built as a result of landward sand transport by waves and the strengthening flood currents. Typical flooding and ebbing patterns are shown in figure .
During the ebb, currents at the inlet entrance remained in a constricted channel through the ebb-tidal shoal. During flood, however the broad ebb-tidal shoal becomes submerged and flooding currents are enhanced by shoaling wave bores. Maximum flood currents reached 1.8 m/s (6 ft/s) (Fig. 7).

During the eighth day of the study the inlet closed during an afternoon flooding tide (Fig. 8). The closing process was simply onshore transport largely due to long period shoaling waves and breakers (Fig. 6). Waves up to 1.9 m (6.2 ft) in height and 9 seconds in period transported sand from the ebb-tidal shoal into the throat of the inlet. The elevation of this sand "plug" at the inlet entrance was at or above the elevation of Mean High Waer. Therefore, there was no chance of reopening of the inlet during the following ebbing tide.

Daily measurements of the closely spaced profiles adjacent to Mecox Inlet indicated the response of the beach to open inlet conditions. In general, the profiles to the east of the inlet (profiles I3 to I7) showed a net gain in volume of the lower beach during the week-long study. Conversely, the profiles to the west of the inlet showed (profiles I8 to I14) a net loss of beach volume over the same period (Fig. 9). This pattern is also reflected in the average change in beach volume for the areas east and west of the inlet (Fig. 10). Although most of the profiles to the west of the inlet showed a slight loss of beach volume from day to day during the process-response study, the bulk of the loss occurred between day 6 and day 7. This is particularly apparent at profiles I-10, I-12, I-13 and I-14 (Fig. 9). Beach volume loss during this period was also recorded at three profiles to the east of the inlet (Fig. 9). Despite the loss of volume on the lower beach during the September opening of Mecox Inlet, the monthly profiles across the entire beach (base of dunes to Mean Low Water) measured before and after the eighth day open inlet conditions did not show and major loss of beach volume (Fig. 2). The interuption of longshore currents due to artificial opening of Mecox Inlet is believed to cause only a minor fluctuation in beach volume. This is especially true compared to the effects of episodic storms on the beach, such as Hurricane Gloria.

Analytical and Numerical Models

Different configurations of Mecox Inlet in terms of length and cross-

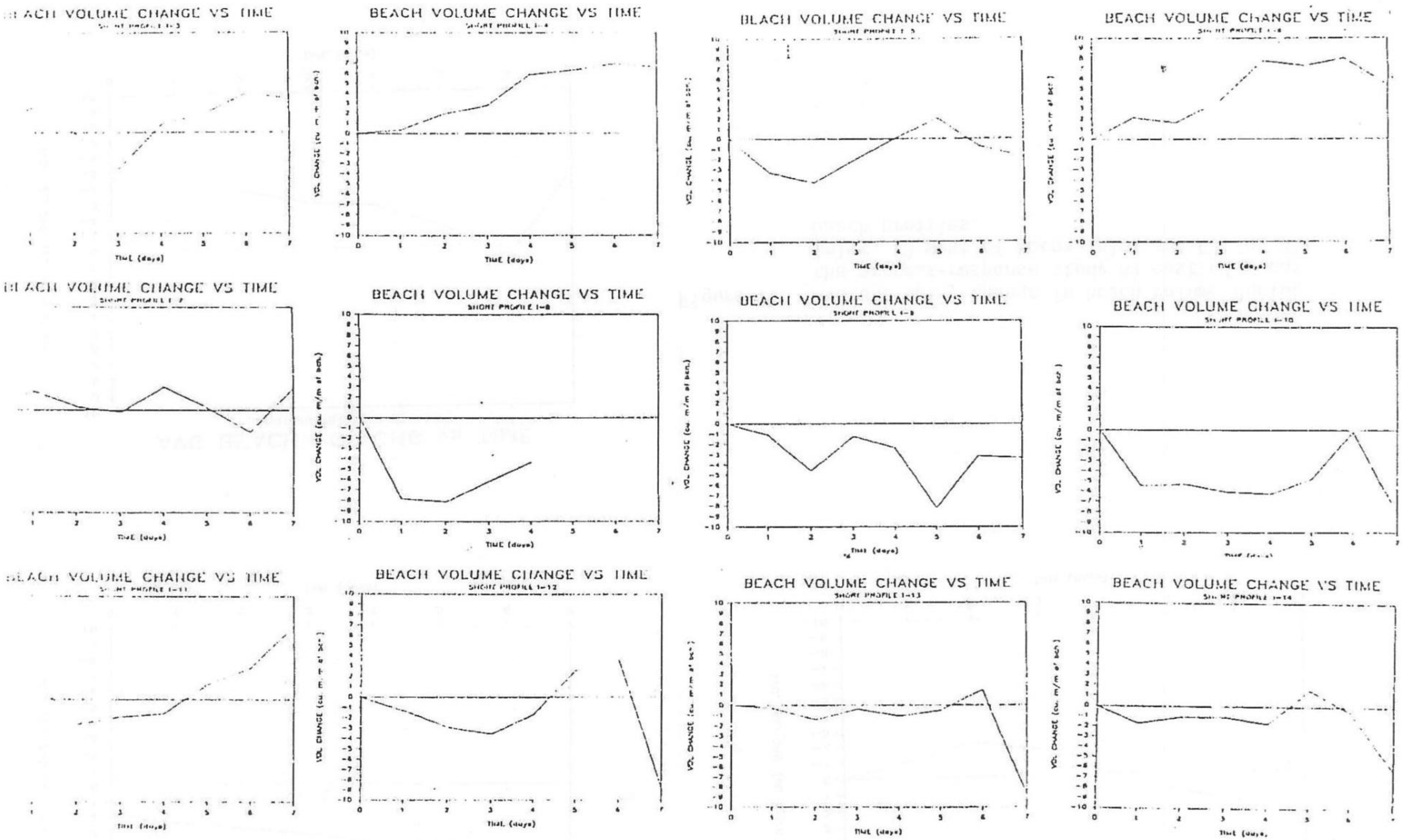
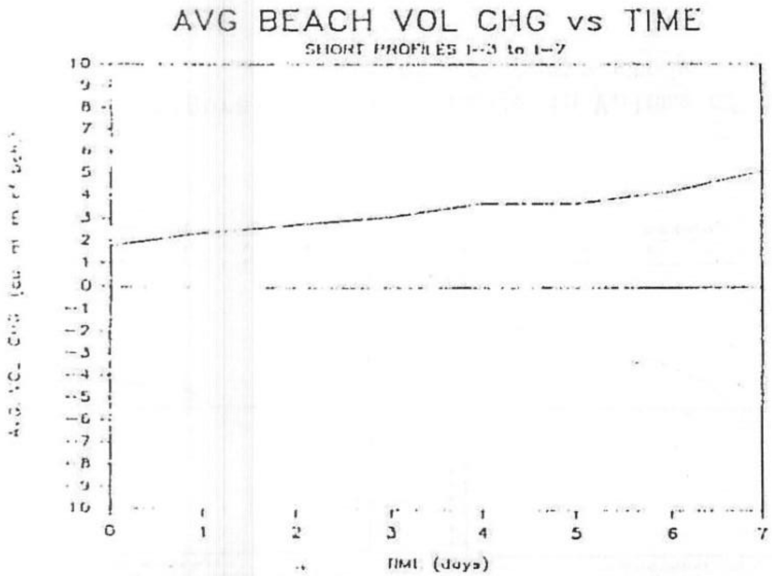
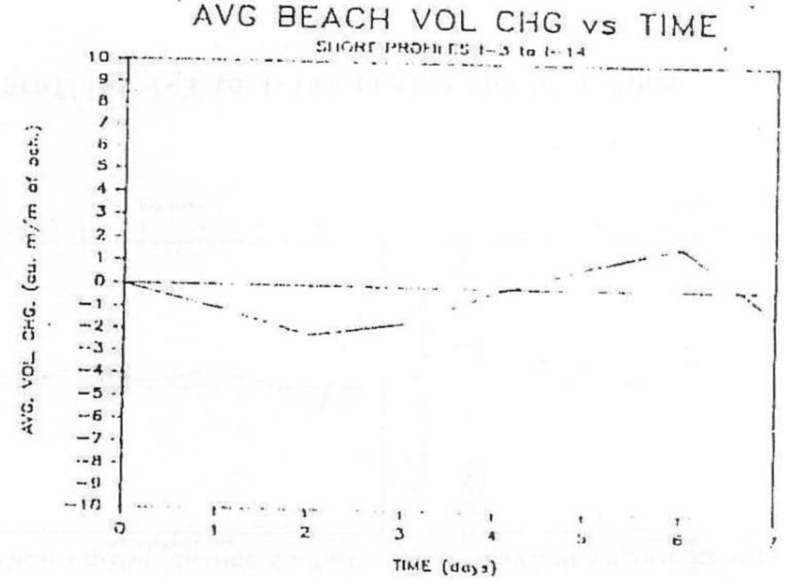


Figure 9. Laily change in Volume of the lower beach (profiles I-3 to I-14) during the week-long process-response study.





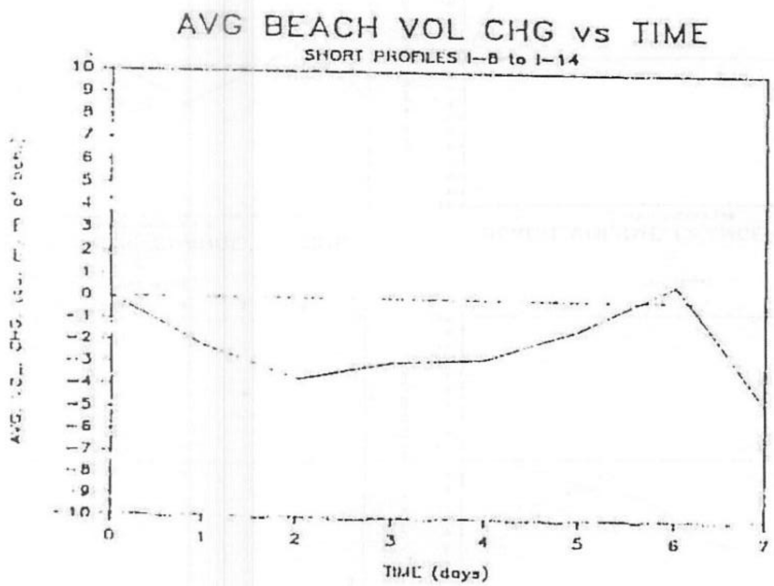


Figure 10. Average daily change in beach volume during the process-response study A) east of Mecox Inlet, B) west of Mecox Inlet and C) for all beach profiles.

sectional area can result in varying conditions of flow in the inlet channel and tidal range in Mecox Bay. In order to assess whether different configurations of the inlet would have a positive impact on stability of adjacent beaches and flushing rates of the bay two types of models were used as predictive tools. Each model provides predictions of tidal currents within the inlet channel and tide-levels in the bay, but differ in level of detail.

As a first step in modeling tidal hydraulics of Mecox Inlet-Bay system a analytical model was used. Such models employ several simplifying assumptions, but provide an exact solution (analytical solution) to the equations that describe the hydrodynamics of inlet-bay systems. In the second part of the model study a numerical model was used to provide greater detail concerning tidal flow patterns in the inlet. Numerical models closely approximate the solution of hydrodynamic equations and account for the configuration of inlet-bay systems in a more realistic way. In addition, numerical models can be coupled with sediment transport models in order to predict patterns of sediment transport within inlet channels.

Analytical Model

The results of the analytical model have been presented in an early interim report to the Town of Southampton and therefore will only be summarized here within the analytical scheme two inlet lengths (1900 ft and 2600 ft) and four different inlet channel cross-sectional areas (600, 700, 960, 1120 ft) were modeled. In addition, for each combination of inlet length and cross-section, two frictional coefficients were assumed (0.236 and 0.112).

Results of the analytical model are summarized in Table 1. The model predicts that the ratio of bay tidal range to the ocean tidal amplitude is small. The largest predicted bay tidal range (0.3 ft) would occur when the inlet channel is short, channel cross-section is large and frictional

Table 1

$A_B = 6.4 \times 10^7\ ft^2$ Surface Area of Bay

$a_o = 1.7$ ft Ocean tide amplitude

$H_c = R = (A_c/162)^{1/2}$

$L_c = 1900$ ft, 2600 ft Length of inlet

$A_c = 600, 700, 960, 1120\ ft^2$ Cross-sectional area of inlet

$f_1 = 0.236$; $f_2 = 0.112$

A_c	Model 1 $f = 0.236$ $L_c = 2600$ ft	Model 2 $f = 0.112$ $L_c = 2600$	Model 3 $f = 0.236$ $L_c = 1900$	Model 4 $f = 0.112$ $L_c = 1900$
Amplitude Ratio (a_b/a_o)				
600	0.050	0.071	0.058	0.083
700	0.060	0.086	0.070	0.100
960	0.089	0.127	0.103	0.148
1120	0.108	0.154	0.125	0.178
Maximum Velocity (Vmax) (ft/s)			1.5 ft/s	45.7 cm/s
600	1.26	1.81	1.47	2.11
700	1.31	1.88	1.53	2.19
960	1.41	2.03	1.65	2.35
1120	1.47	2.10	1.71	2.44
Phase Lag ( ) (Degrees)			e.g. 85° = 2 hours 56 min	
600	87.65	86.61	87.10	85.84
700	87.06	85.77	86.42	84.86
960	85.45	83.46	84.52	82.16
1120	84.39	81.95	83.29	80.41

Max difference = 7°
= 14 min

coefficient is small. Conversely, the smallest predicted bay range (0.1 ft) would occur when the inlet channel is long, channel cross-section is small and frictional coefficient is large. A similar relationship is predicted for tidal current velocities within the inlet channel. The highest predicted velocity (2.44 ft/sec) would occur in the shorter inlet channel of greater cross-section and smaller frictional coefficient. The lowest currents (1.26 ft/sec) would occur in the longer channel of small cross-section and greater friction. Under all combinations of inlet length, channel cross-section and frictional characteristics the phase lag (difference in time of high water) between the ocean and bay tide is large (about 3 hours).

For a given channel length, frictional characteristics and bay area, the optimum channel cross-sectional area can be predicted in terms of maintaining maximum tidal current velocities and bay flushing. These predictions can be presented in the form of stability curves showing the variation of inlet current velocity compared to inlet cross-sectional area. Figure 11 shows inlet characteristics for a bay having the area of Mecox Bay (6.4 x 10^7 ft^2) assuming two inlet channel lengths (2600 ft and 1900 ft) and two values of inlet friction (0.238 and 0.112). These stability diagrams show that given the present inlet configuration, Mecox Bay will always fall on the portion of the stability curve to the left of maximum inlet current speed and channel cross-sectional area. This means that the maximum possible tidal prism (water volume) is not being admitted to the bay and that the inlet could be much larger (3000 to 5000 ft^2 vs 600 to 1000 ft^2 at present). According to the results of the analytical model widening and deepening the present man-made inlet would increase inlet current velocities and tidal flushing of the bay up to a certain point (the peak of the curve in Fig. 11).

The Numerical Model

The numerical model was used to provide more comprehensive predictions of hydraulics and tide induced sediment transport at Mecox Inlet. The specific numerical model used in this study has been tested at a variety of inlets and has resulted in good predictions of inlet current velocities and bay water levels. The numerical model is based on a cross-sectionally averaged, one-dimensional momentum equation derived from the complete equation of motion by Harris and Bodine (1977).

The Grid System

In order to run the numerical model for predictions at Mecox Inlet it was necessary to construct a grid system which describes the geometry of the inlet. Then, a forcing mechanism to drive the model must be specified either as a sinusoidal ocean tide curve or an actual time series of ocean tide levels. In the application to Mecox Inlet possible cases of inlet configuration were represented by two basic grid systems. One is a winding inlet (Plan I) and the other is a more-or-less straight inlet (Plan II). The grid system of Plan I has four cells, one on the seaward side of the inlet mouth, two cells describing the inlet channel and one cell describing the bayside inlet entrance. Because of simpler configuration of the straight inlet only three grid cells were required. Depths along the inlet channel and at the bayside entrance of the inlet were obtained from field surveys when the inlet was open in June and September of 1985. Bathymetry at the seaward end of the inlet was obtained from nautical charts and an offshore survey conducted in March of 1985.

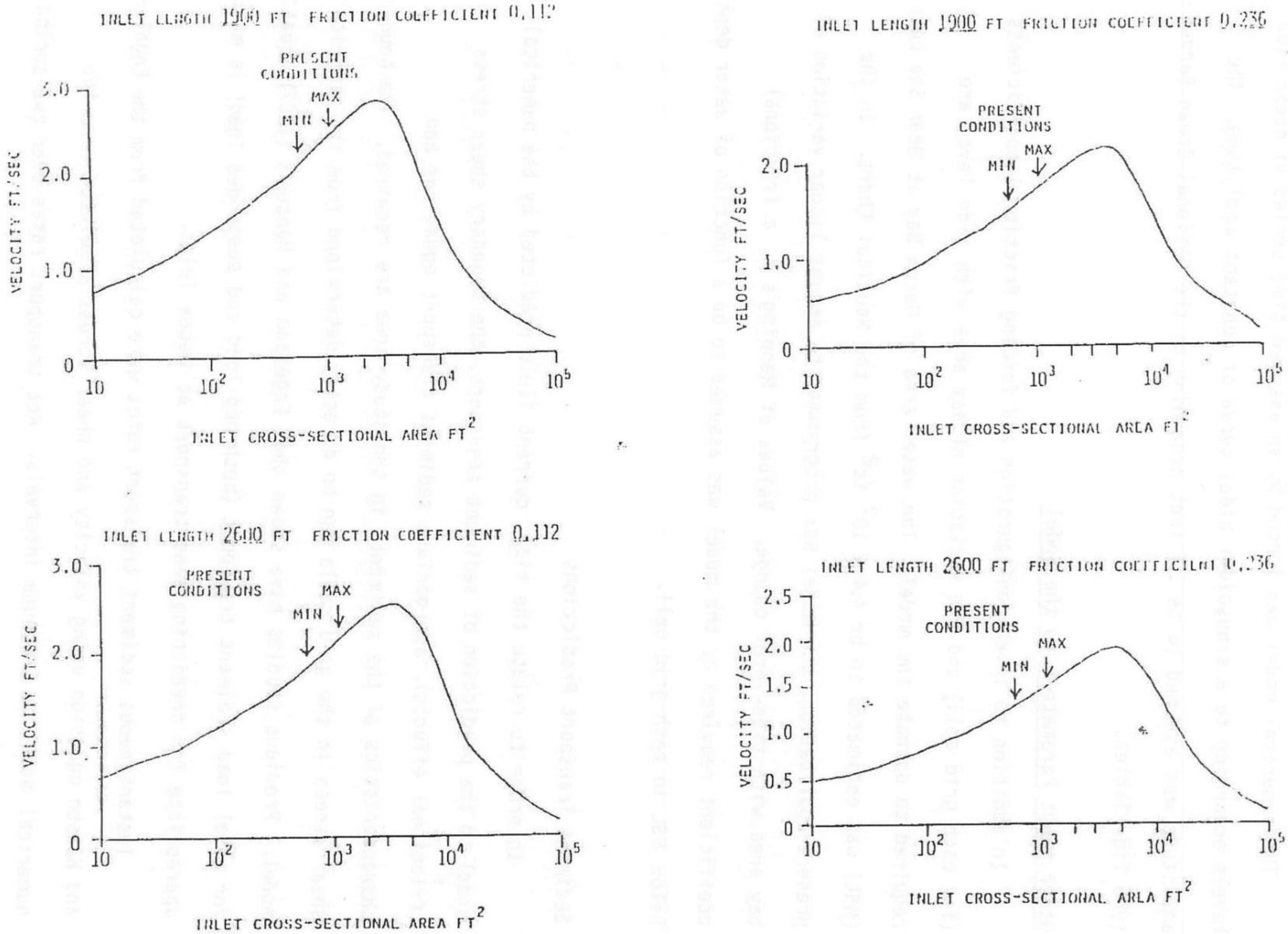


Figure 11. Inlet stability curves predicted from the analytical model using two inlet lengths (1900 ft and 2600 ft) and two frictional coefficients (0.112 and 0.236).

Forcing the Model

The numerical model was forced by an assumed time series of ocean tide levels according to a sinusoidal tidal curve of constant amplitude. The amplitude was assumed to be 1.4 feet according to the National Ocean Survey's 1985 Tide Tables.

Other Input Parameters to the Model

In addition to inlet configuration and forcing frictional coefficients (for each grid cell) and the variation of bay area with tide level are required to operate the model. The water area of Mecox Bay at Mean Sea Level (MSL) was estimated to be 4.4 x 10^7 ft^2 from the Nautical Chart. In the present application, the model was programmed to assume linear variation of bay area with tide-level change. Values of Manning's n, a frictional coefficient required by the model was assumed to be a function of water depth below MSL in each grid cell.

Sediment Transport Predictions

In order to relate the tidal current field predicted by the numerical model to the prediction of sediment transport, the boundary shear stress (frictional effects), appropriate sediment transport equations and characteristics of the sediments in the study area are required. The boundary shear stress in the grid cells can be directly determined from the numerical model. Previous studies have shown that Engeland and Hansen's (1967) equation for total load sediment transport (both bed load and suspended load) is most appropriate for predicting sand transport at Mecox Inlet.

Instantaneous sediment transport rates were calculated from the Engeland and Hansen equation using velocity and shear stress predicted from the numerical model at 5-minute intervals. Net transport rates over two spring-neap cycles (29 days) were computed by averaging instantaneous sediment transport.

Results of Tidal and Sediment Transport Predictions

The numerical and sediment transport models were run for various configurations of Mecox Inlet to assess the effects on inlet currents, bay water level and sand transport patterns. Inlet configurations included the present inlet cross-sectional area (600 ft^2) for both a winding inlet (Plan I) and a straight inlet (Plan II). Then an inlet having a cross-sectional channel area of 1000 ft^2 was modeled for both the winding configuration (Plan III) and the straight configuration (Plan IV). Plan V and VI consisted of a 4000 ft^2 inlet cross-section for the winding and straight configurations respectively. Finally plan VII and Plan VIII consisted of an inlet 10,500 ft^2 in cross-section for the winding and straight configurations.

Results for the Present Situation (Inlet Cross-Section 600 ft^2)

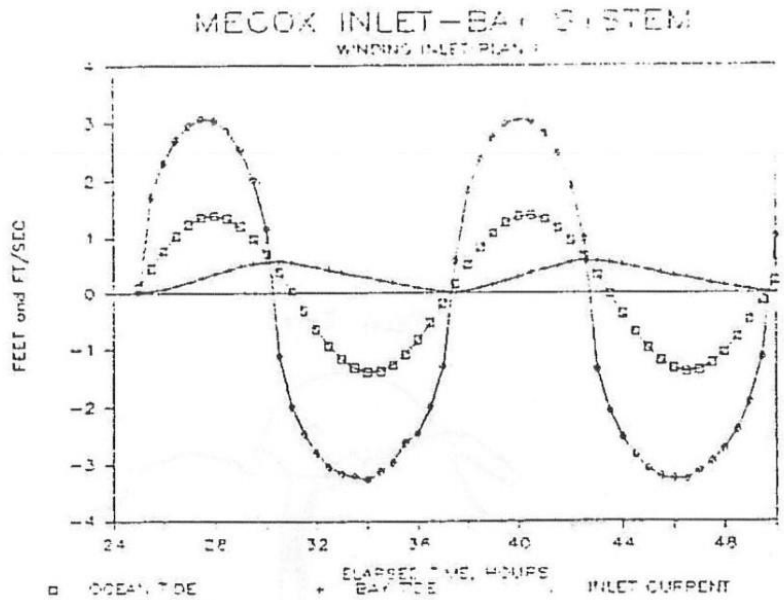
Figure 12 illustrates the results of predictions for the present inlet cross-section of 600 ft^2. Bay water level at high tide is predicted to be 0.58 feet and 0.68 feet above MSL for the winding and straight configurations respectively. This is between 40 and 50% of the ocean water level at high tide. At low tide the bay water level remains at about MSL for both configurations, which is substantially higher than the ocean water level of 1.4 feet below MSL. This means that the bay does not drain completely to the level of the ocean tide under present conditions. Therefore the bay tidal range is only between 20 and 30% of the ocean tidal range when Mecox Inlet is opened to its usual cross-section.

Maximum vertically averaged tidal currents in Mecox Inlet are predicted to be slightly greater than 3 ft/s for both plans, ebbing currents reaching slightly higher speeds than flooding currents (Figure 12). This compares with maximum surface currents of 5 ft/s measured in the inlet during the process-response study in September, 1985. The tidal prism (tidal water volume exchange) for Plan I (winding inlet) is 2.6 x 10^7 ft^3 compared with 3.4 x 10^7 ft^3 for Plan II (straight inlet). This indicates that tidal flushing is 35% more efficient for the straight inlet configuration.

Results from the sediment transport model indicate that there will be convergence of net sediment transport (shoaling) at the bayward and seaward end of the Plan I winding inlet (Fig. 13). For Plan II, the straight inlet erosion will take place at the center of the inlet, whereas shoaling is expected at the seaward end (Fig. 13).

Results for Plans III and IV - Inlet Cross-Section 1000 ft^2

As the inlet cross-sectional is increased to 1000 ft^2, tidal flow through the inlet is more efficient resulting in a higher high tide (0.8 to 0.9 ft above MSL) and a lower low tide (-0.4 to -0.5 ft below MSL) for Plan III and Plan IV (Fig.14). Accordingly the tidal range of the bay would increase to between 40 and 50% of the ocean tidal range (Fig. 14). The tidal prism of Mecox Bay under these conditions would be between 5.4 and 6.4 x 10^7 ft^3. Thus tidal flushing would be up to 2 times more effective compared to present conditions. Maximum tidal currents would be 3.4 ft/s for Plan III (Fig. 15) and 3.8 ft/s for Plan IV (Fig. 15). For plan III (winding inlet) sediment transport predictions suggest shoaling at the seaward end of the inlet and little or no shoaling among the center and bayward side of the inlet (Fig. 16). For Plan IV (straight inlet) sediment transport predictions indicate



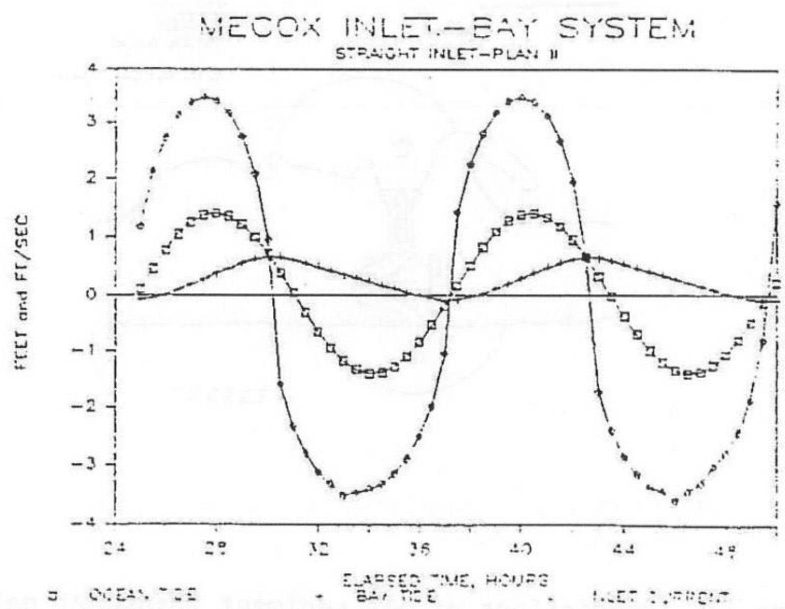


Figure 12. Predictions of inlet tidal current velocity and tide levels in Mecox Bay for a curving inlet channel (Plan I) and a winding inlet channel (Plan II) having a cross-sectional area of 600 ft^2 (present conditions).

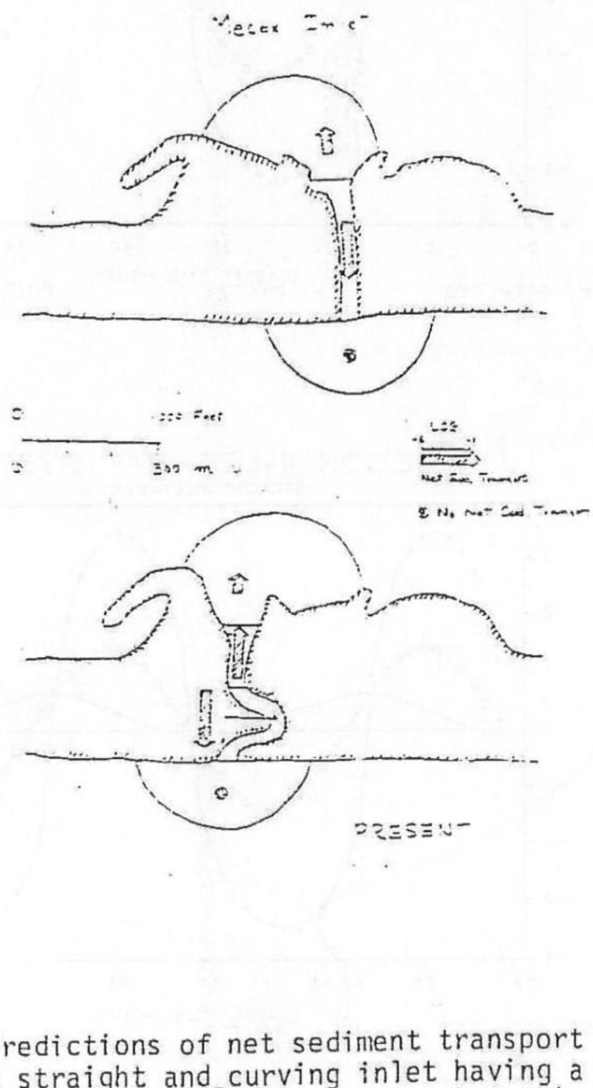
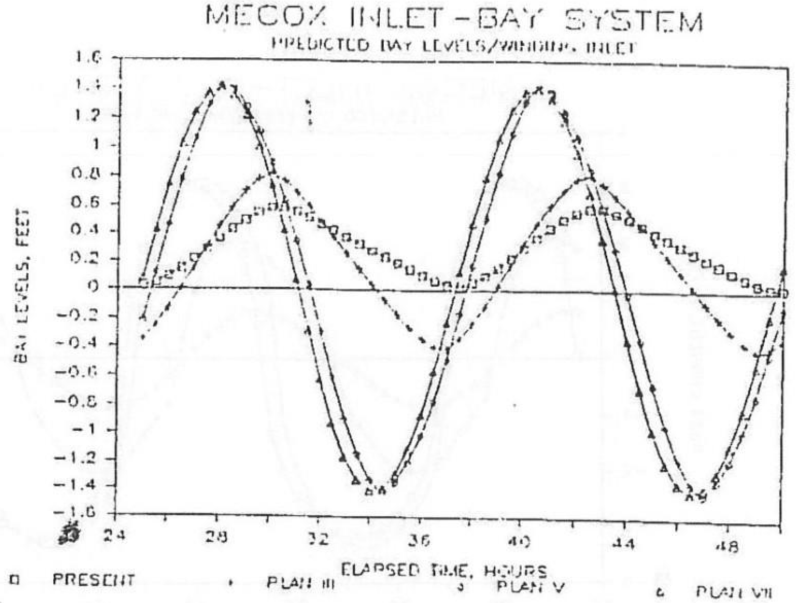


Figure 13. Predictions of net sediment transport patterns for a straight and curving inlet having a cross-sectional area of 600 ft^2 (present conditions).



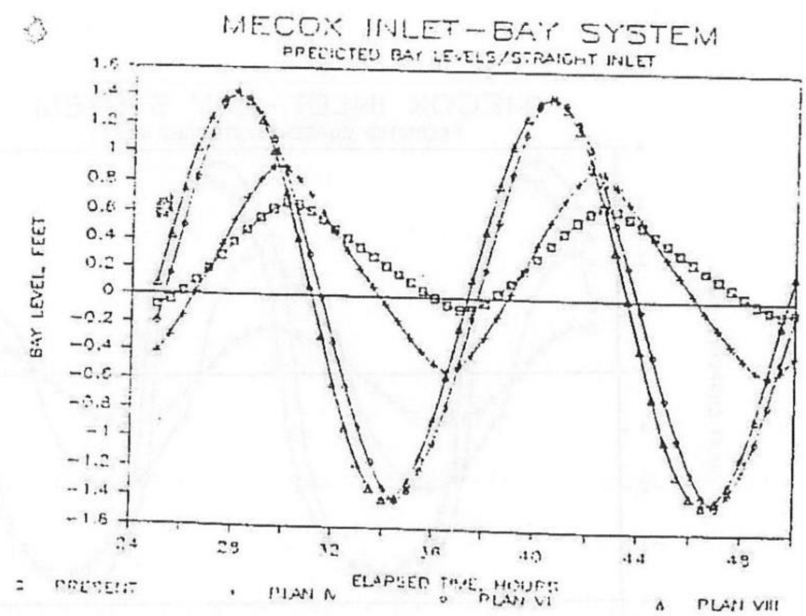


Figure 14. Predictions of tide level in Mecox Bay under present conditions, for an inlet cross-section of 1000 ft^2 (Plans III and IV), an inlet cross-section of 4000 ft^2 (Plans V and VI) and an inlet cross-section of 10,500 ft^2 (Plans VII and VIII).

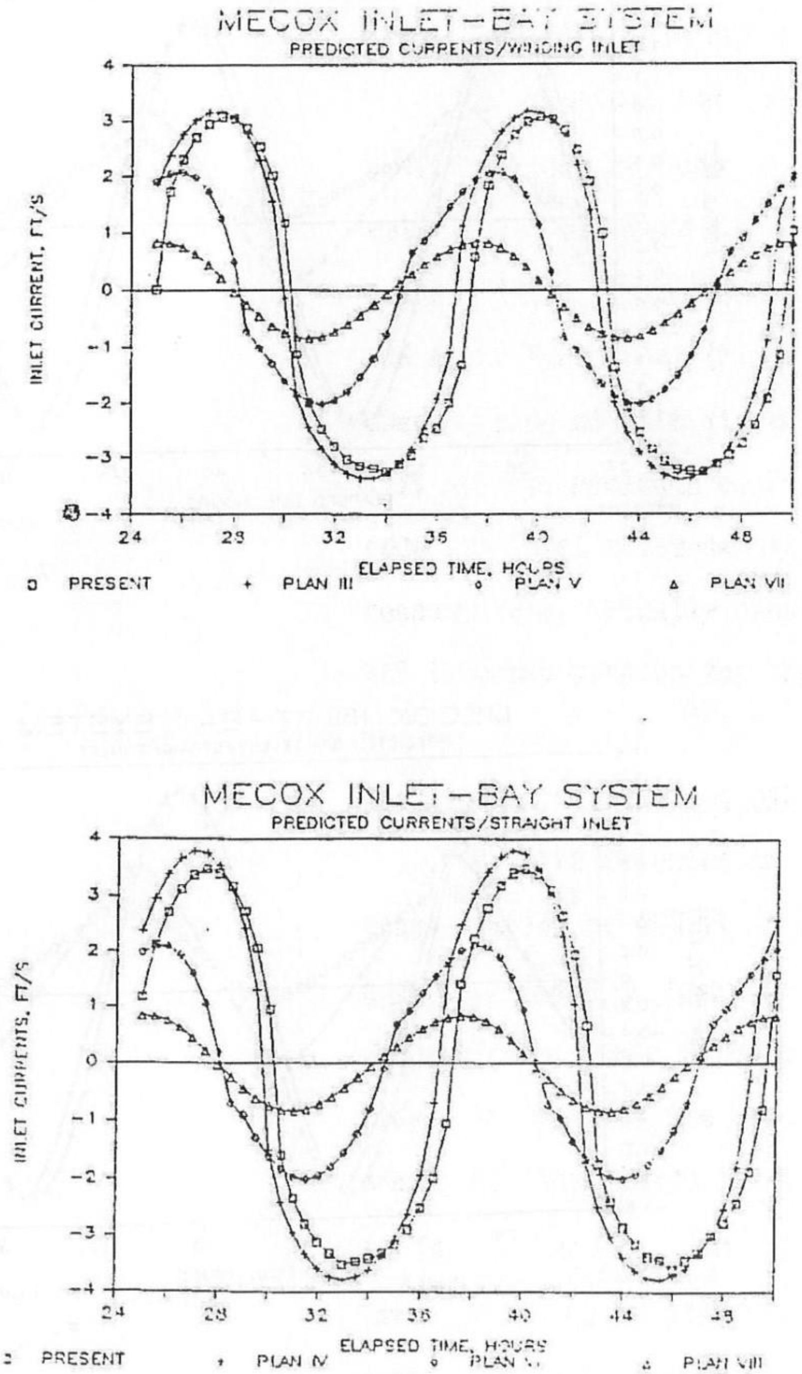


Figure 15. Predictions of tidal currents in Mecox Inlet for present conditions, for an inlet cross-section of 1000 ft^2 (Plans III and IV), for an inlet cross-section of 4000 ft^2 (Plans V and VI) and for an inlet cross-section of 10,500 ft^2 (Plans VII and VIII).

shoaling at the seaward end of the inlet and either erosion or lack of shoaling along the inlet channel and bayward side (Fig. 16).

Results for Plans V and VI - Inlet Cross-Section 4000 ft^2

The large inlet cross-sectional area of Plan V and Plan VI would allow a significant increase in the bay tide according to predictions from the numerical model. Bay water levels at high tide would be approximately 1.45 ft above MSL for both the winding and straight inlets or slightly greater than the ocean high tide (Fig. 14). At low tide the bay level would be approximately equal to the ocean level or about -1.40 below MSL.

Under Plans V and VI maximum tidal current velocities are predicted to be about 2 ft/s or substantially lower than predicted currents for the present situation (Fig. 15). This is due to the greater inlet channel cross-section. The ti prism predicted for both Plans V and Plan VI is about 12.5×10^7 ft^2. This would result in tidal flushing of Mecox Bay that is up to five times more effective than for the present situation (Table 1).

Sediment transport predictions for Plan V and Plan VI indicates net sediment transport in a bayward direction within the inlet channel (Fig. 17). Net transport patterns indicate a convergence of transport or slowing of transport on the bayside of the inlet. Therefore, unlike previous plans considered, an inlet with a 4000 ft^2 cross-section would be subject to shoaling on its bayward side.

Results for Plans VII and VIII - Inlet Cross-Section 10,500 ft^2

An inlet connecting Mecox Bay to the ocean having a cross-section of over 1000 ft^2 would result in virtually unrestricted tidal exchange between bay and ocean. Bay water levels would be the same as ocean water levels and would be completely in phase with ocean tides without delays relative to high and low tide in the ocean (Fig. 14, Table 2).

Although the cross-sectional area (10,500 ft^2) has been increased more than 2.5 times over Plans V and VI, the flushing ability of Mecox Inlet would remain the same as in the previous case. This is due to a marked decrease of maximum current velocity to less than 1 ft/s in an inlet having such a large channel cross-section and a relatively small bay behind it (Fig. 15). In this case net sediment transport by tidal currents is predicted to be negligible because of the nearly symmetrical tidal wave and weak currents (Fig. 18, Table 3).

