

Means of Avoidance and
Minimization of Coral Reef Impacts
During Offshore Coastal
Construction Projects

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Coastal Construction Projects

- **Offshore Fiber Optic Cable (FOC) Installations**
 - **Permitted FOC Projects**
 - **Construction Methodology**
 - Horizontal Directional Drilling (HDD), Cable Laying, Trenching
 - **Environmental Concerns**
 - FRAC OUTS!!
 - **Avoidance and Minimization**
- **Offshore LNG Pipelines**
 - **Permitted and Pending LNG Projects**
 - **Construction Methods**
 - HDD, Tunnel Boring, Pipe laying, Pipe cover
 - **Environmental Concerns**
 - **Avoidance and Minimization**

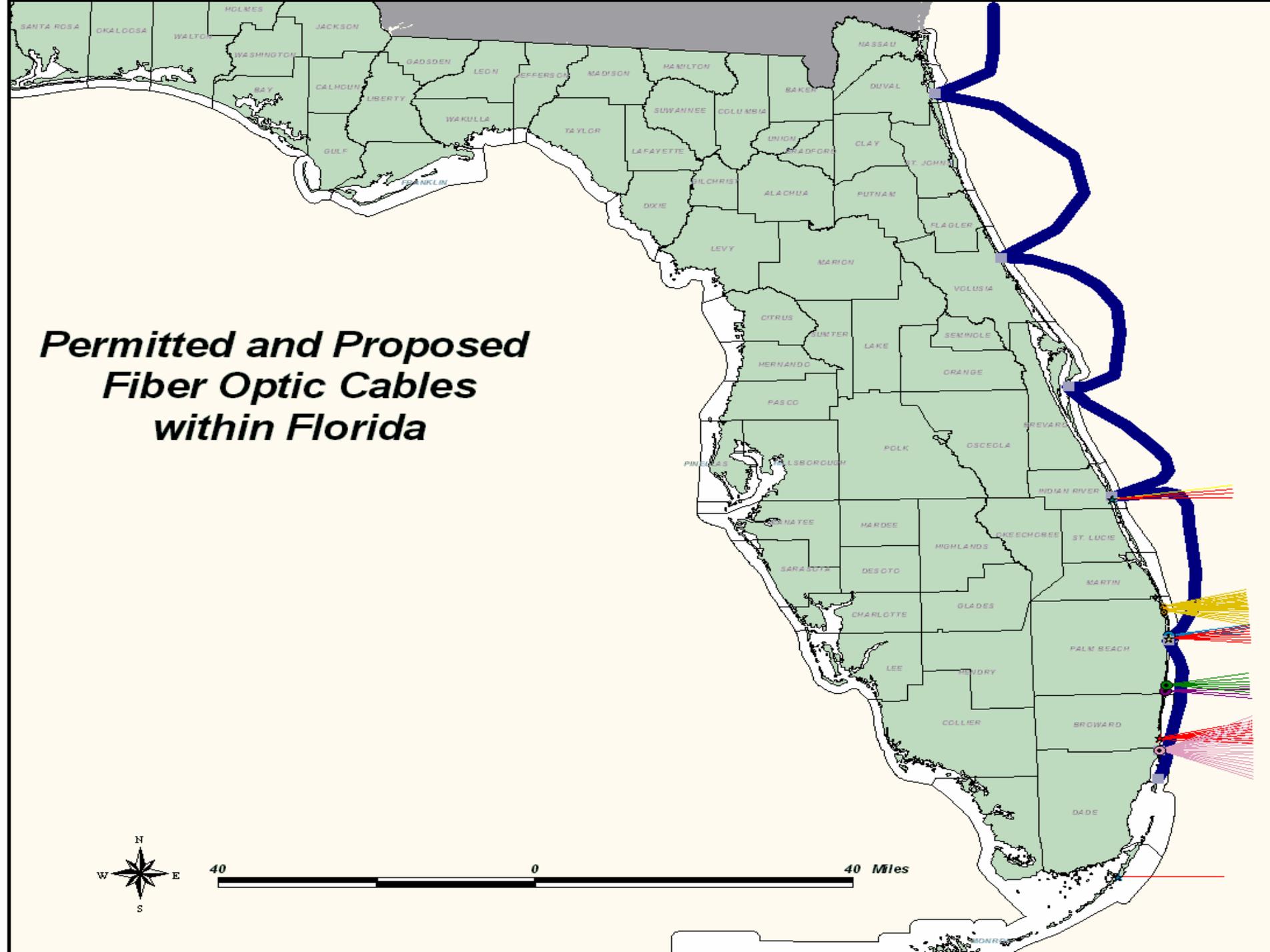
Fiber Optic Cable Permits

- **Tyco Submarine Systems Ltd.**
 - Boca Raton, 6 conduits 2 cables
- **Atlantica USA LLP**
 - Boca Raton, 4 conduits 2 cables
- **Bahamas Internet Cable System**
 - Boca Ration, 2 cables (Tyco's Conduits)
- **New World Network/ COM TECH International**
 - Sunny Isles, 3 conduits 2 cables
- **Florida Teleport LLC**
 - Delray Beach, 2 conduits, 1 cables
- **Many, many un-permitted and military installations**

Permitted and Proposed Fiber Optic Cables within Florida



40 0 40 Miles





Fiber Optic Cable Offshore Installation Methods

Fiber Optic Cable Conduit Installation

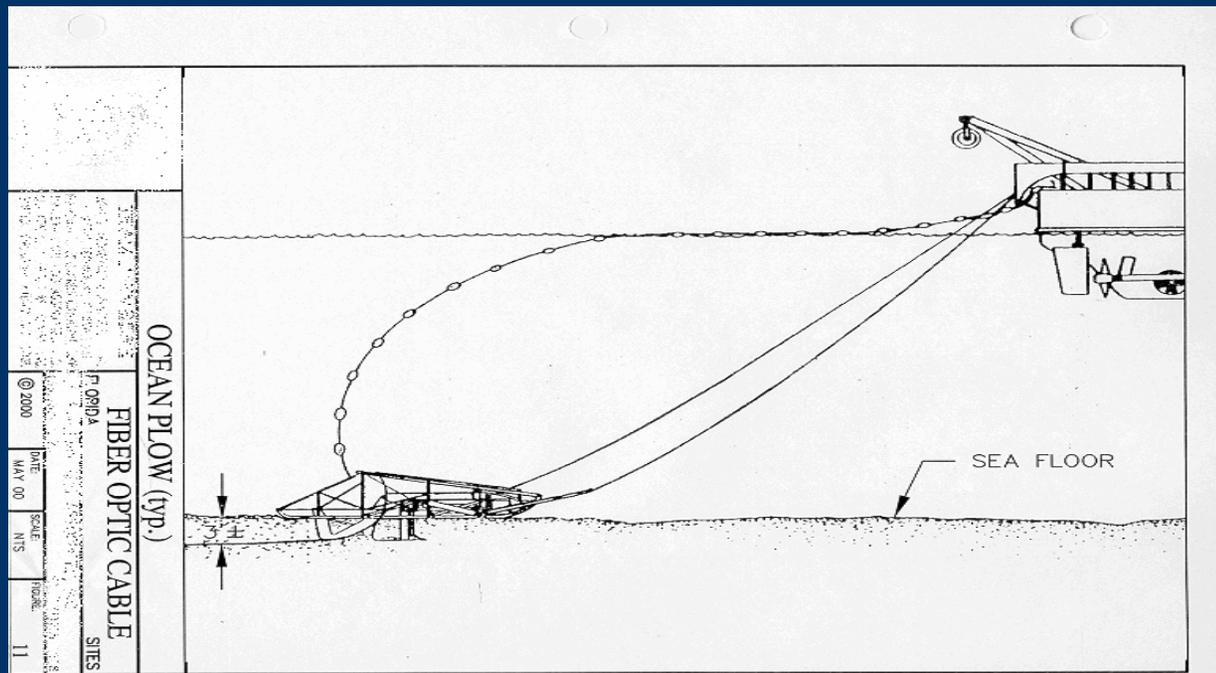
- Horizontal Directional Drill (HDD)
 - HDD from upland site down to a minimum depth of 25-30 feet
 - 2,000 to 4,000 feet out or to a depth of 30 feet
 - Divers hydraulically excavate a 15-ft. diameter hole at the punch out location ~10 feet deep
 - Reaming and backreaming cleans and opens drill hole to larger diameters
 - Conduit emerges from within the hole and is capped, buried, and sandbagged

Fiber Optic Cable Installation

- Laying Cable on Reef and Hardbottom
 - Vessel (20-32 ft. draft) approaches conduit site (into ~ 30-ft. depths) at a rate of 1.5 to 3 knots laying cable on top of reef and hardbottom communities
 - If enough slack, divers can do a post laying inspection to move cable off pinned corals and may clamp cable to prevent movement

Fiber Optic Cable Installation continued...

- Trenching and Connection
 - In unconsolidated bottom, cables may be plowed into the substrate using a sled plow or buried using jetting techniques or divers





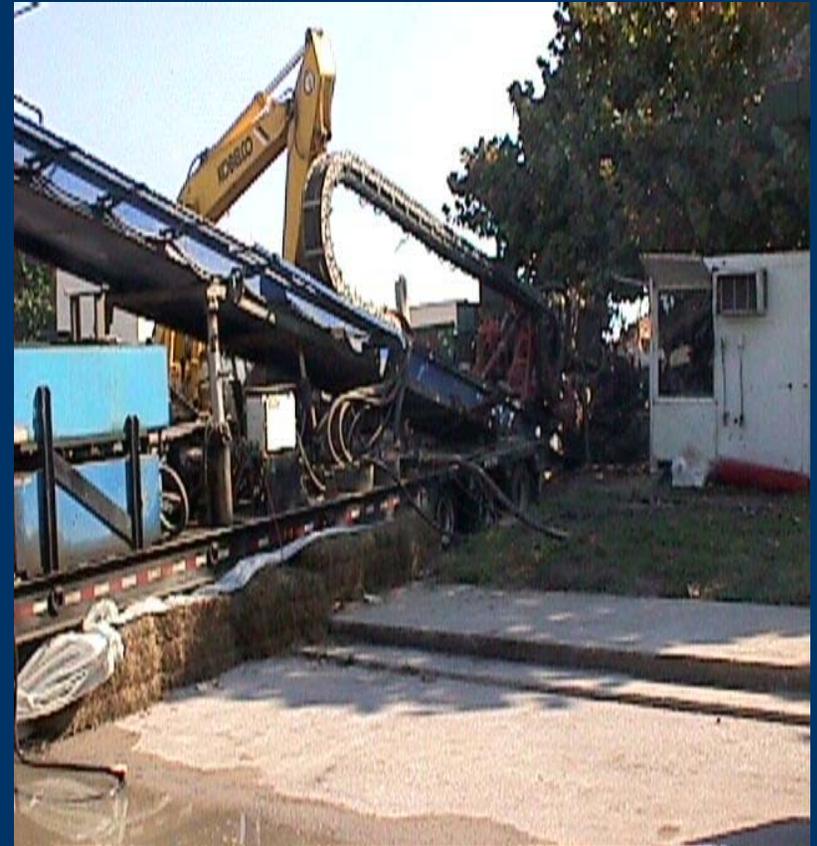
HDD

Three Reef Tracts

Staging Area



Control Room



Drill Rig

Bentonite



Bentonite in Bore Entry



Environmental Concerns



Environmental Impacts

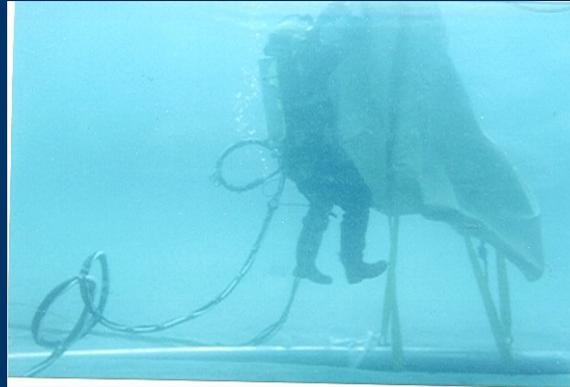
- Water Quality Concerns

- spoil (drill mud and sand) containment and disposal
- dewatering
- turbidity plumes at punch out points
- turbidity caused during trenching installations
- FRAC-OUTS

- Reef/Hardbottom and other fauna

- coral and sponges are abraded or dislodged during installation
- turbidity plumes and frac-outs can smother corals and other filter feeders
- marine mammal entanglements
- oscillations during storm events (strumming)
- cable repairs

Turbidity at “punch out”



Frac-outs: release of drilling lubricants.

