WATER MARKS

Louisiana Coastal Wetlands Planning, Protection and Restoration News

August 2005 Number 29

Sediment Transport

Restoring Louisiana's Coastal Landscape

The Nuts and Bolts of Pipes and Pumps

Using Nature's Blueprint for Coastal Restoration

***WaterMarks* Interview with Mead Allison**

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WaterMarks is published three times a year by the Louisiana Coastal Wetlands Conservation and Restoration Task Force to communicate news and issues of interest related to the Coastal Wetlands Planning, Protection and Restoration Act of 1990. This legislation funds wetlands enhancement projects nationwide, designating approximately $60 million annually for work in Louisiana. The state contributes 15 percent of total project costs.

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ABOUT THIS ISSUE'S COVER . . .
On Timbalier Island, pipeline sediment transport has restored 400 acres of beach, dune and marsh. By supplying sediment to subsiding wetlands and eroding islands, the technique mimics natural land building processes, but at a greatly accelerated pace.

Photo credit: Pontchartrain Institute for Environmental Sciences

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www.lacoast.gov
www.btnep.org
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Land Sinks, Waters Rise, Coastal Wetlands Disappear

FOR 7,000 YEARS, THE MISSISSIPPI RIVER flooded Louisiana's coast with land-building sediment.

The amount of new land this sediment created always exceeded the amount of land lost to the natural processes of subsidence, erosion and sea-level rise. Then in the 20th century, raising the levees erected along the banks of the river prevented its sediment from reaching the coastal marshes. This upset the balance between land lost and land gained, and began the catastrophic retreat of Louisiana's wetlands.

Human Actions Amplify Natural Forces

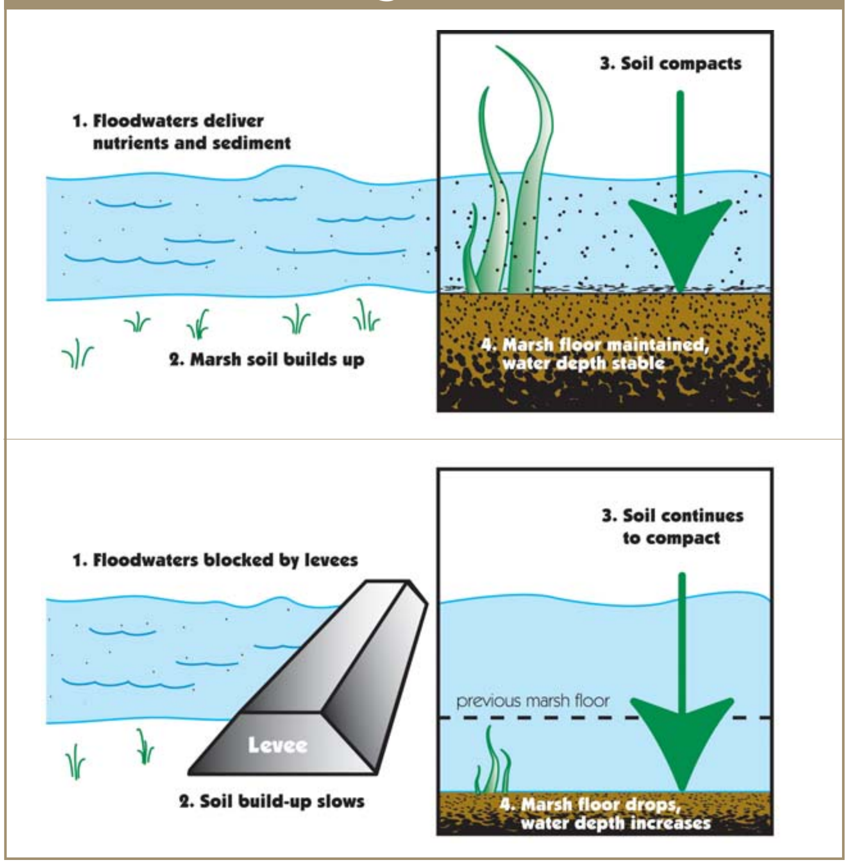
If only deprived of replenishing sediment, the coastal wetlands would eventually succumb to the processes that cause land loss. But human activity speeds the wetlands' disappearance by exacerbating the effects of these natural processes.

Subsidence, the sinking of land

The loose soils of Louisiana's coast naturally compact and sink, or subside. Draining land for agriculture, road and canal construction and urban development removes the water's volume from the soil, speeding the rate of compaction. The weight of buildings, levees and spoil banks further compresses the soil. Disrupting the natural hydrology, protective levees and flood control structures prevent waters carrying nutrients and sediment from replenishing the landscape. According to a report released by the U.S. Geological Survey, without accreting sediment to offset lost elevation, subsidence has accounted for 53 percent of land loss in Louisiana's deltaic plain over the past century.

