

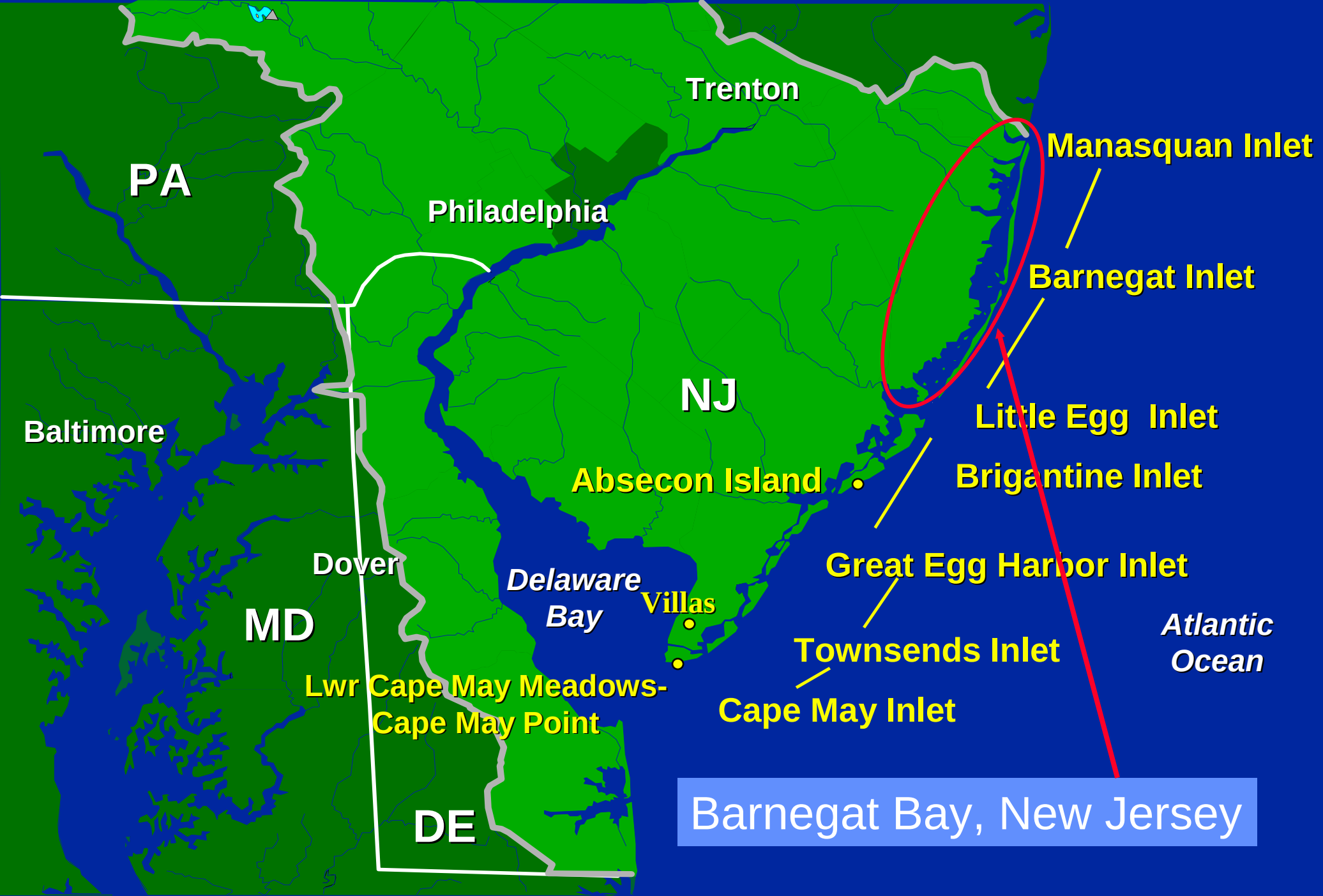
US Army Corps
of Engineers
Philadelphia District