Summary

Seasonal changes in the beach areas adjacent to Mecox Inlet indicate the usual cycle of increased beach volume during late spring and summer months and decreased beach volume during late fall and winter months. This cycle is attributable to the greater frequency of storms (either locally or at sea) in the winter months, which results in higher energy conditions that cut back the beach. Although the eight-month profile data set showed that the beach is subject to significant fluctuations in volume, even on a month to month basis, none of these larger changes corresponded to the two open inlet periods (in June and September) incorporated within the study period. If the opening of Mecox Inlet in June and September of 1985 had any affect on the adjacent beach areas, such effects were apparently small enough or of short enough duration to be masked by changes caused by other factors. These factors include local wave climate, semidiurnal and spring-neap tidal cycles, wind patterns and storms.

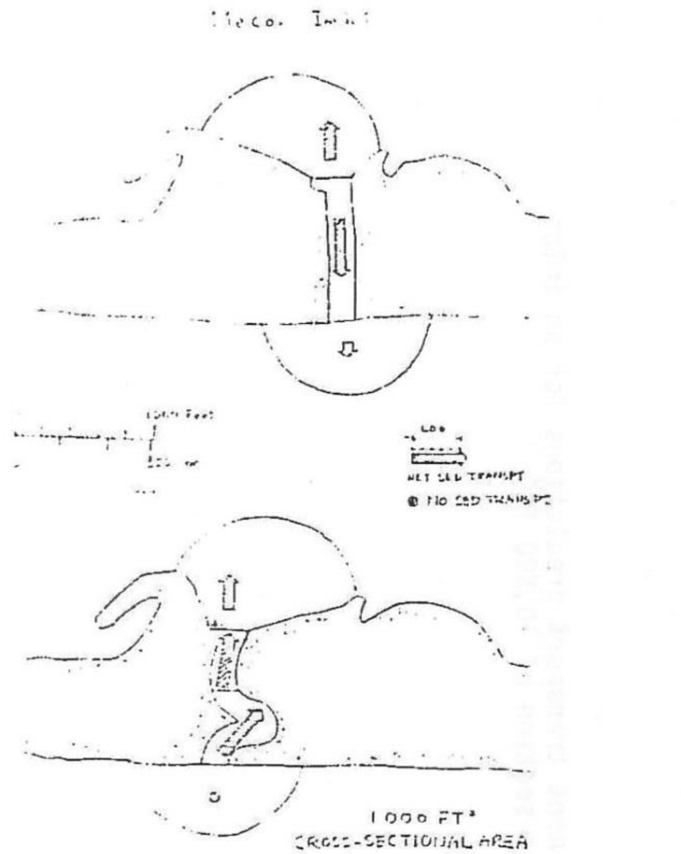


Figure 16. Sediment transport predictions for an inlet cross-section of 1000 ft^2.

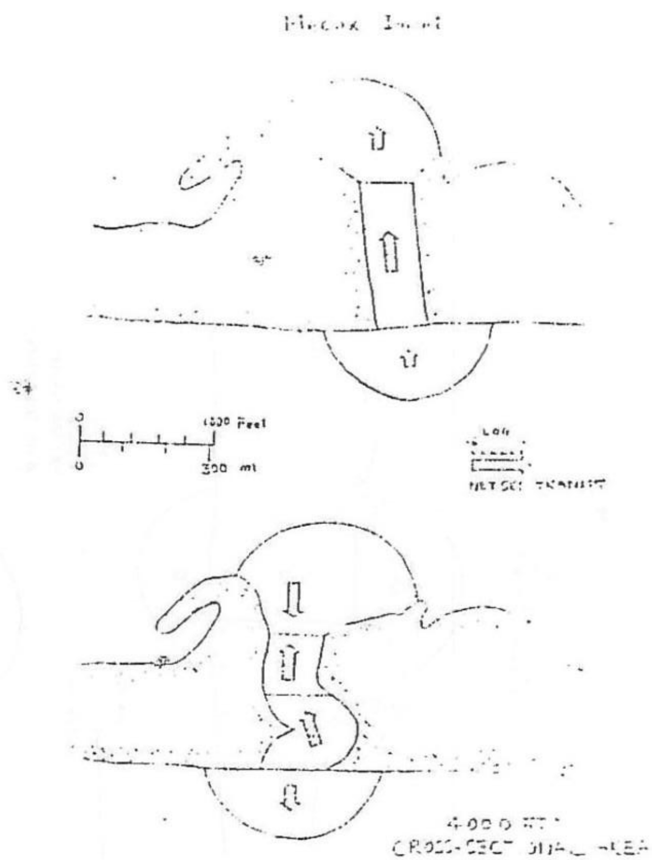


Figure 17. Sediment transport predictions for an inlet cross-section of 4000 ft^2.

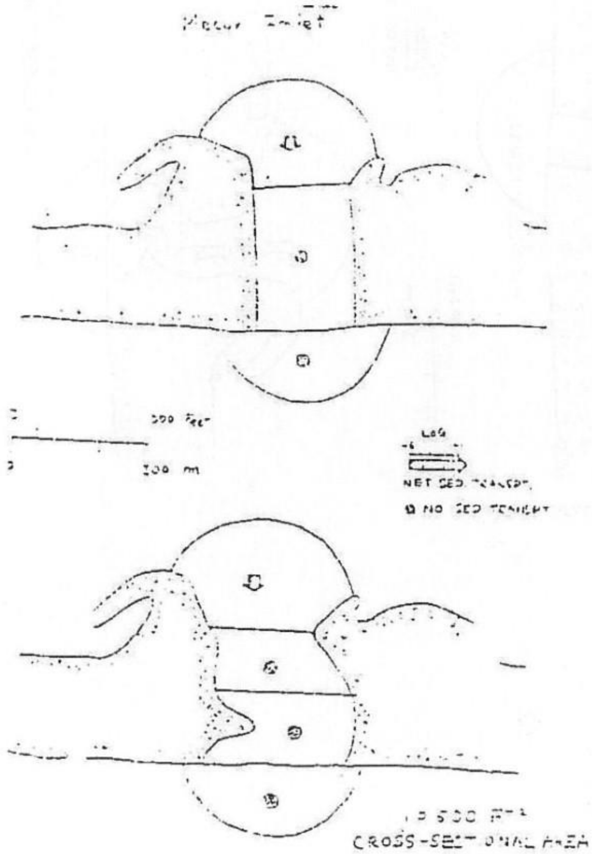


Figure 18. Sediment transport predictions for an inlet cross-section of 10,500 ft^2.

Table 2 Summary of results from the numerical model for the Mecox Inlet

	I	II	III	IV	V	VI	VII	VII
Max. C.								
Flood	3.1	3.5	3.4	3.8	2.1	2.1	0.84	0.8
Ebb, ft/s	3.2	3.5	3.4	3.8	2.0	2.0	0.85	0.
Duration								
Flood	5.3	5.3	5.6	5.6	6.1	6.0	6.2	6.
Ebb, hr	7.1	7.1	6.8	6.8	6.3	6.4	6.2	6.
Max.Disc.								
Flood	1900	2500	3900	4500	8900	9000	9000	890
Ebb, ft^3/s	1300	1800	3000	3500	8000	7900	9000	890
Bay Level								
High W.	0.58	0.66	0.82	0.92	1.44	1.43	1.41	1.
Low W., ft	0.03	-0.09	-0.41	-0.53	-1.42	-1.41	-1.41	-1.
Phase Lag								
High W.	2.4	2.3	2.1	1.8	0.34	0.16	0.0	0.
Low W., hr	3.3	3.1	2.7	2.4	0.42	0.33	0.0	0.
Bay Range	0.55	0.75	1.23	1.45	2.86	2.84	2.82	2.
Bay/Ocean	0.20	0.27	0.44	0.52	1.02	1.01	1.01	1.
Tidal Prism								
107 ft3	2.6	3.4	5.6	6.5	12.6	12.5	12.4	12.

Table 3 Predicted net sediment transport rates for the Mecox Inlet

unit; $g^{-1}cm^{-1}s^{-1}$

Winding Inlet X-area (ft2)	Present	1000	4000	10500
Grid #	Plan I	Plan III	Plan V	Plan VII
4	3.4×10^{-5}	8.7×10^{-4}	-1.4×10^{-3}	-1.1×10^{-5}
3	4.4×10^{-2}	9.9×10^{-2}	1.3×10^{-3}	n.s.t.
2	-3.6×10^{-1}	2.8×10^{-1}	2.8×10^{-4}	n.s.t.
1	n.s.t.	n.s.t.	-2.2×10^{-5}	n.s.t.

Straight Inlet

Grid #	Plan II	Plan IV	Plan VI	Plan VIII
3	1.3×10^{-4}	1.7×10^{-3}	6.7×10^{-5}	-1.1×10^{-5}
2	-3.4×10^{-1}	-3.1×10^{-1}	2.4×10^{-3}	n.s.t.
1	n.s.t.	-1.1×10^{-5}	1.1×10^{-5}	n.s.t.

Note; n.s.t. means no net sediment transport.

The results of the process-response study conducted when Mecox Inlet was open in September, 1985 documented the short-term effects of the inlet in the beach. It is clear that the beach areas within 200 m of the inlet are sensitive to inlet processes. The lower part of the downdrift beach (west of the inlet in this case) suffered an unmistakable loss of beach volume as a result of reduced westwave drift of sand. Conversely, the interruption of longshore drifting of sand by the inlet resulted in a net gain of beach volume on the updrift side of the inlet (east in this case). This pattern of beach volume change is thought to be due to strong wave-current interaction and shoal building at the mouth of the inlet. Strong tidal currents associated with the inlet mouth clearly resulted in reduced longshore current speeds, thus reducing longshore drifting of sand. Although much of the sand supply from shoaling at the inlet mouth is from erosion of the inlet channel after the initial cut, some of the sand supply for shoaling is due to trapping from longshore currents as they are interrupted by inlet-related tidal currents. This process of sand trapping by the inlet is partly responsible for observed beach volume changes during open inlet conditions.

Despite the documented effects of Mecox Inlet on the adjacent beach, these changes are considered very local. None of the long beach profiles that were used to assess volumetric changes of the beach within 500 m (1650 ft) on either side of the inlet registered any significant change at the time of the inlet opening in September 1985. The direct impact of inlet opening on the sand budget seems to be very small and confined to the immediate vicinity of the inlet compared with the effects of episodic storms in particular. The effects of storms on this area are likely to be greater than direct impact of inlet hydraulics at Mecox Inlet. Storms not only cause loss of beach volume by offshore sand transport, but by overwashing the low-lying barrier beach directly seaward of Mecox Bay. Overwashing of the eastern portion of this area during hurricane Gloria is a good example of this. The main source of sand shoaling in the seaward side of Mecox Bay is probably due to ? rather than due to tidal currents associated with the inlet.

Results of both the analytical model and numerical model of Mecox Inlet show that Mecox Bay would support somewhat larger inlet (larger channel cross-section) than is usually present after man-made opening of the inlet. From the initial cut on September 10 of a channel about 200 ft^2 in cross-section, Mecox Inlet eventually increased in size to about 600 ft^2 in cross-section through erosion of its own channel. Predictions from the analytical model indicated for a Bay the size of Mecox Bay and an ocean tidal range of 3.4 ft that the optimum inlet channel cross-section would be on the order of 2000 to 3000 ft^2 in which tidal currents would attain a maximum speed of 2 to 3 ft/s. Therefore, inlet channels of smaller cross-section would tend to undergo scour and increase in cross-section. Results of the numerical model are in general agreement with both observed conditions and predictions from the analytical model. Predictions from the numerical model in which the inlet cross-section was varied between 600 ft^2 and 10,500 ft^2 showed that maximum tidal current velocities would occur when the inlet cross-sectional area is between 1000 and 4000 ft^2. Predictions of net sediment transport rates from the numerical model indicated that significant shoaling would only occur at the seaward end of Mecox Inlet. For inlet cross-sections of 4000 ft^2 or less at inlet cross-sections greater than 400 ft^2 current velocities would not be high enough to maintain the inlet channel which would have a tendency to decrease its cross-section by shoaling. Sediment transport predictions for the present conditions were in good agreement with observations, indicating that sediment supply for shoaling at the inlet entrance is partly from scouring of the inlet channel as it widens after the initial cut.

In addition to allowing an assessment of the effects of Mecox Inlet on adjacent beach areas the results of observations and predictions allow an assessment of tidal flushing of Mecox Bay. A compilation of inlet opening records for the past 13 years shows that Mecox Inlet is on the average opened approximately 5 times each year. Of that number an average of 4 openings are man-made and one is natural (Fig. 19). Based on our record of water level in Mecox Bay over the past eight months artificial opening is completed when the bay level rises by 40 to 50 cm (16 to 20 inches) above the reduced bay level just after an open inlet period. Shortly after the inlet is open salinity in Mecox Bay increases to near oceanic salinity or about 32°/₀₀. After a period of increasing bay level from fresh water influx, bay salinities decrease to about 20°/₀₀. Based on an average rate bay level rise of 1 cm (0.4 inch) per month, the average rate of freshwater influx to Mecox Bay is approximatley 17 ft^3/s.

The flushing time of Mecox Bay (or the time required to replace all the freshwater in the bay at a rate equal to freshwater influx) can be completed using the relatively simple tidal prism method.

$$t = \frac{V}{P}T$$

In this equation t is the flushing time, V is the low tide volume of the bay, P is the tidal prism (intertidal volume) and T is the tidal period (12.42 hours). Using this relationship the computed flushing time for Mecox Bay under present conditions (small inlet channel cross-section) is approximately 2.5 days. At the end of this period the salinity of Mecox Bay should reach near-oceanic values because of the relatively small freshwater discharge into the bay (7.6×10^5 ft^3 per tidal period) compared with the tidal prism (3 x

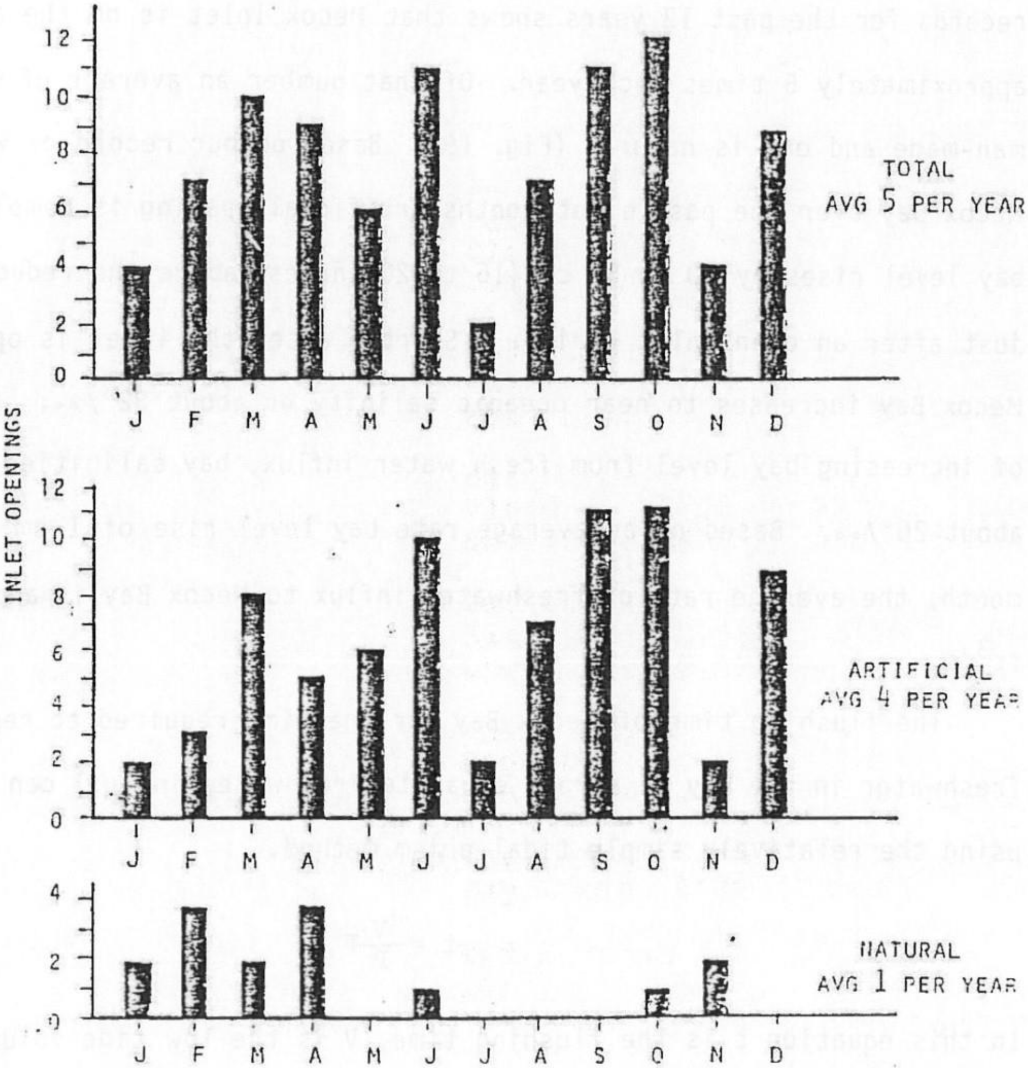


Figure 19. Summary of total artificial and natural openings of Mecox Inlet over the past 13-year period.

10^7 ft^3). Increasing the cross-sectional area of Mecox Inlet to 1000 ft^3 would increase the tidal prism to approximately 6 x 10^7 ft^3 according to predictions from the numerical model. This would result in a decrease of flushing time to approximately 1.2 days. Likewise, increasing the inlet cross-section to 4000 ft^3 or, 10,500 ft^2 would further reduce the flushing time to 0.5 days or one tidal cycles. These simple calculations indicate that increasing the inlet cross-section could reduce the flushing time of Mecox Bay by as much as five times. The flushing time under present conditions is relatively short, however, (2.5 days) and flushing of the bay occurs well within the one to two-week period during which the inlet is commonly open.

Recommendations

Results of studying the Mecox Inlet-Bay system indicate that artificially cutting a small inlet channel across the beach several times per year yields no significant or lasting impact on beach stability as a direct result of inlet hydraulics. Thus, it is recommended that cutting of the inlet should be continued as long as the initial cut is no larger than 200 to 400 ft^2 in cross-section. The initial cut will naturally increase to a dimension of no greater than 600-1000 ft^2 and have no lasting effect on the surrounding beach. However, because the outer inlet channel has a tendency to curve and migrate westward, it is suggested that the initial cut continue to be placed on the east side of the low beach area in front of Mecox Bay. This will minimize and direct impact on developed areas just to the west of Mecox Bay (the area now bulkheaded).

It has been concluded that severe cut-back of the beach in the vicinity of Mecox Inlet occurs episodically largely as a result of storms which cause overwashing and occasional natural opening of the inlet. An example of this is the large washover that occurred at Mecox Inlet during Hurrican Gloria and associated beach erosion. After episodic storms the beach generally recovers within a few weeks. This process is expected to continue, especially since the beach area immediately surrounding the location of Mecox Inlet has no natural dune. An artificially build dune now extends part way across the inlet area and probably prevented overwahing along this section during hurricane Gloria. Extending this duen all the way across the inlet area in the time interval between inlet cuts would prevent overwashing of sand into the bay during minor storms. However, this procedure would be somewhat costly and add to the cost of cutting the inlet. Also, such an artificial dune would not survive a major storm and would provide an additional source of sand for overwashing when it does occur. In addition, the sand supply for building the dune should not come from the beach in front of it. This would also add to the cost.

Results of the study also show that flushing time for Mecox Bay is fairly short, even for a small inlet cut. Therefore increasing the inlet size would not significantly enhance flushing of Mecox Bay, which is already completed in less than one week. However, since salinities in Mecox Bay are quickly reduced after inlet closure due to continuous freshwater influx, more frequent artificial opening of Mecox Inlet could be used to maintain salinity at a higher level in the bay. Results of the study indicate that more frequent opening of the inlet would not increase the risk of erosion to surrounding beaches if the inlet size is small. It is also possible that more frequent opening of the inlet at relatively lower water levels in Mecox Bay would actually help minimize short-term erosion on the adjacent beach that does occur. The strong ebbing currents that transport sand out of the inlet and scour the inlet channel just after opening are a function of elevated water levels in the bay. If the inlet was opened more frequently when bay level has increased only half its usual 40 to 50 cm rise between inlet cuts, ebbing currents after the cut would not be as strong and post-cut scouring of the inlet would not be as great. Under these conditions, the inlet would probably not increase in size as much and close after a shorter period of time. In addition seaward building of ebb-tidal shoals and interference with longshore currents would be reduced. The overall result of weakened inlet processes would be to minimize impact on the surrounding beach.

In itemized form our recommendations are as follows:

1. Maintain the inlet cross-sectional area at 600-1000 ft^2
2. Reduce impact of short-term beach erosion on developed areas by using easterly route through beach
3. Increase flusing of Mecox Bay by increasing the frequency of inlet cutting
4. Reduce the impact of overwashing by establishing a temporary artificial dune across the inlet area.
5. Reduce the impact of storms by closing Mecox Inlet if it opens naturally during a storm and has a large cross-sectional area.

APPENDIX B

2003 Southampton College Study

A COMPREHENSIVE STUDY OF MECOX BAY

FOR THE SOUTHAMPTON TOWN TRUSTEES

CHRISTOPHER GOBLER, PHD,

SOUTHAMPTON COLLEGE, LONG ISLAND UNIVERSITY

June 2003

A COMPREHENSIVE STUDY OF MECOX BAY FOR THE SOUTHAMPTON TOWN TRUSTEES

CHRISTOPHER GOBLER, PHD,

SOUTHAMPTON COLLEGE, LONG ISLAND UNIVERSITY

June 2003

EXECUTIVE SUMMARY

Mecox Bay is an enclosed shallow water inland bay located on the south fork of Long Island, New York. It lies adjacent to the Atlantic Ocean and contains an inlet that is opened periodically during the year by the Town of Southampton, which allows the bay to exchange water with the Atlantic Ocean. The inlet is opened to maintain salinity levels that are ideal for shellfish (>10 ppt) and to control water levels within the bay. The aim of this study was to identify the physical, chemical, and biological effects of opening the Mecox Bay inlet. Five set stations were sampled once a week from 17 January through 13 December 2002. Three stations were located within Mecox Bay, one in the Atlantic Ocean (outside the nearby Shinnecock Inlet) and one in the brackish portion of Mill Creek, which is the largest freshwater tributary flowing into the bay. Results indicated that the opening of the Mecox Bay inlet most directly affected depth and salinity of the bay. Seasonal temperature changes played a direct and indirect role in altering Mecox Bay nutrient concentrations, as did the significant input from tributaries and groundwater. Coliform bacteria densities increase with the closing of the inlet and data from this study indicate that the shellfishing season (closed 15 Apr – 15 Dec) and areas of the bay closed to shellfishing (tributaries, eastern shore) as determined by the NYDEC are appropriate. The presence of high nutrient concentrations promotes phytoplankton growth (high chlorophyll), which results in healthy shellfish populations within Mecox Bay. Mecox Bay can be both phosphate and nitrogen limited for phytoplankton, with phosphate limitation occurring in the winter, early spring, and autumn and nitrogen limitation occurring in the summer. Mecox Bay was found to be approximately 1.5 m deep, and had sediments which ranged from sandy and low in

organic carbon content to muddy and organically enriched (> 10% organic carbon by weight). Benthic and pelagic survey's of Mecox Bay revealed a high level of biodiversity within this ecosystem with substantial abundances of the American Oysters, *Crassostera virginia*, the ribbed mussel, *Geukensia demissa*, the soft shell clam, *Mya arenaria*, the Inland Atlantic silverside, *Menidia beryllina*, and the blue claw crab, *Callinectes sapidus*, being noted.

Introduction

Estuaries are regions of transition from terrestrial to marine environments. They are partially enclosed bodies of water where freshwater mixes with high salinity seawater (Environmental Protection Agency, 2001). Estuaries, which are some of the most productive environments on earth, provide sheltered waters for fish and shellfish spawning, offer migratory birds a spot to rest during migration, and act as a home to a large diversity of wildlife (EPA, 2001). Estuarine habitats are generally areas of high primary production and provide abundant food supplies for their inhabiting organisms (Bruno et al., 1980).

Approximately half of the United States population, 110 million people, lives in coastal areas, which are currently growing three times faster than counties elsewhere in the country (EPA, 2001). As a result, estuaries provide economic benefits through tourism and fisheries and also support public infrastructure by serving as harbors and ports for shipping, transportation, and industry (EPA, 2001). Estuaries act as a habitat for finfish and shellfish, which are of commercial and recreational importance (Bruno et al., 1980). 75% of the United States' commercial fish catch and 80-90% of its' recreational fish catch come from estuaries (EPA, 2001).

Estuaries also play an important ecological role in filtering sediments, nutrients, and pollutants, which generates cleaner and clearer water entering the adjacent marine environment (EPA, 2001). However, many estuarine environments have been anthropogenically degraded by channel dredging, the filling of marshes and tidal flats, water pollution, and shoreline reconstruction (EPA, 2001). The consequences of such actions include: beach and shellfish bed closings, harmful algal blooms, unproductive fisheries, eutrophication, and a loss of habitat for fish and other wildlife (EPA, 2001).

Physical Features of Estuaries:

The combining of salt water and freshwater within estuaries results in the stratification of the water column. While there are several types of stratification, the three types of stratification most commonly seen in estuaries result in a well-mixed water column, a slightly stratified water column, and a highly stratified water column (Berner and Berner, 1992). In well-mixed estuaries, the water mixes evenly so that there is no halocline between the salt and fresh water. Well-mixed estuaries are dominated by tidal flow (Berner and Berner, 1992). In slightly stratified estuaries, the less dense fresh water remains above the denser salt water. There is a small amount of mixing between the two layers and both river flow and tidal flow play an important role (Berner and Berner, 1992). In highly stratified estuaries, the formation of a halocline prevents the mixing of the salt and fresh water layers. In such estuaries, large amounts of river flow dominate the modest influence of tidal flow (Berner and Berner, 1992).

Hypoxia is a period of reduced dissolved oxygen concentration whose frequency, duration, and severity are dependent upon the net movement of bottom waters (Kuo and Neilson, 1987). Hypoxia has been defined as the level at which dissolved oxygen (DO) concentrations are below 3 mg O_2/L (94 μM O_2) in bottom waters (Anderson and Taylor, 2001). Many regulatory agencies define hypoxia as < 3mg O_2/L, because juvenile and adult benthic invertebrate and fish species experience physiological stress below this concentration (Anderson and Taylor, 2001).

The severity of DO depletion in the bottom waters of estuaries depends on a variety of factors, including basin morphology, vertical density stratification, and nutrient and organic matter inputs (Stanley and Nixon, 1992). Hypoxia tends to develop when there is both vertical water column stratification and warm water temperatures (>15°C; Stanley and Nixon, 1992). Stratification in an estuary and DO levels are tightly coupled with freshwater discharge and wind stress. Thus, severe hypoxia occurs more frequently in the upper half of an estuary than near the mouth (Stanley and Nixon, 1992). In shallow water estuaries, wind mixing tends to decrease water column stratification more frequently, resulting in shorter durations of bottom water hypoxia that are limited in spatial extent (Stanley and Nixon, 1992).

Hypoxia also results from an increase of phytoplankton biomass delivering large amounts of organic material to the bottom through sedimentation. Microbial processes occurring with the decay of this material consume oxygen, thus lowering the oxygen content of the water (Richardson and Jørgensen, 1996). If such conditions persist, all of the oxygen will be removed from the water, a process known as anoxia (Richardson and Jørgensen, 1996).

Coliform Bacteria:

Fecal contamination of freshwater by human sewage, including faulty septic tanks, and animal waste from animal husbandry practices and natural waterfowl populations may be used as an indicator to the presence of other harmful pathogens in estuaries (George, et al., 2001). Total coliforms (TC) and fecal coliforms (FC) are two types of fecal bacteria indicators used to determine the microbiological quality of surface waters (George, et al., 2001). Filter-feeding shellfish located within coastal waters may take up both naturally occurring and introduced pathogenic microorganisms when filtering seawater (Jones and Summer-Brason, 1998). Human consumption of raw or partially cooked shellfish containing pathogens can result in diseases in humans (Jones and Summer-Brason, 1998).

Among naturally occurring bacterial pathogens associated with shellfish, pathogenic *Vibrio* spp. pose one of the greatest public health hazards (Jones and Summer-Brason, 1998). Although *Vibrio* spp. are prevalent in warm water estuaries, they have been detected in coastal waters as far north as the Maine coast along the Atlantic Ocean (Jones and Summer-Brason, 1998). Temperature and salinity are useful parameters in predicting densities of *V. vulnificus* and it as been found that the optimum temperature and salinity for *V. parahaemolyticus* is 20 °C and 20 ppt, respectively (Jones and Summer-Brason, 1998). Previous studies have shown that the growth of these autochthonous pathogens may be enhanced in coastal waters receiving nutrients from wastewater and surface runoff (Jones and Summer-Brason, 1998).

Nutrients:

Estuaries and coastal waters often experience eutrophication, an increase in the flow of particulate and dissolved materials into the estuary (Fisher et al., 1995). Such materials include N and P, which promote algal growth when enough light is available (Fisher et al., 1995). Eutrophication of aquatic systems results from allochthonous (nutrient input from outside the system) as well as autochthonous (nutrient recycling within the water column and sediments) sources (Fisher, et al., 1995; Richardson and

Jørgensen, 1996). The external loading of nutrients in estuarine systems can come from soil erosion, which often includes nutrient-enriched fertilizers, disposal of municipal or industrial effluents, anthropogenic sources, such as sewage, and ground water runoff (Fisher et al., 1995). A secondary effect of eutrophication can be hypoxia (Richardson and Jørgensen, 1996).

Phytoplankton Diversity and Distribution:

There are over 4000 described species of phytoplankton in 13 taxonomic classes (Lalli and Parsons, 1997). One of the most abundant phytoplankton groups is the diatoms, belonging to the class Bacillariophyceae (Lalli and Parsons, 1997). Diatoms, which are usually the dominant phytoplankton in temperate and high latitudes, are unicellular and range in size from 2 μm to over 1000 μm (Lalli and Parsons, 1997). All species of diatoms have external skeletons made of silica called frustules (Lalli and Parsons, 1997). Other abundant phytoplankton groups include the dinoflagellates and coccolithophores. Dinoflagellates, which belong to the class Pyrrophyceae, have two flagella giving them enhanced motility (Lalli and Parsons, 1997). Coccolithophorids are small phytoplankton that are generally smaller than 20 μm (Lalli and Parsons, 1997). Coccolithophorids have external shells made up of many calcareous plates, called coccoliths, and like dinoflagellates they have two flagella (Lalli and Parsons, 1997). Coccolithophores are common in warm or cool waters and prosper in low light conditions (Lalli and Parsons, 1997; Graham and Wilcox, 2000). Finally, cyanobacteria, which are found in both coastal and oceanic waters, are an important phytoplankton group, as some species are capable of fixing dissolved gaseous nitrogen (Lalli and Parsons, 1997).

Phytoplankton communities within estuaries are composed of a large diversity of taxa, each of which has distinct physiological characteristics (Pinckney et al., 1997). These differences make some phytoplankton better equipped to take up nutrients under nutrient limited circumstances (Pinckney et al., 1997). This may cause uneven phytoplankton distributions over spatial and temporal scales and in certain situations may cause one species to completely dominate a region, thus creating an algal bloom (Pinckney et al., 1997). Such algal blooms often cause negative effects on water transparency, killing both benthic plants and microalgae that are not able to receive sufficient light for photosynthesis (Graham and Wilcox, 2000). It is estimated that up to 50% of all marine and freshwater algal blooms may be toxic (Graham and Wilcox, 2000). These toxic algal blooms can cause massive fish kills and serious illness or death in humans (Graham and Wilcox, 2000). Biomass accumulation in estuaries may be controlled by the removal of biomass through advective losses, grazing, sinking, and cell death (Fisher, et al., 1995). Previous studies have shown bivalve growth to be dependant upon food availability (suspended algae and phytoplankton), temperature, and current speed (Lorrain et al., 2000).

Phytoplankton Biomass and productivity:

Phytoplankton biomass is an important factor in determining the total primary productivity of an estuary and, as such, studies have used chlorophyll *a* concentrations as an index of phytoplankton biomass (Bruno et al., 1980; Lively et al., 1983). Factors affecting phytoplankton biomass include available nutrient levels, irradiance, temperature, salinity, pH, and water circulation patterns (Pinckney et al., 1997). Primary production occurring in surface waters directly contributes to bottom water organic matter through sedimentation (Fisher et al., 1995). Biogeochemical and ecological processes in estuaries are driven by phytoplankton photosynthesis (United States Geological Survey, 2002). Changes in pH, trace metal speciation, concentrations of dissolved gases (oxygen, carbon dioxide, and methane), inorganic nutrients (nitrate, phosphate, silicate), and organic compounds (amino acids, organosulfur compounds) may all be directly associated with fluctuations in phytoplankton photosynthesis (USGS, 2002).

Phytoplankton and nutrients:

Carbon, nitrogen, phosphorous, silicon, potassium and sulfur are nutrients required for phytoplankton survival (Richardson and Jørgensen, 1996). Phytoplankton allow for nutrients, such as nitrogen, phosphorous, and silicon, which are not usually directly consumed by other organisms, to be stored and utilized by secondary and tertiary consumers of the food chain (Fisher, et a., 1995). In freshwater environments, phosphorous is typically the limiting nutrient to phytoplankton, whereas in marine environments nitrogen, silicon, and phosphorous are all potentially limiting nutrients to phytoplankton (Richardson and Jørgensen, 1996). Due to the mixing of freshwater and seawater, studies of phytoplankton nutrient limitation in estuaries can be complicated by seasonal transitions between N and P limitation (Twomey and Thompson, 2001). Under such circumstances, spatial variability of nutrient limitation may depend on the size of the estuary and the proximity of phytoplankton communities to nutrient sources (river mouths, deep anoxic layers, ocean entrance; Twomey and Thompson, 2001). Under sufficient light conditions, phytoplankton can influence nutrient limitation by their uptake of available nutrients until the limiting nutrient is exhausted (Fisher et al., 1995).

Temporarily Open Estuaries:

Seventy percent of all estuaries in South Africa are temporarily open (Froneman, 2002). Estuaries that remain temporarily open are more susceptible to the accumulation of pollutants than permanently open estuaries (Nozais et al., 2001). Information concerning phytoplankton within temporarily open estuaries is sparse, but as the main primary producers they provide a crucial link between inorganic compounds and organic matter available to higher trophic levels (Nozais et al., 2001). Major changes in phytoplankton biomass are strongly correlated with the open and closed phases of temporarily open estuaries, which in turn influence their interaction with nutrients, irradiance, and water circulation (Nozais et al., 2001).

Mecox Bay:

Mecox Bay is an enclosed, inland bay which is located on the south shore of south fork of Long Island, within the Town of Southampton. Historically, Mecox Bay has hosted one of the most productive oyster populations on the Atlantic Coast and has also hosted a productive soft shell clam community. Mecox also has a clear recreational and aesthetic value to the residents of the Town of Southampton. Mecox Bay lies adjacent to the Atlantic Ocean, and has an inlet which is opened by the Town of Southampton periodically (several times a year) allowing Mecox to exchange with the Atlantic Ocean. Within several days of the channel being opened, natural sediment transport processes close the recently dredged channel. Such town-sanctioned openings ensure that water levels within Mecox Bay do not encroach on home surrounding Mecox Bay and help maintain salinity levels in Mecox within the brackish range ideal for the resident shellfish populations. While these periodic openings clearly affect the salinity and flushing the Mecox Bay, precise impacts on other important biological, chemical and physical parameters are unknown. Moreover, the general biological, chemical, geological, and physical characteristics of the system are unknown. Finally, point sources of pollution, precise residence times, and the general water quality of the system have not been established.

The aim of this study was to generally characterize the physical, chemical, and biological features of Mecox Bay and to identify the effects of opening the Mecox Bay inlet. During 2002, Mecox Bay was monitored on a weekly or biweekly basis. A robust data set of temperature, salinity, dissolved oxygen concentration, depth, coliform bacteria densities, organic and inorganic nutrient concentrations, phytoplankton species composition and abundance, the effect of nutrients (N, P, and Si) on phytoplankton growth rates, bathymetry, sediment composition, as well as benthic and pelagic biodiversity was generated.

Materials and Methods

Five set stations were sampled once a week from 17 January through 13 December 2002. Three stations were located within Mecox Bay, one in the Atlantic Ocean (outside the nearby Shinnecock Inlet) and one in Mill Creek, which is the largest freshwater tributary flowing into the bay (Fig 1). All three stations within Mecox Bay were averaged together as one station representative of the bay. The brackish Mill Creek data is not reported. The stations were reached by a whaler and water samples at each station were collected from the surface using a bucket. Water samples were collected at the bow of the boat to prevent collecting any debris that arose from the motor. The collected water was then transferred from the bucket to carboys using a plastic funnel for storage and transportation purposes. Collected water samples were taken to the Southampton College Marine Station for immediate lab analysis.

Physical Parameters:

Temperature (°C), salinity (ppt), dissolved oxygen (DO; mg/L), and light penetration (m) were measured weekly at each station. A Hydrolab Quanta model CTD probe was lowered through the water column in 0.1 m and 0.2 m intervals, depending on the depth, and temperature, salinity, and DO readings were taken from the attached surface display. The CTD probe was held at depth until the DO reading stabilized. A secchi disk was used to determine light penetration.

Coliform Bacteria:

Water samples for the quantification of coliform bacteria were collected in autoclave sterilized amber glass bottles. Bottles remained sealed until the sample was collected. They were then submerged beneath the water, directed into the current, and opened top down until filled (APHA, 1969). Bottles were sealed, kept in a cooler, and analyzed for coliform bacteria densities (MPN) according to the Multiple-tube Fermentation Method within one hour of collection (Pierce and Leboffe, 1999).

Nutrients:

Once in the lab, water was transferred from the carboys to 500mL Teflon bottles. Samples were removed from the bottles using a 60mL syringe and filtered through a pre-combusted (4 hours at 450°C) 25 mm glass fiber filter in a Swinex Filter Holder into 120 mL nutrient bottles. Samples were then stored at –20°C until time of analysis. All samples were completely thawed in cool water before analysis was conducted. Sample containers were bathed in a 10% HCL acid wash for 24 hrs and rinsed with distilled water prior to use. Silicate, nitrate, phosphate, ammonium, and dissolved organic nitrogen were analyzed according to Parsons, et al. (1984). Nutrient concentrations in each sample were calculated through the use of graphs of sample absorbencies vs. their molarities, the equation for a "best fit" line regression and Beer's Law. Dissolved organic nitrogen concentrations were determined by subtracting the amount of dissolved inorganic nitrogen within the sample from the measured total dissolved nitrogen concentration (Gobler and Sanudo-Wilhelmy, 2001).

Phytoplankton Biomass levels:

Levels of phytoplankton biomass were measured via chlorophyll *a* (chl *a*) analysis for both whole water and <5 μm samples, according to Parsons et al. (1989).