Subsidence also occurs as geologic faults cause layers of earth to shift and settle deep below ground. Some observers believe energy extraction activates faults when chambers beneath the coastal area, emptied of oil

With Floodwaters Blocked, Nutrients, Sediment No Longer Offset Subsidence



and gas, fall in and cause underground strata to collapse.

Erosion, the wearing away of land

The abrasive force of water and wind naturally wears away, or erodes, land. Wherever land and water interface, erosion may occur.

Human manipulation of the landscape has multiplied the force of erosion in wetlands already weakened by sediment deprivation. In the past century, canals built in Louisiana's marshes for navigation and oil and gas activities have created mile upon mile of new stretches where land and water meet. Waves generated by wind and boat wake wash away the edges of these new shorelines, stirring up sediment and carrying it off. The canals also serve as conduits through which salt water enters interior marshes and weakens freshwater vegetation. Without plants to hold it in place, marsh soil disintegrates, hastening the conversion of wetlands to open water.

Sea-level rise, the swamping of land

Historically, some natural fluctuation occurs in the average level of the sea relative to lands but, as a result of human-caused global climate change, scientists predict a sudden and dramatic sea-level rise in the coming century. As mean temperatures climb, polar ice melts, ocean currents change and winds shift, the Louisiana coast could experience average seas nearly two feet higher than at present. Mere inches of elevation could determine the loss or survival of threatened wetlands.

Jerome Zeringue, TLCD

The deterioration of coastal wetlands increases the gulf coast's vulnerability to tropical storms. Rebuilding the landscape with sediment transported from the Mississippi River, restoration projects will increase the protective buffer of Louisiana's marshes.

Returning to the River

As they search for ways to halt the destruction of Louisiana's coastal wetlands, scientists look to the river for help and hope. Allowing the Mississippi to revert to flooding wetlands beyond its levees with its nutrient- and sediment-rich waters would help to alleviate the crisis of land loss, but at the cost of the human community, the infrastructure and commerce of coastal Louisiana. Instead, scientists and engineers seek to replenish the wetlands, yet retain vital flood protection, by controlling the delivery of sediment into the marshes. This can be done by diverting river water through man-made channels, or by capturing the sediment and moving it to project sites.

Draining over 40 percent of the continental United States, the Mississippi River collects sand, silt and clay to become a huge, sustainable source of sediment. The challenge for wetland restoration experts is to capture a portion of the tons of particles carried in the river and transport it to create new land and to nourish existing marshes. Pumps, pipes and dredges can combine to restore some of the benefits that the river's floods historically delivered to coastal Louisiana. **WM**

The *Nuts and Bolts* of Pipes and Pumps

WHAT IF THERE WERE A TECHNIQUE that built hundreds of acres of land in weeks, mimicked natural land-creation processes, and used a renewable resource — Mississippi River sediment — as its raw material?

Rick Smith, Weeks Marine

In coastal Louisiana, wetland restoration projects have typically used the pipeline dredge, a vessel specially designed to collect sediment and send it through a pipeline to the placement site.

Some engineers and scientists say pipeline sediment transport is that technique — and that it could play a major role in saving coastal Louisiana.

"Pipeline transport — moving dredged sediment through pipelines to wetland sites — replicates the natural processes that create wetlands," says coastal oceanographer Dr. Joe Suhayda. "It lets us go out into open water and rebuild marsh in a matter of weeks."

Worldwide, the technology has been put to many uses: Singapore used dredged material to increase the size of its main island by 20 percent; in the Netherlands, 4.2 million cubic yards of sediment were transported via pipeline to build a 100-mile freight railway. In Louisiana, pipeline transport has already been used in major highway construction and is being developed as a technique for reversing land loss on islands, along shorelines, and in wetlands.

Robert Randall, Texas A&M University

Centrifugal pumps on the dredge vessel and boosters every two to four miles along the pipeline keep the slurry moving. Longer pipelines require more pumps, increasing project cost.

In the Pipeline

Pipeline transport begins where the sediment is located. In Louisiana, that's primarily at the bottom of the Mississippi River and the Gulf of Mexico. Collecting sediment from these underwater sites for restoration purposes has typically used a pipeline dredge, a specialized vessel capable of removing sediment from depths down to 70 feet.

The dredge carries a suction pipe mounted on an arm that extends into the water. The end of the pipe might be outfitted with a 32-foot-wide dustpan head or an 8- to 9-foot-diameter cutterhead — an array of blades that rotates like a drill bit. As the pipe moves, it sucks up sediment and propels it through the pipeline.

Large amounts of water keep dredged material moving. "A slurry of one part sediment to two parts water works well with silt and fine sand, but with big

particles such as gravel or balls of clay, there might be 5 percent sediment and 95 percent water," says Rick Smith, chief civil engineer with Weeks Marine Inc.

