RESTORING THE GULF COAST

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New Markets for Established Firms

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None of the opinions or comments expressed in this study are endorsed by the companies mentioned or individuals interviewed. Errors of fact or interpretation remain exclusively with the authors. We welcome comments and suggestions.

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List of Abbreviations

ADB	Asian Development Bank
BLS	U.S. Bureau of Labor and Statistics
CIAP	Coastal Impact Assessment Program
CPRA	Coastal Protection and Restoration Authority
CWA	Clean Water Act
CWPPRA	Coastal Wetlands Planning, Protection and Restoration Act
DSC	Dredging Supply Company
GAO	General Accounting Office
GOMESA	Gulf of Mexico Energy Security Act
HDPE	High Density Polyethylene
KOICA	Korean International Cooperation Agency
LPBF	Lake Pontchartrain Basin Foundation
NOAA	National Oceanic and Atmospheric Association
NRCS	Natural Resources Conservation Service
NRDA	Natural Resource Damage Assessment
OCPR	Office of Coastal Protection and Restoration
SBA	U.S. Small Business Association
USACE	United States Army Corps of Engineers
VOV	Voice of Vietnam
WRDA	Water Resources Development Act

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I. Executive summary

The Mississippi River Delta is a priceless resource. It sustains the Gulf region's unique people and cultures and brings the U.S. economy billions of dollars each year in energy, fishing, shipping and tourism. Yet the delta's many benefits are under threat, because much of the land area is steadily vanishing underwater. Since 1932, on the Louisiana coast alone, human-induced damage and tropical storms have claimed an astonishing 1,883 square miles of wetlands. Between 1985 and 2010, the rate of land loss equated to an area the size of a football field disappearing every hour (Couvillion et al., 2011). This land loss brings communities in the delta region ever closer to open water, placing them at increasing risk from hurricanes and sea level rise.

At stake in the loss of coastal wetlands is not only the environmental health of the Gulf region, but also several of the nation's vital industries. The Gulf region's critical economic role, and the extent to which this role depends on the delta ecosystem, is evident in the following assets provided by the Gulf region:[1]

- 33% of the nation's seafood harvest (NMFS, 2011)
- $34 billion per year in tourism (Oxford Economics, 2010)
- 90% of the nation's total offshore crude oil and natural gas production (EIA, 2011)
- 4,000 offshore oil platforms and 33,000 miles of pipeline (BOEMRE, 2011; NOAA, 2010)
- 10 of the nation's 15 largest shipping ports, by cargo volume (AAPA, 2009)

Coastal wetlands, considered one of the most productive ecosystems in the world, perform at least five crucial environmental services. First, they serve as a nursery for nearly the entire commercial fish and shellfish catch from the Gulf of Mexico. Second, they form the basis of a tourism and recreation industry that includes hunting, fishing, boating, and other revenue-generating and job-creating activities. Third, wetlands act as a sponge for water and wave energy, helping protect against flooding from severe storms and hurricanes. Fourth, they filter pollutants and sediment, acting as a natural water treatment plant. Fifth, healthy wetlands are the largest reservoir of global soil carbon, sequestering millions of tons of carbon annually.[2]

Restoring the Mississippi River Delta, as well as wetlands throughout the Gulf Coast region, will require substantial public funding—an investment that will recover billions of dollars' worth of lost economic benefits. In addition, the restoration work itself will directly create and save jobs. Restoration projects activate a full supply chain linking materials providers, equipment manufacturers, shipbuilders, machinery repair firms, engineering and construction contractors, and environmental resource firms. Many of the firms are based in the Gulf Coast region. Having long worked in the traditional oil and gas industry, they can apply the same skills and equipment to coastal restoration, thus finding new markets and a more diverse client base.

[1] An overview of the Gulf region's critical role is found in Mabus, 2010, a plan of federal support prepared by the Secretary of the Navy at the direction of the President of the United States.
[2] These environmental benefits, and their economic significance, are summarized in Table 1 on page 8.

