DEMONSTRATION PROJECTS

DEMONSTRATION PROJECTS

Project Number	**Project Proposals**
DEMO-01	Hay Bale Demo
DEMO-02	Reconnection of Hydrologically Isolated Wetlands
DEMO-03	Marsh Creation Project Containment Dike Degradation & Gapping
DEMO-04	CREPS: Coastal Restoration & Energy Production System
DEMO-05	Bioengineering of Shorelines and Canal Banks using Live Stakes
DEMO-06	Research to Assess LA Native Plant Efficiency for Bioengineering Applications
DEMO-07	Utilization of Natural Gas Power for Dredging & Placement

DEMO-01

Hay Bale Demo

Demo-01

PPL 22 Demonstration Nominee Fact Sheet
January 2012

Demonstration Project Name: Hay bale Restoration

Coast 2050 Strategy(is): To mitigate, prevent and ultimately reverse coastal erosion by using the only true "green" solution.

Potential Demonstration Project Location(s): Any body of water, be it Gulf, lake, bay or marsh that needs protection to reduce wave energy, reverse erosion with soil creation. This process can be used statewide.

Problem: With the construction of the levee system, the integrity of the natural flow of the Mississippi River has been compromised. An all "natural" solution to put back what the levee's have taken away needs to be approached.

Goals: Deploy and test a "green" approach to restoring the eroding marsh by building barriers of 800 lb round bales of hay, wheat and rice straw to suppress wave action to trap sediment and protect existing vegetation and newly planted vegetation while also increasing nesting habitats.

Proposed Solution: Build barriers with 800 lb round bales of hay, wheat and rice straw. These barriers will suppress the wave action and in time, the wicking of the hay will collect and create sediment and form a natural barrier. Machinery will be used to cut and blow the hay and straw onto sites where dredging is taking place or any other marsh maintenance or reconstruction site. This will help control sediment runoff. Bales can be injected with native seedling plugs to stimulate vegetation growth.

Project Benefits and Advantages: Many of the benefits would include:

1. Cost effective
2. All natural and non toxic
3. Reduce wave energy to help with soil creation and reduce runoff
4. Newly planted marsh grasses and mangroves have an added protection from the barrier along with the protection of existing vegetation.
5. Straw and hay is an excellent source for nesting and colonization of birds and fowl
6. Natural attraction for fish and other aquatic species
7. This process can be used along with other restoration techniques.
8. Opens a market for wheat and rice straw that has no market value at the present time.

Project Costs: $2 million

Preparer(s) of Fact Sheet
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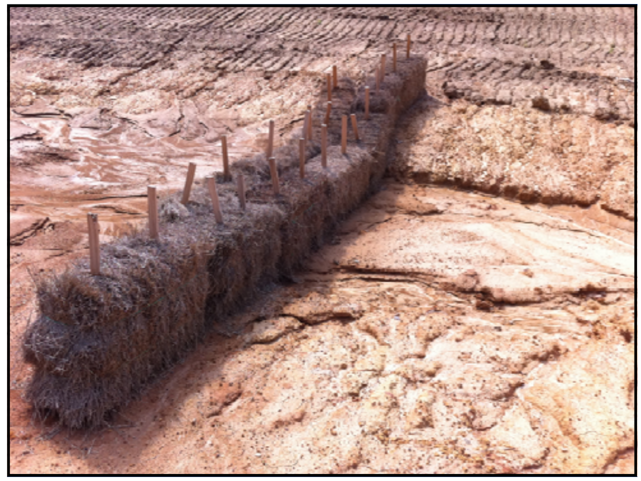
Gulf Coast Preservation & Reclamation



- Jeffress Williams, Sr. Scientist Emeritus, USGS
- Louisiana State University
- USGS, Lafayette, La.
- South Carolina Sea Grant Consortium
- NRCS, Grasslands Reserve Program

Demonstration Advantages and Benefits

- Cost Effective
- All natural and non toxic
- Can be used with other restoration techniques
- Protection of existing and newly planted vegetation
- Excellent source for nesting of birds and water fowl
- Natural attraction for fish and other aquatic species
- We will be raising awareness of the restoration needs along the coast while cleaning and manicuring the suburban areas.
- Early line of defense in the event of another oil spill
- Creating a market for unusable hay and straw

DEMO-02

Reconnection of Hydrologically Isolated Wetlands

Demo-02

PPL22 DEMONSTRATION PROJECT NOMINEE FACT SHEET
24 January 2012

Demonstration Project Name: Reconnection of hydrologically isolated wetlands to improve ecological function

Coast 2050 Strategy(ies):
Coastwide: Restore/sustain marshes, Restore Swamps
Regional: Improve hydrology, restore hydrology

Potential Demonstration Project Location(s):
Swamps, intermediate, brackish, and salt marshes.

Problem:
The juxtaposition of canal spoils banks often results in the impoundment or partial impoundment of costal wetlands thus reducing the exchange between these wetlands and the surrounding areas. This reduced exchange results in fewer but longer flooding and drying events (Swenson and Turner, 1987). The increased flooding may be enough to increase the soil waterlogging to a point where plants may become stressed due to soil chemistry changes (e. g. Mendelssohn et al, 1981; McKee and Mendelssohn 1989) ultimately leading to plant death and wetland loss.

Goals:
1. The primary goal is to re-establish the hydrology within an isolated (impounded or semi-impounded) wetland and improve the connectivity to the surrounding wetland.
2. Improve the soil chemistry by decreasing soil waterlogging.

Proposed Solution:

Re-establish the connectivity to the surrounding wetlands by opening hydrologic pathways. This could be accomplished by (1) putting gaps in existing spoil banks or (2) degrading sections of spoil banks to re-establish overland flow. The concept is to restore the system without using structural components. The openings will be sized to keep the average flow velocities low enough to preclude any scouring of material. It is anticipated that 3 sites will be used. The overall plan (at each site) would be to (1) monitor (~6 months) the hydrology, soil chemistry and fish assemblages in the site; (2) cut gaps, (or degrade spoil bank), to increase connectivity and monitor (~6 months) the changes in hydrology, soil chemistry, and fish assemblages; (3) increase the size of the opening or increase the number of gaps and monitor (~6 months) the hydrology and soil chemistry and fish assemblages.

The hydrologic measurements would include continuous water level (and salinity) instruments (1) within the marsh being re-connected, (2) in the open water and (3) in an adjacent non-impounded marsh area. Water velocity on the marsh and in the openings would also be monitored. Soils chemistry (eH, sulfides) would be monitored in the two marsh areas at each site. The initial gap width used would be 25 feet which corresponds to the gap width currently being used on CWPPRA projects. The fish assemblages would be monitored in the open water and the two marsh areas.

Project Benefits:

1. The re-establishment of a natural hydrologic regime.
2. Lower (or eliminate) plant stress due to waterlogging.
3. Increase connectivity (water, material and organisms) to surrounding wetlands.
4. Provide data on transient fish and invertebrate species access to the marsh.
5. Provide information on optimal sizes of gaps that may be useful for marsh creation projects.

Project Costs:

It is estimated that about 1,000 linear feet of gapping (or spoil bank degrading) would be needed at each of the three sites for a total of 3,00 linear feet. The cost estimate using $15.00 per foot (a marsh buggy backhoe) with a mob/demob cost of $25,000 per site. The total estimated cost is ~~$970,235~~ 1,099,235 including monitoring and a 25% contingency on construction costs.

Preparer(s) of Fact Sheet:

Erick M. Swenson, LSU. 225-578-2730, eswenson@lsu.edu

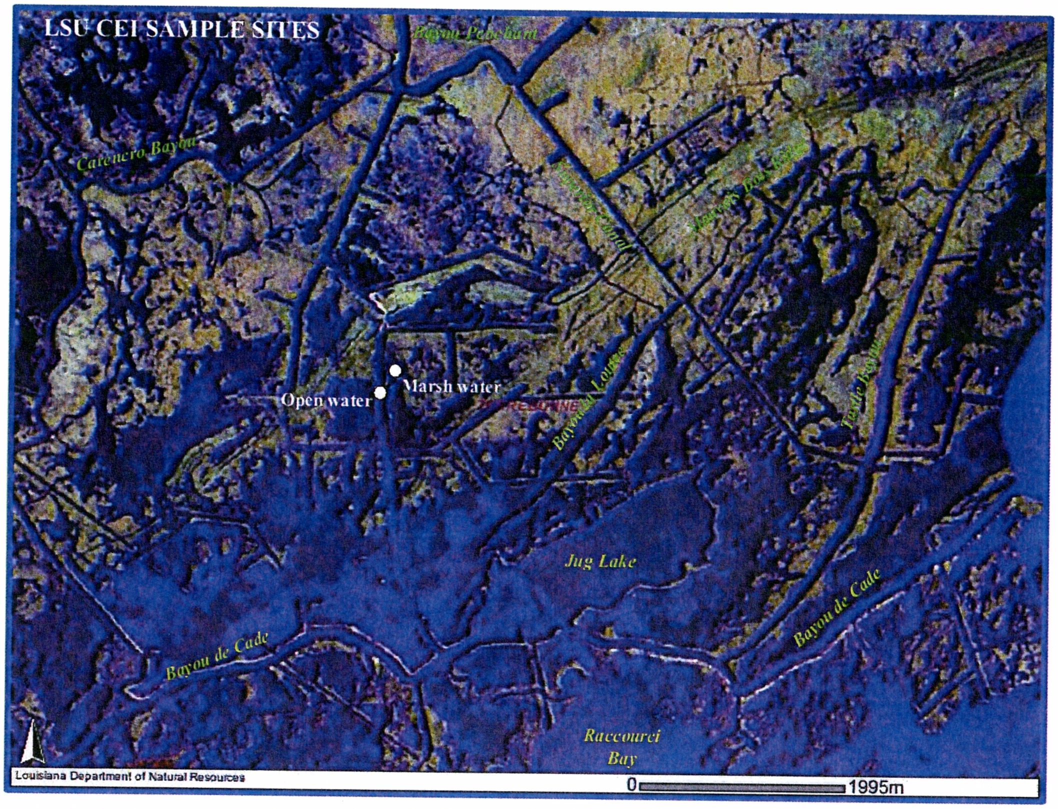
References:

McKee, K. L. and I. A. Mendelssohn. 1989. Response of a freshwater marsh plant community to increased salinity and increased water level. Aquatic Botany 34:301-316.

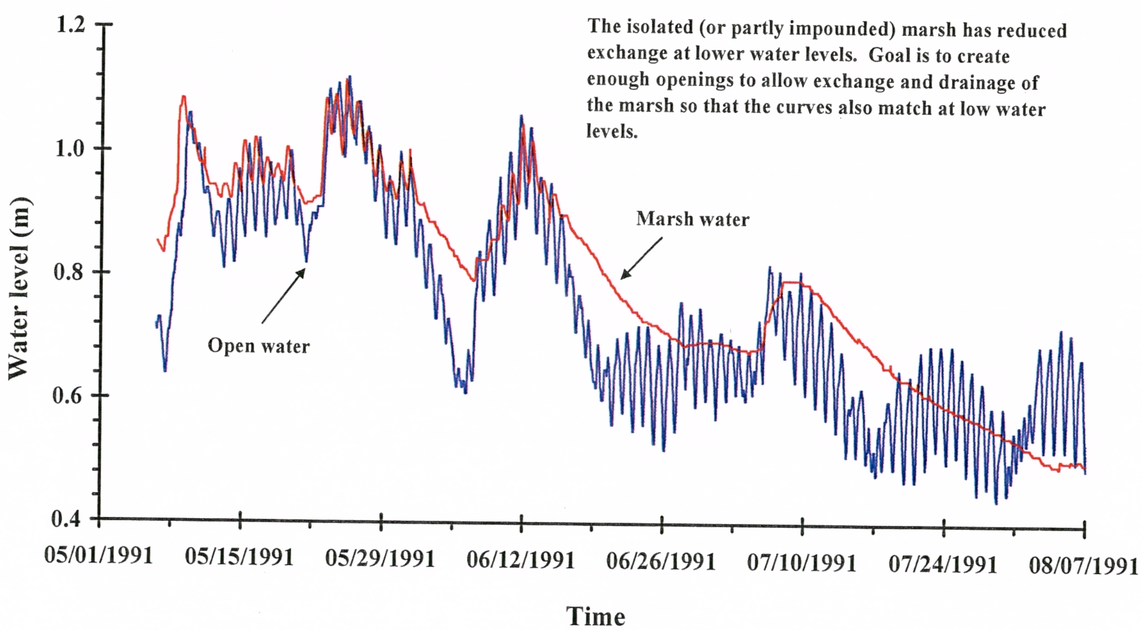
Mendelssohn, I. A., K. L. McKee, and W. H. Patrick, Jr. 1981. Oxygen deficiency in Spartina alterniflora roots: Metabolic adaption to anoxia. Science 214:439-441.

Swenson, E. M., and R. E. Turner. 1987. Spoil banks: Effects on a coastal marsh water level regime. Estuarine, Coastal and Shelf Science 24:599-609.

Example of water levels in an impounded marsh



Hourly water level data site 34 (marshes north of Jug lake)



Data source: E. M. Swenson, LSU

DEMO-03

Marsh Creation Project Containment Dike Degradation & Gapping

Demo-03

PPL22 Marsh Creation Project Containment Dike Degradation and Gapping Demonstration

Coast 2050 Strategy:
Coastwide Strategy: Restore/sustain marshes

Potential Demonstration Project Location:
Coastwide

Problem:
Marsh creation has emerged as the restoration tool of choice within CWPPRA, though some question the appropriateness of excessive reliance on this technique, and the lack of attention to the effects of obtaining the required sediment. While it is not clear that they are always necessary, the vast majority of marsh creation projects designed and built in CWPPRA have included containment dikes. For some time now, some agencies have expressed concern for negative effects of containment dikes on the ecological functions of created marshes. Over time, some "standard" practices for "gapping" or "degrading" the containment levees seem to have taken hold in the program, and assumptions regarding minimum gapping/degradation needed for full ecological function have become accepted by most of the agencies, even though there are no data to support them. It would be very desirable to actually demonstrate the variability in ecological functions of created marshes under different types and degrees of containment dike degradation/gapping.

Goals:
- Develop appropriate design criteria for maximum ecological function and cost-effectiveness.
- Test whether there are differences in ecological connectivity between created marshes and adjacent water and/or wetlands, under a variety of different containment dike degradation treatments
- Test whether there are differences in exchanges of water, suspended solids, nutrients, and organic carbon, between created marshes and adjacent water and/or wetlands, under a variety of different containment dike degradation treatments
- Test whether there are differences in movements of nekton (finfish, shellfish) between created marshes and adjacent water and/or wetlands, under a variety of different containment dike degradation treatments
- Test whether there are differences in the effectiveness of different construction techniques for degrading and gapping containment levees
- Test whether there are differences in the cost-effectiveness of different methods of degrading and gapping containment levees (not just construction techniques, but different degrees of degradation/gapping).

