Demonstration Projects

Demonstration Projects

Project Number	Project Proposals
DEMO-01	Shoreflex II
DEMO-02	Biogenic Oyster Shoreline Stabilization
DEMO-03	Tidal Creek Construction Demonstration
DEMO-04	Marine Gardens/Marsh Armor

DEMO-01

Shoreflex II

SHOREFLEX® II

Permanent Erosion Control Solutions

Eliminates Erosion.
Grows Green. Installs Easily.

Shoreflex®II is a Cable Tied Concrete Block Erosion Control Mat. It is a matrix of 5,000 psi concrete blocks strung in a brick lay pattern preventing channeling and impeding waterflow within the mat. *Shoreflex®II is the latest innovation in a rolled concrete erosion control mat.*

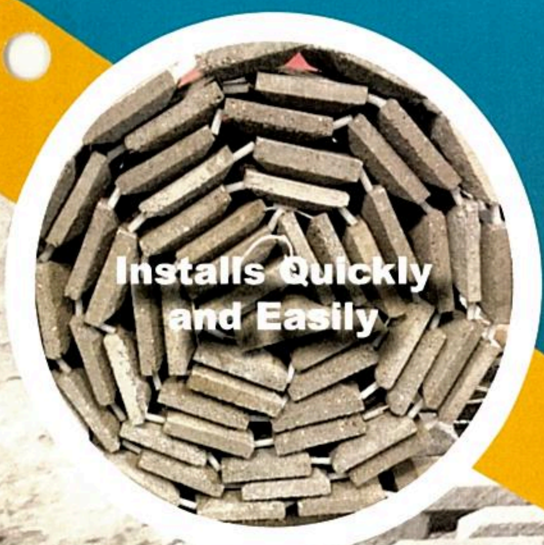
Application Ideas:

- Shoreline Protection
- Roadside Drainage
- Slopes
- Embankments
- Canals
- Channels
- Landfill Downshutes
- Boat Ramps
- Pipeline Protection
- Residential Waterways
- Retention Basins
- Wetland Protection

Testing:

Tested in accordance with ASTM D 6460

Capable of High Flows: Shear 20+psf — Velocity 30+ ft/s — 20% Slope



Standard Roll Size: 16′ x 50′
Custom Sizes Available
Truck Load: 4,000 sqft

shoreflex.com

Engineering & Technical Support Available Upon Request.

Toll Free: 800 575 7293

A Product of Shoretec, LLC
Licensed Producer Premier Concrete Products

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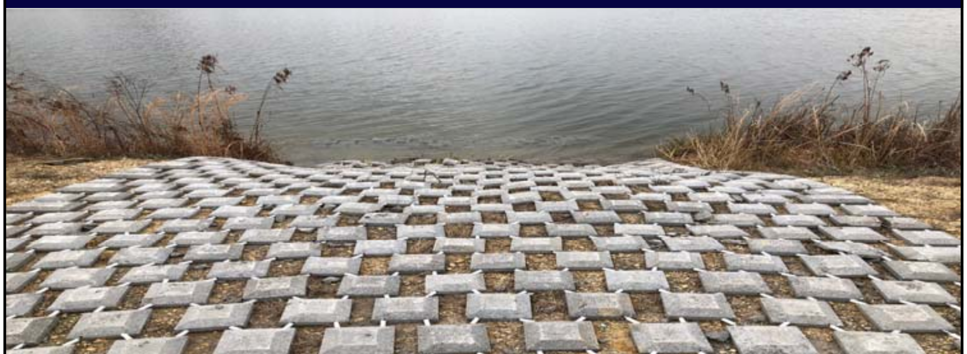
The ShoreFlex®II Performance far exceeds current rolled concrete erosion mats on the marke

Protecting True Living Shorelines



SHOREFLEX II

Presented By: Blaine Sanchez, Product Manager / Engineer

Current Technology

SHOREFLEX II

Conventional Marsh Protection Material

Articulating Concrete Block Mats

Rip Rap Break Waters

Products effectively stop erosion but the natural edge habitat is lost

Erosion Control Products

ShoreFlex II

ACB/ACM

LARGE RIP RAP

HPTRM

TRM

Why ShoreFlex II?

- 400% less weight per square foot than ACBs and Rip Rap
- Significantly higher performance that HPTRMs.
- Cost 50% less than ACBs and larger Rip Rap
- Mat sizes are available up to 16'x50'
- Minimal open area of 30% for vegetation growth
  - ACBs are in the 5-20% open area range
  - Rip Rap is close to 0% open area
- New Innovation is to keep a living shoreline and regain lost habitat while stabilizing the bank

Demonstration Project

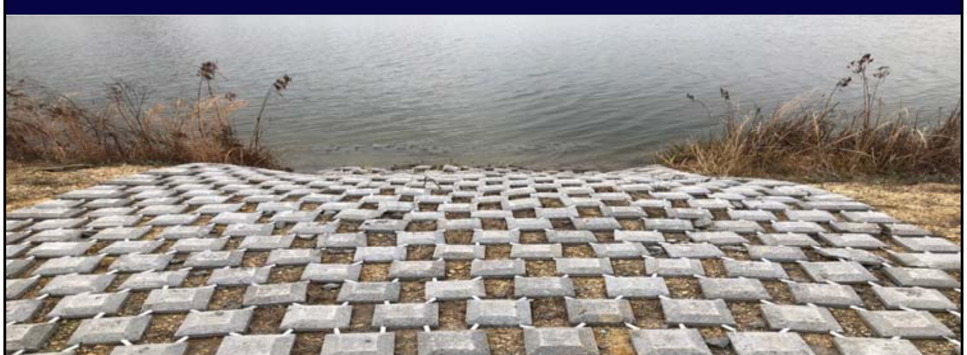
SHOREFLEX II

The Demonstration would be a comparison of a shoreline with ACBs, vegetated ShoreFlex II, and an existing marsh control section with no protection.

- Quantifying Erosion Control Capabilities
  - Shoreline Erosion Rate vs Cost of Protection
- Shoreline Edge Marine Ecosystems
  - Vegetation and Fisheries

Questions?