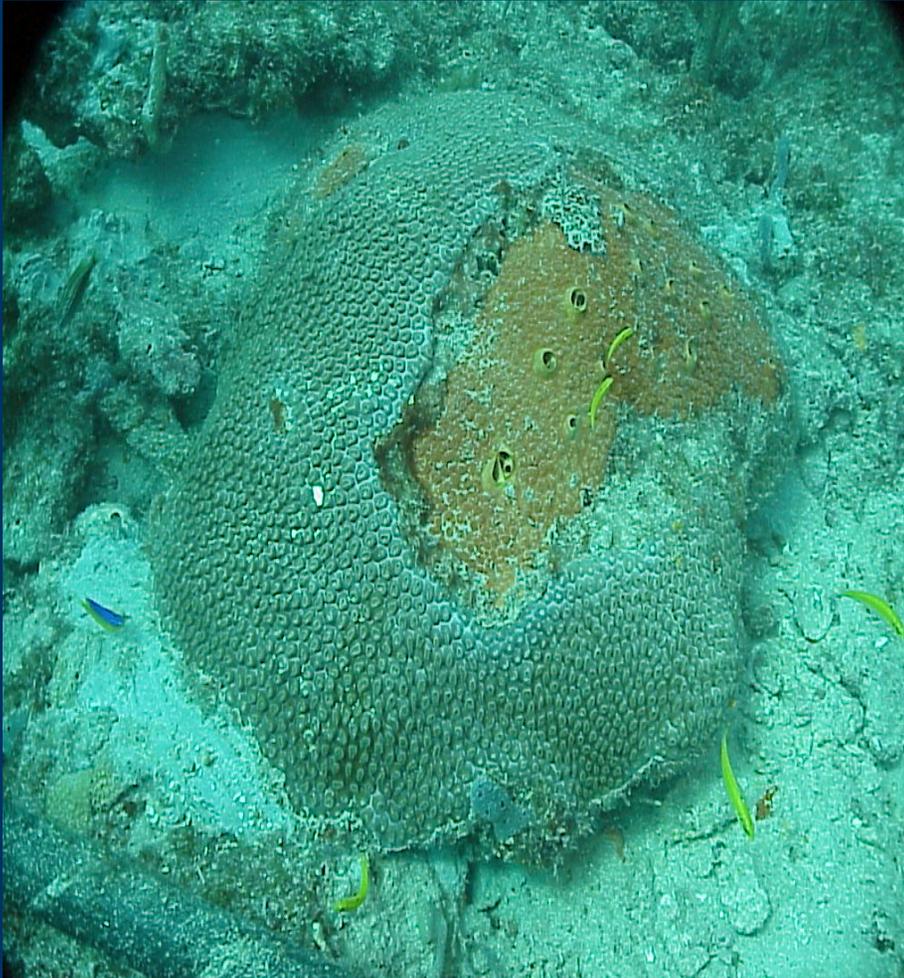
- Forms may be mounding, burps, or uncontrolled flows
- Controls may include, increasing viscosity of bentonite or the addition of additives.



Reported Frac-outs

- **AT&T Hollywood**-none reported by consultant
- **Tyco**- 4,331 square feet
- **Atlantica**- 1,251 square feet
- **Com-Tech**- none reported by consultant

Hard or Stony Coral Impacts Reported



- **Stony Coral Species Impacted include:**
 - Great Star Coral
 - Boulder Brain Coral
 - Grooved Brain Coral
 - Starlet Coral
 - Smooth Star Coral
 - Maze Coral
 - Elliptical Star Coral