Proposed Solution:
- See above

Project Benefits:
- Improved ecological function of created marshes, with minimal additional cost

Project Costs:
The preliminary cost for this project is $1 million.

Preparer of Fact Sheet
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DEMO-04

CREPS: Coastal Restoration & Energy Production System

Demo - 04

PPL22 PROJECT FACT SHEET
January 26, 2011

Demonstration Project Name: CREPS: Coastal Restoration and Energy Production System

Coast 2050 Strategy:

Region 2 Ecosystem Strategies: Restore and Sustain Marshes

6. Enrich existing diversions with sediment.
8. Construct most effective small diversions.

Project Location:
Plaquemines Parish, site TBD. Possibilities include Myrtle Grove, Bohemian, Carlilse, etc.

Problem: Without massive-scale restoration of the Delta cycle, artificial nourishment of the wetlands is necessary to prevent their complete disappearance within years to decades. Existing methods of sediment nourishment include dredging, major diversions, and piping with or without siphons. Each of these is expensive, negatively affect wildlife and fisheries, and can disrupt local communities and industries.

Goals: Demonstrate and quantify the benefits of the CREPS diversion technology.

Proposed Solution:
CREPS consists of a pipe horizontally directional drilled (HDD) under a levee system (>80ft), with the input under water on the river side and the output on dry land outside of the levee. Because the average level of the river is higher in elevation than the wetlands on the outside of the levee, hydrostatic forces will force river water through the pipe. A hydrokinetic turbine will be fixed to the output and generate power. This power can then be used to power pumps to further direct the diversion, power a cutter head to increase the sediment load, or upload to the transmission grid for revenue generation. The demonstration system would consist of a 30in pipe. An average river level of 8ft would result in 50 cfs and 50 kw of power. Volume and power would fluctuate with river level in relation to the pipe output. The demonstration could stand alone as an isolated diversion, or be implemented to increase the sediment load of an existing diversion.

Project Benefits:
Introduce sediment and freshwater into coastal areas with low cost and fast installation timeline, with the added benefit of generated power. CREPS has an advantage over existing pump/siphon systems, as the maintenance costs are minimal, and the technology provides for a potential recurring return on investment. It is similar in cost to install as a major diversion on a cfs basis, but can be constructed in a fraction of the time. It also negates the induced shoaling threat to the maritime industry, and does not hinder existing residential, commercial, or industrial operations during construction or operation.

Project Costs: The total fully funded cost for the project is $1,835,000.

Preparer of Fact Sheet:
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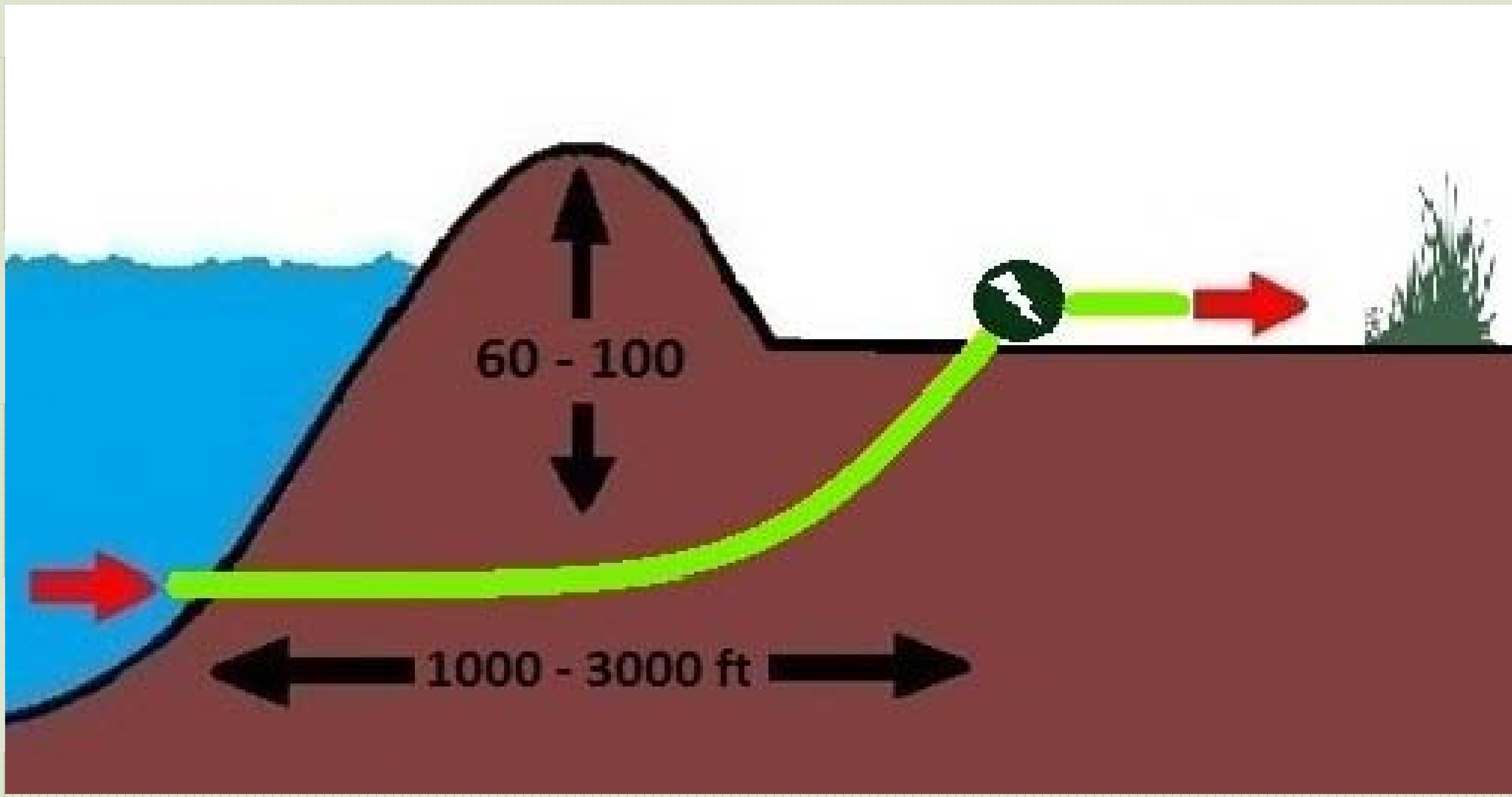
CC-CleanTech LLC

Crescent City Clean Technologies

C R E P S

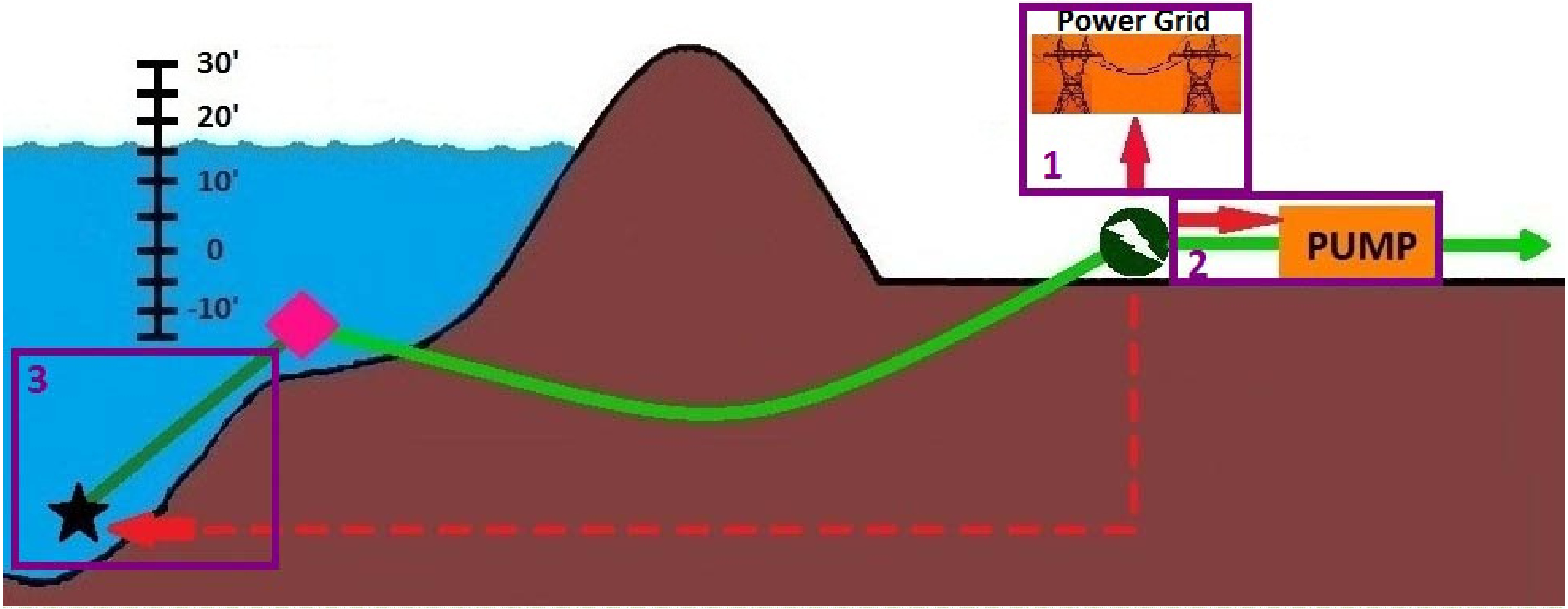
Coastal Restoration and Energy Production System

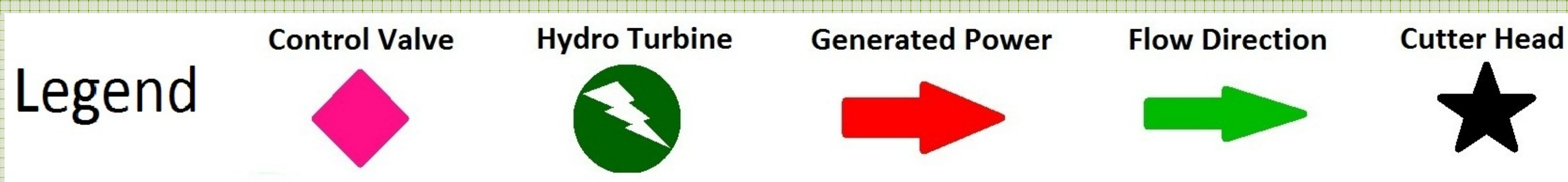
Coastal Restoration and Energy Production System

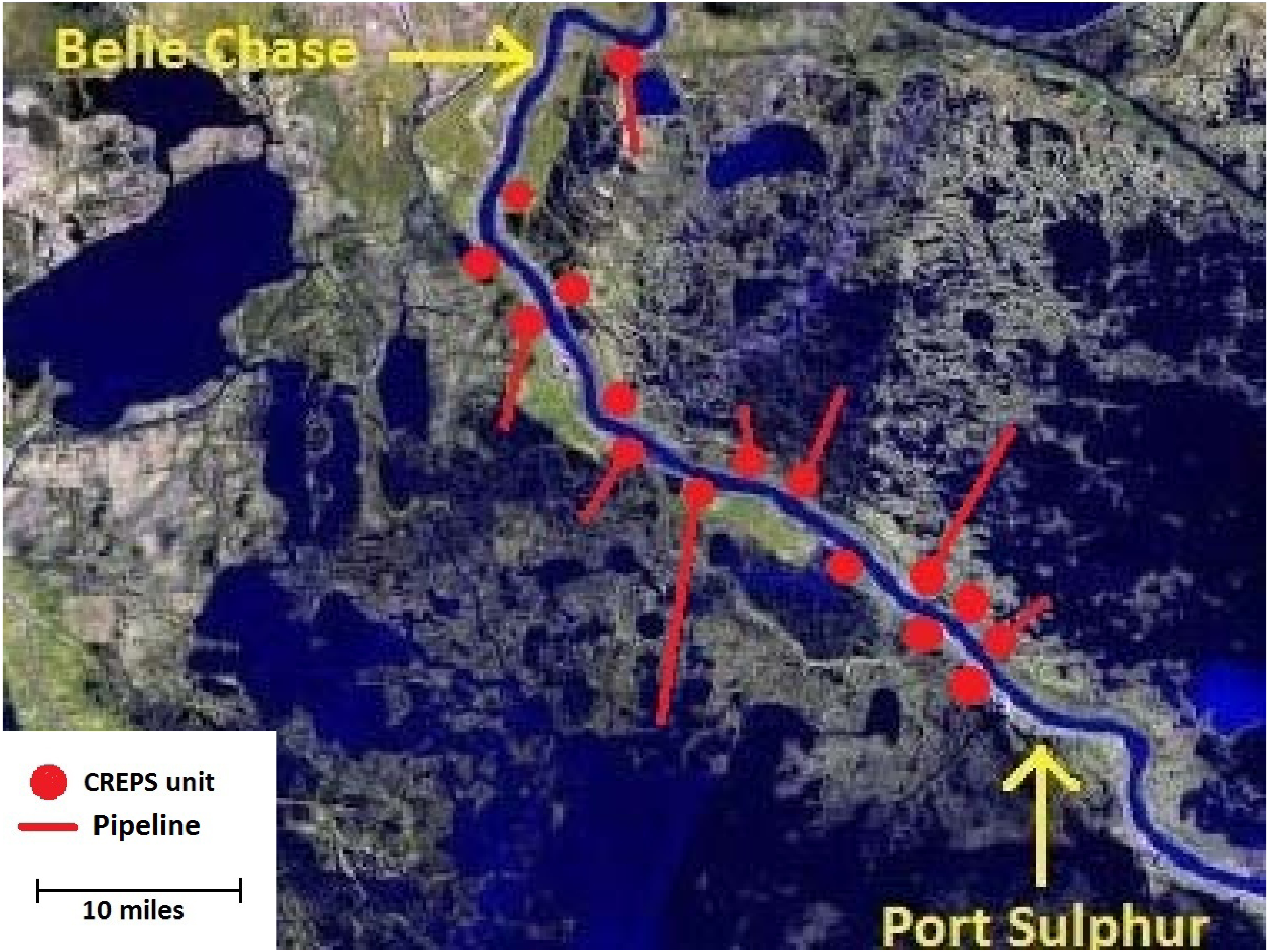


- ✓ Sediment Diversion
- ✓ Power Generation
- ✓ Freshwater Supply
- ✓ Levee Improvement

3 Configuration Options






Belle Chase
Port Sulphur
CREPS unit
Pipeline
10 miles

DEMO-05

Bioengineering of Shorelines and Canal Banks using Live Stakes

PPL 22 Demonstration Project Fact Sheet

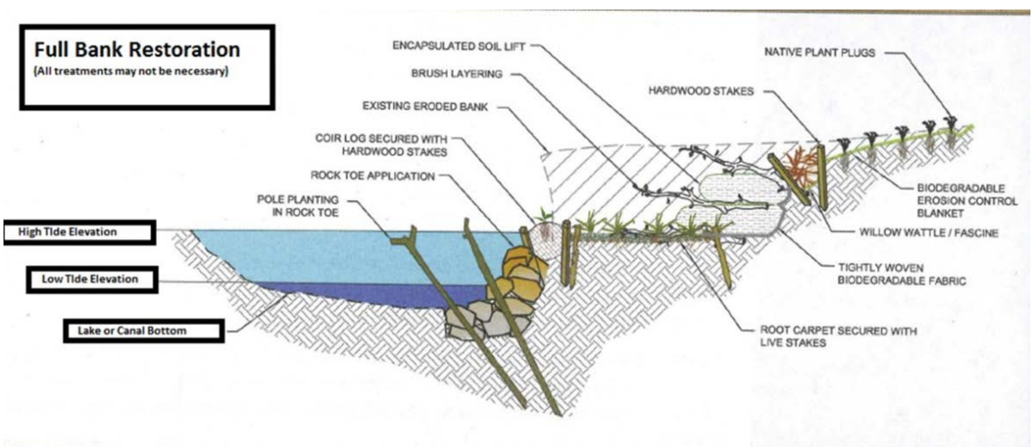
Presented: January 26, 2012

Demo Project Name:

Application of Bioengineering on Shorelines and Canal Banks

Coast 2050 Strategy: Stabilization of major navigation channels, manage bay/lake shoreline integrity, vegetative planting

Background of the technique: General Design



Bioengineering techniques have been used for centuries, all over the world. The first historical use of bioengineering techniques in the United states was by Jonathan Eads in 1878 when he used willow wattles to build jetties to keep the South Pass of the Mississippi River open. Many doubted that the use of such “primitive” methods could yield results but newspapers reported that Eads’ method was wildly successful and economical too.