May 2, 2006

Subaqueous Borrow Pit
Research and Management

Barnegat Bay, NJ

Environmental Restoration of
Dredged Holes

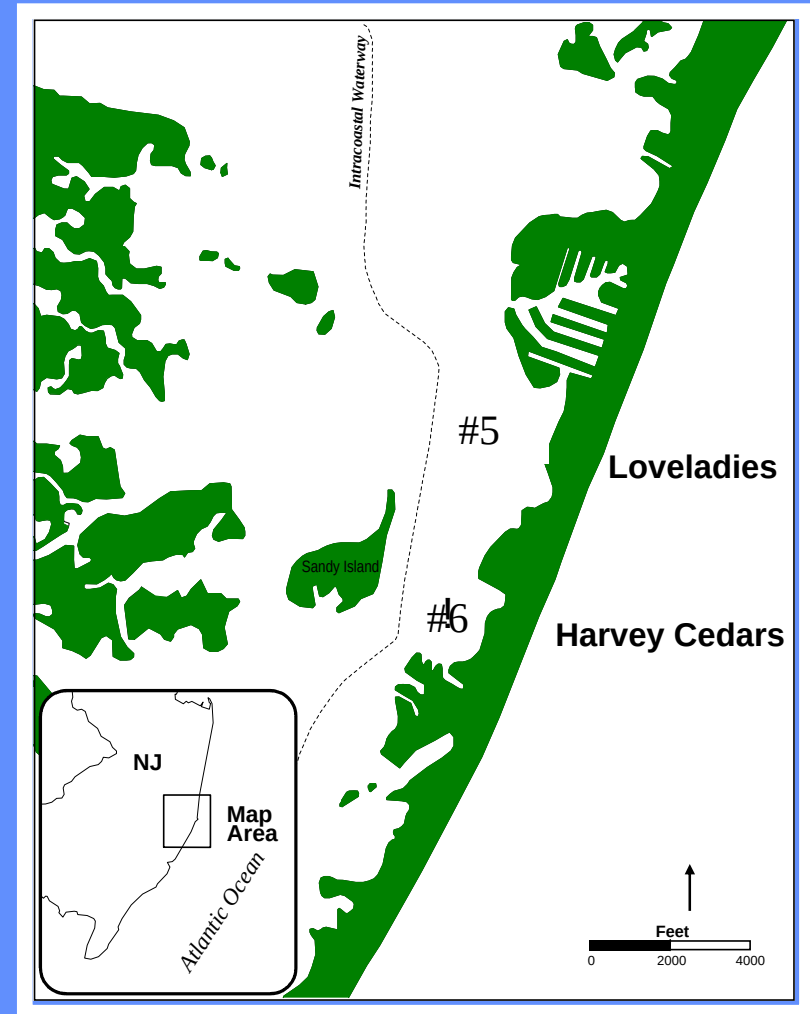


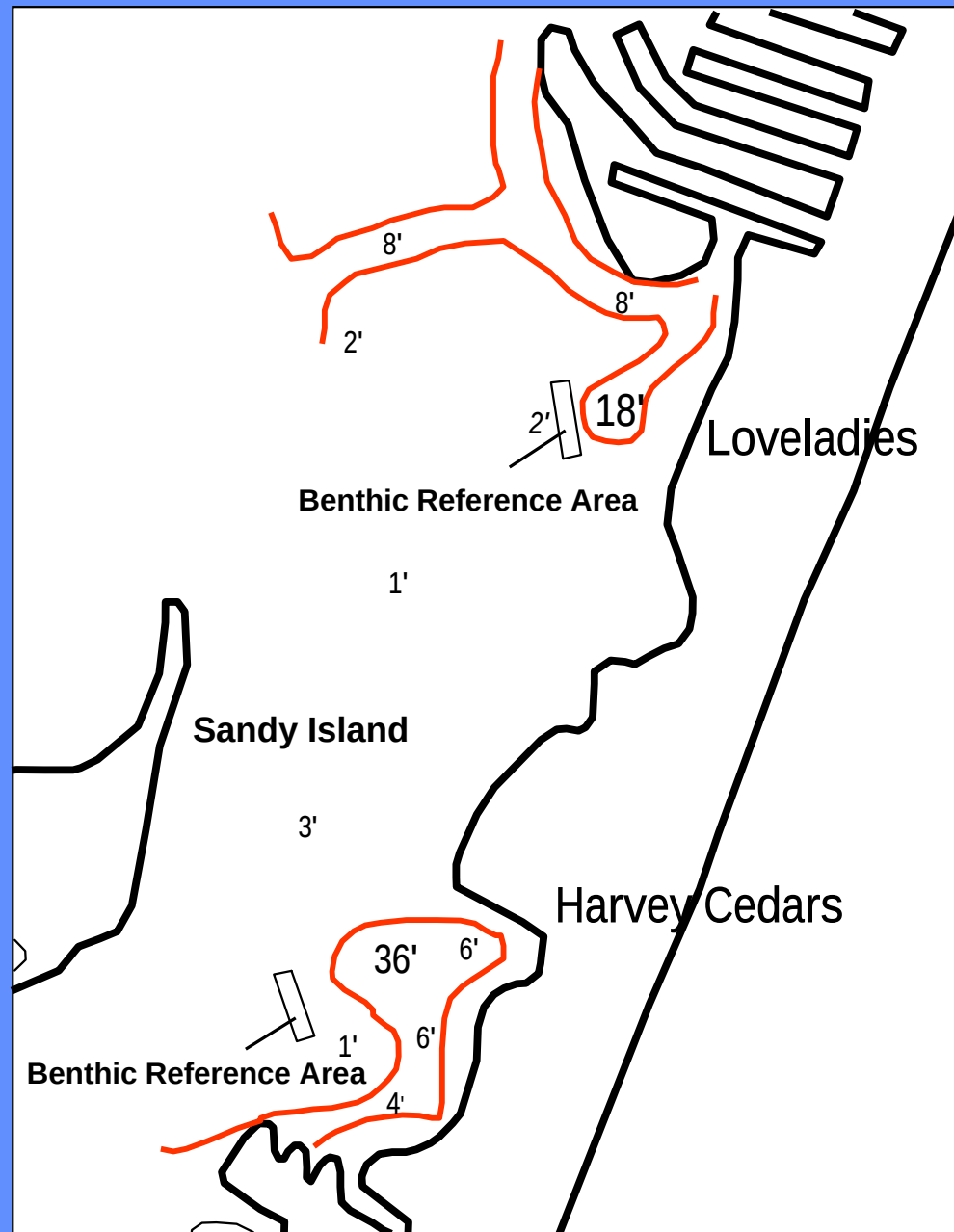
Introduction

- At least 21 holes created in Barnegat Bay when sand was mined for construction fill or hurricane damage fill
- Historical NJDEP studies suggested that dredged holes in Barnegat Bay may have poor habitat
- NJDEP identified the Loveladies (Hole #5) and Harvey Cedars (Hole #6) dredged holes as having good restoration potential
- Studies were conducted in 1999 and 2000 to determine the water quality and ecological condition of the holes

Major Study Elements

- Water quality monitoring
- Summer, fall, winter fish and crab survey
 - trawls, gill nets, crab dredge
- Benthic invertebrate survey
 - deep (18-36)
 - intermediate (8-18)
 - shallow(0-8)





Water Quality Results

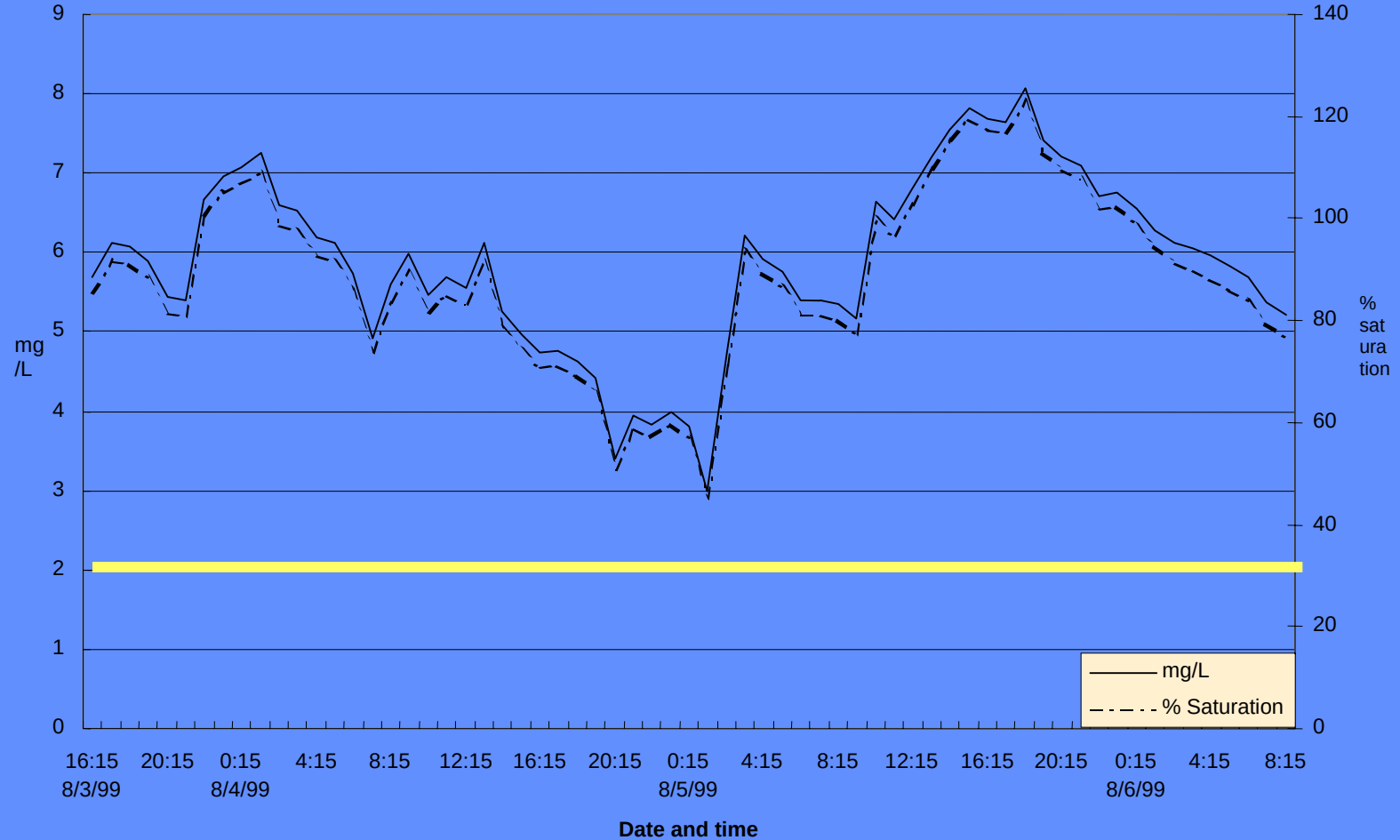
Series 3 Water Quality Multiprobes and Displays

DataSonde® 3 and H2O® Multiprobes

Durable, easy to use, high-performance multiprobes for surveys, profiling, remote or unattended monitoring of primary water quality parameters in fresh, salt, ground, and waste waters to 200 meters.



