

# Bathymetric Sediment Traps In New York Harbor

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## Introduction

Hoffman and Swinburne Island rest in the Lower New York Bay, about a mile from Staten Island (Figure 1). Both islands were made artificially in 1873 for multiple purposes, such as to hospitalize sick immigrants before going to Ellis Island for entry, as well as a place to quarantine patients during the United States cholera epidemic from 1910-1911 and cremate the deceased (Swinburne specifically). They were then adapted to house soldiers during World War II and as a training ground by the United States Merchant Marine in 1938. In 1947 both islands were then abandoned, and now managed by the Staten Island Unit of the Gateway National Recreation Area. Both islands are deserted and now nesting grounds of the snowy egret, black-crowned night heron and the great black-backed gull. The islands have also recently as of 2001, been discovered to give a habitat to Harbor Seals that have been recovering in population after decades of absence in the New York Harbor.

The sediments of the Lower Bay are range from coarse sands in the central Bay with finer sediment found along the coast of Staten Island (Coch, 2016). The Bay floor around these islands are sands and sandy clayey silts (Coch, 2016). Borrow pit in the Harbor floor off Swinburne Island was dredged to provide sand for construction between 1950 and 1976 (Bokuniewicz 1988) leaving a borrow pit about 6 m deep with high relief (Figure 2). In 1981, the maximum depth of the pit exceeded 12 m and about 0.5 m of mud had accumulated on the pit floor. Although the surrounding sea floor was sandy, the pit was subject to anomalously rapid, disequilibrium accumulation of fine-grained sediment. The thickness of mud measured in cores in 1979, 1981, and 1982 showed an average sedimentation rate of about 4.7 cm/yr. The mud substrate, created by this pit amid an otherwise sandy sea floor, would have altered the benthic ecological community of the Lower Bay.