Bioengineering techniques have been tested and endorsed by many of the federal agencies, including the US Army Corps of Engineers (USAQCE), the USDA Natural Resources Conservation Service (NRCS)s and the Federal Emergency Management Agency (FEMA). Plant species have been genetically engineered for use with bioengineered soil/bank stabilization projects. Many of these projects include stabilization of stream and riverbanks as well as use in quickly introducing vegetative cover to restored wetlands. Any and all plants, alive and dead can be used to encourage sedimentation in a wetland or water body. But for this demo project we are specifically referring to the use of live woody vegetation.

Live dormant woody cuttings and poles installed in banks or in rock shorelines have provided the following values:

- Root systems have increased the cohesiveness of soils and improved the strength of banks subjected to shear stress
- The surface portions of growing woody cuttings absorbs wave and precipitation energy and shear forces from water flows to which the slopes would have been subjected
- Native shrubs and trees have more habitat value than rock alone, or invasive species that often populate bare slopes
- Woody plants grow in strength with time, and the root systems send out adventitious roots that infiltrate the soils, forming a mesh that binds soils together. These roots may also provide a support to settling riprap.
- Though it can be costly to apply bioengineering techniques, it is less costly than stone and many other hard engineering techniques. Using simple bioengineering solutions can be quite inexpensive, especially if a source of usable plant materials are nearby.

GOAL

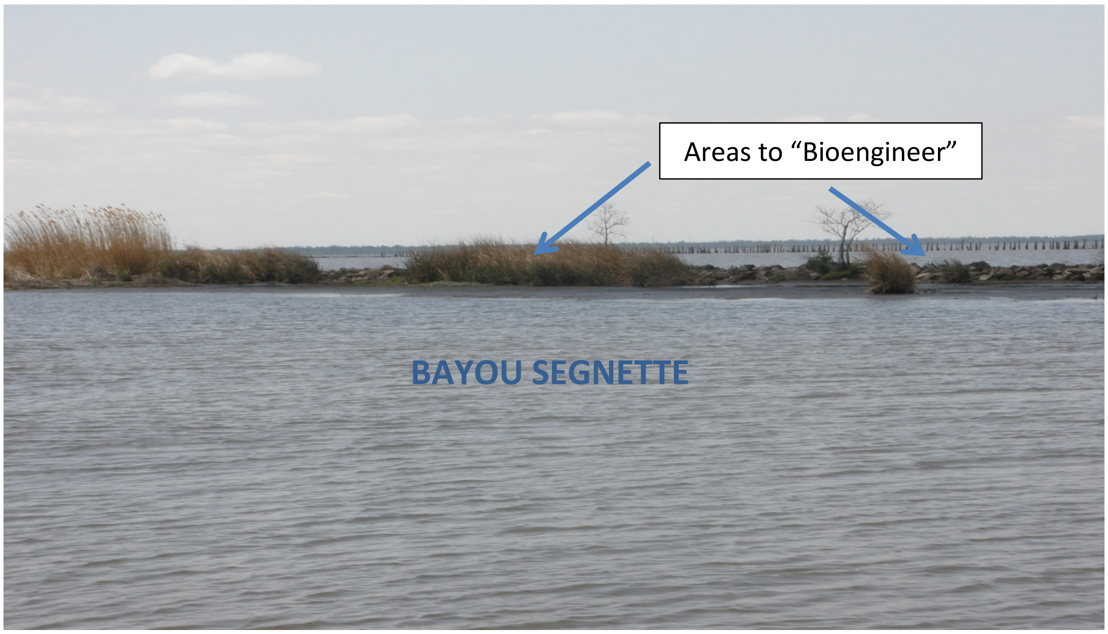
Demonstrate and observe the outcome of using cuttings to stabilize eroding banks and shorelines in freshwater areas; vary installation by using different forms of the plant materials, and variations in installation techniques, including cuttings in bare soil, with erosion control fabric and in joints of rock.

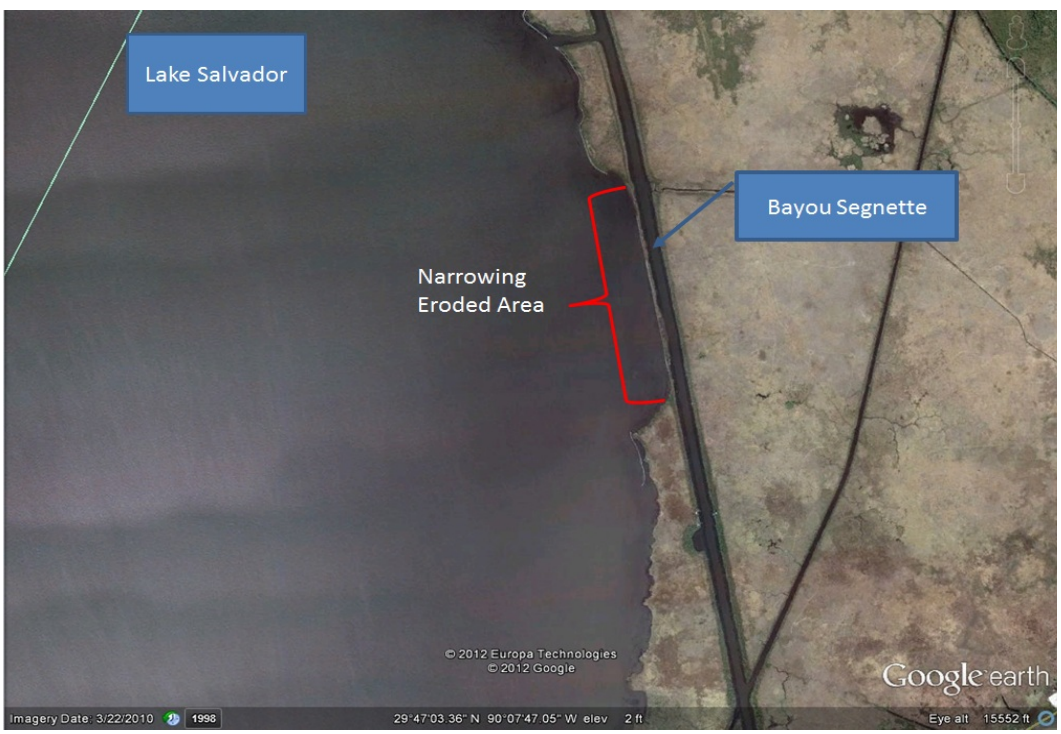
PRELIMINARY METHODS

- Select a location along a bayou/canal that has been subjected to erosion. Install live stakes along 500 feet for each method (total 2500 feet) below. including:
    - Willow whips and poles into minimally eroded bare soil with no grading
    - Regrade eroding banks to smooth slope, install willow whips and poles, plant soil between whips with herbaceous crop and seed
    - Regrade to smooth slope, apply bioengineering erosion control materials (coconut/coir fabric); install willow whips and poles.
    - Install planted coir logs and brush mattresses in addition to above
    - Install 4 other species of shrub cuttings, including, dogwood, buttonbush, wax myrtle, streamco willow

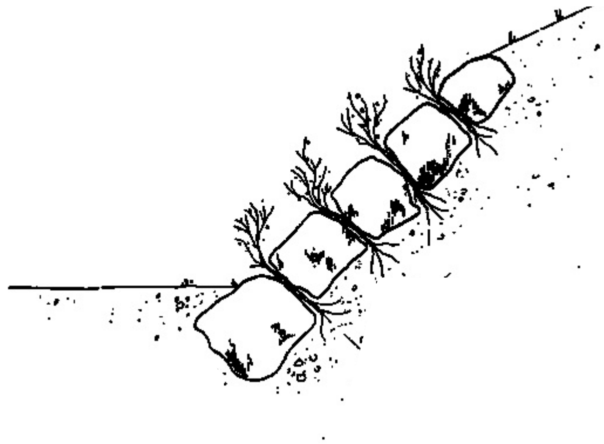
PROPOSED LOCATION

Small isthmus between Bayou Segnette and Lake Salvador. There is a thin strip of rock protection on the lake side, and on the bayou side, there is mudflat/shallow water and some marsh vegetation.

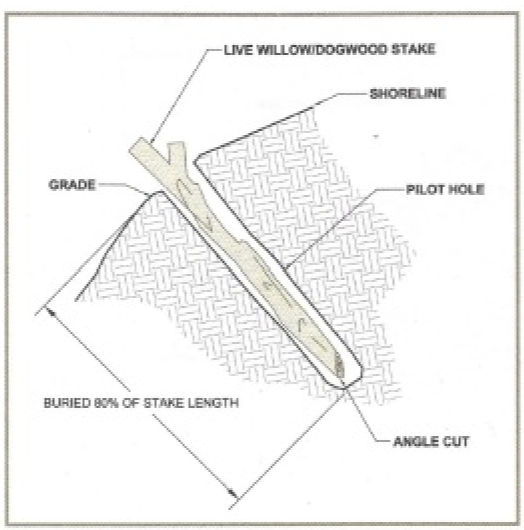




Method Proposed: JOINT PLANT LAKE SIDE---Not to scale (in existing rock)

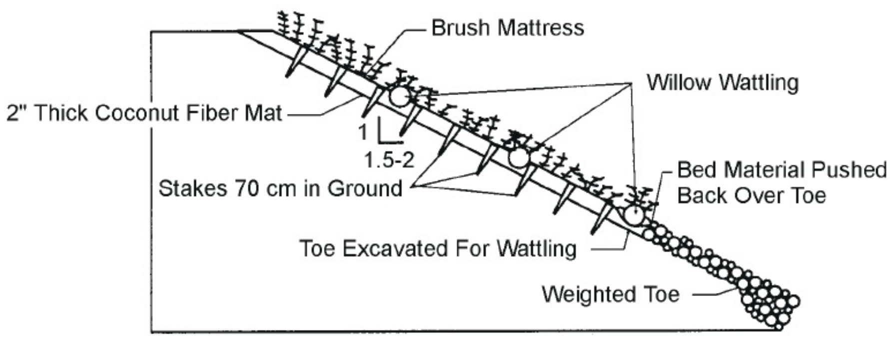


METHOD PROPOSED: BAYOU SIDE-Live Stakes and Brush Mattresses

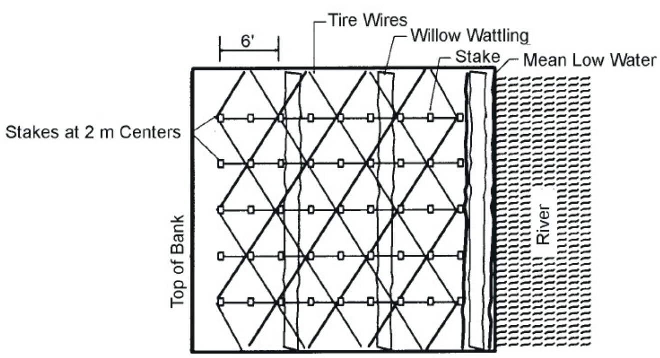


Live Stakes (whips and poles) in <u>existing</u> rock/bank

BAYOU SIDE: BRUSH MATTRESSES



Profile View



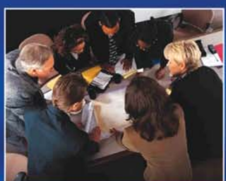
Plan View

Materials used: Willows, dogwoods, buttonbush, bioengineering fabrics, poles, stakes, rope.

Property Ownership: The Jefferson and St. Charles Parish School Boards

Contact: Jane O. Rowan, PWS, Normandeau Associates, Inc. 484-945-2631; 610-635-9359; jrowan@normandeau.com



Application of Bioengineering on Shorelines and Canal Banks

Encouraging natural healing and proliferation of native plant communities in stressed Louisiana wetlands

CWPPRA PPL 22 Demo Project

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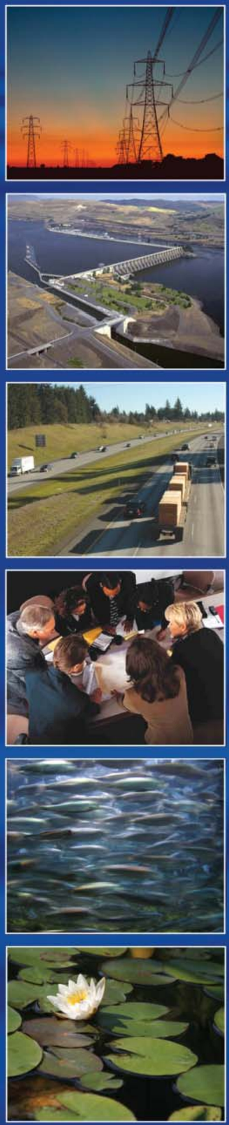
Healthy Herbaceous Growth



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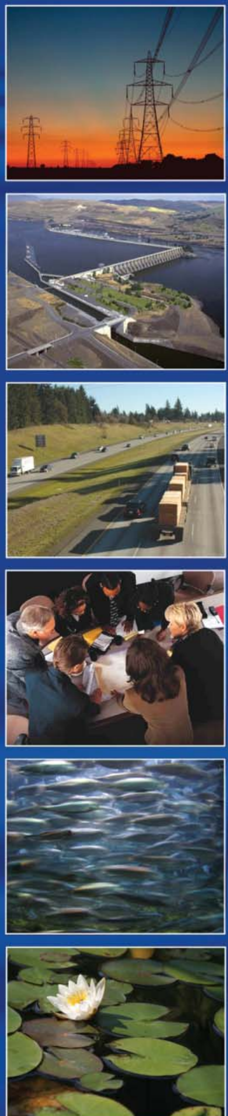
Solid Woody Armoring



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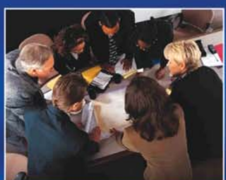

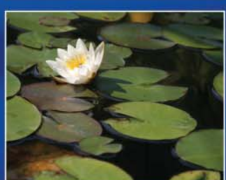

Why Bioengineering?