SHOREFLEX II



www.shoreflex.com

DEMO-02

Biogenic Oyster Shoreline Stabilization

Demo 02

PPL 28 Project Nomination Fact Sheet; January 30, 2018

Demonstration Project Name: Biogenic Oyster Shoreline Stabilization

Potential Demonstration Project Location(s): Coastwide

Problem:
There are hundreds, if not thousands, of small bayous and ponds in the delta are coalescing into ever larger water bodies. This interior land loss is a significant contributor to Louisiana's net land loss. A substantial acreage of eroding lands exists in oyster supportive waters (e.g. as mapped in Melancon et al 1998). Work in oyster supportive waters entails additional cost and risk associated with oyster leases, as well as an incredibly complex network of oil and gas infrastructure.

Finally, dedicated shoreline protection projects perform poorly in the CWPPRA scoring process due to high cost to benefit ratios, often exacerbated by the above challenges. Yet, shoreline protection remains a critical tool for maintaining existing landforms and hydrologic patterns.

Goals:
The specific goal of this proposal is to equip CWPPRA project managers with a new tool for stabilizing interior shorelines at a very low cost, using hand deployed materials from shallow draft vessels.

Proposed Solutions:
ORA's solution is to replace concrete or rock used in conventional structures with using living oyster reef. The basic format is that lightweight "scaffolds" are "planted" with oyster friendly surfaces in prime oyster growing waters. Two or three years of oyster recruitment adds sufficient mass and geometry to each scaffold for use in coastal engineering projects such as living shorelines.

Our initial design consists of bamboo or wooden stakes that have a 6"-36" (depending on water depths and end location) bioengineered coating being developed by LSU. The stakes are affixed to rafts and deployed similar to off-bottom oyster culture operations. After reaching target oyster mass, the stakes are relocated to the living shoreline location and stabbed into the sediment in offset rows. The initial design consists of 4 offset rows on 2 ft centers. The mature Oyster Stakes may be supplemented with a plant fiber mat having a similar bioengineered coating. This design is suitable for hundreds of miles of Gulf Cost estuary shorelines having low to moderate wave energy.

Preliminary Project Benefits:

- 2.5 miles of living oyster reef shoreline protection
- Roughly estimated 45 Acres of prevented loss over 20 years at $58k/acre (based on reducing 15 ft per year local erosion rate by half. final calculation dependent on actual local erosion rate)
- Demonstrate technique to maintain critical landforms in challenging locations

Strategic Benefits to CWPPRA as Concept Scales

- Low cost per mile shoreline stabilization = low cost per acre project.
- Potential for substantial economies of scale
- If operated as an ongoing program, previously constructed shorelines can be maintained with minimum additional dollars.

- Opportunity to mitigate performance risk by utilizing new "pay for success" contracting mechanisms.
- Because of oysters, leverage CWPPRA dollars to capture RESTORE or NRDA dollars.
- Light equipment and shallow draft construction means no access dredging or impact to pipelines
- Create new industry for coastal communities
- Connect oyster leaseholders to coastal restoration

Preliminary Construction Costs:
Demonstration project cost is estimated at $2.6 million, including 5 post construction annual monitoring reports from the vendor.

Preparer(s) of Fact Sheet:
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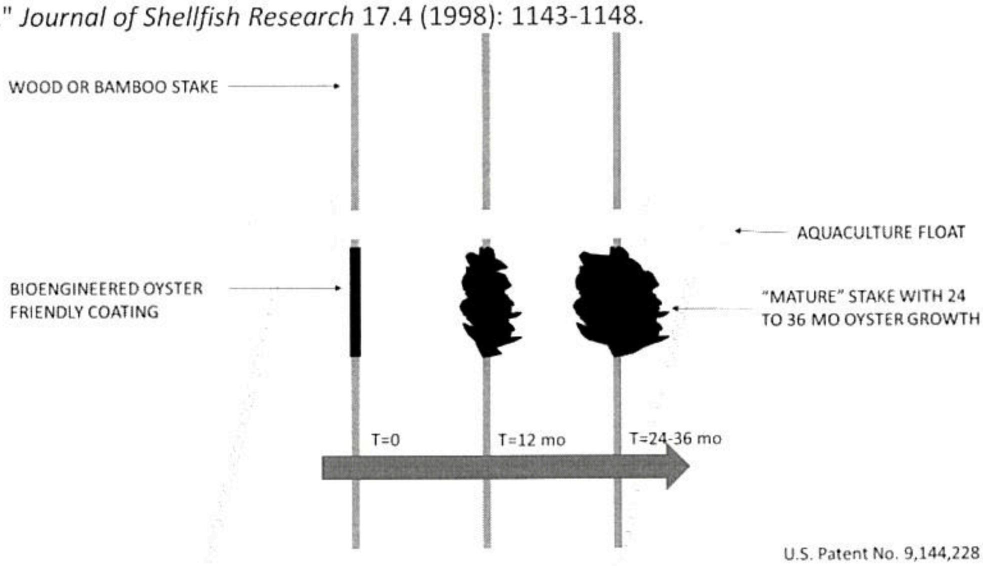
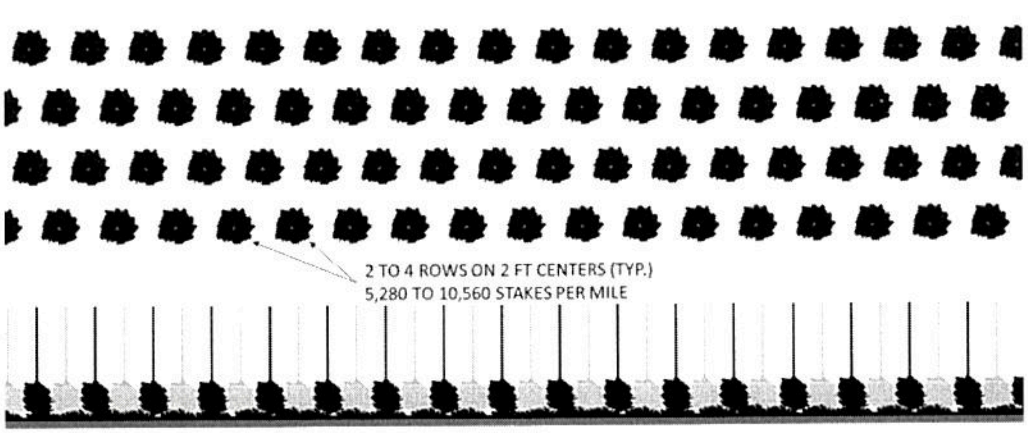
Matthew Campbell, ORA Technologies, LLC, 225-372-5570, matt@oratechnologies.com