Size fractions <5 μm were obtained by filtration of whole water samples through a 5 μm Nytex® mesh (Sin et al., 2000). Measured volumes (100-400 mL) of whole water samples were filtered to collect phytoplankton using a filtration manifold onto 47 mm glass fiber filters. The glass fiber filters were then placed in 20 mL vials and frozen overnight. 10 mL of 90% acetone was then added to the samples to leach out the chlorophyll, which were then placed in the dark at –20°C for 24 hours. The acetone leachate was placed into a cuvette and analyzed using a Turner Designs, model 10 AU, flourometer. The flourometer was calibrated once prior to its first use. 8 drops of 10% HCL were then added to the cuvette and another reading was made with the flourometer. Chlorophyll *a* measurements were given in the units of μg/L. The calculations used to obtain the chlorophyll *a* level were:

$$\text{Chl } a\ (\mu g/l) = (Rb - Ra) * V$$

where Rb was the reading before the addition of 10% HCL, Ra was the reading after the addition of 10% HCL and V was the volume of acetone / volume filtered. The same method was applied to the <5 μm water samples. This method was applied in triplicate for each whole water and <5 μm water samples from each station every week of sampling in order to account for error by use of standard deviation. Samples >5 μm were calculated by subtracting <5 μm samples from whole water samples.

Phytoplankton Species Composition and Abundance:

Phytoplankton species composition and abundance was determined using the Utermöhl method (Hasle, 1978). Whole water samples from each station were preserved using Lugols iodine solution and then stored at 4 °C until the time of analysis, at which point a 15 mL aliquot of the well-shaken sample was poured into a 50 mL settling chamber. Settling chambers consisted of a 50 mL top cylinder and a bottom plate chamber, which consisted of a rectangular perspex plate, a ring, and a coverslip within a circular base plate (Hasle, 1978). After a 24 hr settling period the top cylinder was removed to drain the water and a slide was placed perpendicularly on top of the base plate to cover the water sample located on the coverslip. No abrupt movements were made to the circular base plate to prevent disruption of the settled phytoplankton. The phytoplankton were stored in this manner until they could be observed.

At the time of observation, the coverslip was placed on an inverted microscope from which species identification and cell densities were determined. Only one coverslip per station for each week of sampling was settled and observed using the Utermöhl method. Phytoplankton were counted by the use of a grid (field) system. Ten grids were counted and identified for each coverslip. Phytoplankton smaller than 10 µm were quantified but not identified. Phytoplankton larger than 10 µm were counted and identified to the genus level. Picoplankton (<2 µm) and nanoplankton (2 µm-10 µm) were counted until they exceeded 100 organisms in each category. If 100 plankton were counted before an entire grid was completed, counting for the remainder of that particular grid continued until the grid was completed. More than one grid was counted if the first grid did not provide enough organisms to reach the minimum number of 100. The equation used to determine cell densities was:

$$\frac{\text{\# of organisms/fields counted}}{\text{Volume Settled}} * \frac{\text{Area of the well (mm}^2\text{)}}{\text{Area of the grid (mm}^2\text{)}}$$

where the area of the well was 283 mm^2 and the area of the grid was 0.031655 mm^2.

Phytoplankton Nutrient Limitation Experiments:

Nutrient addition experiments were conducted to identify the type of nutrient regime which promotes phytoplankton growth. Within an hour of collection, 1 L of seawater was transferred to acid clean 1.2 L polycarbonate flasks. Triplicate flasks were amended with sodium nitrate (20 µM), phosphate (1.25 µM), silicate (20 µM), or were left unamended as a control treatment. The concentrations of these additions were similar to previously observed increases of these nutrients in the water column of Long Island embayments and in Mecox Bay (Gobler and Sañudo-Wilhemly, 2001; Gobler and Boneillo, 2003; this study). Nutrient stocks were filter-sterilized (0.2 µm) and stored frozen. Experimental bottles were incubated at a depth of ~ 0.25 m under neutral density screening in Old Fort Pond (OFP) at the Southampton College, LIU, Marine Station, located 10 km west of Mecox Bay. Open tidal exchange with Shinnecock Bay keeps OFP well flushed; temperatures during incubations were typically within 2°C of stations in Mecox Bay. Screening reduced ambient light penetration by 40%. After 24 hrs, experimental flasks were filtered for chlorophyll *a* onto GF/F glass fiber filters. Net growth rates of the total phytoplankton community were calculated from changes in cell densities and chlorophyll *a* using the formula: $k = [\ln(Bt / Bo)] / t$ where k is the net growth rate, Bt is the amount of biomass (cell density or chlorophyll *a*) present at the end of the experiments, Bo represents the amount of biomass at the beginning of experiments, and t is the duration of the experiment in days. Growth responses of each nutrient treatment were compared to the control treatment using a *t*-test. Nutrient additions yielding growth rates which were significantly greater than the control at the 0.05 level of probability were noted in Table 2.

Point Sources of Contaminants:

Tributaries and groundwater entering Mecox Bay were evaluated as potential sources of nutrients and pathogen contaminants. Seven creeks (Bernett Creek, Sam's Creek, Swan's Creek, Calf Creek, Hayground Cove, Mill Pond, and Channel Pond) were sampled six times during the year: 14 Mar, 11 Apr, 3 Jun, 17 Jun, 10 Oct and 7 Nov. During each date, surface freshwater (< 0.1 ppt) samples were obtained, processed and analyzed for levels of nutrients and coliform bacteria (*see above methods*).

When Mecox Bay was opened during the month of June, groundwater entering the bay was sampled from twenty locations surrounding the bay using three meter, Teflon-lined, PVC piezometers with 2.5 cm horizontal screened slits along the lower 25 cm located at the mean high water mark (Gobler & Sañudo-Wilhemy 2001; Gobler and Boneillo, 2003). Previous research on eastern Long Island has demonstrated that groundwater collected with such piezometers is more representative of the groundwater which enters surface waters than groundwater collected from coastal wells (Gobler & Sañudo-Wilhemy 2001). Deployment of piezometers 24 hrs before sampling allowed for equilibration with the benthic environment (Capone and Bautista, 1985). High groundwater seepage rates at Mecox Bay typically allowed intertidal samplers to fill with fresh groundwater (salinity < 0.1 ppt) when sampled during low tide. Groundwater was sampled using a peristaltic pump equipped with acid-washed Teflon tubing. To ensure representative groundwater was sampled, wells were purged at < 100 mL min^{-1} and samples were not obtained until the conductivity, dissolved oxygen, temperature, and pH of the pumped groundwater stabilized (Puls and Powell, 1992; Puls and Paul, 1995).

Nutrient and salinity samples were filtered with acid-cleaned, polypropylene capsule filters (0.2 µm; MSI Inc.) or precombusted GF/F glass fiber filters in the field, and immediately stored on ice and were frozen within 2 hrs. Groundwater was grouped into four regions (West, Northwest, East, Northeast) based on its general chemical characteristics.

Residence Time:

The residence time of Mecox Bay was estimated using three methods. Firstly, tidal exchange volumes were calculated using a salt balance (Fisher et al. 1979) between Mecox Bay and the coastal Atlantic Ocean (Fig 1) according to the following equation:

$$Q_T = (Q_{GW} + Q_{RO} + Q_{precip} + Q_C) \; / \; [1 - (S_{MB} / S_{AO})]$$

where Q represents the water fluxes from net tidal exchange (T), groundwater (GW), surface run-off (RO), precipitation (precip) and creeks (C), and S is the mean annual salinities for Mecox Bay (MB) and the coastal Atlantic Ocean (AO). The estimated mean volume of Mecox Bay was divided by the tidal exchange volumes to determine residence times.

A second method used to determine residence times was measuring the net change in water transport out of the Mecox Bay inlet when the inlet was open. During 12-hr tidal cycles, currents (m s^{-1}) into and out of the bay were measured, and fluxes of water were estimated based on the length and width of the inlet opening. A net or residual transport current was determined, and the estimated mean volume of Mecox Bay was divided by this net, residual current to determine residence times.

Finally, residence time was estimated by observing changes in salinity in Mecox Bay during the times the inlet was open. Historical records (Southampton Town Trustees, pers. comm.) indicate that the maximal salinity achieved in Mecox Bay is typically on the order of 25 ppt. Hence, it was assumed that once the opened Mecox Bay has reached this full salinity, the bay has been completely flushed by ocean water.

Benthic surveys:

During the March and April of 2002, a comprehensive benthic survey of Mecox Bay was conducted. Using GPS to mark stations, 10 east-west transects were conducted across Mecox Bay and Mill Creek. At each of the 50 stations samples, water depth was measured and a sediment sample was obtained by means of a PVC coring device. Sediment samples were stored frozen in Zip-loc bags until analysis. For sedimentary analysis, samples were dried, and then split. Half of the sample was sieved to determine grain size diameter using a Ro-Tap (Barbanti and Bothner, 1993). The particle diameters classes were summed to characterize sediment into three broad categories: Sand (> 500 µm), sandy mud (180 – 500 µm), and mud (< 180 µm). The other half of the dried sediment sample was weighted and combusted at 500°C for 24 hrs and weighed again. Changes in weight during combustion were used to estimate the percent organic carbon content of the sediments using the loss on ignition technique (Leong and Tanner, 1999). Survey maps of bathymetry (depth) and sediment characteristics were made using isobars constructed by a computer program.

In addition to surveying the sediment, shellfish densities in Mecox Bay were also estimated during benthic transects. Shellfish samples were obtained via raking and via a scallop dredge. Shellfish caught during surveys were sized and numbers were converted to densities per 10 meters squared by estimating the area covered during each dredge or rake. Gear inefficiencies associated with each technique, as well as the timing of our survey (April: the end of shellfish harvesting season) likely contributed to a substantial underestimation of reported densities, although relative differences in densities across the bay are likely to be accurate. Underestimates were likely greatest for the soft shell clam, *Mya arenaria*, as this species is typically found in shallow regions which were not accessible via the benthic surveying techniques used by this project.

Pelagic seining surveys:

During the spring of 2002, seining surveys were conducted within the bay and tributaries of Mecox. A beach seine which was 8 m long by 2 m high with a mesh size of 6mm was utilized to collect pelagic organisms according to Araujo et al. (1999). Fish, crabs, and shrimp caught were identified, quantified and measured. A literature search was conducted to approximate the salinity tolerances of each species caught.

RESULTS

Physical Parameters:

During 2002, the Mecox Bay inlet was opened multiple times by human intervention or natural events. After each opening, it was closed by natural sediment transport processes. Mecox Bay inlet was dredged opened by the Town of Southampton on 8 Feb and remained open until 6 Mar. The channel was opened again by the Town on 29 May and it closed in early Jul. On 23 Sep, the town opened the inlet for a third time and it closed in early Oct. Due to successive storm events, the inlet was sporadically open throughout the autumn months with tidal washover occurring 16-21 Oct and 9-12 Nov.

Inlet openings and closings had a clear impact on the depth of Mecox Bay. After the Feb inlet opening, Mecox Bay contained depths of approximately 1.4 m (Fig 2). With the inlet closed, the depth of Mecox Bay continued to increase during the months of Apr and May to a depth of approximately 2 m (Fig 2). During the Jun opening of the inlet, Mecox Bay reached a minimal depth of 1.2 ± 0.2 m on 10 Jun (Fig 2). With the closing of the inlet in Jul, the depth of Mecox Bay increased through the summer and averaged 1.4 ± 0.1 m during Sep (Fig 2). With the inlet opening sporadically in the autumn, depths ranged from a low of 1.5 ± 0.2 m (14 Nov) to a high of 2.2 m (7 Nov; Fig 2). The average secchi depth throughout the study was 1.1 ± 0.2 m (Fig 3). The lowest secchi depths occurred during the summer months of Jul and Aug; 0.88 (16 Jul), 0.73 m (1 Aug), and 0.75 m (12 Aug; Fig 3).

The salinity in the Atlantic Ocean remained fairly constant throughout the study (32.1 ± 1.1 ppt; Fig 4). In contrast, the salinity of Mecox Bay varied with the opening of the inlet. Before the opening on the inlet on 8 Feb, the salinity was at its annual minimum, 6 ppt (7 Feb; Fig 4). With the opening of the inlet, the salinity increased during Feb to a high of 26.6 ppt on 7 Mar (Fig 4). With the closing of the inlet on 6 Mar, the salinity continued to steadily decrease until 22 May, when the salinity reached a low of 14.0 ppt (Fig 4). With the opening of the inlet again on 29 May, the salinity increased during Jun to 25.6 ppt (17 Jun) and then dropped to 14.2 ppt (10 Oct) while the inlet was closed (Fig 4). The salinity varied slightly during the sporadic autumn inlet openings but remained between 13.7 ppt (13 Dec) and 15.6 ppt (7 Nov; Fig 4).

Temperatures followed an expected seasonal pattern during this study. The temperature rose from <5 °C in both Mecox Bay and the Atlantic Ocean in Jan to a peak of 20.8 °C in Mecox Bay and 11.7 °C in the Atlantic Ocean on 18 Apr (Fig 5). Both Mecox Bay and the Atlantic Ocean experienced slight temperature declines during May to 15.9 °C and 11.3 °C on 22 May, respectively (Fig 5). During Jul and Aug, temperatures in Mecox Bay reached their seasonal peak, remaining above 25.0 °C (Fig 5). The temperature in the Atlantic Ocean peaked at 21.7 °C on 1 Aug, remained around 21°C during Sep, and then continuously declined for the remainder of the year (Fig 5). Through the autumn, the temperature of Mecox Bay steadily decreased to <4.0 °C in Dec (Fig 5).

Bottom dissolved oxygen (DO) in Mecox Bay also displayed a seasonal cycle (Fig 6). Bottom DO ranged between 8.0 mg/L and 10.0 mg/L during the spring until Jun, where it began to continually decreased to a low of 2.71 mg/L on 2 Jul (Fig 6). Bottom DO rose to 6.9 mg/L on 16 Jul, stayed at approximately 5.5 mg/L in Aug and then gradually increased to a peak of 12.8 mg/L in Dec (Fig 6).

The residence time of Mecox Bay ranged from 5 to 26 days during the study (Table 1). During the Feb opening, both salt balance calculations and salinity observations suggested a residence time of approximately 18 days. During the Jun opening, salt balance, salt observations, and current measurements indicated a residence time of 19-26 days. During a brief inlet opening in Nov, current measurements indicated a residence time of 5 days.

Nutrients:

Dissolved inorganic nitrogen (DIN) concentrations in Mecox Bay displayed a clear seasonal cycle. Levels started high at 36.6 ± 3.1 μM on 17 Jan and increased to 49.2 ± 10.5 μM on 24 Jan before continuously decreasing to 21.4 ± 3.0 μM on 25 Feb (Fig 7). After slightly increasing to 22.6 ± 1.1 μM on 7 Mar, DIN concentrations in Mecox Bay steadily decreased to a low of 0.8 ± 0.1 μM on 3 Jun (Fig 7). The average DIN concentration in Mecox Bay during the summer (Jun-Sep) was 1.8 ± 0.6 μM (Fig 7). In the autumn, DIN levels began increasing once again to over 25 μM in Nov and Dec (Fig 7). The DIN concentration in the Atlantic Ocean remained steady throughout the year, averaging 3.2 ± 1.8 μM (Fig 7).

Phosphate concentrations in Mecox Bay increased from low levels in winter and spring (Jan-Mar, 0.4 ± 0.2 μM; Fig 9) to higher levels in summer (Jul-Sep, 1.2 ± 0.4 μM Fig 9). After 20 Sep, phosphate concentrations continually decreased to a low of 0.1 ± 0.0 μM on 13 Dec (Fig 9). The average phosphate concentration in the Atlantic Ocean throughout the year was 0.8 ± 0.2 μM (Fig 9). Phosphate concentrations ranged from a high of 1.2 ± 0.0 μM (15 Feb) to a low of 0.4 ± 0.1 μM (22 May; Fig 9).

Seasonal variability in DIN and DIP concentrations resulted in dramatic shifts in DIN:DIP ratios in Mecox Bay during 2002. The DIN:DIP ratio decreased from 135 on 17 Jan to 34.1 on 15 Feb (Fig 10). The ratio then increased to 111 on 28 Mar before gradually decreasing to < 1 in Jun and throughout the summer and early autumn (Fig 10). Starting in Oct, the DIN:DIP ratio continually increased to a high of 247 on 13 Dec (Fig 10). The DIN:DIP ratio in the Atlantic Ocean remained steady throughout the year with a mean of 4.3 ± 2.4 (Fig 10). Consistent with these ratios, phytoplankton populations in Mecox Bay showed phosphorous limitation throughout the winter, spring, and late autumn (Jan-May and late Nov-Dec), but were nitrogen limited in the summer and early autumn (Jun-Oct; Table 2). In contrast, Atlantic Ocean populations were sporadically nitrogen limited through the year (Table 2).

DON - Dissolved Organic Nitrogen

DON concentrations in Mecox Bay seemed to change seasonally and with the opening of the inlet. DON concentrations in Mecox Bay decreased during the Feb opening of the inlet from 43.9 ± 8.4 μM (7 Feb) to 26.3 ± 8.2 μM (7 Mar; Fig 11). DON concentrations then gradually increased to 50.8 ± 10.2 μM (22 May) before again decreasing to a level of 34.6 μM on 17 Jun, during which the Mecox Bay inlet was open

(Fig 11). The DON concentration then continually increased until 12 Aug (87.3 ± 3.6 μM; Fig 11). There was then a decrease in DON concentration throughout the autumn and winter months, reaching a low of 13.8 ± 3.3 μM on 13 Dec (Fig 11). In the Atlantic Ocean, DON concentrations steadily increased from 9.7 ± 6.3 μM (17 Jan) to 25.7 ± 3.6 μM (16 Jul; Fig 11). After the 16 Jul high, the DON concentration steadily decreased to a year low of 6.8 ± 0.8 μM on 13 Dec (Fig 11).

Throughout the year, the concentration of silicate in Mecox Bay was consistently higher than in the Atlantic Ocean (Fig 12) and silicate concentrations followed a pattern similar to that seen in DON concentrations. Silicate concentrations in Mecox Bay decreased from 43.3 ± 4.5 μM on 17 Jan to 21.3 ± 0.2 μM on 25 Feb before increasing to 44.7 ± 7.9 μM on 8 May (Fig 12). Silicate concentrations decreased again throughout Jun (19.4 ± 4.1 μM on 17 Jun) and then increased to an annual peak of 87.9 ± 6.6 μM on 1 Aug (Fig 12). After 1 Aug, silicate concentrations continually decreased for the remainder of the year, reaching 37.4 ± 3.4 μM on 13 Dec (Fig 12). In the Atlantic Ocean, with the exception of 7 Mar (8.4 ± 4.0 μM) and 8 May (6.3 ± 0.8 μM) silicate concentrations ranged between 1 μM and 2 μM for the first six months of the year (Fig 12). Silicate concentrations reached a year high of 31.6 ± 5.5 μM (5 Sep) in the Atlantic Ocean (Fig 12). The concentration of silicate in the Atlantic Ocean varied between 2.92 ± 2.1 μM and 31.6 ± 5.5 μM throughout the autumn months before reaching 4.4 ± 0.1 μM on 13 Dec (Fig 12).

The tributaries and groundwater entering Mecox Bay provided a significant source of nutrients to the bay. Burnett and Sam's Creeks were the largest contributors of nitrate to Mecox Bay (188.8 ± 27.0 μM and 153.4 ± 67.0 μM, respectively; Fig 13). Swan's Creek and Channel Pond contributed the most DON (83.5 ± 45.1 μM and 74.7 ± 29.8 μM, respectively) and Hayground Cove and Mill Pond were the biggest contributors of silicate (13.4 ± 4.4 μM and 51.8 ± 34.4 μM; respectively; Fig 13). Relatively small concentrations of ammonium and orthophosphate were found in all seven tributaries (6.9 ± 5.3 μM and 0.6 ± 0.2 μM respectively; Fig 13). The largest concentration of nitrogen in groundwater was observed in the eastern portion of the bay (500.5 ± 206.0 μM; Fig 8). The largest concentration of phosphate from groundwater was observed in the northeast corner of the bay (8.5 ±5.9 μM; Fig 8). The average phosphate concentration throughout Mecox Bay was 5.0 ± 3.3 μM (Fig 8). Silicate concentrations in groundwater were largest in the northwest and eastern corners of the bay (69.9 ± 7.8 μM and 61.3 ± 45.7 μM, respectively; Fig 8).

Coliform Bacteria:

Coliform bacteria densities increased with increasing temperatures in both Mecox Bay and the Atlantic Ocean and densities were generally higher when the inlet was closed (May and Jul-Sep; Fig 14). Despite the inlet being closed, densities were lowest at all locations during the spring months of Mar and Apr (8 ± 7 colonies/100mL; Fig 14). Densities of coliform bacteria rose to a peak in May (between 60 ± 29 colonies/100mL and 76 ± 29 colonies/100mL; Fig 14). Densities then dropped during the June inlet opening (between 30 ± 23 colonies/100mL and 34 ± 16 colonies/100mL), but were higher in July and August when the inlet was closed (25 ± 17 colonies/100mL and 570 ± 484 colonies/100mL; Fig 14). Densities of coliform bacteria also increased during the autumn months, throughout which there was heavy rainfall (Table 4). Coliform bacteria densities in the Atlantic Ocean were lower than Mecox Bay throughout the year (2.8 ± 4.3 colonies/100mL; Fig 14).

The creeks entering Mecox Bay were a large source of coliform bacteria for the bay. Kellis Pond supplied the lowest densities of coliform bacteria out of all the creeks tested; 169.5 ± 248.8 colonies/100mL (Fig 15). Sam's Creek and Hayground Cove were the largest point sources for coliform bacteria to Mecox Bay with annual averages of 542.8 ± 268.4 colonies/100mL and 509.5 ± 798.8 colonies/100mL, respectively (Fig 15).

Phytoplankton Biomass:

With the exception of 24 Jan, concentrations of whole chl *a* (μg/L) were higher in Mecox Bay than in the Atlantic Ocean throughout the year (Fig 16). Whole chl *a* concentrations peaked during the Feb inlet opening (5.7 ± 0.7 μg/L, 25 Feb) and immediately after the Feb opening of the inlet (10 ± 0.2 μg/L, 14 Mar; Fig 16). Chl *a* concentrations then decreased to 3.5 ± 0.2 μg/L on 22 May before peaking for a second time during (13 ± 0.4 μg/L, 17 Jun) and after (maximum of 18 ± 0.7 μg/L, 1 Aug) the Jun opening of the Mecox Bay inlet (Fig 16). High chl *a* levels were sustained in Mecox Bay during Jul and Aug. After the high summer chl *a* concentrations, levels decreased during the autumn months to 6.9 ± 0.7 μg/L (10 Oct) with the exception of two blooms seen on 17 Oct (15 ± 0.8 μg/L) and 31 Oct (12 ± 0.6 μg/L; Fig 16). By 13 Dec, the concentration of whole chl *a* decreased to 2.8 ± 0.6 μg/L (Fig 16). Chl *a* concentrations in the Atlantic Ocean averaged 1.9 ± 0.4 μg/L throughout the year (Fig 16). High levels of chl *a* in the Atlantic Ocean were observed on 25 Feb (3.0 ± 0.4 μg/L), 16 Jul (4.4 ± 2.2 μg/L), and 17 Oct (4.40 ± 0.1 μg/L; Fig 16). Average percentages of size-fractionated chl *a* for the *a* for the entire length of the study showed that <5 µm phytoplankton comprised the majority of phytoplankton found in Mecox Bay (70.9 ± 15.0%) and the Atlantic Ocean (57.9 ± 48.6%; Fig 17).

Species Composition and Abundance:

In a manner consistent with the size fraction data, small phytoplankton dominated throughout the study at each station. With a few exceptions (8 May and 3 and 10 Oct in Mecox Bay and 3 and 10 October for the Atlantic Ocean), picoplankton occurred at larger densities than nanoplankton (Fig 18, 19). In both Mecox Bay and the Atlantic Ocean, picoplankton and nanoplankton densities were lowest between 24 Jan and 18 Apr (Fig 18, 19). Picoplankton and nanoplankton densities in Mecox Bay peaked during the summer and early autumn months (Fig 18).

Picoplankton and nanoplankton densities in the Atlantic Ocean were highest during the summer months with peaks in picoplankton occurring on 4 Jun (71,775 cells/mL), 2 Jul (211,216 cells/mL), and 5 Sep (196,109 cells/mL) and peaks in nanoplankton occurring on 8 May (21,245 cells/mL), 11 Jun (24,404 cells/mL), and 3 Oct (55,889 cells/mL; Fig 19). After an Oct decrease, picoplankton densities peaked again on 7 Nov (49,764 cells/mL) before decreasing to 15,859 cells/mL on 13 Dec (Fig 19). Nanoplankton densities remained below 5,906 cells/mL (31 Oct) after the 24 Oct peak (Fig 19).

Unlike the smaller phytoplankton, larger cells displayed cycles of peaks and drops in abundance through the year. In Mecox Bay, dinoflagellates reached peaks on 14 Mar (1,536 cells/mL), 4 Apr (2,570 cells/mL), 22 May (1,062 cells/mL), 11 Jun (1,263 cells/mL), 12 Aug (842 cells/mL), 24 Oct (2,182 cells/mL), and 14 Nov (842 cells/mL; Fig 20). Dinoflagellate densities were consistently higher than diatoms and ciliate densities. Diatoms in Mecox Bay peaked on 24 Jan (345 cells/mL), 4 Apr (517 cells/mL), 3 Oct (1,531 cells/mL), and 14 Nov (574 cells/mL; Fig 20). The density of diatoms was lowest during the summer months (Jun through Sep; Fig 20). Ciliates in Mecox Bay often peaked after dinoflagellates, with peaks occurring on 28 Mar (1,651 cells/mL), 4 Jun (957 cells/mL), 2 Jul (373 cells/mL), and 5 Sep (383 cells/mL; Fig 20). The densities of ciliates were lowest in Jan and Feb and from Oct to Dec.

With the exception of 10 Oct (38 cells/mL), diatom cell densities in the Atlantic Ocean were larger than dinoflagellate and ciliate densities (Fig 21). Dinoflagellates and diatoms peaked many times throughout the year. The largest dinoflagellate peaks occurred during the summer (20 cells/mL on 8 May, 187 cells/mL on 4 Jun, and 230 cells/mL on 12 Aug; Fig 21). The largest peaks in diatom densities in the Atlantic Ocean occurred on 8 May (804 cells/mL), 12 Aug (976 cells/mL), 3 Oct (880 cells/mL), and 27 Nov (871 cells/mL; Fig 21). Except for 17 Jun (57 cells/mL) and 3 Oct (77 cells/mL), ciliates cell densities in the Atlantic Ocean remained constant at 0 cells/mL (Fig 21).

Benthic surveys

Bathymetry surveys of Mecox Bay revealed that deepest areas of the bay were 2 – 2.5 m, in a thin band through the middle of the bay (Fig 22). The bulk of the bay was1.5 – 2 m deep, although areas along the shore, by the inlet and within Mill Creek were < 1 m (Fig 22). The composition of bottom sediments is partly consistent with the depth of the bay. Specifically, the deepest regions of Mecox in the bay's center contain sediments which are muddy and rich in organic carbon (> 5% of sediment by weight; Fig 23, 24). By contrast, most of the shallow perimeter sediments are sandy and have a low organic carbon content (< 1% of sediment by weight; Fig 23, 24). The exception to this trend was Mill Creek, which was shallow, but had muddy and organically enriched sediments (> 5% of sediment organic carbon by weight; Fig 23, 24). The most abundant shellfish in Mecox Bay was the American Oyster, *Crassostera virginia*, although moderate densities of the ribbed mussel, *Geukensia demissa*, and the soft shell clam, *Mya arenaria*, were also found (Fig 25). The shellfish were somewhat evenly distributed through the bay, although the greatest densities of all species were found in the southwest corner of the bay (*Crassostera virginia* densities ~ 2.5 m^{-2}; Fig 25). Amongst the smaller, infaunal benthic invertebrates, polychaetes, oliochaetes, and amphipods were the most abundant organisms noted during this study (data not shown). They were found primarily in sandy sediments (data not shown).

Pelagic surveys

Pelagic seining surveys conducted during the spring of 2002 revealed a great diversity of fish and invertebrates in Mecox Bay. The most abundant fish species found was the Inland Atlantic silverside (*Menidia beryllina*) while the most abundant pelagic invertebrate was the blue claw crab (*Callinectes sapidus*; Table 5). Other abundant fish included the Atlantic silverside (*Menidia menidia*), the sheepshead minnow (*Cyprinodon varigatus*) and the stripped killifish (*Fundulus majalis*; Table 5). Nearly all pelagic organisms were found within various creeks surrounding Mecox Bay, with Atlantic Silversides, Atlantic herring, and Japanese shore crabs being the exceptions (Table 5).

Discussion

Current Status of Mecox Bay:

Mecox Bay acts as a highly productive estuary for shellfish, particularly the American oyster, *Crassostera virginia* (Fig 25; Southampton Town Trustees, pers. comm.). Densities of oysters in Mecox exceed almost any other embayment on Long Island (COSMA, 1985) and landings and recruitment of oysters have been increasing in recent years (Fig 25; Southampton Town Trustees, pers. comm.). This represents a marked departure from most other Long Island estuaries where shellfish populations have been failing (COSMA, 1985; Bricelj and Lonsdale, 1997). Therefore, it is of great interest to compare Mecox Bay to other Long Island estuaries in order to identify factors which may enhance shellfish growth. The biggest difference is that Mecox Bay is mostly closed and therefore does not have frequent exchanges with the Atlantic Ocean, as more open estuaries would experience. Accordingly, Mecox Bay has lower salinity, 17.4 ± 5.1 ppt, compared to other Long Island estuaries, in particular Great South Bay, Peconic Bay, Long Island Sound, Shinnecock Bay, and Moriches Bay, whose average salinity levels are 24-30 ppt (Table 3; SCDHS, 1976-2002). Since oysters are known to grow quicker within brackish salinities (Thompson, 1997), the brackish environment in Mecox Bay may physiologically benefit the resident population. Mecox Bay also has higher DIN concentrations, 14.3 ± 13.5 μM, than the previously mentioned Long Island estuaries, where average DIN concentrations range between 1 and 5 μM (Table 3; SCDHS, 1976-2002). Although there are moderately higher chlorophyll *a* (chl *a*) concentrations present in Mecox Bay relative to Peconic Estuary, Shinnecock Bay, and Moriches Bay (SCDHS, 1976-2002), these levels may be mitigated by the presence of filter feeding bivalves within the bay (Officer et al., 1982). With the Mecox Bay inlet remaining mostly closed throughout the year, there is no loss of phytoplankton through the flushing of the inlet. Therefore, the phytoplankton community within Mecox Bay experiences high net growth. The elevated levels of nitrogen and chl *a* in Mecox Bay suggest the high levels of primary productivity are supporting dense and productive shellfish populations (COSMA, 1985). The existence of higher chl *a* levels in Great South Bay relative to Mecox Bay (SCDHS, 1976-2002), in concert with the dramatic loss of shellfish populations in Great South Bay during recent decades, supports the hypothesis that filter feeders play an important role in regulating algal biomass in shallow Long Island estuaries.

During 2002, phytoplankton populations in Mecox Bay were both phosphorous and nitrogen limited (Table 2). In contrast, most Long Island estuaries are only nitrogen limited (Gobler and Sañudo–Wilhelmy, 2001b; Gobler, et al., 2002). Such nitrogen limitation is similar to the Atlantic Ocean (Table 2) and may be the result of larger exchanges of water between the estuaries and the ocean and longer residence times. Mecox Bay was phosphorous limited between Jan and the beginning of May and in late Nov and Dec and was nitrogen limited from Jun to Oct (Table 2). Systems are determined to be phosphorus limited when the DIN:DIP ratio is above the ideal Redfield Ratio value of 16:1 and nitrogen limited when below the same value (Berner and Berner, 1992). Accordingly, the DIN:DIP ratio in Mecox Bay was 87.6 ± 55.5 from Jan-May and Nov-Dec, but was 3.7 ± 4.1 during Jun-Oct (Fig 10). The seasonal change in phosphorus and nitrogen limitation seen in Mecox Bay has also been observed in Chesapeake Bay (Howarth et al., 1995).

Picoplankton comprised the majority of phytoplankton cells within Mecox Bay (Fig 18). This data concurs with the size fractioned chl *a* data (Fig 17) and with other studies of Long Island estuaries, showing that small phytoplankton dominate the total phytoplankton biomass (Lively et. al., 1983). This dominance of small phytoplankton, however, may not be good for shellfish. Previous studies of Long Island estuaries have linked high cell densities of small phytoplankton to a decline in shellfish (Lively et. al., 1983) due to their inability to retain small cells (Bass et al., 1990). However, the abundance of shellfish in Mecox Bay suggests there must be enough larger algal biomass to support robust growth (Fig 16). Microplankton (>10 μm) within Mecox Bay were dominated by dinoflagellates and ciliates (Fig 20), while diatoms dominated microplankton in the Atlantic Ocean (Fig 21). These results are consistent with other studies which have found diatoms in open, well flushed waters around Long Island but dinoflagellates in more eutrophic areas (Bruno, et al., 1980; Gobler and Boneillo, 2003). Dinoflagellates and ciliates within Mecox Bay could be herbivorous grazers which consume the smaller phytoplankton (Grahmn and Wilcox, 2000). The abundance of such algal grazers may not only be promoted by the presence of prolific numbers of picoplankton, but they may also regulate the algal biomass.

The composition of Mecox Bay bottom sediments is likely influenced by the depth, hydrography, and productivity of this estuary. The prevalence of coarse grain, organically deplete sediments around the perimeter and near the inlet of this system (Fig 23, 24) is likely due to the heavier physical motion of the water within these regions. These regions are shallow, and thus are the most likely to be influenced by surface wave motion. Moreover, when the inlet is open, these regions are also subject to tidal currents. The sum of these motions is likely to keep fine grain material, such as mud, in suspension, but allows coarser material (sands) to remain. By contrast, the deeper portions of Mecox in the bay's center are less subject to these actions, and thus fine grain material, which is organically enriched, settles in these regions (Fig 23,24). The abundance of fine grain, organically rich material in Mill Creek is likely a reflection of the drastic reduction of currents in this tributary as it passes through constricted, high flow region under the Route 27 bridge to the more quiescent, brackish portion of the tributary south of the bridge. In addition, the process of flocculation, which occurs as freshwater and saltwater mix, is likely to cause organic particle formation and settling in Mill Creek (Sharp et al., 1984). Finally, the high levels of nutrients and phytoplankton biomass in Mill Creek (data not shown) are also likely to contribute to a high rate of deposition of organic matter in this tributary.

As stated previously, Mecox Bay hosts a notable abundance of multiple shellfish, including the American Oyster, *Crassostera virginia*, the ribbed mussel, *Geukensia demissa*, and the soft shell clam, *Mya arenaria* (Fig 25). Although densities of shellfish in the north, northeast, and southern regions of the bay were similar, densities were highest in the southwest corner and lower in the northwest and southeast. Reduced densities in the southeast corner may reflect the meandering of ocean inlet into this region during all 2002 inlet openings. The lower food (phytoplankton) content and high salinities in this region may restrict oyster growth. The lower shellfish densities in the northwest corner of the bay is likely a function of this region including Mill Creek, which had low salinity, muddy sediment, and frequent phytoplankton blooms of dinoflagellates, all properties which may negatively impact filter feeding oysters (Thompson, 1997). The higher shellfish abundances in the southwest corner of Mecox Bay may be due to the more sandy and variable sediment composition of this region. The proximity of this region to Mill Creek may also be beneficial in that this region seemed to receive higher levels of food (phytoplankton), but had ideal brackish salinities (Thompson, 1997).

Pelagic surveys in Mecox Bay revealed a high level of diversity of both fish and invertebrates (Table 5). The great abundance of the blue claw crab (*Callinectes sapidus*) indicates the potential for another successful fishery in the ecosystem. Initially, there was concern that some species of fish or invertebrates may suffer ill effects from the opening and closing of the inlets and the associated drastic changes in salinity in this bay. Such a scenario could be a particularly troublesome for ocean dwelling organisms which could become trapped in Mecox Bay once the ocean inlet has closed. However, the seining survey and subsequent literature search indicated that most pelagic fish and invertebrates found in Mecox Bay are euryhaline, being able to live in waters of a wide range of salinity (Table 5).

Health of Mecox Bay:

One goal of this study was to access the health of the Mecox Bay ecosystem. High nitrogen levels are present in the bay (Fig 7) and may be partly due to input from the tributaries and groundwater (Fig 8,13). The tributaries and groundwater entering Mecox Bay are a major source of nutrients (Fig 8, 13, 15). High levels of nitrogen are present in the tributaries entering Mecox Bay (up to 200 μM; Fig 13). Groundwater was also a major source of nitrogen for Mecox Bay, particularly on the eastern shore of the bay where nitrogen levels exceeded 500 μM (Fig 8). The peak levels of DIN in tributaries (200μM) and in groundwater (500μM) entering Mecox Bay exceeds levels previously reported around other Long Island estuaries (Gobler and Sañudo–Wilhelmy, 2001a; Clark, et al., submitted). The sources of the high nutrient levels entering Mecox Bay from the tributaries and groundwater are likely to be anthropogenic, due to the large amount of housing and/or farming in the area (Richardson and Jorgensen, 1996; LaRoche et al., 1997; Gobler and Sañudo–Wilhelmy, 2001a). Anthropogenic sources may also be the cause of high dissolved organic nitrogen (DON) levels seen in Mecox Bay (Fig 11). These nutrients likely support the high levels of primary and secondary productivity in this system.

The high levels of nitrogen in Mecox Bay may be responsible for the increase in phytoplankton densities, which could in turn die off and result in lower dissolved oxygen (DO) levels. The Mecox Bay water column, however, is usually well mixed (data not shown) a condition which seemingly prevents hypoxic conditions. The DO levels were usually above the hypoxic threshold of 3 mg/L, except on 2 Jul and during some summer observations in Hayground Cove, which is poorly flushed (data not shown; Fig 6).

Most of Mecox Bay is open to shellfishing between 15 Dec and 15 Apr, although the NYDEC threshold for closing the shellfish bed is 70 MPN during this period. In 2002, densities of coliform bacteria were below the NYDEC threshold of 70 MPN during the time Mecox Bay was open to shellfishing. Coliform densities reached levels above 70 MPN for the first time on 8 May (Station 3), 22 May (Station 2), and 16 Jul (Station 1;

Fig 14). It is believed therefore that the shellfish season is appropriately chosen. As of 8 May, Station 3, at 93 colonies/100mL, was the only station above the NYDEC closing threshold (Fig 14) and throughout the study, station 3 consistently had coliform densities the same or higher than stations 1 and 2 (Fig 14). Moreover, coliform input from the creeks into Mecox Bay averaged 350.2 ± 153.5 colonies/100mL (Fig 15). Hence, the permanent closing of station 3 and Mecox Bay tributaries to shellfishing also seems to be a necessary precaution for the ecosystem.