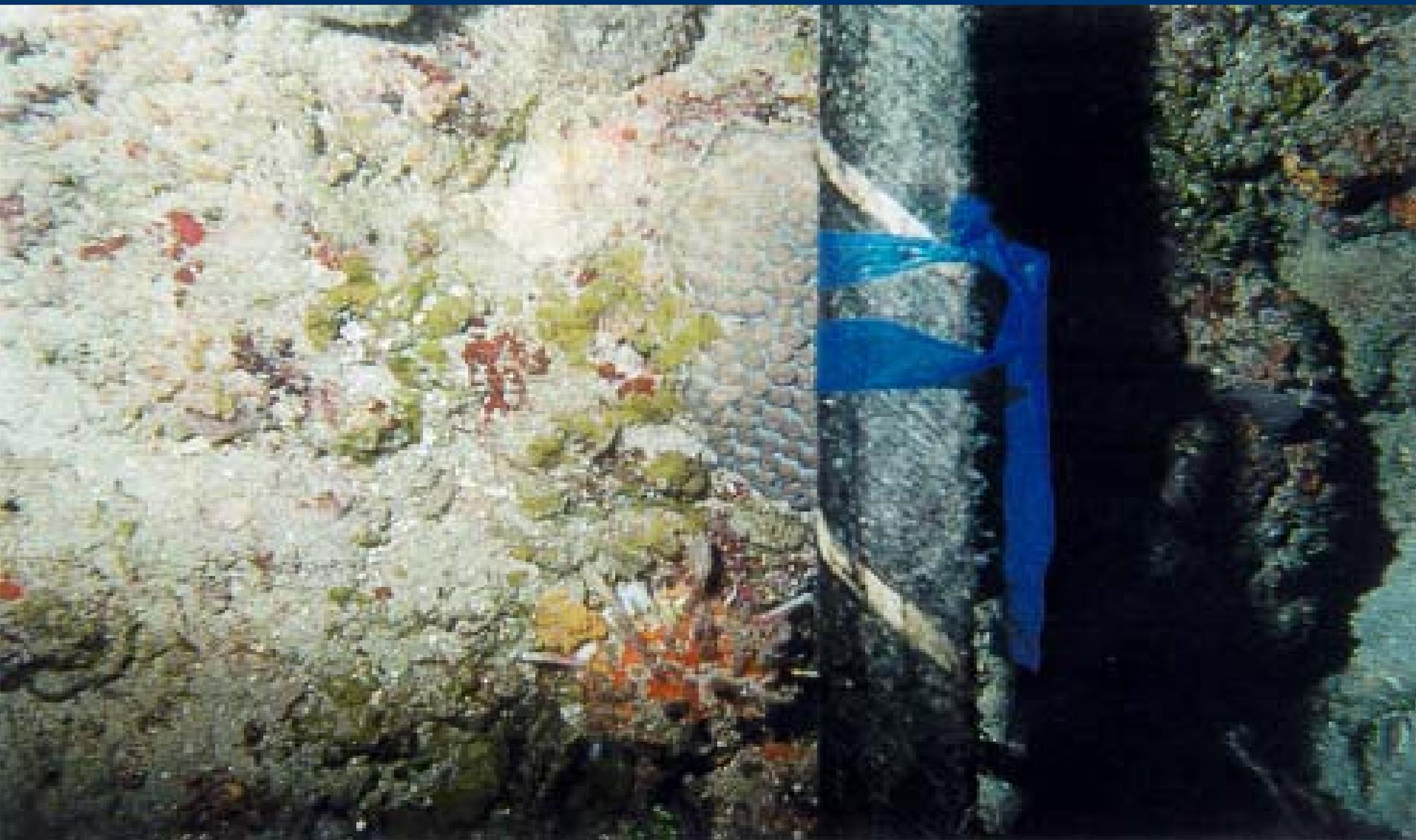
Shading Damage



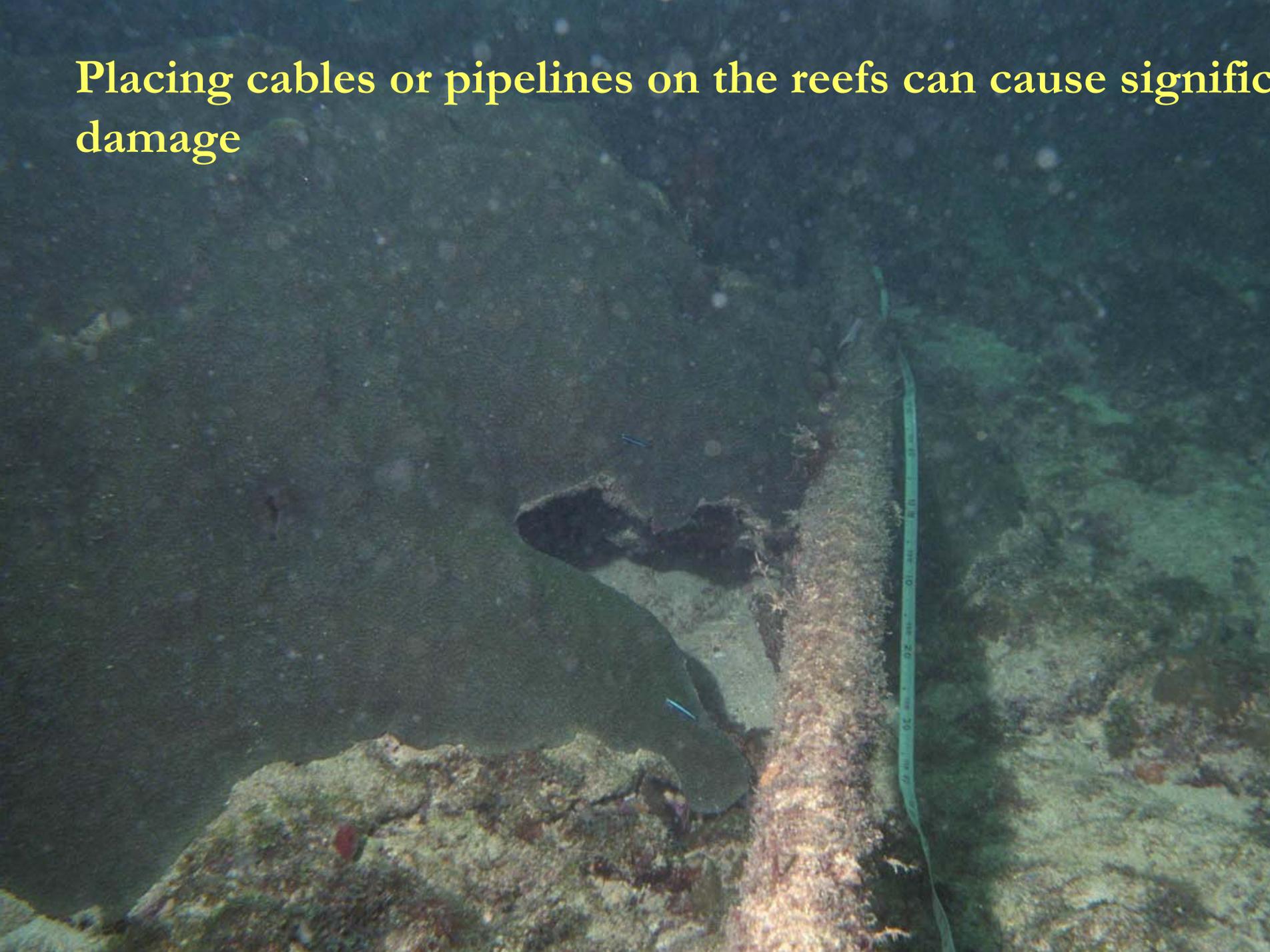
Cable Touching Coral



Cable over Coral



Placing cables or pipelines on the reefs can cause significant damage



Although the reefs do eventually heal to a deg



Sea-Turtle Impact Minimization for Dune Beachfront Staging Area



Best Management Practices during Directional Drilling

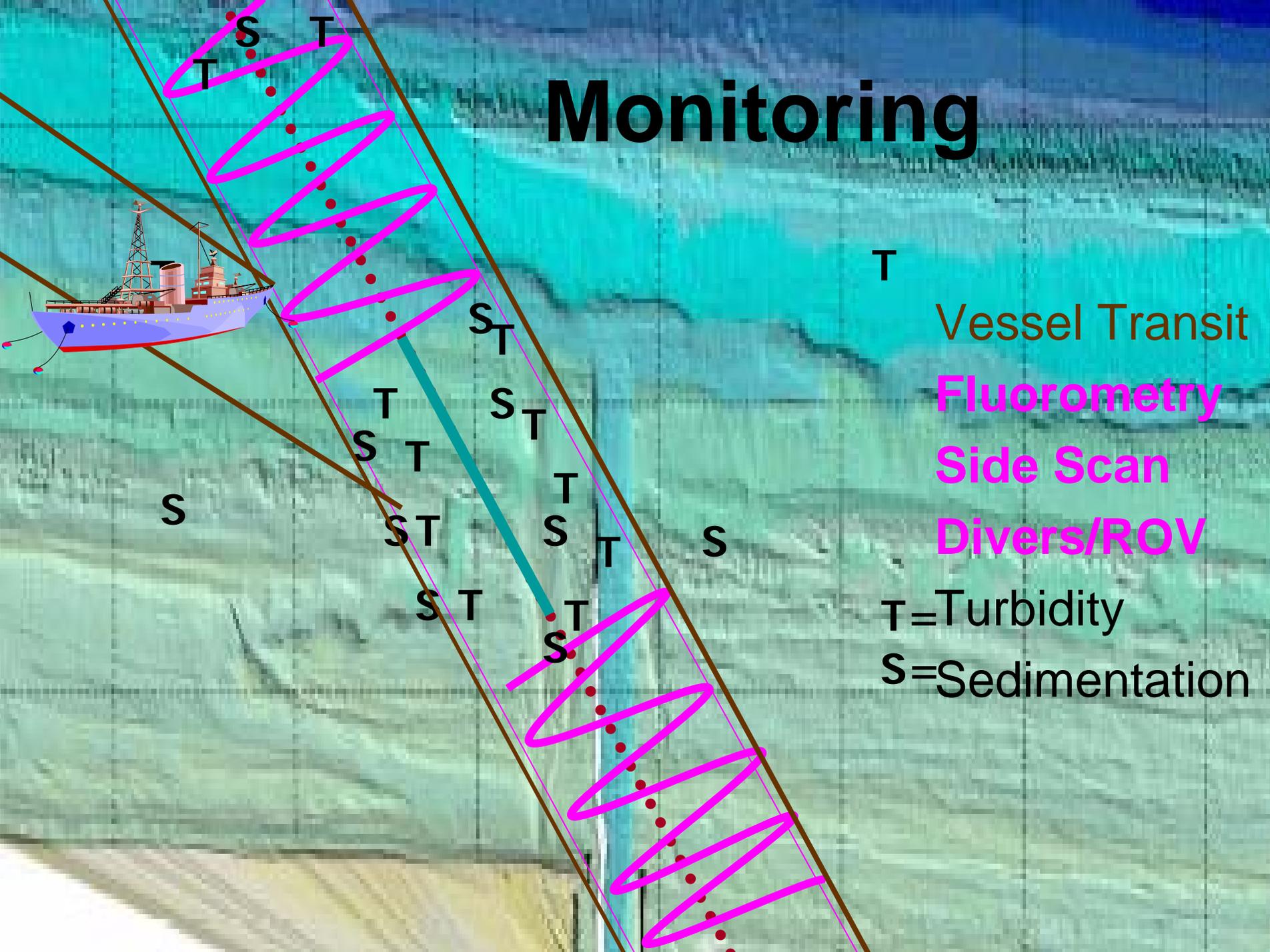
- **Spoil Containment:** Best management practices for erosion control and turbid discharges in excess of State water quality standards shall be maintained by using staked hay bales, staked filter cloth, sodding, seeding, and mulching, staged construction and the installation of turbidity screens around the immediate project site.
- **Frac-outs:** In order to minimize the possibility of a bentonite release, the volume of bentonite in the drill string and the drill pressure will be monitored at all times during the directional drilling operation. The site project manager shall consider the use of seawater, in place of bentonite, as a drilling lubricant during the last 30 to 50 feet of the directional bore.
- **Protected Species:** With the exception of the horizontal drilling phase of the project, no construction, operation, transportation or storage of material/equipment are authorized seaward of the existing dune crest during the marine turtle nesting season (1 March through 31 October). No temporary lighting of the construction area visible from any part of the beach is authorized at any time during marine turtle nesting season. No permanent lighting is authorized.

Fluorescent Dyes and Side Scan Sonar

- Rhodamine WT with fluorometer.
- Side scan sonar used where there are sandy bottoms.



Monitoring



T
Vessel Transit

Fluorometry

Side Scan

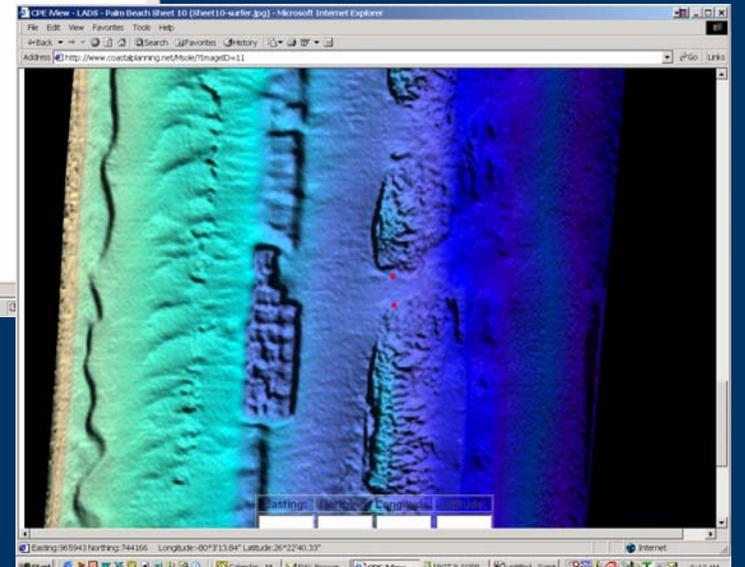
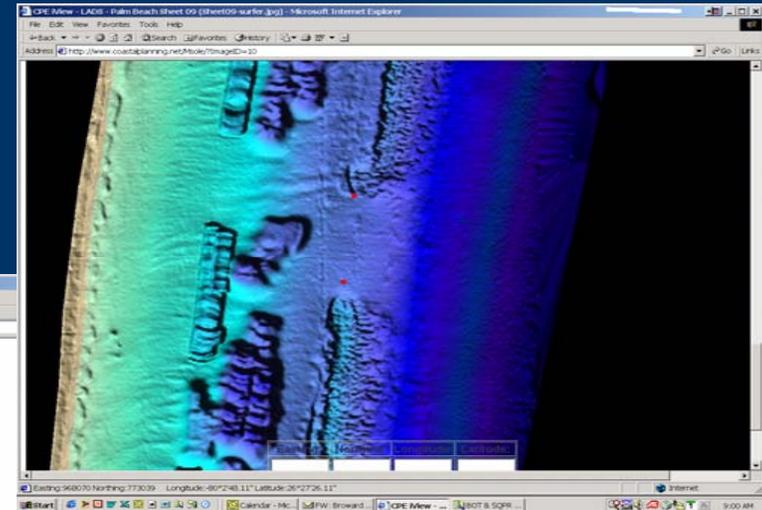
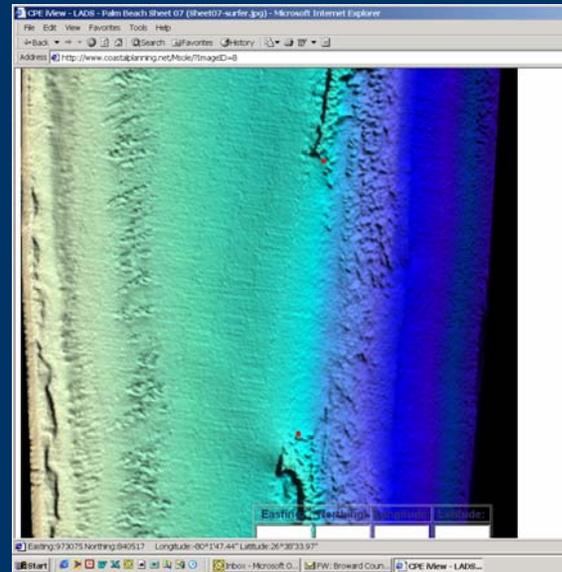
Divers/ROV

T=Turbidity

S=Sedimentation

Avoidance Practices in Cable Laying

- Reef Gaps
- 18-21.004(2) Resource Management
- 18-21.011 (2) (b) Fees



Applications for telecommunication lines received after October 29, 2003 shall be subject to the following:

- Applicant provides satisfactory evidence of a need by providing documentation
- Limited to no more than six telecommunication lines and conduits except where the applicant can affirmatively demonstrate that the landing site will support a larger number of such lines and that the routing to the State's territorial limits within the territorial sea will cause no more than minimal individual and cumulative impacts.
- Prohibited on or under submerged lands within Biscayne Bay Aquatic Preserve, Biscayne Bay National Park, and Monroe County.
- Conduits for telecommunication lines shall be directionally drilled under nearshore benthic resources, including the first reef and any other more inshore reefs off Southeast Florida, to the maximum extent practicable and shall punch out in a location that avoids or minimizes impacts to benthic resources such as seagrasses and live bottom communities including corals and sponges.
- While locating in these areas is not required for approval, special consideration areas are designated for telecommunication lines and associated

Fees

- Private easements for telecommunication lines and associated conduits that are subject to the provisions of paragraph 18-21.004(2)(I), F.A.C., shall be a one-time easement value and enhanced value fee of \$5.06 for installations outside of special consideration areas or a one-time easement value fee of \$0.06 for installations inside such areas.
- The fee shall be revised annually on March 1 and increased or decreased based on the average change in the Consumer Price Index, calculated by averaging the Consumer Price Index over the previous five-year period, with a 10 percent cap on any annual increase.