- Provides strong protection of banks without weighing much
- Allows natural plant community to develop
- Provides native plants a "leg up"
- Grows in strength with time
- Provides habitat and wildlife food
- Is truly **SUSTAINABLE**

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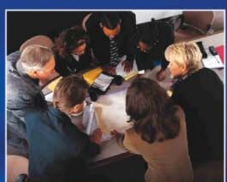
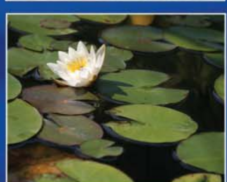
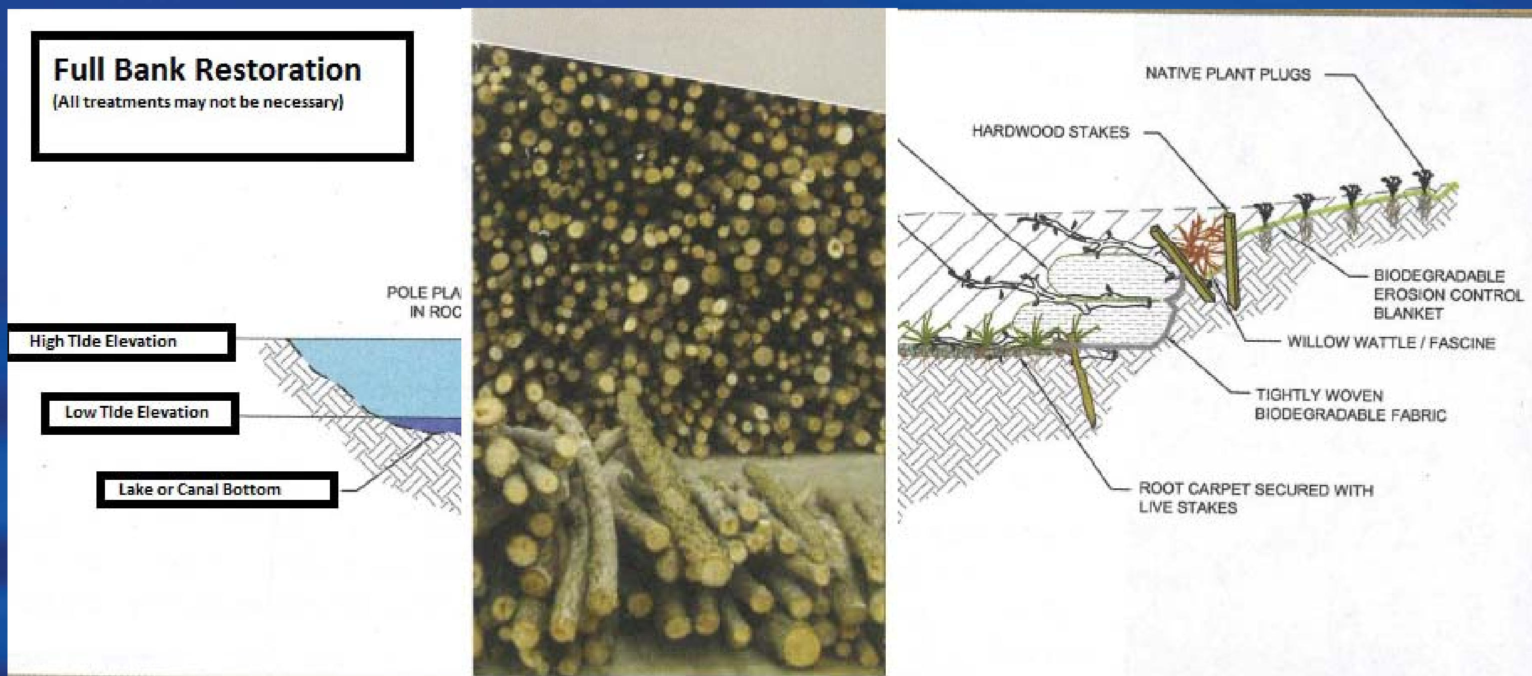




Bioengineered Canal Bank/Shoreline



Adapted from Cardno
JFNew Resource Catalog

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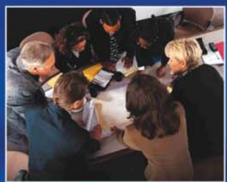
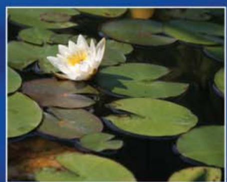
Selection of Methodology





- Based on site
  - Location
  - Existing condition
  - Fetch
  - Substrate
  - Access
  - Plant community
  - Salinity/Water Quality

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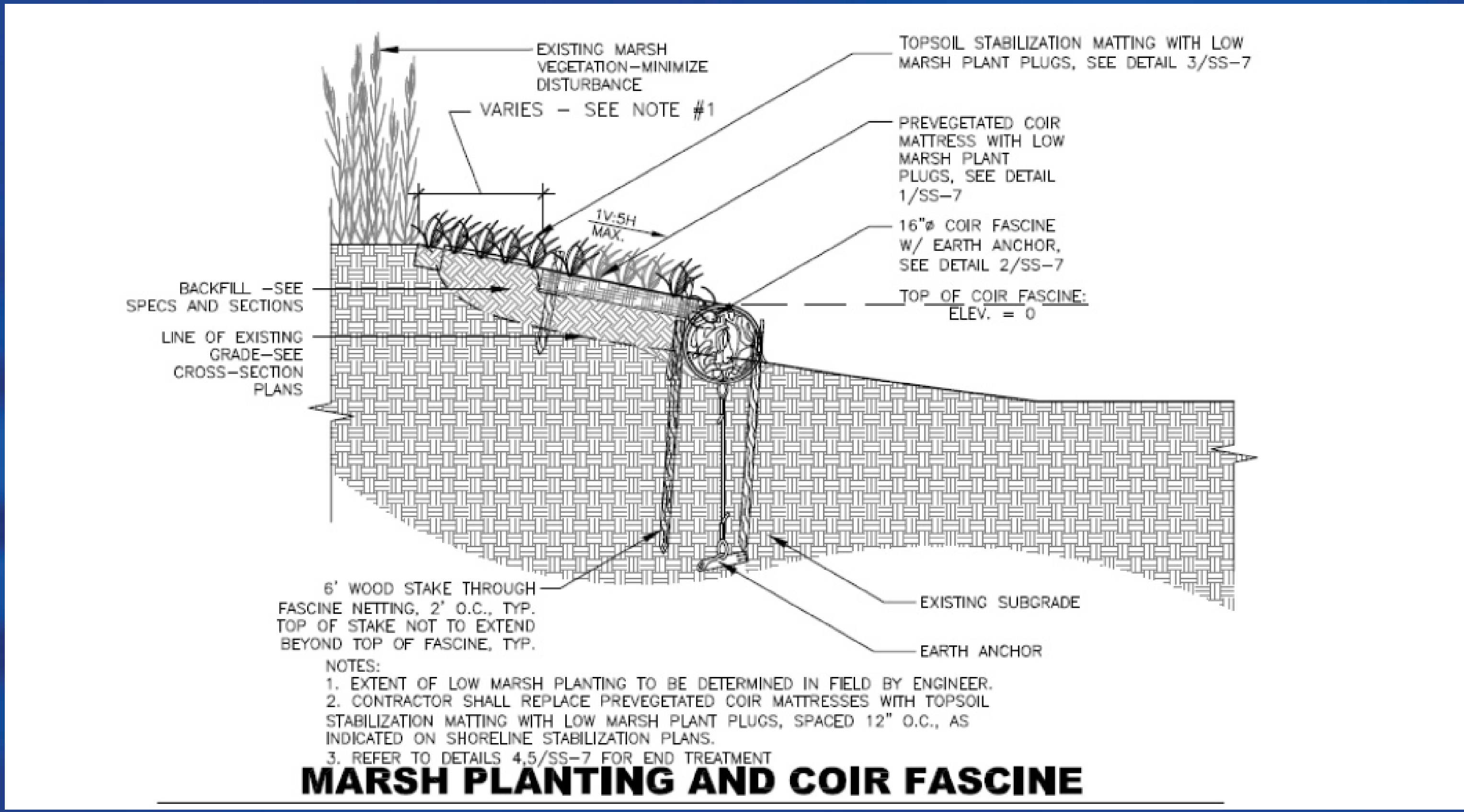
Marsh Shoreline Planting





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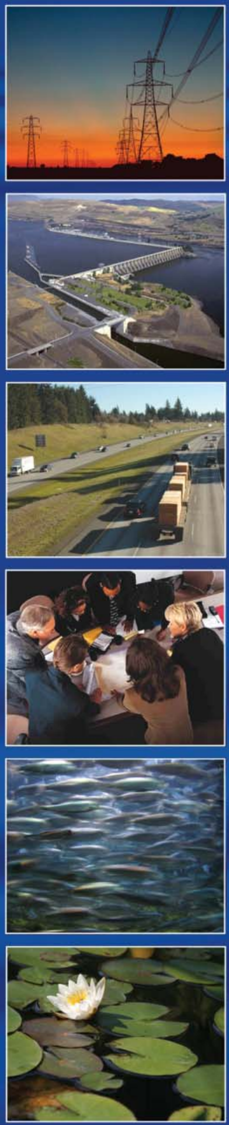
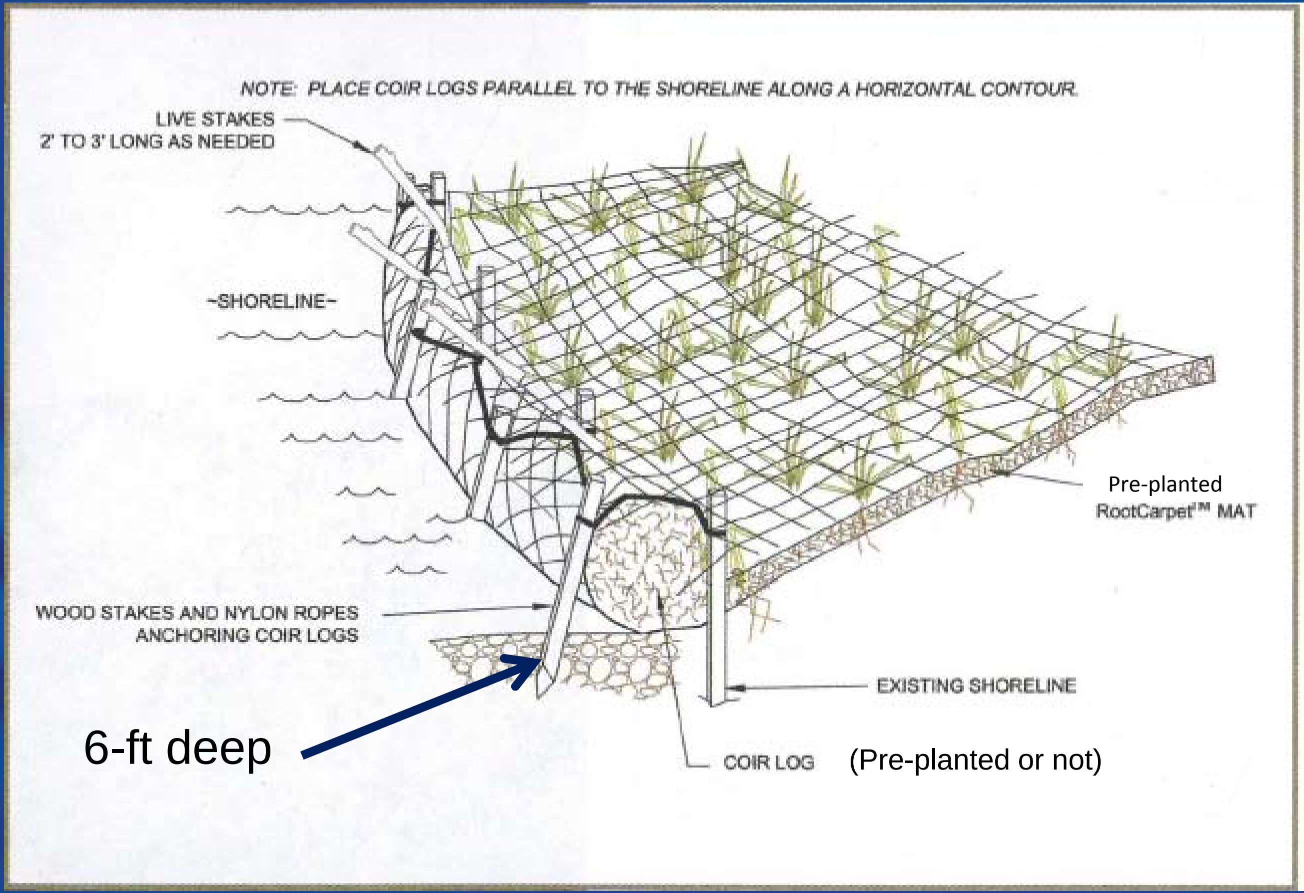
Coir Log & Pre-planted Coir Mattress





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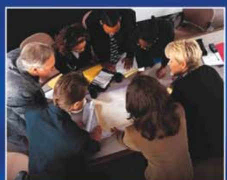

Layered lifts wrapped in coir fabric, with brush layering of live cuttings or bare rooted shrubs

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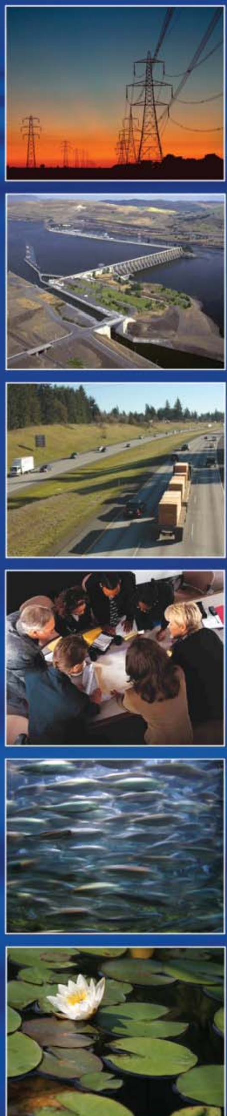
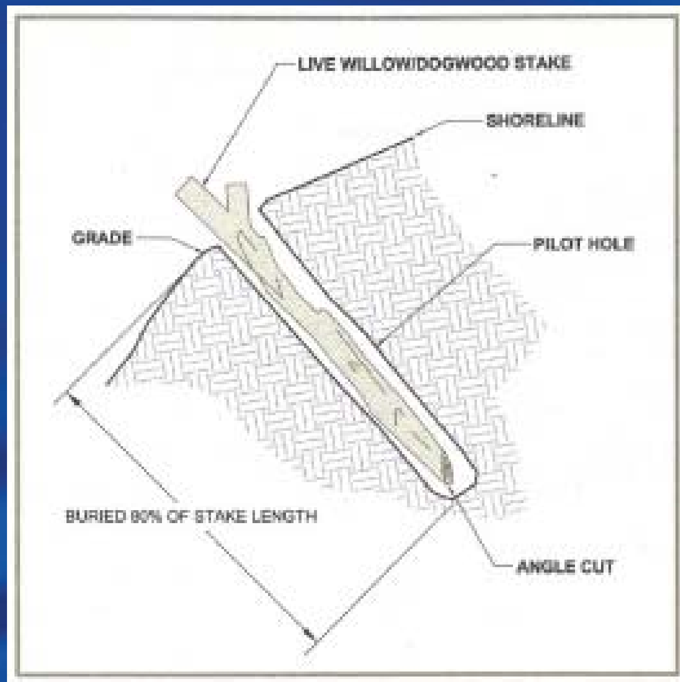
Building Sustainable Communities on an Ecological Foundation
Bioengineering GROUP