From the data collected, the opening of the inlet appears to decrease coliform bacteria densities in Mecox Bay (Fig 14). Densities of coliform bacteria were always low in the Atlantic Ocean (Fig 14). Densities of coliform bacteria dramatically increased when the Mecox Bay inlet was closed, particularly in the warm summer months, and decreased with the opening of the inlet during Jun (Fig 14). It is also likely that the heavy rainfall seen in the autumn months contributed to the high densities of coliform bacteria seen at that time (Table 4).

Impact of Inlet Openings on Mecox Bay:

The residence time of Mecox Bay is variable and dependent on many factors, including the size of the inlet, the strength of the tides, the prevailing winds, and the state of the Atlantic Ocean. Although the average residence time in Mecox Bay was 18.7 ± 7.5 days during the course of this study, the residence time ranged from 5 days in Nov to 26 days in Jun (Table 1). In contrast, West Neck Bay, Shelter Island has an average residence time of 14 days (Dilorenzo and Ram, 1991) and North Sea Harbor, Southampton has an average residence time of 3 days (Gobler and Boneillo, 2003). The residence time of Peconic Estuary is approximately 50 days and in Great South Bay it is 100 days (Hardy, 1976; Wilson, et al., 1991). The difference in residence times between Mecox Bay and the other small Long Island bays may be the result of a smaller inlet size and fewer openings and thus lower exchanges with the Atlantic Ocean. Depending on the structure of the Mecox Bay inlet, the time needed to flush the bay is variable.

Almost all of the parameters measured during the study were higher in Mecox Bay than in the Atlantic Ocean (Table 3). Salinity concentrations, phosphate concentrations and diatom cell densities were the only parameters that showed higher annual mean levels in the Atlantic Ocean. The higher phosphate levels seen in the Atlantic Ocean is consistent with the general consensus that marine systems are nitrogen limited (Richardson and Jørgensen, 1996). However, it can generally be stated that inlet opening will dilute most parameters within Mecox Bay. Rapid input from groundwater and tributaries, particularly during cooler months, will prevent Mecox Bay from being completely flushed of contaminants such as nitrogen. The opening of the inlet did effectively reduce coliform bacteria, DON, and silicate in Mecox Bay during 2002.

Physical parameters were strongly and obviously influenced by the opening of the Mecox Bay inlet. The parameters most influenced by the opening of the inlet during this study were the depth, salinity, and DO of Mecox Bay. The depth of Mecox Bay increased with the closing of the inlet and decreased with the opening of the inlet (Fig 2). Salinity levels within Mecox Bay dramatically increased during the openings of the inlet from 6.3 ppt (7 Feb) to 26.6 ppt (7 Mar) and again from 13.96 ppt (22 May) to 25.6 ppt (17 Jun; Fig 4). In contrast, the average salinity in the Atlantic Ocean remained fairly constant at 32.1 ± 1.1 ppt (Fig 4). These results indicate rapid freshwater input to the system from groundwater and tributaries, in concert with inlet openings, play an important role in regulating water level in Mecox Bay. DO decreased with the Jun opening of the inlet and increased dramatically with the closing of the inlet in Jul (Fig 6). As with the sporadic inlet openings during the autumn, DO concentrations followed variable increases and decreases, finally increasing to an annual high in Nov after the closing of the inlet (Fig 6).

Higher phosphate concentrations in the Atlantic Ocean relative to Mecox Bay during the winter and early spring months resulted in the delivery of phosphate to phosphate limited phytoplankton in Mecox Bay during the Feb opening of the inlet (Fig 9). The increased levels of phosphate seemed to simulate a phytoplankton bloom as levels of chl *a* increased during the Feb inlet opening (Fig 16). At the time of the opening of the Mecox Bay inlet in late May and Jun, nitrogen concentrations in the Atlantic Ocean were occasionally greater than in Mecox Bay (Fig 7). With the opening of the inlet in Jun, chl *a* concentrations in Mecox Bay increased, suggesting that during the summer, the Atlantic Ocean may bring nitrogen into Mecox Bay (Nixon, et al., 1994).

Temperature followed an expected seasonal pattern during this study and may have directly or indirectly influenced nutrient levels within Mecox Bay (Fig 5). The levels of dissolved inorganic nitrogen (DIN) in the bay decreased with the warming temperatures and again increased with the declining autumn temperatures (Fig 7). In fact, DIN levels were highly and inversely correlated with bay temperature during this study (r^2=0.66, P<0.000001). With lower water temperature, marine organisms have a lower metabolic rate and thus lower nutrient uptake. A decrease in uptake rate by organisms during the cooler months may explain the increase in DIN seen at that same time. Also, higher groundwater and stream flow in winter, due to less evaporation, may increase DIN levels (Steinhuis, et al., 1985). Benthic fluxes decrease with decreasing temperatures and this may explain the coinciding decreases in phosphate concentrations in late fall (Fig 9; Gobler and Sañudo–Wilhelmy, 2001a).

In conclusion, the opening of the Mecox Bay inlet has a prominent effect on some physical, chemical, and biological attributes of Mecox Bay. Depth and salinity are most directly affected by the opening of the inlet. Seasonal temperature changes play a direct and indirect role in altering Mecox Bay nutrient concentrations, as does the significant input from tributaries and groundwater. Large nutrient input into Mecox Bay likely supports high levels of primary and secondary productivity in the system. Coliform bacteria densities increase with the closing of the inlet and data from this study has shown that the shellfishing season and areas of the bay open to shellfishing as determined by the NYDEC to be accurate. The presence of large nutrient concentrations promotes phytoplankton growth, which results in healthy shellfish populations within Mecox Bay. The low flushing rate of Mecox Bay, resulting from the inlet remaining closed most of the year, creates a phytoplankton community with higher net growth than that seen in most open estuaries, particularly Peconic Estuary and Great South Bay. Mecox Bay is both phosphate and nitrogen limited, with phosphate limitation occurring in the winter, early spring, and autumn and nitrogen limitation occurring in the summer. This contrasts with the nitrogen limitation seen in most Long Island estuaries.

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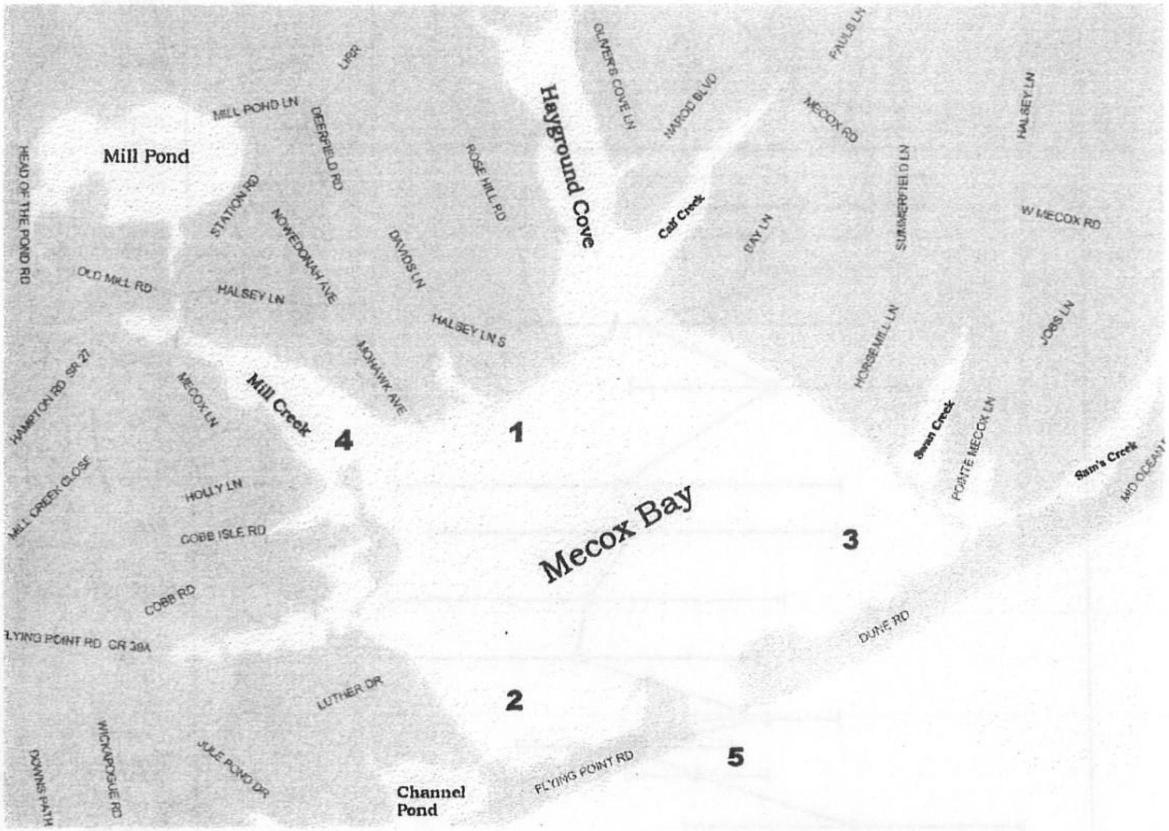


Figure 1: Location of set sampling stations for Mecox Bay, Long Island, New York. Stations 1, 2, and 3 are within Mecox Bay. Station 4 is within the brackish region of Mill Creek. Station 5 is located in the Atlantic Ocean just outside the Mecox Bay Inlet.

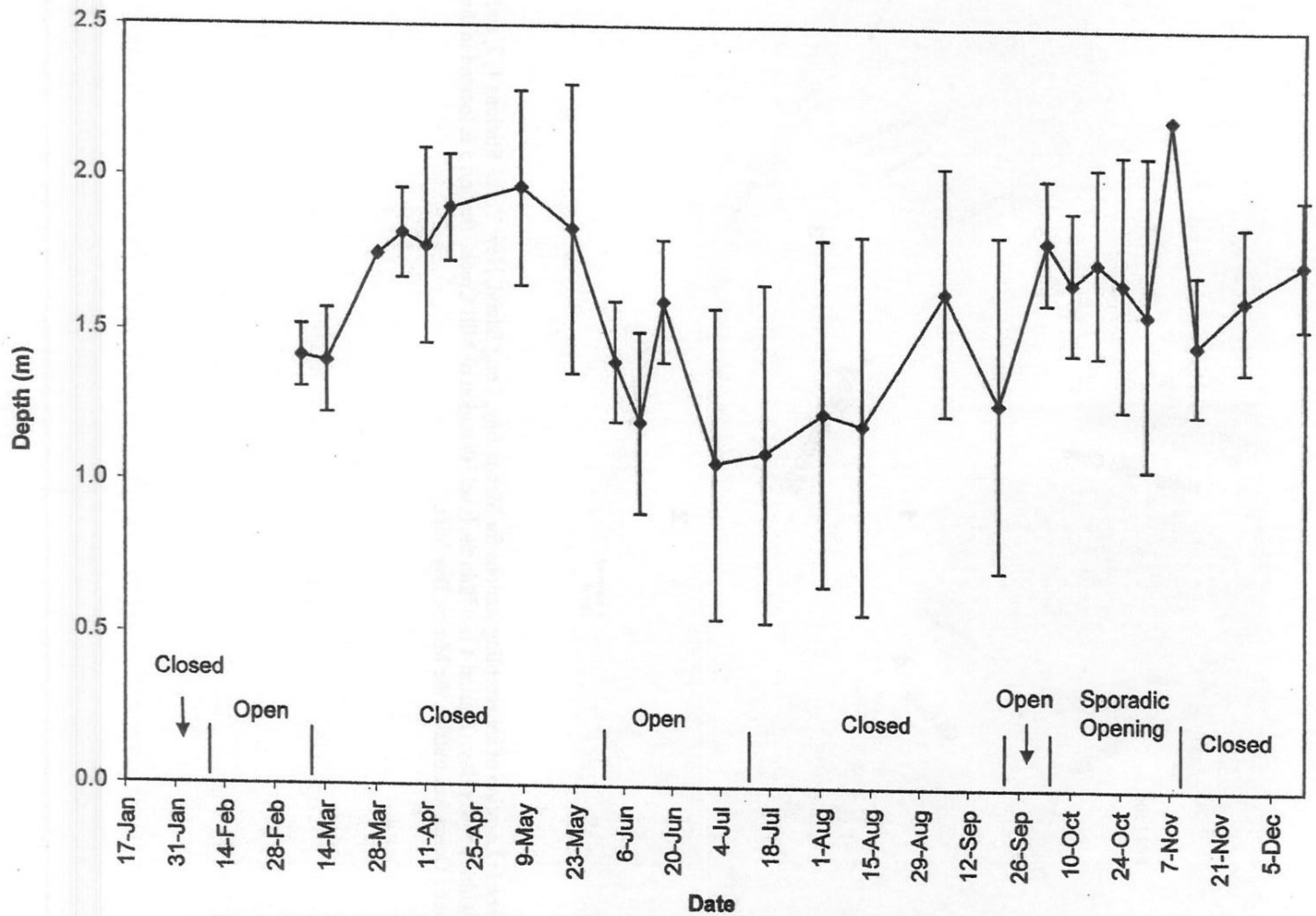


Figure 2: Mean Depth of Mecox Bay. The opening and closing of the inlet is also shown. The y-axis indicates the depth in meters. The x-axis indicates the date. Error bars represent ± 1 standard deviation.

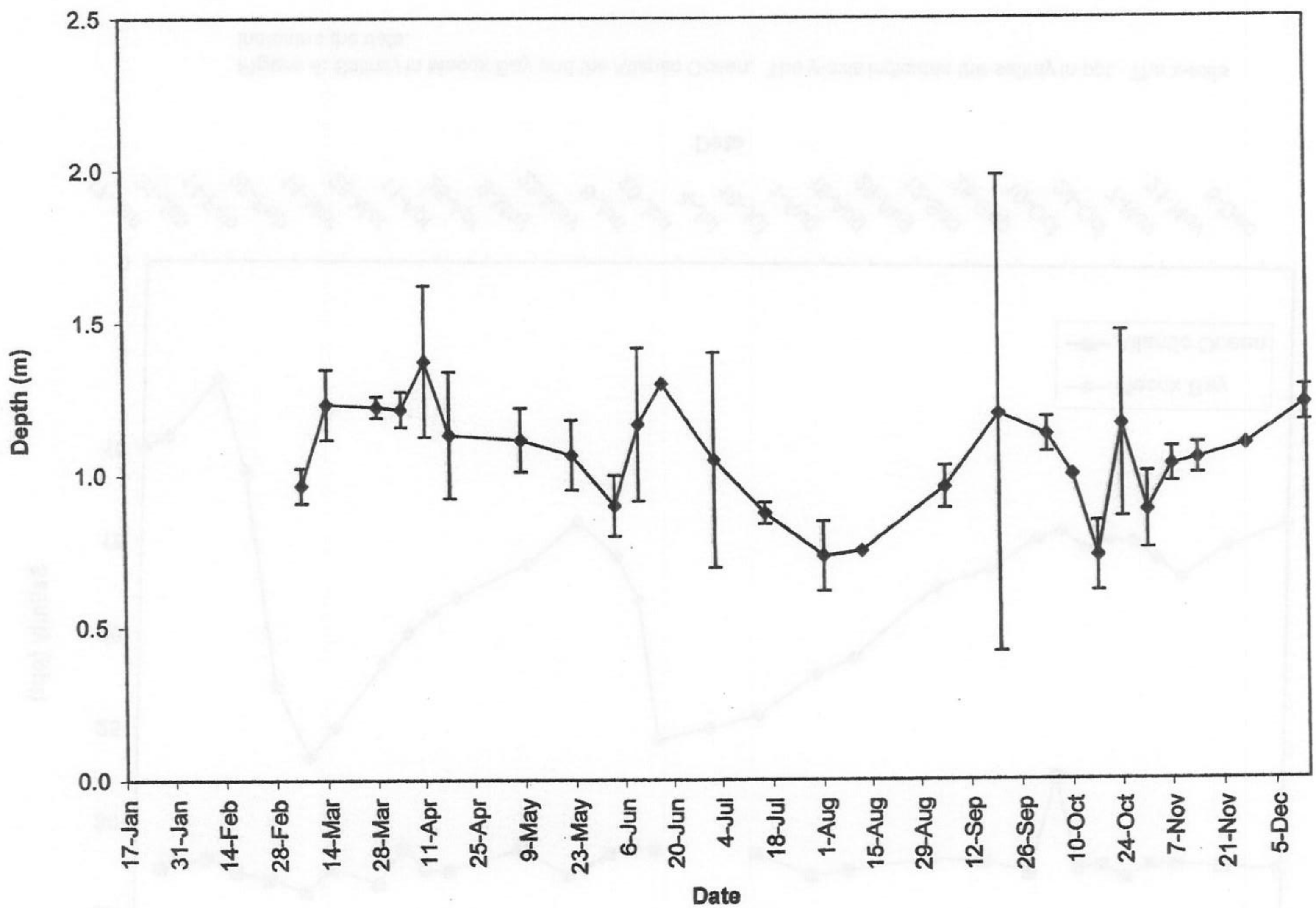


Figure 3: Mean secchi depth of Mecox Bay. The y-axis indicates the depth in meters. The x-axis indicates the date. Error bars represent ± 1 standard deviation.

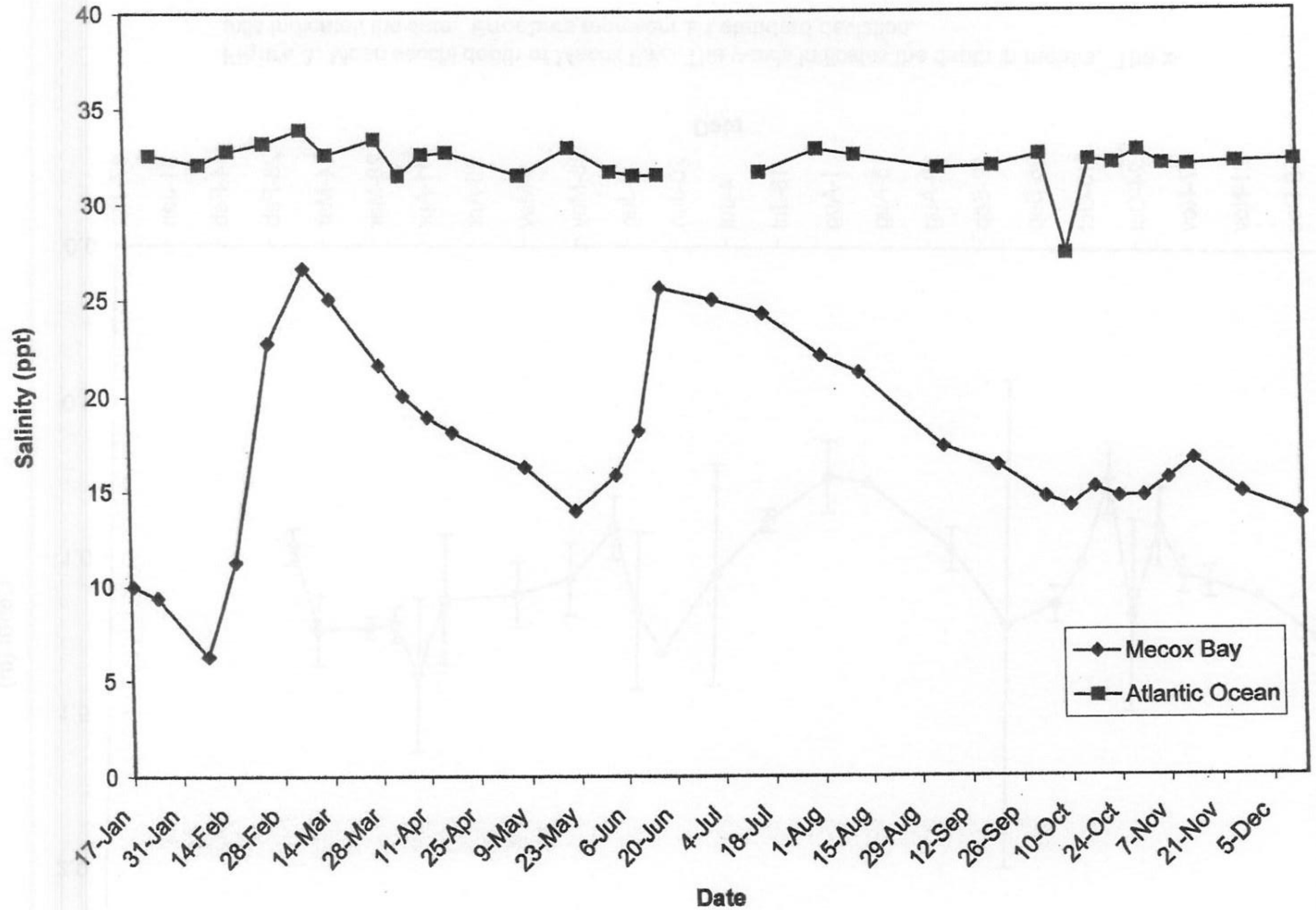


Figure 4: Salinity in Mecox Bay and the Atlantic Ocean. The y-axis indicates the salinty in ppt. The x-axis indicates the date.

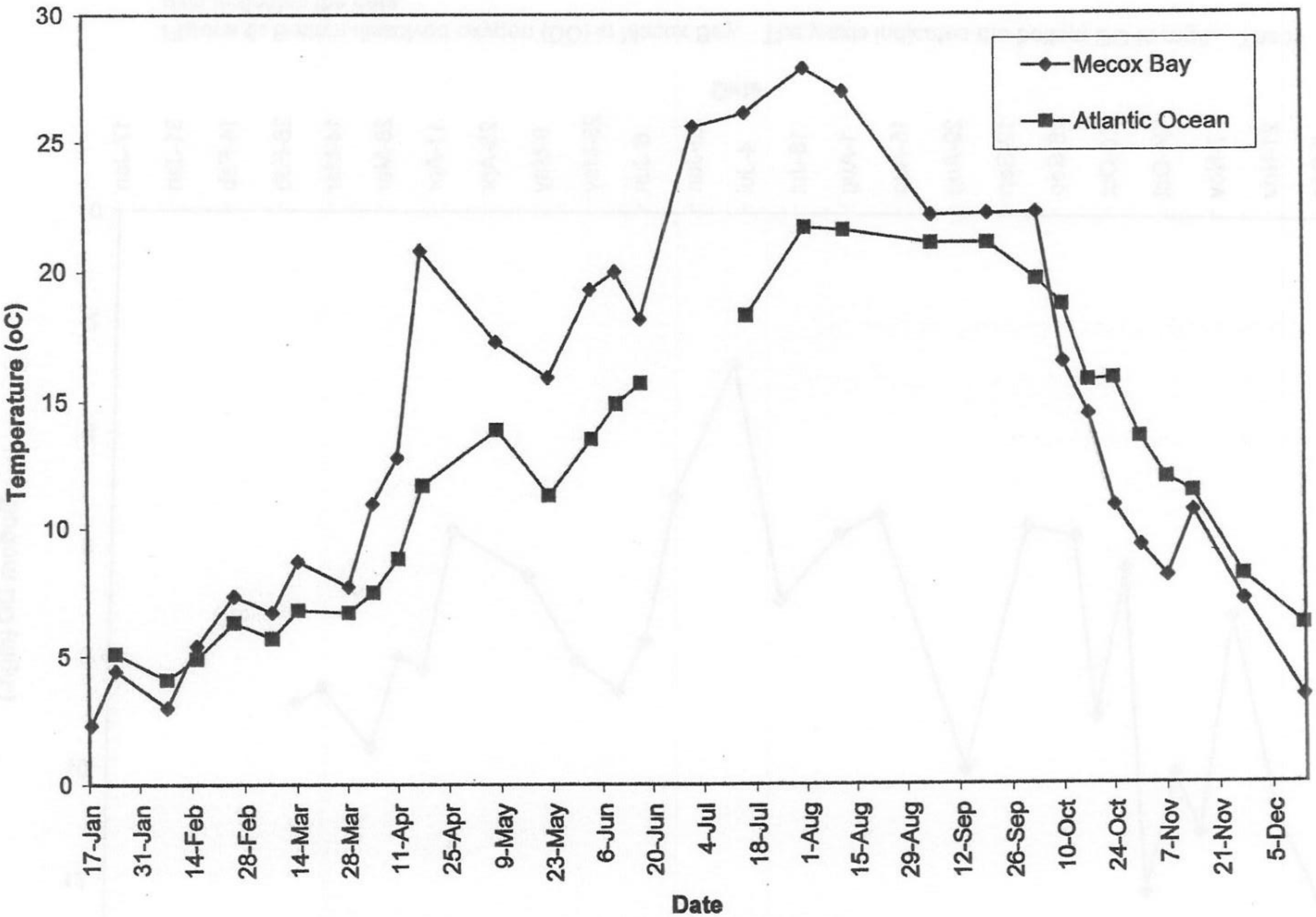


Figure 5: Temperature in Mecox Bay and the Atlantic Ocean. The y-axis indicates the temperature in oC. The x-axis indicates the date.

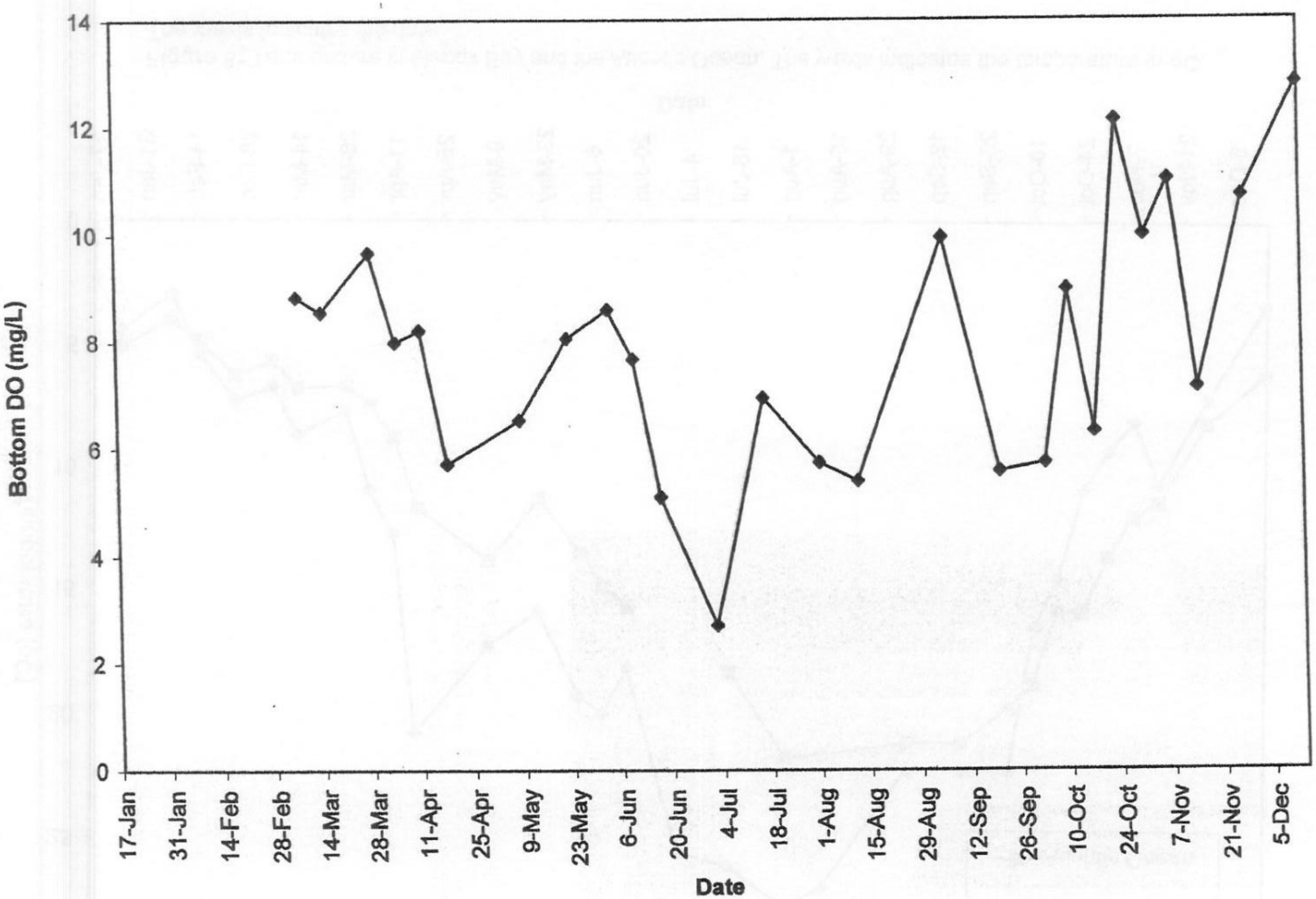


Figure 6: Bottom dissolved oxygen (DO) in Mecox Bay. The y-axis indicates the bottom DO in mg/L. The x-axis indicates the date.

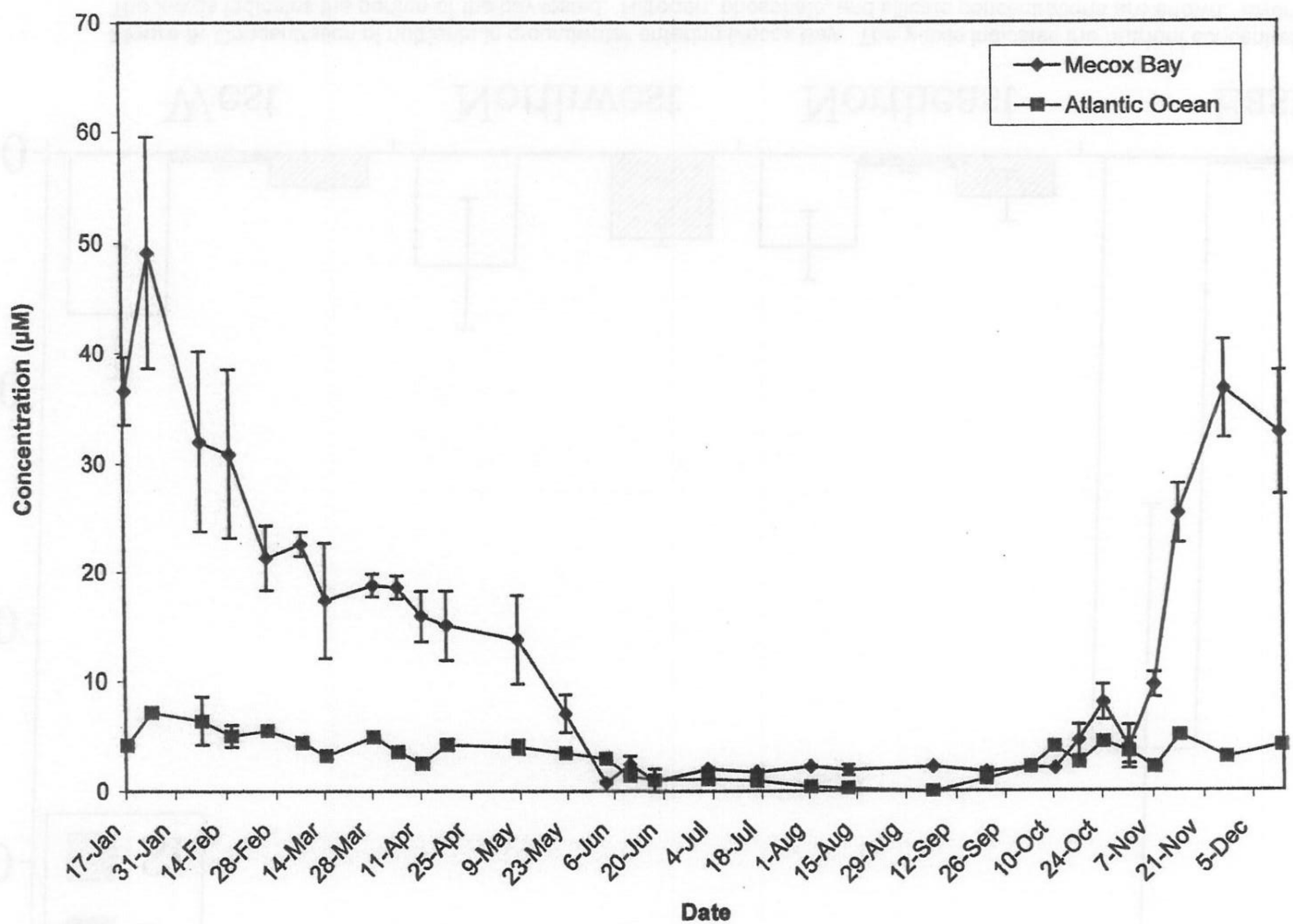


Figure 7: DIN concentrations in Mecox Bay and the Atlantic Ocean. The y-axis indicates the DIN concentration in µM. The x-axis indicates the date. Error bars represent ± 1 standard deviation.

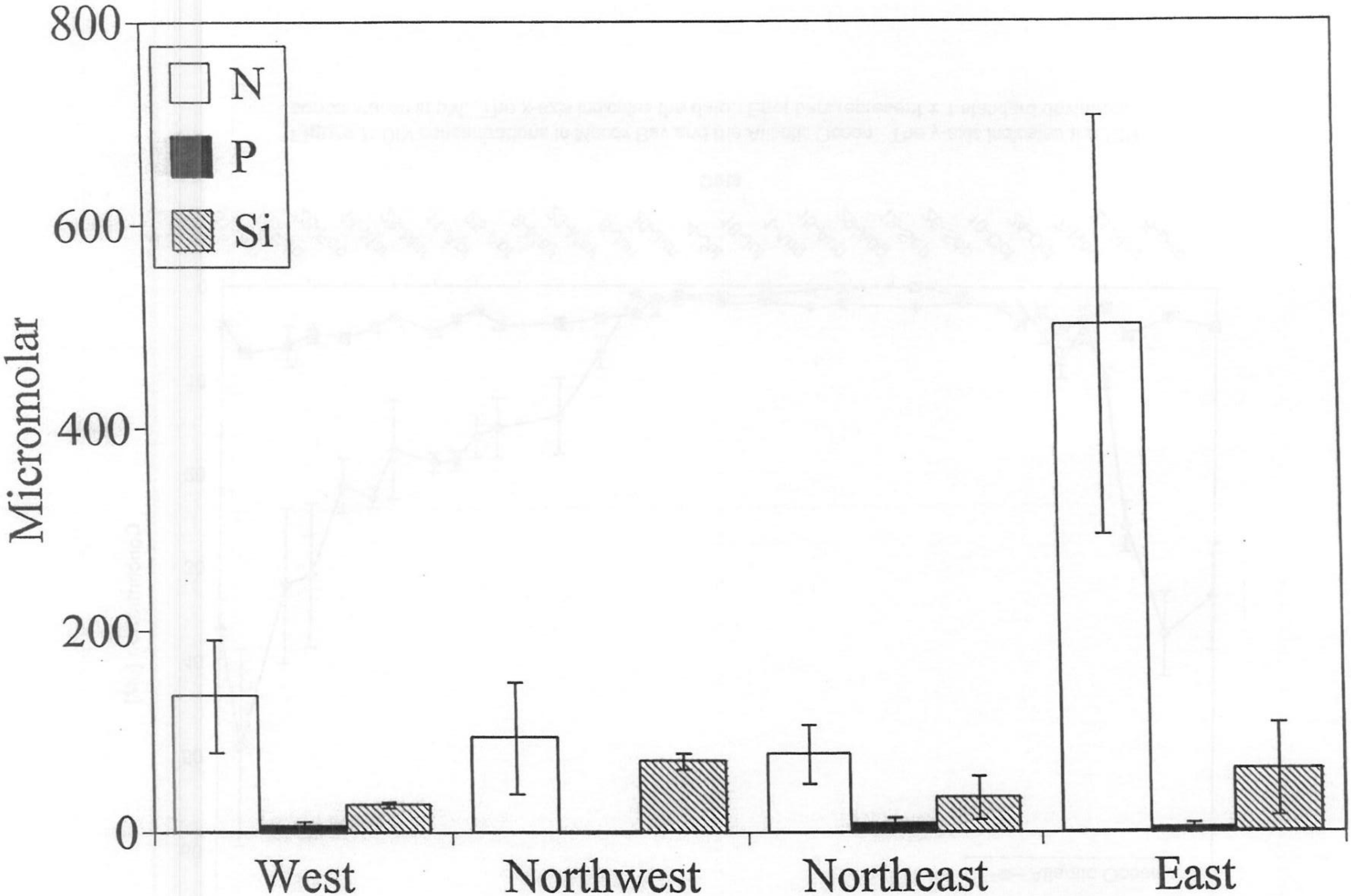


Figure 8: Concentration of nutrients in groundwater entering Mecox Bay. The y-axis indicates the nutrient concentration in µM. The x-axis indicates the portion of the bay tested. Nitrogen, phosphate, and silicate concentrations are shown. Error bars represent ± 1 standard deviation.

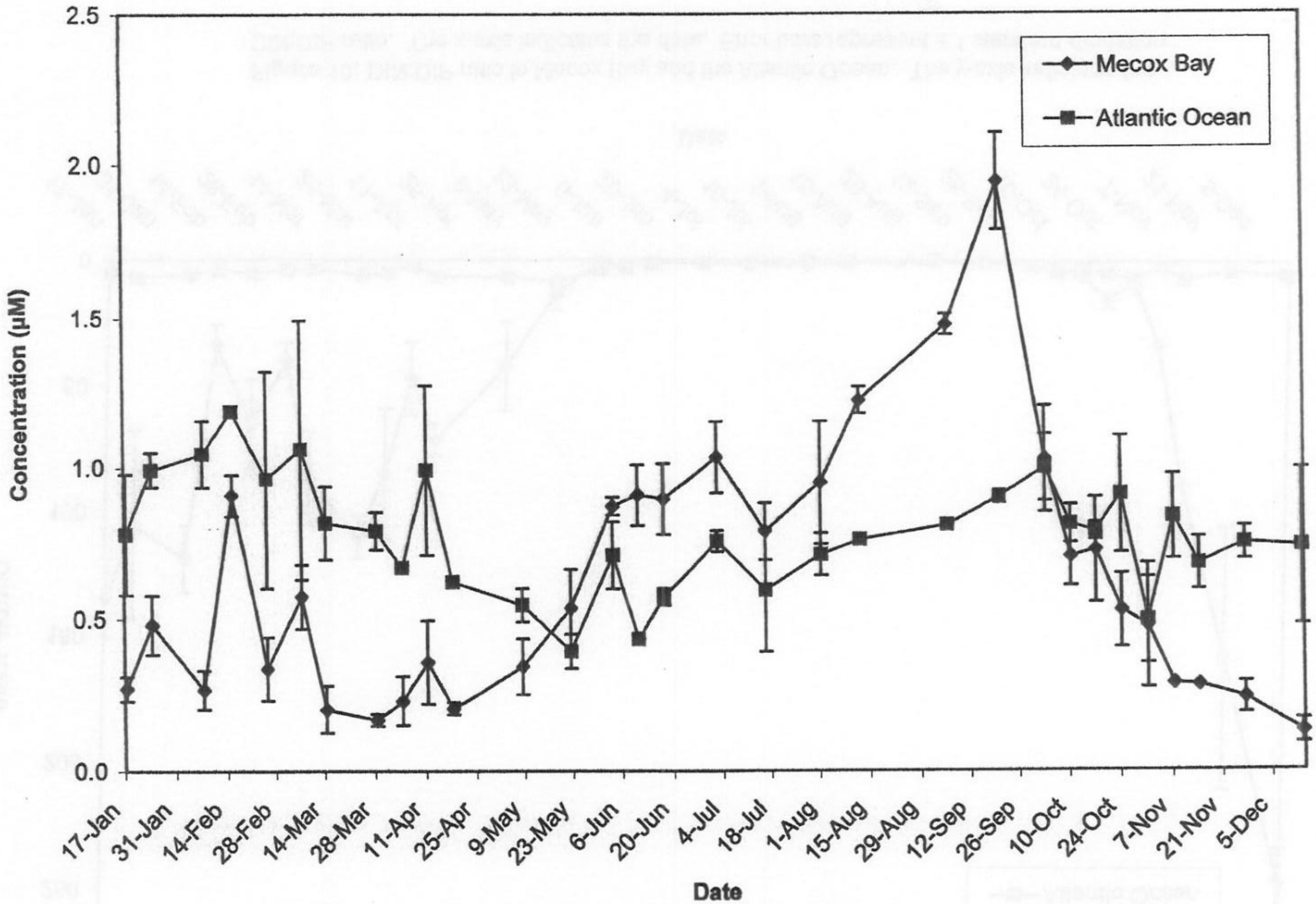


Figure 9: Phosphate concentrations in Mecox Bay and the Atlantic Ocean. The y-axis indicates the phosphate concentration in µM. The x-axis indicates the date. Error bars represent ± 1 standard deviation.