A coastal restoration segment is already in place within the marine construction industry. The most comprehensive effort to create demand for restoration work is the Coastal Wetlands Planning, Protection and Restoration Act, through which 151 coastal restoration or protection projects have been authorized over the past 20 years, with funding ranging from $30 million to $80 million annually. Over 110,000 acres in Louisiana have benefited (CWPPRA, 2011a, 2011b). According to the 2007 Louisiana Master Plan, adequately preventing further land loss along the Louisiana coast will cost $50 billion over three decades (GAO, 2007).

The amount of public funding that in fact will be invested remains to be seen. But with so much further work to be done, a question arises: if the commitment were to expand on the scale needed, what kinds of jobs would be created, in what types of firms, and in what U.S. locations?

This study is based on a sample of 138 firms linked to coastal restoration projects already undertaken or completed.[3] The analysis examines all types of firms across eight categories of the value chain.

Six key findings:

1. **Coastal restoration provides job opportunities in the Gulf Coast region and 32 other states.** Of the total 387 employee locations nationwide, 258 locations, or 67 percent, are in the five Gulf states of Texas, Louisiana, Mississippi, Alabama and Florida. Additional, though smaller, concentrations of firms are found in the Pacific Coast (32 locations) and the Midwest (25 locations).
2. **Coastal restoration comprises a small but growing share of work for many firms within the marine construction industry**. For most firms involved, coastal restoration comprises 25 percent or less of overall operations. For the largest firms, the share may be less than five percent. This is not surprising, since to date, the total volume of coastal restoration projects has created a small amount of work at best. Typically, marine construction firms undertake larger flood protection or dredging projects to maintain navigational channels, supplementing such work with coastal restoration.
3. **The firms are mostly small and medium-sized**. According to SBA guidelines on number of employees, 67 percent of the firms in our sample qualify as small businesses. Over 42 percent—or 55 of the 129 firms with employee data—have fewer than 100 employees. Restoration projects involve firms of all sizes, but they appear to be particularly important to small and medium-sized firms, providing a valuable stream of work in a fragile economy.
4. **Coastal restoration offers important opportunities for well-established firms to utilize under-used resources.** The average age of equipment firms is 55 years, and for service firms, 44 years. These firms have a long history of serving oil and gas companies. As such contracts declined along with oil production over the years, a number of firms along the value chain took on work in coastal restoration, thus diversifying beyond a single, shrinking client base. Looking ahead, an expanded coastal restoration effort would enable many more such firms to put traditional resources to use.

[3] The sample was constructed based on USACE contract award lists (USACE, 2011), CWPPRA project completion reports (CWPPRA, 2011c), information compiled by the OCPR, and company interviews.

5. **Equipment manufacturers are increasingly turning to export markets.** With sales of construction equipment down in the United States, exports are an important source of new demand. Several small and medium-sized firms in our sample are orienting increasingly to foreign markets. Depending on the year, exports comprise 30-50 percent of these firms' business.
6. **Building a job-creating industry will require steady work, and a higher volume of work than in the past.** As in any industry, job creation in coastal restoration is tied to demand for the product. But unlike most industries, demand for coastal restoration work today comes entirely from government-funded projects. A recurring theme observed in interviews with sample firms is the unsteady nature of demand for coastal restoration work—in part because of uncertainties and delays in funding mechanisms, and in part because the total volume of funding historically has been low. Additional funding and stability in investment will make it easier to create and save jobs.

To restore and protect the benefits that coastal wetlands provide to the Gulf region and U.S. economy will require an increased funding commitment, one that is sustained over the coming decades. A significant one-time source of funding—for example, the Clean Water Act penalties from the 2010 BP oil spill—could serve as a kickstart to launch this long-term investment. Similarly, a sustained funding commitment would give relevant firms the confidence to scale up their labor force and capital equipment. Thus, additional economic benefits would accrue to the region and the nation by developing a job-creating coastal restoration segment of the marine construction industry.

