Working With Nature Beneficial Use Studies

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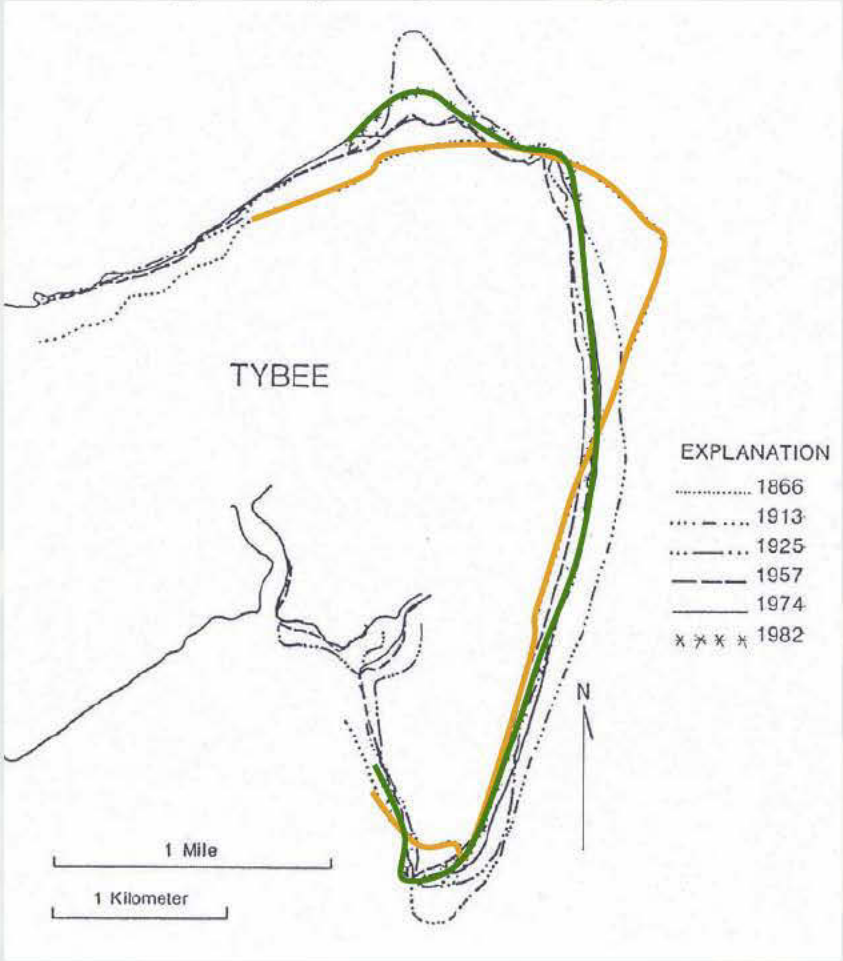
Beach/Nearshore Placement:

- Beach Placement: Generally beach quality material (90%-92% sand)
- Pump material onto or near beach – may or may not be optimal placement
- Sometimes the least cost option
- Examples
  - Grand River (Great Lakes)
  - Brunswick Harbor (Atlantic)

History of Tybee Island Shoreline



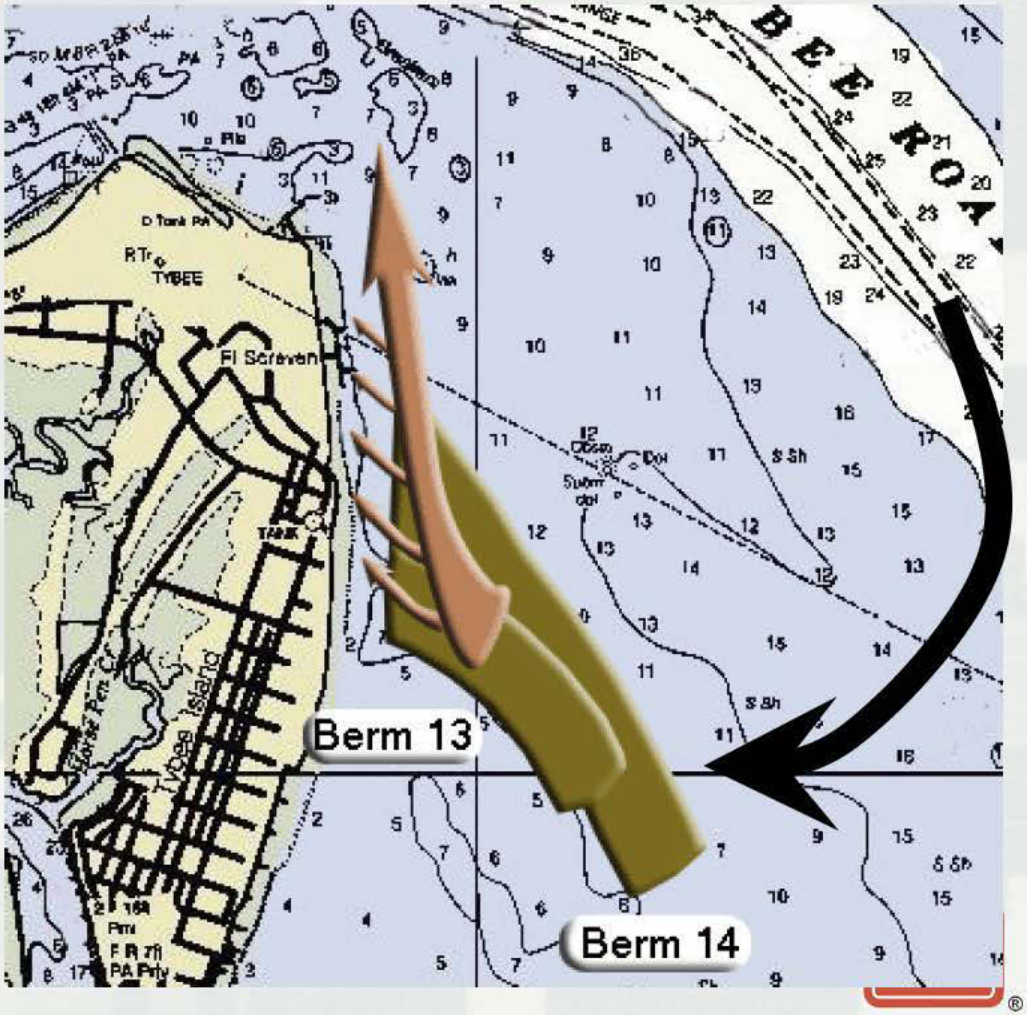
1866
1982

Savannah Nearshore Placement Study Methods:

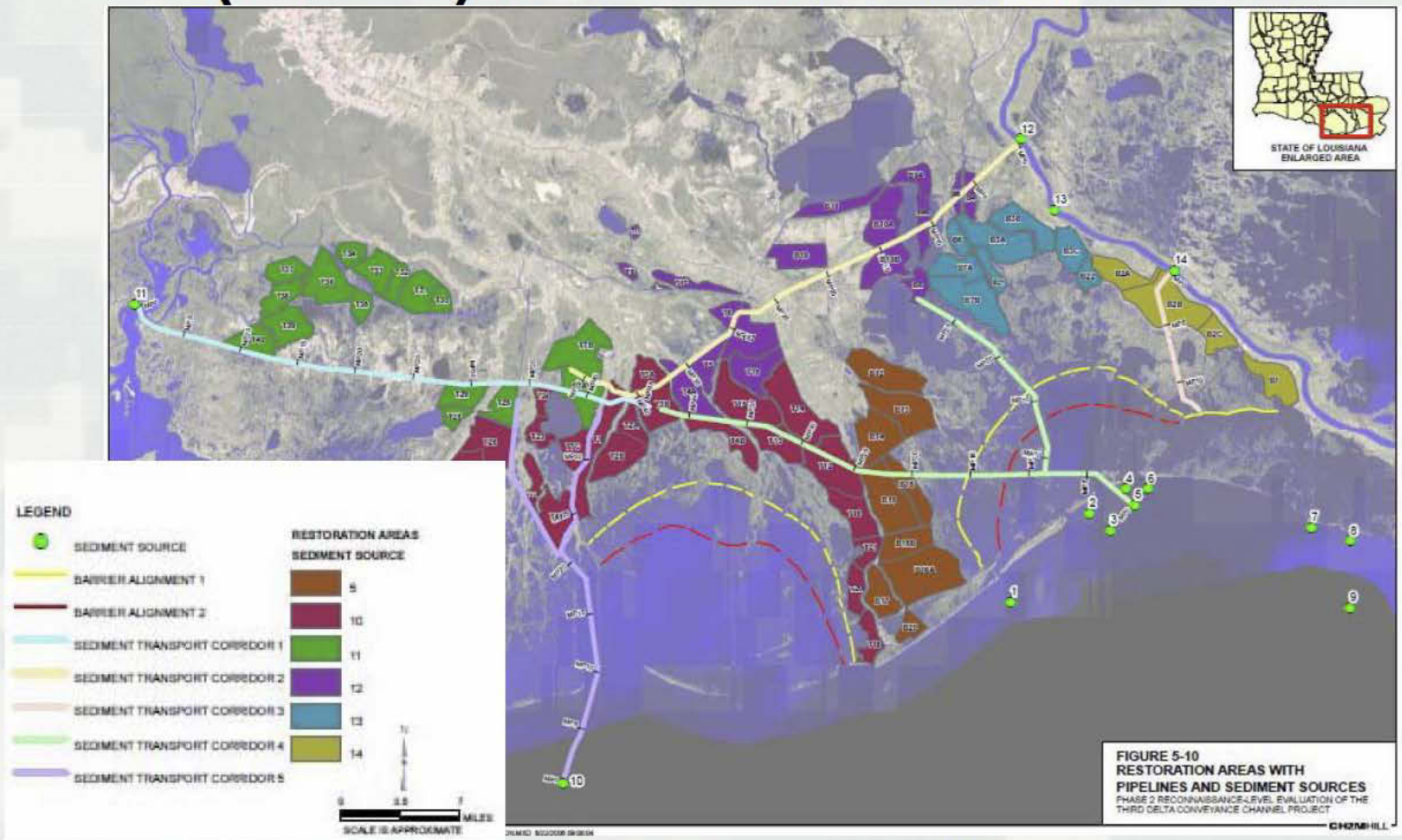
- **High sand content, not beach quality**
- **Placement along the inside of the ebb shoal**
- **Natural transport mechanisms winnow fines**
- **Natural processes transport sand longshore across the depleted north beach inside of the ebb shoal**
- **Cost > offshore placement**
- **Cost < offshore placement + beach nourishment**