Hole 5
Dissolved Oxygen



**Yellow line indicates where hypoxic levels start
DO monitored one-meter from the bottom**

Hole 6
Dissolved Oxygen

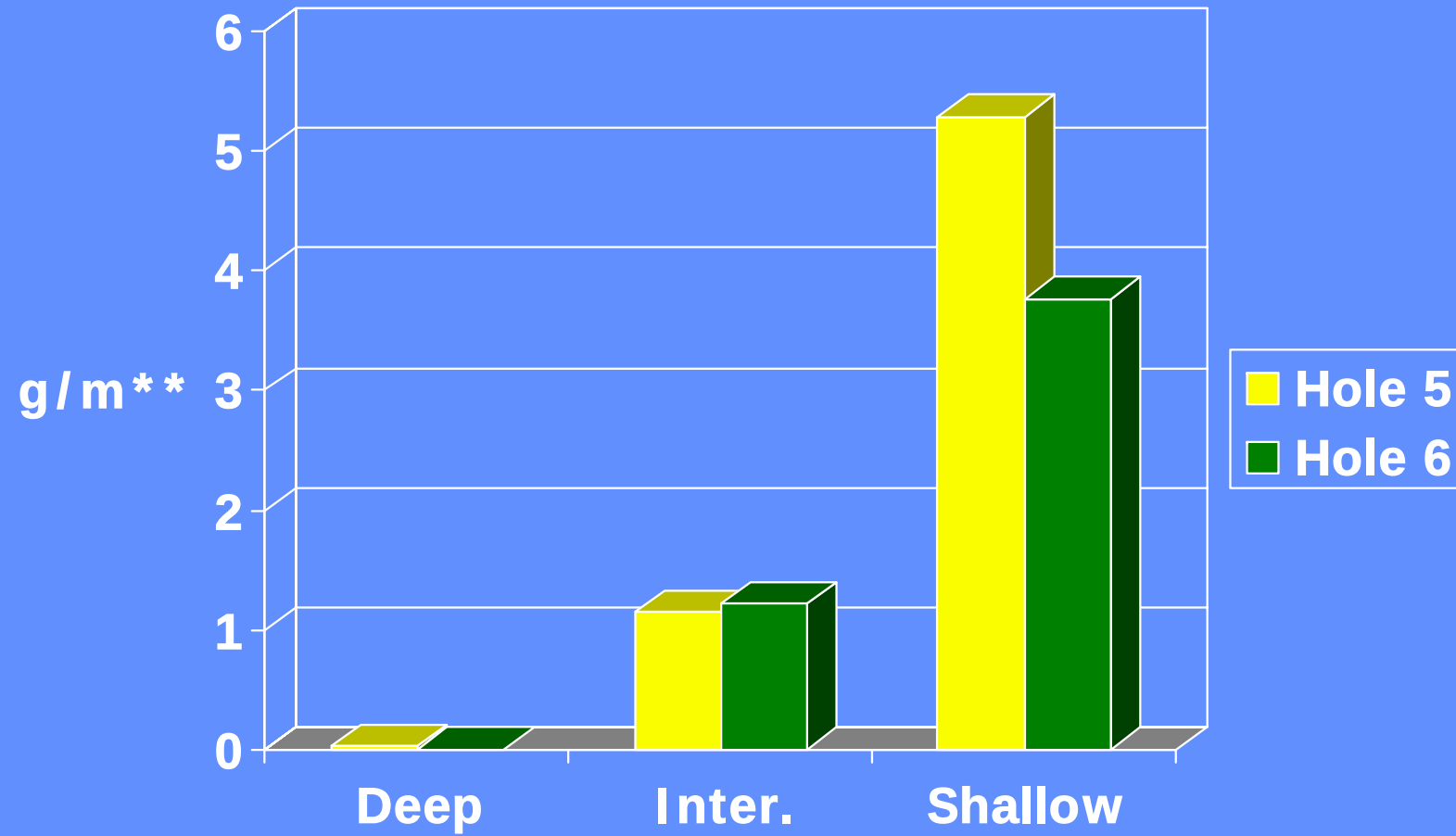


**Yellow line indicates where hypoxic levels start
DO monitored one-meter from the bottom**

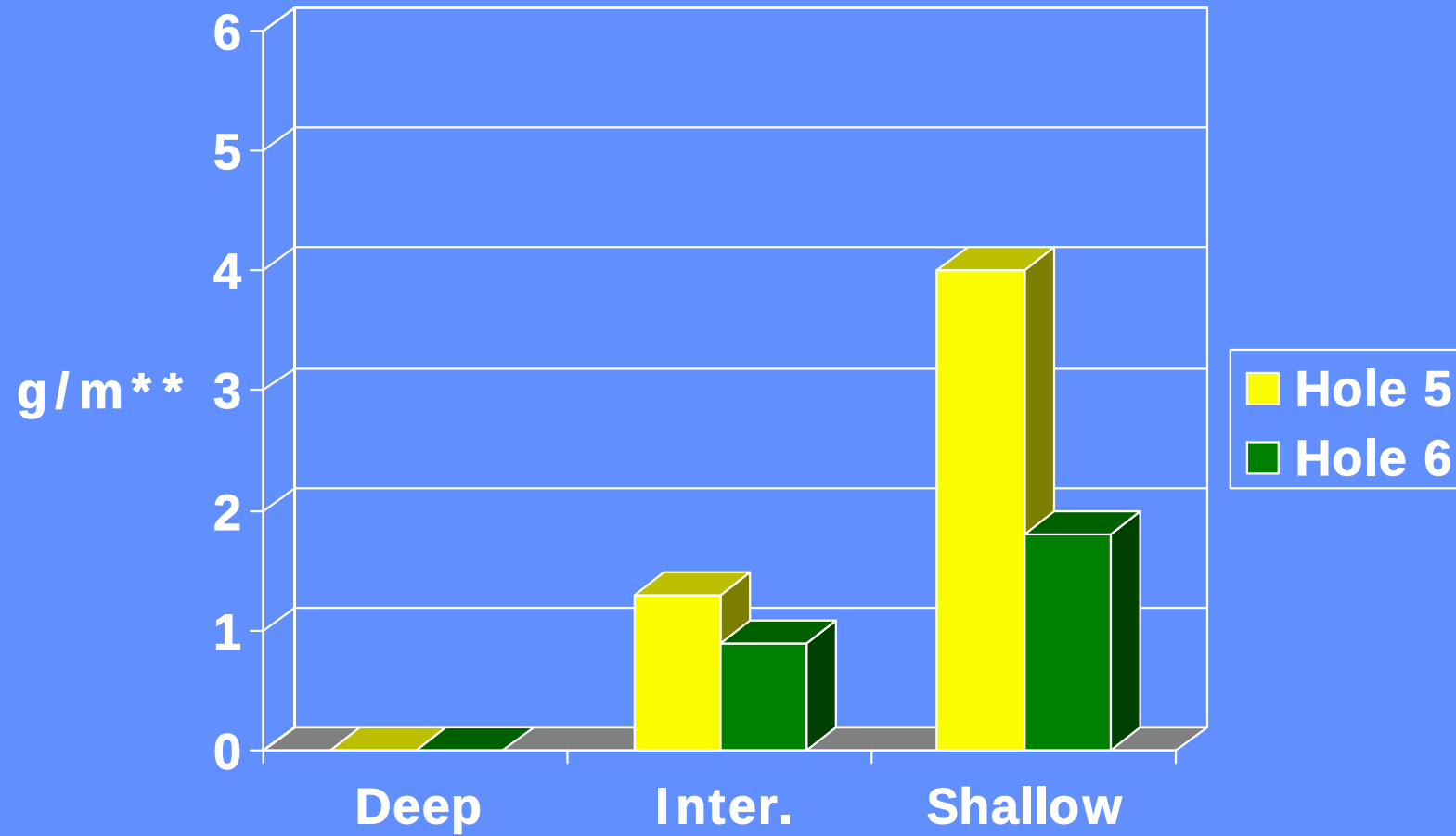
Benthic Survey Results