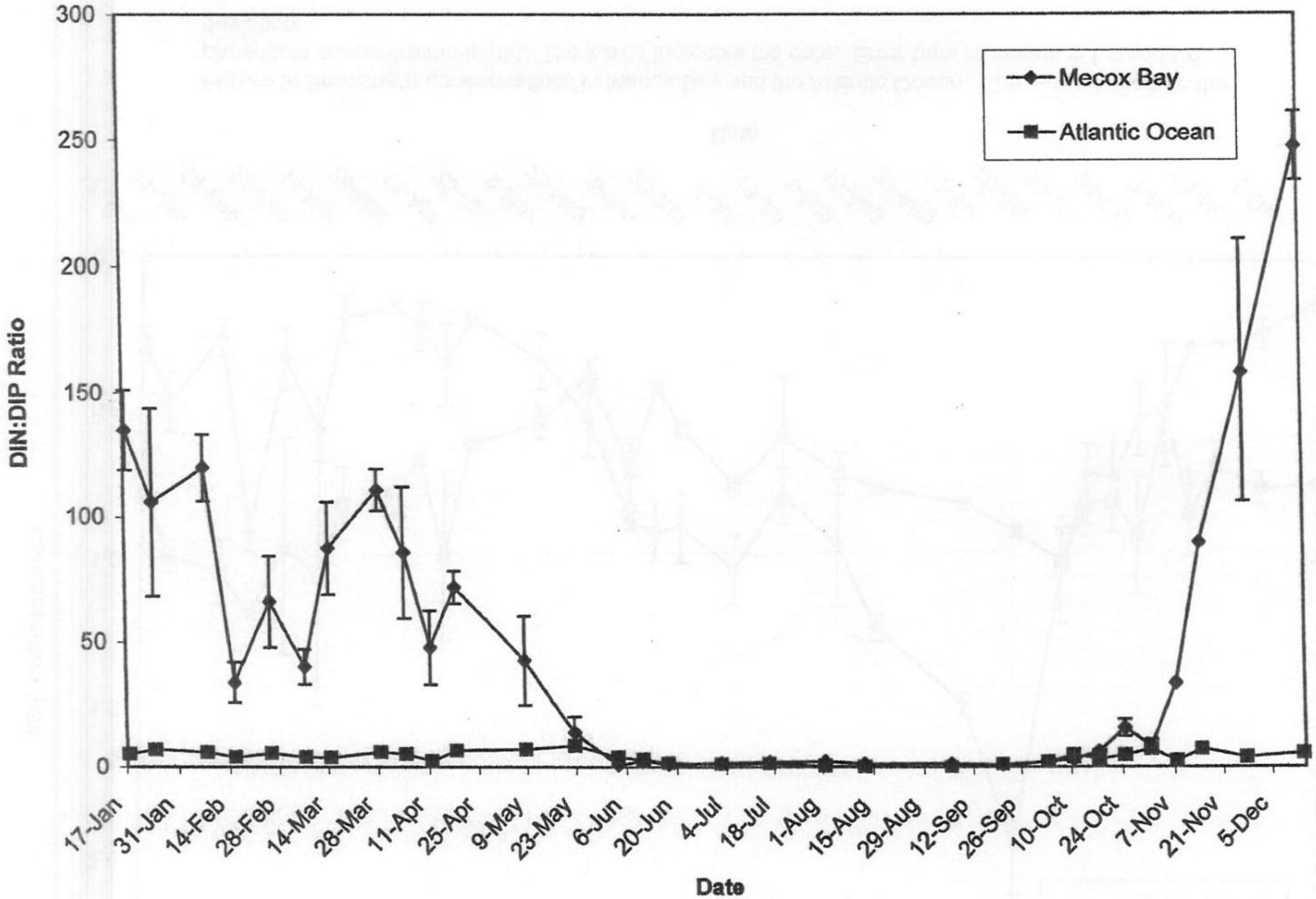


Figure 10: DIN:DIP ratio in Mecox Bay and the Atlantic Ocean. The y-axis indicates the DIN:DIP ratio. The x-axis indicates the date. Error bars represent ± 1 standard deviation.

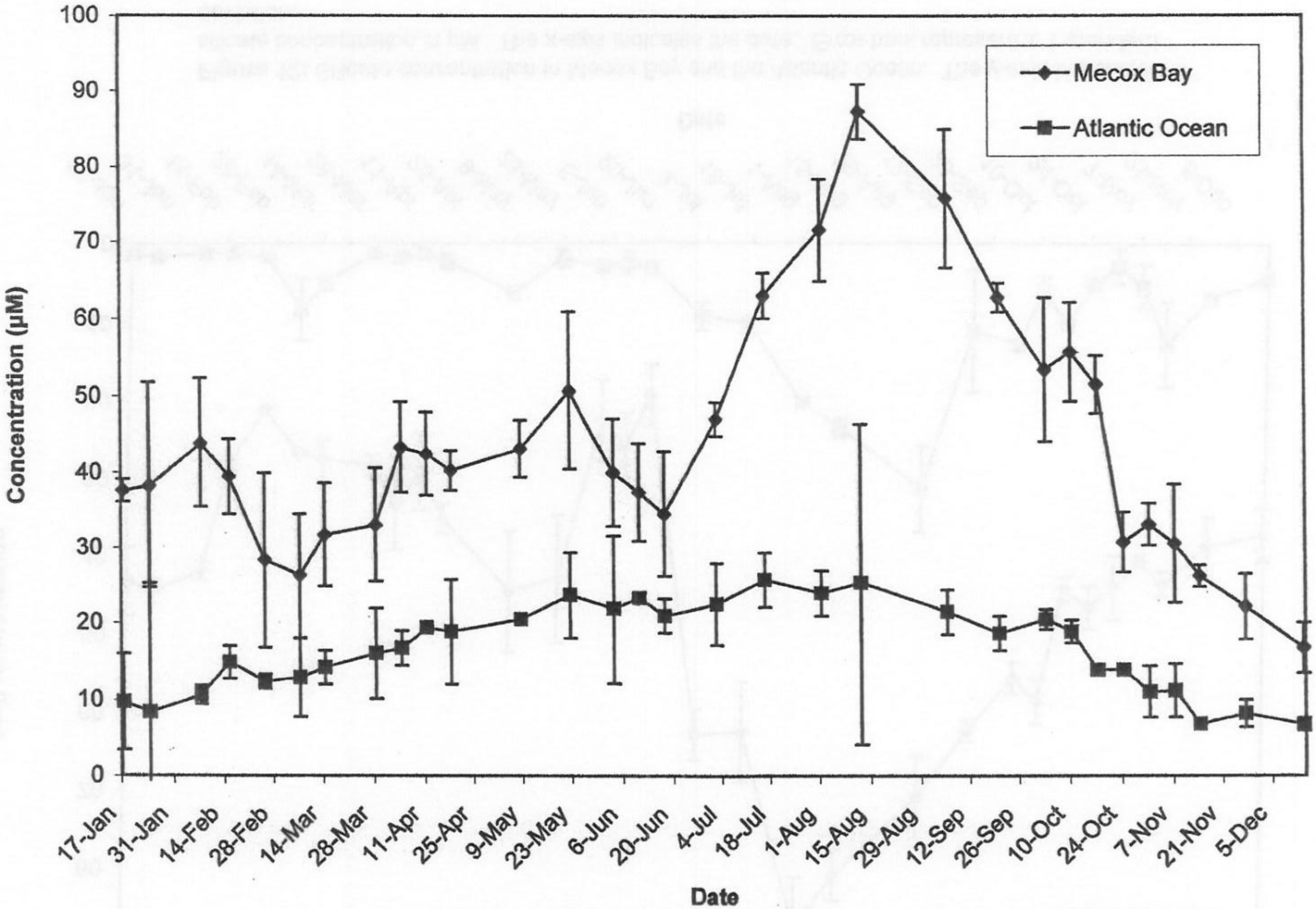


Figure 11: DON concentration in Mecox bay and the Atlantic Ocean. The y-axis indicates the DON concentration in µM. The x-axis indicates the date. Error bars represent ± 1 standard deviation.

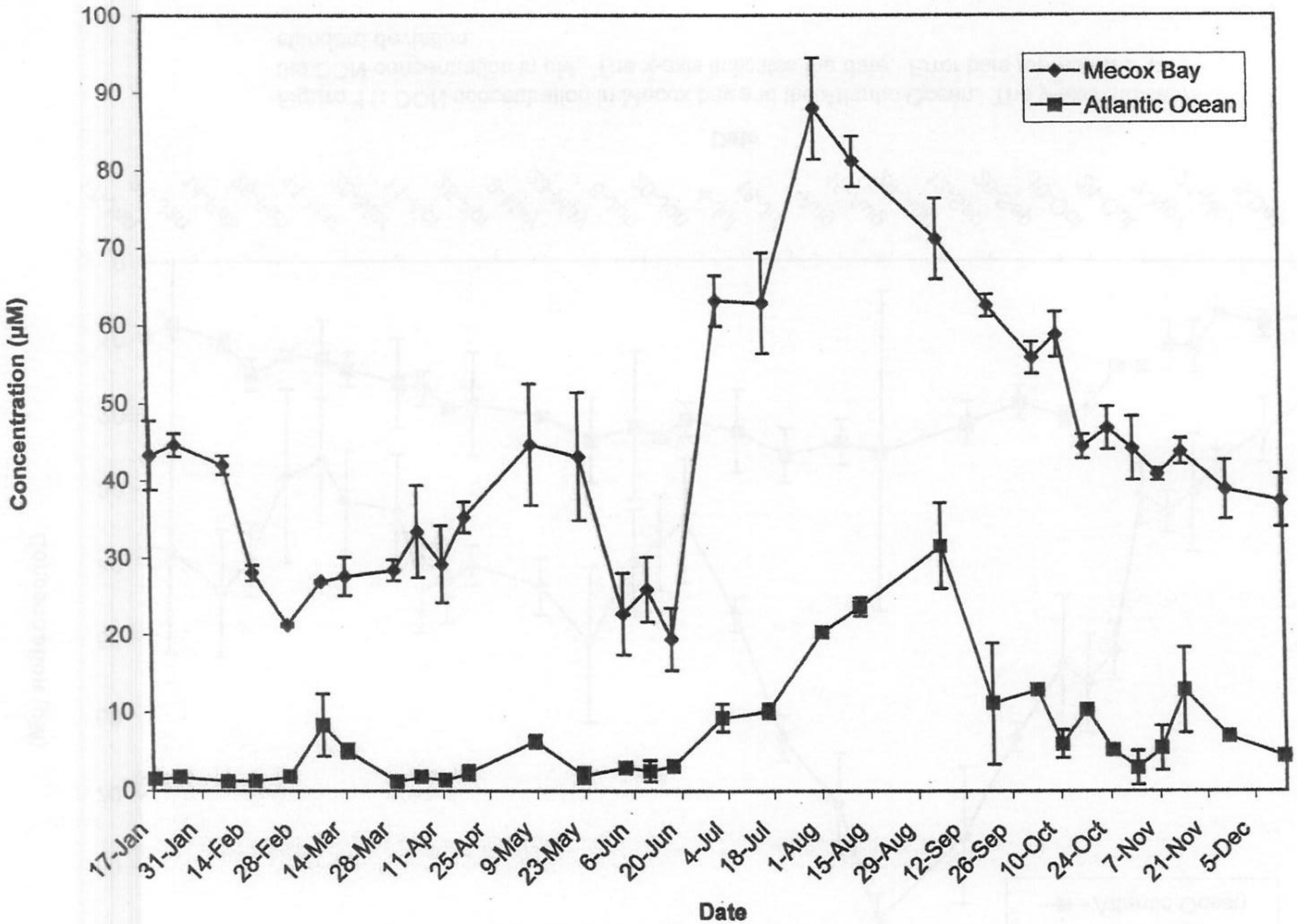


Figure 12: Silicate concentration in Mecox Bay and the Atlantic Ocean. The y-axis indicates the silicate concentration in µM. The x-axis indicates the date. Error bars represent ± 1 standard deviation.

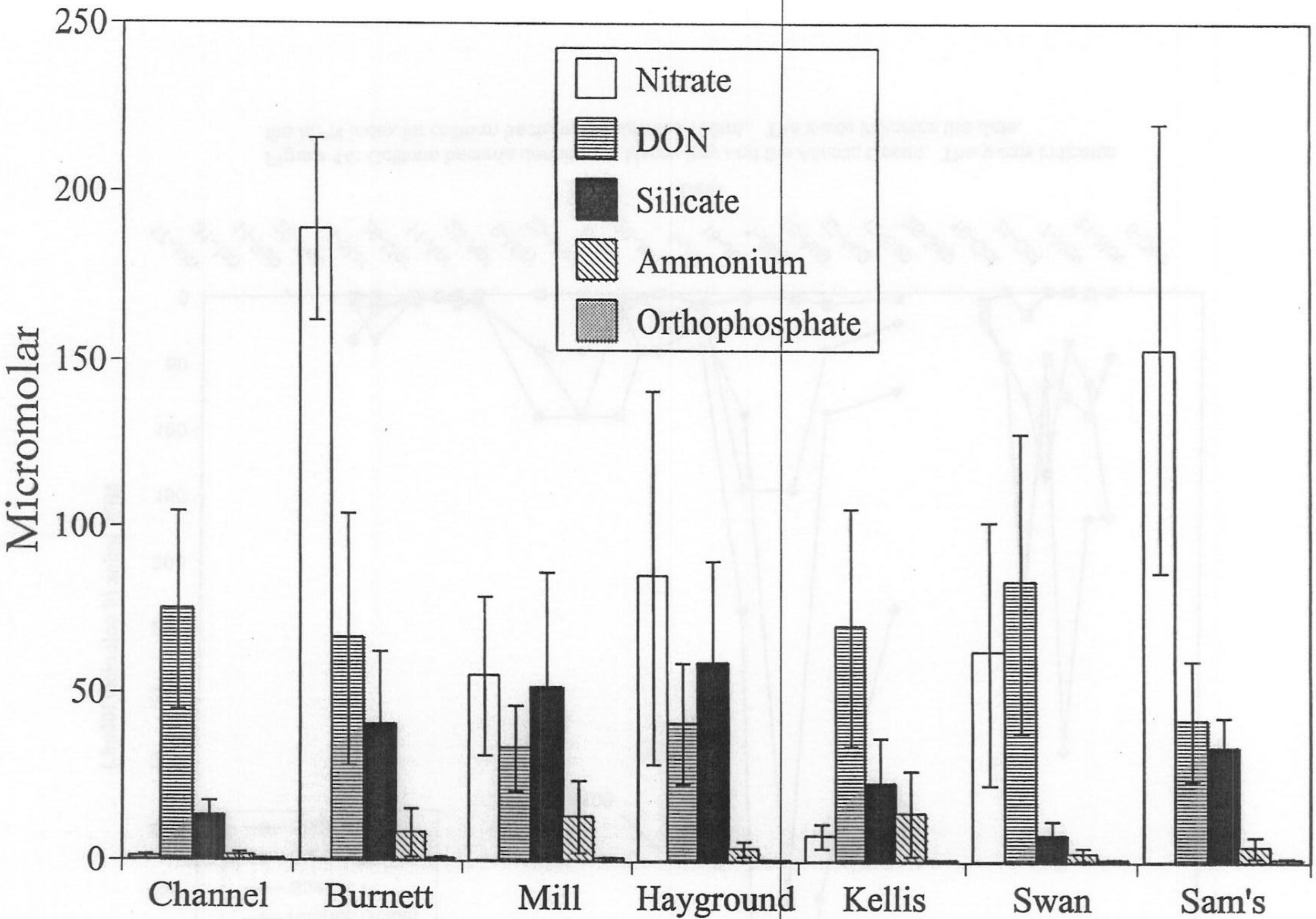


Figure 13: Concentration of nutrients in tributaries entering Mecox Bay. The y-axis indicates the nutrient concentration in µM. The x-axis indicates the tributary. Nitrate, DON, silicate, ammonium, and orthophosphate concentrations are shown for each tributary. Error bars represent ± 1 standard deviation.

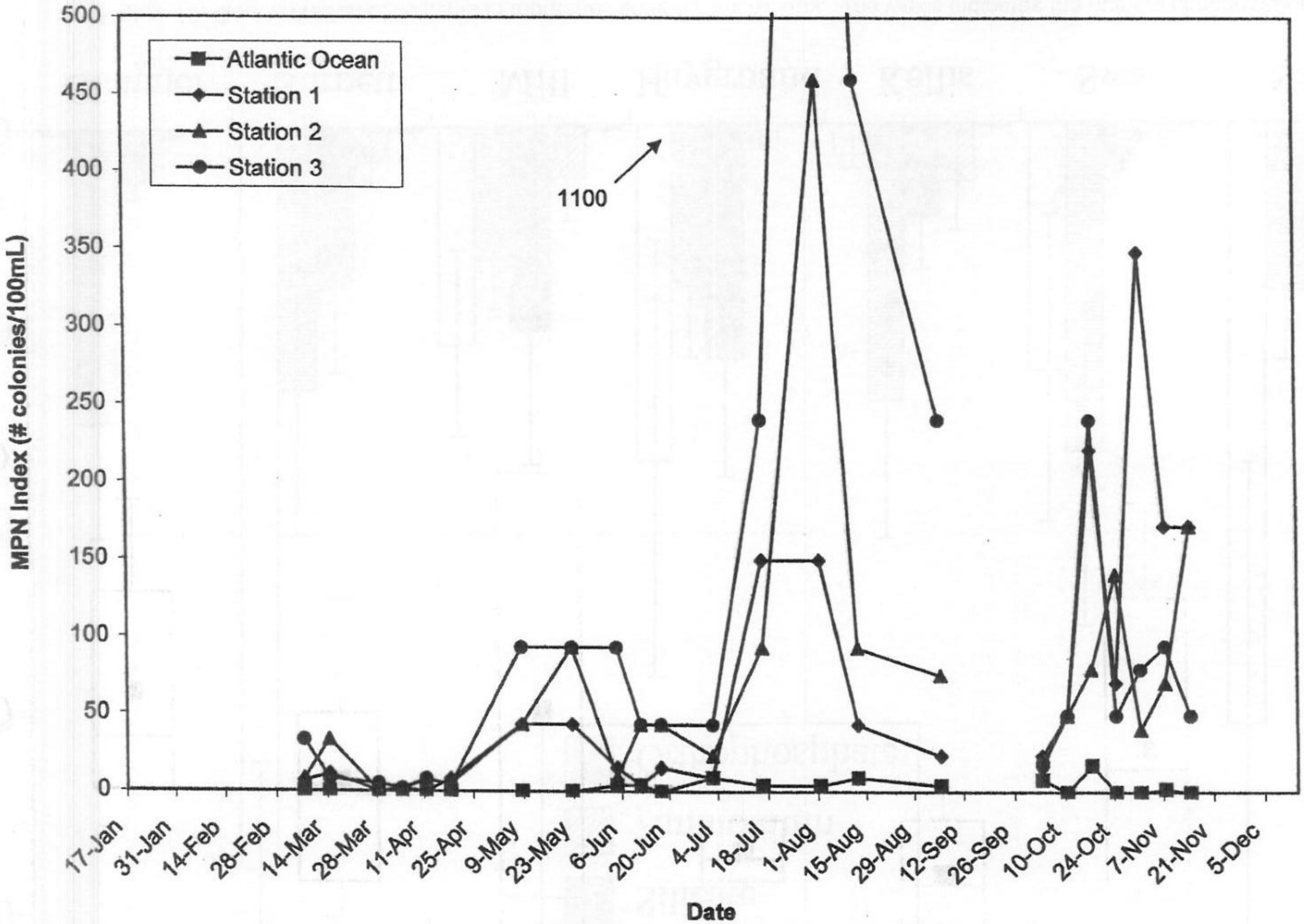


Figure 14: Coliform bacteria densities in Mecox Bay and the Atlantic Ocean. The y-axis indicates the MPN index for coliform bacteria in #colonies/100mL. The x-axis indicates the date.

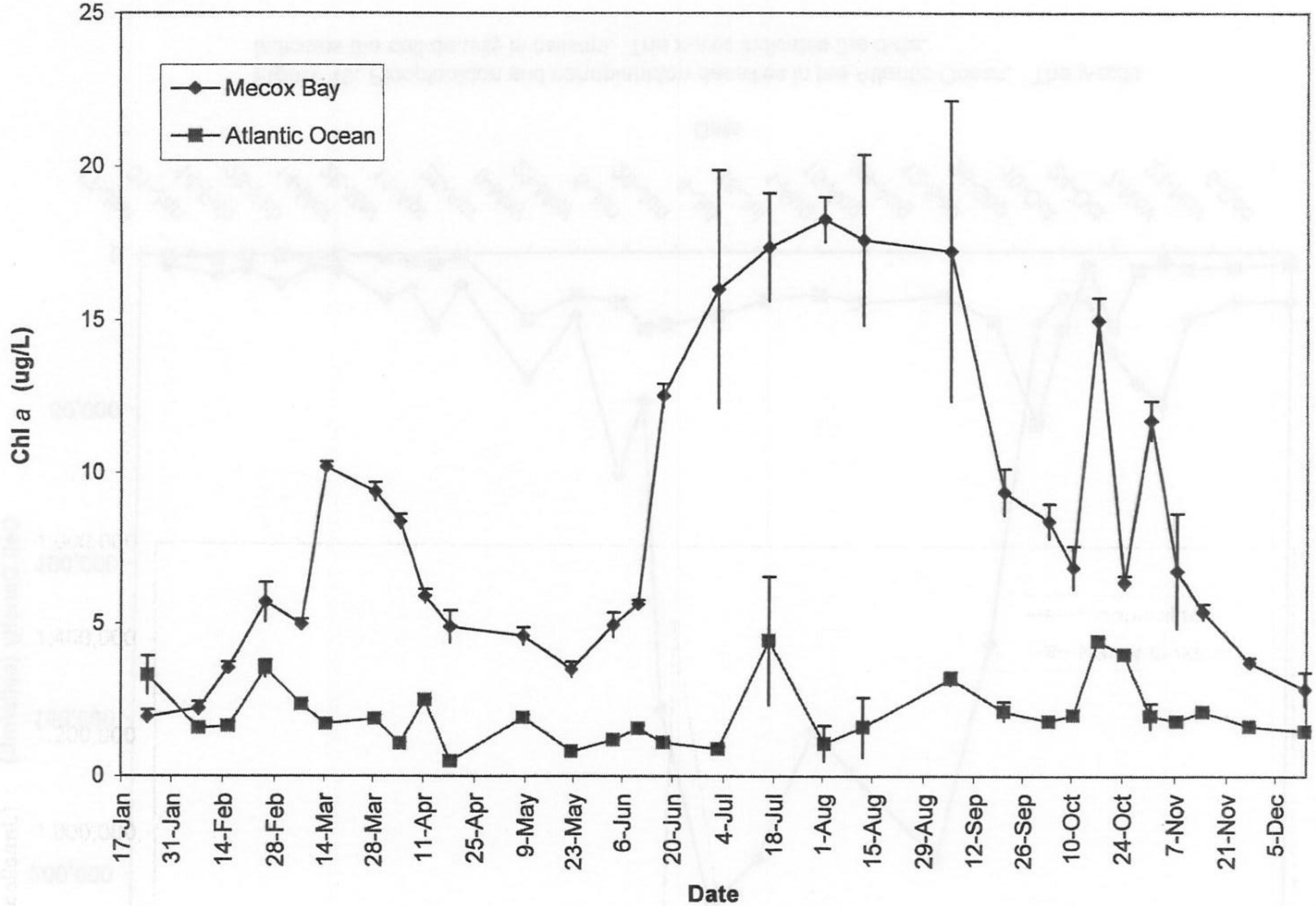


Figure 16: Whole Chlorophyll a (chl a) levels in Mecox Bay and the Atlantic Ocean. The y-axis indicates the chl a concentration in μg/L. The x-axis indicates the date. Error bars represent ± 1 standard deviation.

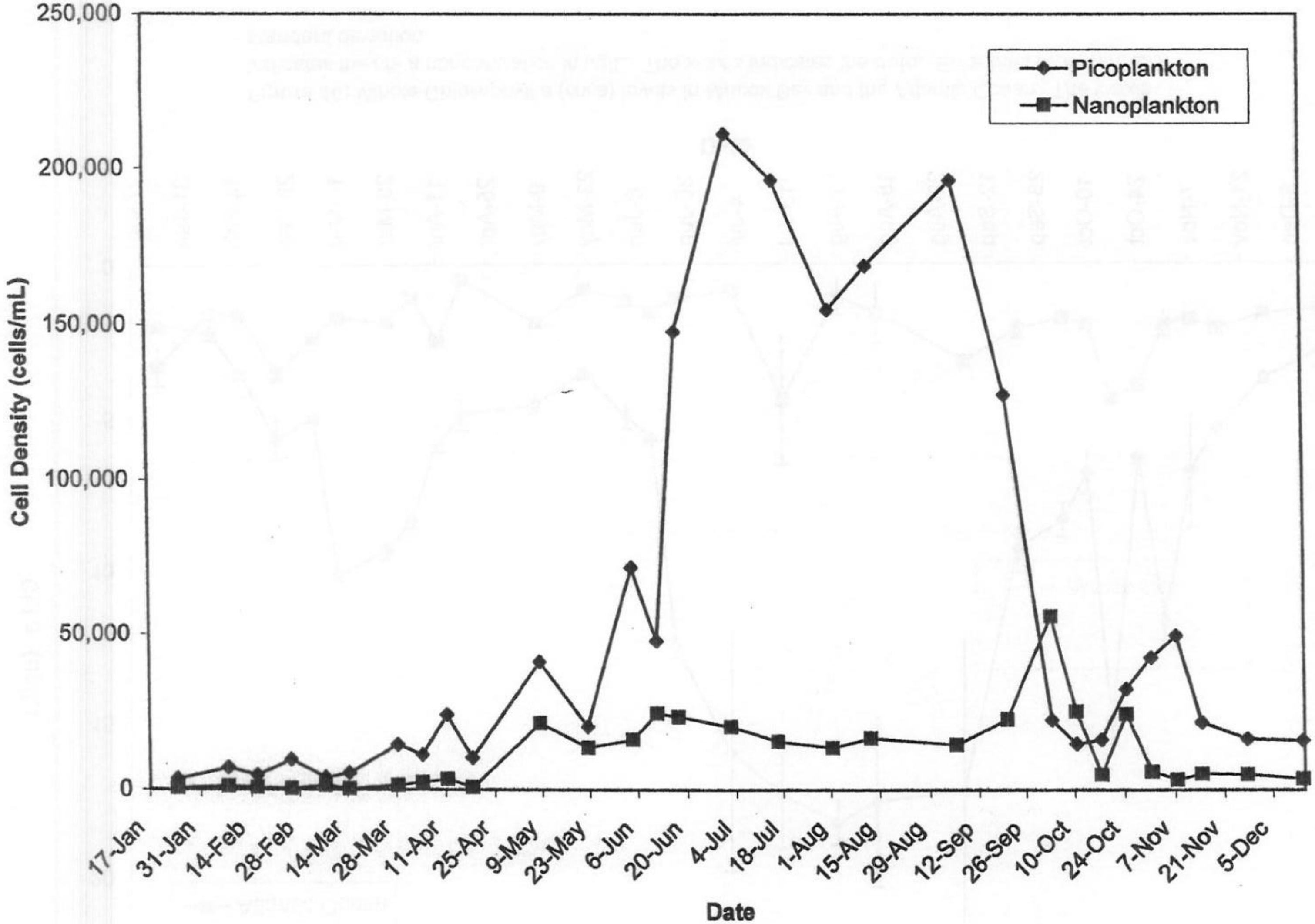


Figure 19: Picoplankton and nanoplankton densities in the Atlantic Ocean. The y-axis indicates the cell density in cells/ml. The x-axis indicates the date.

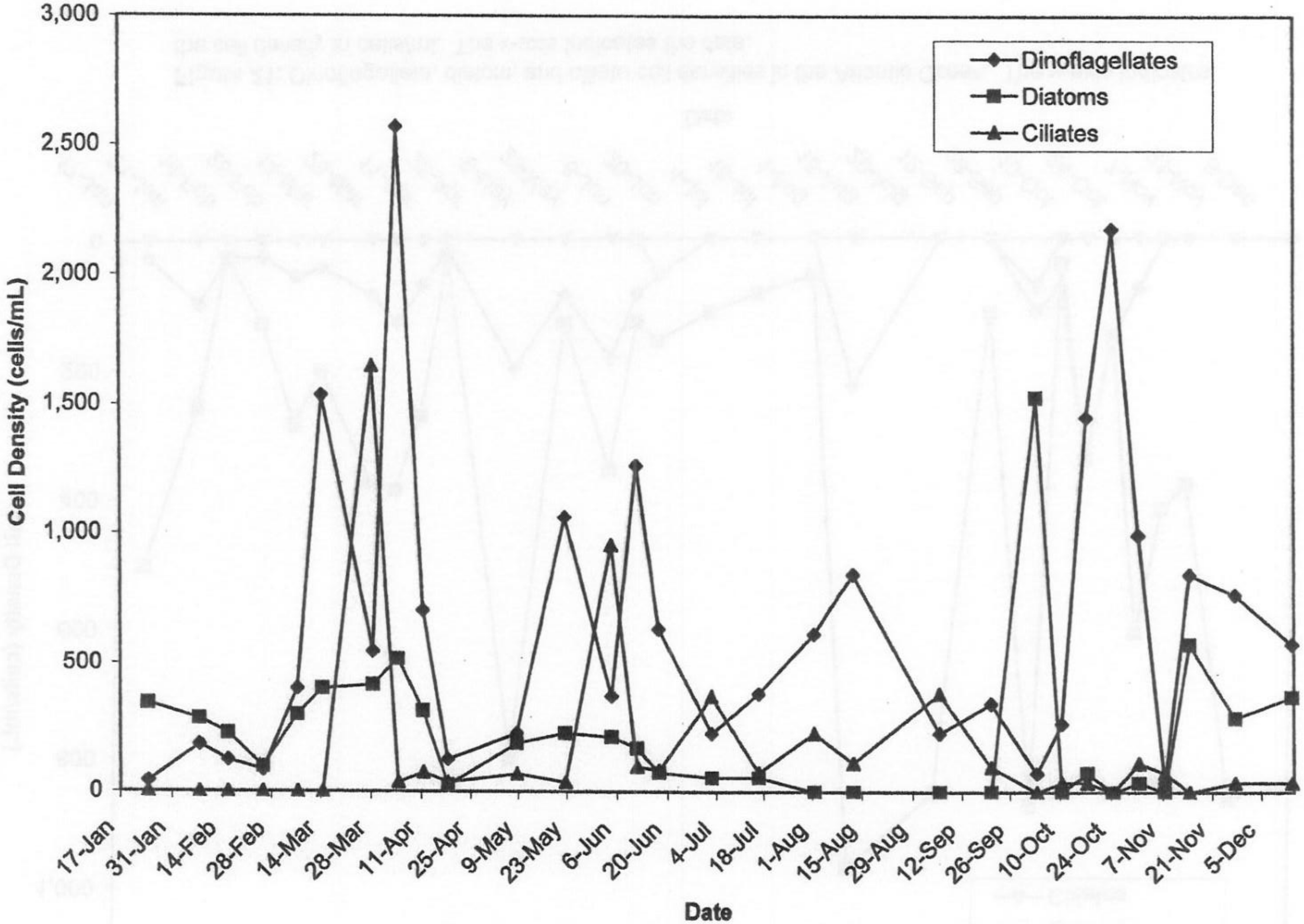


Figure 20: Dinoflagellate, diatom, and ciliate cell densities in Mecox Bay. The y-axis indicates the cell density in cells/ml. The x-axis indicates the date.

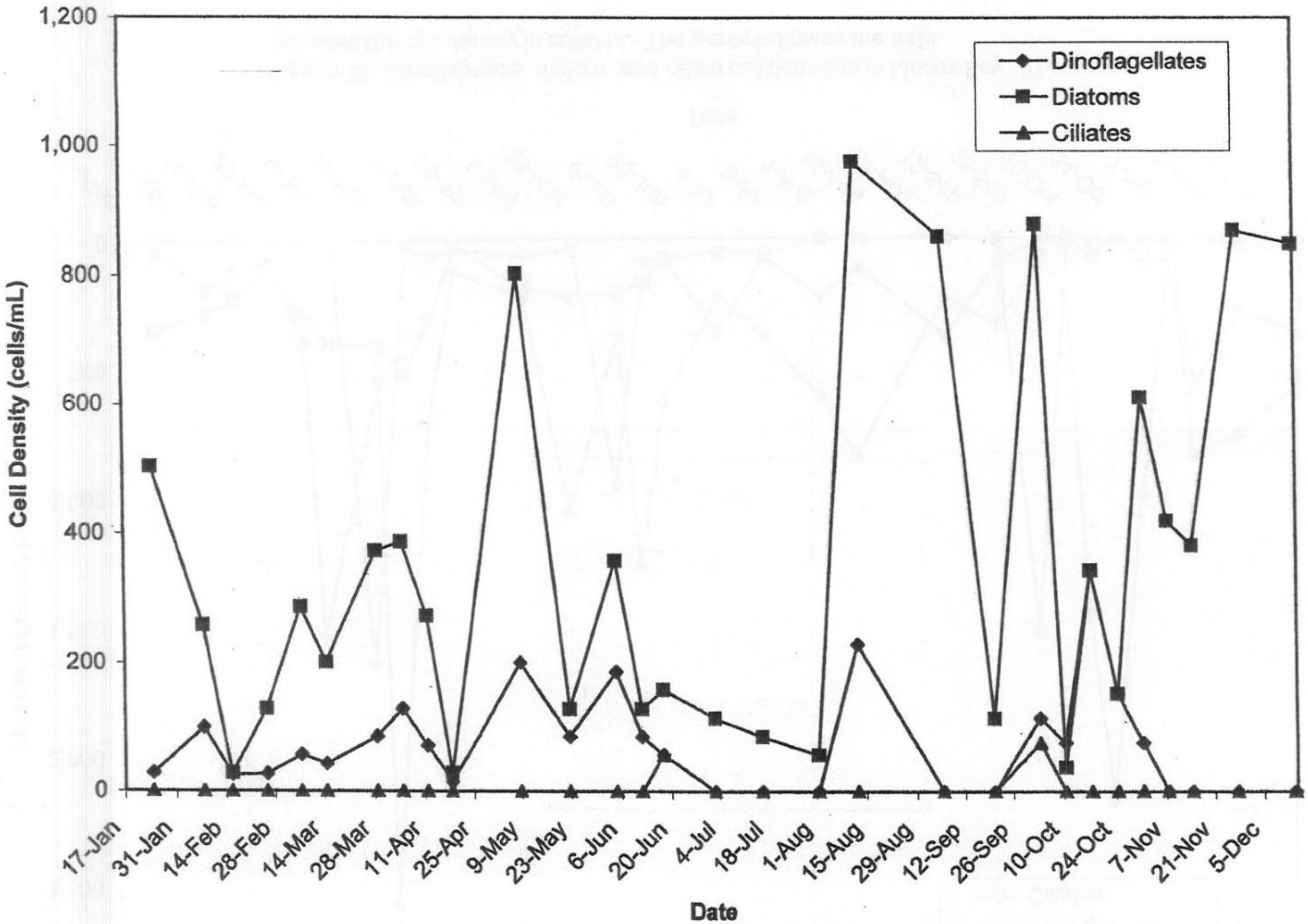


Figure 21: Dinoflagellate, diatom, and ciliate cell densities in the Atlantic Ocean. The y-axis indicates the cell density in cells/ml. The x-axis indicates the date.

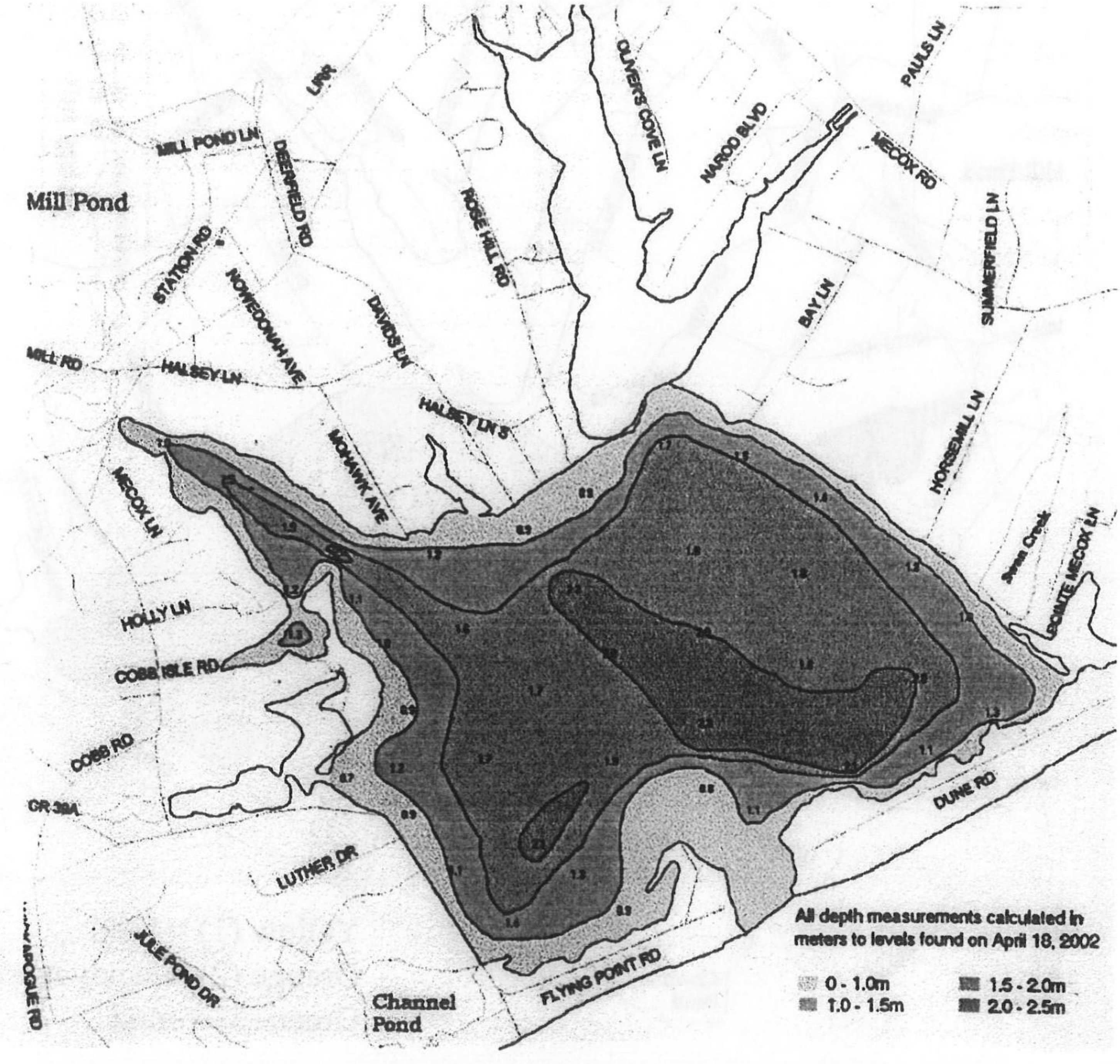


Figure 22. Bathymetry of Mecox Bay. Depths, in meters, were normalized to 18 Apr 2002, which is representative of the 'average' depth or state of the bay.