Powerful pumps — one or more located on the vessel, plus boosters along the pipeline — propel the slurry 24 hours a day, seven days a week until work is completed. "To keep material from piling up in the pipeline, we adjust speed based on particle size — fine sand flows at 14 feet per second, while gravel requires 18 feet per second," Smith says. "We can increase speed by placing the booster pumps closer together. A typical pump can move fine particles about four miles, larger particles two miles. For a long pipeline, we would place pumps every two to four miles, depending on particle size."

At the placement site, dredged material spews from the pipeline in a muddy rush. Sediment particles collect and pile up; as water drains away, new land is created.

Robert Randall, Texas A&M University

Complex pump arrangements, like the one on this sea-based platform, are often required to move slurry carrying particles of varied sizes over long distances.

Stuck in the Middle

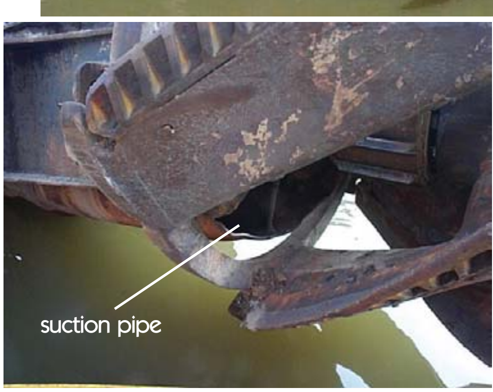
For Smith, the beginning and end of the pipeline are simple and straightforward: "It's the middle that's complicated."

Say a project calls for dredging sediment at site A and placing it 10 miles away at site B. "Because of right-of-way issues, oilfield infrastructure, the location of canals and so forth, we might have to lay 16 miles of pipeline, which calls for four or more pumps," Smith says.

"Large boats can't navigate the canals leading to hard-to-access sites, so we have to fuel the pumps using an endless fleet of small barges," Smith says. "It's like trying to build an interstate by hauling dirt with pickup trucks."

To ease this and other logistical burdens, Suhayda and Smith advocate installing semi-permanent structures — such as temporary canals that will be filled in after a project has been completed — for access to remote marshes. Using pipeline transport in con-

Rick Smith, Weeks Marine



Rick Smith, Weeks Marine

Above: The suction pipe on a pipeline dredge vessel is often fitted with a cutterhead, a massive mouthpiece eight or nine feet in diameter.
Left: As the cutterhead rotates, it agitates sediment, directing it into the suction pipe.

Wim J. Vlasblom, Delft University, Netherlands

To build one of the largest infrastructure projects in Dutch history, sediment was pumped through 100 miles of pipeline to create the bed for a two-track freight railway.

cert with other techniques, such as diversions from the river or hauling sediment in barges, could further increase efficiency.

"We can make this technology even more efficient by using it with complementary techniques, and tailoring each application to the specific environment," Suhayda says. "The possibilities for pipeline transfer are exciting — if applied correctly, this technology could save the wetlands." WM

Is Pipeline Transport Too Expensive?

Critics of pipeline transport say it's more expensive than other restoration methods, yet preliminary data show the technology could be a cost-effective way to build new land. Why the disagreement?

"It's misleading to compare techniques in terms of cost per acre," says Rex Caffey, director of Louisiana State University's Center for Natural Resource Economics and Policy. "Restoration benefits are qualitative as well as quantitative — not just 'how much did we build' but also 'what benefit does this new land provide?'"

Many variables combine to determine project cost. In pipeline transport, for example, the distance from removal area to placement site determines the number of pumps and pipe segments needed. Pipeline transport is more cost effective for short distances; however, while the cost per cubic yard could vary by several dollars over longer distances, it is a proven technology throughout the world and may hold great potential as an effective tool for many parts of coastal Louisiana. Shea Penland, director of the University of New Orleans' Pontchartrain Institute for Environmental Sciences, cites as an example one project that restored broken marsh with sediment from an adjacent canal for $1.35 per cubic yard — "That's dirt cheap!" he says.

"Through experience, we're learning not only how to apply the technology most effectively, but also how to evaluate the relationship between distance, benefit and cost," says Caffey. "Preliminary figures suggest this is a very promising technology."

Penland agrees. "Pipeline transport may prove to be one of the cheapest, as well as fastest and most effective, restoration processes available."

Using Nature's Blueprint for Coastal Reconstruction

TO REBUILD LOUISIANA'S COASTAL LANDSCAPE, scientists and engineers are turning to a natural concept that appears quite simple: deliver sediment directly to areas that need replenishment, just as the Mississippi's floodwaters did in years past. But each step in a sediment transfer project demonstrates the complexity of replicating this natural process.

Finding Sources

Every project begins by selecting sediment that has characteristics suited to the project's goals. Sand is best for rebuilding barrier islands, for example, while nutrient-rich silt boosts the growth of fragmented marshes.