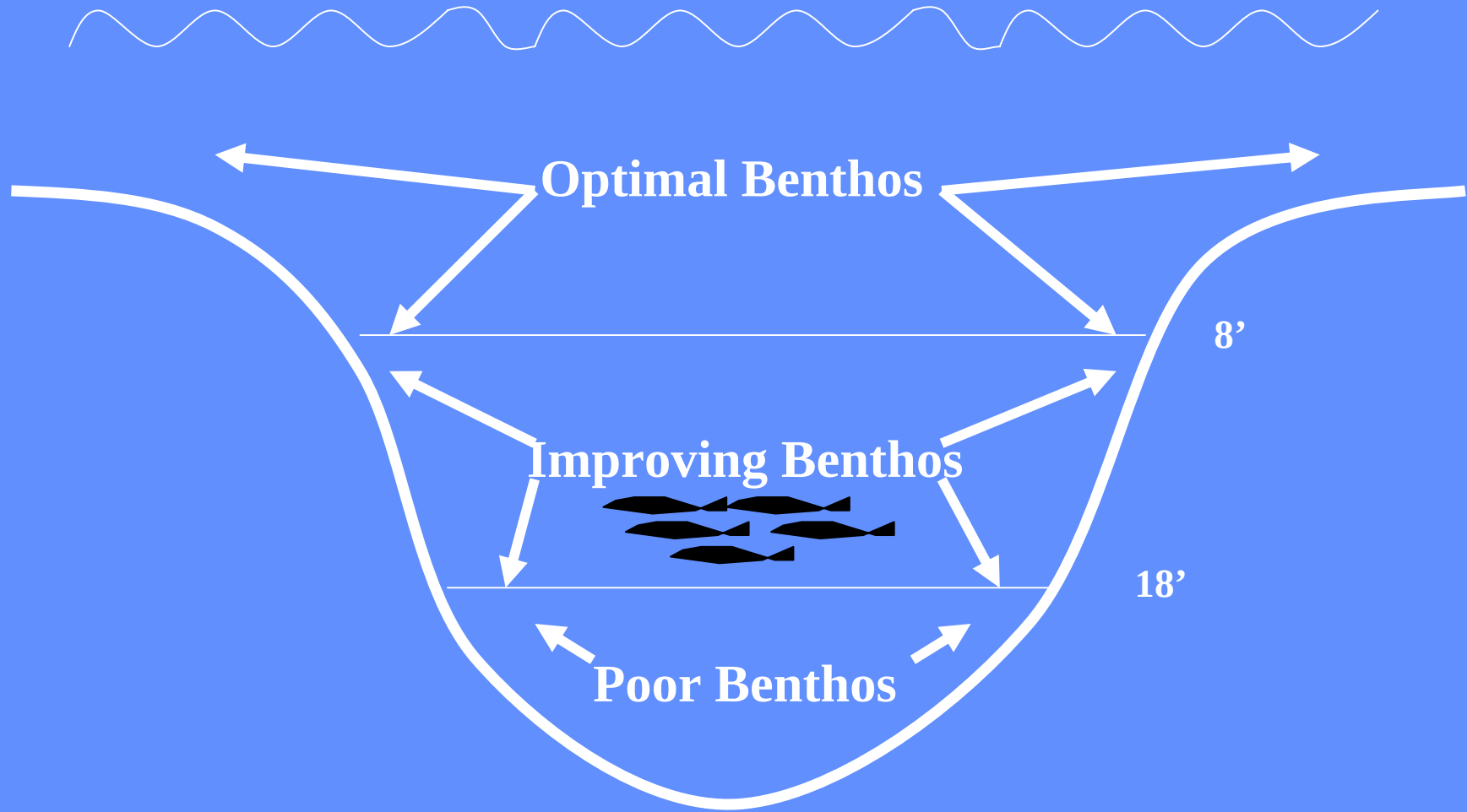


Spring Biomass



Summer Biomass





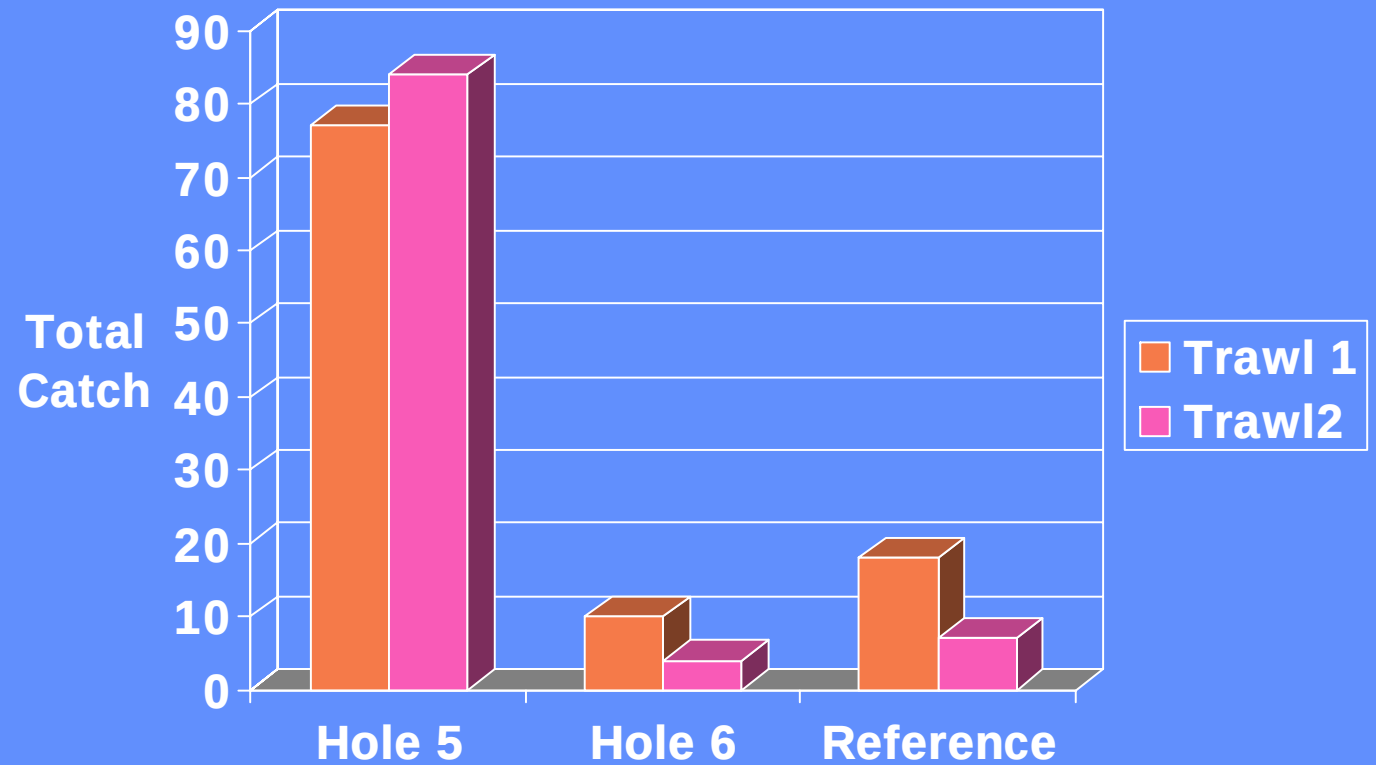
Fish Survey Results



SUMMER SAMPLES

16-Foot Otter Trawl Results

Juvenile Weakfish



Fall and Winter Samples

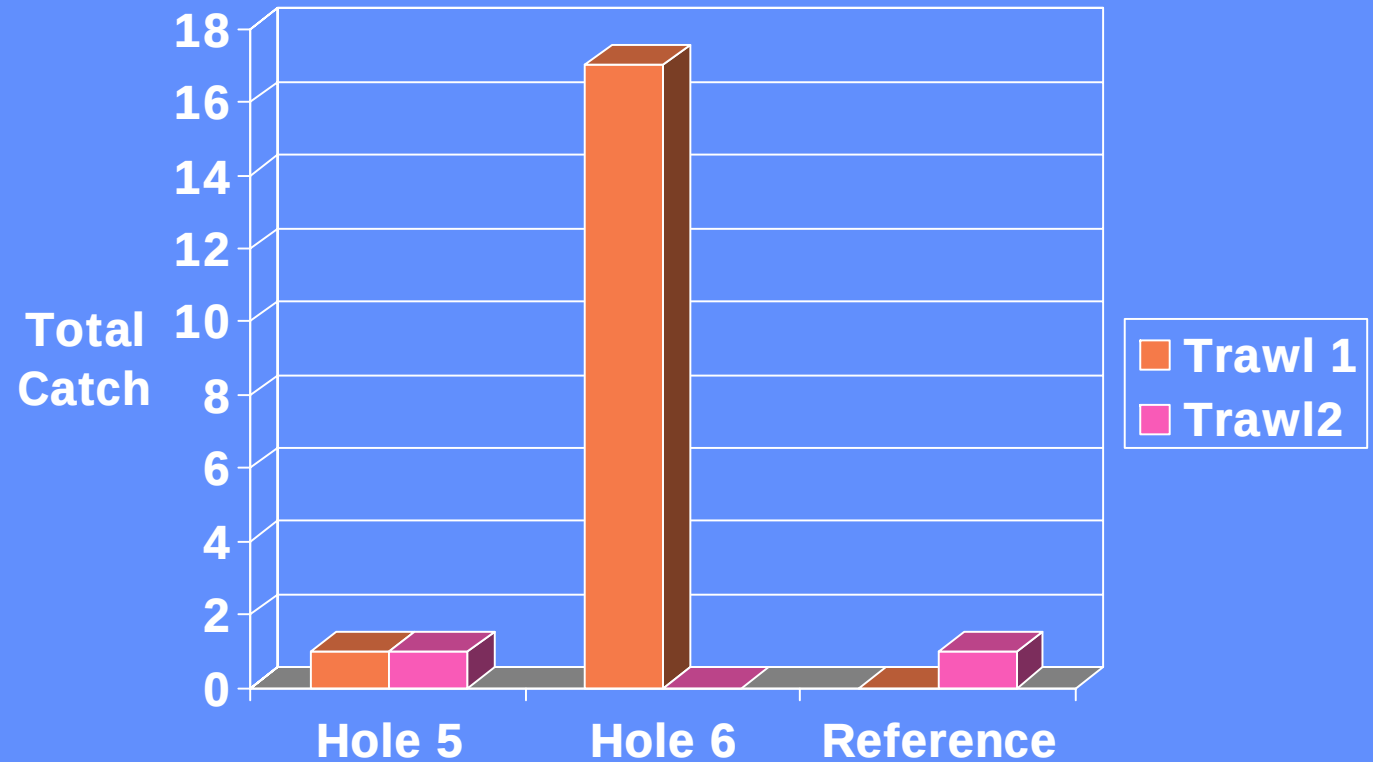
- Trawls
- Gill nets
- Crab Dredging
- Barnegat Bay and two other holes