II. Introduction

The Mississippi River Delta is a priceless resource. It sustains the Gulf region's unique people and cultures and brings the U.S. economy billions of dollars each year in energy, fishing, shipping and tourism. Yet the delta's many benefits are under threat, because much of the land area is steadily vanishing underwater. Since 1932, on the Louisiana coast alone, human-induced damage and tropical storms have claimed an astonishing 1,883 square miles of wetlands. Between 1985 and 2010, the rate of land loss equated to an area the size of a football field disappearing every hour (Couvillion et al., 2011). This land loss brings communities in the delta region ever closer to open water, placing them at increasing risk from hurricanes and sea level rise.

At stake in the loss of coastal wetlands is not only the environmental health of the Gulf region, but also several of the nation's vital industries. The Gulf region's critical economic role, and the extent to which this role depends on the delta ecosystem, is evident in the following assets provided by the Gulf region:[4]

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Coastal wetlands, considered one of the most productive ecosystems in the world, perform at least five crucial environmental services. First, they serve as a nursery for nearly the entire commercial fish and shellfish catch from the Gulf of Mexico. Second, they form the basis of a tourism and recreation industry that includes hunting, fishing, boating, and other revenue-generating and job-creating activities. Third, wetlands act as a sponge for water and wave energy, helping protect against flooding from severe storms and hurricanes. Fourth, they filter pollutants and sediment, acting as a natural water treatment plant. Fifth, wetlands are the largest reservoir of global soil carbon, sequestering millions of tons of carbon annually. These environmental benefits and their economic significance are summarized in Table 1.

[4] An overview of the Gulf region's critical role is found in Mabus, 2010, a plan of federal support for long-term Gulf Coast restoration, prepared by the Secretary of the Navy at the direction of the President of the United States.

Table 1. Economic and environmental benefits of healthy wetlands

Type of benefit	Significance
Seafood species habitat	Wetlands provide a home to more species, per area, than any other type of habitat. They serve as a nursery for many important marine species such as fin fish, shrimp, oysters and crab. By weight, **97 percent of commercial fish and shellfish** catch from the Gulf of Mexico depend on estuaries and wetlands during their life cycle.
Recreation	Wetlands bring revenue from hunting, fishing, bird watching, boating, and nature photography. Tourism and recreation represent eight percent of jobs in the Gulf Coast Region. In 2009, the Gulf of Mexico accounted for more than **44 percent (by weight) of marine recreational fishing catch** in the United States.
Flood protection	Wetlands act as a sponge for water and wave energy, reducing storm surge and retaining floodwaters. U.S. coastal wetlands provide an estimated **$23 billion worth of storm protection annually.**
Water filtering	Wetlands filter pollutants and sediment, saving millions of dollars in water treatment costs. Mississippi River Delta wetlands filter water from **41 percent of the continental United States.**
Carbon sequestration	Wetlands store nearly 33 percent of the Earth's soil organic matter, making them the largest reservoir of global soil carbon. Loss of Gulf Coast wetlands means that the United States loses **3.2 million tons of CO_2 sequestration** every year—or the equivalent of adding 600,000 automobiles to the road annually.

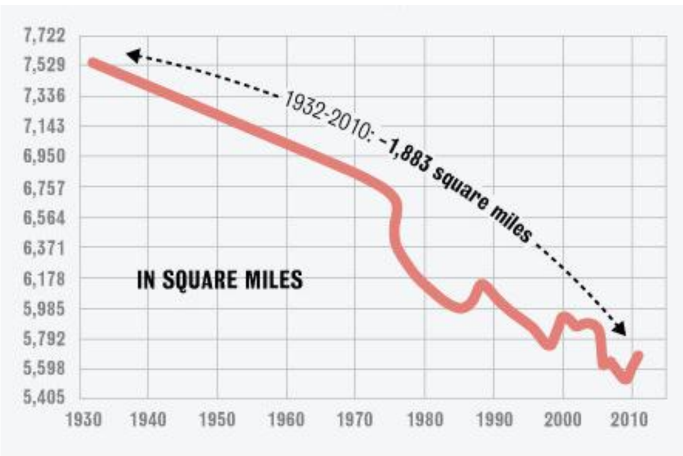
Source: (Gordon et al., 2011; Gulf Restoration Network, 2010; NOAA, 2011)

Unfortunately, economic exploitation of Gulf Coast resources has taken a serious toll on wetlands, marshes, estuaries, and offshore resources such as barrier islands. Agriculture and urban development have converted extensive forested wetlands (also called marshes) along the Mississippi River Delta. The oil and gas industry has damaged thousands of acres of wetlands through exploration, drilling, site preparation, and pipeline installation. Depressurization from oil and gas production increases subsidence (land loss through sinking), while oil spills destroy marine grasses, kill marine wildlife, and erode marshes (Ko & Day, 2004).