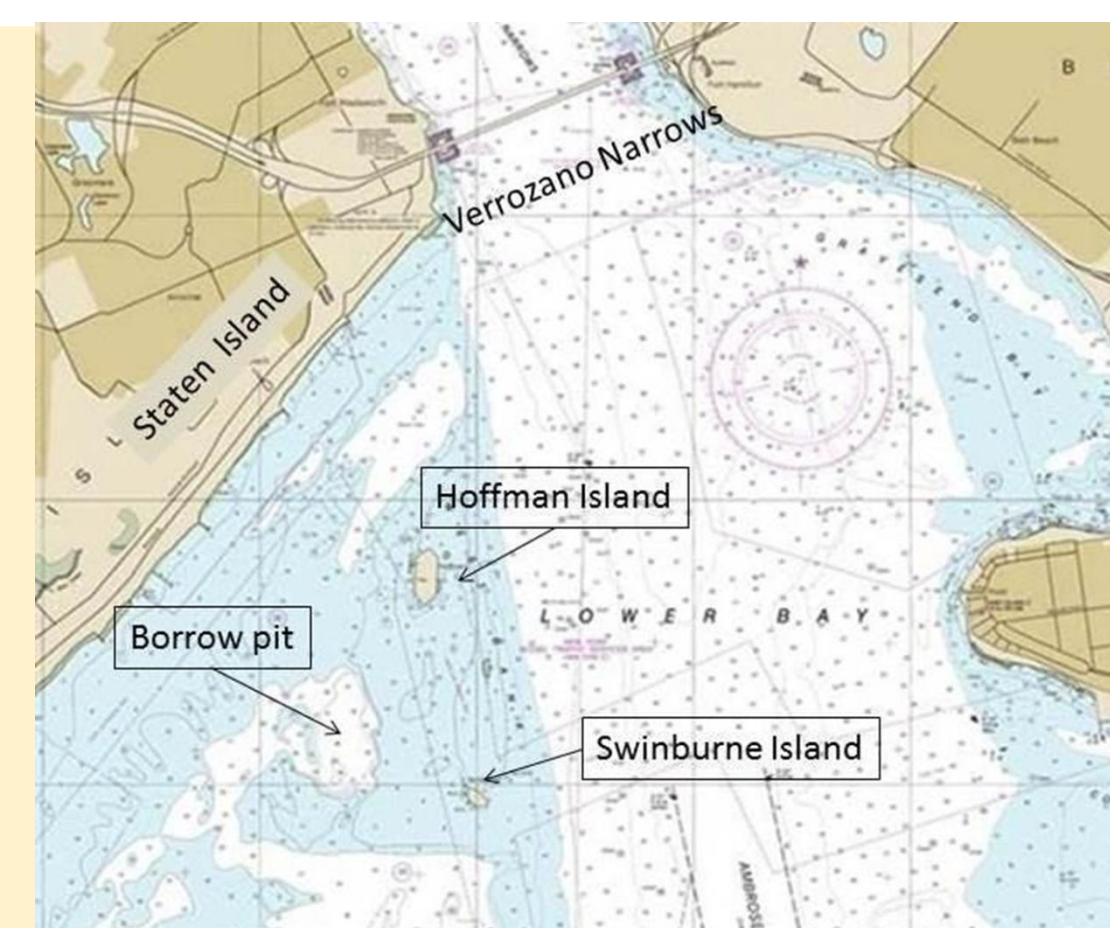


Figure 1: Map Hoffman and Swinburne islands in Lower Bay of New York Harbor bay

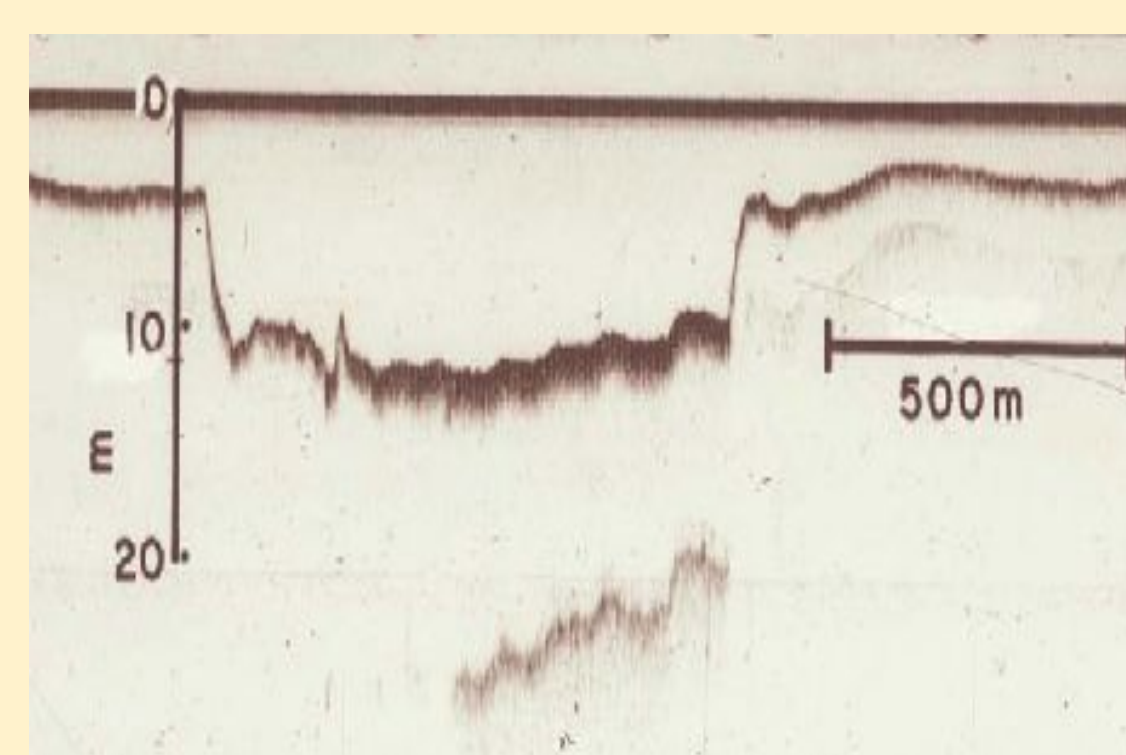


Figure 2: 1981 depth profile over the Hoffman-Swinburn borrow pit.

## Goals

In 2018, the borrow pit was re-surveyed in order to detect changes that may have occurred over a fifty-year period.

## Methods

Surveys were done from the Harbor School's R/V *Privateer* (Figure 3) On 1 December, 2018 The bathymetry was recorded with a Raytheon DE-735A and positions were determined underway with a Trimble Geo XT 2005 (Figure 4). Water depths were measured to the nearest foot (0.3 m) and corrected for the tide. Locations recorded in UTM (18N) coordinates.