Minimization Practices in Cable Laying

Specific Conditions:

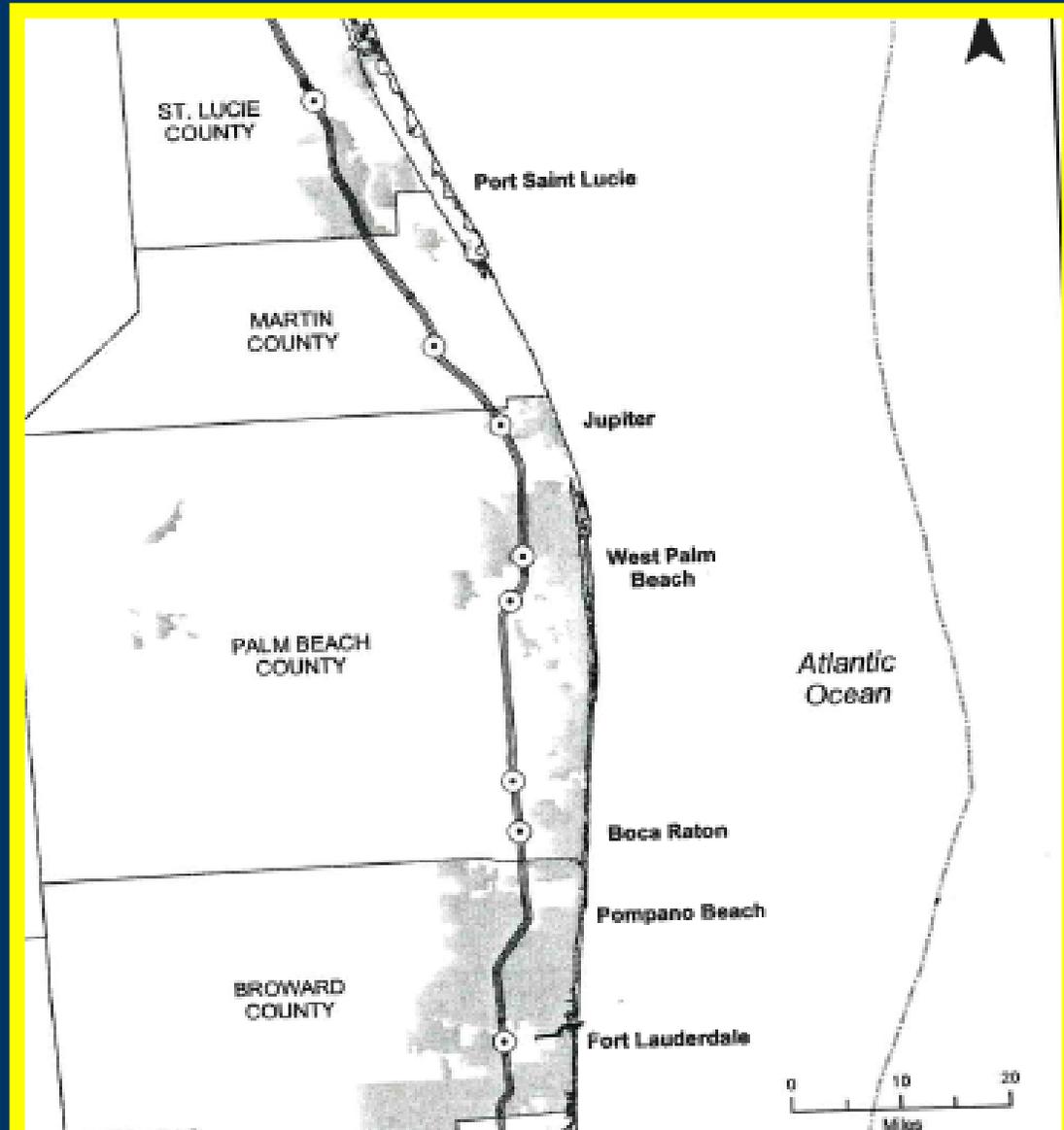
- To the extent practicable and considering weather, safety, and navigational control, the speed of the cable-laying vessel shall not exceed 2 knots speed over ground (S.O.G.).
- The permittee shall ensure that vessels associated with the cable project are not anchored on hard bottom and that divers will visually inspect the bottom before anchoring.
- The permittee shall have divers in place for a post lay to assure the cable is moved to free pinned corals and severed or dislocated corals are tagged for repair or relocation.

Minimization Efforts Post Lay Restoration

- Divers adjust cables in an attempt to free pinned soft corals.
- Severed or abraded stony corals are tagged for repair or relocation.
- Repair and monitoring reports are sent to FDEP

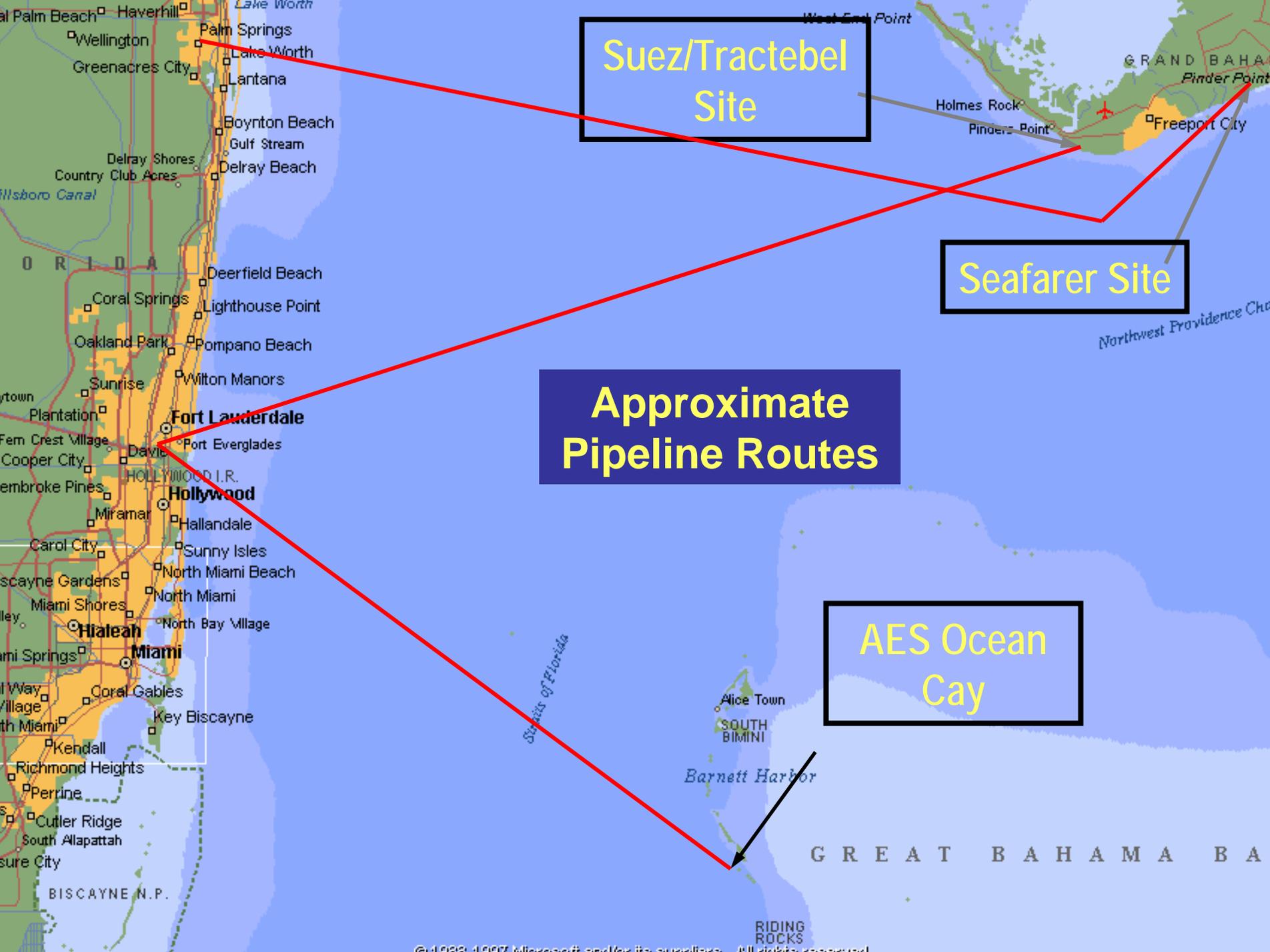


LNG Pipeline Construction



LNG Project Status

- AES
 - 24” LNG Pipeline
 - Original permit used HDD construction
 - Modified permit issued 2/22/2005 to use tunnel
- Calypso
 - 24” LNG Pipeline
 - Original permit used HDD construction
 - Modification for tunneling expected June 2006
- Seafarer
 - 26” LNG Pipeline
 - Currently “in-house” proposing tunnel method