Both the Mississippi River and the Gulf of Mexico are rich sources of available sediment. Because sediment from neither of these sources enters the wetlands naturally, it's referred to as "new" sediment. New river sediment is also renewable. "Draining the interior of the continent, the Mississippi continuously replenishes its sediment load," says Shea Penland, director of the Pontchartrain Institute for Environmental Sciences at the University of New Orleans. "It carries all the kinds of sediment needed for wetland restoration. We can choose to dredge a point bar for silt and clay, for example, or a mouth bar for coarser sand."

Although the most immediate source may be the huge deposits at the mouth of the Mississippi River, sediment can also come from bays, waterways and the Gulf of Mexico. Maintenance dredging of navigation channels can provide material for rebuilding wetlands, as can offshore shoals. "There are large, ancient bodies of sand 10 to 30 feet underwater that we can excavate without digging big holes in the sea floor or altering the wave fields," says Penland. Access to these sources may be restricted by oil and gas infrastructure and buffer zones, but, Penland says, "There is plenty of sand within reach to restore our coast."

Whatever the source, sediment delivered via pipeline is tested for grain size and contaminants. "Because contaminants don't stick easily to the relatively coarse sediment we use," says Nancy Powell, hydrologic engineer with the U.S. Army Corps of Engineers, "the risk of contamination is actually quite low. A greater concern is the degree of salinity in the sediment's slurry. Too much salt will kill a freshwater marsh."

Moving the Material

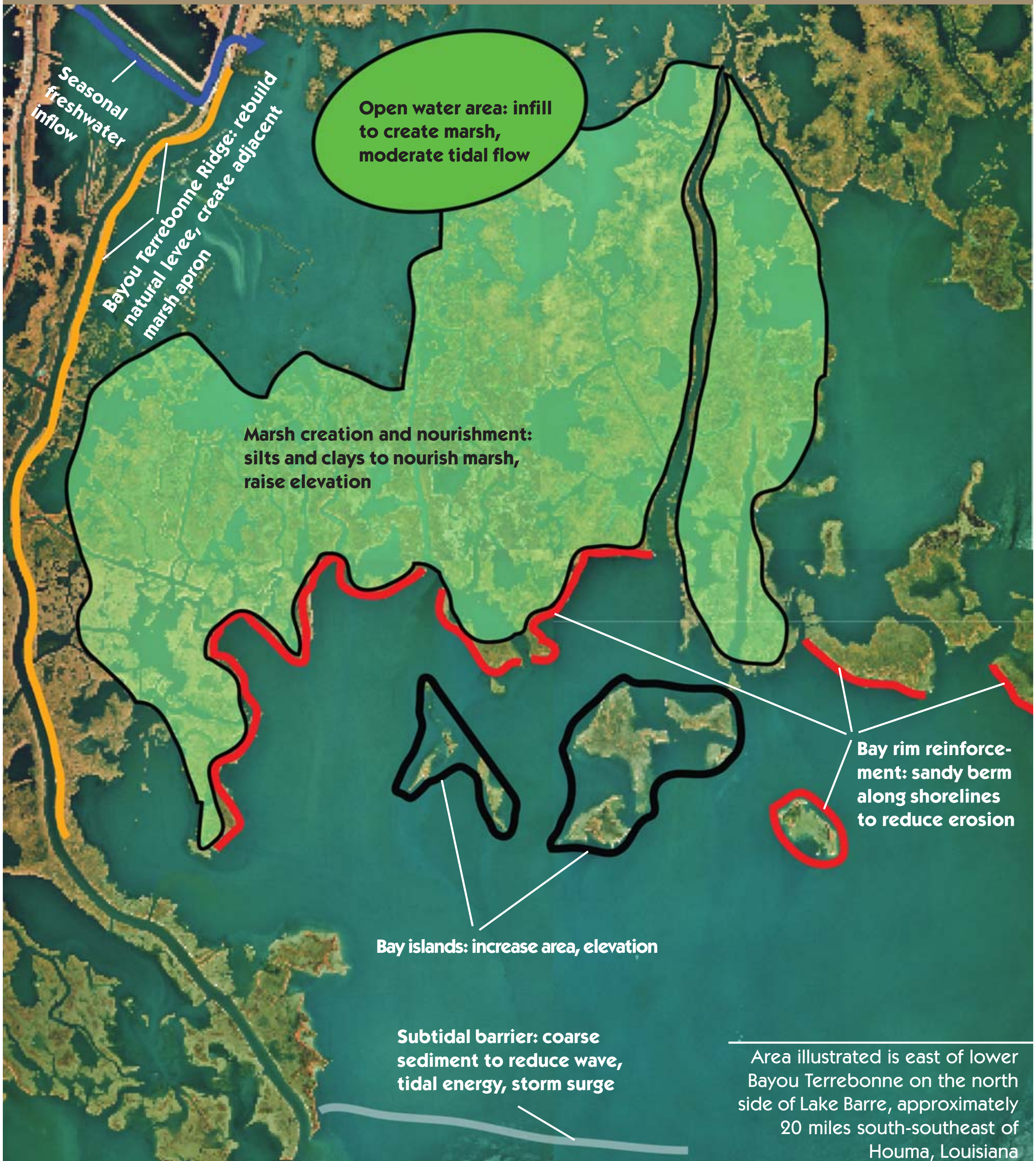
Sediment is usually delivered by pipeline over distances ranging from a few yards to many miles to

continued on page 10

Dennis Barkmeyer, HESCO, Inc.