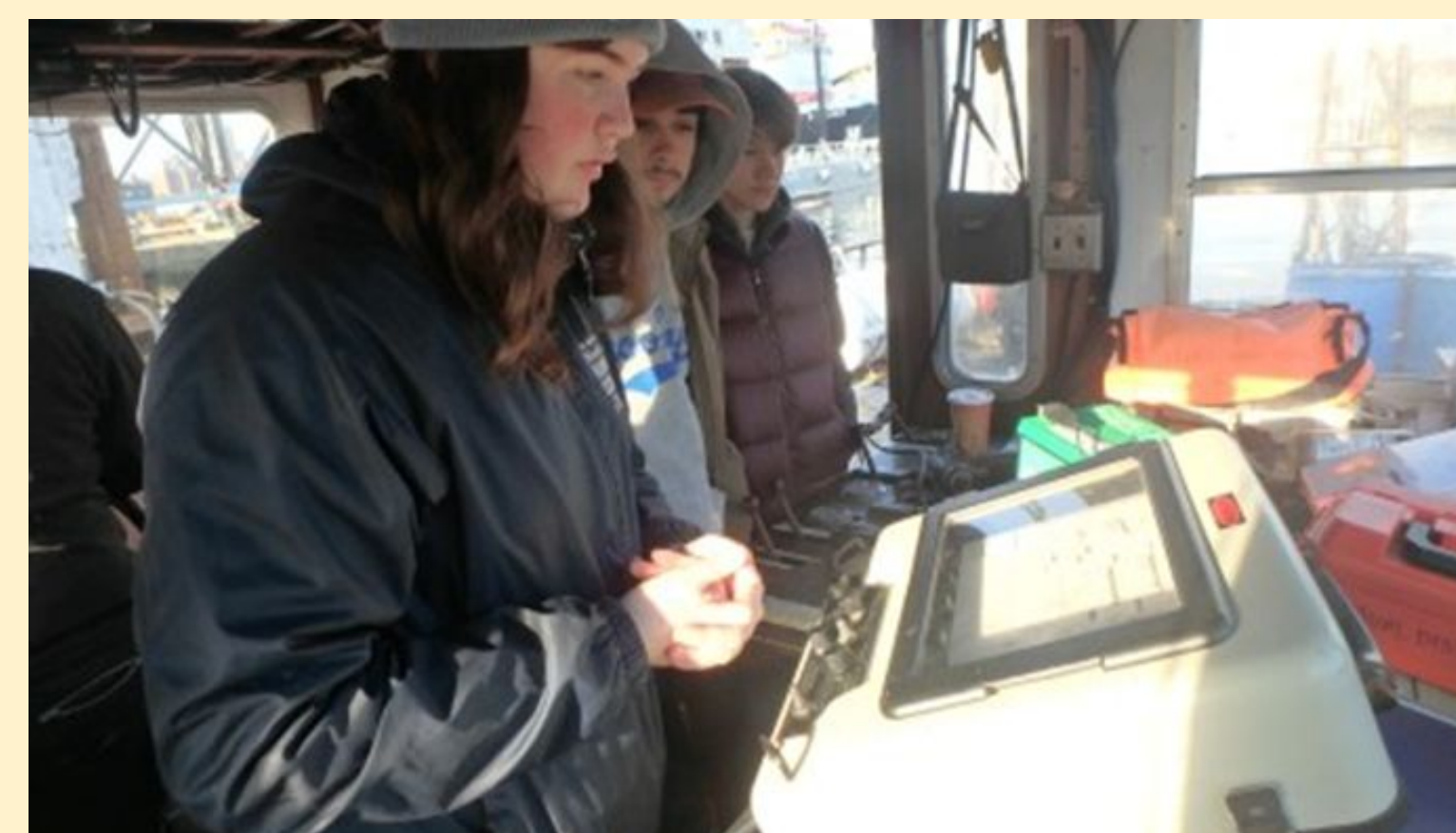


Figure 3: (Front to back) Emily Lysakova, Nicholas Ring, and Jonah Florholmen-Bouman calibrating the Raytheon DE-735A on the R/V Privateer.



Figure 4: R/V Privateer.