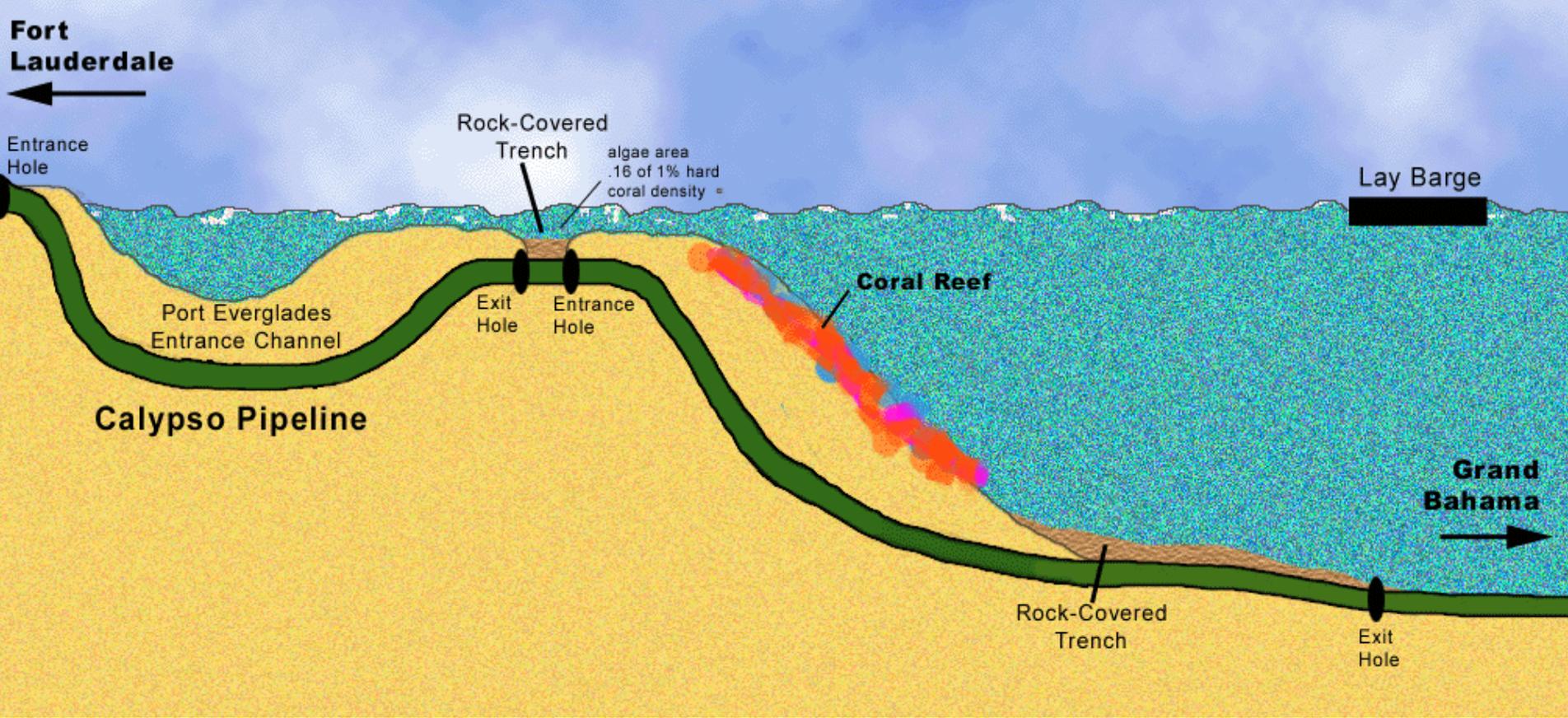
Suez/Tractebel Site

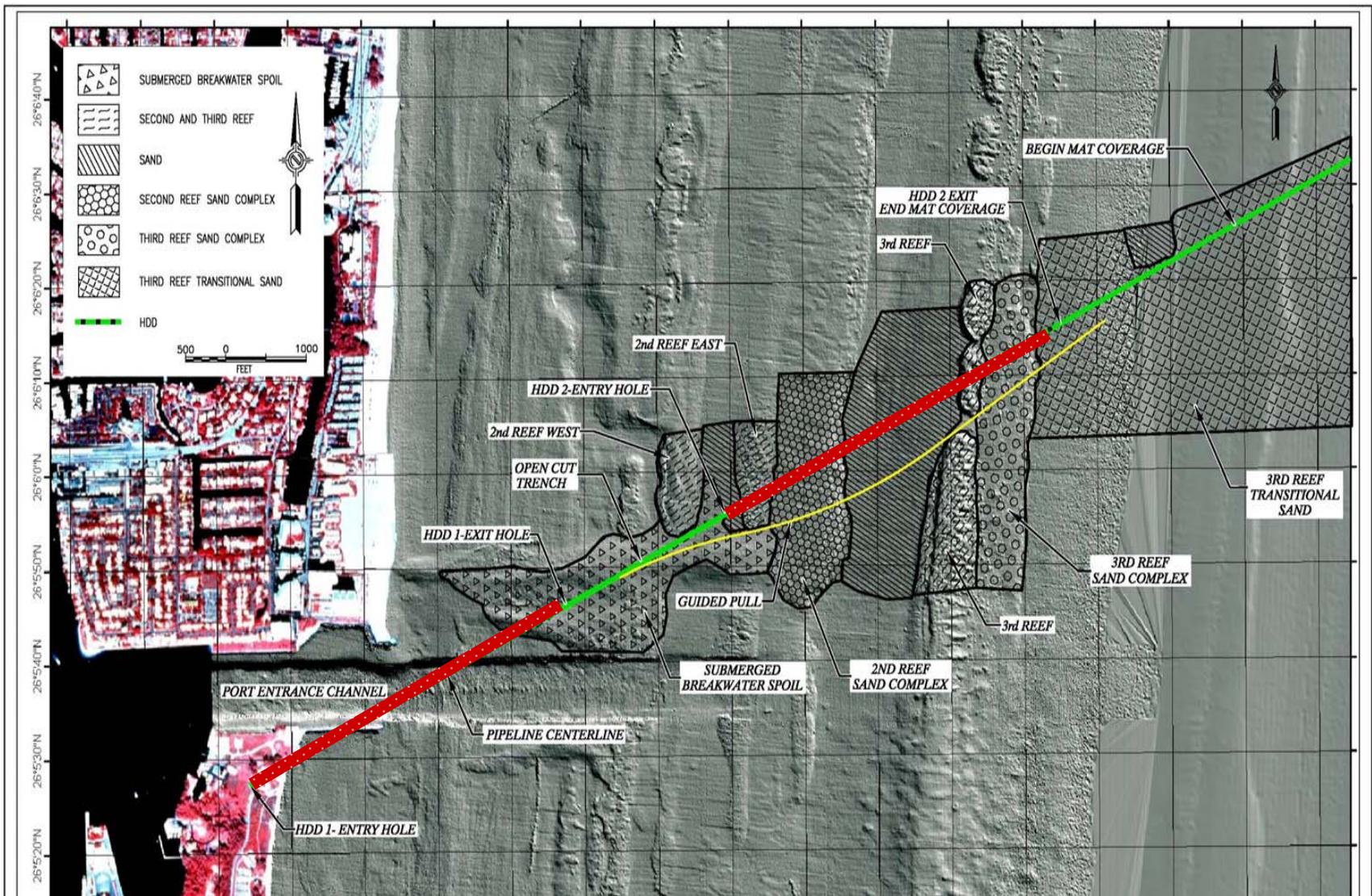
Seafarer Site

Approximate Pipeline Routes

AES Ocean Cay

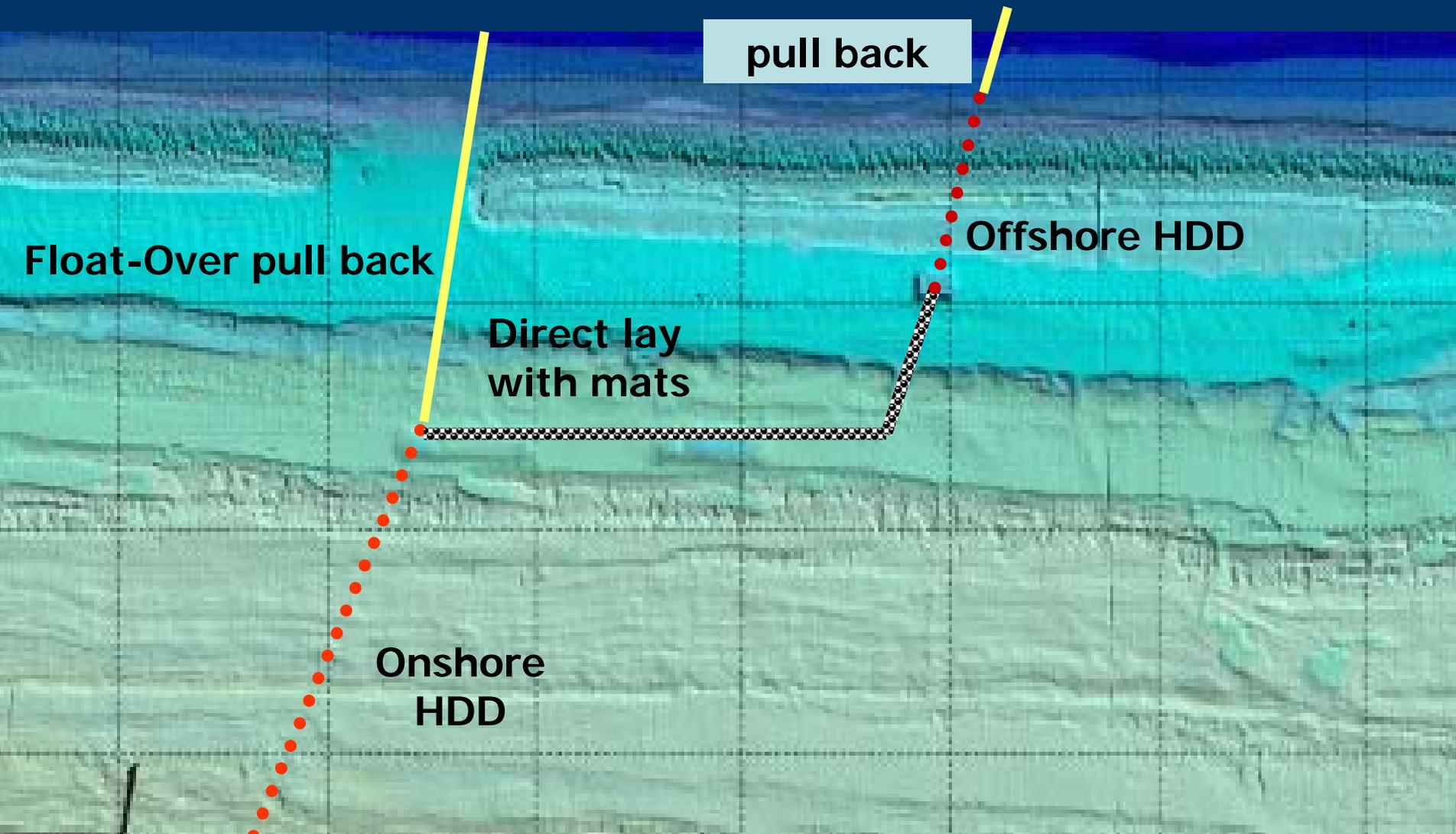
Horizontal Directional Drilling and Pull back