FALL SAMPLES

16-Foot Otter Trawl Results

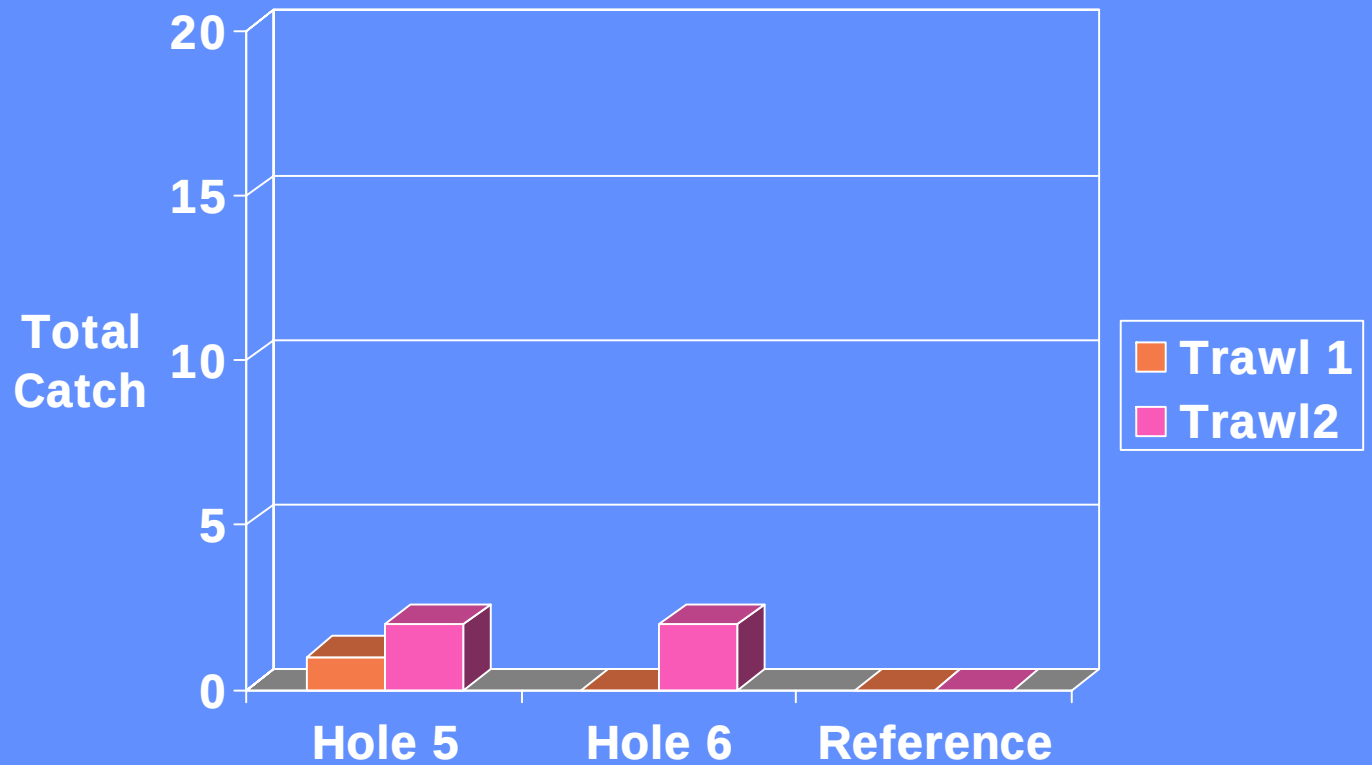
Juvenile
Atlantic
Croaker
(25 mm)



WINTER SAMPLES

16-Foot Otter
Trawl Results

4-Spined
Stickleback



Fall and Winter Samples Results

- Fall use of holes by fish limited
- No evidence that fish and crabs over-winter in deep holes



Summary of Sampling Findings

- Loveladies (Hole #5) potential weakfish nursery area in summer
- No over-wintering by fish and crabs
- Dissolved Oxygen levels appear okay, but no invertebrates in deep sediments
- Benthic community conditions improve with shallower depths

Potential Source Material Locations

- Barnegat Inlet
- Oyster Creek Channel
- Double Creek Channel
- NJ Intracoastal Waterway

Fill Placement Depth and Volume

Dredged Hole #6 to -18 ft NAVD
(125,000 cy)

Dredged Holes #5 & #6 to -12 ft NAVD
(260,000 cy)

Dredged Holes #5 & #6 to -6 ft NAVD
(430,000 cy)

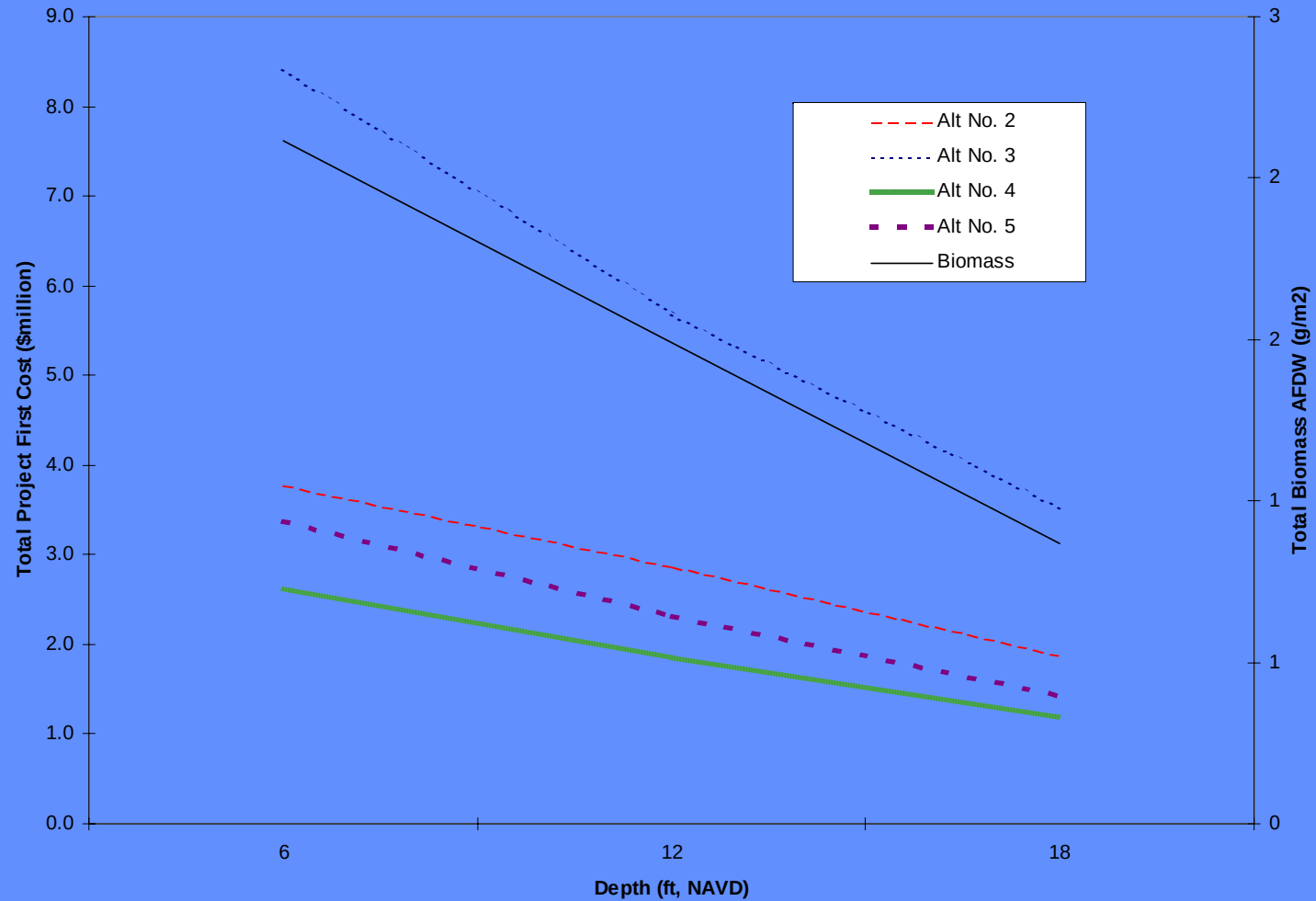
Alternatives and Dredging Methodology

- Alternative 1: No Action
- Alternative 2: 24 inch Hydraulic from Barnegat Inlet, Oyster Creek Channel and/or Double Creek Channel
- Alternative 3: 21 cy Mechanical from Barnegat Inlet, Oyster Creek Channel and/or Double Creek Channel
- Alternative 4: 12 inch Hydraulic from NJIWW, 2000 ft distance
- Alternative 5: 12 inch Hydraulic from NJIWW, 6000 ft distance