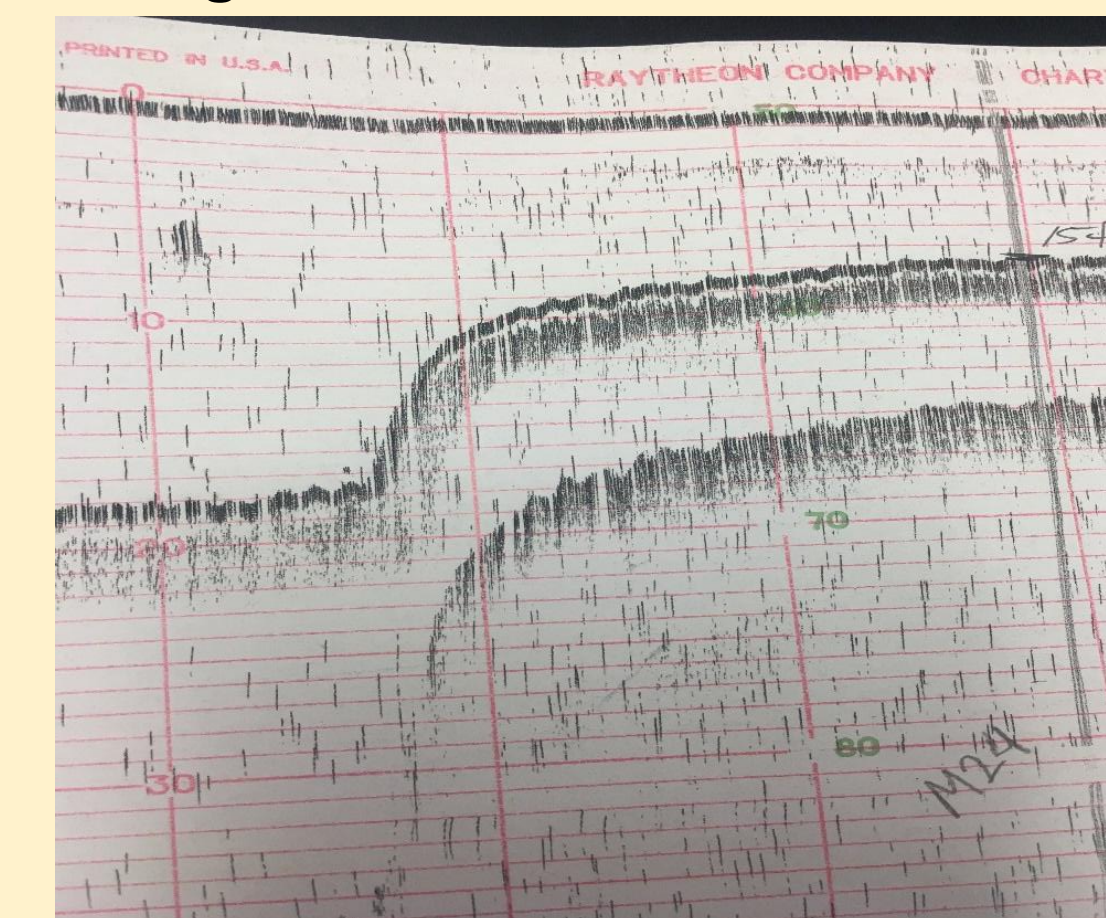


Figure 5: Fathometer record between mark 23 and mark 24 of the Hoffman Swinburne Survey.