Suez/Tractebel Guided Pull

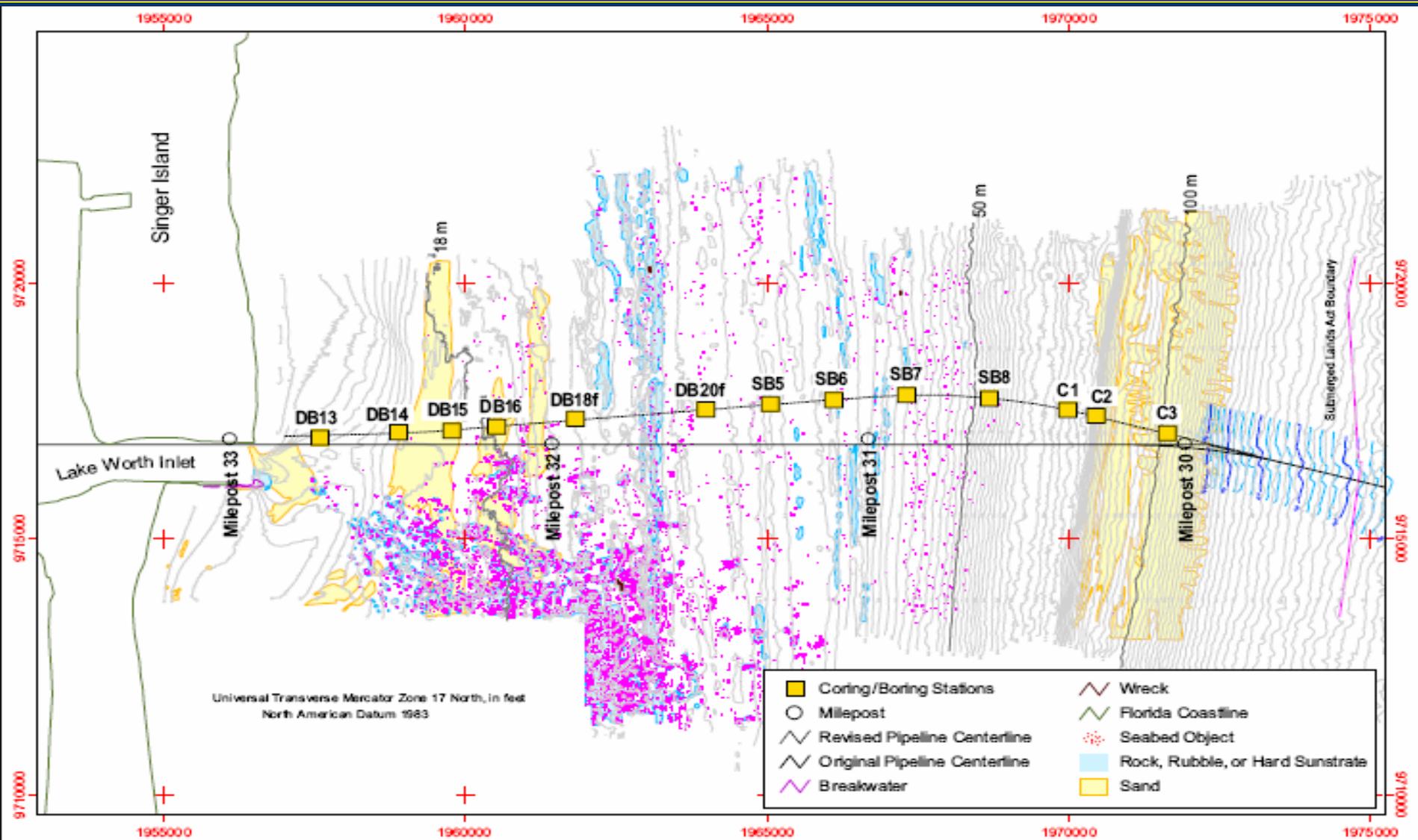
AES Ocean Express Construction



el Paso Seafarer Landing

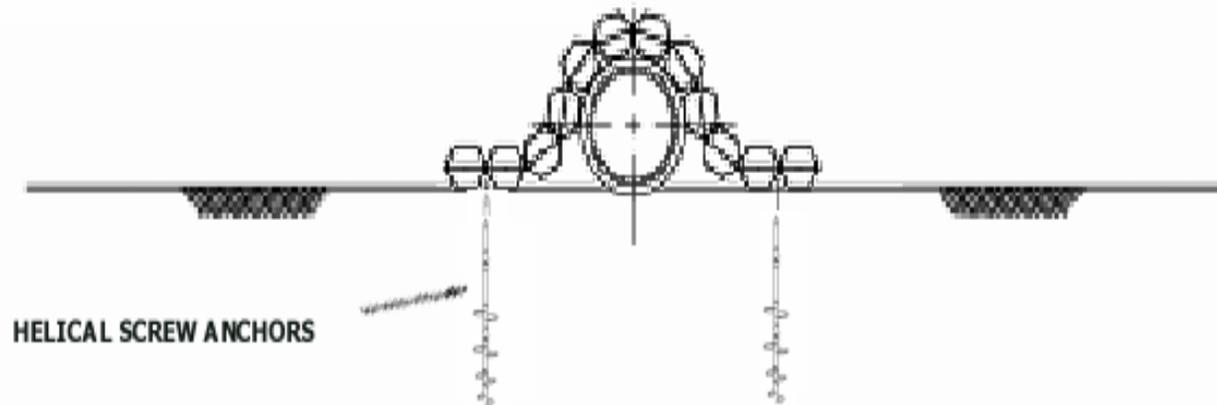
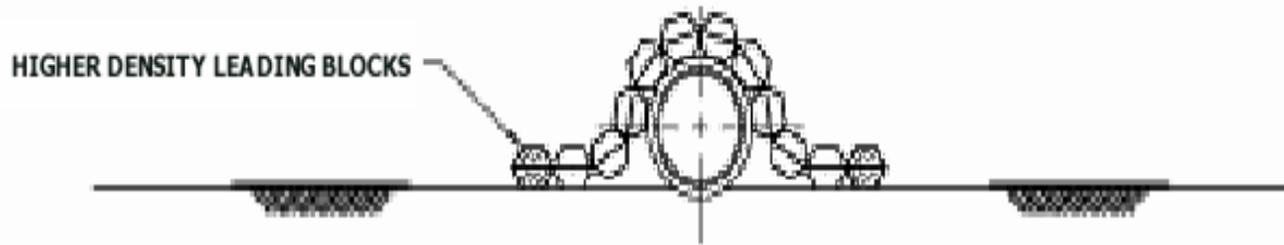


Seafarer Nearshore



Inter reef - Pipeline protection

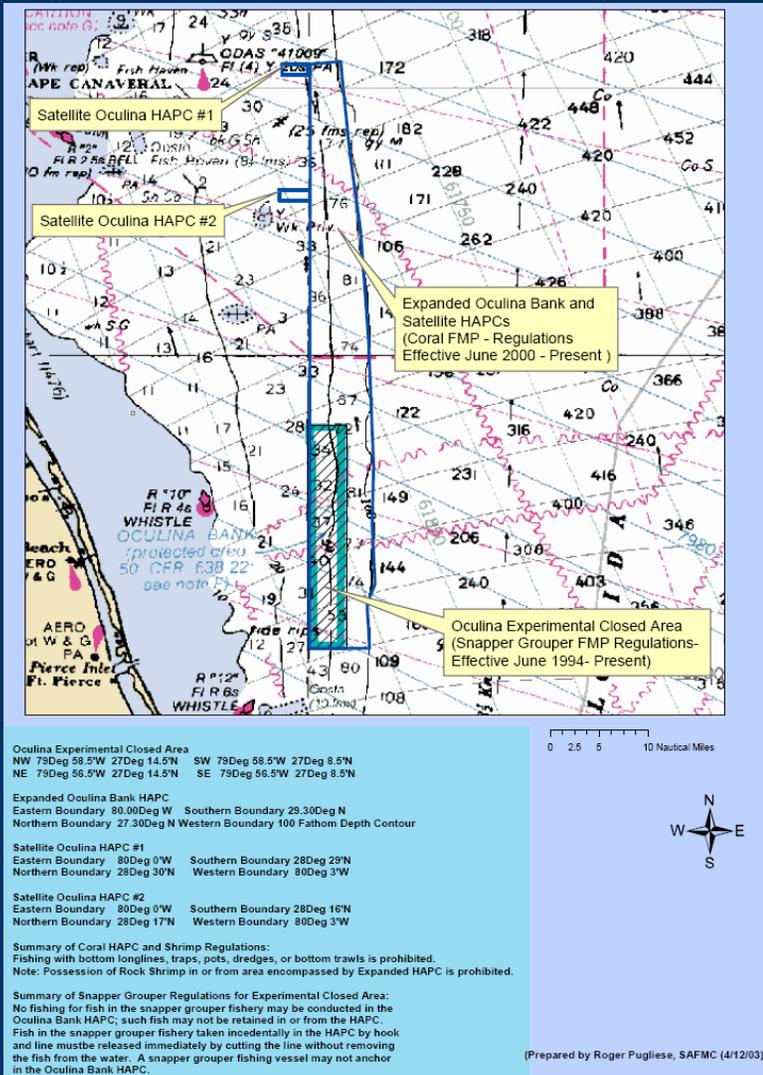
ADDITIONAL STABILIZATION METHODS



Environmental Concerns

- Tractebel Calypso
- Concrete Mat impacts
- Guided Pull Method
- Horizontal Directional Drilling
 - drilling mud release
 - failed pullback
- AES Ocean Express
- Float-Over Installation in shallow water
- Horizontal Directional Drilling
 - drilling mud release
 - failed pullback
- Deepwater Coral

Deep-water Coral Habitats

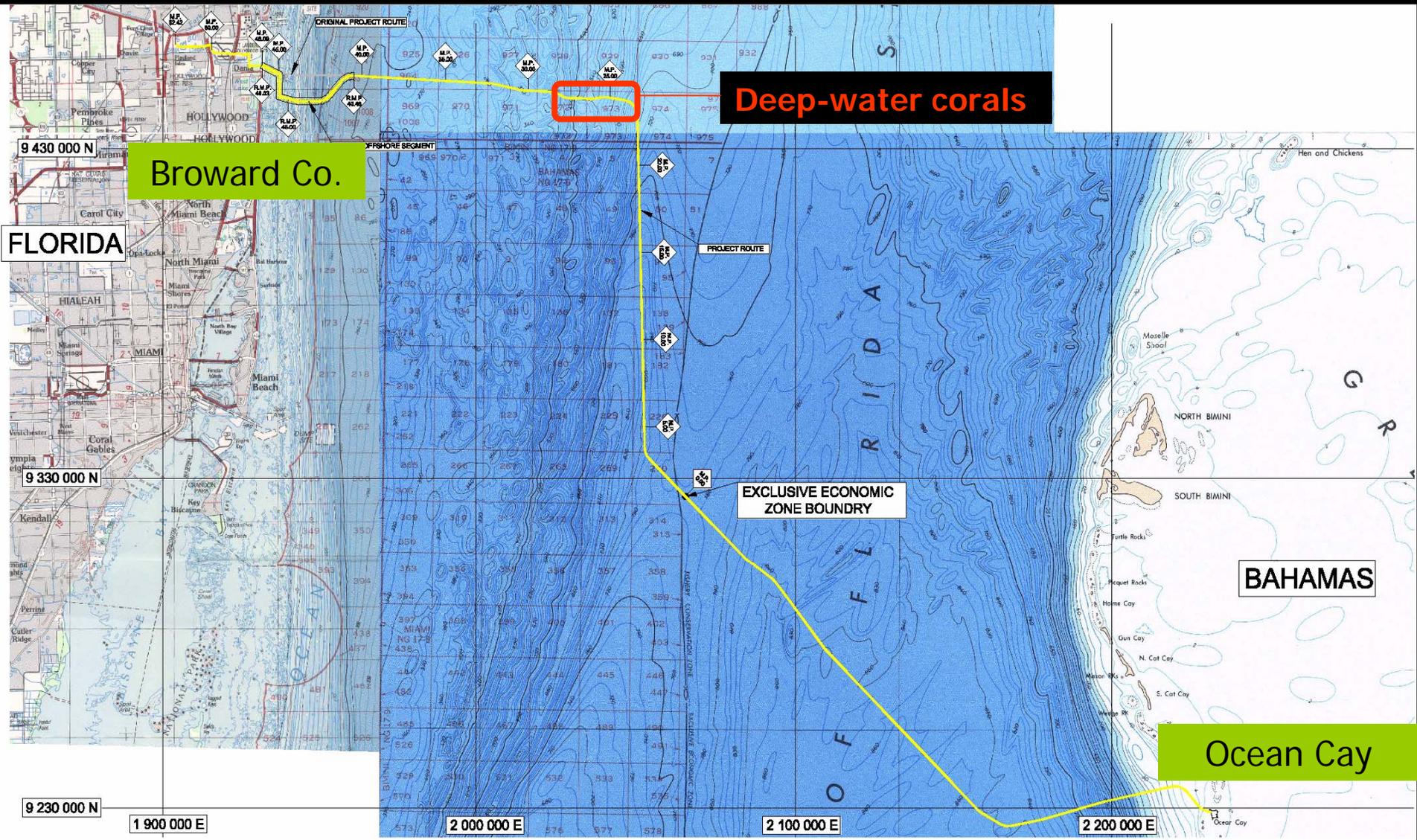


Oculina Bank (HAPC)



Offshore Lophelia Explorations

Miami Terrace - Escarpment



Deep-water corals

Broward Co.