References
Powers, S. P., Rouhani, S., Baker, M. C., Roman, H., Murray, J., Grabowski, J. H., ... & Hester, M. W. (2015). Loss of oysters as a result of the Deepwater Horizon oil spill degrades nearshore ecosystems and disrupts facilitation between oysters and marshes. *DWH Oyster NRDA Technical Working Group Report*.

Melancon Jr, Earl, et al. "Oyster resource zones of the Barataria and Terrebonne estuaries of Louisiana." *Journal of Shellfish Research* 17.4 (1998): 1143-1148.





PPL 28 Demonstration Proposal:
Biogenic Oyster Reef Shoreline Protection

January 2018

ORA TECHNOLOGIES

Tyler Ortego
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BACK TO THE BASICS

$2,500,000 per mile → $138k per acre ✗

$1,000,000 per mile → $55k per acre ✓

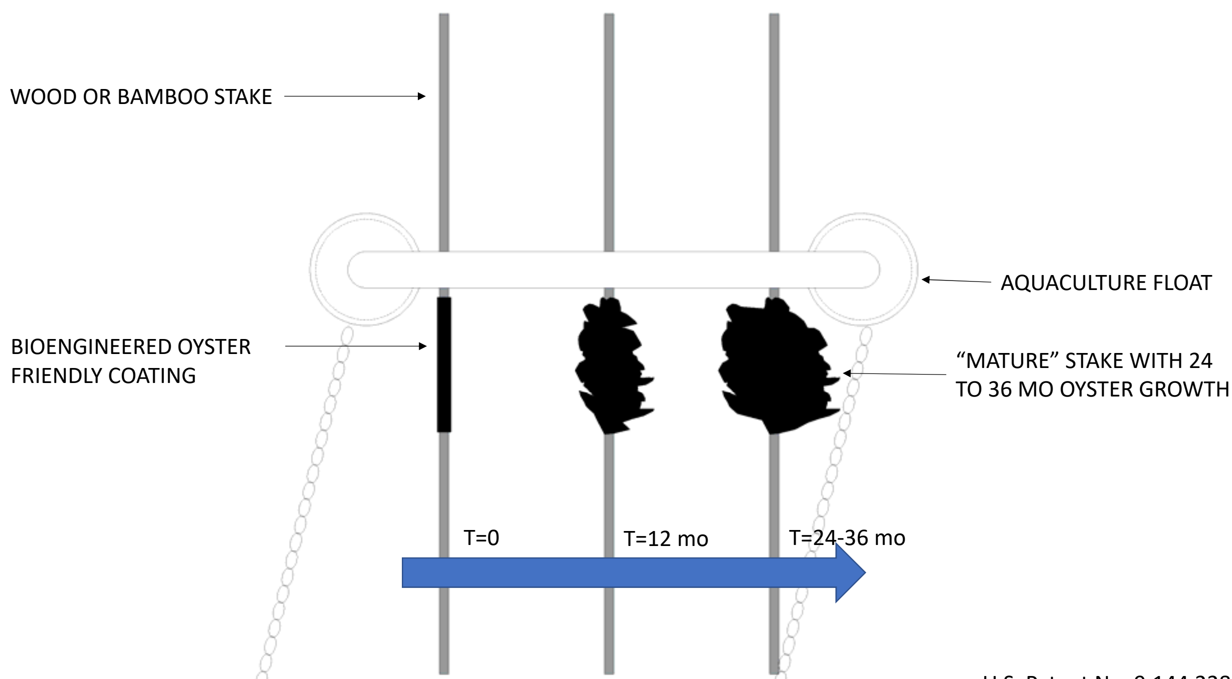
$500,000 per mile → $28k per acre ?

$250,000 per mile → $24k per acre !?!

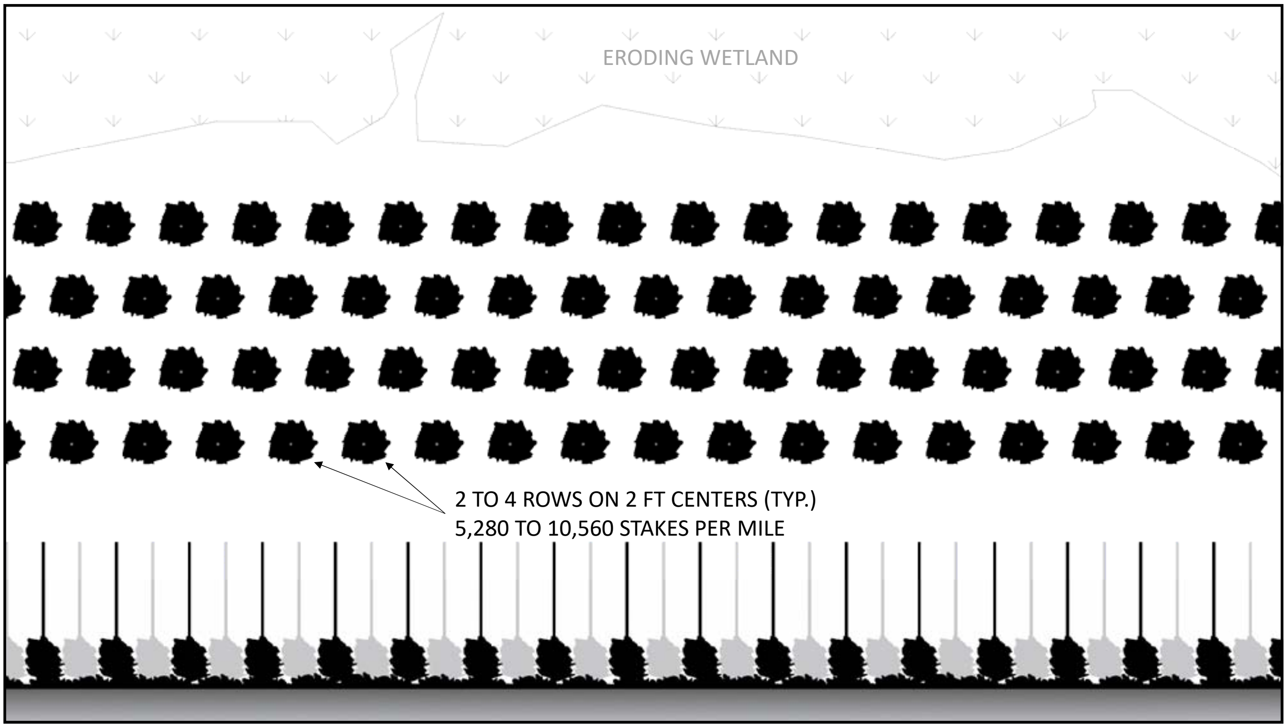
Note: based on preventing 7.5 ft per year of erosion for 20 years