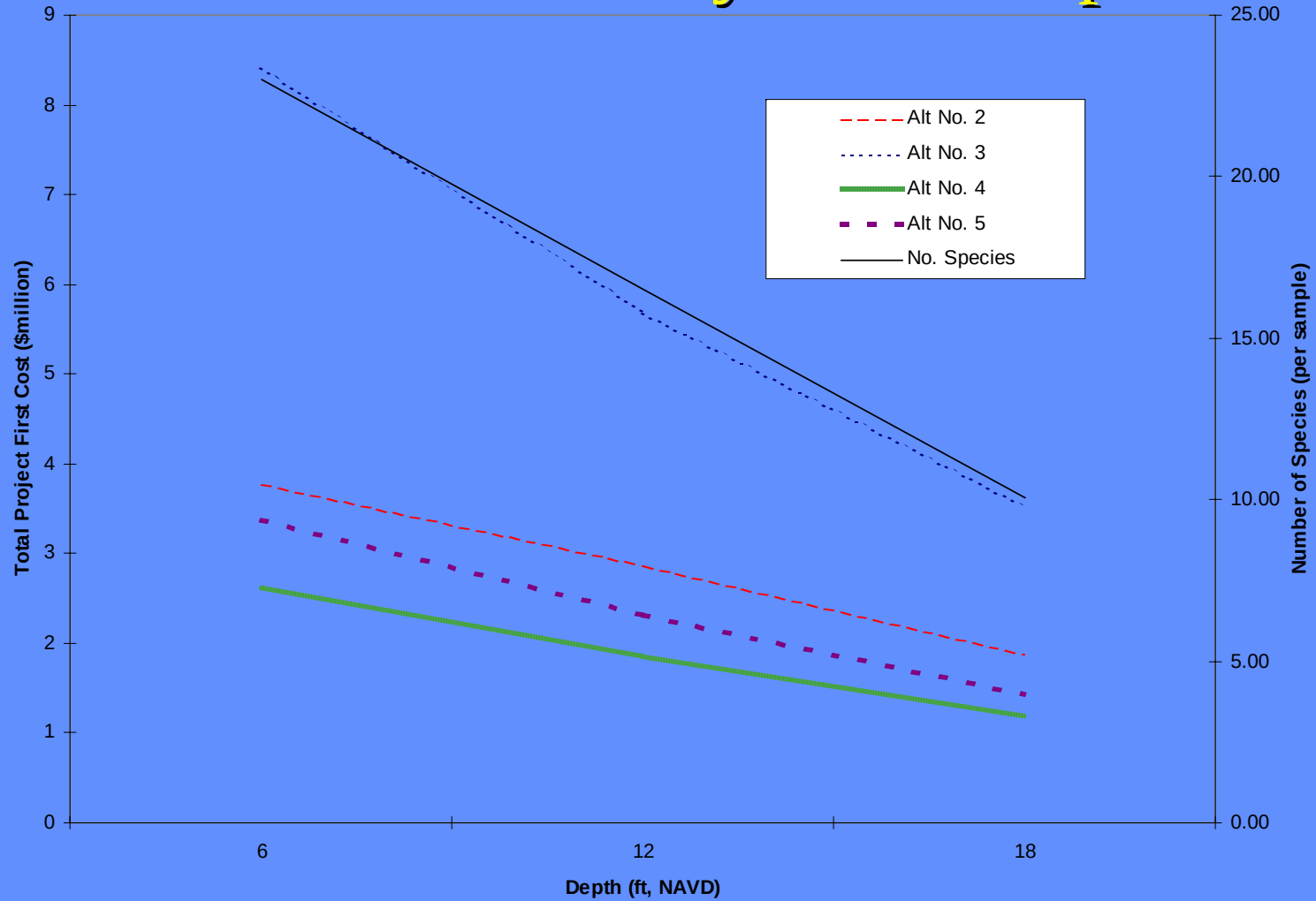
Cost Estimates - CEDEP Program

Fill Depth (ft, NAVD)	Alternative Total First Cost (\$ million)			
	No. 2	No. 3	No. 4	No. 5
-6	3.8	8.4	2.6	3.4
-12	2.9	5.7	1.9	2.3
-18	1.9	3.5	1.2	1.4