Recommendations

- Move mixed material from channel to Berm
- Allow natural winnowing to remove fine content
- Longshore transport patterns will move sediment into sand-starved north Tybee littoral zone

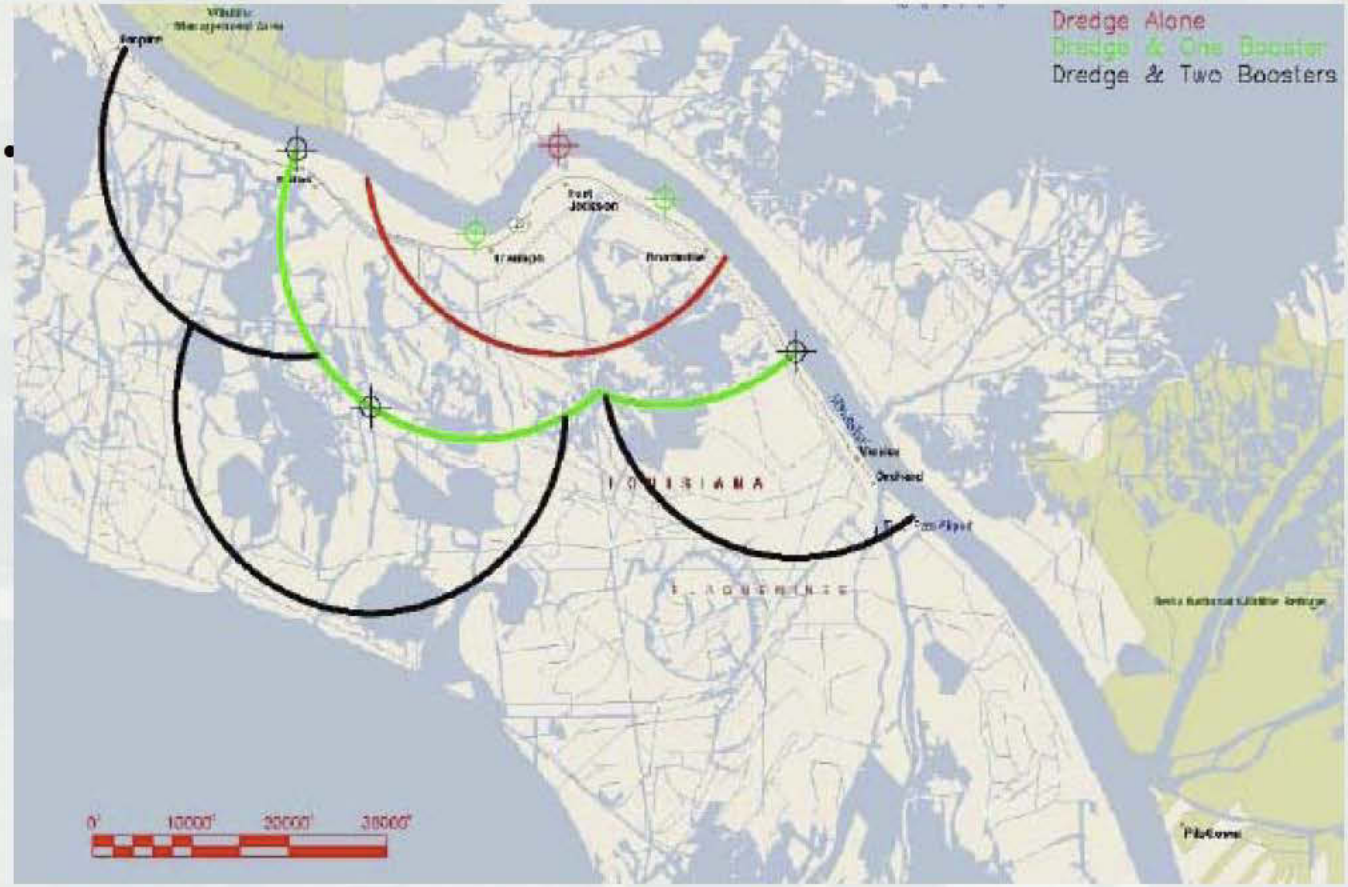


Long Distance Conveyance (LDC) for Beneficial Use



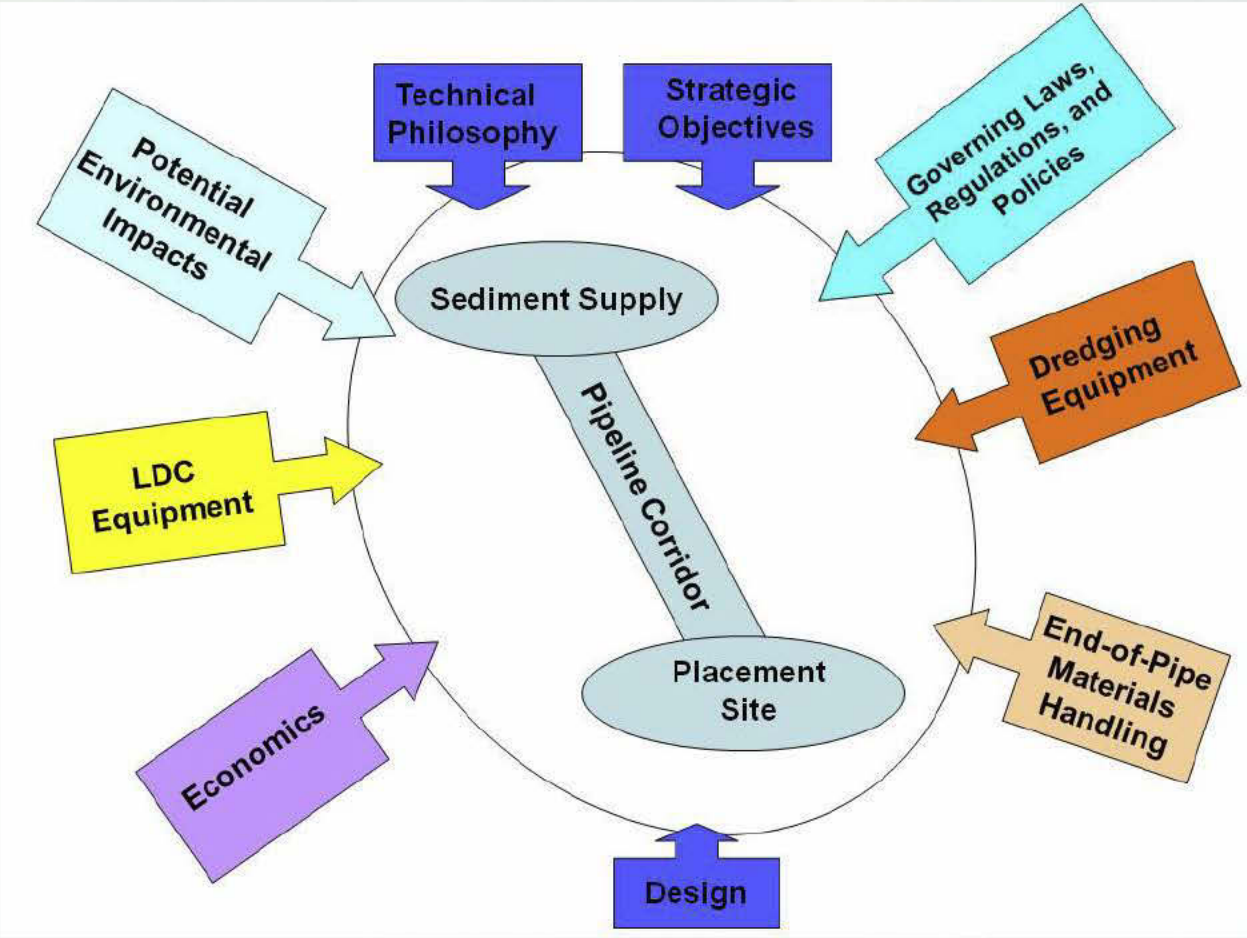
Reconnaissance-level evaluation Third Delta Conveyance Channel (TDCC) of pipeline conveyance alternative areas with pipelines and sediment sources (source: CH2M HILL 2006).

Basic LDC Concept



Pumping distance as function of adding booster pumps
(source: Hales et al. 2003).

LDC "System" for Beneficial Use

- 

Optimization of LDC Components

Centrifugal Booster Pump (source GIW).

Positive Displacement Booster Pumps (source: Pipeline Systems, Inc.).

- Centrifugal pumps vs. positive displacement?
- Temporary vs. permanent pipelines?
- Single vs. rehandling (depot) sediment?
- End-of-pipe placement methods (thin layer, etc.)?
- Equipment and methods to minimize wetland environmental impacts?