ORA TECHNOLOGIES

ORA Technologies' mission is to radically change the economics of coastal infrastructure.



U.S. Patent No. 9,144,228



TIMELINE

	Q1 '18	Q2 '18	Q3 '18	Q4 '18	Q1 '19	Q2 '19	Q3 '19	Q4 '19	2020	2021	2022
Install test stakes & grow											
Data report for final vote											
PPL Selection Process											
Contracting											
Fabricate and Install Stakes in Nursery(ies)											
Grow, monitor, report											
Install Living Shorelines											

DEMONSTRATION PROJECT PROPOSAL

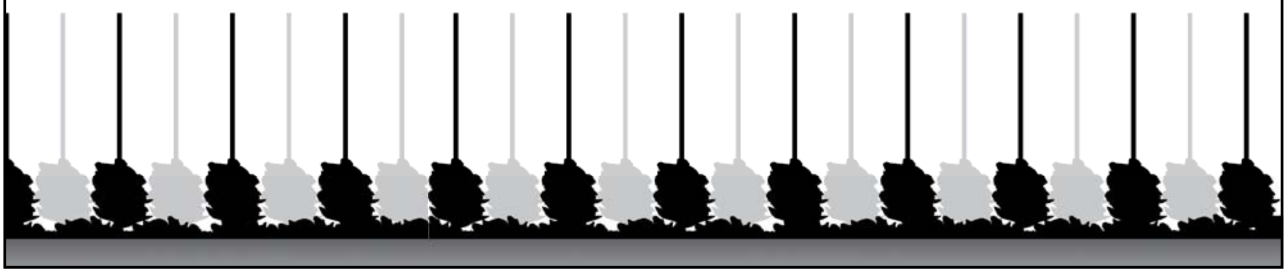
2.5 MILES OF LIVING OYSTER REEF SHORELINE PROTECTION.

3 ROWS OF OYSTER SCAFFOLD STAKES ON 2 FT CENTERS.

SINGLE LOCATION OR DISTRIBUTED.

5 YEARS OF ANNUAL MONITORING REPORTS.

PROJECT COST: $2.6 MILLION



DEMO-03

Tidal Creek Construction Demonstration

Demo 03

PPL28 PROJECT NOMINEE FACT SHEET
January 2018

Project Name
Tidal Creek Construction Demonstration Project

Louisiana's 2017 Coastal Master Plan
Not applicable

Project Location
Recently completed marsh creation projects - anywhere

Problem
Marsh creation projects comprise the majority of CWPPRA projects. Unless trenasses or tidal creeks are deliberately constructed, the typical marsh creation or beneficial use project often results in a solid expanse of marsh having no interspersed waterways or channels to enable fish access into the interior marsh. Because many fish and invertebrates only use the marsh edges, a lack of channels may reduce fish usage of the created marsh. The at-risk saltmarsh topminnow (*Fundulus jenkinsi*) appears to prefer these small tidal creek habitats. The topminnow and other resident fish that use such habitats serve as forage for many commercially and recreationally important finfish. Thus the creation of tidal creeks may elevate production of important finfish species. Additionally, rails, wading birds, and other wildlife utilize the edges of tidal creeks for foraging.

If a convenient and low-cost method of creating such creeks could be found and used when construction equipment was still on-site, the fish and wildlife habitat value of created marshes might be substantially increased.

Goals
The project goal is use contractor experience to develop more effective and low-cost means to create tidal creeks in recently constructed marsh creation project areas.

Proposed Solution
This demonstration project would establish a competition process offering prize money to the developer of the most cost effective and successful method for creating small tidal creeks within recently constructed and unvegetated marsh creation project sites. The CWPPRA Engineering & Environmental Work Groups would determine the winner of the competition. The marsh creation sites used for the demonstration project would be sites where the sponsoring agencies agree to allow creek construction.

Demonstration Project Evaluation Parameters

1. **Innovativeness:** Through use of a competition process, a low-cost and innovative technique is being sought, such a plow pulled behind a marsh buggy.
2. **Applicabililty or Transferability:** The method would likely be applicable to non-sand fill marsh creation or beneficial use sites.
3. **Potential Cost-Effectiveness:** Cost-effectiveness would be one of two primary criteria for success.
4. **Potential Environmental Benefits:** Discovery and use of a low-cost method for creating tidal creeks would improve fish and wildlife habitat values of created marshes and beneficial use sites.

5. **Potential for Technological Advancement:** Currently, tidal creeks are constructed using a marsh buggy backhoe before or after marsh creation. Development of a plow technology would reduce time and cost for tidal creek construction. This in turn may allow for construction of more creeks and improved fish and wildlife habitat values.

