

## CONSTRUCTION OF A BREACH CLOSURE IN A BARRIER ISLAND

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### ABSTRACT

A breach was opened in the barrier beach along the south shore of Long Island, New York during a winter storm in January, 1980. Due to public safety and environmental concerns, a contract to close the breach using sand fill was awarded to a local contractor. This paper discusses the evolution of the construction procedures developed to allow the contractor to successfully complete the project on schedule and on budget.

### 1.0 INTRODUCTION

Moriches Inlet is located on the south shore of Long Island, approximately 130 kilometers (80 miles) east of New York City as shown on Figure 1. The inlet, which forms the primary outlet through the barrier island between Moriches Bay and the Atlantic Ocean, is stabilized by two stone jetties approximately 245 meters (800 feet) apart.

During January 1980, a severe northeast storm resulted in the breaching of the barrier island immediately to the east of the inlet. The breach, initially 90 meters (300 feet) in width, was probably the result of excessive erosion/washover from the bayside of the barrier island coupled with high waves and tides on the oceanside.

Tidal currents and wave action in the area resulted in the rapid growth of the breach until the fall of 1980 when, due to local concerns regarding exposure to storm induced flooding and effects on shellfish beds, construction was begun to effect its closure. At that time, the breach, shown in Figure 2, had expanded to nominally 885 meters (2900 feet) in width with an average depth of 3 meters (10 feet). The plan selected for the closure consisted of the placement of 1.2 million cubic yards of beach fill with a final crest elevation of +4 meters (+13.25 feet) MLW and side slopes of 1:25.

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The purpose of this paper is to discuss the development and implementation of construction procedures utilized to close the breach given the following criteria:

- minimize the loss of fill material placed in the breach
- minimize the time required to complete construction (maximum 6 months)
- allow construction to be accomplished primarily with land plant
- complete construction without creating any permanent structural modifications in the area

Monitoring of the inlet and breach area was conducted during construction activities to insure that these areas were reacting to the closure operations as expected. Several design modifications were instituted during construction as a result of these monitoring operations which contributed to the successful closure of the breach.

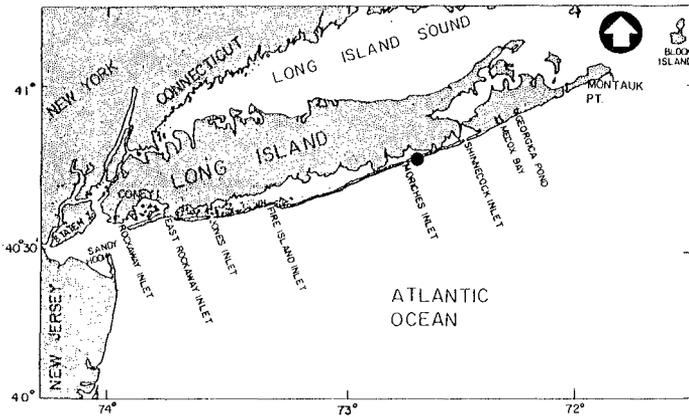


Figure 1 - Site Location



**Figure 2 - Breach Immediately Prior to Closure (7/12/80)**

## 2.0 SITE DESCRIPTION

Moriches Inlet is one of the five inlets through the barrier beach along the south shore of Long Island. Although the inlets and bays are interconnected, each inlet system functions relatively independently. Moriches Inlet primarily drains Moriches Bay from the Quantuck and Quogue Canals to the east to Narrow Bay to the west as shown on Figure 3.

Moriches Inlet has been opened and closed numerous times over the period in which records have been maintained (Reference 1). The present inlet was formed in 1931 as a result of a March storm. Between 1931 and 1947, the inlet migrated westward about 1220 meters (4,000 feet). A stone jetty was constructed along the west side of the inlet in 1947, in an attempt to stabilize it, however the inlet closed again during a storm in May, 1951.

The present stone jetties were constructed during 1952 and 1953, and extended in 1954. Despite the presence of the jetties, navigation through the inlet has been considered unsafe due primarily to the shifting shoals offshore of the inlet. The stabilized inlet has also experienced progressive erosion along the bay shoreline to the east of the jetties, as shown in Figure 4. This erosion was noted in a 1958 U.S. Army Corps of Engineers review of the inlet and has been described numerous times since then as the erosion became more pronounced, culminating in the breach during the January, 1980 storm.