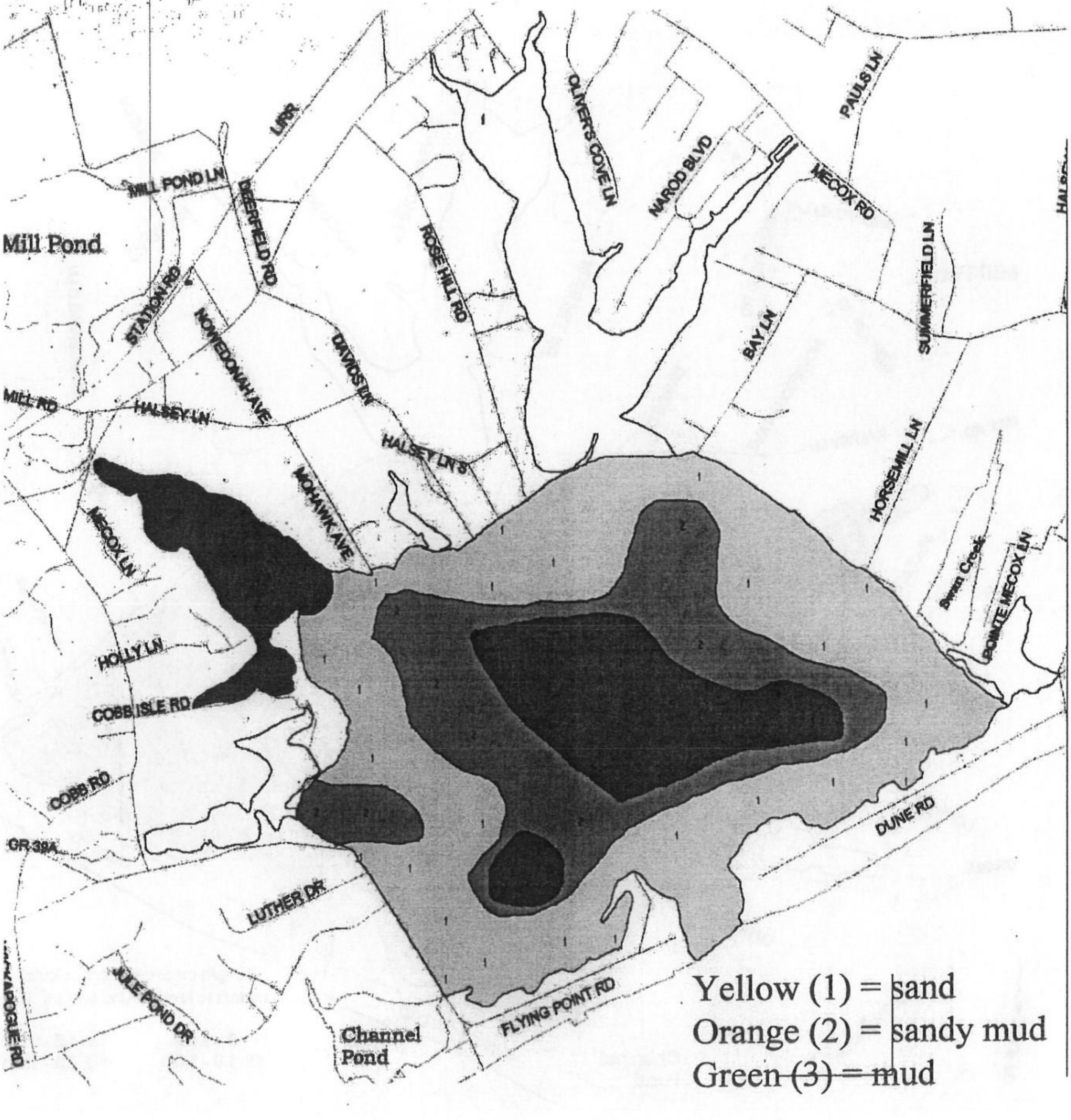


Figure 23. Sediment composition of Mecox Bay as determined by standard sieve analysis

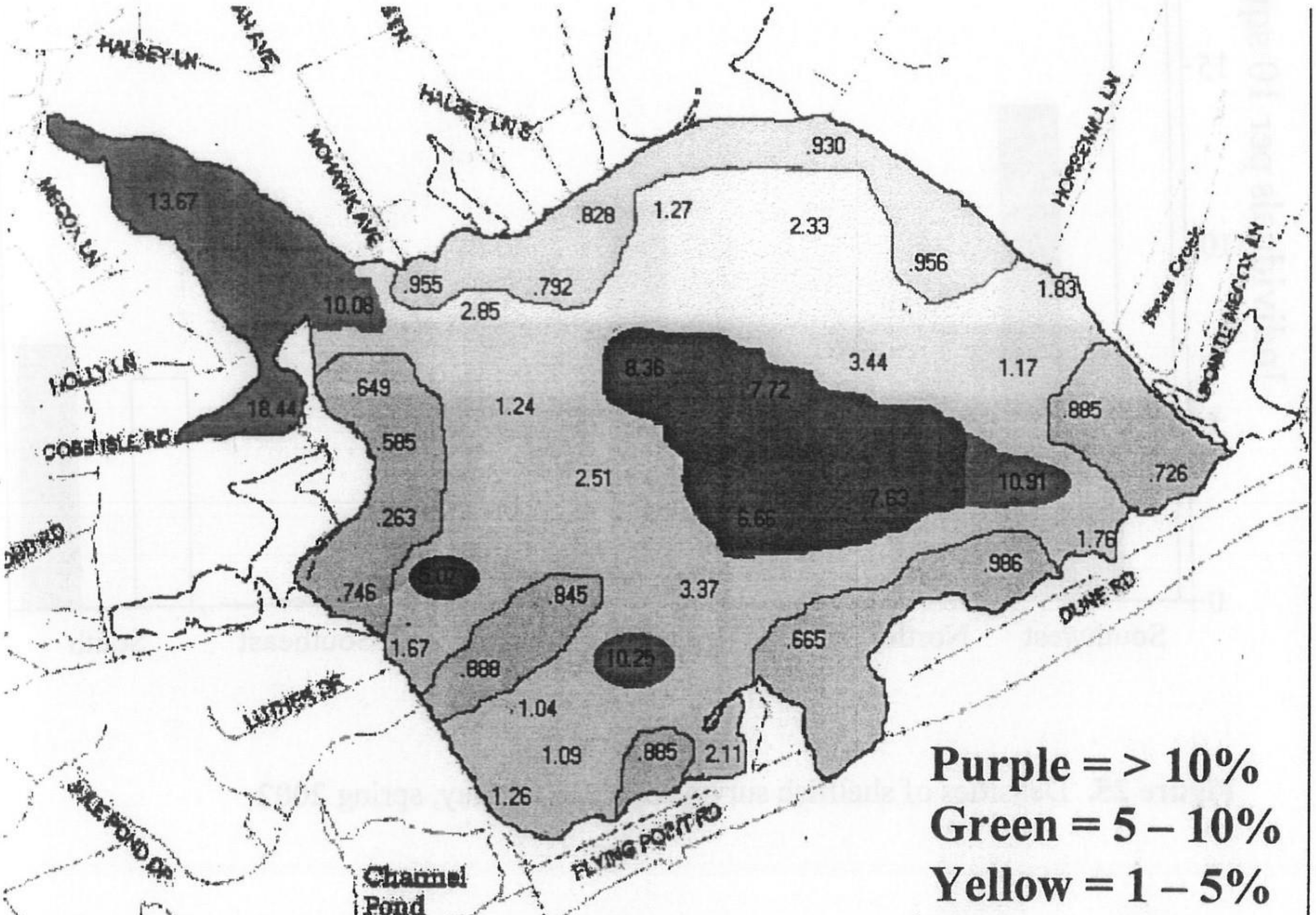


Figure 24. Sediment organic carbon content of Mecox Bay expressed as a percentage of weight.

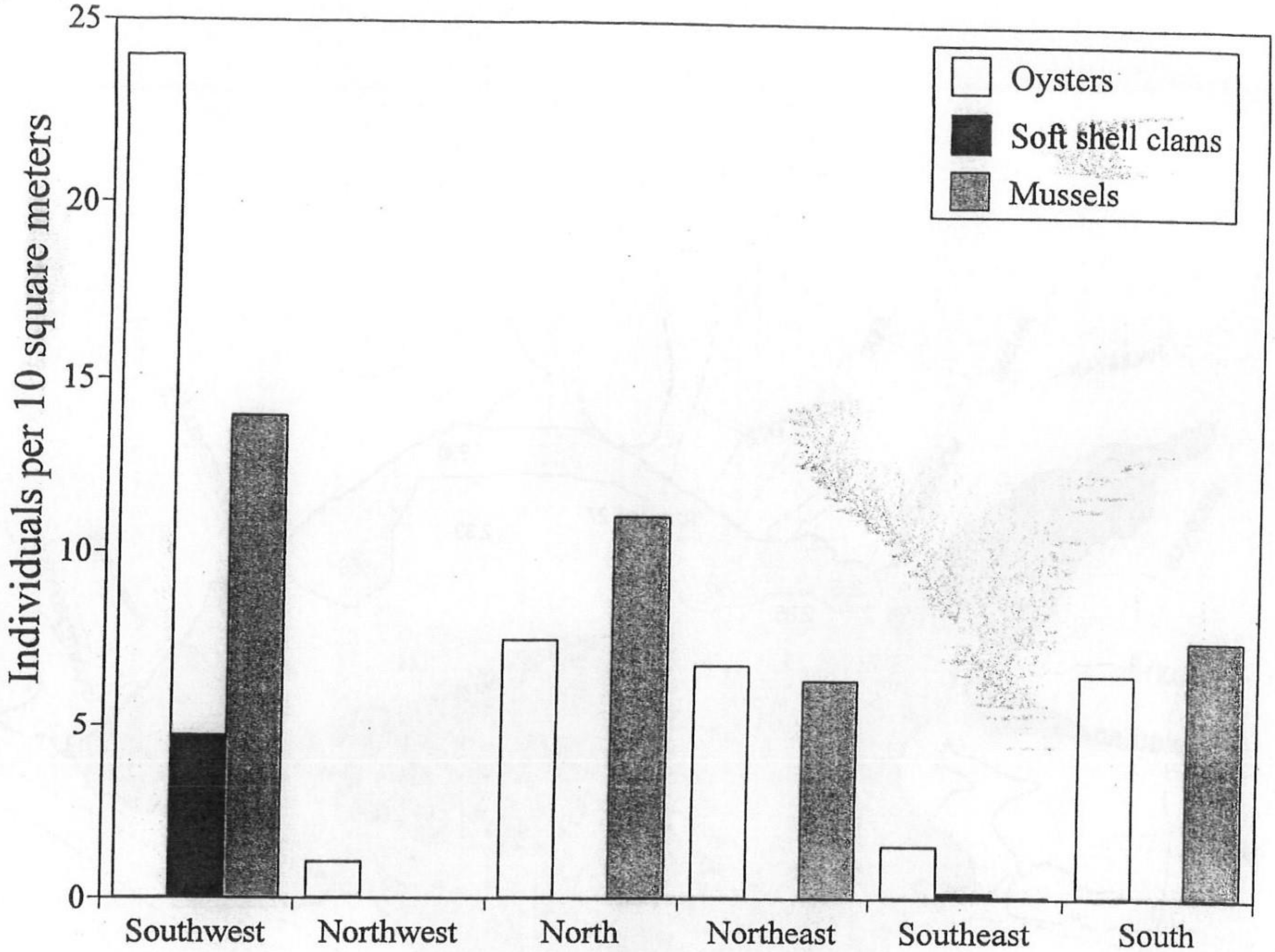


Figure 25. Densities of shellfish surveyed in Mecox Bay, spring 2002.

Table 1: Residence time of Mecox Bay.

Time frame	Residence time (d)	method
Feb	18	observed salinity change
Feb	19	salt balance
June	19	observed salinity change
June	25	current measurements
June	26	salt balance
November	5	current measurements

Table 2: Nutrient limitation in Meocx Bay and the Atlantic Ocean.

Nutrient Limitation

date	Mecox	Ocean
24-Jan	P	-
7-Feb	-	-
15-Feb	P	-
25-Feb	P	-
7-Mar	-	-
14-Mar	P	-
28-Mar	P	-
4-Apr	P	-
11-Apr	P	N
18-Apr	P	-
8-May	P	-
22-May	-	-
3-Jun	-	N
10-Jun	-	N
17-Jun	N	N
2-Jul	N	-
16-Jul	N	N
1-Aug	N	-
12-Aug	N	N
5-Sep	-	N
20-Sep	N	-
3-Oct	N	-
10-Oct	N	N
17-Oct	N	-
24-Oct	N	N
31-Oct	N	-
7-Nov	-	N
14-Nov	-	-
27-Nov	P	-
13-Dec	P	-

Table 3: Annual means of parameters in Mecox Bay and the Atlantic Ocean

	Mecox Bay	Atlantic Ocean
Mean depth	1.6 ± 0.3 m	-
Mean secchi depth	1.1 ± 0.2 m	-
Salinity	17.4 ± 5.1	32.1 ± 1.1
Temperature	14.0 ± 7.8 °C	12.5 ± 5.8 °C
Bottom DO	7.9 ± 2.4	-
DIN	14.3 ± 13.5 μM	3.2 ± 1.8 μM
Phosphate	0.6 ± 0.4 μM	0.8 ± 0.2 μM
DIN:DIP ratio	49.7 ± 59.6	4.3 ± 2.4
DON	43.2 ± 16.1 μM	16.6 ± 5.7 μM
Silicate	43.7 ± 17.2 μM	7.0 ± 7.2 μM
Coliform bacteria	91.0 ± 121.0 colonies/100mL	2.8 ± 4.3 colonies/100mL
Whole chl *a*	8.4 ± 5.1 μg/L	1.9 ± 0.4 μg/L
<5 chl *a*	6.8 ± 4.3 μg/L	1.3 ± 1.2 μg/L
picoplankton	317,822 ± 313,763.9 cells/mL	56,932 ± 67,696.4
nanoplankton	117,883 ± 126,616.3 cells/mL	11,537 ± 12,228.4 cells/mL
dinoflagellates	657 ± 626.0 cells/mL	73 ± 82.9 cells/mL
diatoms	227 ± 298.6 cells/mL	360 ± 298.9 cells/mL
ciliates	156 ± 339.2 cells/mL	4.0 ± 17.2 cells/mL

Table 4: Total Monthly Rainfall in 2002 for Southampton, NY.

Month	Total Rainfall (cm)
Feb	2.6416
Mar	7.4676
Apr	10.3378
May	11.4046
Jun	8.9916
Jul	2.4384
Aug	5.1308
Sep	16.9672
Oct	10.1092
Nov	5.9436
Dec	11.5062

Table 5. Pelagic seining survey, spring 2002

Species	Total	# around perimeter	% around perimeter	# in creeks	% in creeks	salinity ranges
Inland silverside (*Menidia beryllina)*	1175	83	7.06	1092	92.9	prefers lower salinities
Atlantic silverside (*Menidia menidia)*	110	110	100	0	0	prefers higher salinity
Mix (Atlantic + Inland silversides)	248	70	28.2	178	71.7	
sheepshead minnow (*Cyprinodon varigatus)*	120	11	9.2	109	90.8	0-90ppt
striped killifish (*Fundulus majalis)*	115	4	3.5	111	96.5	prefers higher salinity, rarely enter freshwater
marsh killifish (*Fundulus confluentus)*	34	0	0	34	100	
fourspined stickleback (*Apeltes quadracus)*	37	0	0	37	100	found throughout bay, retreat to deeper water during winter
mummichug (*Fundulus heteroclitus)*	12	4	33.3	8	66.6	prefers low salinity
alewife (*Alosa pseudoharengus)*	2	1	50	1	50	andronomous, young remain in fresh or brackish water
atlantic herring (*Clupea harengus)*	2	2	100	0	0	
banded killifish (*Fundulus diaphanus)*	58	0	0	58	100	prefers low salinity, 5-20
white perch (*Morone americana)*	14	1	7.1	13	92.9	0-full seawater, usually <18ppt
American eel (*Anguilla rostrata)*	1	0	0	1	100	catronomous
Blueclaw Crab	160	21	13.1	139	86.9	
Green Crab	3	2	66.7	1	33.3	
Sand shrimp	22	20	90.9	2	9.1	
Grass shrimp	45	3	6.7	42	93.3	
Japanese shore crab	2	2	100.0	0	0.0	
Total speices	18		8		10	
Total number	2,160	334	286	1,826	1,642	

APPENDIX C

NYSDEC Inlet Management Permit

and

Emergency Authorizations

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

DEC PERMIT NUMBER 1-4736-03009/00005
FACILITY/PROGRAM NUMBER(S)

PERMIT

Under the Environmental Conservation Law

EFFECTIVE DATE February 21, 2006
EXPIRATION DATE(S) February 20, 2016

TYPE OF PERMIT ■ New ☐ Renewal ☐ Modification ☐ Permit to Construct ☐ Permit to Operate

- ■ Article 15, Title 5: Protection of Waters
- ☐ Article 15, Title 15: Water Supply
- ☐ Article 15, Title 15: Water Transport
- ☐ Article 15, Title 15: Long Island Wells
- ☐ Article 15, Title 27: Wild, Scenic and Recreational Rivers
- ■ 6NYCRR 608: Water Quality Certification
- ☐ Article 17, Titles 7, 8: SPDES
- ☐ Article 19: Air Pollution Control
- ☐ Article 23, Title 27: Mined Land Reclamation
- ☐ Article 24: Freshwater Wetlands
- ■ Article 25: Tidal Wetlands
- ☐ Article 27, Title 7; 6NYCRR 360: Solid Waste Management
- ☐ Article 27, Title 9; 6NYCRR 373: Hazardous Waste Management
- ☐ Article 34: Coastal Erosion Management
- ☐ Article 36: Floodplain Management
- ☐ Articles 1, 3, 17, 19, 27, 37; 6NYCRR 380: Radiation Control

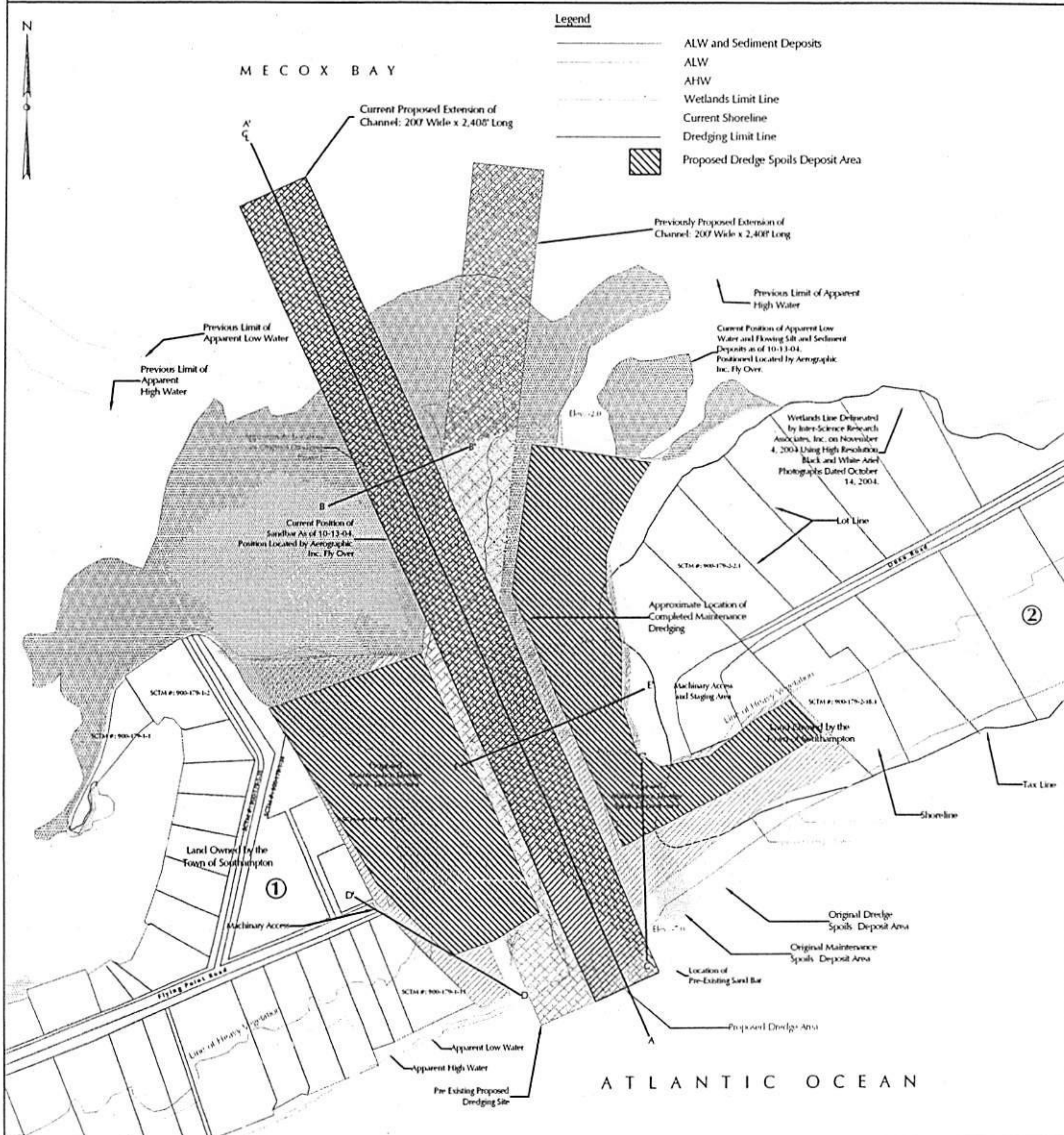
PERMIT ISSUED TO			TELEPHONE NUMBER
Board of Trustees of the Freeholders and Commonalty of the Town of Southampton			(631) 287-5717
ADDRESS OF PERMITTEE			
116 Hampton Road, Town Hall, Southampton, NY 11968			
CONTACT PERSON FOR PERMITTED WORK			TELEPHONE NUMBER
Inter-Science Research Associates, P.O. Box 1201, Southampton, NY 11969-1201			(631) 283-5958
NAME AND ADDRESS OF PROJECT/FACILITY			
Mecox Bay and the Atlantic Ocean			
COUNTY	TOWN	WATERCOURSE	NYTM COORDINATES
Suffolk	Southampton	Mecox Bay/Atlantic Ocean	

DESCRIPTION OF AUTHORIZED ACTIVITY:

Dredge to 6 ft. below mean low water a 200 ft. wide by 2408 ft. long channel from Mecox Bay to the Atlantic Ocean. Resultant 30,000 cubic yards of dredged material to be placed on the beaches east and west of the inlet as beach nourishment. All work must be done in accordance with the attached plans prepared by Inter-Science on 8/25/04 and stamped NYSDEC approved on 2/21/06.

By acceptance of this permit, the permittee agrees that the permit is contingent upon strict compliance with the ECL, all applicable regulations, the General Conditions specified **(see page 2 & 3)** and any **Special Conditions** included as part of this permit.

PERMIT ADMINISTRATOR:	ADDRESS	
George W. Hammarth (DMG)	Region 1 Headquarters, Bldg. #40, SUNY, Stony Brook, NY 11790-2356	
AUTHORIZED SIGNATURE	DATE	
George W. Hammarth	February 23, 2006	Page 1 of 4



Purpose: Dredging Plan / Proposed Conditions

Adjacent Property Owners:
900-179-1-33: Alixander Lollins and Stuart Baker
900-179-1-39: Town of Southampton
900-179-1-34: Marcia and Richard Godosky
900-179-1-35: Joint Ownership
900-179-1-2: Ethel Hurvitz
900-179-1-1: Burnetts Cove Association, Inc
900-179-2-2.1: Jay and Prudence Mortimer
900-179-2-15: Town of Southampton

Plan View

0 400' 800'

Scale: 1"=400'

Client:
Board of Trustees of the Freeholders and Commonalty of the Town of Southampton
116 Hampton Road, Town Hall
Southampton, NY 11968

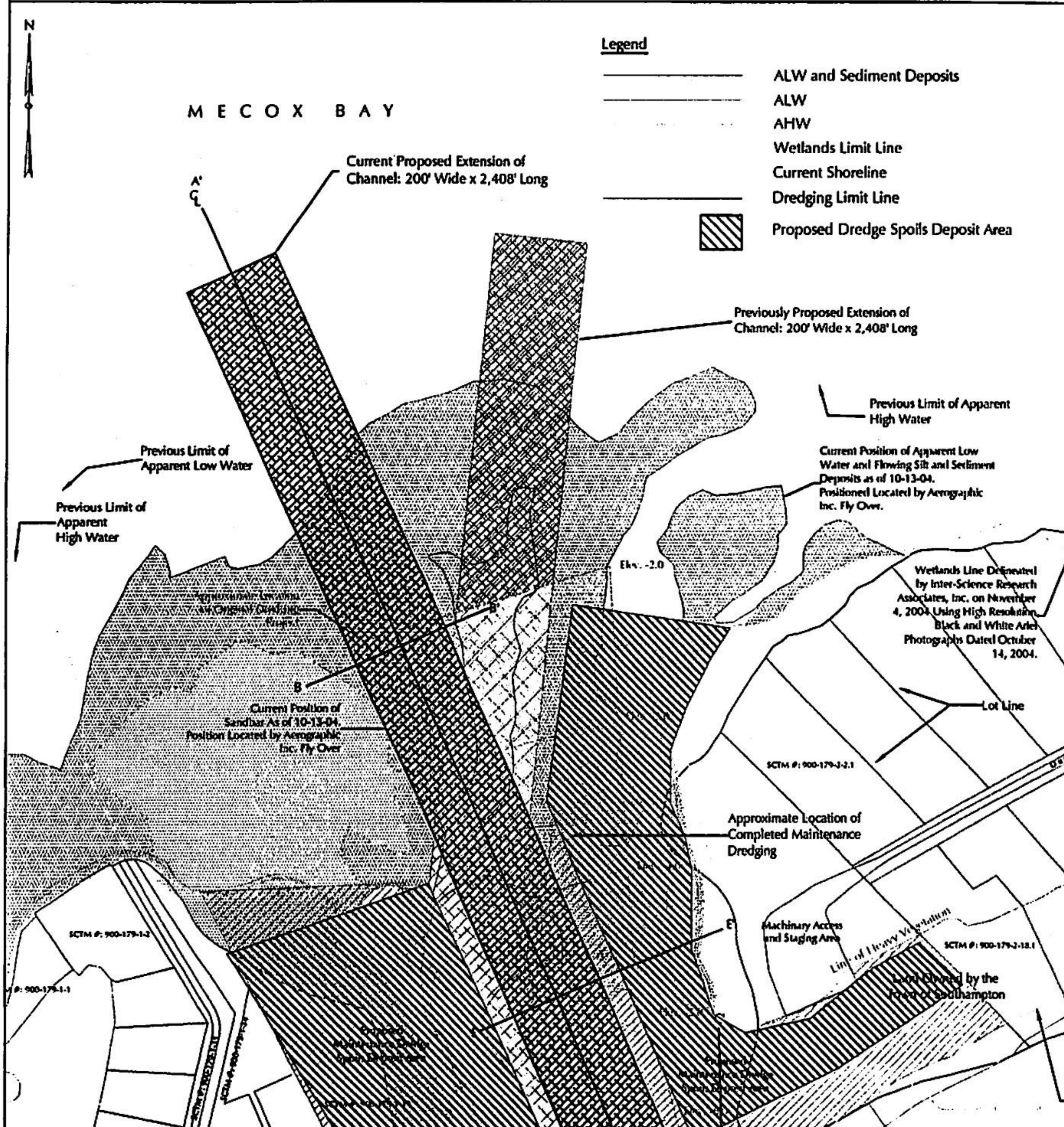
Disclaimer: This drawing is for concept design purposes only. Prior to construction, all design

Name of Project:
Dredge Project

Location of Project:

In: Mecox Bay
County: Suffolk County
Applicant: Inter-Science Research Associates, Inc.
PO Box 1201 Southampton, NY 11969

File: Southampton Town/Mecox Bay/ACOE Set.dwg



Purpose: Dredging Plan / Proposed Conditions

Adjacent Property Owners:
900-179-1-33: Alixander Lollins and Stuart Baker
900-179-1-39: Town of Southampton
900-179-1-34: Marcia and Richard Godosky
900-179-1-35: Joint Ownership
900-179-1-2: Ethel Hurvitz
900-179-1-1: Burnetts Cove Association, Inc
900-179-2-2.1: Jay and Prudence Mortimer
900-179-2-15: Town of Southampton

Detail View #1

0 300' 600'

Scale: 1"=300'

Client:
Board of Trustees of the Freeholders and Commonalty of the Town of Southampton
116 Hampton Road, Town Hall
Southampton, NY 11968

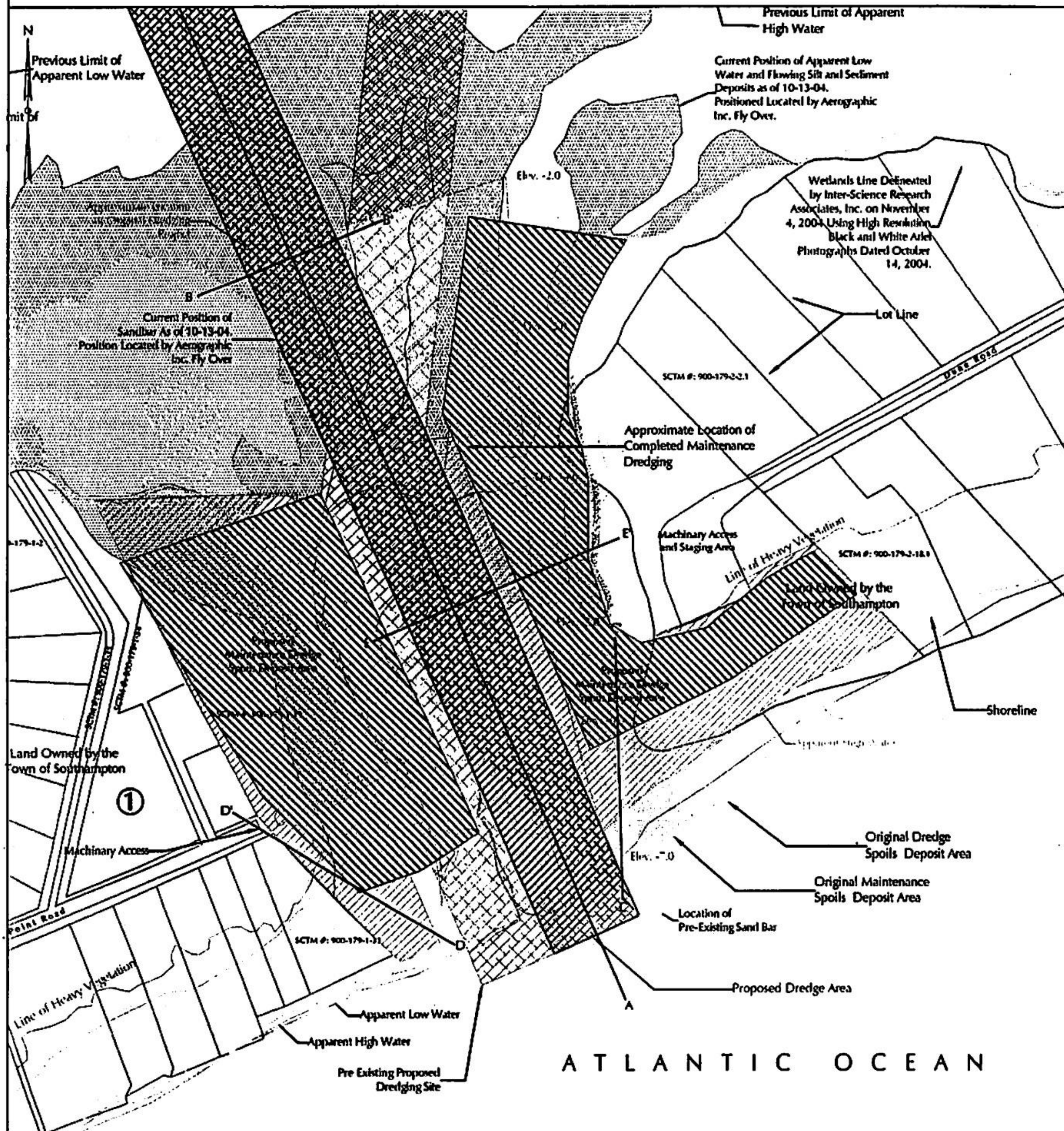
Disclaimer: This drawing is for concept design purposes only. Prior to construction, all design

Name of Project:
Dredge Project

Location of Project:

In: Mecox Bay
County: Suffolk County
Applicant: Inter-Science Research Associates, Inc.
PO Box 1201 Southampton, NY 11969

File: Southampton Town/Mecox Bay/ACOE Set.dwg



Purpose: Dredging Plan / Proposed Conditions

Adjacent Property Owners:
900-179-1-33: Alixander Lollins and Stuart Baker
900-179-1-39: Town of Southampton
900-179-1-34: Marcia and Richard Godosky
900-179-1-35: Joint Ownership
900-179-1-2: Ethel Hurvitz
900-179-1-1: Burnetts Cove Association, Inc
900-179-2-2.1: Jay and Prudence Mortimer
900-179-2-15: Town of Southampton

Detail View #2

0 300' 600'

Scale: 1"=300'

Client:
Board of Trustees of the Freeholders and Commonalty of the Town of Southampton
116 Hampton Road, Town Hall
Southampton, NY 11968

Disclaimer: This drawing is for concept design purposes only. Prior to construction, all design

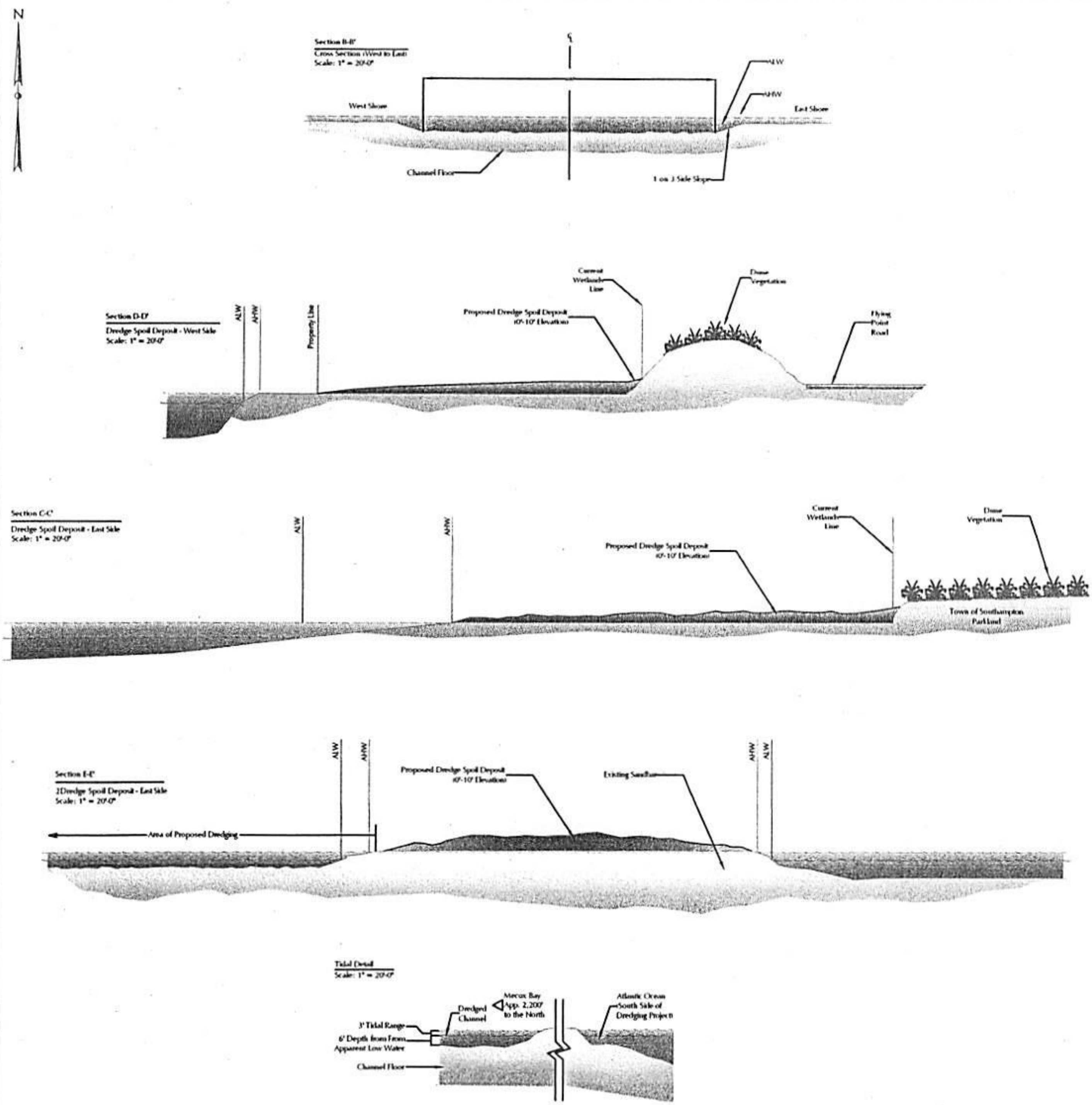
Name of Project:
Dredge Project

Location of Project:

In: Mecox Bay
County: Suffolk County
Applicant: Inter-Science Research Associates, Inc.
PO Box 1201 Southampton, NY 11969

File: Southampton Town/Mecox Bay/ACOE Set.dwg

4 of 5



Purpose: Dredging Plan / Proposed Conditions

Adjacent Property Owners:
900-179-1-33: Alixander Lollins and Stuart Baker
900-179-1-39: Town of Southampton
900-179-1-34: Marcia and Richard Godosky
900-179-1-35: Joint Ownership
900-179-1-2: Ethel Hurvitz
900-179-1-1: Burnetts Cove Association, Inc
900-179-2-2.1: Jay and Prudence Mortimer
900-179-2-15: Town of Southampton

Profile View

0 100' 200'

Scale: 1"=100'

Client:
Board of Trustees of the Freeholders and Commonalty of the Town of Southampton
116 Hampton Road, Town Hall
Southampton, NY 11968

Disclaimer: This drawing is for concept design purposes only. Prior to construction, all design

Name of Project:
Dredge Project

Location of Project:

In: Mecox Bay
County: Suffolk County
Applicant: Inter-Science Research Associates, Inc.
PO Box 1201 Southampton, NY 11969

File: Southampton Town/Mecox Bay/ACOE Set.dwg

NYS DEPARTMENT OF ENVIRONMENTAL CONSERVATION

EMERGENCY AUTHORIZATION

Pursuant to Environmental Conservation Law Article 70 (6 NYCRR Part 621)

N.Y.S. D.E.C. REGION 1
Division of Environmental Permits
SUNY @ Stony Brook
50 Circle Road
Stony Brook, NY 11790 - 3409

DEC # 1-4736-03009 / 00008

EFFECTIVE DATE: June 14, 2016 **EXPIRATION DATE:** June 24, 2016

Name & Address of Permittee/Applicant: Town of Southampton
116 Hampton Rd.
Southampton, N.Y. 11968

Telephone #: (631) 287-5717

Name & Address of Contact/Agent: Inter-Science Research Associates, Inc.
PO Box 1201 – 36 Nugent St.
Southampton, N.Y. 11969-1201

Project Location: Mecox Cut; Atlantic Ocean Beach Between the Termini of Flying Point Road and Dune Road. Town of Southampton, Suffolk County.