## Results

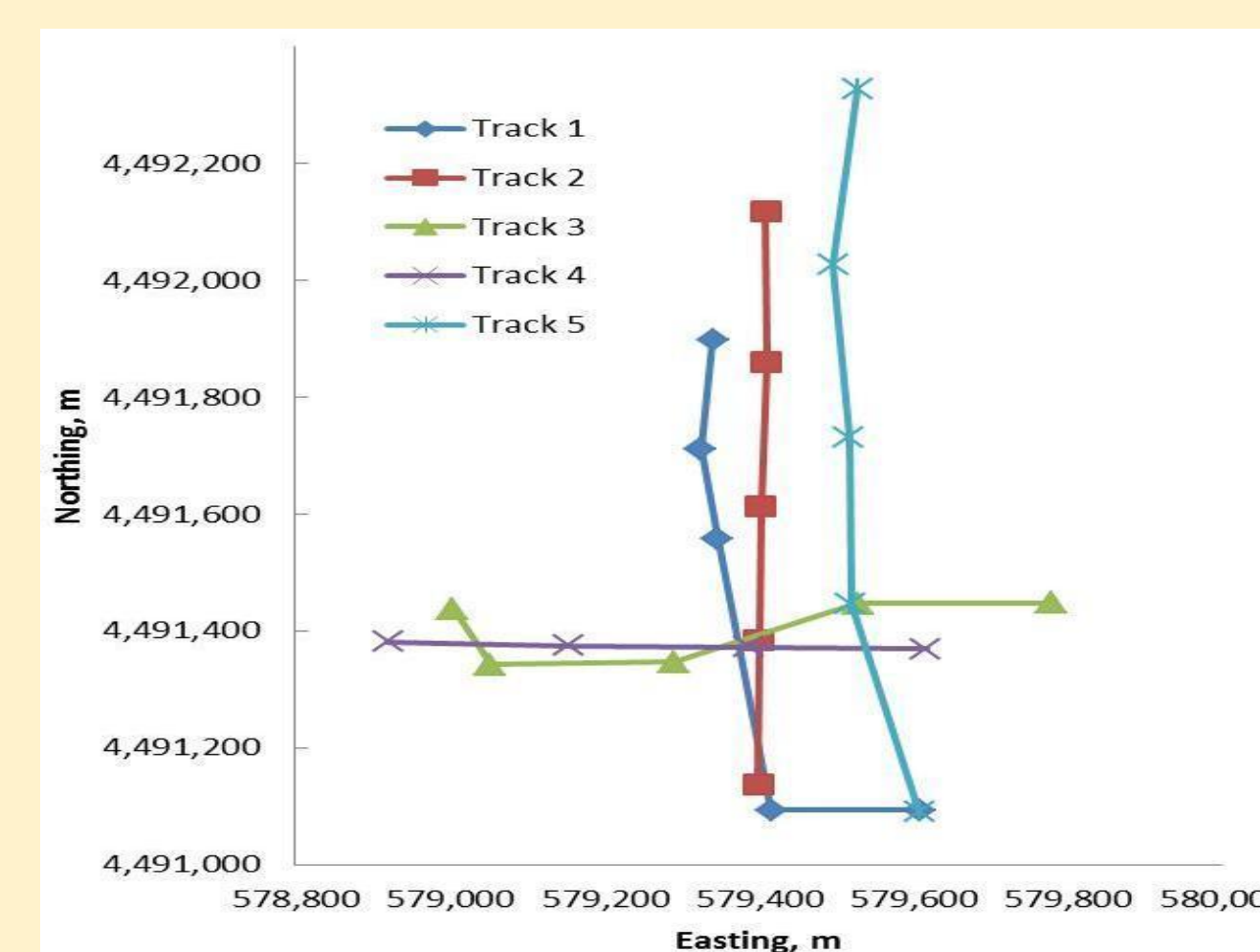


Figure 6: Bathymetric survey lines run on 1 December 2018. UTM coordinates 18N.