Environmental conditions along the ocean shoreline in the vicinity of Moriches Inlet are typical of the entire south shore of Long Island. Nearshore wave heights average nearly 0.7 meters (2.3 feet) with maximum heights of approximately 4.1 meters (13.5 feet) (Reference 2). The lowest wave conditions occur during the months of May through September. Peak wave heights typically occur in February and March. Wave periods typically average between 4 and 7 seconds.

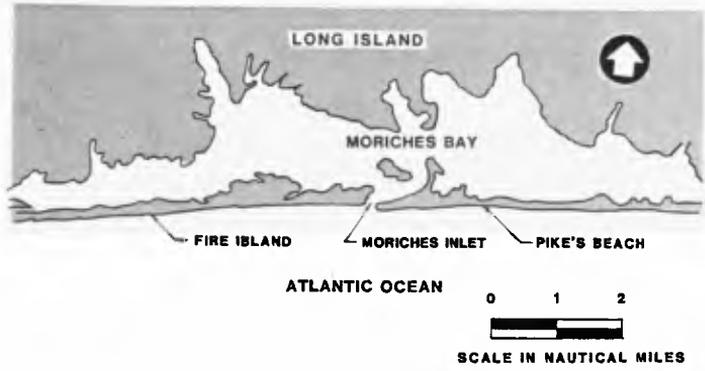


Figure 3 - Site Plan



Figure 4 - Erosion Along Pikes Beach (2/70)

Current velocities in the breach were estimated to be up to 5 feet per second prior to the start of closure operations. Current and bathymetric conditions were monitored during closure operations to assist in the development of the final closure procedures. The monitoring program and an analysis of inlet and tidal prism changes are the subject of a separate paper (Reference 3). Current velocities measured during closure operations ranged from zero during slack tide to over 1.7 meters (5.5 feet) per second at peak conditions.

Longshore transport in the inlet area is predominantly from east to west. The littoral transport rate averages over 300,000 cubic yards per year.

### 3.0 ALTERNATIVES CONSIDERED

A number of alternative procedures were considered to effect closure of the breach within the constraints identified above. Additional constraints considered in evaluating alternatives included:

- material sources were 600,000 cubic yards from bay dredging and 600,000 cubic yards from an upland source
- the contractor had a considerable quantity of PZ-27 steel sheet pile in varying lengths available for use

Preliminary options investigated included:

- placement of fill with no temporary retaining structures
- use of concrete pipe temporary retaining structures
- use of barges to retain the fill temporarily
- use of steel sheet pile temporary retaining structures

The initial option of placement of the sand fill with no temporary retaining structures included placement of the upland fill material along the ocean and bay sides of the breach to act as retention dikes for the dredged sand. The intent of this placement procedure was to provide protection for the dredged sand from severe erosion while it was in a slurry state. This option was discarded due to the expected high loss of fill even considering the special placement of materials proposed.

The second option evaluated for closure involved the use of scrap concrete pipe as a temporary retention dike for the sand fill. The concrete pipe was available in lengths ranging from 2.4 to 3.6 meters (8 to 12 feet) and diameters to 1.5 meters (60 inches). Several alternatives were developed to effect closure using the concrete pipes including placement in horizontal and vertical configurations to retain the sand fill. An additional alternative called for placement of the concrete pipes parallel to the currents and was intended to reduce the potential scour of the bottom as the breach was closed by providing culverts for the flow and scour protection. A controlled cutoff of the flow could then be effected by placing pipes to close off the culverts providing a quiet area to place fill. All alternatives involving the use of concrete pipes were ultimately discarded due primarily to the cost of transporting the pipes to and from the project site.

A third option evaluated consisted of sinking barges in the breach area to stop the current flow and allow placement of the sand fill. This option was discarded primarily due to the shallowness of the breach area which would require dredging to move the barges into position. In addition, due to the scouring of the bottom causing settlement of the barges as well as placement of fill along one side, it was felt that difficulties would be experienced in raising the barges at the conclusion of the project.