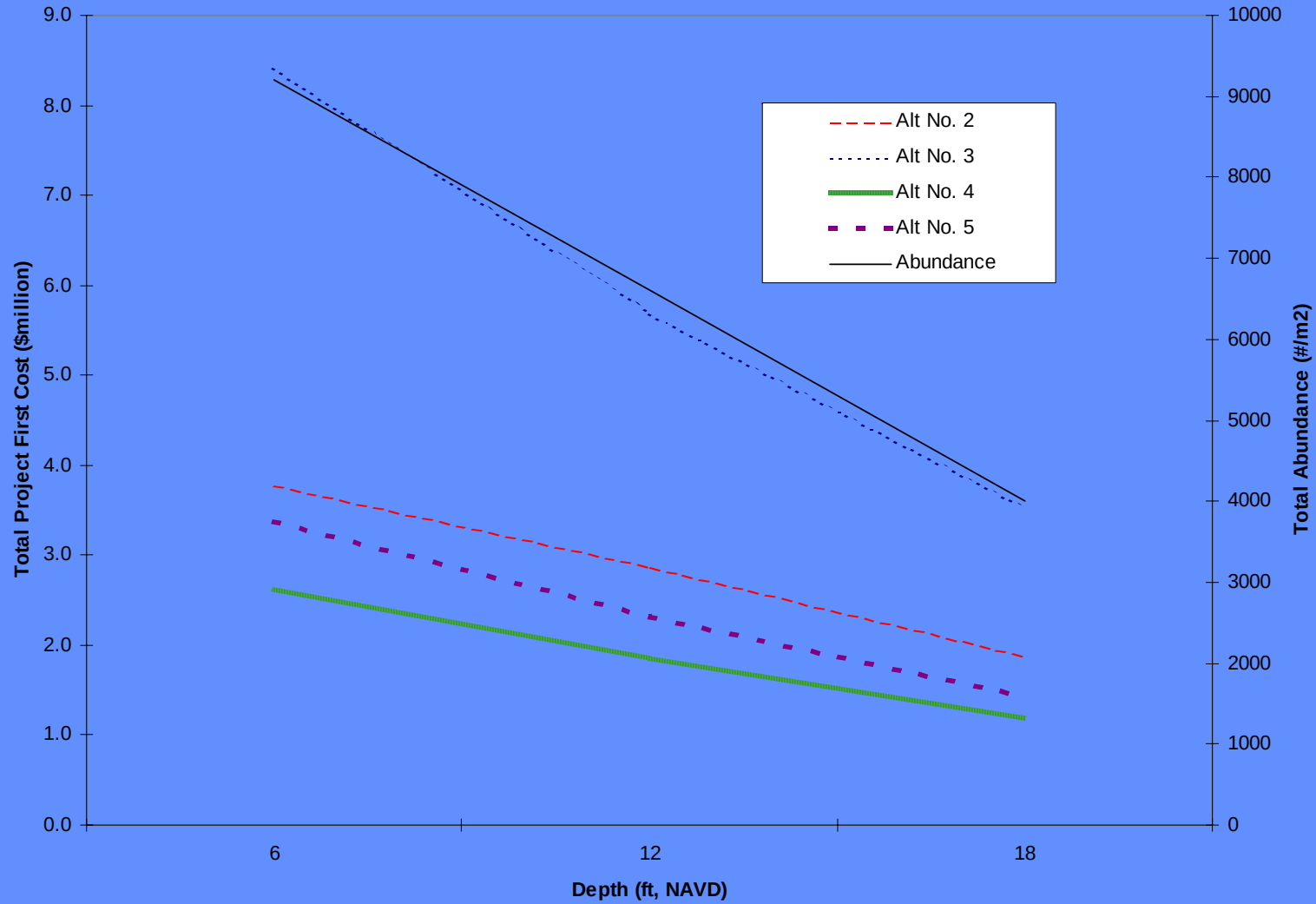
Incremental Cost Analysis -Biomass



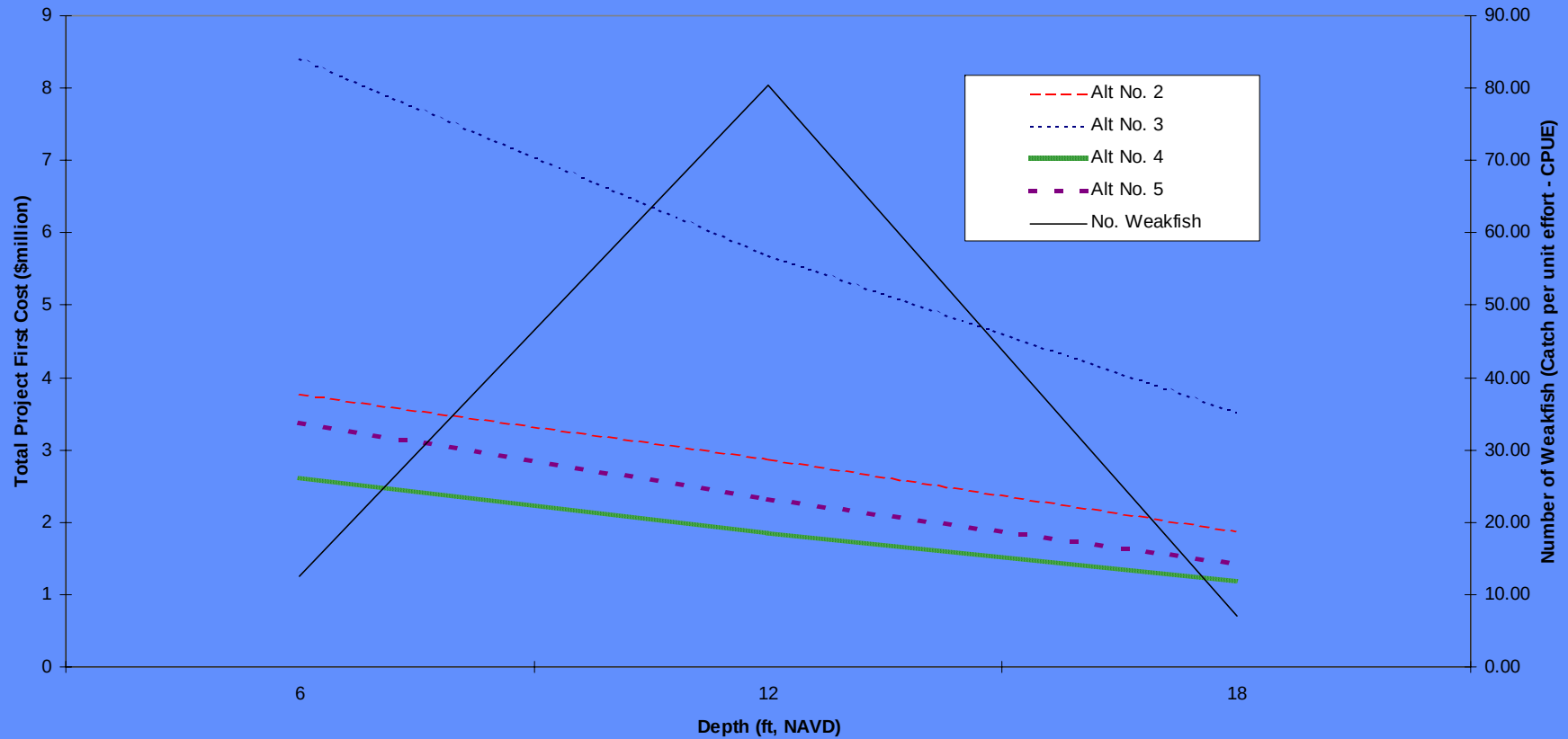
Incremental Cost Analysis -No. Species



Incremental Cost Analysis -Abundance



Incremental Cost Analysis -No. Weakfish



Conclusions

- COST - Lowest Cost for NJIWW as Source of Material
- BENTHOS - Cost increase equivalent to benefit increase, highest cost for optimal environment
- FISH - Maximum fish numbers at intermediate depth, intermediate cost

Recommendations

- Fill holes no shallower than 12 feet; an apparent breakpoint for improving benthic conditions
- Retain depth contours to maintain fish refuge function and increase habitat heterogeneity in Barnegat Bay
- Monitor biological parameters after filling holes

Refined Recommendations

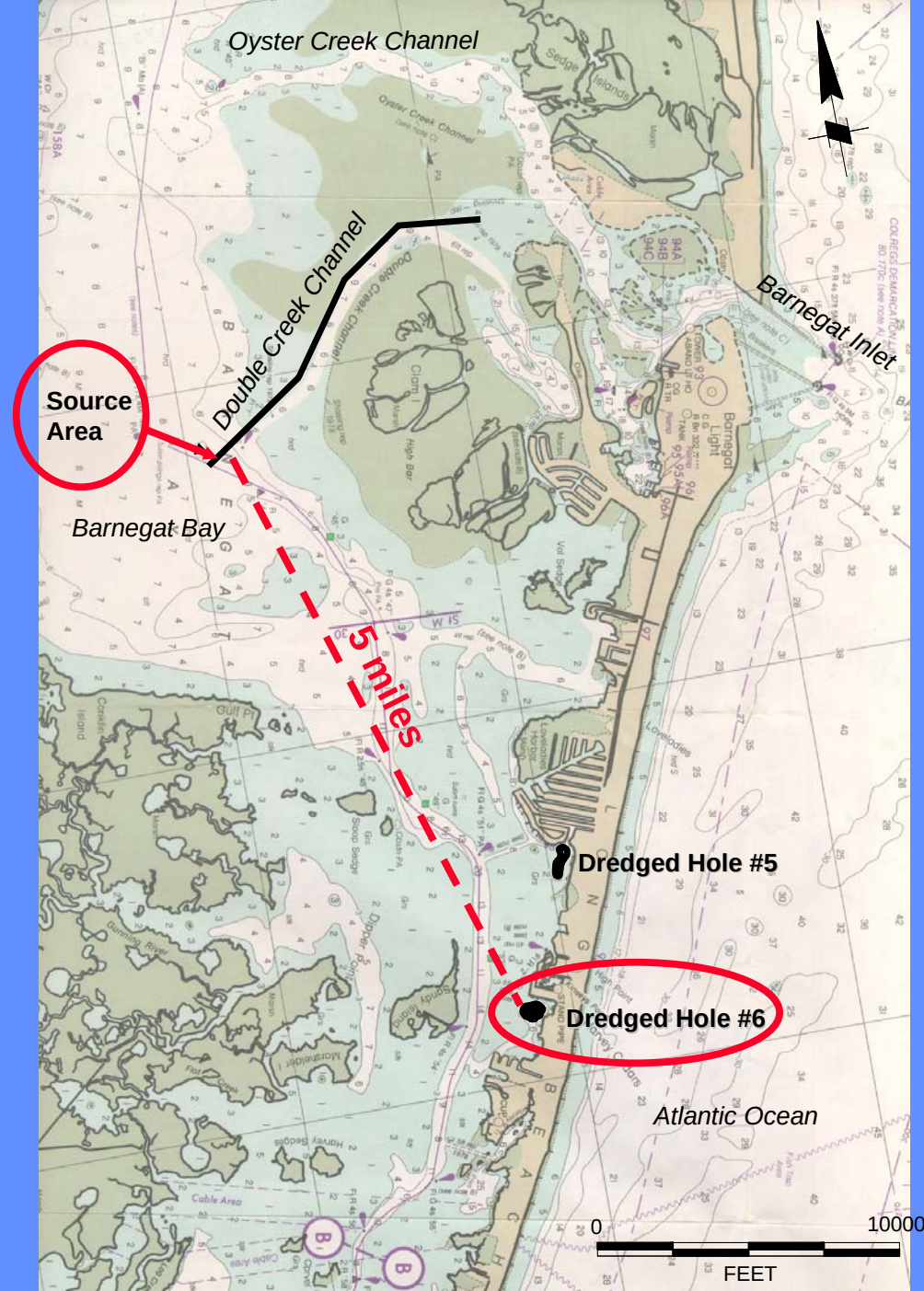
- Obtain material from Double Creek Channel
- Partially fill Harvey Cedars Hole (#6) to 18 feet
- Create mounds in hole
- Do not change the depths at Loveladies (#5)
- Monitor biological parameters after filling Harvey Cedars hole



1) Material collected with cutterhead suction dredge.