In addition to this damage from the oil and gas industry, engineering of shipping canals and navigation networks has further degraded wetlands. Likewise, large-scale water management projects designed to prevent flooding along the Mississippi River Delta have starved the wetlands and barrier islands of the sediment and nutrients they need (CPRA, 2008; Wilkins et al., 2008). Finally, climate change presents additional threats. Sea rise from the Gulf of Mexico not only inundates low lying marshes, but also alters salinity in naturally freshwater or brackish areas. Extremes in rainfall trends in watersheds hundreds of miles up the Mississippi River have varying effects on sediment dispersion (Twilley, 2007).

Added to these causes of human-induced degradation, a series of natural and man-made disasters have caused alarming jumps in wetland loss. The U.S. Geological Survey estimated that tropical storms Katrina and Rita in 2005 claimed roughly 217 square miles of wetlands (Schleifstein, 2011).[5] Storms Gustav and Ike in 2008 damaged another 94 square miles. According to the U.S. Geological Survey, over the past 25 years, the Louisiana coastline has lost more than 16 square miles of wetlands per year, or the equivalent of a football field every hour (Couvillion et al., 2011). While the natural process of marsh building takes place over thousands of years, in less than 100 years the Mississippi Delta has lost 1,875 square miles of land (see Figure 1). It is estimated that without bold, immediate action, another 513 square miles will be lost by 2050 (CPRA, 2008).

Figure 1. Land area loss in coastal Louisiana, 1932-2010



Source: (Schleifstein, 2011), based on (Couvillion et al., 2011)

In recent years, considerable damage in the Gulf region has been attributed to wind and storm surge from hurricanes. The actual impact of extreme storms varies from year, but on average, the Gulf Coast experiences an estimated $14 billion in economic losses annually. Further land development and subsidence, along with sea-level rise, are expected to contribute to an acceleration in such losses. It is estimated that by 2030, the cumulative economic damage could reach $350 billion (Entergy, 2010).

Wetland loss is a crisis of dramatic proportions, and addressing the crisis will require substantial investment. However, this investment will not only restore the lost economic benefits that wetlands provide; it will also create and save jobs linked to the restoration work. The projects activate a full supply chain linking materials providers, equipment manufacturers, shipbuilders, machinery repair

[5] However, when the flooding receded, this figure was later adjusted downward as a portion of the affected wetland area seemed to recover (Schleifstein, 2011).

firms, engineering and construction contractors, and environmental resource firms. Many of the firms are based in the Gulf Coast region. Having long worked in the traditional oil and gas industry, they can supply the same skills and equipment to coastal restoration, finding new markets and a more diverse client base.

A coastal restoration segment is already in place within the marine construction industry, consisting exclusively of government-funded projects. In the 20 years since the enactment of the Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA), 151 coastal restoration or protection projects have been authorized, with funding ranging between $30 million and $80 million annually. Over 110,000 acres in Louisiana have benefited (CWPPRA, 2011a, 2011b). Projects use various techniques to divert sediment from major rivers into wetland areas, restore or mimic natural drainage patterns, reduce shoreline erosion, protect barrier islands, create marshes, and plant vegetation. The work involves a large variety of firms in and around the Gulf as well as others throughout the United States.