Other Considerations: none

Preliminary Costs:
The estimated project cost for construction, awards, and monitoring is $1.5M.

Preparer(s) of Fact Sheet:
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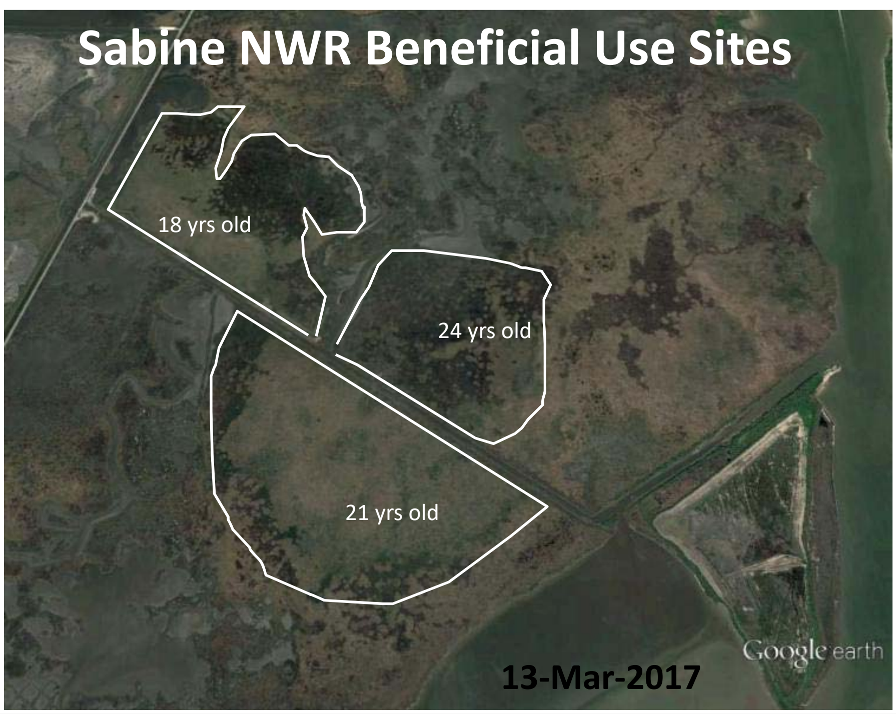
PPL28 Tidal Creek Construction Demo Project

Sabine NWR Beneficial Use Sites



Marsh creation along Bayou Rigolettes (BA-36)

Marsh Creation near Round Lake (BA-37)

Tidal Creek Construction Demo

I. Eng/Env Wk Grps develop success critieria

II. Advertise public idea competition

 a) Eng Wk Grp select/fund top three methods

III. Construction at cooperating marsh creation sites

 a) 3 reps for each of 3 methods

III. Monitoring (field, GIS, fisheries)

IV. Award to most cost effective method

(creek dimensions: 5 – 10 ft wide, 6 - 12” deep at low tide)

Project Costs

I.	Method Dev.	$50k x 3	$150k
II.	Constr. Mob-Demob:	$60k x 3	$180k
III.	Constr. Operation:	$30k x 3	$ 90k
IV.	CPRA field monitoring:	$150k x 2 yrs	$300k
V.	USGS GIS monitoring:	$90k x 2 yrs	$180k
VI.	Univ. fish monitoring:	$210k x 1 yrs	$210k
VII.	Monitoring rpts:	$ 50K x 3	<u>$150k</u>
			$1,260k
V.	Awards	$150k – 1st place	
		$ 80k – 2nd place	
		TOTAL Cost =	**$1,490k**

DEMO-04

Marine Gardens/Marsh Armor

Demo 04

PPL28 DEMONSTRATION PROJECT NOMINEE FACT SHEET
February 1, 2018

Demonstration Project Name: Marine Gardens/Marsh Armor

Potential Demonstration Project Location(s): Coastwide: Louisiana Gulf Coast

Problem: High Costs of shoreline protection. Shoreline protection is needed in areas to protect marsh and marsh creation projects. Losing marsh is very costly. However, traditional methods of shoreline protection carry high costs due to material costs, heavy equipment mobilization, extensive planning and time to construct. Funds are inadequate and limited according to the Master Plan. There are maintenance costs due to the sinking of rocks in coastal environments. Rock is expensive and not well suited for all areas. Low cost armoring is needed for areas exposed to open water and to secure breaches. Breaches in the coastal marshes are known to exacerbate land loss.

Proposed Solution: This demonstration addresses the problems of shoreline protection and the typically high costs to implement such projects by proposing alternative methods of rapid, low-cost construction that provide more protection per dollar spent. The proposal is to build and install three trapezoidal erosion control structures using a reinforced marine geopolymer concrete matrix with a 3D robotic shotcrete forming procedure. These structures would be 500 feet long and would be installed at three different locations.

Goals:

1. Construct three cost effective permanent shoreline protection hard armor structures that would restore and protect coastal marsh areas.
2. Demonstrate Marine geopolymer concrete as superior quality, faster, more versatile and less expensive construction method for shoreline protection construction. (100 lin. Ft. per hr., material costs demo $192/cu. yd, production costs $110/cu. yd.) Constructed with 4-8-man crews. No molds required.
3. Demonstrate benefits of a trapezoidal tube modular design, 3D construction versatility and benefit of built-in abrasion resistant diversion pipes and or living structures.
4. Effectively monitor and document the ability of the project to meet stated goals.

Describe demonstration project features in as much detail as possible.

The site will be surveyed and engineered by Batture LLC. If required, appropriate fill will be applied for leveling. A portable 36-foot-long Robotic arm manufactured by Shotcrete Technologies Inc. will be installed on a Marsh Master II lightweight marsh buggy and will be used to form/print/extrude and install the protection structure. The project will utilize a mixture of a low-cost geopolymer concrete formula using local minerals and local soils at ambient conditions. This process will create permanent, hardened, stable structures that would form a solid protection barrier wherever shoreline protection is needed. Geopolymer concrete composite materials are made of common soils including Mississippi River sand or sediments from the Gulf of Mexico (55% -60%) and waste minerals (slag and ferrous 25%-38%) from local industrial plants. The remainder of the mix is composed of silicate binding agents/polymerizing agents. When the materials are properly mixed and cured, the geopolymer forms a new mineral species or stone. It is inert, non-porous, and non-leaching, and it produces a mild cathodic charge proven to stimulate shellfish production.

