Constructing Oyster Reef for Shoreline Stabilization and Restoration

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Five Year, Multi-Phase Project

Partnering effort involving DOD, USFWS, Tampa Bay Watch, EPC, TBEP, others

An innovative, cost-effective approach for ‘natural’ shoreline stabilization

Triple benefit – shoreline stabilization, improves habitat diversity, water quality improvement
The Problem

Increased erosion along eastern shoreline, particularly at southeast corner

- Loss of natural resources
- Loss of coastal habitat
- Impacts to archeological site (National Register eligible)
- Impacts to government assets (golf course)
Alternative Stabilization Approaches

Planting *Spartina alterniflora* and seedling mangroves

SWFWMD and local high school nursery program

Two efforts, planted over 3,000 grass plugs during each event – both were washed away within days under normal conditions
The Solution

Reef Balls and Oyster Shell Bags

• Reef ball - a flat-bottom, hollow, concrete half dome with holes
  – Originally developed for off-shore coral reef creation and reconstruction
  – smaller version is used for oyster reef creation

• Oyster shell bag - plastic mesh bag filled with fossilized oyster shell
3 Benefits:

Water Quality Improvement
Shoreline Stabilization
Habitat Enhancement

- Oysters can filter up to 9.8 gallons of water per HOUR
- Filter algae in nutrient laden waters
- Stabilize bottom sediments, reduce turbidity

Establish marsh grass

Sediment accumulation behind domes
The Demonstration Site – Phase I

- Constructed six 100 ft oyster reef zones with four different configuration of Reef Balls
- Constructed two 100 ft oyster bars with shell bags

January 2004
The Demonstration Phase - *Installation*

Five half-day events

~70 MacDill Community Volunteers

~12 NOAA Volunteers

~23 Off-base Volunteers
  - Naval Reserve
  - GE ELFUN
  - Local Community

MacDill Environmental

Tampa Bay Watch staff

*Total Man-hours ~430*
The Demonstration Phase

Spacing between reef zones
- Allows movement of water (flushing)
- Permits access to back side of reef for fish and other sea life
- Creates habitat diversity, allows movement of sea life

March 2004
Monitoring Results

Sediment accumulation as of February 2006

Feb ‘06

4.0” 2.5” 1.8” 1.5” 1.6”

0.5” 0.25” 2.0” 3.5”

4.5”

Feb ‘06

4.0” 3.5”
<table>
<thead>
<tr>
<th>Configuration</th>
<th>% Oyster Coverage</th>
<th>Avg Oyster Size (mm)</th>
<th>Green Mussels present</th>
<th>Avg Sediment Accumulation</th>
<th>Wildlife Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base to base</td>
<td>100%</td>
<td>54</td>
<td>No</td>
<td>&lt;1.0”</td>
<td>Crabs, baitfish, mullet, minnows, conch, blue crabs, sheephead, heron, ibis, egret, raccoon</td>
</tr>
<tr>
<td>Base to base – front row only</td>
<td>~75%</td>
<td>41</td>
<td>No</td>
<td>3.5”</td>
<td></td>
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<tr>
<td>Base to base – outer edge all around</td>
<td>~75%</td>
<td>45</td>
<td>No</td>
<td>2.8”</td>
<td></td>
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<tr>
<td>3 foot spacing</td>
<td>~30%</td>
<td>44</td>
<td>No</td>
<td>2.3”</td>
<td></td>
</tr>
<tr>
<td>Oyster Bag Reef</td>
<td>~75%</td>
<td>43</td>
<td>No</td>
<td>3.1”</td>
<td></td>
</tr>
</tbody>
</table>
Site Photographs

Oyster Dome Reef

Base-to-base configuration

January 2005
Oyster Shell Bar (Bar) Reef
January 2005
Sediment Accumulation

Base-to-base perimeter with random interior

January 2005

5” of sediment accumulation

3-foot spacing
Marsh Grass Planting – November 2005 & April 2006

Over 400 High School and Junior high students have visited MacDill to participate in marsh grass planting events through the “Bay Grasses to Classes” program through Tampa Baywatch
Marsh Grass Growth

Looking SE

Looking North

July 2006
Phases 2 & 3

- Phase 2 installed 1,500 oyster shell bags to create 350-ft oyster reef
- Phase 3 began installation of 1,500 Reef Balls and 1,700 oyster shell bag bar (28 tons of shell) to create 975-ft oyster reef

PHASES 4 & 5

- Phase 4 will construct 800+ foot reef between Phase 1 and Phase 3 site
- Phase 5 will construct 800+ foot reef west of Phase 3 site
Phase 2 Constructed

- Completed in March 2005
- 395 feet of oyster reef
- Protects 300 feet of shoreline

3-bag base under a single bag layer

4-bag base
2-bag middle layer
single-bag top layer
Phase 3 – Lo-Pro Oyster Units will be installed along ~970 feet of shoreline. The four serpentine lines will be constructed using 195 domes and each will protect 120 linear feet of shoreline.

375’ long, three rows wide to the mangroves in the top right of the photo (564 domes)

Phase 2 - 395’ of oyster shell bars

150’ dome line in front of mangroves

Dome lines will overlap 20’ with a 10’ gap

Phase 3 – 340 oyster shell bar

375’ long, three rows wide to the mangroves in the top right of the photo (564 domes)

1,569 domes + 1,725 shell bags = 970 feet protected

Phase 2&3

Started 2006

Completion 2007

1,569 domes + 1,725 shell bags = 970 feet protected
Costs & Partnering

- $100K for Phase 3 (2007)
  - $30K Air Force
  - $30K USFWS (?)
  - $30K ??
- $120+ K for Phases 4 & 5 (2008 & 2009)
  - $60K Air Force
  - $60K Other

- ~75% of costs go to materials/supplies (reef balls + delivery)
- Remainder of funds to permitting, design, agency coordination
- Volunteers used to installed domes and construct shell bags
- NOAA typically supplies oyster shell for shell bags
- Loader/Gators/Trucks/Tractor – In house (CE and Golf Course)
Thanks Too....

- US Fish & Wildlife Service
- Tampa Bay Watch
- MacDill AFB Groups & Squadrons
- MacDill AFB Environmental & CE
- NOAA Fisheries
- Tampa Naval Reserve
- VOLUNTEERS!!