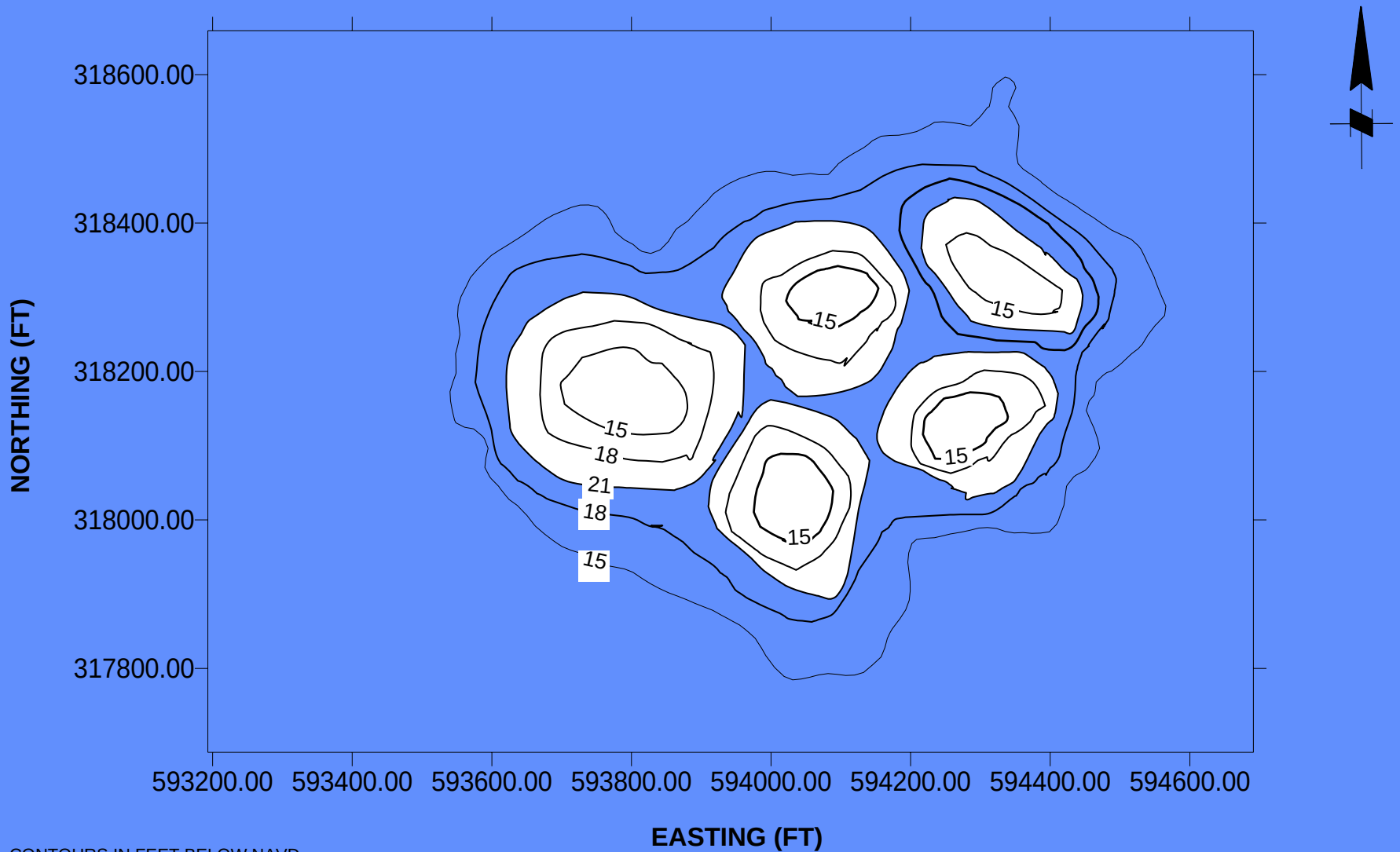
2) Material transported via pipeline.

3) Deposition with baffle plate, sand box, or pipeline with submerged diffuser.



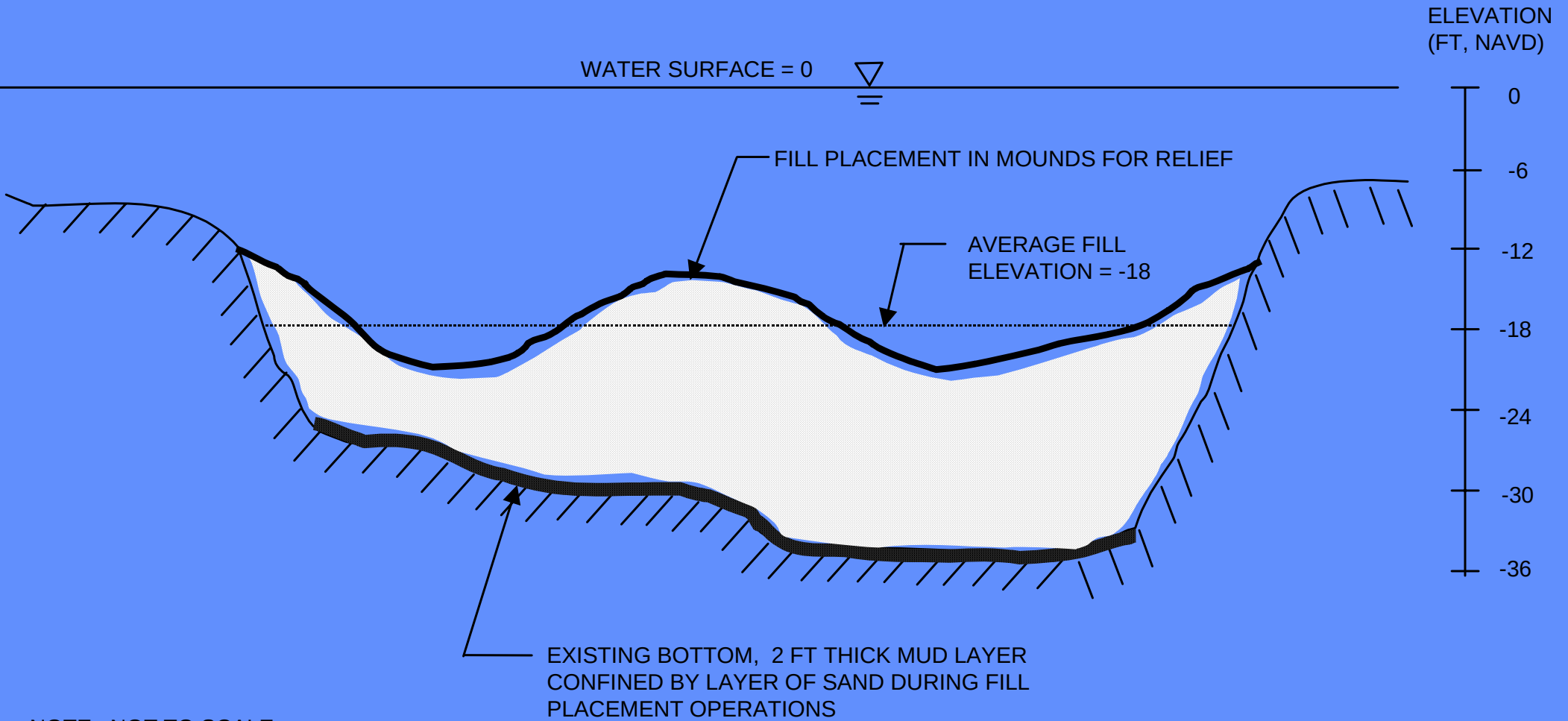


Existing
Bathymetry



Selected Plan

Selected Plan



NOTE: NOT TO SCALE,
VERTICAL SCALE EXAGGERATED

Post Construction Monitoring Results

- None

Lessons Learned

- Extensive scientific data and patience may be needed due to distrust.
- Data from instruments important, but may not fully explain site dynamics.
- Biomass is one way to combine various species for cost analysis.
- Turbidity curtains, while required and important when they work, may prove worse than useless.
- When partnering, cost sharing entities may still be driven by their individual missions.