Live Stakes
(Joint or direct plant)





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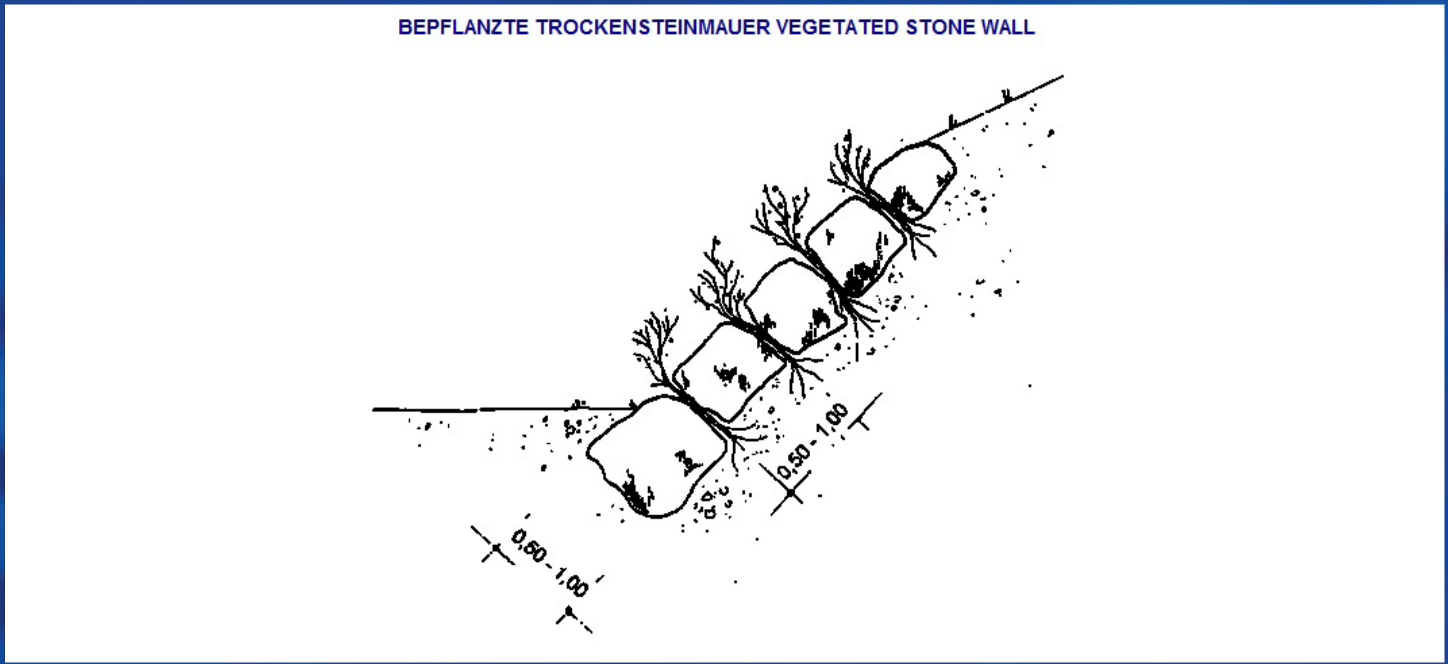
Rock Joint Planting





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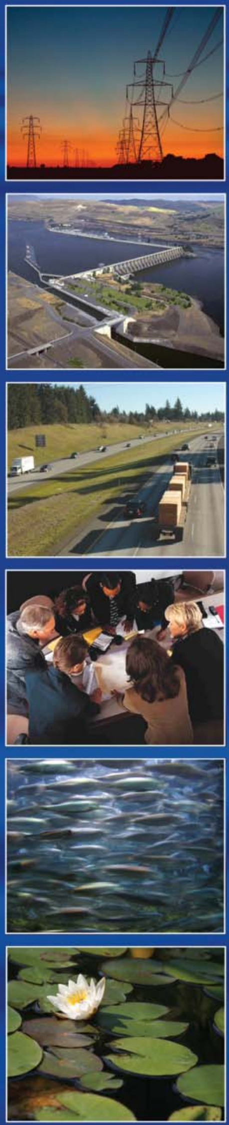
Brush Mattress, Live Stake and Pole Plantings



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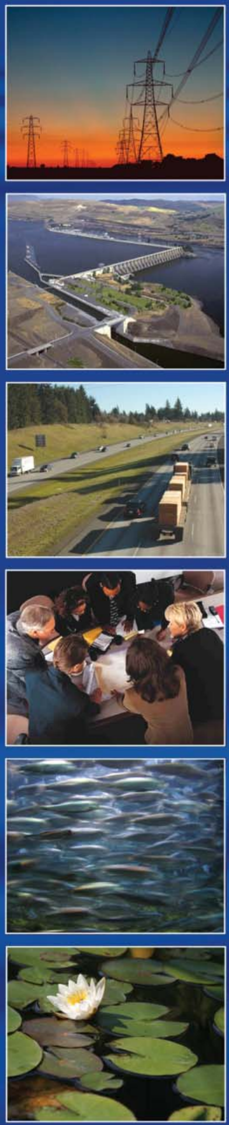
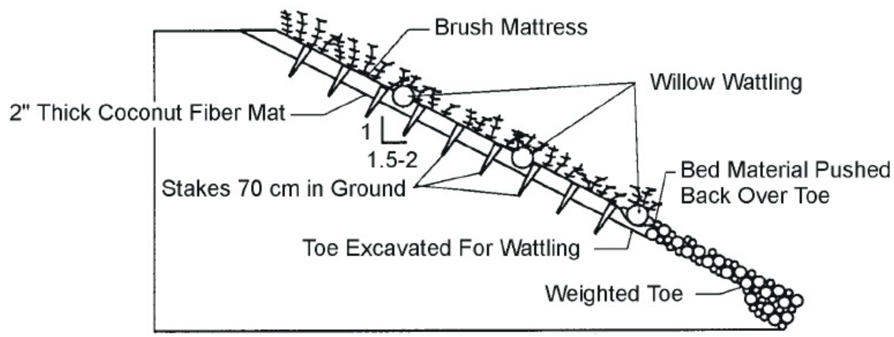
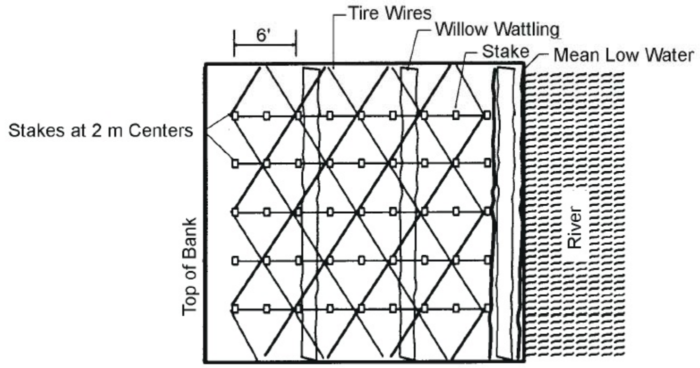
Fascines/Brush Mattresses

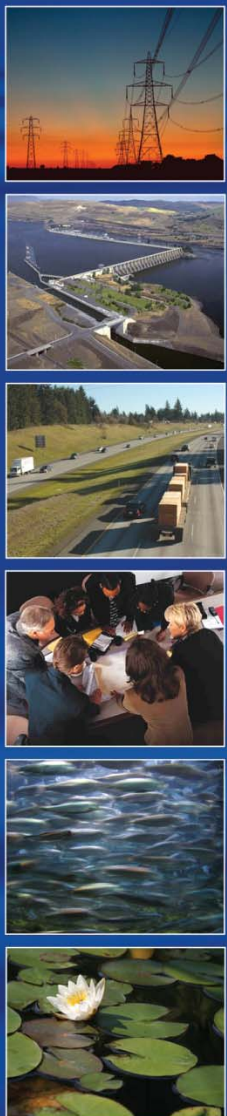




Profile View



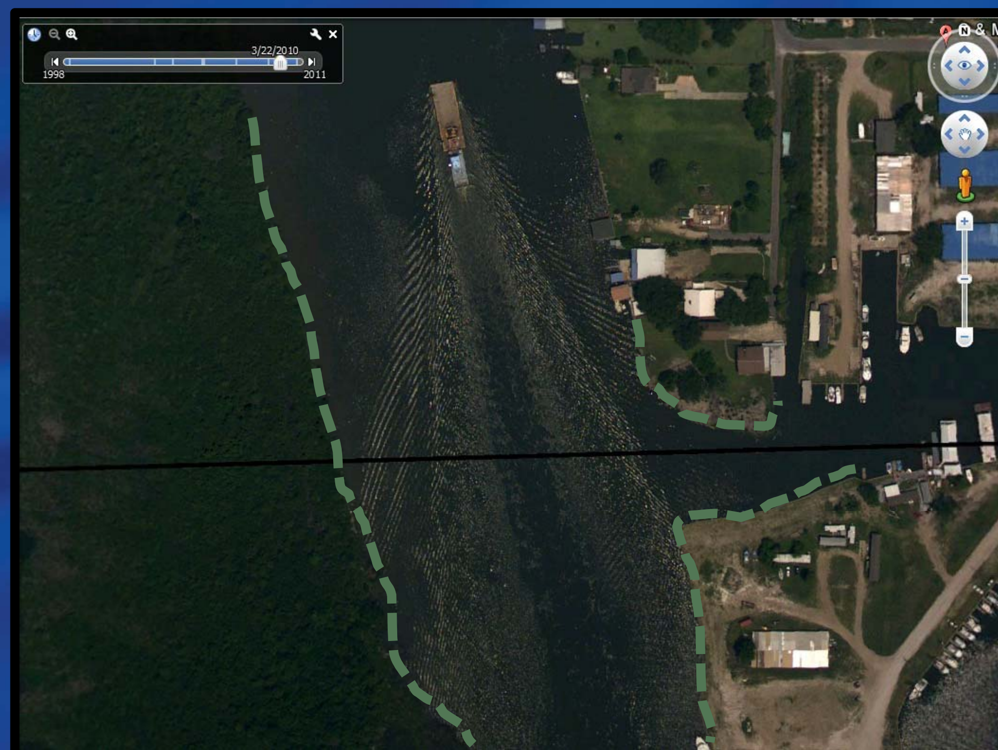
Plan View



Proposed Applications

Eroding areas already stabilized with rock, or not:

- Live stakes
- Joint Planting
- Coir Fascines
- Brush wattles



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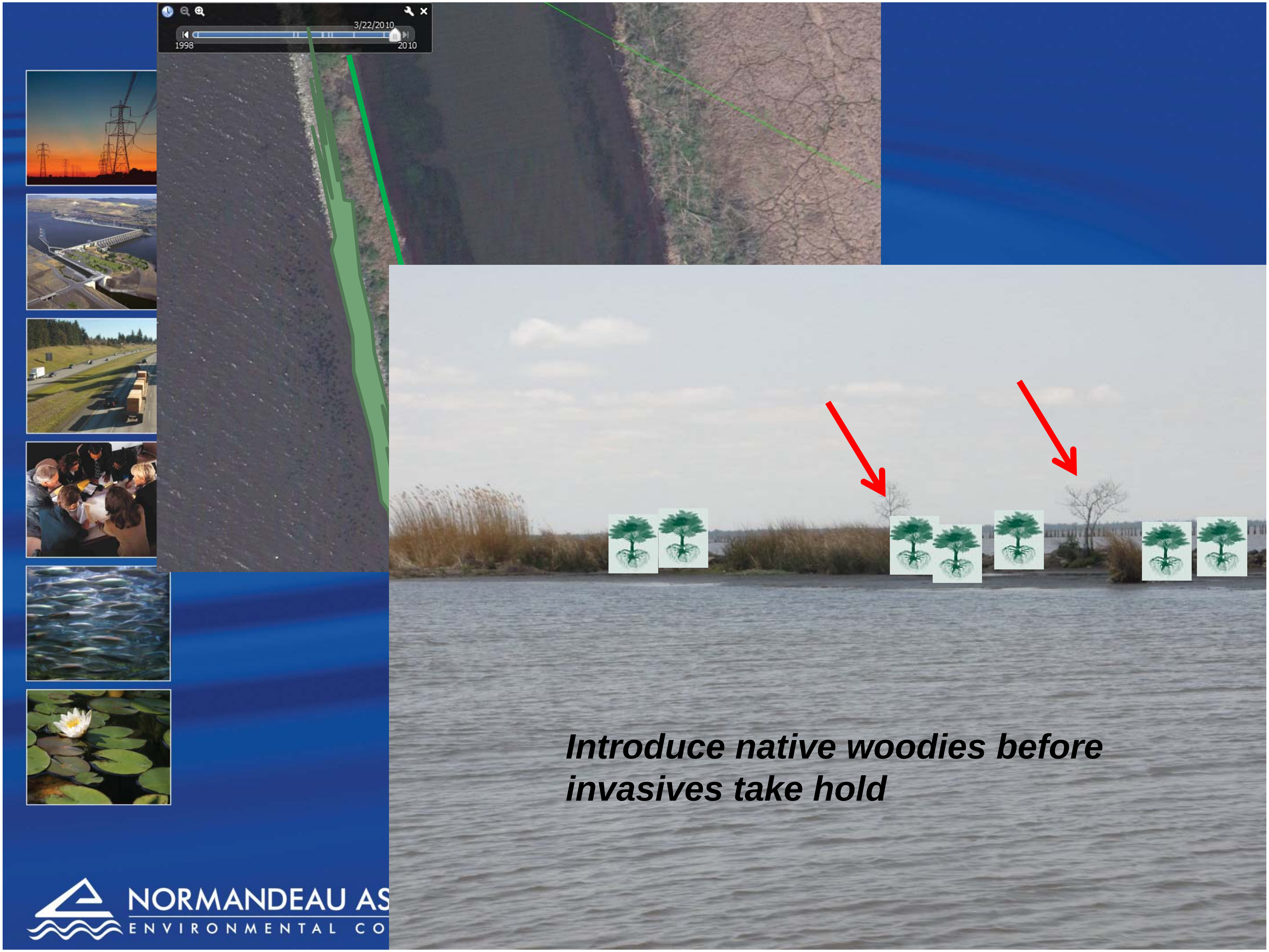
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1998
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Introduce native woodies before invasives take hold
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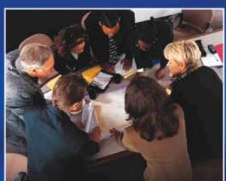

Research Needs

- Bioengineering is very plant dependent
- Sustainable if the mode of growth is appropriate
  - Adventitious roots
  - Ability to root from cuttings
  - Develops strong and extensive root systems
  - NATIVE or Infertile/non-invasive
- Various native species should be tested
- Very little to no testing done on LA woody species

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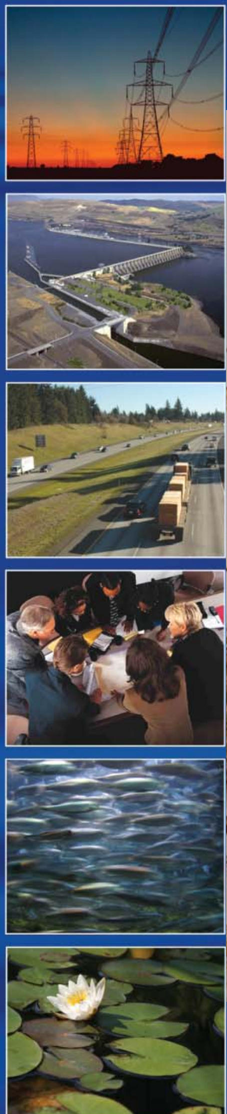

Thank you!