Issues and Obstacles:

- Least cost requirement in federal standard
- Cost share partners/Funding Sources
- Regulatory criteria
- Suitable Material
- Dredge plant/capacities/time schedule
- Types of dredging contracts/payment methods
- Environmental impacts
- Dredge Schedule/Supply of material for beneficial use

Courtesy of IDR

Beneficial Uses for Fisheries Habitat Enhancement

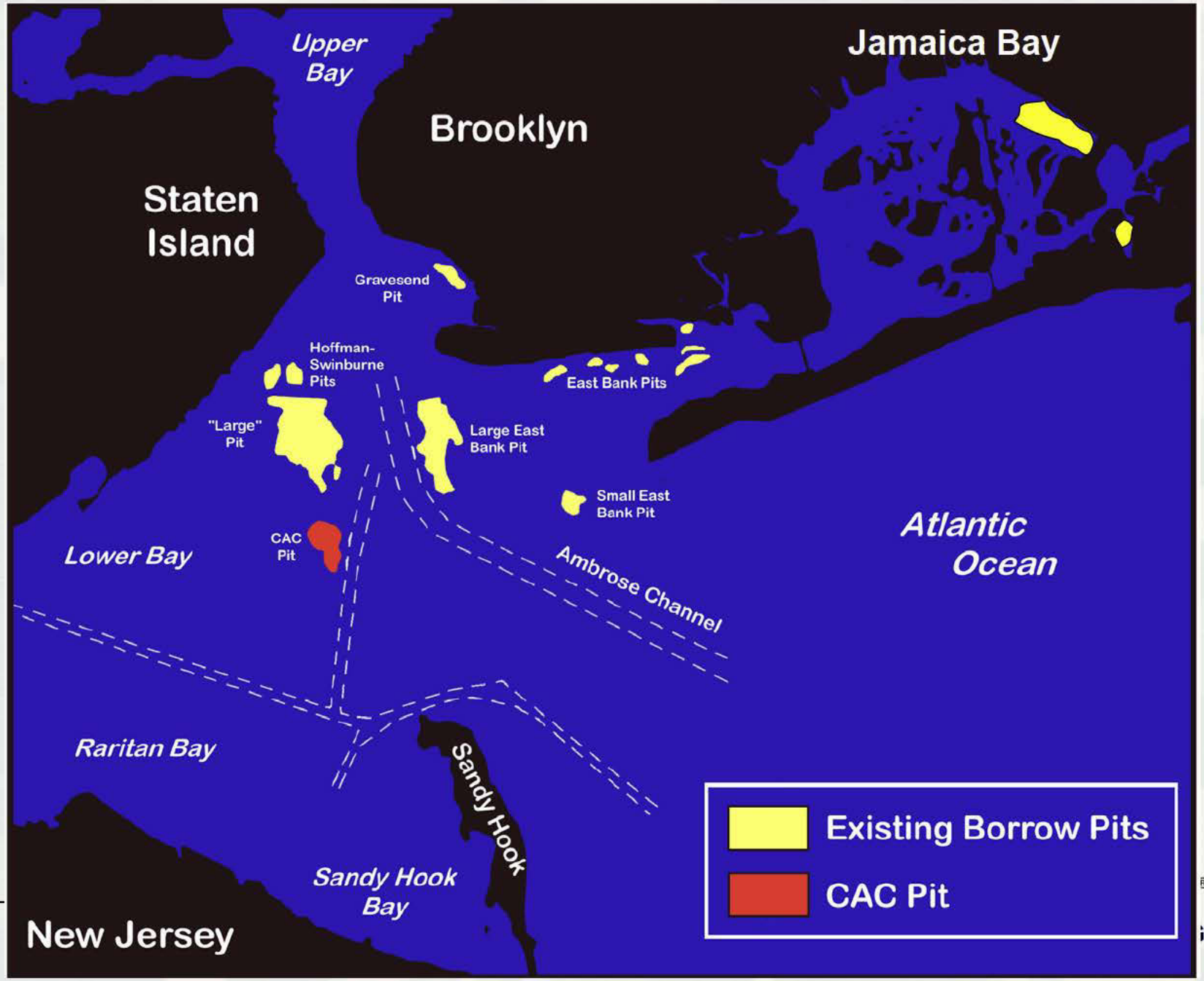
- Dredged material for marsh creation or restoration
- Dredged material as a substrate for oyster reefs or seagrass beds
- Dredged material for intertidal mudflat creation or restoration
- Dredged material for bird islands
- ★ Dredged material for open-water fish habitat

Open-Water Beneficial Use Strategies

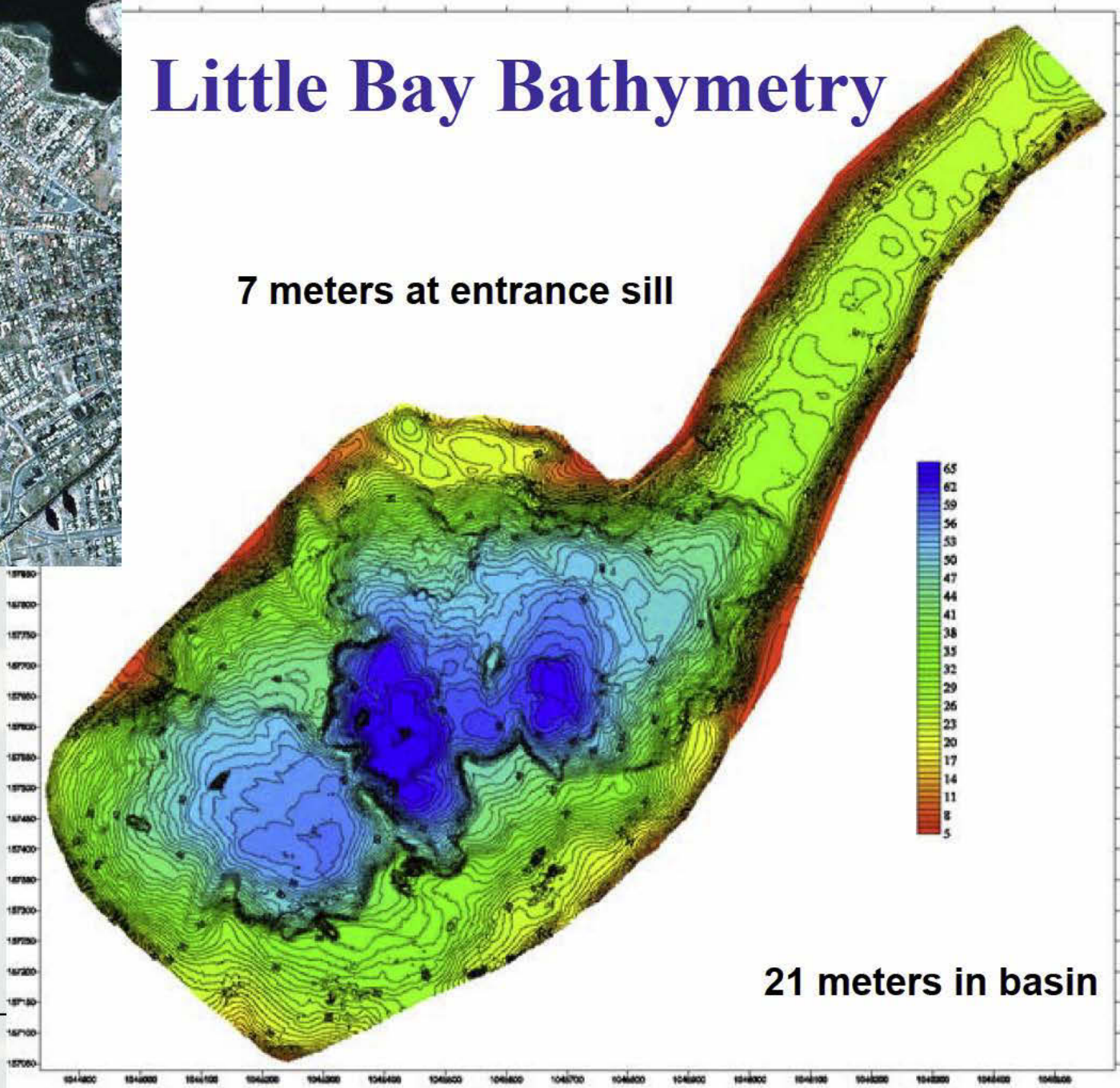
- Fill it in
  - Restore pits and borrow sites
- Spread it out
  - Thin-layer placement in estuaries
  - Spray disposal on marsh surfaces
- Pile it up
  - Berms and mounds

Filling Pits or Borrow Sites

- Examples of "filling it in"
  - Little Bay, New York
  - Barnegat Bay, New Jersey