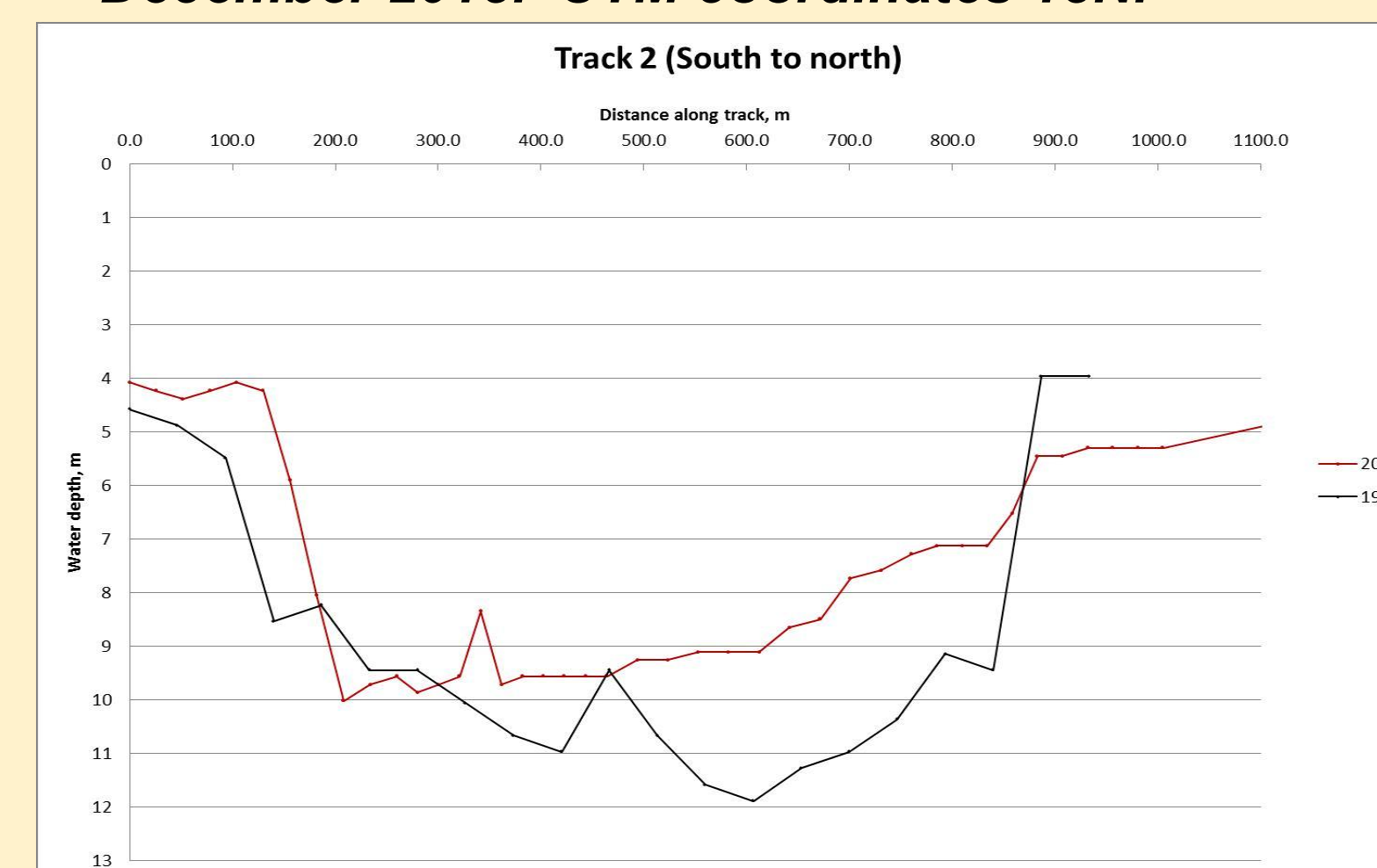


Figure 7: Comparison of depth profiles from previous survey in 1979 to 2018 along Track 2.

Six bathymetric survey lines were run through the area (Figure 5). Three of these were in the north-south direction and three on the east-west direction. In 2018, our survey results showed that as much as two meters of addition mud had accumulated by 2018, corresponding to a long term deposition rate of about 5.1 cm/year (Figures 6 and 7). These values are in good agreement with the earlier (1981) estimate of 4.7 cm/yr. Based on the strength of the acoustic reflection, the pit floor appeared to be muddy.