Jane Offringa Rowan, PWS
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DEMO-06

Research to Assess LA Native Plant Efficiency for Bioengineering Applications

CWPPRA PL 22 PROJECT NOMINEE

January 26, 2012

Project Name:
Research to assess LA Native Plants for Bioengineering Applications

Coastwide 2050 Strategy: Stabilization of Major Navigation Channels, Management of Bay/Lake Shoreline Integrity, Vegetative Planting, Maintain or Restore Ridge Function, Terracing

Problem: The Louisiana Delta and Coast has experienced extreme climate and man-induced events over the last 200 years that has resulted in a "perfect storm" for deterioration of fragile wetland systems both along the coast, lakes and riverways, and within the interior swamps. The perception is that a lack of sediment supply from the Mississippi River and other channelized bayous is the major reason for the loss of wetlands and coastal systems. But other reasons compound the problem. Thousands of oil/gas canals excavated in the marshes and swamps have provided conduits for salt water to enter strictly freshwater systems. Massive water removal from developed areas via ditches and pumps lower the regional water tables. Exposure of peats saturated for thousands of years are now experiencing drainage, exposure to increased nutrients and are subjected to saline water. Severe weather systems push surging waters into ecosystems adapted to calm waters. All of these factors combine to result in deterioration of the plant community and the peat they form and on which they continue to grow and thrive. Diverse native plant communities crumble under this scenario and less diverse systems made up of plants that are able to thrive in widely varying conditions thrive. Unfortunately, many of these highly tolerant plants are not native, and non-native plants have out-competed native plants in many locations further limiting the ability for the wetland systems to heal themselves.

Bioengineering techniques were developed hundreds of years ago to increase the cohesiveness and stability of soils and to direct water and sediment to more appropriate locations. The first documented use of bioengineering techniques was by Jonathan Eads who demonstrated that willow fascines constructed into jetties could keep the South Pass of the Mississippi River open. His methods were wildly successful as well as economical. The methodology was not often put into use (at least that we know) over the ensuing years until the late 1980's and early 1990's when methods being used in Europe introduced and put into practice in the United States. Both the US Army Corps of Engineers (USACE) and the Natural Resource Conservation Service (NRCS) provided "how to" manuals to apply many different types of bioengineering techniques, but mostly using native easily rooting species like willow and dogwood. Research within the NRCS plant centers, mostly in New York (Big Flats) and New Jersey (Rutgers) resulted in the development of some willow species specifically for bioengineering of streambanks. These willows (Streamco—*Salix purpurea*) were introduced from Europe for making baskets and has naturalized, quickly taking hold of the soils they are planted in. The stems and branches are very flexible and bend after subjection to rapid water flow and recover their erect habit quickly. Streamco willow can grow to 2-4 feet within 2 years and reach full height of 20 feet in 5-7 years. The NRCS shrub is a male clone and does not develop sucker roots, thereby limiting its invasiveness.

The Streamco willow was developed to grow in Eastern US and Southern Canada for uses in stream bank bioengineering. The NRCS states that ***"When grown in combination with good stands of grass, it is equal in resistance to riprap of seven inch medium stone size".*** Native willows also have a strong propensity for stabilizing soils quickly, as does some species of dogwood, buttonbush, elderberry, and other species. There has been some work on woody plant species appropriate for the "Southeast" as shown in the list attached (included in the demo presentation) however, the grouping of states that are listed as appropriate for southeast species includes North Carolina out to Texas, with Louisiana being included in that grouping. Due to the Louisiana delta being unique in its geomorphology and soils, as well as its extensive and unique plant communities, and, due to the great need to develop means to establish *native* plants to stabilize soils and maintain the foundation of the wetland community (peat and roots), it may be advantageous in the long run to test and develop species that can be specifically adapted to bioengineering applications.

This demo project proposes that a strategy be developed and applied for existing plant centers in the state to begin identification of woody native species that can be used for bioengineering applications, to test them in varying locations, and if appropriate to genetically "engineer" some species to be able to withstand additional stresses within Louisiana wetlands, including:

- **Salinity Tolerance**
- **Ability to root quickly from cuttings**
- **Ability to quickly develop strong root systems and to increase soil cohesiveness**
- **Value for wildlife use (but not overuse)**
- **Sustainability—does the species grow and increase in strength, or does its presence allow for other native woody plants to grow and increase in strength**
- **Ability to withstand heavy wave action, fetch.**
- **Ability to create a root network that could "buoy up" rock used to stabilize the toe of banks or shorelines**

Proposed Strategy: Break this study into five phases from initial data gathering, collaboration with various government agencies and researchers in agricultural universities to development of specifications and guidebooks for parishes and private citizens to apply:

- Phase I : Data gathering, collaboration to determine candidate species-select 10-20 to test
- Phase II: Nursery/Greenhouse: initial spec and application scenarios using existing information
- Phase III: Controlled growth scenarios-application with variables, including location, fresh, intermediate, brackish (measuring mortality, root mass development, growth characteristics) sedimentation value, substrate type, volunteers, diversity over time, maintenance needs, site preparation, etc.
- Phase IV: Implement into existing projects, and monitor
- Phase V: Update application standards and specifications

Project Benefits:

It is hoped and assumed that development of a list of appropriate species, their efficacy in retaining and stabilizing soils, various applications on how they function best, their ability to regenerate/heal themselves and to raise the elevation of the areas in which they grow will have broad application within the state. There is probably less opportunity for application of bioengineering techniques in salty water areas, but there are multiple opportunities to use these techniques for stabilizing the shorelines of lakes and bayous/canals, as well as edges of open water areas that once were floating marshes. In addition, using this method may result in a vastly less expensive means to restore LA wetlands if applied in multiple locations and as a regular means to soften and improve stabilization projects by those using harder engineering methods.

PROPOSED BY: Jane O. Rowan, PWS, Normandeau Associates, Inc. jrowan@normandeau.com; Office, 484-945-2631; Cell: 610-635-9359






Research to assess LA Native Plants for Bioengineering Applications

CWPPRA PPL 22 Demo Project

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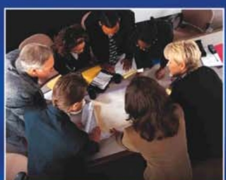
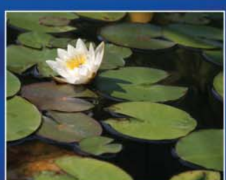
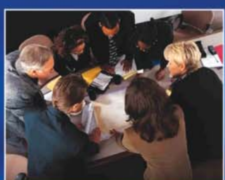


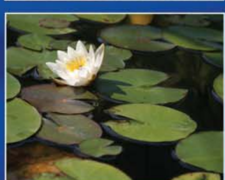


Proposed Demo Project

- Develop shortlist of appropriate (native) woody plants according to application based testing results:
  - Ability to adventitiously root from cuttings
  - Ability to develop strong subsurface root system, or floating mat
  - Range of tolerance to salinity
  - Resilience to wave energy
  - Ability to encourage sedimentation
  - Habitat/wildlife food value
- Develop planting standards and specifications
- Provide guide book for agencies, consulting firms and private citizens to apply methods appropriately





Candidate Species

- Tried and True: willows, dogwoods, buttonbush, elderberry
- Potential: Wax myrtle, *Baccharis, Clethra, Iva, Sesbania*
- Functional: Infertile (genetically engineered) willows, etc.
- Hopeful: tupelo, cypress, red maple

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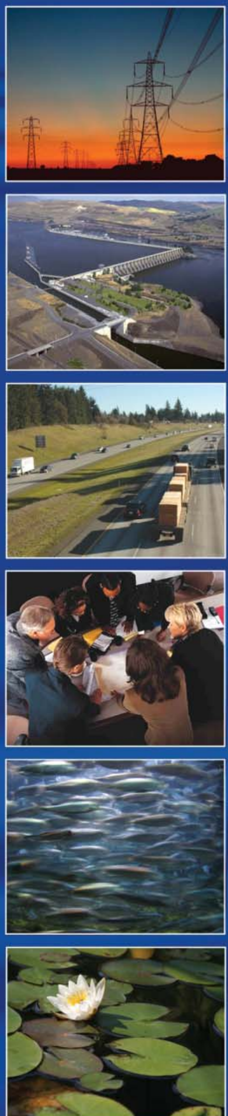

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Mandalay National Wildli






Louisiana Coastal Wetlands Conservation and Restoration Task Force

rev. May 2008
Cost figures as of: January 2012

Floating Marsh Creation Demonstration (LA-05)

Project Status

Approved Date: 2003 **Project Area:** N/A
Approved Funds: $1.08 M **Total Est. Cost:** $1.08 M
Net Benefit After 20 Years: N/A
Status: Maintenance and Monitoring
Project Type: Demonstration: Marsh Creation
PPL #: 12

Location

This project is located within the fresh and intermediate marshes of the Mandalay Wildlife Refuge in Terrebonne Basin.

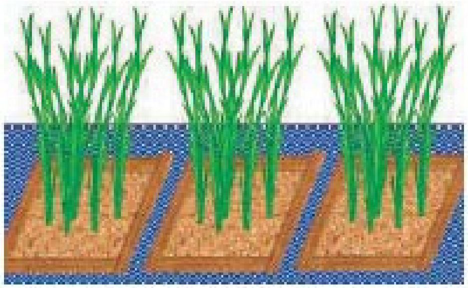
Problems

Tens of thousands of acres of marsh within the fresh and intermediate zones of the Barataria and Terrebonne Basins converted to open water between 1968 and 1990. Large areas of fresh and intermediate open water exist in marsh interiors presenting opportunities for reestablishment within those basins. These types of open water areas are not well-suited for typical projects such as sediment diversions, beneficial use of dredge material, or dedicated dredging because they are generally located at long distances from natural sediment sources, frequently dredged navigation channels, or other water bodies with bottom substrates containing material suitable for marsh creation. Additionally, the substrate under these large areas of fresh and intermediate open water is often fluid organic matter which would not support the weight of added sediment.

Progress to Date

The Louisiana Coastal Wetlands Conservation and Restoration Task Force approved funding for this demonstration project at their January 2003 meeting. Project monitoring is underway.

This project is on Priority Project List 12.



This illustration shows an example of one of several possible designs that were tested for this project.

Restoration Strategy

The purpose of this demonstration project is to develop and field test unique and previously untested technologies for creating floating marsh for potential use in fresh and intermediate zones. The first phase of the project consisted of two components in which buoyant vegetated mats or artificial floating systems (AFS) were developed and tested in a controlled environment during the first two years of the project. Various combinations of plant species, planting methods, structure materials and substrates were tested to determine optimal buoyancy and structure design. In addition, plant response to environmental effects was evaluated in effort to identify methods to accelerate floating marsh mat development. For the second phase of the project, the AFSs were then deployed into open water areas for field testing on Mandalay National Wildlife Refuge in 2006. Monitoring of the AFSs field performance is ongoing. The goal of this project is to develop methods for restoration of open areas within deteriorated floating marsh and other freshwater areas where establishment of maidencane (Panicum hemitomon) marsh is desired. In addition, the technology being developed is to be transferable to wider applications across the LA coastal area.