Emergency Authorization Type

Article 25 of the ECL, 6NYCRR Part 661: Tidal Wetlands
Article 15, Title 5 of the ECL, 6NYCRR Part 608: Protection of Waters
Article 15, Title 5 of the ECL, 6NYCRR Part 608: Water Quality Certification

Project Description: Mechanically excavate a channel across the beach to establish a connection between Mecox Bay and the ocean. The channel will be of approximate dimensions 220 feet long by 10 feet wide by 4 feet deep. Up to 1,000 cubic yards of excavated sand will be stockpiled on the upper beach on the west side of the cut. The channel is necessary to relieve very high water levels in Mecox Bay. The work shall be as shown on the two attached maps by Inter-Science Research Associates, Inc. stamped "NYSDEC Approved 6/14/16".

Finding That An Emergency Exists:

Based on the Department's review of the situation and the information provided by the Board of Trustees of the Freeholders & Commonality of the Town of Southampton and Inter-Science Research Associates, Inc., and having consulted with the Department's Bureau of Wildlife, the Department has determined that this situation meets the definition of an emergency, "**an event which presents an immediate threat to life, health, property, or natural resources,"** as defined in the Uniform Procedures regulations, Section 621.12. There is currently an immediate threat to human health and welfare, and water quality in Mecox Bay due to the back-up or temporary failure of septic systems on properties in the Mecox Bay watershed from the extraordinarily high groundwater levels associated with the high pond surface water level. The high pond water level / groundwater level is also causing the flooding of the basements of many homes in the watershed.

Accordingly, the Department hereby makes a finding that an emergency exists pursuant to Section 621.12 of the Uniform Procedures Act regulations due to the threat noted above. The Department has determined that emergency action is necessary in order to protect the public welfare and health, and the surface water quality in Mecox Bay.

Authorized and issued by:

George W. Hammarth
Deputy Regional Permit Administrator

Please note further that this Emergency Authorization is granted subject to the following conditions in accordance with Section 621.12(e) (2) of the Uniform Procedures regulations:

SPECIAL CONDITIONS

All work is to be performed in accordance with the conditions described below:

1. Activities authorized by this permit shall be conducted before June 21 or prior to the date when monitoring indicates that the nests located in front of 209 or 421 Dune Road (see approved plans) have hatched, whichever occurs first.

2. The activities authorized by this permit must be conducted under the supervision of a DEC-approved environmental monitor to ensure that there is no disturbance to the state and federally-listed piping plover and the state listed least tern as a result of the project. The monitor shall survey the project area before the start of any regulated activity each day and must remain on the project site supervising activities throughout the work day. If the monitor observes the presence of piping plovers or least terns within the construction area, and determines that the project activities are disturbing these species, the monitor must stop the project and immediately contact NYSDEC Region 1 Bureau of Wildlife (Kevin Jennings 631-444-0307).

3. All trucks and mechanical equipment must access the beach from Flying Point Road as shown on the approved plans. Vehicles and equipment associated with this project must be restricted to areas west of the cut.

4. The permittee shall grade the beach to remove all tire tracks or ruts made by trucks and earth moving equipment immediately upon completion of the authorized work.

5. After project completion, the Town of Southampton plover stewards shall fence any additional piping plover foraging areas which may be formed as a result of changes to the water level in Mecox Bay.

6. All activities authorized by this emergency authorization must be in strict conformance with the approved plans submitted by the applicant or his agent as part of the emergency authorization application.

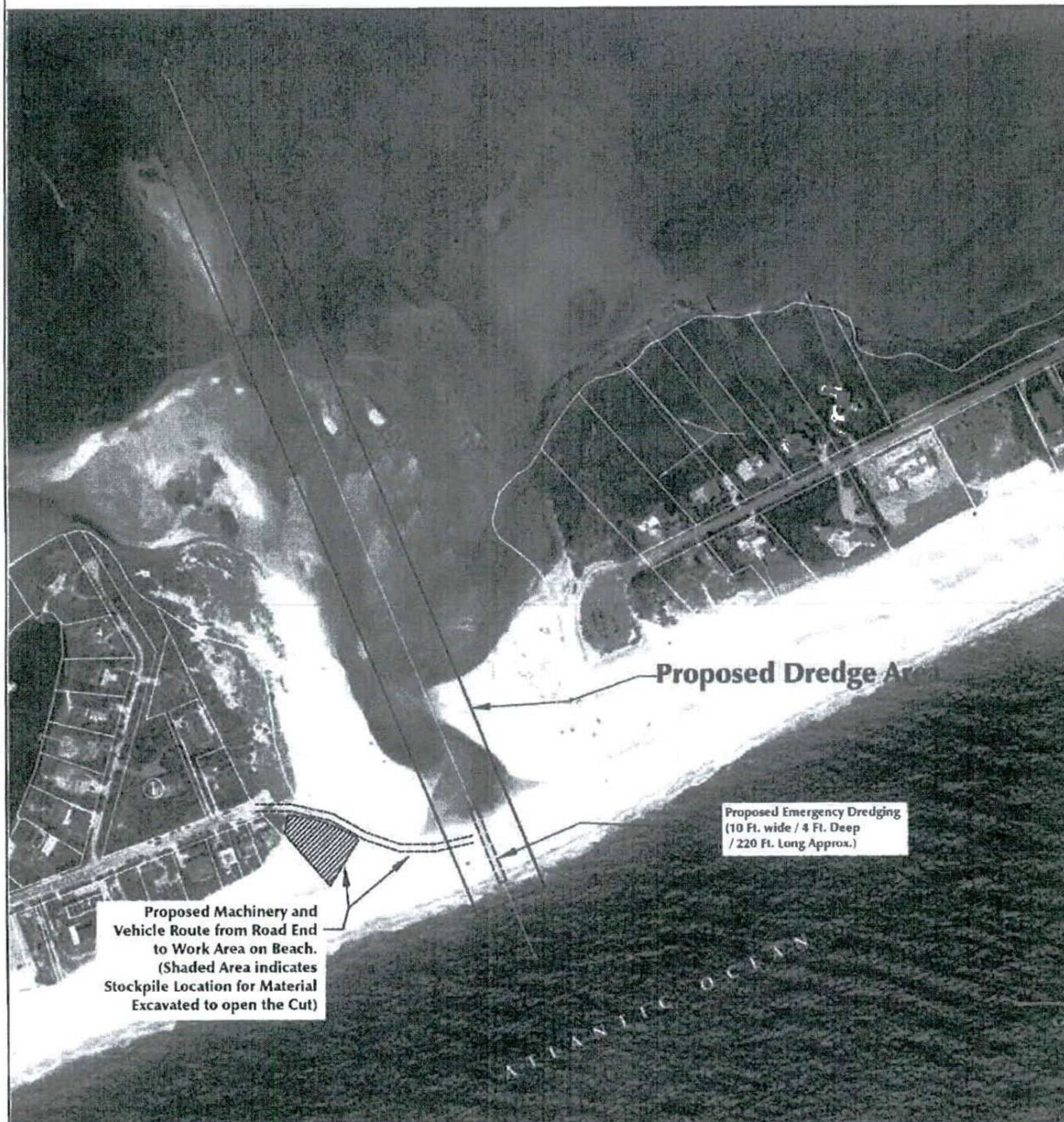
This Emergency Authorization is issued for a 10-day period commencing on the effective date and ending at midnight on the expiration date and may not be renewed. DEC's review of the Town of Southampton's application for a standard Tidal Wetlands, Protection of Waters and Water Quality Certification permit for the opening of the Mecox Cut is ongoing.

As per 6 NYCRR Part 621, Section 621.12(i), a person who violates any term or condition of an Emergency Authorization will be ordered to perform any necessary restoration or mitigation of environmental damage resulting from that action.

Failure to comply with the terms and conditions of this Emergency Authorization will be considered a violation of Article 25 of the Environmental Conservation Law and its implementing regulations, 6 NYCRR Part 661; and Article 15, Title 5 of the ECL and its implementing regulations, 6NYCRR Part 608.

cc: USACE
USFWS
Wildlife
BOH-TW
File

NYSDEC
APPROVED AS PER TERMS
AND CONDITIONS OF
PERMIT NO. 1-4736-03009/00009
DATE 6/14/16 [signature]



Purpose: Dredging Plan / Proposed Conditions

Adjacent Property Owners:
900-179-1-33: Alixander Lollins and Stuart Baker
900-179-1-39: Town of Southampton
900-179-1-34: Marcia and Richard Godosky
900-179-1-35: Joint Ownership
900-179-1-2: Ethel Hurvitz
900-179-1-1: Burnetts Cove Association, Inc
900-179-2-2.1: Jay and Prudence Mortimer
900-179-2-15: Town of Southampton
900-179-2-18.1: Avra and Munro Bank

Dredge Channel with Access

0 400' 800'

Scale: 1"=400'

Client:
Board of Trustees of the Freeholders and Commonalty of the Town of Southampton
116 Hampton Road, Town Hall
Southampton, NY 11968

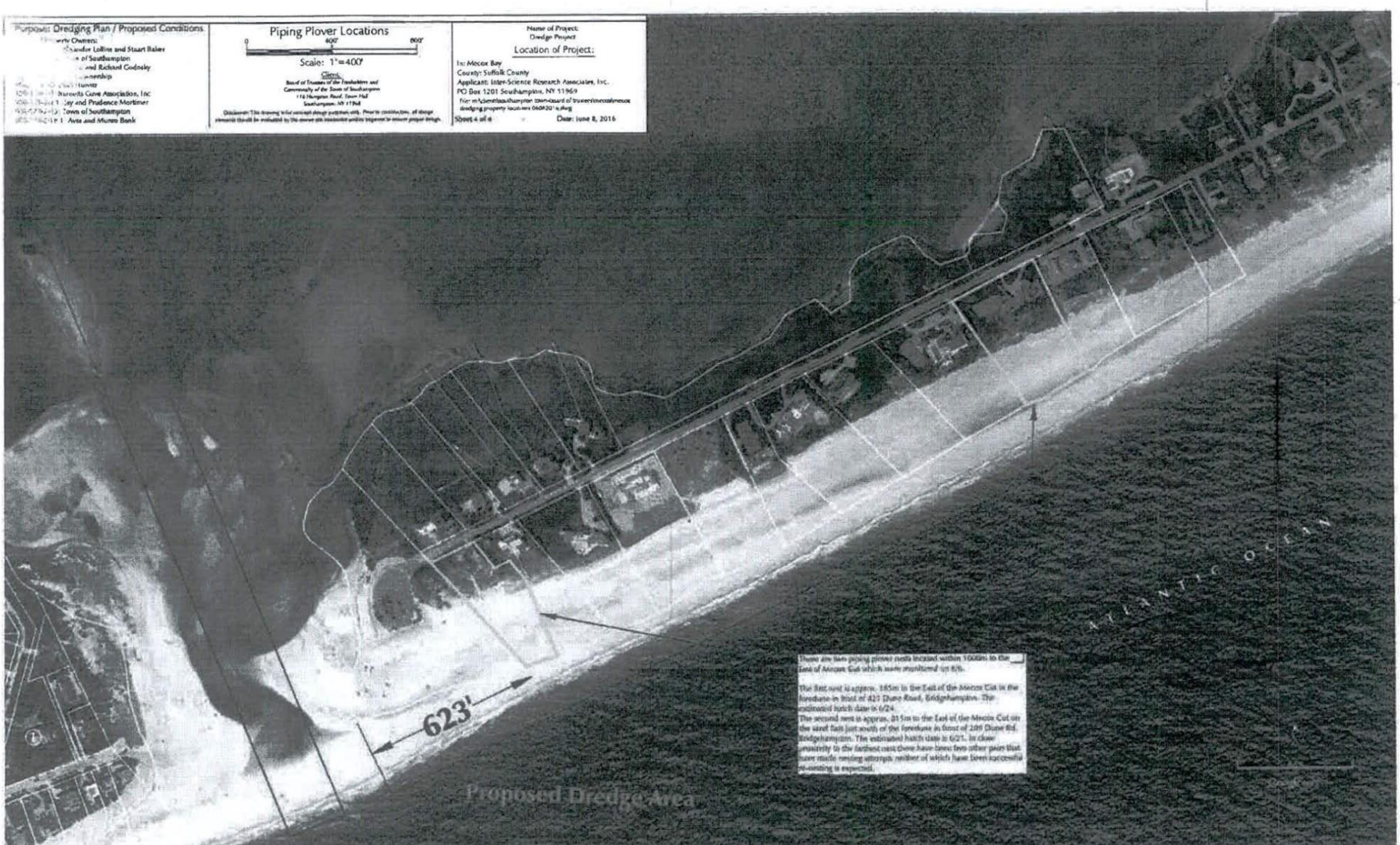
Disclaimer: This drawing is for concept design purposes only. Prior to construction, all design elements should be evaluated by the owner site contractor and/or engineer to ensure proper design.

Name of Project:
Dredge Project

Location of Project:

In: Mecox Bay
County: Suffolk County
Applicant: Inter-Science Research Associates, Inc.
PO Box 1201 Southampton, NY 11969
File: m:\clients\southampton town-board of trustees\mecox\mecox dredging aerial overlay w emergency dredge alt 3 06082016.dwg

Sheet 3 of 4 Date: June 8, 2016



NYSDEC
APPROVED AS PER TERMS
AND CONDITIONS OF
PERMIT NO. 1-4736-03009/00008
DATE 6/14/16 JWA

NYS DEPARTMENT OF ENVIRONMENTAL CONSERVATION

EMERGENCY AUTHORIZATION

Pursuant to Environmental Conservation Law Article 70 (6 NYCRR Part 621)

N.Y.S. D.E.C. REGION 1
Division of Environmental Permits
SUNY @ Stony Brook
50 Circle Road
Stony Brook, NY 11790 - 3409

DEC # 1-4736-03009 / 00008

29AUG'16AM11:58 TRUSTE

EFFECTIVE DATE: August 25, 2016 **EXPIRATION DATE:** September 24, 2016

Name & Address of Permittee/Applicant: Town of Southampton
116 Hampton Rd.
Southampton, N.Y. 11968

Board of Trustees of the Commonality of the Town of Southampton
116 Hampton Rd.
Southampton, N.Y. 11968

Telephone #: (631) 287-5717

Name & Address of Contact/Agent: Trustee Scott Horowitz
(631) 740-1290

Project Location: Mecox Cut; Atlantic Ocean Beach Between the Termini of Flying Point Road and Dune Road. Town of Southampton, Suffolk County.

Emergency Authorization Type

Article 25 of the ECL, 6NYCRR Part 661: Tidal Wetlands
Article 15, Title 5 of the ECL, 6NYCRR Part 608: Protection of Waters
Article 15, Title 5 of the ECL, 6NYCRR Part 608: Water Quality Certification

Project Description: Mechanically excavate a channel across the beach to establish a connection between Mecox Bay and the ocean. The channel will be of approximate dimensions 220 feet long by 10 feet wide by 4 feet deep. Up to 1,000 cubic yards of excavated sand will be stockpiled on the upper beach on the west side of the cut. The channel is necessary to release water containing unsafe concentrations of cyanobacteria and to relieve high water levels in Mecox Bay. The work shall be as shown on the attached map by Inter-Science Research Associates, Inc. stamped "NYSDEC Approved 8/25/16".

Finding That An Emergency Exists:

Based on the Department's review of the situation and the information provided by the Board of Trustees of the Commonality of the Town of Southampton, and having consulted with the Department of Environmental Conservation's Bureau of Wildlife, DEC has determined that this situation meets the definition of an emergency, "**an event which presents an immediate threat to life, health, property, or natural resources,"** as defined in the Uniform Procedures Regulations, Section 621.12. There is currently an immediate threat to human health, welfare, and water quality in Mecox Bay due to an overgrowth or bloom of cyanobacteria (blue-green algae) in the bay. This has prompted officials of the Suffolk County Department of Health Services to issue a public notification recommending that people refrain from swimming, wading or otherwise using the waters of Mecox Bay and keep children and pets away from the area.

Accordingly, the Department hereby makes a finding that an emergency exists pursuant to Section 621.12 of the Uniform Procedures Regulations due to the threat noted above. The Department has determined that emergency action is necessary in order to protect the public welfare and health, and the surface water quality in Mecox Bay.

Authorized and issued by:

George W. Hammarth
Deputy Regional Permit Administrator

Please note further that this Emergency Authorization is granted subject to the following conditions in accordance with Section 621.12(e) (2) of the Uniform Procedures Regulations:

SPECIAL CONDITIONS

All work is to be performed in accordance with the conditions described below:

1. If the activities authorized by this permit are undertaken prior to August 31, 2016, the work must be conducted under the supervision of a DEC-approved environmental monitor to ensure that there is no disturbance to the state and federally-listed piping plover and the state listed least tern as a result of the project. The monitor shall survey the project area before the start of any regulated activity each day and must remain on the project site supervising activities throughout the work day. If the monitor observes the presence of piping plovers or least terns within the construction area, and determines that the project activities are disturbing these species, the monitor must stop the project and immediately contact NYSDEC Region 1 Bureau of Wildlife (Kevin Jennings 631-444-0307).

2. All trucks and mechanical equipment must access the beach from Flying Point Road as shown on the approved plan. Vehicles and equipment associated with this project must be restricted to areas west of the cut.

3. It is the permittee' s responsibility to contact the Suffolk County Department of Health Services (Michael Jensen: michael.jensen@suffolkcountyny.gov / 631-852-5760) prior to the start of any activities authorized herein to determine whether there are any public health concerns for people swimming, wading or otherwise coming into contact with the waters of the Atlantic Ocean in the vicinity of the Mecox Cut during the period when the pond is draining and for some period thereafter. The permittee shall follow any and all recommendations made by SCDHS for the protection of ocean beach users from cyanobacteria-related water quality impacts.

4. All activities authorized by this emergency authorization must be in strict conformance with the approved plan submitted by the applicant or his agent as part of the emergency authorization application.

This Emergency Authorization is issued for a 30-day period commencing on the effective date and ending at midnight on the expiration date. This authorization may be renewed for an additional 30-day period provided the permittee requests said renewal in writing and complies with all conditions contained herein.

Said renewal request must be submitted to the Regional Permit Administrator no later than 7 days prior to the expiration of the original 30-day period and no additional activity may occur after the expiration of the original 30-day period unless authorized in writing by the Department prior to commencement of said activities. DEC's review of the Town of Southampton's application for a standard Tidal Wetlands, Protection of Waters and Water Quality Certification permit for the opening of the Mecox Cut is ongoing.

As per 6 NYCRR Part 621, Section 621.12(i), a person who violates any term or condition of an Emergency Authorization will be ordered to perform any necessary restoration or mitigation of environmental damage resulting from that action.

Failure to comply with the terms and conditions of this Emergency Authorization will be considered a violation of Article 25 of the Environmental Conservation Law and its implementing regulations, 6 NYCRR Part 661; and Article 15, Title 5 of the ECL and its implementing regulations, 6 NYCRR Part 608.

cc: Michael Jensen - SCDHS
USACE
USFWS
Carrie Meek Gallagher – DEC Regional Director
Wildlife
BOH-TW
file

NYSDEC
APPROVED AS PER TERMS
AND CONDITIONS OF
PERMIT NO. 1-4736-03009/00008
DATE ~~6/14/16~~ 8/25/16

Purpose: Dredging Plan / Proposed Conditions

Adjacent Property Owners:
900-179-1-33: Alixander Lollins and Stuart Baker
900-179-1-39: Town of Southampton
900-179-1-34: Marcia and Richard Godosky
900-179-1-35: Joint Ownership
900-179-1-2: Ethel Hurvitz
900-179-1-1: Burnetts Cove Association, Inc
900-179-2-2.1: Jay and Prudence Mortimer
900-179-2-15: Town of Southampton
900-179-2-18.1: Avra and Munro Bank

Dredge Channel with Access

0 400' 800'

Scale: 1"=400'

Client:
Board of Trustees of the Freeholders and Commonalty of the Town of Southampton
116 Hampton Road, Town Hall
Southampton, NY 11968

Disclaimer: This drawing is for concept design purposes only. Prior to construction, all design elements should be evaluated by the owner site contractor and/or engineer to ensure proper design.

Name of Project:
Dredge Project

Location of Project:

In: Mecox Bay
County: Suffolk County
Applicant: Inter-Science Research Associates, Inc.
PO Box 1201 Southampton, NY 11969
File: m:\clients\southampton town-board of trustees\mecox\mecox dredging aerial overlay w emergency dredge alt 3 06082016 dwg

Sheet 3 of 4 Date: June 8, 2016

NYS DEPARTMENT OF ENVIRONMENTAL CONSERVATION

EMERGENCY AUTHORIZATION

Pursuant to Environmental Conservation Law Article 70 (6 NYCRR Part 621)

N.Y.S. D.E.C. REGION 1
Division of Environmental Permits
SUNY @ Stony Brook
50 Circle Road
Stony Brook, NY 11790 - 3409

DEC # 1-4736-03009 / 00011

EFFECTIVE DATE: October 11, 2016 **EXPIRATION DATE:** November 10, 2016

Name & Address of Permittee/Applicant: Town of Southampton
116 Hampton Rd.
Southampton, N.Y. 11968

Board of Trustees of the Commonality of the Town of Southampton
116 Hampton Rd.
Southampton, N.Y. 11968

Telephone #: (631) 287-5717

Name & Address of Contact/Agent: Trustee Scott Horowitz
(631) 740-1290

Project Location: Mecox Cut; Atlantic Ocean Beach Between the Termini of Flying Point Road and Dune Road. Town of Southampton, Suffolk County.

Emergency Authorization Type

Article 25 of the ECL, 6NYCRR Part 661: Tidal Wetlands
Article 15, Title 5 of the ECL, 6NYCRR Part 608: Protection of Waters
Article 15, Title 5 of the ECL, 6NYCRR Part 608: Water Quality Certification

Project Description: Mechanically excavate a channel across the beach to establish a connection between Mecox Bay and the ocean. The channel will be of approximate dimensions 220 feet long by 10 feet wide by 4 feet deep. Up to 1,000 cubic yards of excavated sand will be stockpiled on the upper beach on the west side of the cut. The channel is necessary to relieve high water levels in Mecox Bay. The work shall be as shown on the attached map by Inter-Science Research Associates, Inc. stamped "NYSDEC Approved 8/25/16".

Finding That An Emergency Exists:

Based on the Department's review of the situation and the information provided by the Board of Trustees of the Commonality of the Town of Southampton, DEC has determined that this situation meets the definition of an emergency, "**an event which presents an immediate threat to life, health, property, or natural resources,**" as defined in the Uniform Procedures Regulations, Section 621.12. There is currently an immediate threat to human health, welfare, and water quality in Mecox Bay due to the back-up or temporary failure of septic systems on properties in the Mecox Bay watershed from the high groundwater levels associated with the high pond surface water level. This high pond water level / high groundwater level can also cause flooding of the basements of houses in the watershed.

Accordingly, the Department hereby makes a finding that an emergency exists pursuant to Section 621.12 of the Uniform Procedures Regulations due to the threat noted above. The Department has determined that emergency action is necessary in order to protect the public welfare and health, and the surface water quality in Mecox Bay.

Authorized and issued by:

George W. Hammarth
Deputy Regional Permit Administrator

Please note further that this Emergency Authorization is granted subject to the following conditions in accordance with Section 621.12(e) (2) of the Uniform Procedures Regulations:

SPECIAL CONDITIONS

All work is to be performed in accordance with the conditions described below:

1. The cut shall be closed using the material stockpiled from the cut opening if the channel moves more than 150 feet from the excavated center line or the cut does not close by itself within 14 days of the opening.

2. All trucks and mechanical equipment must access the beach from Flying Point Road as shown on the approved plan. Vehicles and equipment associated with this project must be restricted to areas west of the cut.

3. All activities authorized by this emergency authorization must be in strict conformance with the approved plan submitted by the applicant or his agent as part of the emergency authorization application.

This Emergency Authorization is issued for a 30-day period commencing on the effective date and ending at midnight on the expiration date. This authorization may be renewed for an additional 30-day period provided the permittee requests said renewal in writing and complies with all conditions contained herein.

Said renewal request must be submitted to the Regional Permit Administrator no later than 7 days prior to the expiration of the original 30-day period and no additional activity may occur after the expiration of the original 30-day period unless authorized in writing by the Department prior to commencement of said activities. DEC's review of the Town of Southampton's application for a standard Tidal Wetlands, Protection of Waters and Water Quality Certification permit for the opening of the Mecox Cut is ongoing.

As per 6 NYCRR Part 621, Section 621.12(i), a person who violates any term or condition of an Emergency Authorization will be ordered to perform any necessary restoration or mitigation of environmental damage resulting from that action.

Failure to comply with the terms and conditions of this Emergency Authorization will be considered a violation of Article 25 of the Environmental Conservation Law and its implementing regulations, 6 NYCRR Part 661; and Article 15, Title 5 of the ECL and its implementing regulations, 6 NYCRR Part 608.

cc: USACE
USFWS
Nica B. Strunk, Esq.
Carrie Meek Gallagher – DEC Regional Director
Wildlife
BOH-TW
file

NYSDEC
APPROVED AS PER TERMS
AND CONDITIONS OF
PERMIT NO. 1-4736-03009/00008
DATE 8/25/16

Purpose: Dredging Plan / Proposed Conditions

Adjacent Property Owners:
900-179-1-33: Alexander Lollins and Stuart Baker
900-179-1-39: Town of Southampton
900-179-1-34: Marcia and Richard Cedarly
900-179-1-35: Joint Ownership
900-179-1-2: Ethel Hurvitz
900-179-1-1: Burnetts Cove Association, Inc
900-179-2-3.1: Jay and Prudence Mortimer
900-179-2-15: Town of Southampton
900-179-2-18.1: Awa and Munro Bank

Dredge Channel with Access

0 400' 800'

Scale: 1" = 400'

Client:
Board of Trustees of the Freeholders and Commonalty of the Town of Southampton
116 Hampton Road, Town Hall
Southampton, NY 11968

Name of Project:
Dredge Project

Location of Project:
In: Mecox Bay
County: Suffolk County
Applicant: Inter-Science Research Associates, Inc
PO Box 1201 Southampton, NY 11969

Sheet 3 of 4
Date: June 8, 2016

NYS DEPARTMENT OF ENVIRONMENTAL CONSERVATION

EMERGENCY AUTHORIZATION

Pursuant to Environmental Conservation Law Article 70 (6 NYCRR Part 621)

N.Y.S. D.E.C. REGION 1
Division of Environmental Permits
SUNY @ Stony Brook
50 Circle Road
Stony Brook, NY 11790 - 3409

DEC # 1-4736-03009 / 00014

EFFECTIVE DATE: December 13, 2016 **EXPIRATION DATE:** January 12, 2017

Name & Address of Permittee/Applicant Town of Southampton
116 Hampton Rd.
Southampton, N.Y. 11968

Board of Trustees of the Commonality of the Town of Southampton
116 Hampton Rd.
Southampton, N.Y. 11968

Telephone #: (631) 287-5717

Name & Address of Contact/Agent: Trustee Scott Horowitz
(631) 740-1290

Project Location: Mecox Cut; Atlantic Ocean Beach Between the Termini of Flying Point Road and Dune Road. Town of Southampton, Suffolk County.

Emergency Authorization Type

Article 25 of the ECL, 6NYCRR Part 661: Tidal Wetlands
Article 15, Title 5 of the ECL, 6NYCRR Part 608: Protection of Waters
Article 15, Title 5 of the ECL, 6NYCRR Part 608: Water Quality Certification

Project Description: Mechanically excavate a channel across the beach to establish a connection between Mecox Bay and the ocean. The channel will be of approximate dimensions 220 feet long by 10 feet wide by 4 feet deep. Up to 1,000 cubic yards of excavated sand will be stockpiled on the upper beach on the east side of the cut. The channel is necessary to establish a temporary flushing connection between the bay and the ocean in order to address a bloom of cyanobacteria confirmed on December 2, 2016 and to regulate the salinity of the bay to support the survival of shellfish and finfish. The work shall be as shown on the attached map stamped "NYSDEC Approved 12/13/16".

Finding That An Emergency Exists:

Based on the Department's review of the situation and the information provided by the Board of Trustees of the Commonality of the Town of Southampton, DEC has determined that this situation meets the definition of an emergency, "**an event which presents an immediate threat to life, health, property, or natural resources,**" as defined in the Uniform Procedures Regulations, Section 621.12. There is currently an immediate threat to human health, welfare, and water quality in Mecox Bay due to the overgrowth of blue-green algae in a tributary of the bay as confirmed by the Suffolk County Department of Health Services news release of December 2, 2016. In addition, The Board of Trustees of the Freeholders & Commonality of the Town of Southampton has confirmed that the salinity level in Mecox Bay is currently too low for the survival of shellfish and finfish, which are significant natural resources.

Accordingly, the Department hereby makes a finding that an emergency exists pursuant to Section 621.12 of the Uniform Procedures Regulations due to the threat noted above.

The Department has determined that emergency action is necessary in order to protect the public welfare and health, natural resources and the surface water quality in Mecox Bay.

Authorized and issued by:

George W. Hammarth
Deputy Regional Permit Administrator

Please note further that this Emergency Authorization is granted subject to the following conditions in accordance with Section 621.12(e) (2) of the Uniform Procedures Regulations:

SPECIAL CONDITIONS

All work is to be performed in accordance with the conditions described below:

1. The cut shall be closed using the material stockpiled from the cut opening if the channel moves more than 150 feet from the excavated center line or the cut does not close by itself within 14 days of the opening.

2. The area east of the cut footprint is important habitat for the reproductive activities of state and federally listed species of shorebirds. If the permittee stores the material excavated pursuant to this emergency authorization on the east side of the cut, it must do so in accordance with one of the following two provisions:

- If the material is not placed as a stockpile, it must be graded upon excavation in a manner which maintains the placement area's suitability as nesting and foraging habitat for the piping plover and least tern.

- If the material is placed as a stockpile, it is the Permittees responsibility to monitor the condition of the stockpile area. If the stockpile area is not in a condition to support piping plover and least tern nesting and foraging (inappropriate grades, slopes or surface irregularities, etc.) by March 15, 2017, the permittee must grade the stockpile area to re-establish suitable nesting conditions by March 31, 2017.

3. All activities authorized by this emergency authorization must be in strict conformance with the approved plan submitted by the applicant or his agent as part of the emergency authorization application.

This Emergency Authorization is issued for a 30-day period commencing on the effective date and ending at midnight on the expiration date. This authorization may be renewed for an additional 30-day period provided the permittee requests said renewal in writing and complies with all conditions contained herein.

Said renewal request must be submitted to the Regional Permit Administrator no later than 7 days prior to the expiration of the original 30-day period and no additional activity may occur after the expiration of the original 30-day period unless authorized in writing by the Department prior to commencement of said activities. DEC's review of the Town of Southampton's application for a standard Tidal Wetlands, Protection of Waters and Water Quality Certification permit for the opening of the Mecox Cut is ongoing.

As per 6 NYCRR Part 621, Section 621.12(i), a person who violates any term or condition of an Emergency Authorization will be ordered to perform any necessary restoration or mitigation of environmental damage resulting from that action.

Failure to comply with the terms and conditions of this Emergency Authorization will be considered a violation of Article 25 of the Environmental Conservation Law and its implementing regulations, 6 NYCRR Part 661; and Article 15, Title 5 of the ECL and its implementing regulations, 6 NYCRR Part 608.

cc: USACE
USFWS
Nica B. Strunk, Esq.
Carrie Meek Gallagher – DEC Regional Director
Wildlife
BOH-TW
file

NYSDEC
APPROVED AS PER TERMS
AND CONDITIONS OF
PERMIT NO. 1-4736-03009/00014
DATE 12/13/16

NYS DEPARTMENT OF ENVIRONMENTAL CONSERVATION

EMERGENCY AUTHORIZATION

Pursuant to Environmental Conservation Law Article 70 (6 NYCRR Part 621)

N.Y.S. D.E.C. REGION 1
Division of Environmental Permits
SUNY @ Stony Brook
50 Circle Road
Stony Brook, NY 11790 - 3409

DEC # 1-4736-03009 / 00017

EFFECTIVE DATE: March 27, 2017 **EXPIRATION DATE:** March 31, 2017

Name & Address of Permittee/Applicant: Town of Southampton
116 Hampton Rd.
Southampton, N.Y. 11968

Board of Trustees of the Commonality of the Town of Southampton
116 Hampton Rd.
Southampton, N.Y. 11968

Telephone #: (631) 287-5717

Name & Address of Contact/Agent: Trustee Scott Horowitz
(631) 740-1290

Project Location: Mecox Cut; Atlantic Ocean Beach Between the Termini of Flying Point Road and Dune Road. Town of Southampton, Suffolk County.

Emergency Authorization Type

Article 25 of the ECL, 6NYCRR Part 661: Tidal Wetlands
Article 15, Title 5 of the ECL, 6NYCRR Part 608: Protection of Waters
Article 15, Title 5 of the ECL, 6NYCRR Part 608: Water Quality Certification

Project Description: Mechanically excavate a channel across the beach to establish a connection between Mecox Bay and the ocean. The channel will be of approximate dimensions 220 feet long by 10 feet wide by 4 feet deep. Up to 1,000 cubic yards of excavated sand will be stockpiled on the upper beach on the west side of the cut. The channel is necessary to establish a temporary flushing connection between the bay and the ocean in order to regulate the water level in the bay. The work shall be as shown on the attached map stamped "NYSDEC Approved 3/27/17".

Finding That An Emergency Exists:

Based on the Department's review of the situation and the information provided by the Board of Trustees of the Commonality of the Town of Southampton, DEC has determined that this situation meets the definition of an emergency, "**an event which presents an immediate threat to life, health, property, or natural resources,**" as defined in the Uniform Procedures Regulations, Section 621.12. There is currently an immediate threat to significant property on the parcels adjacent to Mecox Bay due to the rising water level in the bay. Elevated water levels in this bay have a negative effect on the functioning of the septic systems on the residential properties around the water body and can temporarily raise the groundwater elevation in the area, leading to water in basements.

Accordingly, the Department hereby makes a finding that an emergency exists pursuant to Section 621.12 of the Uniform Procedures Regulations due to the threat noted above.

The Department has determined that emergency action is necessary in order to protect the public welfare and health, natural resources and the surface water quality in Mecox Bay.

Authorized and issued by:

George W. Hammarth
Deputy Regional Permit Administrator

Please note further that this Emergency Authorization is granted subject to the following conditions in accordance with Section 621.12(e) (2) of the Uniform Procedures Regulations:

SPECIAL CONDITIONS

All work is to be performed in accordance with the conditions described below:

1. **Definition of Terms** This emergency authorization allows the opening of the channel or "cut" across the beach to temporarily connect Mecox Bay with the ocean. Because of the hydraulic characteristics of the flowing connection between the water bodies, the dimensions of the initially excavated channel are not maintained. Accordingly, it is necessary to define the following terms for the purposes of this authorization:

Cut Open: A flowing connection between the pond and the ocean which exists during any astronomical tide stage.

Cut Closed: A condition in which the connection between the bay and the ocean is closed during all normal tidal stages. The minimum parameters of the closed condition are the existence of an area of sand at least 150 feet wide (north-south) of minimum elevation +5 NAVD`88 with maximum slope 1 vertical to 15 horizontal (1:15) to existing grade on both the bay and ocean sides in place across the channel.

2. **Cut Must be Closed by March 31, 2017** The bay-ocean cut allowed by this emergency authorization must be closed in accordance with Special Condition 1 above, with the cut area and all associated stockpile and access areas graded smooth and left in a suitable condition to provide habitat for piping plovers and other listed shorebirds by 11:59 PM on March 31, 2017.

3. **Remove Material From Stockpile Location by March 31, 2017** All stored sand must be removed from the stockpile location, with the underlying beach substrate graded smooth to match the surrounding, undisturbed areas by 11:59 PM on March 31, 2017.

4. **Permittee Must Obtain Authorization of All Involved Landowners** It is the permittee' s responsibility to obtain the permission of the owners of all properties upon which the activities allowed by this emergency authorization will be conducted before starting work.

5. **Permittee Must Monitor & Control Position of Bay-Ocean Cut** The permittee shall monitor the position and condition of the bay – ocean cut on a daily basis whenever it is open. If the open cut moves more than 150 feet off the approved alignment, the permittee must take immediate action to either maintain the cut on the approved alignment or close it in conformance with the definition given in Special Condition 1 above.

6. **Closing the Bay-Ocean Cut** The permittee shall use the material stockpiled on-site to close the cut by moving or grading the sand into place to achieve the minimum closed cut specification set forth in Special Condition 1. If the quantity of on-site stockpiled material is insufficient to meet the minimum closed cut specification, beach compatible sand from another source must be used to supplement the on-site material.

7. **All Excavated Material Must Remain in the Atlantic Ocean Littoral System** All sand removed to open the Mecox Bay – ocean cut must remain in the Atlantic Ocean littoral system.

8. **Excavated Materials Above AHW** All material excavated or dredged pursuant to this emergency authorization shall be placed landward of the line of apparent high water.

9. **No Disturbance to Vegetated Tidal Wetlands** There shall be no disturbance to vegetated tidal wetlands as a result of the activities authorized herein.