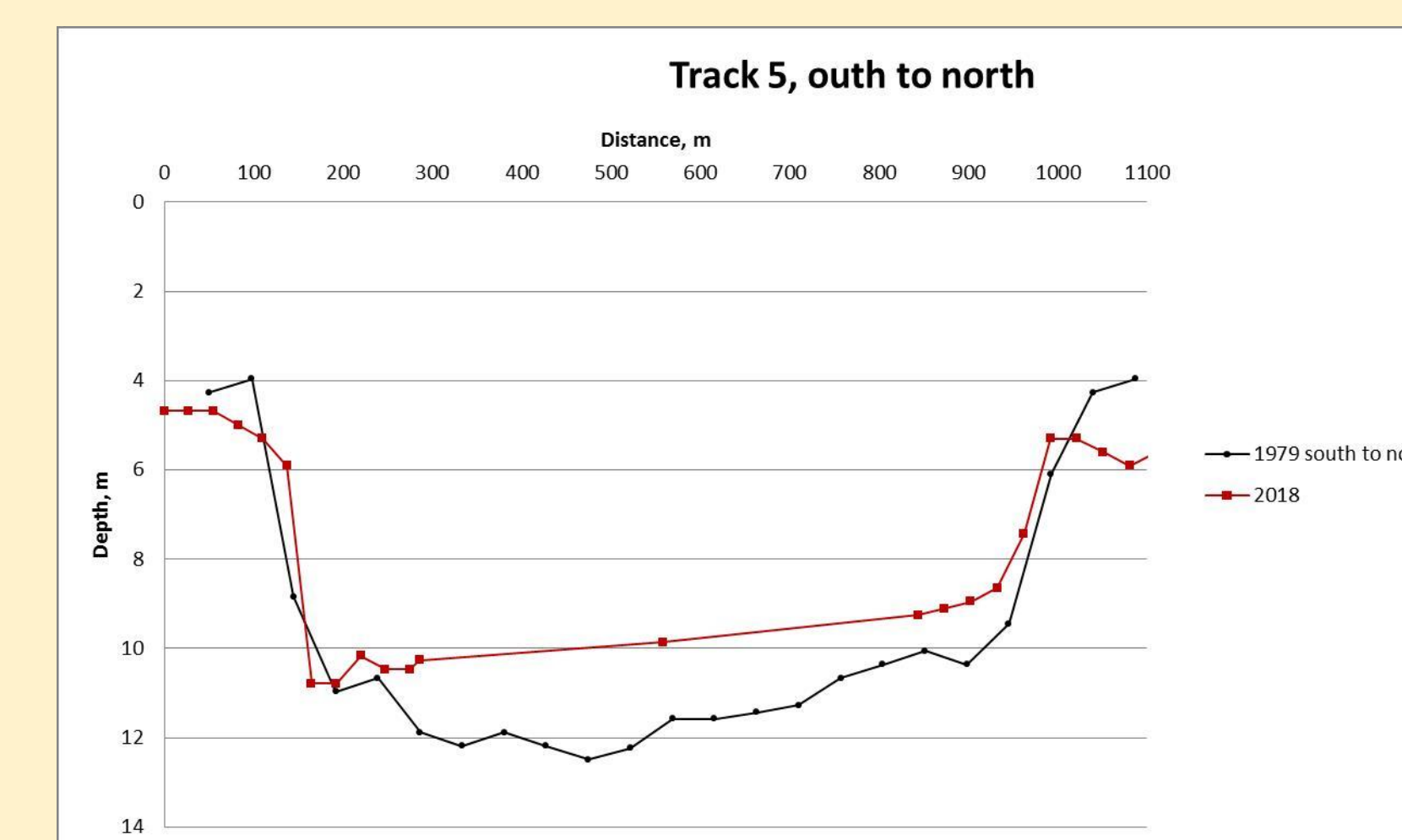


Figure 8: Comparison of depth from previous survey in 1979 to 2018 along track 5.

## Discussion

The rapid deposition of mud has continued within this artificial bathymetric feature while the surrounding sea floor remains sand. The benthic communities inhabiting these different substrates were found to be opportunistic species in 1982, distinct from those established communities on the surrounding, sandy sea floor (Cerrato and Scheier, 1984). The change in habitat caused by the excavation of sand appears to be a persistent one and should be expected to also have occurred in other dredged borrow areas in the Lower Bay.

## Conclusion

The bathymetric relief caused by the borrow pit has continued to trap fine-grained sediment. This feature and others like it in the Lower Bay appear to be permanent habitat alterations.

## References

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- Coch, N.K. 2016. Sediment Dynamics in the Upper and Lower Bays of New York Harbor, Journal of Coastal Research: 756–767.
- Cerrato, R and F.T. Scheier, 1984. The effects of borrow pits on the distribution and abundance of benthic fauna in the Lower Bay of New York Harbor, Stony Brook University's Marine Sciences Research Center Special Report 59:315pp.

## Acknowledgments

Our thanks are due to Captain Mike Abegg and Gino Santana of the R/V *Pioneer* as well as Kyle Walter Nicholas Ring from Stony Brook University and Jonah Florholmen-Bouman from the Harbor School. We were fortunate to have the guidance of Dr. Mauricio Gonzalez and Henry Bokuniewicz.