Some sites require artificial barriers to hold sediment in place until vegetation takes root. Here pop-up baskets of metal and fabric keep sediment from washing away.

Proposal for Eastern Terrebonne Rebuilds Landscape with Piped Sediment



Reed, D.J., report from September, 2004 workshop sponsored by US EPA Region 6, Concepts for Large Scale Restoration in Coastal Louisiana Using Long Distance Conveyance of Dredged Material

The concept of transporting dredged materials through long-distance pipelines brings together numerous stakeholders in coastal restoration. In 2003, the Gulf Chapter of the Western Dredging Association (WEDA) joined with Region Six of the Environmental Protection Agency and the U.S. Army Engineer Research and Development Center in Vicksburg, Mississippi, to sponsor a workshop on this technology.

Representing WEDA, Ancil Taylor of Bean Stuyvesant LLC pointed out that such conferences give the dredging industry an opportunity to share its practical understanding of pipeline transport. “We have years of experience doing this throughout the world,” says Taylor. “We can assist in designing projects that operate in the most constructive, cost-effective way.”

A follow-up workshop developed concepts for employing the technique in large-scale projects. The resulting proposal for eastern Terrebonne, illustrated above, suggests seven applications to rebuild marsh, shoreline and ridge features and moderate erosion in this severely degraded area. By building on existent and submerged landscape elements, the concept avoids the constraints of depositing sediment at an excessive water depth or on a substrate that would not support material at the desired elevation.

places where it is most needed, or to locations difficult to rebuild by other restoration methods. “In theory, we could move sediment for hundreds of miles, but typically in Louisiana, pipelines run less than 10 miles,” says Rachel Sweeney, ecologist and project manager with the National Marine Fisheries Service.

Whenever possible, pipeline routes are laid along existing channels and canals to minimize their impact on the environment. Although pipelines don’t take up much space, Sweeney says installing them raises a lot of questions: “Who resolves property rights along transport routes? What footprint does setting up pipes leave in the fragile marsh? Is it better for the pipes to float or sink? How do you protect oyster beds and fisheries, and who maintains the pipelines? These are some of the transport issues we have to consider in designing a successful project.”

Shaping the Landscape

After a pipeline route is established, deciding how much material to transport depends on the site’s projected elevation. “Elevation dictates how wet a wetland is,” says Powell. “Engineers set a target height and then calculate how much and how quickly the transported sediment will compact.”

Once the pipeline starts to discharge its load, the sediment is shaped to fulfill the project’s objectives. The sediment may be piled up with earth-moving equipment, or sprayed in a thin layer directly onto existing marsh. Or a pipeline might discharge sediment into water where drifts and currents carry it to its intended destination.

Sediment enhances the skeleton of a landscape, pumping up components such as ridges and bay rims. Underwater, sediment can form features like berms and reefs that reduce erosion by breaking up the energy of waves and tidal flow.

Keeping It in Place

Sediment consisting of large particles drains quickly and will stay put on its own. Earth-moving equipment packs down layer after layer of coarse sediment to build barriers to waves and storm surge. Fine clays and silts, however, may need structures to hold them in place while they compact and become stable. Low dikes of rock or earth, or barriers of synthetic fiber confine the material during settling until vegetation takes root, either through hand planting or through natural colonization. “We’ve used tubes and bags and fabric baskets that pop open and fill with water,” says Powell. “We position them to ensure drainage, then leave them until elevation builds up.”

Long-term Health

An area newly constructed from transported sediment can be quite barren. Given time, natural colonization is likely to take place, although hand plantings can jump-start natural vegetative growth and encourage fauna habitation. But the health and longevity of created marshes, like natural ones, depend on regular doses of rejuvenating sediment and nutrients. One method of feeding the marsh is to leave transport pipes in place permanently. Another is to periodically flood project sites with sediment-laden river water. Near the river’s mouth, where there are no levees, this can be done by diverting water through gaps cut into the river banks.

While building a functional wetland with transported sediment is not simple, its possibilities excite wetlands scientists. “Pipeline transport creates new land quickly,” says Penland. “We need to use it on a scale that has never been tried before. In building the river levees, we demonstrated the power we have to control huge floods. We can use that same power to restore the environment, too.” WM

From water to wetlands

Pipeline Projects Build New Marsh

IN THE UNITED STATES PIPELINE SEDIMENT TRANSFER is a relatively new tool for wetland restoration, but in coastal Louisiana it's already been successful.