For more project information, please contact:

NRCS

Federal Sponsor:
Natural Resources Conservation Service
Alexandria, LA
(318) 473-7756

CPRA

Local Sponsor:
Coastal Protection and Restoration Authority
Baton Rouge, LA
(225) 342-4736

www.LaCoast.gov

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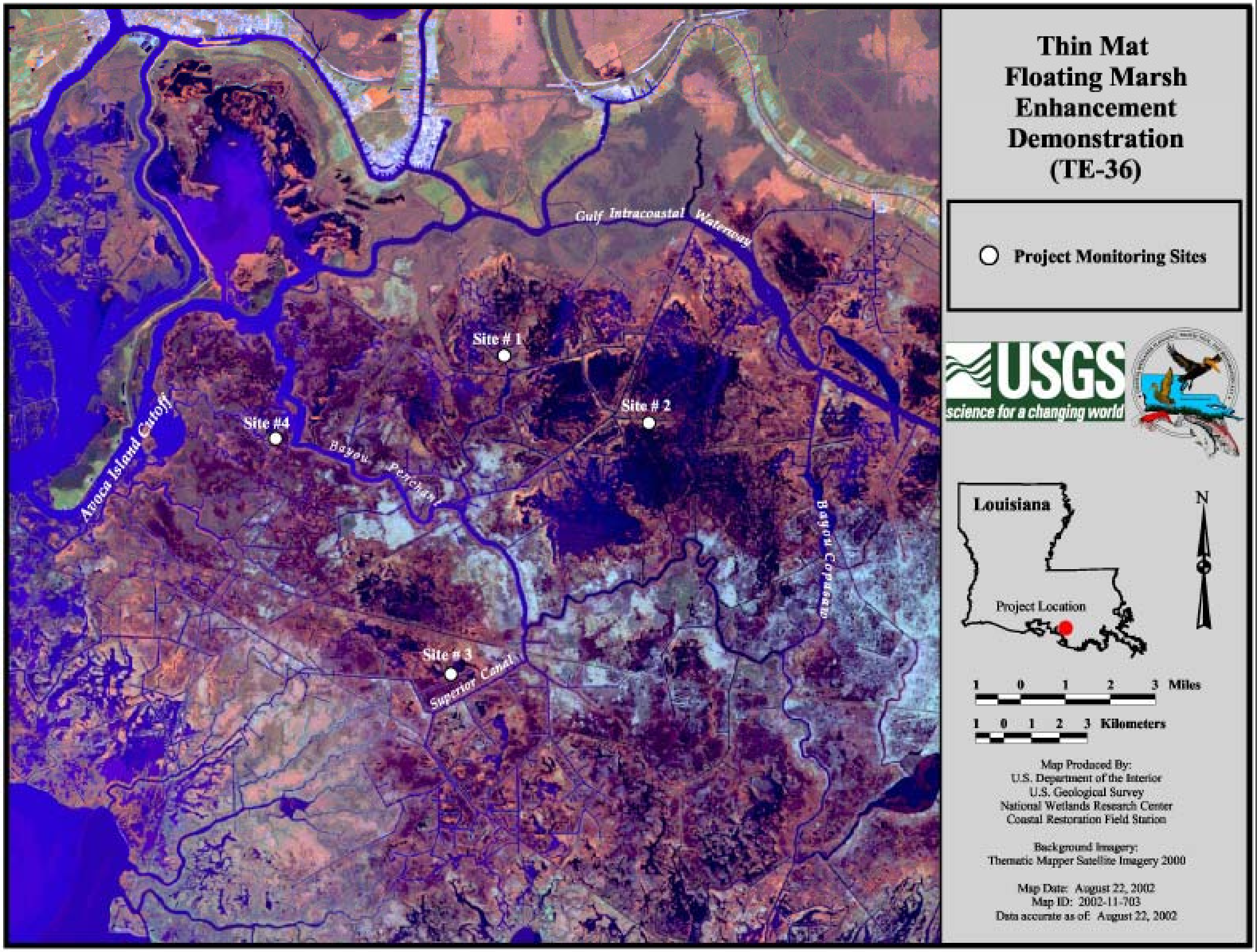

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DEMO-07

Utilization of Natural Gas Power for Dredging & Placement

Demo-07

PPL 22 DEMONSTARTION NOMINEE FACT SHEET

January 26, 2012

Demonstration Project Name:

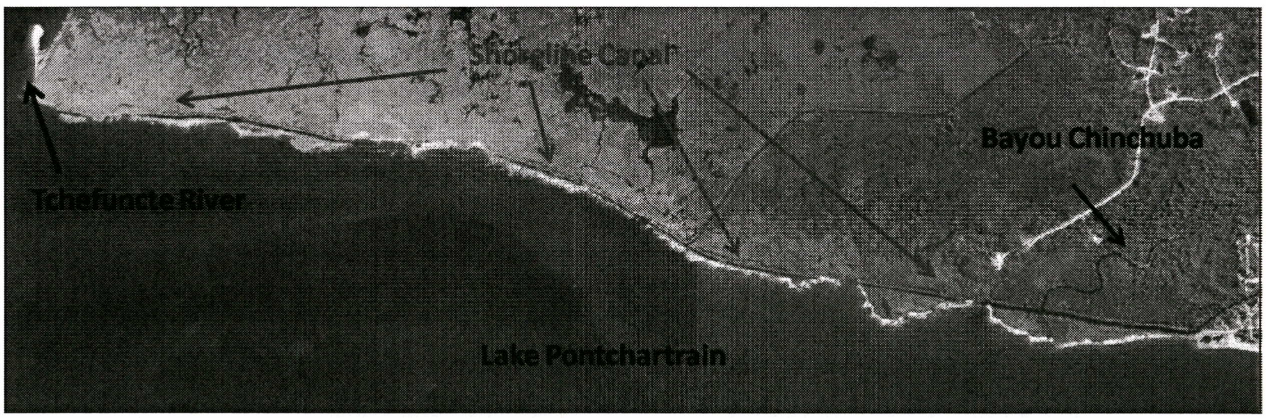
Utilization of Natural Gas Power for Dredging and Placement

Coast 2050 Strategy/Strategies:

Multiple Strategies

Potential Demonstration Project Location(s):

Potential demonstration locations could be anywhere along the coast. As an example, filling up of canals that run parallel to the shorelines of Pontchartrain Lake on the north shore is a good idea.



Problem:

Past marsh creation projects and current planning for future marsh creation projects assumes a status quo of the dredging industry's use of diesel engines for their pumps. Louisiana State Master Draft Plan 2012 envisages approximately $17 billion for marsh creation for the next 50 years. Recently, CWPPRA Technical Committee has decided to suspend (in lieu of de-authorization) PPL 10 project, "Benneys Bay Diversion Project (MR-13)" based on the high cost of dredging associated with the project. The majority of the cost of creating marsh substrate can be attributed to the fuel. Through this demonstration project we could show the viability of using natural gas as fuel for dredging activities, thereby substantially reducing the cost of marsh creation.

Goals:

Conversion of diesel engines to natural gas for hydrologic pumping of sediment may create a significant savings in cost and, therefore, expand the usefulness or feasibility of marsh creation. This project is proposed to demonstrate the feasibility of using natural gas in lieu of diesel and demonstrate cost effectiveness. This approach could be replicated for many upcoming coastal restoration projects that utilizes dredging and material placement.

Proposed Solution:

In order to evolve a cost effective approach to dredging and placement of material to create wetland substrate, natural gas operated dredges and its accessories are proposed. This demonstration project is expected to answer the feasibility and the viability of such an approach. The following paragraphs describe some of the feasibility and viability questions that could be addressed by this demonstration project.

Working along with natural gas providers and dredgers, a prototype dredge natural gas engine is to be designed and manufactured. Use of natural gas would require cost to convert the conventional diesel engine to natural gas use. Diesel combustion engine would likely need to be replaced with possibly larger natural gas engines. The natural gas engines may need to be supplemented with transmissions to develop adequate torque to drive large pumps. The supply of natural gas for dredging would be different than diesel.

Storage of natural gas on a potentially mobile barge represents new hazards. Flow lines could possibly be used if the barge or engines were fixed. Of course, due to the current infrastructure of natural gas lines across south Louisiana access to natural gas is generally good. Nevertheless, there would be front-end conversion costs.

Compressed Natural Gas (CNG) is starting to be commercially viable as a portable fuel alternative. http://www.cngnow.com/what-is-cng/Pages/default.aspx. Compressed natural gas volume at typical compression of 3,600 psi is approximately four times the volume of a gallon of diesel. The additional space may require small transport shuttle barges but is still a manageable volume transport for dredge project.
http://205.254.135.7/oiaf/aeo/otheranalysis/aeo_2010analysispapers/factors.html

The current dredging industry is based on diesel use primarily because of its availability and the traditional need for portability and flexibility. This need may be greatly diminished by long-term planning of sediment delivery systems. Long-term contracts or other incentives could be devised. Louisiana has a long tradition of policy and revenue derived from oil and natural gas, creating a significant policy environment for expanded use of natural gas.

Project benefits:

On an energy equivalency basis, one barrel of oil is generally equivalent to 5.8 MCF (1,000 cubic feet of gas). Natural gas is currently selling around $3.00 MCF, and a barrel of oil is $92. Diesel is currently $3.65 per gallon retail, or 20% more than gasoline. Simple calculations suggest that the cost of an equivalent (BTU) natural gas is about 1/5th the cost of unrefined crude oil. The natural gas cost compared to retail cost of diesel is about 1/6th.

There are other advantages to natural gas use other than simply cost of the product. If a delivery system (flow line) was put in place, there would not be re-occurring cost to deliver fuel as would be the case with barging or trucking diesel. Also it is well known that combustion engines which use natural gas have significantly lower maintenance since the fuel is more uniform than diesel.

Long-term contracts with fixed-pricing is common for natural gas, but not for diesel. Using the leverage of the state and incentives for a long-term contract with the oil and gas industry could induce a favorable pricing for the natural gas for 10 years or more. This would allow coastal planning to proceed with a reliable cost for its energy supply. The conversion of hydrologic dredging equipment to natural gas seems to offer an enormous price advantage and could greatly expand the application of marsh creation by pumping sediment.

Natural gas is also a cleaner fuel reducing air pollution. Some consider it a transition fuel to non-fossil fuels in the future. It seems especially appropriate for coastal restoration projects to use a more environmentally friendly fuel. Natural gas is largely supplied domestically in the US. It is basically an American product.

Current estimates are that we have sufficient natural gas supplies for decades to come. This is due in part to new exploration and development techniques for natural gas such as so called "shale gas". Natural gas is also a Louisiana product. More than half of Louisiana's onshore and offshore production is natural gas. Using natural gas instead of diesel does reduce our dependence on imported oil supply. With the cost saving anticipated by this approach, within the available funding, more coastal restorations efforts can be realized.

Total Project Cost+25%:

<$1.0 Million (for filling canals along Lake Pontchartrain by following traditional means)

Demonstration Project Parameters

(P1) Innovativeness: The proposed demonstration project contains technology that has not been developed fully for routine application in coastal Louisiana and is unique and duplicative in nature. Therefore, the proposed demonstration project is innovative.

(P2) Applicability or Transferability: The proposed technology could be transferred to all areas of the coastal zone. Natural gas is available and could be distributed to the areas of coastal restoration via pipeline or any other transportation methods. This viability also will be tested during the implementation of this project. Already there is a network of natural gas pipeline conveyance is available. In addition, other transportation methods such as barge transportation should be investigated for its viability and safety issues.

(P3) Potential Cost Effectiveness: Simple calculations suggest that the cost of an equivalent (BTU) natural gas is about 1/5th the cost of unrefined crude oil. The natural gas cost compared to retail cost of diesel is about 1/6th. Long-term contracts with fixed-pricing is common for natural gas, but not for diesel. Using the leverage of the state and incentives for a long-term contract with the oil and gas industry could induce a favorable pricing for the natural gas for 10 years or more. This would allow coastal planning to proceed with a reliable cost for its energy supply.

(P4) Potential Environmental Benefits: Environmental benefits are two fold. Using natural gas is less polluting to the environment since it is cleaner than diesel and emissions will be much lesser resulting in lower carbon foot print. Secondly, since the coast savings are in order of 3-6 times, the created wetland acreage will be 3-6 times within the available funding. If the proposed demonstration project proves to be feasible and viable, the suspended projects (CWPPRA and other projects) could be revisited.

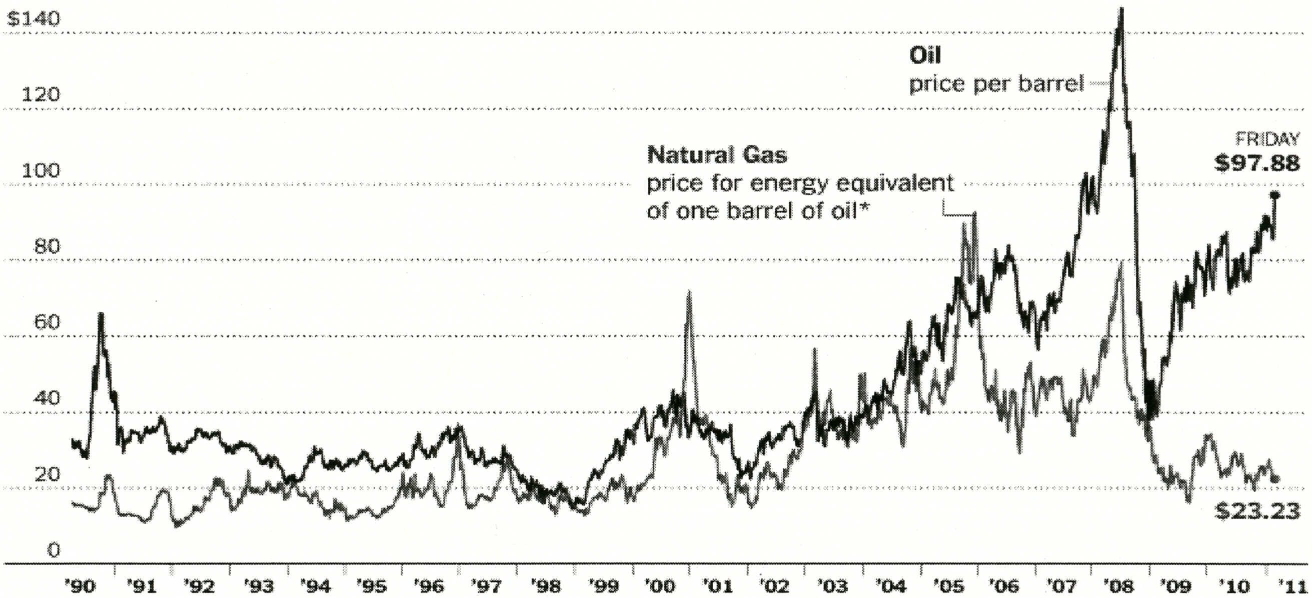
(P5) Recognized Need for Information to be Acquired: OCPR recently contracted Arcadis/Ecology and Environment, Inc team to investigate innovative dredging contracting methods to reveal inherent constraints if any, in reducing the cost of dredging. There is a recognized need to reduce dredging cost coast wide. Transition to natural gas from diesel fuel is discussed in many forums. However, there is a lack of information with regard to feasibility of transitioning in terms of natural gas distribution, conversion of diesel engine to natural gas driven engines, safety, etc. The demonstration project is designed in such a way that these questions could be answered.

(P6) Potential for Technological Advancement: The proposed demonstration project will significantly advance the traditional technology currently being used. The current technology of using diesel fuel to generate electricity to run dredge equipment will be improved to accommodate the new and available natural gas. This will also encourage the natural gas industry to think in terms of improving natural gas distribution. The increased efficiency of natural gas distribution is expected to positively affect other sectors of economy. It is the expectation that the proposed new technology will completely replace the existing technique at a lower cost with increasing wetland benefits.