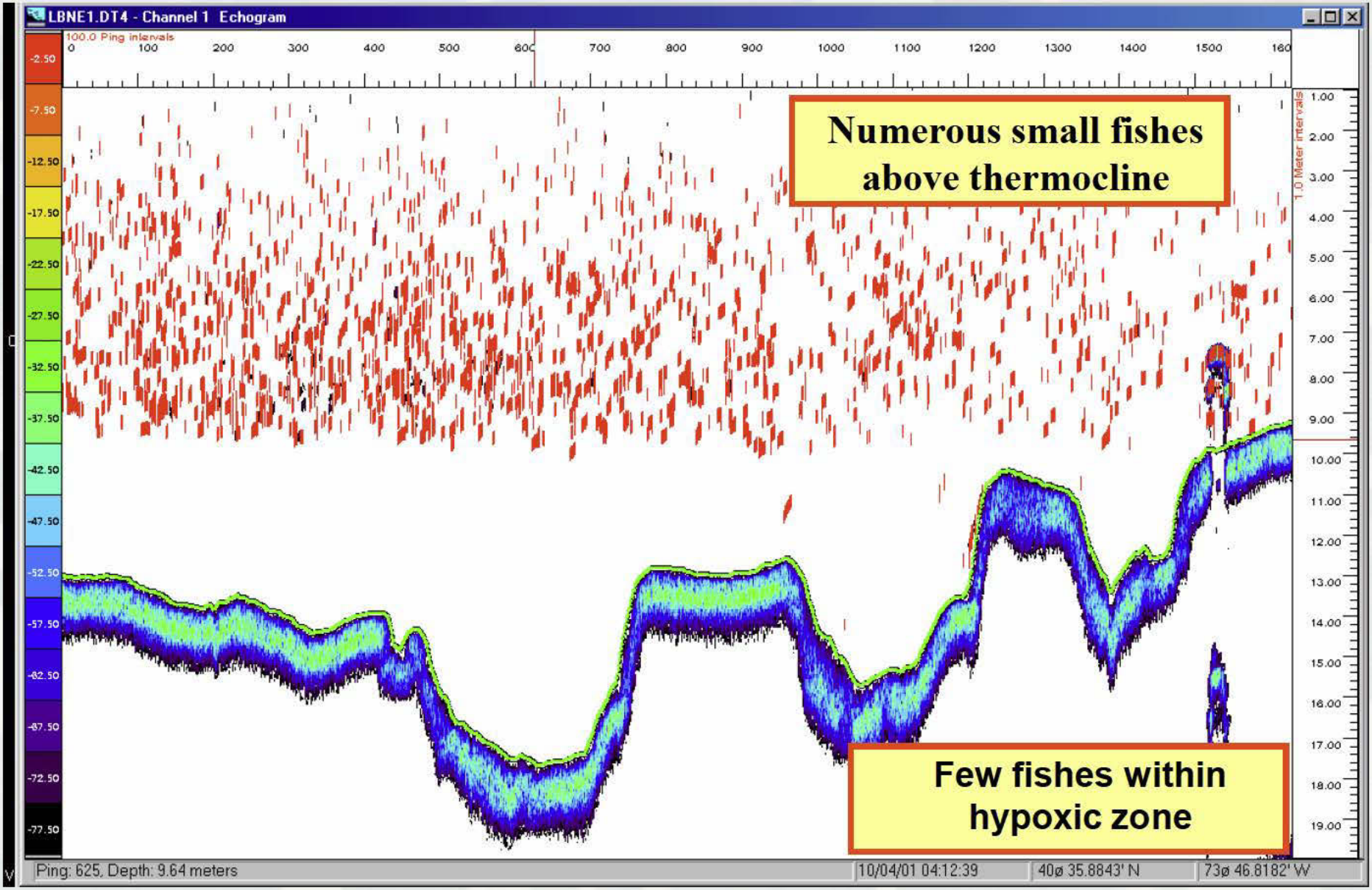

Upper Bay
Jamaica Bay
Brooklyn
Staten Island
Gravesend Pit
Hoffman-Swinburne Pits
East Bank Pits
"Large" Pit
Large East Bank Pit
Small East Bank Pit
CAC Pit
Lower Bay
Atlantic Ocean
Ambrose Channel
Raritan Bay
Sandy Hook
Sandy Hook Bay
New Jersey
Existing Borrow Pits
CAC Pit

Little Bay Bathymetry



Poor Habitat Quality in Pit Basin

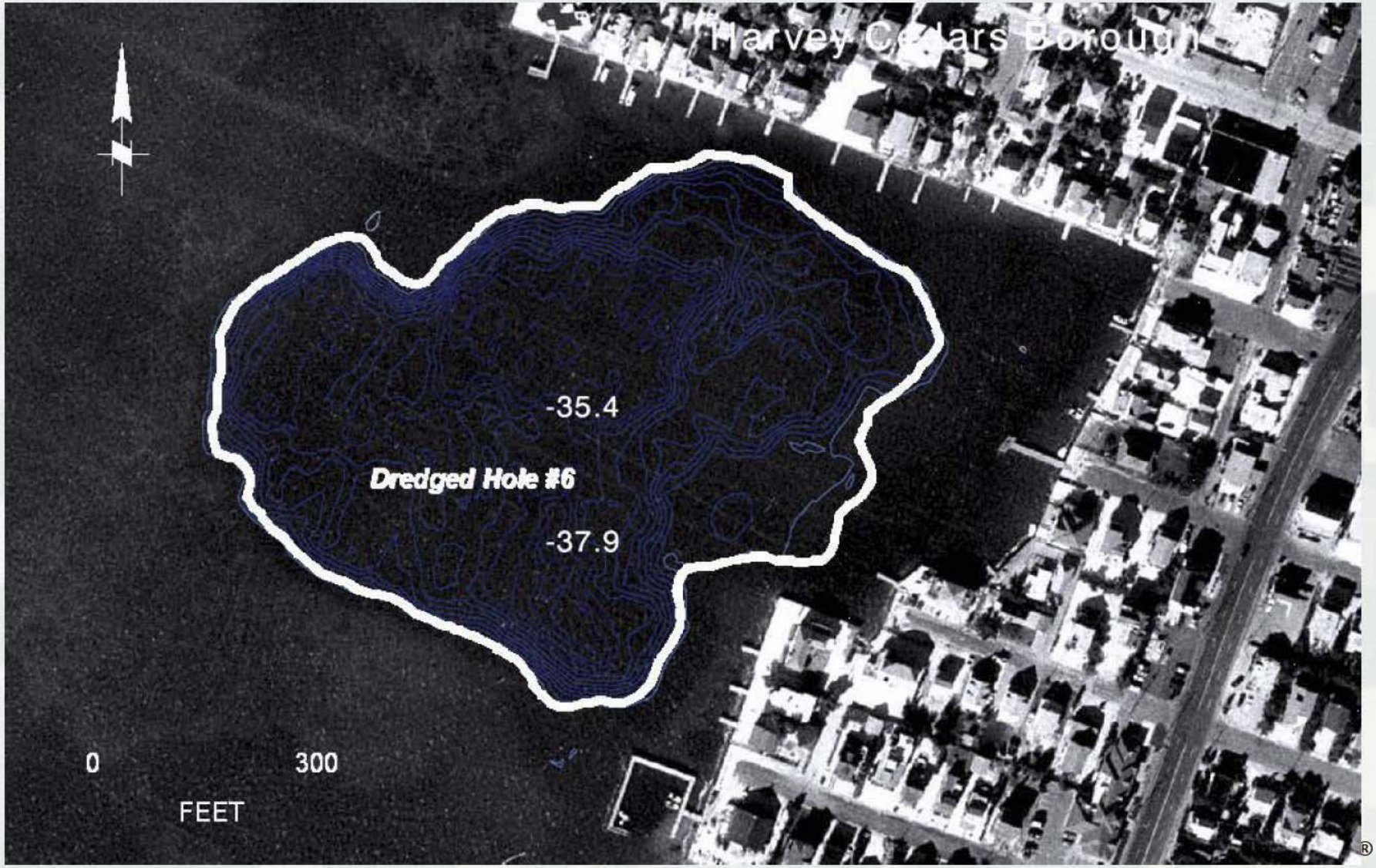
Little Bay echogram, at night during ebb tide



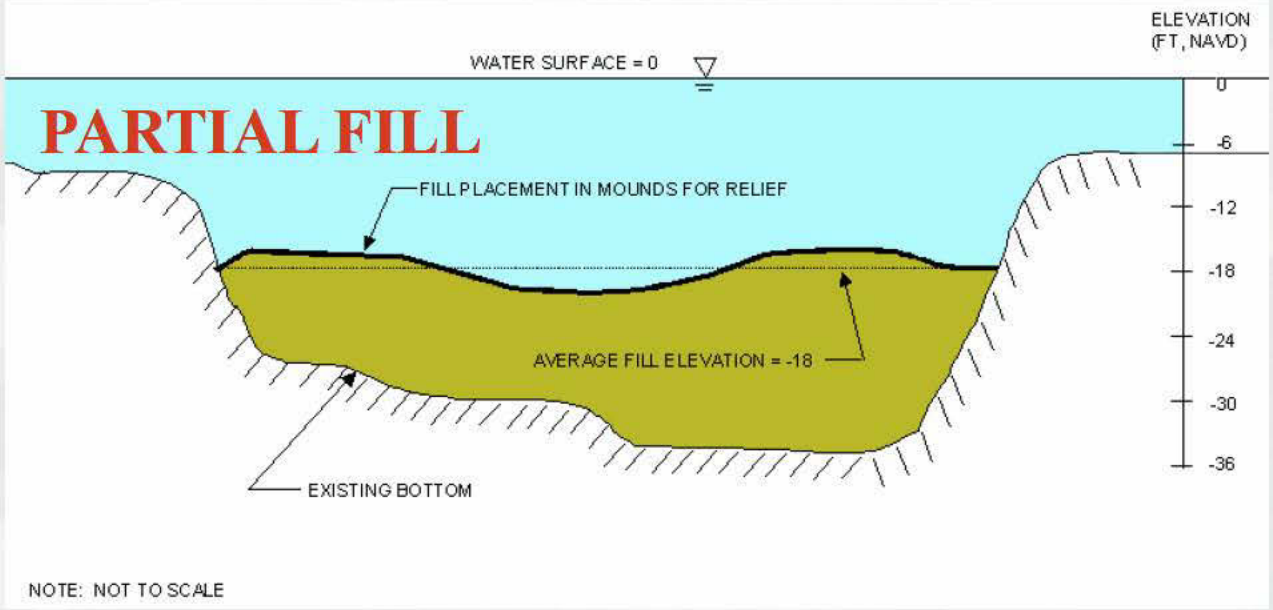
Pit Restoration Options

- **Fill completely**
  - to re-establish historical bathymetry contours
  - to provide foundation for seagrass or mollusc bed "caps"
- **Fill partially**
  - to maintain vertical relief
  - to attract recreational fishery resources