A geopolymer foundation mat and appropriate anchors will be put in place. The structure foundation will be composed of a geopolymer reinforced mat that is 20 ft. wide and up to 1 inch thick. It will be installed and allowed to set. After it has set, the construction of the geopolymer trapezoid can begin. (100 linear ft./hr.) The trapezoid is a continuous structure with a 9-ft. wide base, 7-ft. wide top, with a 3-ft. height. Its low and wide design adds stability and displacement. The structure walls, top, bottom, center bulkhead and mat are all made from a Marine geopolymer stone- reinforced matrix that will be anchored in position. The materials will undergo independent testing and certification by a qualified lab prior to installation. (7500- 10,000 psi). All formulas will meet the standards of the Geopolymer Institute located in Saint-Quentin, France.
Two built-in culverts, as shown on the attached drawing end view, can be used to divert moving water/sediment, support the weight of maintenance vehicle, or be backfilled for ballast or settling. Optionally, it can have an open top and filled for living structure tree line. Each end will have an additional 5 ft. of foundation mat and will be properly tapered or contoured for the location.

Preliminary Project Benefits:
Describe demonstration project benefits in as much detail as possible.

1. Rapid construction, effective low-cost shoreline protection for the program.
2. Easily applied in shallow areas and in less stable soils, with lightweight equipment
3. Less sinking and maintenance than limestone. Uses less material with higher compressive strength, density, greater surface displacement and is anchored.
4. Absorbs and deflects wave energy reducing the potential for interior marsh loss.
5. Protects and enhances existing or planted shoreline vegetation.
6. Design features collects sediment by reducing wave energy.
7. Protects and enhances aquatic life, promotes shellfish production on structure.
8. Stable enough to handle maintenance vehicles.
9. Can be extended or have an optional open top living structure. (i.e. tree line)

Preliminary Construction Costs:
The estimated construction cost including a 25% contingency is $1,180,221.

Preparer(s) of Fact Sheet:
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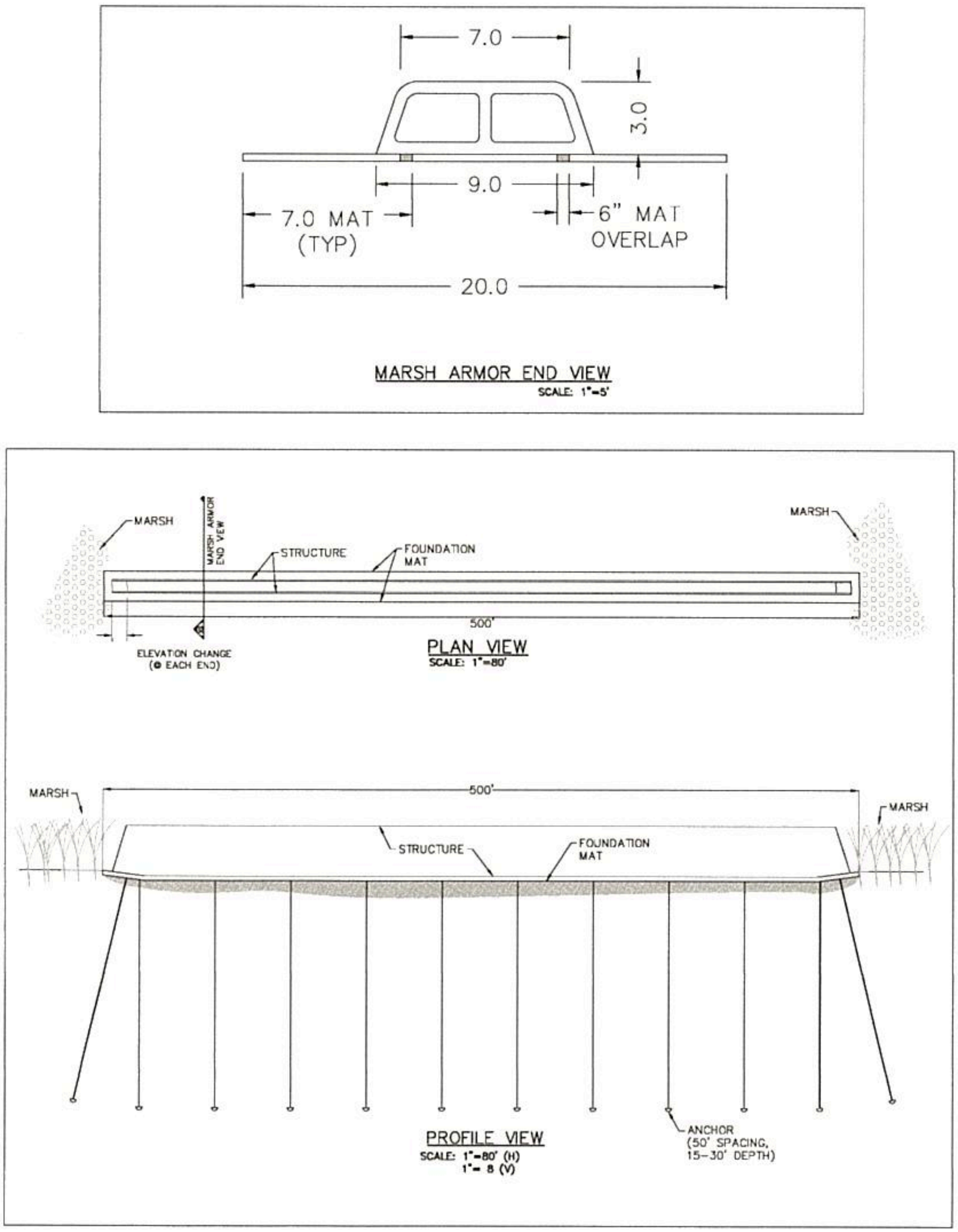
Jennifer Snape, Batture LLC, (480) 522 -9502, jsnape@batture-eng.com

Appendix A

Figure 1. Marsh Armor trapezoidal coastal erosion structure made with geopolymers



These are a few videos that can give you an idea at how this technology can be used. There are a number of different settings and mixtures that can be used to produce different affects and products.