This report will describe in detail what coastal restoration comprises and what kinds of jobs it can save and create. The analysis will provide the following:

- **Overview** of the specific equipment and services that perform coastal restoration
- **Value chain analysis** of the firms involved
- **Firm-level analysis** of lead firms in the 13 most significant categories of the value chain
- **Case study of two Gulf Coast firms** that traditionally served the oil and gas industry but have found an additional market in coastal restoration
- **Discussion of the types of jobs and geography of jobs** in the coastal restoration value chain

The intent of this analysis is to provide a foundation for further study of the potential for U.S. firms, especially Gulf Coast firms, to grow a thriving niche in the marine construction industry around restoring coastal wetlands in the United States.

III. What is coastal restoration?

The most effective way to restore and protect wetland ecosystems is to encourage, and usually accelerate, the same natural dynamics that created the Gulf coast and the Mississippi River Delta in the first place. Typically, a project seeks to restore or build natural buffers by erecting barriers, recover the natural flow of river water, and dredge sediment from a river channel so it can be re-deposited to build up a wetland area.

Over the past two to three decades it has grown clear that coastal restoration is a necessary complement to traditional flood protection structures such as levees and flood walls. Damage from Katrina and other storms demonstrates that within a feasible budget, structural measures alone cannot fully protect the Gulf coast from a 100- or 500-year storm. In reality, to protect the coast adequately and realize the benefits of wetlands, flood protection (structural measures) and coastal restoration (natural buffers) must go hand in hand (CPRA, 2008; Entergy, 2010).

To date, government funding for projects in the Mississippi Delta region has gone overwhelmingly to flood protection. In this report, we focus specifically on the coastal restoration side, since it has received far less attention but is just as vitally needed. Coastal restoration represents an important opportunity for firms in the Gulf Region and elsewhere in the United States to grow a new market. In addition, many of the firms already engaged in structural flood protection are well positioned to do coastal restoration also.

Three project types

For the purposes of this report, coastal restoration projects are simplified into three main categories: 1) shoreline and barrier island protection, 2) diversions, and 3) marsh creation.[6]

1) Shoreline and barrier island protection projects are designed to reverse erosion and resist storm surge and sea-level rise. Several techniques can weaken the destructive force of waves before they reach the shore: terracing, creating marshes (see below), building rocky barriers such as berms, or restoring oyster reefs as natural shoreline protection. Wave-dampening fences can be made of treated lumber and galvanized fencing, or even discarded Christmas trees. On-shore techniques include sand-filled geotextile tubes, sand-trapping fences and marine grass plantings that protect dunes and fight erosion. Dredged material is relocated to build up barrier islands.

2) Diversion projects recreate the natural flow of freshwater in order to decrease saltwater intrusion and redeposit sediment onto degraded coastal marshes and swamps. To allow nutrients and sediment from a river to flow into and sustain the surrounding wetlands, a crevasse can be cut into an artificial levee. Gates, weirs, or siphons are also used to channel freshwater and enhance sediment delivery. Terraces or other natural structures can help trap sediment to create new marsh land.