Since 1994, Breaux Act projects using piped sediment have created more than 3,000 acres of new land. Some experts say we've only scratched the surface of the technique's potential.

"Conceivably, we could use this technology to offset all of our land loss," says coastal oceanographer Dr. Joe Suhayda. "We could stop the loss of Louisiana's coast."

The success of three pipeline transport projects — at Bayou LaBranche, at West Bay, and on Timbalier Island — illustrates the technique's land-building potential.

A Successful Start

As Interstate 10 travelers sweep past the southern shore of Lake Pontchartrain, they look out over one of the Breaux Act's first success stories: the lush, green wetlands near Bayou LaBranche.

Just a decade ago, the area was open water — the result of more than 150 years of subsidence, flooding and erosion that began when railroad construction in the 1830s altered the flow of water through the wetland. By the 1990s, only a narrow strip of marsh separated the ponds from Lake Pontchartrain.

The Bayou LaBranche Wetland Creation project, located just east of the

Billy Hicks, USACE

Billy Hicks, USACE

These before and after photographs of the LaBranche wetlands show the dramatic results dredged sediment can produce. "LaBranche is an excellent example of the advantages and use of pipelined sediment," says Suhayda. "If you drive along I-10 today, you can't tell the area was ever open water. That's the most important aspect of pipeline conveyance of sediment — what is now open water can be made back into marsh."

Bonnet Carre Spillway near New Orleans, involved dredging sediment from the bottom of Lake Pontchartrain, then pumping it through a 7,500-foot-long pipeline to the open water area. In four weeks, nearly 2.7 million cubic yards of sediment were placed to create 300 acres of land.

"With the Bayou LaBranche project, it was immediately obvious we would be able to use this technique to create marsh," says Gregory Miller, project manager with the U.S. Army Corps of Engineers. "Because LaBranche is one of the most visible Breaux Act projects, people who remember the area as open water can view these wetlands, and see that it's possible to literally build land."

Pipeline, Diversion Restore Marsh

West Bay embodies one of the ironies of wetland loss: though only a few yards from the sediment-rich waters of the Mississippi, the marsh subsided and converted to open water.

To restore the marsh, the West Bay Sediment Diversion project, located about five miles from the river's Head of Passes, required dredging a 440-foot-wide, 25-foot-deep channel from the river to the bay, and pumping the dredged material into the bay's open water area.

"The goal of the project was to create a diversion through which sediment-laden water would flow naturally to the marsh during high river stages, creating land over the course of 20 years," Miller explains. "But by pumping in the dredged material from the channel, we were able to restore 200 acres right away."

Marsh creation in West Bay will continue, Miller says, as sediment dredged from the river to maintain the navigation channel is used to build more wetlands. Over the long term, however, the diversion itself will nourish and continue building marsh. "This project shows how well piped sediment complements other restoration methods. It jump-started the land-building process, and the river will do the rest."

Greg Miller, USACE

As the pipeline dredge California dug the West Bay Diversion channel through the right bank of the Mississippi River, the sand mined from the bank was pumped through a pipeline to the deteriorating marsh of West Bay (at left in photo). The project created new wetlands, which the river will sustain and enlarge when high stage flows naturally divert into the marsh.

Fortifying Barrier Islands

Louisiana's barrier islands, the coast's first line of defense against hurricanes, are eroding even more rapidly than the inland marshes they protect.

"In the past, the Mississippi River directed sediment toward barrier islands, but today the river sends sediment off into the gulf," explains Beverly Ethridge, environmental scientist with the Environmental Protection Agency. "As storms wash away sand

from these islands, there is nothing to replace it."

Timbalier Island, a narrow strip of land south of Terrebonne Bay, had suffered extensive hurricane damage. "We knew this barrier island would vanish within 50 years if it didn't receive new sediment," says Patty Taylor, EPA project manager.

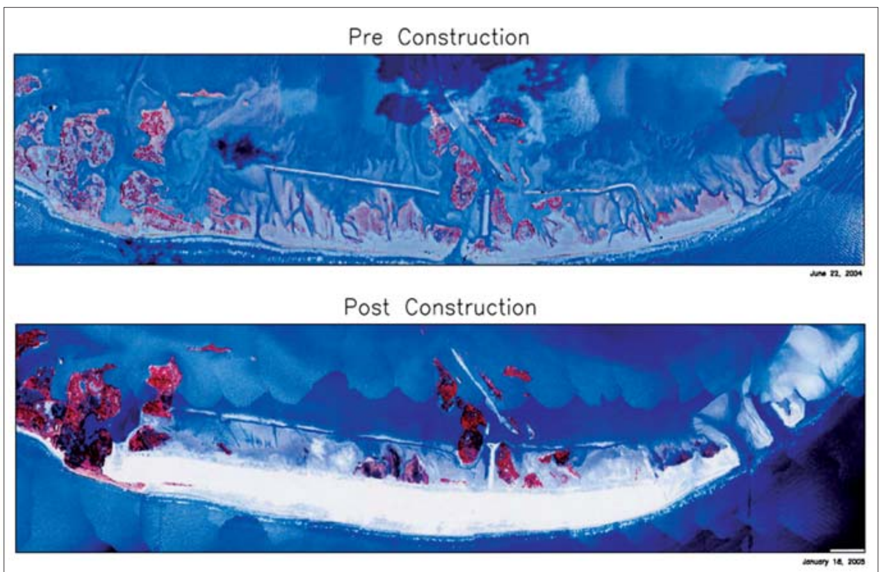
In the Timbalier Island Dune and Marsh Restoration project, 4.6 million cubic yards of sand were pumped to the island from three miles out in the gulf. The project was the first to use sand from so far offshore, says Taylor, who explains that sand dredged from the gulf is superior to that harvested closer to land.