Shotcrete is a method where the product is pumped to the nozzle where it is combined with air and mixed with hardeners, usually on large volume projects. Extrusion methods are used without air, are used with lower pressure and would be compared to pumping or squeezing it out similar to toothpaste, either through a mold or in a continuous stream. The arm we use is primarily for shotcrete applications, but can be extruded as well.

This video is shotcrete formed from the inside of a small tunnel

http://youtu.be/GpnHZYaEhzU?t=2m31s

You may see video of a different style robot that is used for aqueduct and diversion piping, the material is applied in a circular pattern, it can be done vertically or horizontally.

This is a basic shotcrete forming video done manually, this method is used to form buildings and in the swimming pool industry, to give you an idea of how a mix sticks and forms, manual method has a lot different of applications, usually on small or medium size projects and repairs..

https://www.youtube.com/watch?v=YanHEgfepC0

This is a example of a qualification panel showing a nozzleman placing wetmix shotcrete using the bench method. ...

This is a video of Apis Cor , a robot in Russia that is completely automated, operates only in extrusion mode. It is used to build economy homes with a geopolymer mix at a home in 24 hours. The extrusion method can be done with most robotic arms.

Apis Cor: first residential house has been printed!
https://www.youtube.com/watch?v=xktwDfasPGQ

SHOTCRETE TECHNOLOGIES, INC.
PROJECT SHEET
TRASVASES MANABI WATER PROJECT. ECUADOR.

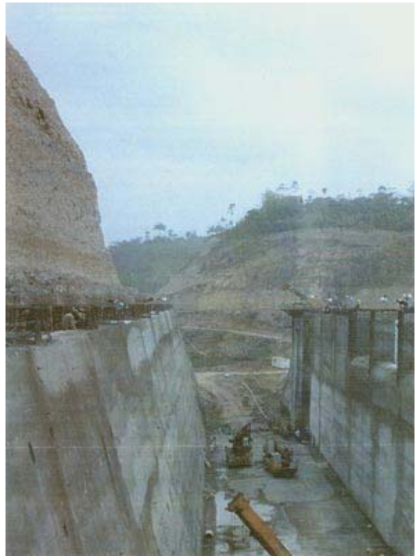
Trasvases Manabi Water Project, Ecuador
By replacing traditional "form and pour" methods with high production shotcrete, the massive Trasvases Manabi Water Project in Ecuador finished months ahead of schedule. Contractor Norberto Odebrecht in conjunction with Shotcrete Technologies, Inc., and Commercial Shotcrete, Inc. of Phoenix, AZ placed over six thousand cubic meters of shotcrete in less than half the time it would have taken by the specified method, and put the project a whole rainy season ahead.


Note worker in circle at right

Centre de Rehabilitacion (CRM) of Manabi, chose Norberto Odebrecht to construct the two hundred twelve million dollar project that would provide a constant supply of water for drinking, irrigation, and industrial use by optimizing Ecuador's seasonal rainfall patterns. Having been on site since May of 1999, by July of 2001, the project was five months ahead of schedule and Danilo Abdanur, construction manager, began to realize that he could perhaps complete the entire project by the Rainy season (late November), if he could come up with a much quicker method to complete the spillway walls of the Conguillo Dam. At twenty five meters high, sixty and one hundred centimeter thick walls with a 1" tolerance and a minimum of six thousand cubic meters of concrete, the specified "form and pour" method would not meet Abdanur's aggressive schedule.

Kristian Loevlie, of Shotcrete Technologies, Inc. was called in to meet with Odebrecht, the Owners and Engineers to discuss the possibility of erecting these massive walls using shotcrete. Having done high volume shotcrete projects all over the world, Loevlie explained that good shotcrete is a high quality "in-place" concrete, often with much higher compressive strengths. The Group was convinced that this innovative solution would allow them to meet their aggressive schedule.

With the decision made to shotcrete the massive walls, time was of the essence and Shotcrete Technologies quickly pulled in Commercial Shotcrete Inc. of Phoenix, Arizona for the application expertise and supervision. Mix designs and testing using local materials, and training local laborers were fast-tracked. Once the shotcrete pumps arrived on site, the first two weeks were spent on training and testing. Alberto Medina, of Commercial Shotcrete and his various supervisors managed the entire process. When the shotcrete application went into production mode, the crews (using the' "hand-held" nozzling technique) reached a daily rate of more than one hundred eighty cubic meters of shotcrete using two pumps on two shifts.



The very workable "wet shotcrete" mix was placed through heavy rebar and mesh directly onto a twenty-five meter high dirt excavation requiring extensive temporary support. By using shotcrete, the initial support and final one meter thick structural walls were done simultaneously. ST-ALKALI FREE ACCELERATOR was used for water control and temporary ground support.

This continuous process of excavation, reinforcement, initial support, and final structure was very fast, efficient, cost effective, and shaved months off the time traditional methods would have taken. By the end of November, the spillway walls were finished and ready for the rainy season.

According to Danilo Abdanur, Construction Manager for Odebrecht, the key to the projects success was choosing the proper expertise, with the proper equipment, an efficient working site, adequate support equipment, a well-trained crew, a consistent mix design, and adhering to a daily maintenance schedule. However, the biggest factor in the success of this project was taking the perceived risk on a technology that he had not used for this specific application.

The Trasvases Project is one of the many innovative projects around the world for which Shotcrete Technologies, Inc. is known. For the complete press release on this project click here.

For additional information about this or any other projects, please call Shotcrete Technologies at (303) 567-4871 or send an e-mail request with name and address to info@shotcretetechnologies.com.