10. **Storage of Equipment, Materials** The storage of construction equipment and materials shall be on the beach landward of the line of apparent high water or on a road.

11. **Project Drawing** All activities authorized by this emergency authorization must be as shown on the attached drawing stamped "NYSDEC Approved 3/27/17.

This Emergency Authorization is issued for a five (5) day period commencing on the effective date and ending at 11:59 PM on the March 31, 2017. This authorization may not be renewed.

As per 6 NYCRR Part 621, Section 621.12(i), a person who violates any term or condition of an Emergency Authorization will be ordered to perform any necessary restoration or mitigation of environmental damage resulting from that action.

Failure to comply with the terms and conditions of this Emergency Authorization will be considered a violation of Article 25 of the Environmental Conservation Law and its implementing regulations, 6 NYCRR Part 661; and Article 15, Title 5 of the ECL and its implementing regulations, 6 NYCRR Part 608.

cc: USACE
USFWS
Nica B. Strunk, Esq.
Carrie Meek Gallagher – DEC Regional Director
Wildlife
BOH-TW
file

N Y S D E C
APPROVED AS PER TERMS
AND CONDITIONS OF
PERMIT NO. 1-4736-03009/00017
DATE 3/22/17

DRAWING 1 OF 1

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Division of Environmental Permits, Region 1
SUNY @ Stony Brook, 50 Circle Road, Stony Brook, NY 11790
P: (631) 444-0365 I F: (631) 444-0360
www.dec.ny.gov

May 26, 2017

Town of Southampton
116 Hampton Road
Southampton, NY 11968

RE: Emergency Authorization No.: 1-4736-03009/00020
Mecox Cut

Dear Permittee:

In conformance with the requirements of the State Uniform Procedures Act (Article 70, ECL) and its implementing regulations (6NYCRR, Part 621) we are enclosing your Emergency Authorization for the referenced activity. Please carefully read all conditions and special Emergency Authorization conditions contained in the Emergency Authorization to ensure compliance during the term of the Emergency Authorization. If you are unable to comply with any conditions please contact us at the above address.

The Department anticipates any future requests to be carried out through a permit and long term management plan. We look forward to working with the Town of Trustees to complete that process.

Note: This Emergency Authorization expires on June 8, 2017.

Sincerely,

John A. Wieland
Deputy Permit Administrator

JAW/ls

NYS DEPARTMENT OF ENVIRONMENTAL CONSERVATION

EMERGENCY AUTHORIZATION

Pursuant to Environmental Conservation Law Article 70 (6 NYCRR Part 621)

N.Y.S. D.E.C. REGION 1
Division of Environmental Permits
SUNY @ Stony Brook
50 Circle Road
Stony Brook, NY 11790 - 3409

DEC # 1-4736-03009/00020

EFFECTIVE DATE: May 26, 2017 **EXPIRATION DATE:** June 08, 2017

Name & Address of Permittee/Applicant: Town of Southampton
116 Hampton Rd.
Southampton, N.Y. 11968

Town of Southampton
Board of Trustees
116 Hampton Rd.
Southampton, N.Y. 11968

Telephone #: (631) 287-5717

Name & Address of Contact/Agent: Trustee Scott Horowitz
(631) 740-1290

Project Location: Mecox Cut; Atlantic Ocean Beach Between the Termini of Flying Point Road and Dune Road, Town of Southampton, Suffolk County.

Emergency Authorization Type

Article 25 of the ECL, 6NYCRR Part 661: Tidal Wetlands
Article 15, Title 5 of the ECL, 6NYCRR Part 608: Protection of Waters
Article 15, Title 5 of the ECL, 6NYCRR Part 608: Water Quality Certification
ECL 11-0535, 6NYCRR Part 182

Project Description: Mechanically excavate a channel across the beach to establish a connection between Mecox Bay and the ocean. The channel will be of approximate dimensions 220 feet long by 10 feet wide by 4 feet deep. Up to 1,000 cubic yards of excavated sand will be side cast on the west side of the cut and remain where it is placed. The channel is necessary to relieve high water levels in Mecox Bay. The work shall be as shown on the accompanying aerial plan stamped "NYSDEC Approved 5/26/17.

Finding That An Emergency Exists:

Based on the Department's review of the situation and the information provided by the Board of Trustees of the Freeholders & Commonality of the Town of Southampton, and having consulted with the Department's Bureau of Wildlife and Bureau of Marine Habitat Protection, the Department has determined that the circumstances confronting the property owners fronting Mecox Bay as well as the health of the Bay itself, as more fully set forth below meets the definition of an emergency, **"an event which presents an immediate threat to life, health, property, or natural resources,"** as defined in the Uniform Procedures regulations, Section 621.12. There is currently an immediate threat to human health and welfare, and water quality in Mecox Bay due to the back-up or temporary failure of septic systems on properties in the Mecox Bay watershed from the extraordinarily high groundwater levels associated with the high pond surface water level. The high pond water level / groundwater level is also causing the flooding of the basements of many homes in the watershed.

Accordingly, the Department hereby makes a finding that an emergency exists pursuant to Section 621.12 of the Uniform Procedures Act regulations due to the threat noted above. The Department has determined that emergency action is necessary in order to protect the public welfare and health, and the surface water quality in Mecox Bay.

Authorized and issued by:

John A. Wieland

for George W. Hammarth
Deputy Regional Permit Administrator

Please note further that this Emergency Authorization is granted subject to the following conditions in accordance with Section 621.12(e) (2) of the Uniform Procedures regulations:

SPECIAL CONDITIONS

All work is to be performed in accordance with the conditions described below:

1. Activities authorized by this permit shall be conducted before any nests located within 1,000 meters of the work area produce hatchings. If an unavoidable need arises to conduct authorized activities after hatching, the permittee shall notify the Department (kevin.jennings@dec.ny.gov; george.hammarth@dec.ny.gov). Work may be permitted after additional consultation with the Department.

2. The activities authorized by this permit must be conducted under the supervision of a DEC-approved environmental monitor to ensure that there is no disturbance to the state and federally-listed piping plover and the state listed least tern as a result of the project. The monitor shall survey the project area before the start of any regulated activity each day and must remain on the project site supervising activities throughout the work day. If the monitor observes the presence of piping plovers or least terns within the construction area, and determines that the project activities are disturbing these species (including but not limited to the interruption of incubation, prevention of foraging, causing of territorial displays), the monitor must stop the project and immediately contact NYSDEC Region 1 Bureau of Wildlife (Kevin Jennings; 631-444-0307, kevin.jennings@dec.ny.gov).

3. The permittee must provide notice of commencement of work to DEC (Kevin Jennings; 631-444-0307, kevin.jennings@dec.ny.gov) and (George Hammarth 631 444-0371, George.Hammarth@dec.ny.us) at least 24 hours prior to the start of any work authorized by this authorization.

4. All material excavated to open the cut must be side cast on the west side of the cut and remain where it is placed in order to minimize activity that may disturb nesting birds and habitat. There shall be no stockpiling of material.

5. All trucks and mechanical equipment must access and exit the beach from Flying Point Road as shown on the approved plans. Vehicles and equipment associated with this project must be restricted to areas west of the cut.

6. The permittee shall grade the beach area disturbed by construction to remove all tire tracks or ruts made by trucks and earth moving equipment immediately upon completion of the authorized work.

7. After project completion, the Town of Southampton plover stewards shall fence any additional piping plover foraging areas which may be formed as a result of changes to the water level in Mecox Bay.

8. Upon completion of the work authorized herein, the permittee shall prohibit recreational off-road-vehicle (ORV) driving into the cut area for the remainder of the shorebird nesting season. This prohibition may take the form of the full closure of the ORV beach access points to the west (Flying Point Road) and east (Scott Cameron Town Beach) of the cut area or the implementation of a system to divert ORVs away from the cut area immediately upon entrance to the beach (west from the Flying Point Road access point and east from the Scott Cameron Beach access point).

9. All activities authorized by this emergency authorization must be in strict conformance with the approved plans submitted by the applicant or his agent as part of the emergency authorization application.

10. It is the permittee's responsibility to obtain any and all other approvals or authorizations required for this project from federal, state and local agencies.

This Emergency Authorization is issued for a 14 day period commencing on the effective date and ending at midnight on the expiration date and may not be renewed.

As per 6 NYCRR Part 621, Section 621.12(i), a person who violates any term or condition of an Emergency Authorization will be ordered to perform any necessary restoration or mitigation of environmental damage resulting from that action.

Failure to comply with the terms and conditions of this Emergency Authorization will be considered a violation of Article 25 of the Environmental Conservation Law and its implementing regulations, 6 NYCRR Part 661; and Article 15, Title 5 of the ECL and its implementing regulations, 6NYCRR Part 608.

cc: USACE
USFWS
DEC Wildlife
DEC TW
File


1/2
N Y S D E C
APPROVED AS PER TERMS
AND CONDITIONS OF
PERMIT NO. 1-4736-03009/00020
DATE 05-26-2017
SAW
BRIDGEHAMP
Access Route
Fencing to redirect ORV opposite direction of the cut
Initial excavation and expected footprint of the flowing cut once established
All material will be sidecasted on west side of cut, no stockpile will be created
Fencing to redirect ORV opposite direction of the cut

PHOTO 1

2/2

NYSDEC
APPROVED AS PER TERMS
AND CONDITIONS OF
PERMIT NO. 1-4736-03009/00020
DATE 05-26-2017
JAW

PHOTO 2

NYS DEPARTMENT OF ENVIRONMENTAL CONSERVATION

EMERGENCY AUTHORIZATION

Pursuant to Environmental Conservation Law Article 70 (6 NYCRR Part 621)

N.Y.S. D.E.C. REGION 1
Division of Environmental Permits
SUNY @ Stony Brook
50 Circle Road
Stony Brook, NY 11790 - 3409

DEC # 1-4736-03009/00023

EFFECTIVE DATE: September 11, 2017	**EXPIRATION DATE:** October 11, 2017
Name & Address of Permittee/Applicant:	Town of Southampton 116 Hampton Rd. Southampton, N.Y. 11968 Town of Southampton Board of Trustees 116 Hampton Rd. Southampton, N.Y. 11968
Telephone #: (631) 287-5717	
Name & Address of Contact/Agent:	Trustee Edward J. Warner, Jr. (631) 287-5717
Project Location:	Mecox Cut; Atlantic Ocean Beach Between the Termini of Flying Point Road and Dune Road, Town of Southampton, Suffolk County.

Emergency Authorization Type

Article 25 of the ECL, 6NYCRR Part 661: Tidal Wetlands
Article 15, Title 5 of the ECL, 6NYCRR Part 608: Protection of Waters
Article 15, Title 5 of the ECL, 6NYCRR Part 608: Water Quality Certification

Project Description: Mechanically excavate a channel across the beach to establish a connection between Mecox Bay and the ocean. The channel will be of approximate dimensions 400 feet long by 10 feet wide by 4 feet deep. Up to 1,000 cubic yards of excavated sand will be stockpiled on the east side of the cut. The channel is necessary to relieve high water levels and re-establish salinity levels in Mecox Bay. The work shall be as shown on the accompanying aerial plan stamped "NYSDEC Approved 09/11/17.

Finding That An Emergency Exists:
Based on the Department's review of the situation and the information provided by the Board of Trustees of the Freeholders & Commonality of the Town of Southampton, and having consulted with the Department's Bureau of Wildlife and Bureau of Marine Habitat Protection, the Department has determined that the circumstances confronting the property owners fronting Mecox Bay as well as the health of the Bay itself, as more fully set forth below meets the definition of an emergency, "**an event which presents an immediate threat to life, health, property, or natural resources,"** as defined in the Uniform Procedures regulations, Section 621.12. There is currently an immediate threat to human health and welfare, and water quality in Mecox Bay due to flooding of properties in the Mecox Bay watershed from the high groundwater levels associated with the high pond surface water level.

Accordingly, the Department hereby makes a finding that an emergency exists pursuant to Section 621.12 of the Uniform Procedures Act regulations due to the threat noted above. The Department has determined that emergency action is necessary in order to protect the public welfare and health, and the surface water quality in Mecox Bay.

Authorized and issued by:

John A. Wieland
Deputy Regional Permit Administrator

Please note further that this Emergency Authorization is granted subject to the following conditions in accordance with Section 621.12(e) (2) of the Uniform Procedures regulations:

SPECIAL CONDITIONS

All work is to be performed in accordance with the conditions described below:

1. All activities authorized by this emergency authorization must be in strict conformance with the approved plans submitted by the applicant or his agent as part of the emergency authorization application.

2. It is the permittee's responsibility to obtain any and all other approvals or authorizations required for this project from federal, state and local agencies.

This Emergency Authorization is issued for a 30 - day period commencing on the effective date and ending at midnight on the expiration date.

As per 6 NYCRR Part 621, Section 621.12(i), a person who violates any term or condition of an Emergency Authorization will be ordered to perform any necessary restoration or mitigation of environmental damage resulting from that action.

Failure to comply with the terms and conditions of this Emergency Authorization will be considered a violation of Article 25 of the Environmental Conservation Law and its implementing regulations, 6 NYCRR Part 661; and Article 15, Title 5 of the ECL and its implementing regulations, 6NYCRR Part 608.

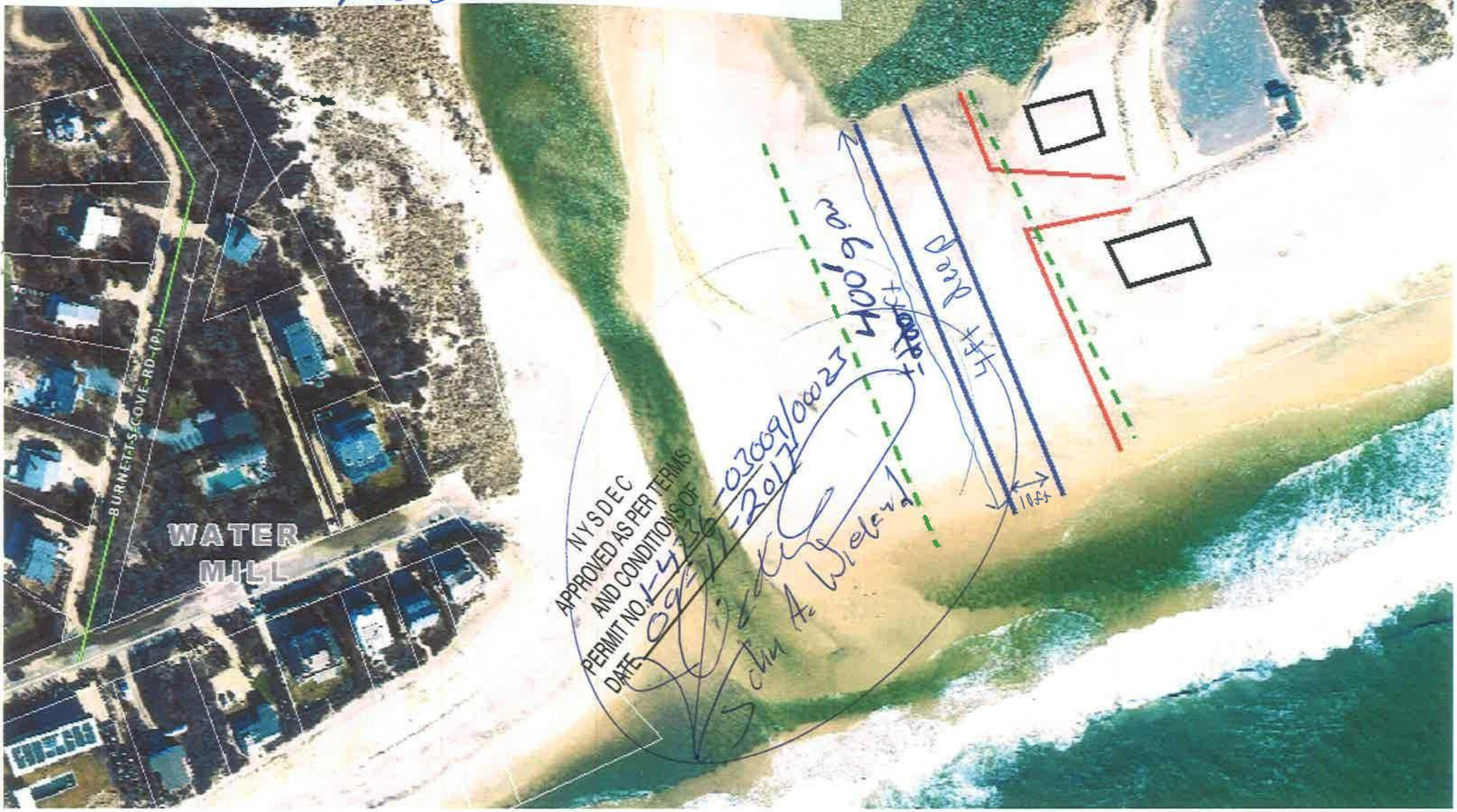
cc: USACE
USFWS
DEC Wildlife
DEC TW
File

Access Route

Initial Excavation and expected footprint of the flowing cut once established

Fencing to redirect ORV

Stockpiled dredge material (~~4000~~ cubic yards) 4000 gov



NYS DEPARTMENT OF ENVIRONMENTAL CONSERVATION

EMERGENCY AUTHORIZATION

Pursuant to Environmental Conservation Law Article 70 (6 NYCRR Part 621)

N.Y.S. D.E.C. REGION 1
Division of Environmental Permits
SUNY @ Stony Brook
50 Circle Road
Stony Brook, NY 11790 - 3409

DEC # 1-4736-03009 / 00027

EFFECTIVE DATE: November 9, 2017 **EXPIRATION DATE:** December 8, 2017

Name & Address of Permittee/Applicant Town of Southampton
116 Hampton Rd.
Southampton, N.Y. 11968

Town of Southampton
Board of Trustees
116 Hampton Rd.
Southampton, N.Y. 11968

Telephone #: (631) 287-5717

Name & Address of Contact/Agent: Trustee Scott Horowitz
(631) 740-1290

Project Location: Mecox Cut; Atlantic Ocean Beach Between the Termini of Flying Point Road and Dune Road. Town of Southampton, Suffolk County.

Emergency Authorization Type

Article 25 of the ECL, 6NYCRR Part 661: Tidal Wetlands
Article 15, Title 5 of the ECL, 6NYCRR Part 608: Protection of Waters
Article 15, Title 5 of the ECL, 6NYCRR Part 608: Water Quality Certification

Project Description: Mechanically excavate a channel across the beach to establish a flowing connection between Mecox Bay and the ocean. The channel will be of approximate dimensions 600 feet long by 10 feet wide by 4 feet deep. Up to 4,000 cubic yards of excavated sand will be stockpiled on the upper beach on the east side of the cut. The channel is necessary to relieve high water levels in Mecox Bay. The work shall be as shown on the attached sketch stamped "NYSDEC Approved 11/ 9 /17".

Finding That An Emergency Exists:
Based on the Department's review of the situation and the information provided by the Board of Trustees of the Freeholders & Commonality of the Town of Southampton, the Department has determined that this situation meets the definition of an emergency, **"an event which presents an immediate threat to life, health, property, or natural resources,"** as defined in the Uniform Procedures regulations, Section 621.12. There is currently a threat to human health and welfare on some properties around Mecox Bay due to the back-up or temporary failure of septic systems from the extraordinarily high groundwater levels associated with the high pond surface water level. The high pond water level / groundwater level is also causing the flooding of the basements of many homes in the watershed. In addition, recent precipitation events have lowered the pond's salinity to a level which stresses and has the potential to permanently damage commercially significant shellfish resources in the bay.

Accordingly, the Department hereby makes a finding that an emergency exists pursuant to Section 621.12 of the Uniform Procedures Act regulations due to the threat noted above.

The Department has determined that emergency action is necessary to protect the public welfare and health, and the natural resources of Mecox Bay.

Authorized and issued by:

George W. Hammarth
Deputy Regional Permit Administrator

Please note further that this Emergency Authorization is granted subject to the following conditions in accordance with Section 621.12(e) (2) of the Uniform Procedures regulations:

SPECIAL CONDITIONS

1. All activities authorized by this emergency authorization must be in strict conformance with the approved plans submitted by the applicant or his agent as part of the emergency authorization application.

2. The permittee must monitor the location and condition (width, average depth, alignment) of the open cut daily. If the cut does not close naturally within 15 days of the initial opening, the permittee shall assess the situation to determine whether the project goals (bay water levels lowered by 16-20 inches as determined by observation of the water level gauge/s in the bay and the increase of bay salinity to 16-20 parts-per-thousand) have been achieved every five days in consultation with DEC. If it is determined that the project goals have been achieved, or if the cut channel moves more than 150 feet off the center line of the approved alignment, the permittee shall use the material stockpiled from the cut opening and, if necessary, additional clean, beach compatible sand to close the cut channel.

3. It is the permittee's responsibility to obtain all other approvals or authorizations required for this project from federal, state and local agencies.

4. The project area provides vital reproductive habitat for listed species of beach nesting shorebirds such as the piping plover and least tern during the spring and summer. It is the permittee's responsibility to ensure that any stockpiles or other accumulations of sand resulting from this project are removed, with the beach graded to the slopes and the level of surface smoothness appropriate for the nesting of shorebirds by March 31, 2018.

This Emergency Authorization is issued for a 30-day period commencing on the effective date and ending at midnight on the expiration date. One, 30-day extension may be granted, if warranted.

As per 6 NYCRR Part 621, Section 621.12(i), a person who violates any term or condition of an Emergency Authorization will be ordered to perform any necessary restoration or mitigation of environmental damage resulting from that action.

Failure to comply with the terms and conditions of this Emergency Authorization will be considered a violation of Article 25 of the Environmental Conservation Law and its implementing regulations, 6 NYCRR Part 661; and Article 15, Title 5 of the ECL and its implementing regulations, 6NYCRR Part 608.

cc: USACE
USFWS
Wildlife
BOH-TW
File

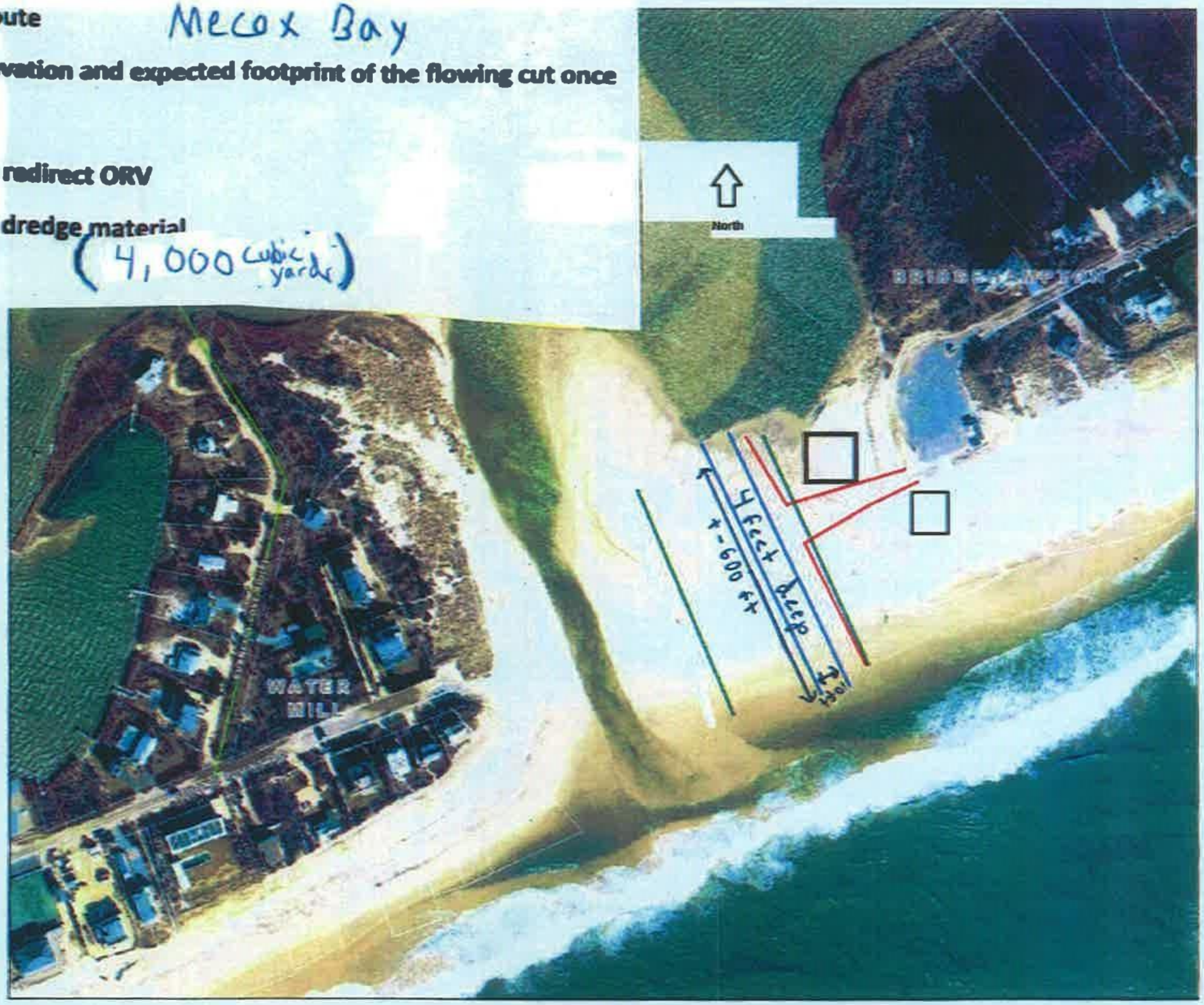
Access Route

Mecox Bay

Initial Excavation and expected footprint of the flowing cut once established

Fencing to redirect ORV

Stockpiled dredge material (4,000 cubic yards)



N Y S D E C
APPROVED AS PER TERMS AND CONDITIONS OF
PERMIT NO. 1-4736-03009/00027
DATE 11/9/17

NYS DEPARTMENT OF ENVIRONMENTAL CONSERVATION

EMERGENCY AUTHORIZATION

Pursuant to Environmental Conservation Law Article 70 (6 NYCRR Part 621)

N.Y.S. D.E.C. REGION 1
Division of Environmental Permits
SUNY @ Stony Brook
50 Circle Road
Stony Brook, NY 11790 - 3409

DEC # 1-4736-03009 / 00014

EFFECTIVE DATE: December 13, 2016 **EXPIRATION DATE:** January 12, 2017

Name & Address of Permittee/Applicant Town of Southampton
116 Hampton Rd.
Southampton, N.Y. 11968

Board of Trustees of the Commonality of the Town of Southampton
116 Hampton Rd.
Southampton, N.Y. 11968

Telephone #: (631) 287-5717

Name & Address of Contact/Agent: Trustee Scott Horowitz
(631) 740-1290

Project Location: Mecox Cut; Atlantic Ocean Beach Between the Termini of Flying Point Road and Dune Road. Town of Southampton, Suffolk County.

Emergency Authorization Type

Article 25 of the ECL, 6NYCRR Part 661: Tidal Wetlands
Article 15, Title 5 of the ECL, 6NYCRR Part 608: Protection of Waters
Article 15, Title 5 of the ECL, 6NYCRR Part 608: Water Quality Certification

Project Description: Mechanically excavate a channel across the beach to establish a connection between Mecox Bay and the ocean. The channel will be of approximate dimensions 220 feet long by 10 feet wide by 4 feet deep. Up to 1,000 cubic yards of excavated sand will be stockpiled on the upper beach on the east side of the cut. The channel is necessary to establish a temporary flushing connection between the bay and the ocean in order to address a bloom of cyanobacteria confirmed on December 2, 2016 and to regulate the salinity of the bay to support the survival of shellfish and finfish. The work shall be as shown on the attached map stamped "NYSDEC Approved 12/13/16".

Finding That An Emergency Exists:

Based on the Department's review of the situation and the information provided by the Board of Trustees of the Commonality of the Town of Southampton, DEC has determined that this situation meets the definition of an emergency, "**an event which presents an immediate threat to life, health, property, or natural resources,**" as defined in the Uniform Procedures Regulations, Section 621.12. There is currently an immediate threat to human health, welfare, and water quality in Mecox Bay due to the overgrowth of blue-green algae in a tributary of the bay as confirmed by the Suffolk County Department of Health Services news release of December 2, 2016. In addition, The Board of Trustees of the Freeholders & Commonality of the Town of Southampton has confirmed that the salinity level in Mecox Bay is currently too low for the survival of shellfish and finfish, which are significant natural resources.

Accordingly, the Department hereby makes a finding that an emergency exists pursuant to Section 621.12 of the Uniform Procedures Regulations due to the threat noted above.

The Department has determined that emergency action is necessary in order to protect the public welfare and health, natural resources and the surface water quality in Mecox Bay.

Authorized and issued by:

George W. Hammarth
Deputy Regional Permit Administrator

Please note further that this Emergency Authorization is granted subject to the following conditions in accordance with Section 621.12(e) (2) of the Uniform Procedures Regulations:

SPECIAL CONDITIONS

All work is to be performed in accordance with the conditions described below:

1. The cut shall be closed using the material stockpiled from the cut opening if the channel moves more than 150 feet from the excavated center line or the cut does not close by itself within 14 days of the opening.

2. The area east of the cut footprint is important habitat for the reproductive activities of state and federally listed species of shorebirds. If the permittee stores the material excavated pursuant to this emergency authorization on the east side of the cut, it must do so in accordance with one of the following two provisions:

- If the material is not placed as a stockpile, it must be graded upon excavation in a manner which maintains the placement area's suitability as nesting and foraging habitat for the piping plover and least tern.

- If the material is placed as a stockpile, it is the Permittees responsibility to monitor the condition of the stockpile area. If the stockpile area is not in a condition to support piping plover and least tern nesting and foraging (inappropriate grades, slopes or surface irregularities, etc.) by March 15, 2017, the permittee must grade the stockpile area to re-establish suitable nesting conditions by March 31, 2017.

3. All activities authorized by this emergency authorization must be in strict conformance with the approved plan submitted by the applicant or his agent as part of the emergency authorization application.

This Emergency Authorization is issued for a 30-day period commencing on the effective date and ending at midnight on the expiration date. This authorization may be renewed for an additional 30-day period provided the permittee requests said renewal in writing and complies with all conditions contained herein.

Said renewal request must be submitted to the Regional Permit Administrator no later than 7 days prior to the expiration of the original 30-day period and no additional activity may occur after the expiration of the original 30-day period unless authorized in writing by the Department prior to commencement of said activities. DEC's review of the Town of Southampton's application for a standard Tidal Wetlands, Protection of Waters and Water Quality Certification permit for the opening of the Mecox Cut is ongoing.

As per 6 NYCRR Part 621, Section 621.12(i), a person who violates any term or condition of an Emergency Authorization will be ordered to perform any necessary restoration or mitigation of environmental damage resulting from that action.

Failure to comply with the terms and conditions of this Emergency Authorization will be considered a violation of Article 25 of the Environmental Conservation Law and its implementing regulations, 6 NYCRR Part 661; and Article 15, Title 5 of the ECL and its implementing regulations, 6 NYCRR Part 608.

cc: USACE
USFWS
Nica B. Strunk, Esq.
Carrie Meek Gallagher – DEC Regional Director
Wildlife
BOH-TW
file

APPROVED AS PER TERMS
AND CONDITIONS OF
PERMIT NO. 1-4736-03009/00014
DATE 12/13/16

NYS DEPARTMENT OF ENVIRONMENTAL CONSERVATION

EMERGENCY AUTHORIZATION

Pursuant to Environmental Conservation Law Article 70 (6 NYCRR Part 621)

N.Y.S. D.E.C. REGION 1
Division of Environmental Permits
SUNY @ Stony Brook
50 Circle Road
Stony Brook, NY 11790 - 3409

DEC # 1-4736-03009 / 00030

EFFECTIVE DATE: February 2, 2018	**EXPIRATION DATE:** March 4, 2018
Name & Address of Permittee/Applicant	Town of Southampton 116 Hampton Rd. Southampton, N.Y. 11968 Town of Southampton Board of Trustees 116 Hampton Rd. Southampton, N.Y. 11968
Telephone #: (631) 287-5717	
Name & Address of Contact/Agent:	Trustee Scott Horowitz (631) 740-1290
Project Location:	Mecox Cut; Atlantic Ocean Beach Between the Termini of Flying Point Road and Dune Road. Town of Southampton, Suffolk County.

Emergency Authorization Type

Article 25 of the ECL, 6NYCRR Part 661: Tidal Wetlands
Article 15, Title 5 of the ECL, 6NYCRR Part 608: Protection of Waters
Article 15, Title 5 of the ECL, 6NYCRR Part 608: Water Quality Certification

Project Description: Mechanically excavate a channel across the beach to establish a flowing connection between Mecox Bay and the ocean. The channel will be of approximate dimensions 600 feet long by 10 feet wide by 4 feet deep. Up to 4,000 cubic yards of excavated sand will be stockpiled on the upper beach on the west side of the cut. The channel is necessary to relieve high water levels in Mecox Bay. The work shall be as shown on the attached sketch stamped "NYSDEC Approved 2/ 2 /18".

Finding That An Emergency Exists:
Based on the Department's review of the situation and the information provided by the Board of Trustees of the Freeholders & Commonality of the Town of Southampton, the Department has determined that this situation meets the definition of an emergency, **"an event which presents an immediate threat to life, health, property, or natural resources,"** as defined in the Uniform Procedures regulations, Section 621.12. There is currently a threat to human health and welfare on some properties around Mecox Bay due to the back-up or temporary failure of septic systems from the extraordinarily high groundwater levels associated with the high pond surface water level. The high pond water level / groundwater level is also causing the flooding of the basements of many homes in the watershed. In addition, recent precipitation events have lowered the pond's salinity to a level which stresses and has the potential to permanently damage commercially significant shellfish resources in the bay.

Accordingly, the Department hereby makes a finding that an emergency exists pursuant to Section 621.12 of the Uniform Procedures Act regulations due to the threat noted above.

The Department has determined that emergency action is necessary to protect the public welfare and health, and the natural resources of Mecox Bay.

Authorized and issued by:

George W. Hammarth
Deputy Regional Permit Administrator

Please note further that this Emergency Authorization is granted subject to the following conditions in accordance with Section 621.12(e) (2) of the Uniform Procedures regulations:

SPECIAL CONDITIONS

1. All activities authorized by this emergency authorization must be in strict conformance with the approved plans submitted by the applicant or his agent as part of the emergency authorization application.

2. The permittee must monitor the location and condition (width, average depth, alignment) of the open cut daily. If the cut does not close naturally within 15 days of the initial opening, the permittee shall assess the situation to determine whether the project goals (bay water levels lowered by 16-20 inches as determined by observation of the water level gauge/s in the bay and the increase of bay salinity to 16-20 parts-per-thousand) have been achieved every five days in consultation with DEC. If it is determined that the project goals have been achieved, or if the cut channel moves more than 150 feet off the center line of the approved alignment, the permittee shall use the material stockpiled from the cut opening and, if necessary, additional clean, beach compatible sand to close the cut channel.

3. It is the permittee's responsibility to obtain all other approvals or authorizations required for this project from federal, state and local agencies.

4. The project area provides vital reproductive habitat for listed species of beach nesting shorebirds such as the piping plover and least tern during the spring and summer. It is the permittee's responsibility to ensure that any stockpiles or other accumulations of sand resulting from this project are removed, with the beach graded to the slopes and the level of surface smoothness appropriate for the nesting of shorebirds by March 31, 2018.

This Emergency Authorization is issued for a 30-day period commencing on the effective date and ending at midnight on the expiration date. One, 30-day extension may be granted, if warranted.

As per 6 NYCRR Part 621, Section 621.12(i), a person who violates any term or condition of an Emergency Authorization will be ordered to perform any necessary restoration or mitigation of environmental damage resulting from that action.

Failure to comply with the terms and conditions of this Emergency Authorization will be considered a violation of Article 25 of the Environmental Conservation Law and its implementing regulations, 6 NYCRR Part 661; and Article 15, Title 5 of the ECL and its implementing regulations, 6NYCRR Part 608.

cc: USACE
USFWS
Wildlife
BOH-TW
File

N Y S D E C
APPROVED AS PER TERMS
AND CONDITIONS OF
PERMIT NO. 1-4736-03009/00030
DATE 2/2/18 [initials]

Purpose: Dredging Plan / Proposed Conditions

Adjacent Property Owners:
900-179-1-33: Alexander Lollins and Stuart Baker
900-179-1-39: Town of Southampton
900-179-1-34: Marcia and Richard Godosky
900-179-1-35: Joint Ownership
900-178-1-2: Ethel Horwitz
900-179-1-1: Burnetts Cove Association, Inc
900-179-2-2.1: Jay and Prudence Mortimer
900-179-2-15: Town of Southampton
900-179-2-18.1: Aura and Munro Bank

Dredge Channel with Access

0 — 400' — 800'

Scale: 1" = 400'

Client:
Board of Trustees of the Freeholders and Commonalty of the Town of Southampton
116 Hampton Road, Town Hall
Southampton, NY 11968

[illegible]

Name of Project:
Dredge Project

Location of Project:

In: Mecox Bay
County: Suffolk County
Applicant: Inter-Science Research Associates, Inc
PO Box 1201 Southampton, NY 11969
File: [illegible]

Sheet 3 of 4 Date: June 8, 2016

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Division of Environmental Permits, Region 1
SUNY @ Stony Brook, 50 Circle Road, Stony Brook, NY 11790
P: (631) 444-0365 | F: (631) 444-0360
www.dec.ny.gov

Amendment to Emergency Authorization of August 20, 2018

Scott Horowitz, Southampton Trustee
Board of Trustees of the Commonality of the Town of Southampton
116 Hampton Road
Southampton, NY 11968

September 4, 2018

Re: Mecox Cut Opening
DEC EA # 1-4736-03009/00036

Dear Mr. Horowitz:

The Department of Environmental Conservation (DEC) has reviewed your request to modify special condition # 2 of the Emergency Authorization which allows the temporary opening of the Mecox Cut inlet to the Atlantic Ocean. It has been determined that the proposed modifications will not substantially change the scope of the authorized actions or the existing special conditions. Further, limiting the period of the cut opening was intended to preclude tropical storms from causing any damage that would not have occurred if the cut were closed. Given that the tropical weather forecast today, Tuesday September 4, 2018, does not foresee any tropical storm effects reaching the project location within a week's time, DEC can agree that the cut may remain open for an additional seven days, beyond the originally approved 14 days.

Therefore, unless the tropical weather forecast changes substantially, special condition #2 is modified to allow the cut to remain open seven additional days. At the end of seven additional days the cut must be closed, if it has not closed on its own. The Trustees may request also request additional time at the end of the additional seven days.

All other terms and conditions remain as written in the original authorization. All involved are reminded that this Emergency Authorization expires September 19, 2018 and may be extended once for an additional 30 days, at the DEC's discretion. In order for the authorization to be extended the Town and the Trustees must request such extension seven days prior to the expiration of the EA.

Sincerely,

Roger Evans
Regional Permit Administrator

cc: USACE
USFWS
C. M. Gallagher, NYSDEC
DEC Wildlife
DEC BOH-TW
DEC Coastal Erosion Unit
Nica B. Strunk, Esq.