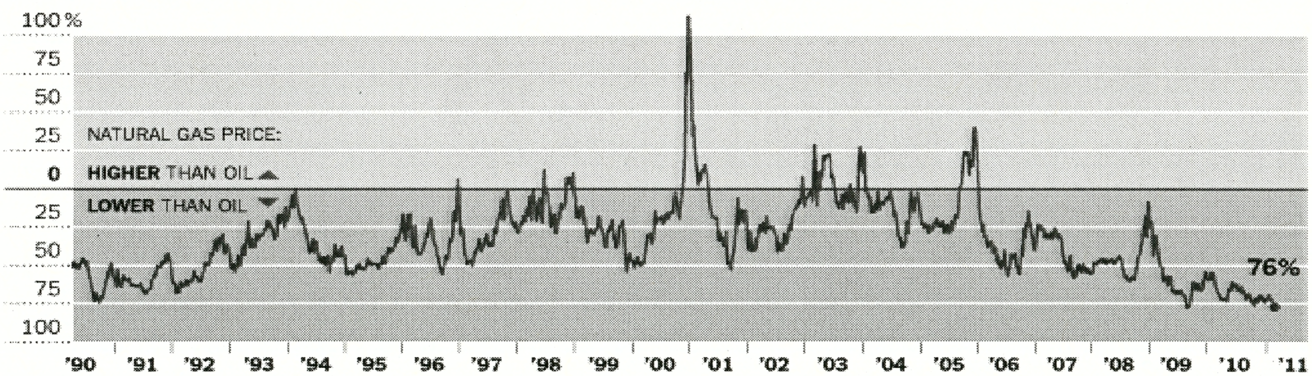
Preparer of Fact Sheet:

Dr. Mohan Menon, Principal Scientist, Ecology and Environment, Inc. 225-281-1149 or 225-298-5080; mmenon@ene.com, on behalf of Dr. John Lopez, Lake Pontchartrain Basin Foundation

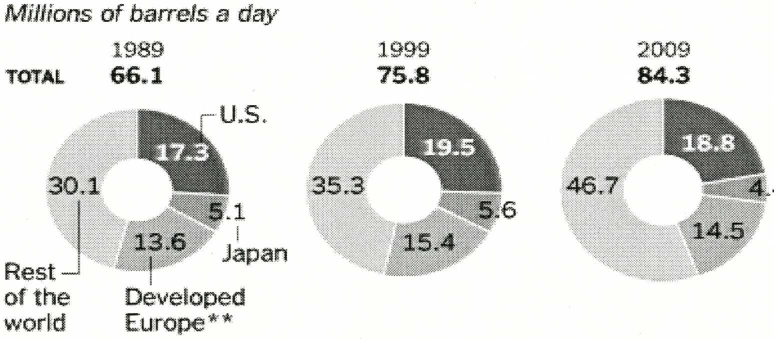
Weekly price *in Jan. 2011 dollars**



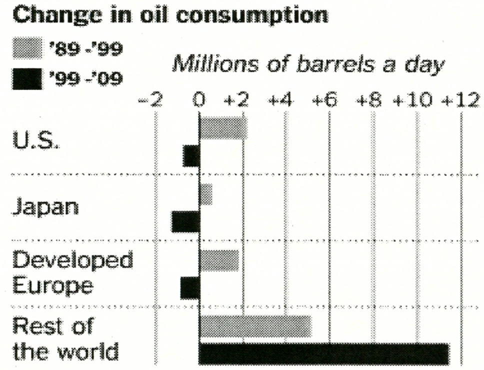
Difference in price between natural gas and oil
for equivalent energy value



World oil consumption
Millions of barrels a day



Change in oil consumption



*Weekly prices for nearby futures contracts in New York, with natural gas prices converted at rate of 5.8 million B.T.U.'s per barrel. Natural gas futures began trading in 1990. Prices are adjusted to 2011 dollars using Consumer Price Index. Latest prices are through Thursday, Feb. 24. **Developed Europe includes Austria, Belgium, Britain, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, the Netherlands, Norway, Poland, Portugal, Slovakia, Spain, Sweden, Switzerland and Turkey.

Sources: Bloomberg Financial Markets; U.S. Energy Information Administration

40

ecology and environment, inc.

Celebrating 40 Years of Green Solutions

Utilization of Natural Gas Power for Dredging and Placement

Dr. Mohan Menon, Principal Scientist, Ecology and Environment, Inc.
225-281-1149; mmenon@ene.com

ecology and environment, inc.
Celebrating 40 Years of Green Solutions

on behalf of
Dr. John Lopez, Lake Pontchartrain Basin Foundation

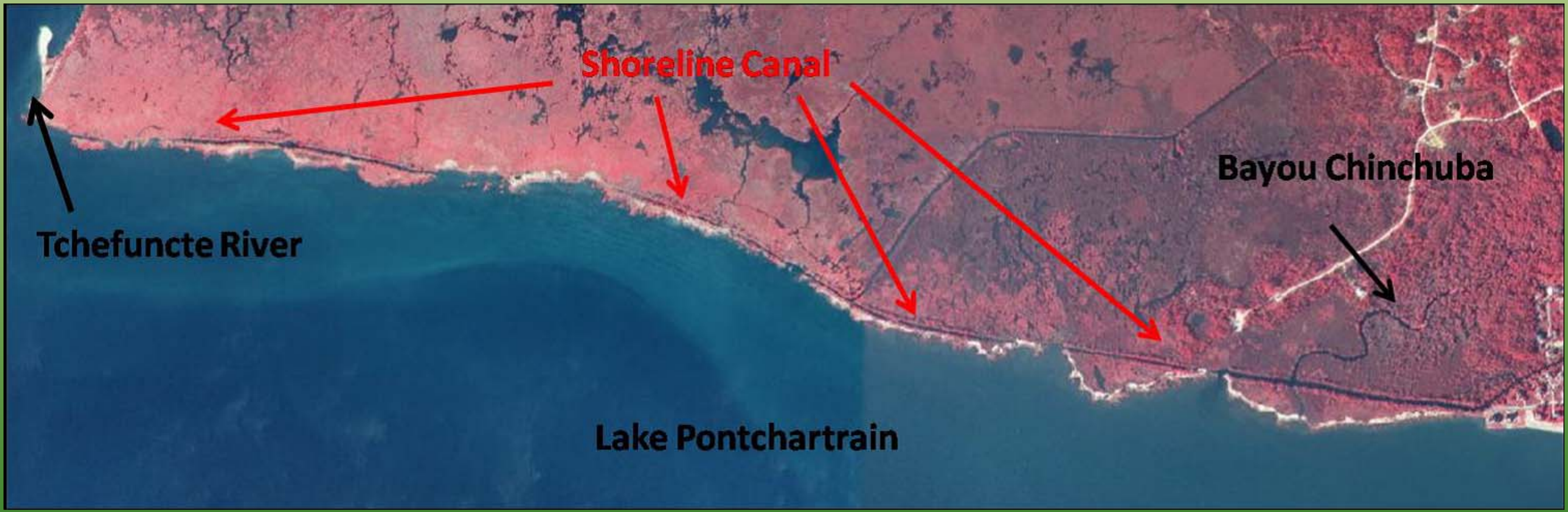
LAKE PONTCHARTRAIN BASIN FOUNDATION
SAVE OUR COAST SAVE OUR LAKE

Concept

- Coast 2050 Strategy/Strategies:
  – Multiple Strategies
- Project Location(s): Potential (as an example)
  – The canals that run parallel to the shorelines of Pontchartrain Lake on the north shore- Potential Location

Details

Potential Area



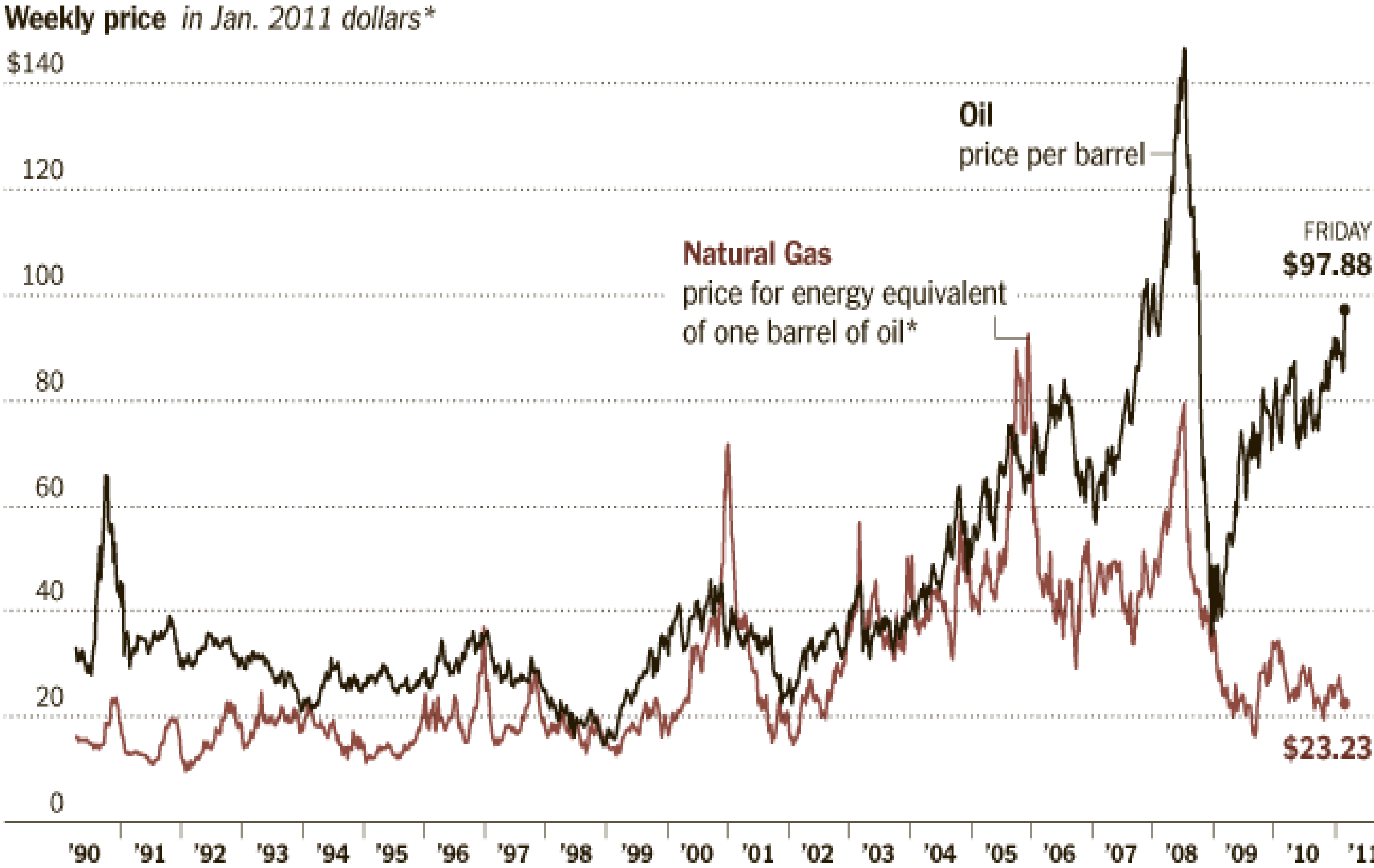
ecology and environment, inc.
Celebrating 40 Years of Green Solutions

Details

- Problem:
  - Past marsh creation projects, current planning for future marsh creation projects utilizes a **status quo of the dredging industry's use of diesel engines** for their pumps
  - Recently, CWPPRA Technical Committee has decided to suspend (in lieu of de-authorization) PPL 10 project, **"Benneys Bay Diversion Project (MR-13)"** based on the high cost of dredging associated with the project
  - Dredging is costly – That is the problem. Utilizing natural gas instead of diesel is to be examined

Details

- Goals:
  – Conversion of diesel engines to natural gas for hydrologic pumping of sediment is expected to create significant cost savings
    - demonstrate the feasibility of using natural gas in lieu of diesel
    - Replicate this approach for many upcoming marsh creation projects (according to State's Master Plan 2012 (draft) ~$17 billion for marsh creation; $5 B savings)



Difference in price between natural gas and oil

for equivalent energy value

Details

- Viability of using Natural Gas
  - Working along with natural gas providers and dredgers, a prototype dredge **natural gas engine is to be designed and manufactured.**
  - Use of natural gas would require **cost to convert** the conventional diesel engine to natural gas use.
  - Diesel combustion engine would likely need to be replaced with possibly **larger natural gas engines**.
  - The natural gas engines may need to be supplemented with transmissions to develop **adequate torque** to drive large pumps.
  - The **supply of natural gas** for dredging would be different than diesel.

Details

- **Storage of natural gas** on a potentially mobile barge represents **new hazards**
- **Flow lines could possibly be used** if the barge or engines were fixed. There would be front-end conversion costs
- **Compressed Natural Gas (CNG)** is beginning to be commercially viable as a portable fuel alternative

Details

- Project benefits:
- Cost
  - On an energy equivalency basis, one barrel of oil is = 1,000 cubic feet = 5.8MCF gaseous equivalent
  - Natural gas is currently selling around **$3.00 MCF**, and a barrel of oil is $92. Diesel is currently **$3.65 per gallon** retail, or 20% more than gasoline. ($3.00 versus $92)
  - Simple calculations suggest that the cost of an equivalent (BTU) natural gas is about **1/5th the cost of unrefined crude oil**. The natural gas cost compared to retail cost of diesel is about 1/6th
- If a delivery system (flow line) was put in place, there would not be re-occurring cost for delivery
- combustion engines which use natural gas have significantly lower maintenance

Details

- Project Benefits
  - **Long-term contracts** with fixed-pricing is common for natural gas
  - **Natural gas is also a cleaner fuel** reducing air pollution
  - **Natural gas is largely supplied domestically** in the US

Details

- Total project Cost+25%: <$1.0 Million
  - Assumptions
    - Canal Width: 40 feet
    - Depth: 8 feet
    - Settlement Factor: 20% (depth 9.6 feet)
    - Cross section: 384 sq. ft.; 14.22 cubic yards/linear foot
    - 11,980 feet of canal
    - Calculation:
      - 170,382.22 Cubic yards of dredge material
      - **$3.5/cy** (Traditional dredging using diesel fuel)
      - Dredging Cost: $596,337.78
      - Engineering Design and Permitting (15%)
      - With 25% Contingency, **$857,235.56; (with 30% savings, Cost is $635,000)**

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Demonstration Project Parameters

- (P1) Innovativeness:
  - The proposed demonstration project contains technology that has not been developed fully for routine application in coastal Louisiana
  - The technology described here is unique and duplicative in nature.
  - **The proposed demonstration project is innovative**

- (P2) Applicability or Transferability:
  - The proposed technology could be transferred to all areas of the coastal zone
    - Natural gas is available and could be distributed to the areas of coastal restoration via pipeline or any other transportation method
  - The viability will be tested during the implementation of this project.
    - Pipeline conveyance of natural gas across coastal areas is possible. Already there is a network of natural gas pipeline conveyance is available. In addition, other transportation methods such as barge transportation should be investigated for its viability and safety issues.

Demonstration Project Parameters

- (P3) Potential Cost Effectiveness:
  - Compared to the traditional method, utilization of diesel fuel for dredge equipment, there is a substantial cost savings for the proposed approach
  - Long-term contracts with fixed-pricing is common for natural gas, but not for diesel
- (P4) Potential Environmental Benefits:
    - Using natural gas is less polluting
    - since the cost savings are in order of 3-6 times, the created wetland acreage will be 3-6 times within the available funding.

Demonstration Project Parameters

- (P5) Recognized Need for Information to be Acquired:
  - Arcadis/Ecology and Environment, Inc team investigated innovative dredging contracting methods to reveal dredging cost reduction. There is a **recognized need to reduce dredging cost coast wide**
  - Transition to natural gas from diesel fuel is **discussed in many forums**. However, there is a **lack of information**

- (P6) Potential for Technological Advancement:
  - The proposed demonstration project will significantly advance the traditional technology currently being used
  - The current technology of using diesel fuel to generate electricity to run dredge equipment will be improved to accommodate the new and available natural gas
  - Will improve natural gas distribution
  - Will positively affect other sectors of economy
  - Will replace the existing technique at a lower cost with increasing environmental and wetland benefits.