BARNEGAT BAY – HOLE #6

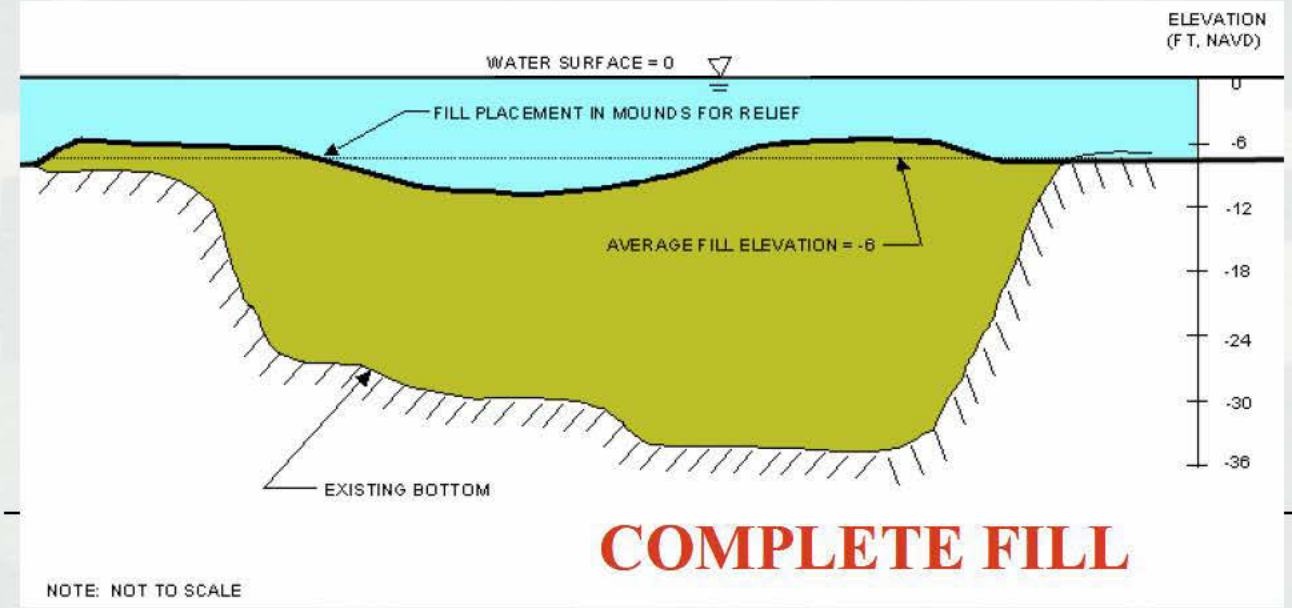


Restoration Alternatives for Dredge Hole #6



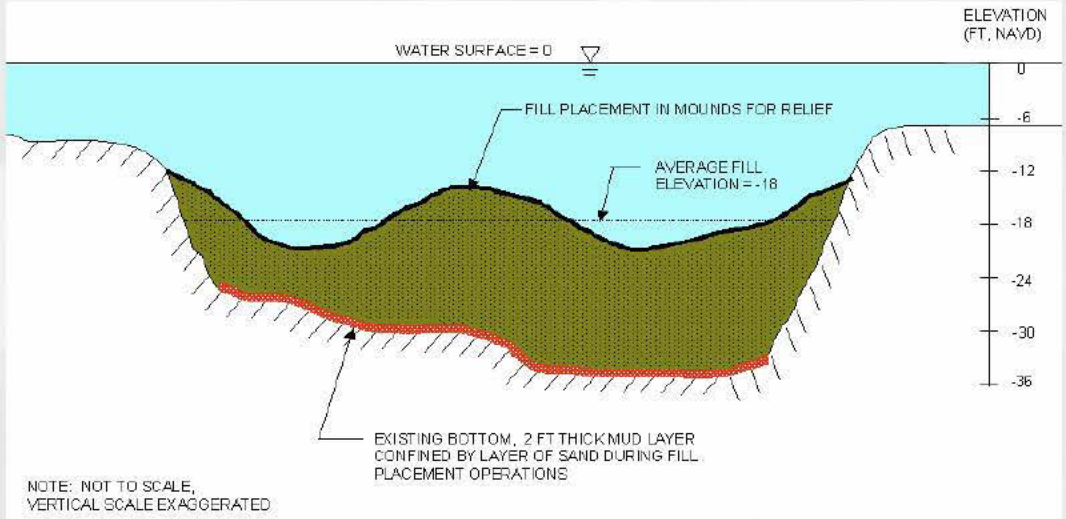
Option #1:

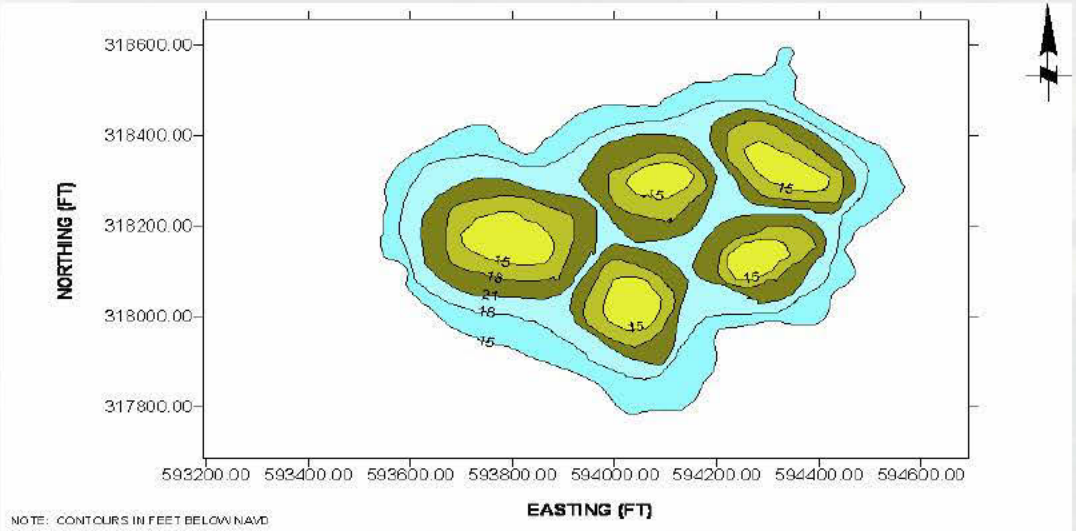
Fill from -38 ft to -18 ft MLW and create sand ridges in basin.



Option #2:
Completely fill pit to restore to historical bathymetry (-6 ft) contours.

SELECTED PLAN – Partial Fill

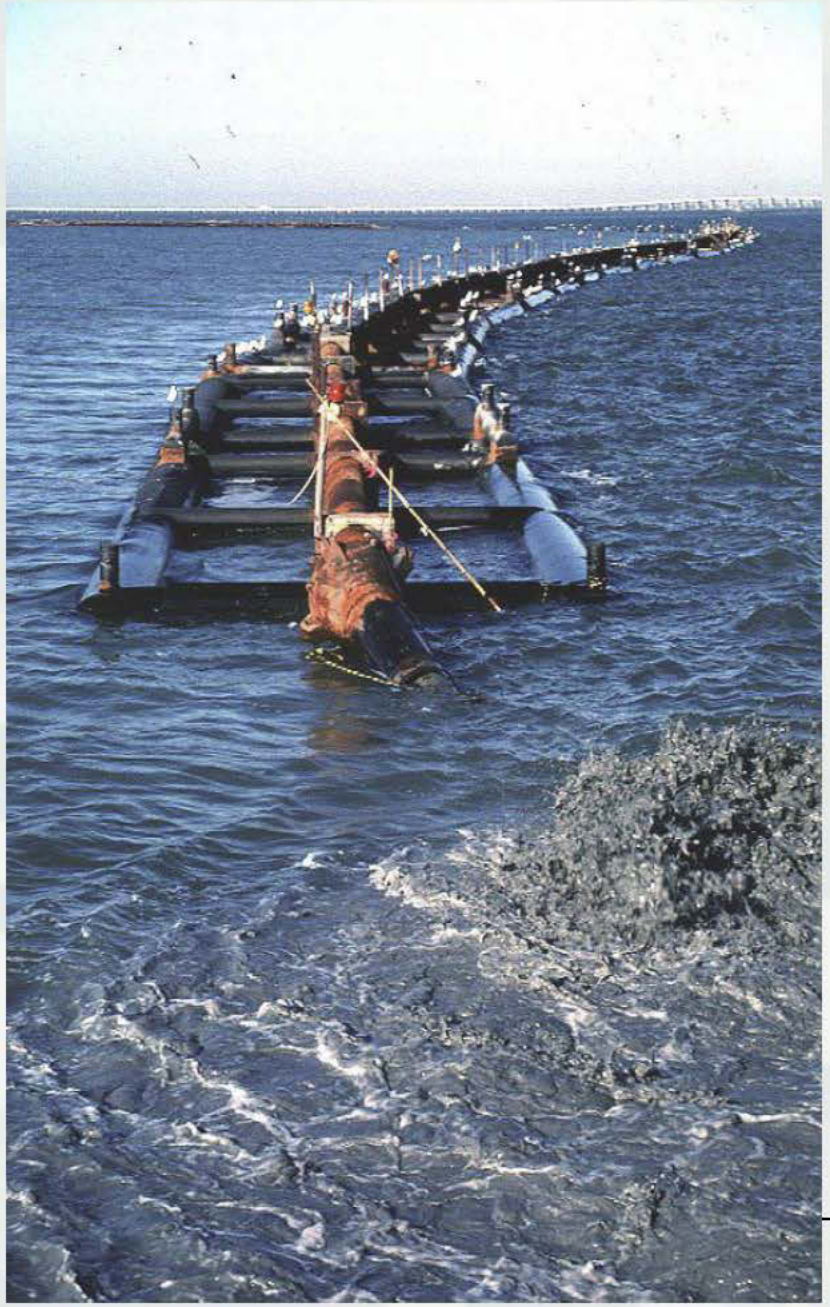




- **Hydraulically place 125,00 cu yds of clean sandy material.**
- **Place a minimum of 3 ft of sandy material over the 2 ft thick mud layer.**
- **Fill to an average depth of -18 ft.**
- **Mound material to create bottom complexity and to create relief to enhance fish habitat.**
- **Tops of mounds ~15 ft MLW**
- **Construction completed: February 2005**

Thin-Layer Placement

- Examples of "spreading it out"
  - Open-water
    - Mississippi Sound Demonstration
    - Mobile Bay, Alabama
  - Marsh surfaces
    - Multiple Louisiana sites
    - Chesapeake Bay, Blackwater Refuge
    - Jamaica Bay, New York



Thin-layer placement of hydraulically pumped dredged material easily achieved by regular movement of discharge terminus.