The fourth option investigated was the use of steel sheet piles driven to act as a retention wall for the fill during placement. Two basic alternative schemes utilizing the steel sheeting were developed and evaluated. The first, consisted of two single rows of sheet piles driven along the ocean and bay sides of the breach to effectively seal off the fill. Several potential problems were envisioned which caused this alternative to be discarded. These were:

- exposure of the sheet pile wall to ocean waves causing stability problems and scour at the toe
- scour of the sand fill placed between the widely separated walls due to currents moving around the ends of the sheet pile walls and by direct wave attack from the southwest

In response to these concerns, a second sheet pile alternative was developed. This alternative, shown in Figure 5, consisted of two parallel rows of sheet pile driven approximately 30 meters (100 feet) apart along the bay side of the breach. The advantages of this alternative were felt to include:

- control of tidal currents in the fill area
- potential for trapping a portion of the predominantly westward littoral drift
- protection for most of the retaining structure from wave attack
- protection against complete loss of the placed fill material in the event of a storm during construction

This alternate was eventually selected for use in the closure operation.

In an effort to further minimize fill loss it was decided to place the fill material from upland sources between the sheetpile dikes and along the ocean side of the breach. Dredge fill would then be placed between these two protective arms forming the center of the closure.

During final selection of the construction alternative, concerns over the stability of the cantilever sheet pile retaining walls under construction loads and the effects of scour along the bayside were addressed. Stability calculations were made to determine minimum setback distances for equipment operating within the sheet pile walls as well as the maximum tolerable scour along the bayside. In an effort to control this scour and enhance the stability of the retaining wall, short sheet pile "spurs", as shown on Figure 5, were proposed to be driven at right angles to the main wall on the bay side.

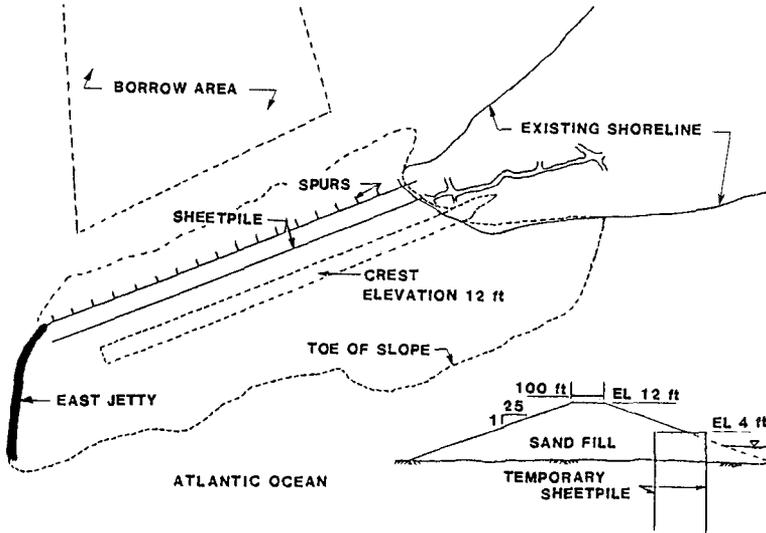


Figure 5 - Selected Construction Plan

4.0

CONSTRUCTION PROCEDURES/MONITORING

Construction operations began in early October ,1980. Initial operations consisted of cutting and stabilizing a haul road over the dunes leading to the construction site and moving in equipment and sheet piles. Placement of fill material from upland sources and driving of sheet pile walls commenced on October 10. Figure 6 is an aerial view of the construction site made on October 12, showing a short section of the sheet pile wall in place and the beginning of a sand bar along the ocean side of the closure. This bar was in evidence throughout the closure operations and seemed to be due to the entrapment of the westward littoral transport. In any event, the bar migrated westward as closure operations progressed and provided additional protection from the ocean waves to both the fill material and the exposed portions of the sheet pile wall.

Placement of the sheet pile walls was accomplished using a Link Belt 138, 70 ton crane fitted with a vibratory hammer as shown on Figure 7. Construction operations were able to be continued during most weather and sea conditions although at several times the safety of the construction crew guiding the sheet piles into position required shutdown of these activities as shown on Figure 8.