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42 Inch Pipe Repair
Mesa County, Colorado

This severely deteriorated culvert was relined with one (1") inch thick high strength shotcrete. Using a camera equipped remote control track robot to pull in the concrete hose, this pipe was relined in hours and put back in service twelve (12) hours later. Pumping through 150 feet of one and a half (1-1/2") inch concrete hose the high strength water impermeable material was applied in two (2) hours. The material gives the pipe a load bearing capacity of H80.

Shotcrete Technologies, Inc.

Select Horizontal Lining Projects

DATE	PROJECT	LOCATION	TYPE	DIMENSIONS	THICKNESS	REMARKS, All structural repair
2005	Union Pacific Railroad	Hotchkiss, CO	CMP	2000 lf x 42" ID	3/4"	Lined 400 lf/day for 7 days
2005	Mesa County, CO	Grand Junction, CO	CMP	110 lf x 36" ID	1"	Lined in one day
2005	Elbert County, CO	Simla, CO	CMP	85 lf x 96" ID	1"	2 culverts at this dimension
2005	City of Glenwood Springs	Glenwood Springs, CO	CMP		1/2"	Several Culverts Multiple diameters
2005	Town of Castle Rock	Castle Rock, CO	CMP	450 lf x 60" ID	1"	storm sewer
2007	Kiewit Western	Rocky Mtn. National Park	CMP	96 lf x 24" ID	3/4"	45 degree grade in national park
2007	El Paso County		CMP	60 lf x 60" Id	1"	2 culverts at this dimension
2007				80 lf 36" UD	1"	3 culverts at this dimension
2008	City of Idaho Springs	Idaho Springs, CO	brick	Manhole		3 manholes
2009	El Paso County	Colorado Springs	CMP	60 lf x 36" ID	1"	6 oval culverts, structural repair
2008	Jeffco Road & Bridge	Colorado	CMP	38 lf x 18" ID	1"	3 culverts on Golf Course
		Colorado		42 lf x 18" ID	1"	difficult access
		Colorado		28 lf x 24" ID	1"	
2008	Mt. Snow Report	Vermont	CMP	450 lf x 48" ID	3/4"	Reline culvert under parking lot
				120 lf x 72" ID	2"	Dam Outlet
2008	Kansas DOT	Topeka, KS	CMP	50 lf x 30"x50"	3/4"	Under I-70 various oval
				55 lf x 23"x36"	3/4"	Oval highway culvert
				196 lf x 42"x32"	3/4"	Oval highway culvert
				175 lf x 44" ID	3/4"	Circular, stepped inclines
2009	BNSF Railroad (Aecom)	LA Junta, CO	Tile	550 LF x 5.5 ft.	1 1/2"	Storm sewer-diesel inflow
2006	MMWS Sewer District	Milwaukee, WI	Concrete	9000 lf 60" ID	3/4"	Sewer tunnel + various manholes
2009	Sequoia Nat'l Park	California	CMP	various	1"	9 various lengths and diameters
2005-2009	CO Dept. of Transportation	Colorado	CMP	various		Many culvert repairs under I-70
2009	Yosemite Nat'l Park	California	CMP	24" ID	1"	100 foot long culvert
2010	Rocky Mtn. Nat'l Park	Colorado	CMP	various	1"	various lengths and diameters
2011	Robinson Construction	Trenton, MO	CMP	160 lf x 36" & 260 lf x 24"	3/4"	ConAgra
2013	Johnson Construction	Rifle, Colorado	CMP	100 lf x 72"ID	2"	under highway for CDOT

Specific Project details available upon request.

SHOTCRETE TECHNOLOGIES, INC.

PPL 28 PROPOSED DEMONSTRATION PROJECT
MARINE GARDENS – MARSH ARMOR
3D SHOTCRETE PRINTER/ GEOPOLYMER STRUCTURES

Versatility Project – cost effective solutions, merging off the shelf exponential technologies to coastal protection.

Shoreline Protection/Ridge Building/Barrier Island / Berm Armor

PPL 27 PROPOSED DEMONSTRATION PROJECT
MARINE GARDENS-MARSH ARMOR

- Location: Anywhere in Louisiana, can be incorporated into existing projects
- Problem: High cost of traditional methods and materials for hard armor protection, limited funding for projects. Present materials and methodologies are limited. (LSU Law Study)

- Solution: Goals to demonstrate:
- Versatility, durability and cost effectiveness of Marine geopolymer concretes
- Versatility, speed and cost effectiveness of 3D shotcrete construction
- Ability for stone to attract and enhance shellfish production
- Versatility of modular trapezoid tube structure in sediment/fresh water diversion, shoreline protection , ridge building, cost effectiveness
- Potential benefits of merging exponential technologies

WHAT ARE GEOPOLYMERS?

- Made from ordinary soils and industrial mineral waste streams (fly ash, GGBS, Red Mud, Cu slag) Simple minerals – depolymerized silica and alumina, sand and clay
- Inorganic Nano polymers that form new macromolecular structures.
- Concretes, Ceramics, Foams and other materials based on well proven sciences using an alumina silicate bond.
- Produced locally, inert, non porous, protects iron reinforcement, fire, pest, nutria proof
- Superior material to OPC (Portland cement)
- Can be worked as traditional OPC, extruded or 3D printed.

PROPOSED TEST SOLUTION

- 500' geo polymer reinforced trapezoid tube 9' base with 2 sediment diversion pipes
- Can be used for Shoreline protection or Ridge Building wherever needed
- Proof of concept for all stated goals


Our project :
Is a collaboration between several organizations, to create a rapid infrastructure in coastal erosion protection in the Gulf of Mexico, by merging exponential off the shelf technologies and well developed material sciences.
Geo Polymer Sciences - 3D Print Industrial Building Scale production
Guidelines, independent testing and certification of materials in accordance with established procedures and guidelines of “The Geopolymer Institute”.
Products - Marsh Armor, Marsh Crete, Marsh Matts, Marsh Tubes, Marsh Mender Products and Delivery methods to bring coastal erosion infrastructure
Submitting for PPL28 Demonstration Project
Total costs to CWPPRA capped 1,100,000 to 1,300,000
MARSH MASTER