"The high quality sand performed even better than expected," says Chris Williams, project manager for the Louisiana Department of Natural Resources. "We were able to complete the project $3.5 million under budget while creating more land than was originally intended, for a total gain of approximately 400 acres."

The Timbalier Island project is another example of the potential of pipeline transport, Suhayda says.

"Pipeline transport is unique among restoration techniques in that it can truly restore land, rather than merely slow the rate of loss," Suhayda says. "Within weeks, open water can become land." WM

Chris Williams, LADNR



In the Timbalier Island Dune and Marsh Restoration project, a pipeline dredge was used to collect sand from the floor of the Gulf of Mexico. "That's one of the unique features of this project," says the EPA's Beverly Ethridge. "By pumping sand from three miles offshore, this project brought new sediment into a sediment-starved environment."

Pipe Dreams: the Future of Pipeline Transport

Pipeline transport is still evolving as a restoration technique, but its use is increasing. Since the Bayou LaBranche restoration in 1994, over a dozen Breaux Act projects have included piped sediment, and several more are planned. In the Scofield Bayou area, the **Riverine Sand Mining/ Scofield Island Restoration** project (Plaquemines Parish) calls for pumping Mississippi River sediment 10 miles to restore the eroded and subsiding shoreline. The **Mississippi River Sediment Delivery System — Bayou Dupont** project (Plaquemines and Jefferson parishes) will restore broken marsh using sediment pumped from the river. The **Pass Chaland to Grand Bayou Pass Shoreline Restoration** project (Plaquemines Parish) will use dredged sediment to restore beach, dune and marsh to bolster the fragile shore of Bay Joe Wise. And two planned projects will mine sediment from Ship Shoal to rebuild barrier islands in the severely eroded Isles Dernieres chain: the **Ship Shoal: Whiskey West Flank Restoration** project, which will transport sediment approximately eight miles to rebuild dune and marsh habitat on Whiskey Island; and the **New Cut Dune and Marsh Restoration** project, which calls for pumping sand 10 to 12 miles to close New Cut, a breach between East and Trinity islands.

WaterMarks Interview with Mead Allison

The process of taking mud and sand dredged from the Mississippi River or offshore sites and moving it by pipeline or barge to project sites is known as sediment transfer. Dr. Mead Allison, professor of earth and environmental sciences at Tulane University, discusses the significance of this process to the protection and restoration of Louisiana's coastal wetlands.

***WaterMarks:* In the last couple of years, the idea of transferring sediment to coastal wetlands has been the focus of conferences, papers and coffee room discussions. Why the interest?**

Allison: Sediment transfer does something that no other restoration tool can — it builds land quickly. A project using sediment transfer can pour thousands of cubic yards of material into an area in a matter of weeks. The result is the replacement of open water with solid ground, and that can't be accomplished in any other way.

***WaterMarks:* How is it different from freshwater diversions? When water from the Mississippi flows into the marsh, doesn't it carry sediment and build land?**

Allison: Diversions bring nutrients and fresh water to the marsh, but only relatively small amounts of sediment. In the short term, even "sediment" diversions that cut deep into the water column to capture more suspended material don't deliver nearly the volume of material available in sediment transfers.

Freshwater diversions are excellent options for protecting an existing marsh, but as a reconstructive tool, they aren't the first choice.

***WaterMarks:* Thousands of cubic yards of sediment is a lot of material to place in a matter of weeks. Can engineers control where it all ends up?**

Allison: That's another advantage of sediment transfer — it offers pinpoint control. An engineer can send a stream of sediment across and around healthy marsh and place it into an area that has turned into open water or a subsidence pond. And since the pipeline slurry contains a relatively small amount of water, that part of a marsh can be rebuilt at minimal impact to surrounding habitat. For example, the slurry wouldn't change salinity levels or water column turbidities beyond the immediate area, and therefore wouldn't affect the value of oyster leases.