Beneficial Use???

Mimics storm disturbance, minimizes recovery time, and enhances secondary production.

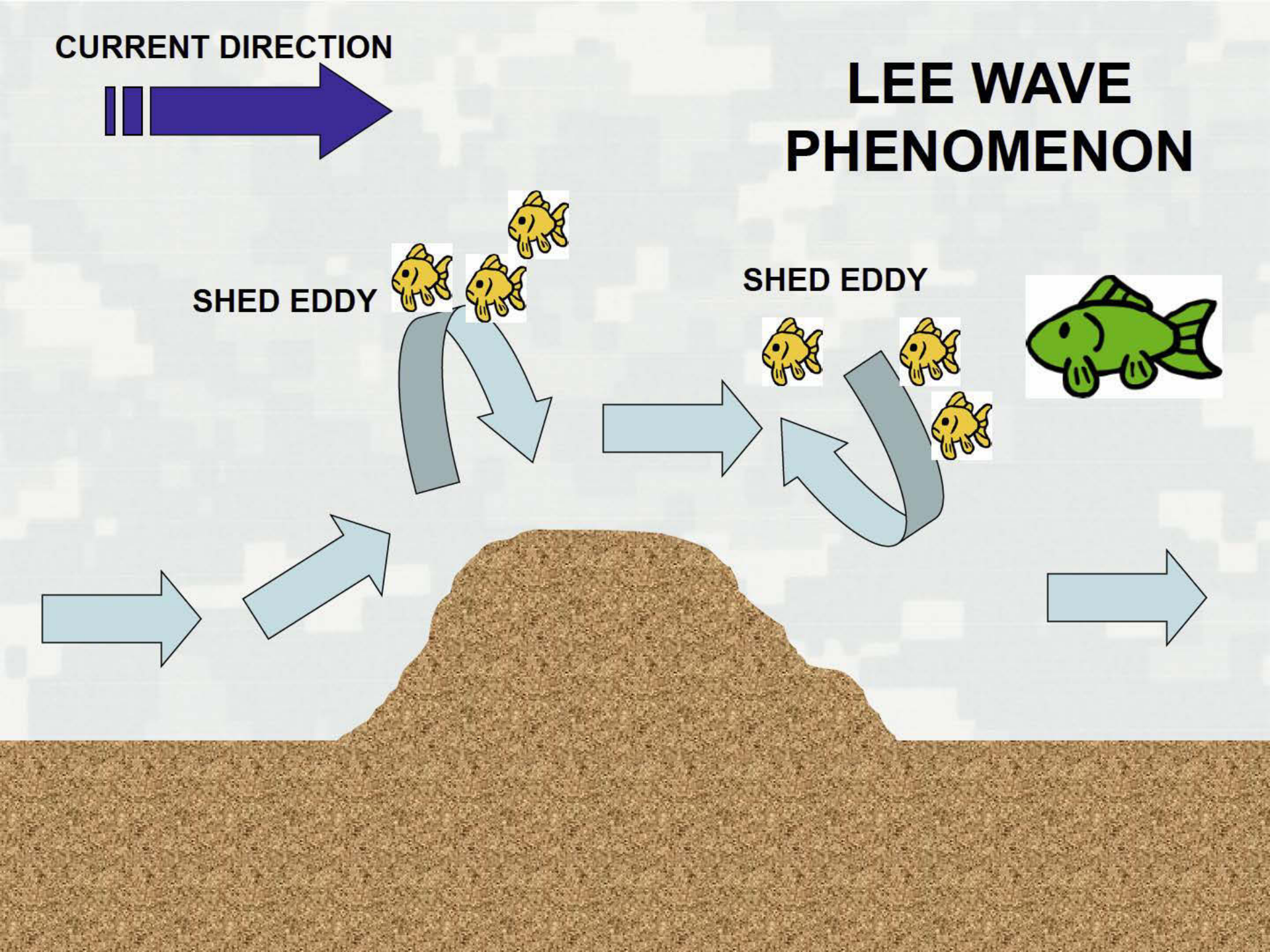
6 to 8 cm
OVERBURDEN

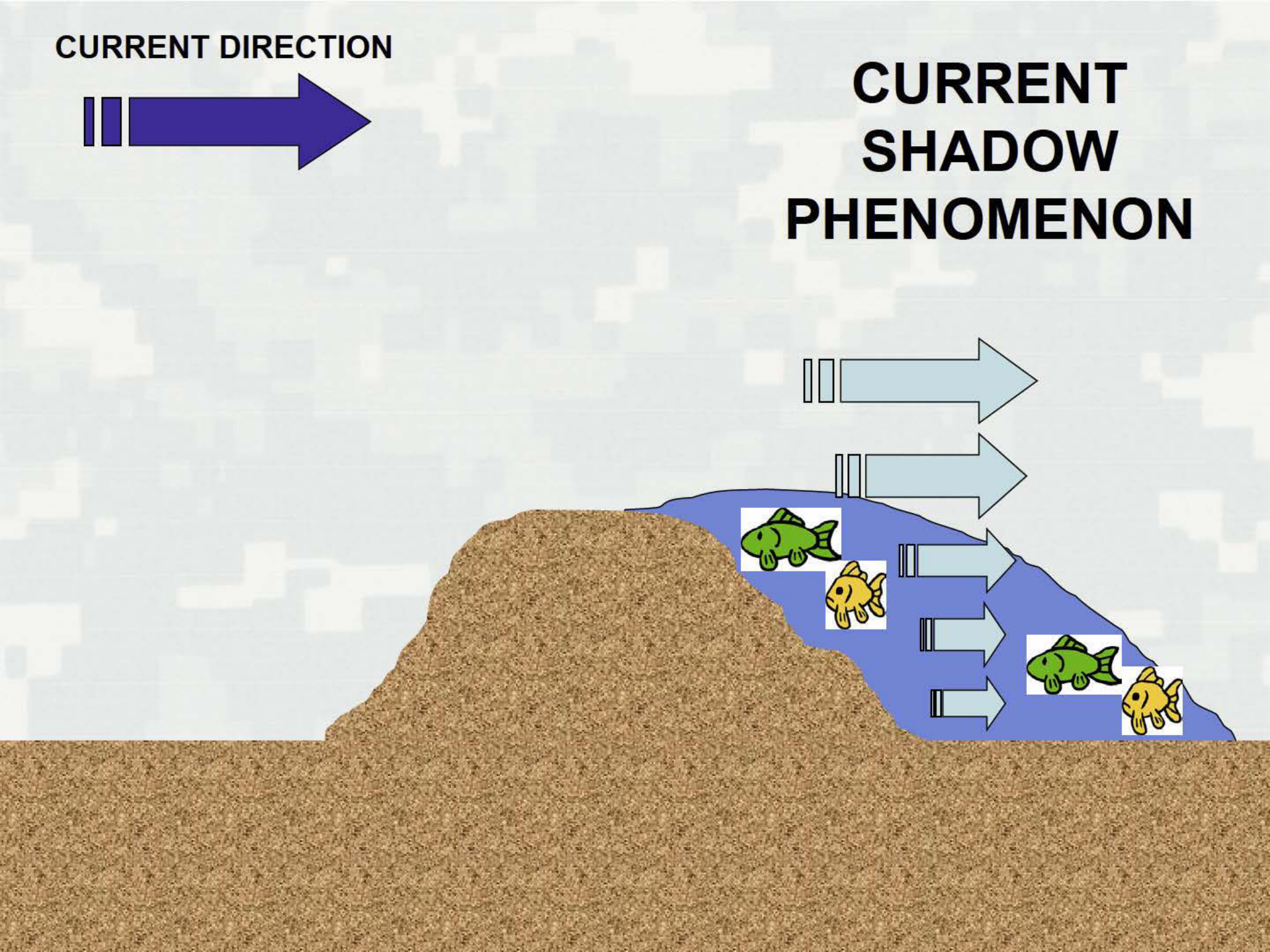
New interface

Relict interface

Building Berms or Mounds

- Examples of "piling it up"
  - Mobile, Tampa, Norfolk "soft mega-mounds"
  - Galveston "soft mini-mounds"
  - Wilmington hard artificial reef
  - New Jersey hard reef grid