FLORIDA

EXCLUSIVE ECONOMIC ZONE BOUNDARY

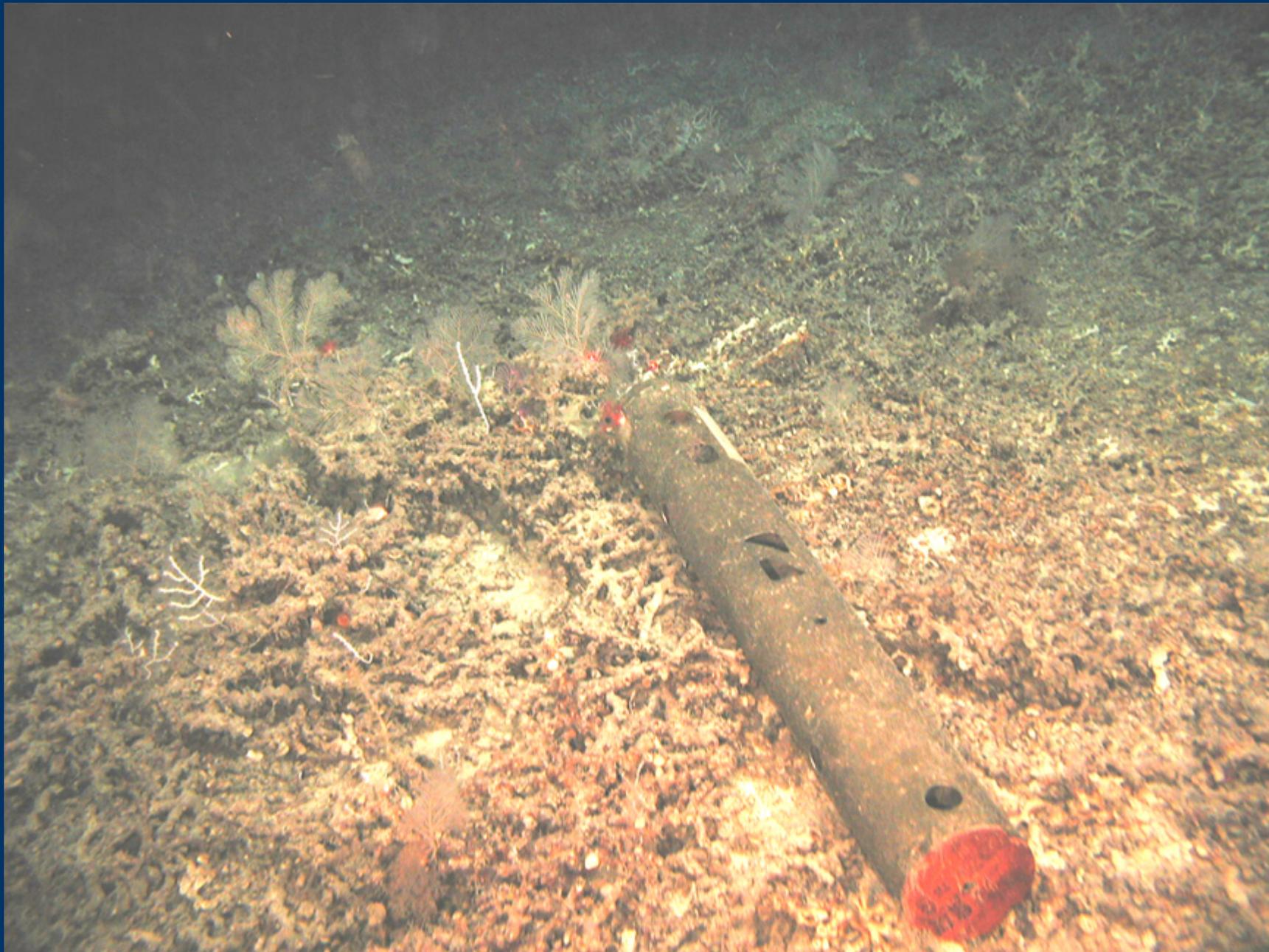
BAHAMAS

Ocean Cay

A coral thicket in ~1800' of water.







Avoidance/Minimization

- Selection of routes that avoid impacts to high and medium density reef systems;
- Designation of temporary work areas; contingency work areas; exclusion zones; vessel transit areas; vessel holding areas; anchor safety zones; use of midline buoys on mooring lines to prevent anchor sweep;
- Implementation of a coral relocation plan prior to and during construction;
- Use of horizontal directional drilling (HDD) incorporating marine riser systems to avoid direct impacts to the offshore reefs;
- Use of guide piles in sandy areas to reduce impact areas;

Avoidance/Minimization

- Realignment of the concrete mats which reduces the permanent impact corridor from 16 feet wide to 9 feet wide;
- Use of a float-over system with associated lateral guidance system during HDD pull-thru operations to avoid impacts to higher relief reefs; and
- Development of a comprehensive Environmental Construction Monitoring and Verification Plan (ECMVP).
 - Turbidity monitoring with implementation of a voluntary 15 NTU turbidity standard at reef edges;
 - Sedimentation monitoring
 - Frac-out monitoring program

Avoidance/Minimization

- Development of Nearshore Construction Plans
 - Vessel Transit and Work Areas (real-time monitoring)
 - Anchor Plans (including midline buoys, helical screw anchors)
 - Horizontal Directional Drilling (including frac-out monitoring using fluorometry, side scan, divers/ROV)
 - Turbidity Monitoring (including more stringent 15 NTU's)
 - Sedimentation Monitoring (plates and coral stress indicators)
 - Coral Relocation

Avoidance/Minimization

- “One Try”
- Reef Construction First then deepwater
- Inadvertent Coral Impact Bond
- Coral Repairs
- Tunneling!
- Exit pit design

Tunneling

Calypso

Tunnel Machine Selection

Earth Pressure Balance Machine (EPBM)



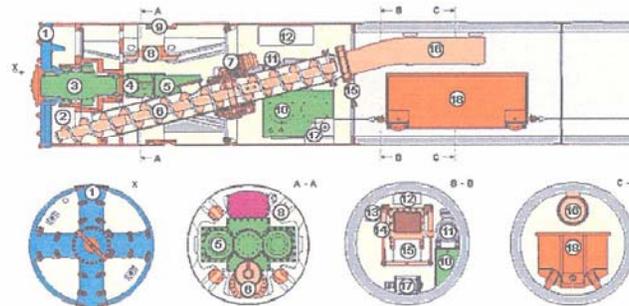
- Excavation face supported by regulating excavation volume versus advance rate.
- Required extensive use of soil conditioner and foams.
- Significantly more US experience in large tunnels.

Tunneling

Calypso

Tunnel Machine Selection

Earth Pressure Balance Machine (EPBM)



1. cutting wheel
2. extraction chamber
3. drive shaft
4. epicycloidal gear
5. electrical drive motor
6. screw conveyor

7. screw drive
8. steering cylinder
9. shield articulation seal
10. hydraulic tank
11. electric motor
12. main electricity supply

13. ELS target
14. telescope cylinder
15. discharge slide gate
16. discharge pipe
17. cable winch
18. thick matter conveyor

Tunneling

Calypso

Tunnel Machine Selection

Slurry Tunneling Machine

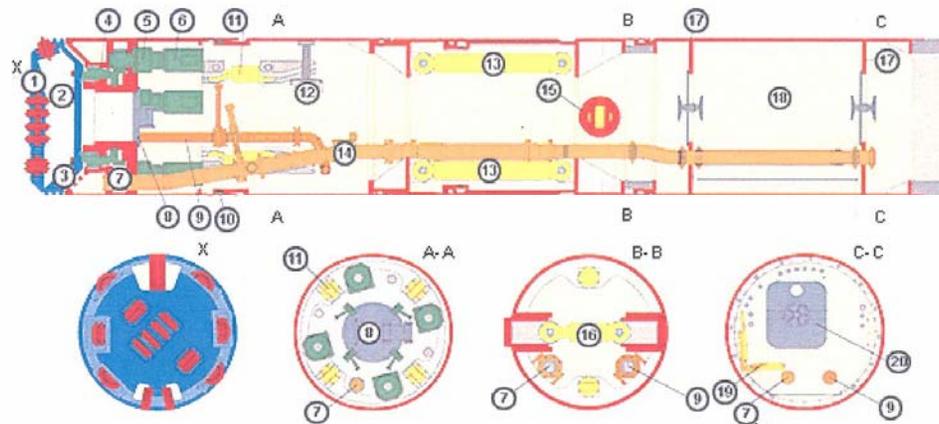


- Excavation face support by slurry under control and balance counter pressure
- Access through door to working face to remove obstacles or replace worn out cutting tools
- More secure excavation system under high pressure

Tunneling

Calypso

Tunnel Machine Selection Slurry Tunneling Machine



- | | | | |
|-----------------------|-----------------------------|------------------------|------------------------|
| 1. cutting wheel | 6. drive motor | 11. steering cylinder | 16. gripper cylinder |
| 2. extraction chamber | 7. conveyor conduit | 12. target | 17. pressure wall lock |
| 3. crusher space | 8. pressure wall door | 13. telescope cylinder | 18. lock |
| 4. main bearing | 9. supply conduit | 14. bypass | 19. lock seat |
| 5. gear unit | 10. articulated shield seal | 15. gripper | 20. lock door |