***WaterMarks:* It's going to take a lot of sediment to raise the floor of subsidence ponds in coastal Louisiana. Where's it all going to come from?**

Allison: Two main sources have been identified, the Mississippi-Atchafalaya River and offshore sites such as Ship Shoal. But the Mississippi is a cost-effective option — as you might imagine, it's expensive to build and maintain a 20-mile pipeline on the open sea, or barge sand to land. So the Mississippi's the first choice for areas reasonably close to the channel, but even so, additional decisions have to be made since several different types of sediment are found in the river. For example, there's a layer that's actively moving along the river bottom called the bedload sand sheet, but there is also relict fluvio-deltaic sediment below the sand sheet that the river has incised. Both could be used in sediment transfer projects.

***WaterMarks:* So what's significant about the distinction between the two?**

Allison: Among other things, the relict layer is nonrenewable and its removal will deepen the river channel, while the active

sand sheet is continually replenished from sand supplied from upstream. The relict source is also more diverse in its composition and degree of consolidation.

***WaterMarks:* Does this mean anything to restoration planners?**

Allison: It means a great deal. Sediment transfer has exceptional potential as a restoration tool, but that potential is limited to the amount of sediment that's available. The relict source, while containing substantial amounts of sediment, is finite. When it's gone, it's gone. The sand sheet is renewable, but it's also finite. There's only so much that moves down the Mississippi in a year.

***WaterMarks:* And is it possible that at some point the demand for sediment will exceed the supply?**

Allison: If we bring our restoration projects up to the level they need to be, it will certainly happen. Today we are casually watching this resource slide into the gulf. In the future, we'll see it as white gold and we'll be doing everything we can to capture every last grain.

***WaterMarks:* What is the downside of extracting large quantities of sediment from the river? Aren't there significant contaminants trapped in the sediment that will be dumped into the marshes?**

Allison: There's a common misconception that the river sediments are badly contaminated. A recent study by the U.S. Geological Survey shows that the total suite of contaminants in fine grained sediments from the river channel is surprisingly low. Sands have an even lower potential for contamination. We also know that these same fine grained sediments discharge out of the mouth of the Mississippi and are drawn up into the marshes with tides and storm surges. And there's no evidence that the marshes are suffering any negative effects.

***WaterMarks:* There's also a concern that removing sediment will unbalance the vegetative and aquatic life in the river as well as where it's deposited.**

Allison: The bed of the Mississippi is a harsh environment. It's constantly moving and shifting and doesn't support a complex ecosystem. Removing sediment is unlikely to have a significant consequence.

At the project site, however, the effect of large-scale deposition of sediment may initially be negative, especially on organisms such as the bay bottom benthic community. But that won't be long term. These organisms will reestablish themselves, or others will take their place in the newly established marshes, and the ecosystem will come back into balance. Mobile aquatic life such as fish should be relatively unaffected.

***WaterMarks:* And levees won't be threatened?**

Allison: I'm not an engineer, but I know the levees are underpinned by relict layers, which are highly consolidated. It's likely that removal of sediment from the thin, surficial sand sheet won't have an effect on levees. Mining the relict source will have to be done judiciously, however, to avoid undermining the sediments that provide a foundation for the levees. Fortunately, there's a lot of geotechnical expertise around that will make that possible.

***WaterMarks:* You've addressed the common concerns about the possible downside of sediment transfer as a restoration tool. Are there other misunderstandings among lay or even technical people that concern you?**

Allison: I do have a concern that even professionals forget that the amount of sediment carried by the Mississippi is finite. There will come a time when there isn't enough to meet the needs of all the projects proposed, at least not on a cost effective basis. In the present, however, it's frustrating that we have barely begun to tap this restoration resource.

I'm also concerned that our citizens think that restoration projects last forever — they don't realize that they have a limited lifespan. Whatever we do in restoration won't be a permanent fix. If we successfully restore a barrier island or marsh, it's possible that a single major hurricane will slice it up again. But if that happens, it will have done its work by protecting thousands of people, industries and infrastructure. As taxpayers, we shouldn't see that as failure, we should see it as success. **WM**

Plaquemines Parish Taps River Sediment

Greg Miller, USACE

Over the last decade, Breaux Act projects using dredged sediment delivered via pipeline have built thousands of acres. During construction of the West Bay Sediment Diversion, for example, sediment dredged from the bank of the Mississippi River was pumped into the deteriorating wetlands of West Bay in Plaquemines Parish. The result: more than 200 acres of rebuilt land.

"In our parish, where land is being lost more rapidly than in any other area of the state, pipeline transport has been used to build land for marinas, highways and subdivisions," says Benny Rousselle, Plaquemines Parish president. The commercial and infrastructure applications of pipeline conveyance are well established, he says. "It's vital that we also continue to look for opportunities to apply that technique to coastal restoration."

Future projects in Plaquemines and other coastal parishes plan to restore wetlands using sediment pumped from the river. In the Mississippi, Rousselle notes, "We have the resources to restore our coast running right through the middle of the state." WM

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