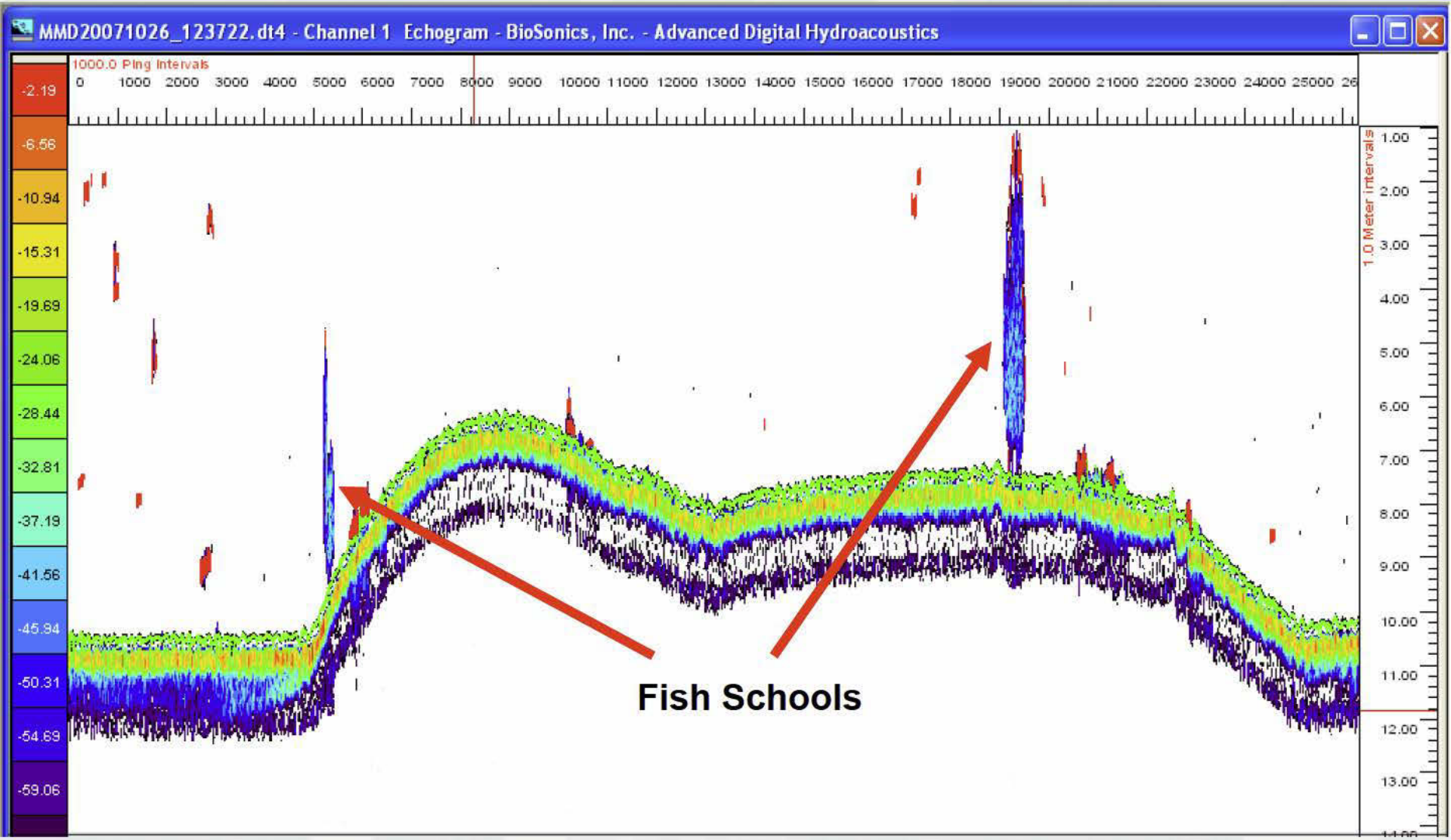

CURRENT DIRECTION
LEE WAVE PHENOMENON
SHED EDDY
SHED EDDY


CURRENT DIRECTION
CURRENT SHADOW PHENOMENON

Offshore Mound Fisheries Habitat Design Features

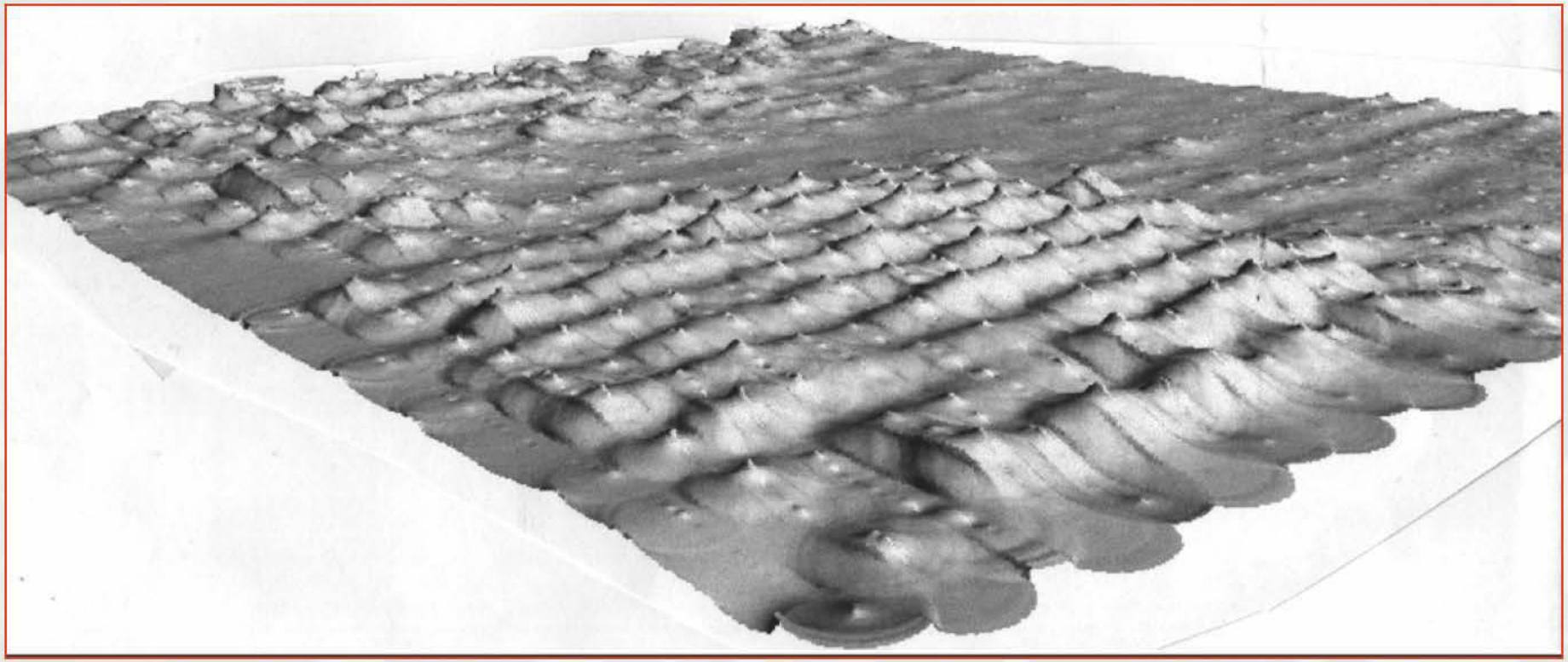
- Side slopes (steeper is better!)
- Footprint (area and number)
- Orientation to currents (optimize current shadow and lee wave, shed eddy effects)
- Material type (interstitial spaces if possible)
- Vertical lift (preferably > 10% of water column)