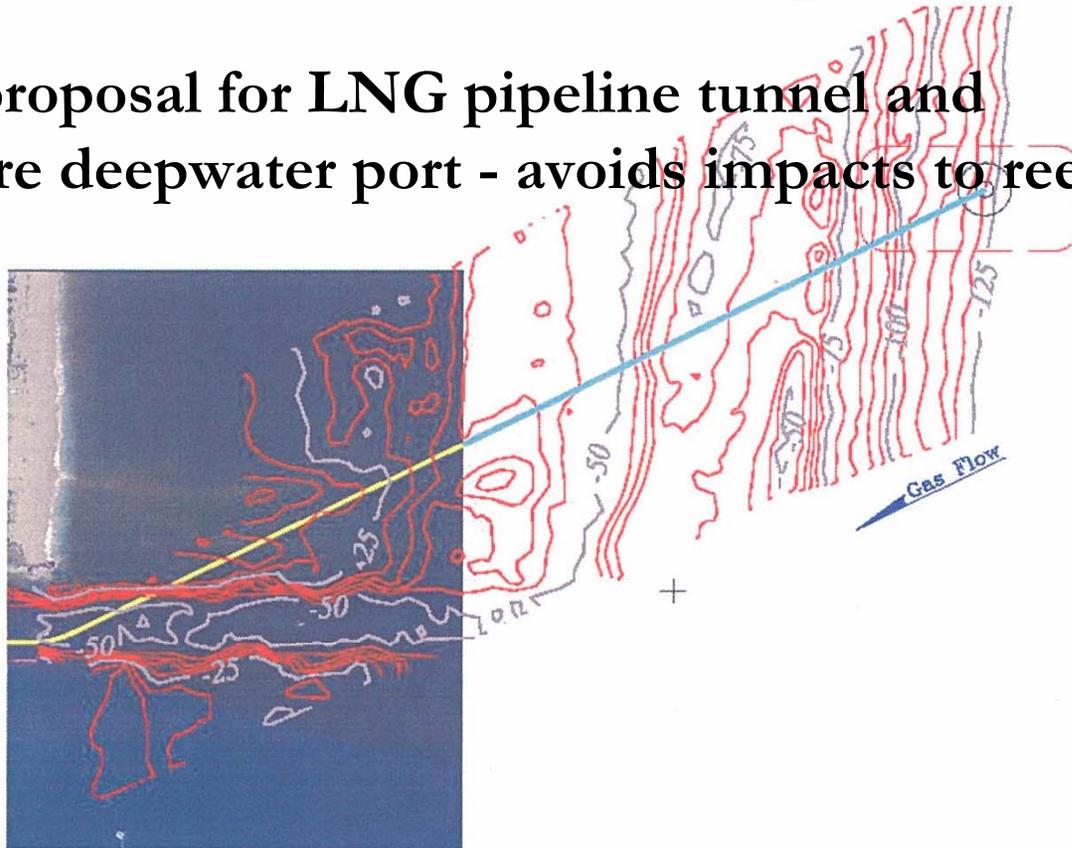
SVZ

Suez/Tractebel Tunnel Route

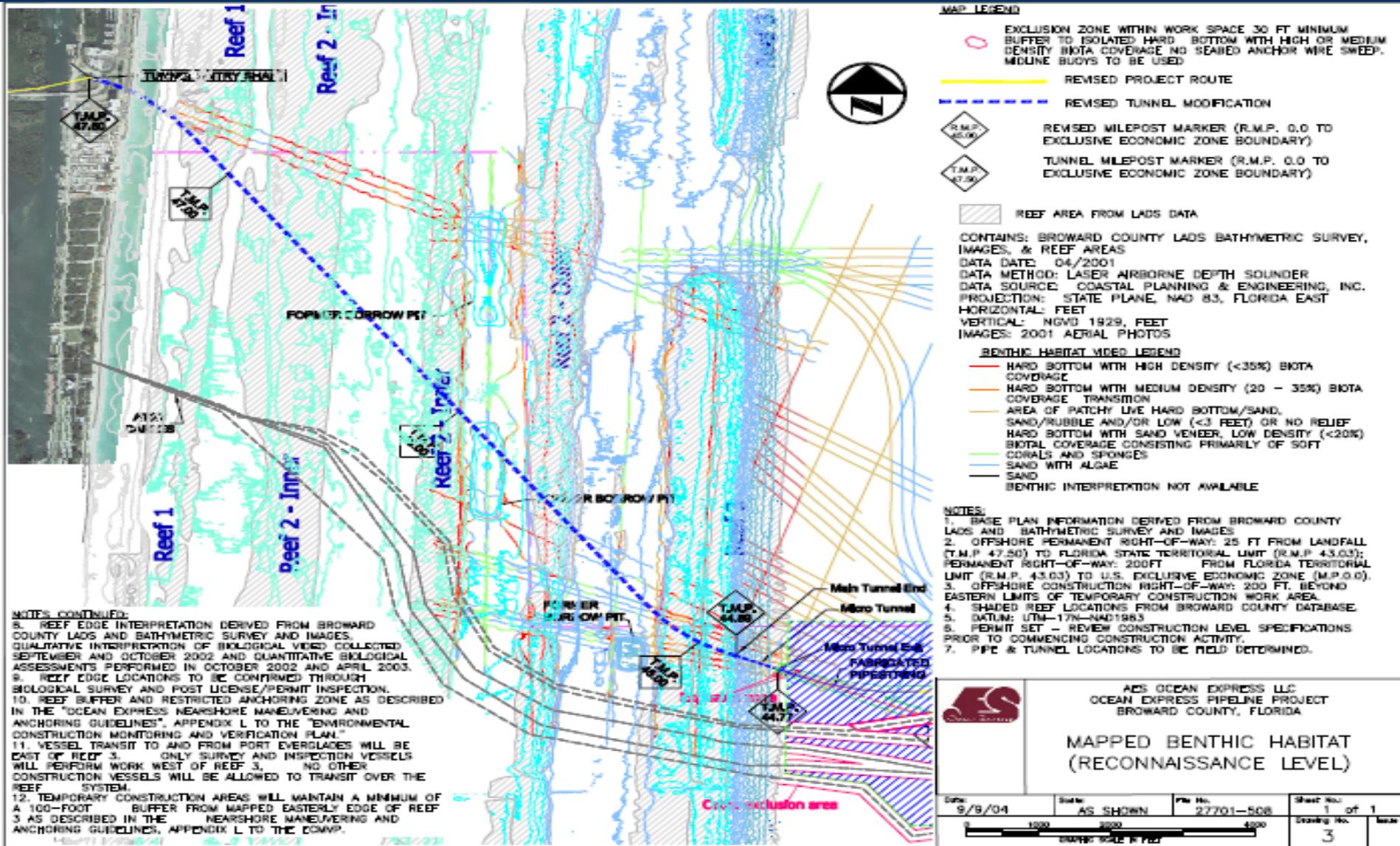
Alignment Plan and Profile

Plan - Off-shore Section of Alignment

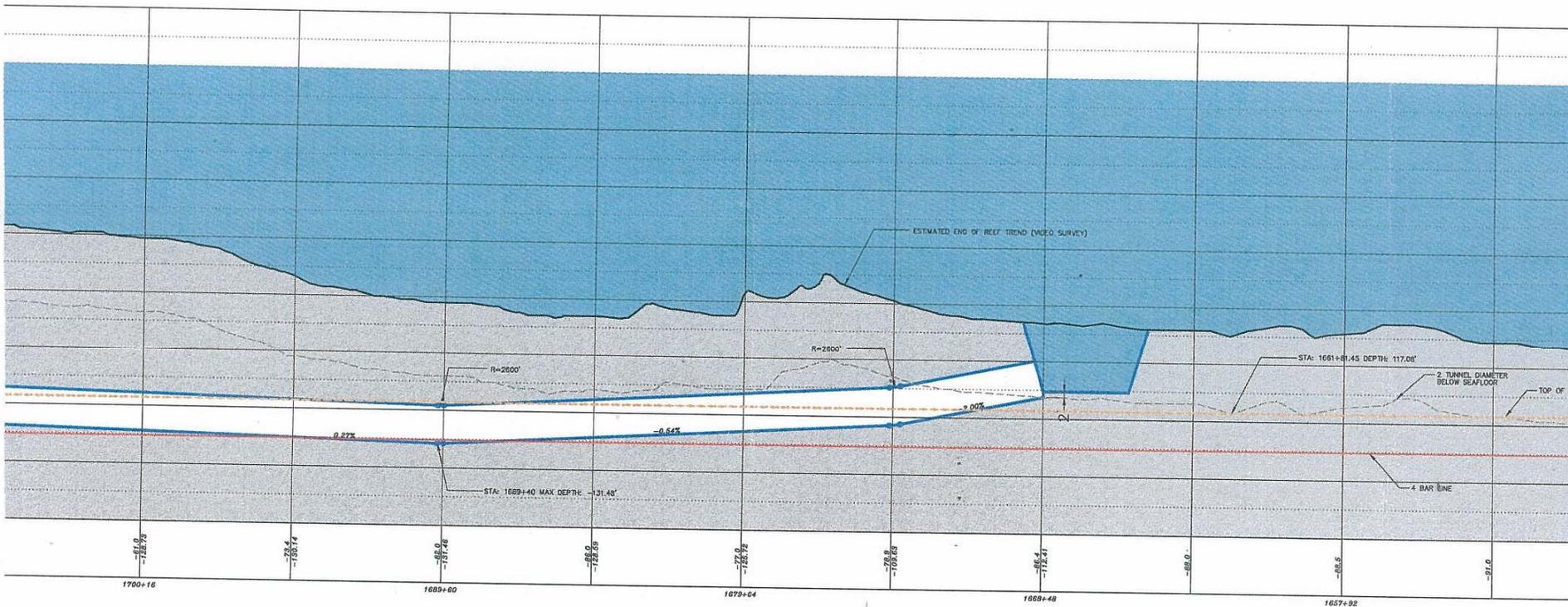
New proposal for LNG pipeline tunnel and offshore deepwater port - avoids impacts to reefs.



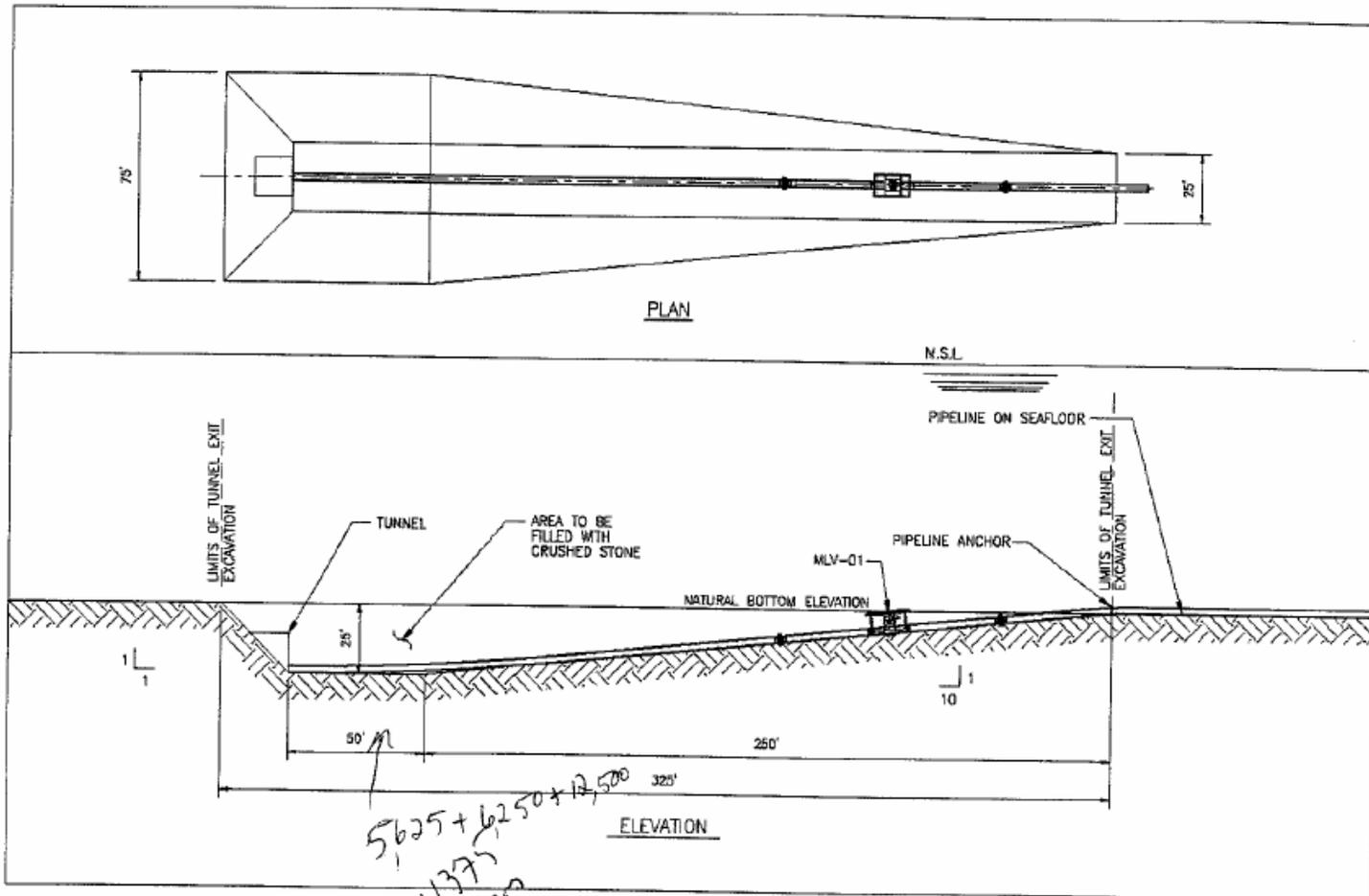
AES Ocean Express Tunnel Route



Seafarer Tunnel Profile with Exit Pit



Seafarer Exit Pit Design for Minimization



DRAWING 01142-094

Exit Pit Design Assuming Moderately Consolidated Soils
(1:1 slope and 25ft depth)



Types of Mitigation Proposed

- Artificial Reefs
- Tire reef removal
- Seagrass Preservation
- Feasibility Study for offshore mooring buoy/anchoring system Broward County...obvious reasons.

THE END

Questions?