**Figure 6 - Initial Construction (10/12/80)  
(note sheet pile retaining walls)**



**Figure 7 - Pile Driving Equipment**



**Figure 8 - Pile Driving Activities in Rough Conditions**

Monitoring of the closure operations was conducted based on periodic field surveys as well as reports from construction foremen onsite. Of primary concern were the stability of the bayside sheet pile wall, reaction of the open portion of the breach as closure operations progressed and stability of the exposed east jetty. As shown on Figure 9, a deep channel began to form adjacent the east jetty as the closure was affected. Current measurements obtained during this period indicated that the primary flow was being shifted back to the original inlet, however significant currents were still being experienced in the breach. As discussed below, the changes in this section were closely monitored to attempt to prevent any further deterioration of the east jetty.

Additional concerns were identified during soundings made along the bayside of the sheet pile wall by the construction crew, indicating significant scour occurring along one section of the wall. A site visit by the engineers indicated that the sources of the problem were twofold involving both the spacing of the sheet pile spurs and the location of the sand bar on the bayside of the wall. As shown in Figure 10, the sand bar was causing flow from the Bay Channel to pass along the sheet pile wall. To alleviate this problem, the dredge was instructed to cut a channel through the sandbar to allow flow from the Bay Channel to move into the old inlet and spacing of the spurs was reduced in this area.

Final closure operations were begun in the beginning of December. As shown on Figure 11, the tidal currents were primarily moving in and out of the bay through the old inlet, due in part to the cut made by the dredge through the sand bar. To further channel the flow into the inlet a long spur was constructed to deflect the ebb tide away from the breach. These procedures worked as sand began to naturally accumulate in the remaining breach opening and closure operations were completed with no further difficulties on December 15.

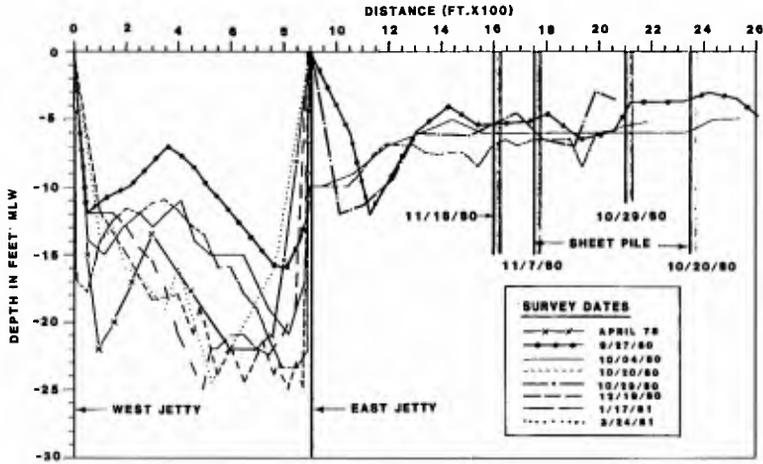


Figure 9 - Cross Section Changes During Construction



Figure 10 - Construction Progress (12/4/80)

Placement of sand from upland sources and by dredging continued until mid January, 1981. The sheet pile walls were also removed during this period and all construction activities were completed by the beginning of February 1981.



**Figure 11 - Preparations For Final Closure (12/4/80)**

#### 5.0 CONCLUSIONS

As a result of the construction procedures developed in this study, the breach in the barrier island was closed utilizing primarily land based plant supported by dredging conducted in relatively protected areas. Despite working during a typically stormy portion of the year, construction delays due to weather were minimal. The closure of the breach was effected nominally 2 months after startup of construction and the overall project was completed within 5 months of startup.

Losses of material were limited to approximately 15 percent of the gross volume of material placed at the site. These losses included those experienced during a storm which occurred several weeks after closure operations began. This storm had a return period of slightly over two years and caused some damages to the exposed sheet pile walls as well as loss of fill. Most observers agreed, however, that without the sheet piles, the majority of the fill placed would have been lost.

Close cooperation between the engineers and contractor allowed procedural and design changes to be made as site conditions changed. This cooperation contributed to the timely and successful completion of the project within the constraints of the owner and the contractor.

## 6.0 ACKNOWLEDGEMENTS

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