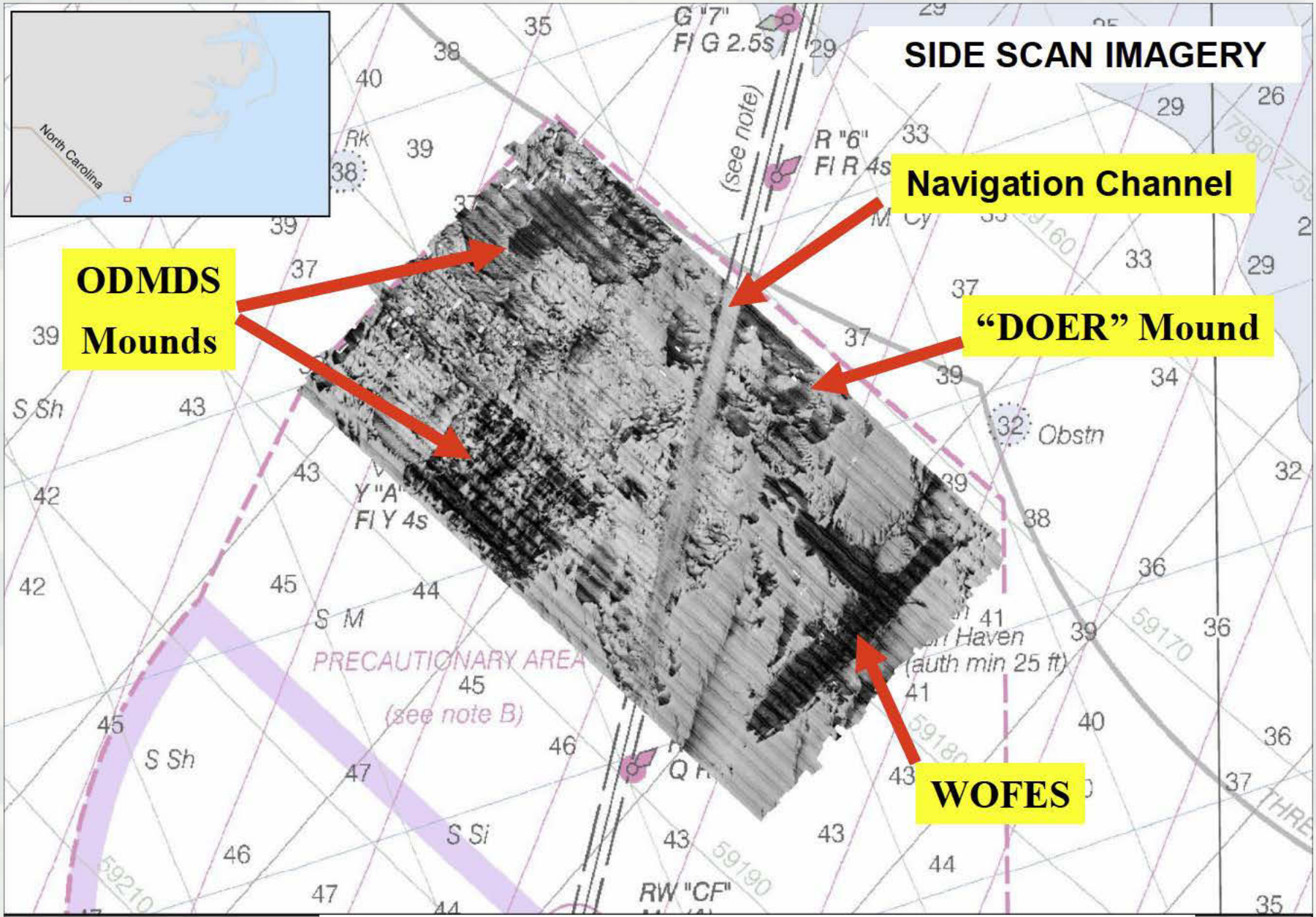
FISHERIES HYDROACOUSTICS ECHOGRAM: MOBILE OFFSHORE DREDGED MATERIAL MOUND



Bathymetry of Galveston Offshore Berms

Constructed of dredged material placed as single hopper barge loads

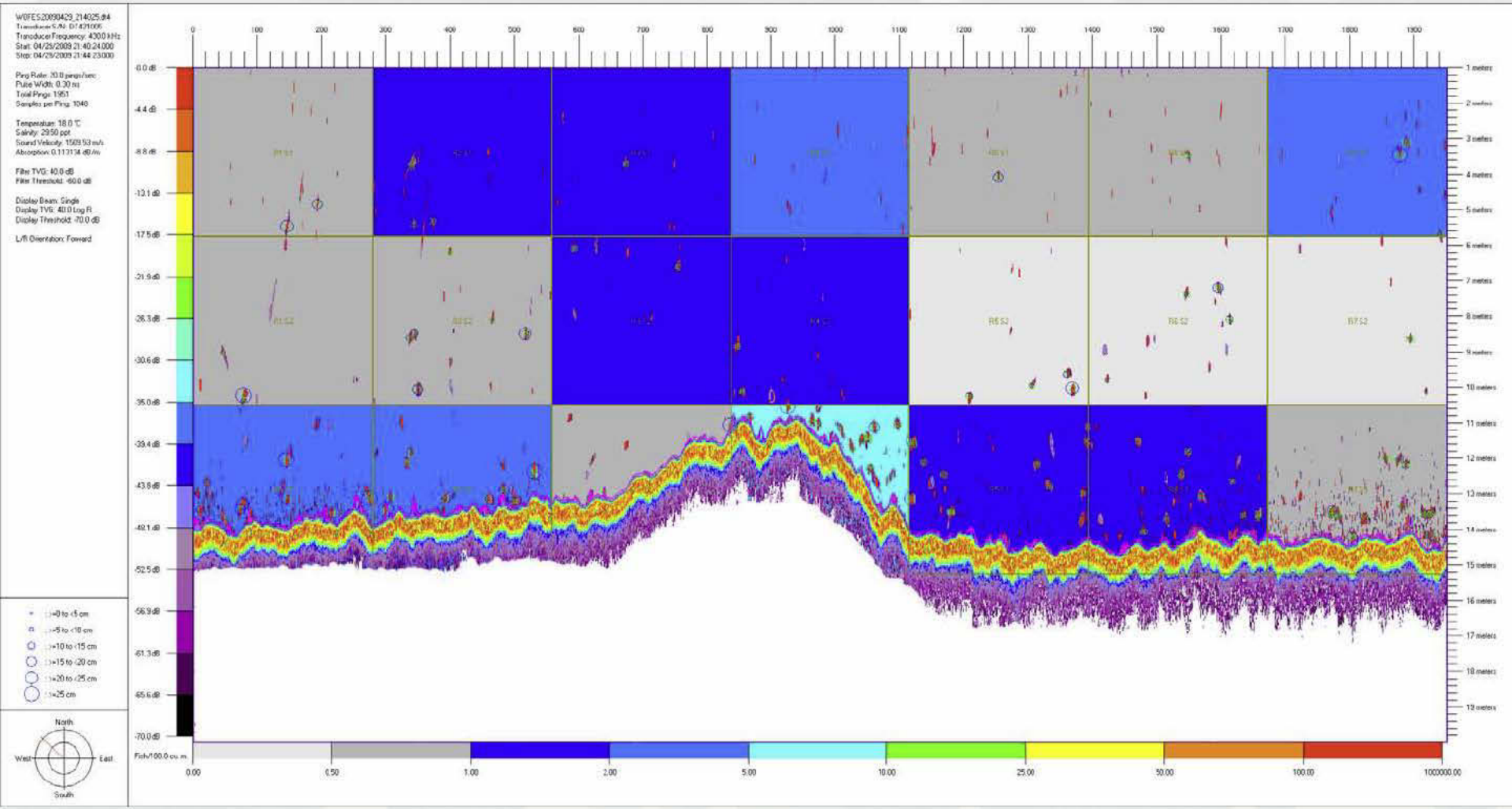




WILMINGTON OFFSHORE FISHERIES ENHANCEMENT STRUCTURE

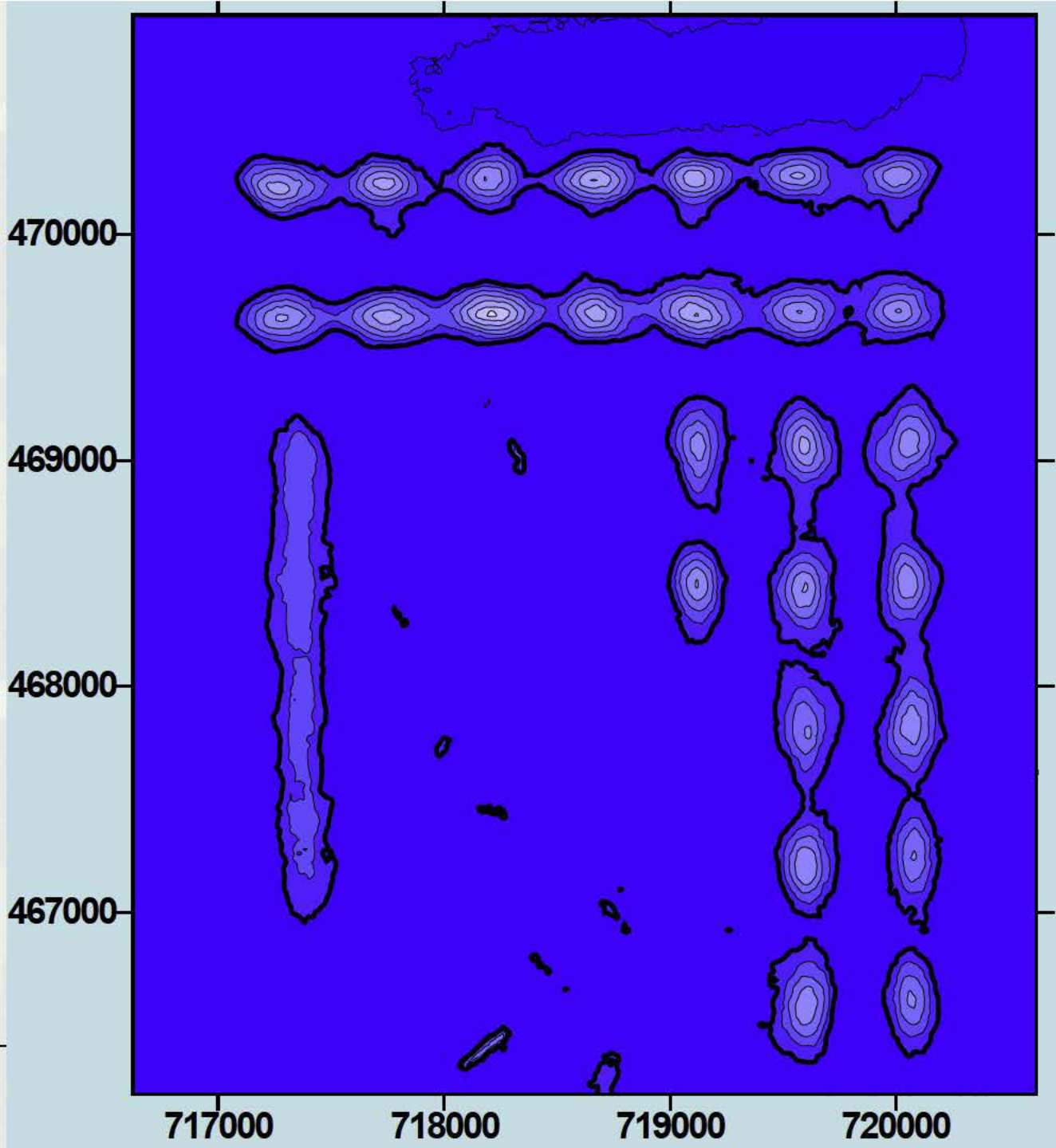
Fish Density Plot

Example WOFES Transect



Shark River Reef

Constructed of Rock from the Kill van Kull Waterway Deepening Project



Advantages of Beneficial Use Placement Options

- Environmental enhancement
- Can be cost effective
- Provide long-term placement sites
- More reliable navigation project programming
- Positive public relations