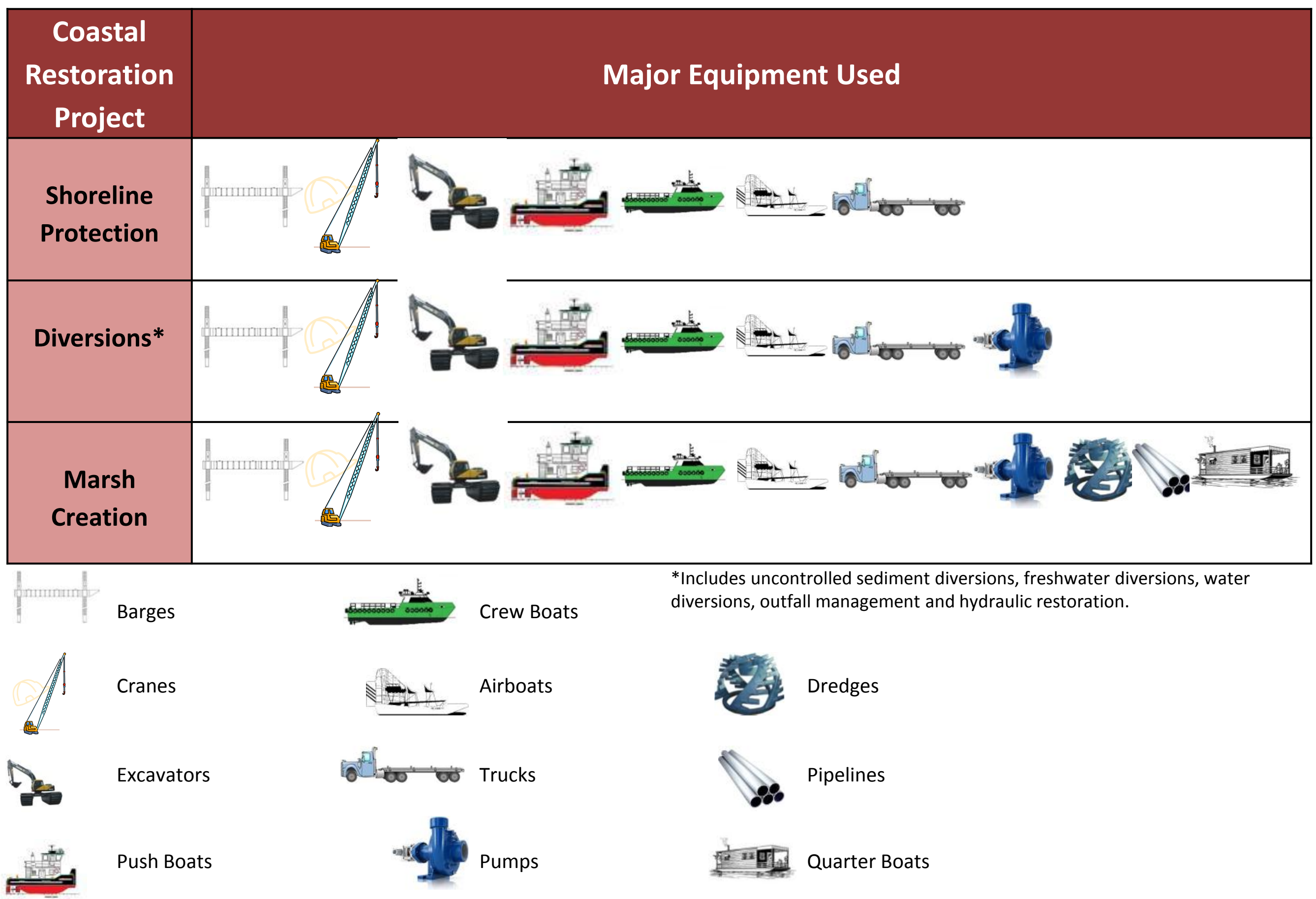
[6] These descriptions are culled from (CPRA, 2011).

3) Dredged material marsh creation entails excavating sediment from underwater locations and transporting it elsewhere via a barge or pipeline to create marshes. Sediment can be dredged from shipping channels or from strategic "borrow" sites. It is transported to a deteriorated wetland and applied to specific elevations so that marsh plants will grow (CPRA, 2011; Welp & Ray, 2011).

Major equipment

Each coastal restoration activity requires a different combination of equipment.[7] Since many projects share similar objectives, types of equipment will frequently overlap. Figure 2 shows the major types of relevant equipment that would likely be deployed for each of the three principal coastal restoration projects—shoreline protection, diversions, and marsh creation.

Figure 2. Major equipment associated with coastal restoration, by project type



Source: CGGC based on CWPPRA completion reports (CWPPRA, 2011c)

Restoration projects use three main categories of equipment: 1) marine vessels, 2) mechanical machinery, and 3) hydraulic machinery.

[7] For information on materials and products used in restoration projects, see the section, "Value Chain," beginning on page 3.

Marine vessels

Barges comprise *hopper barges* to transport materials such as rocks to project sites or to transport sediment from a project borrow site to the placement site; *equipment barges* to transport heavy machinery or to host mobile trailers used as office or meeting space; and *spud barges* to provide stability against heavy winds, waves, or tides so that a crane or other equipment can operate. Spud barges have large vertical steel shafts called "spuds" that are lowered and driven into the underwater floor to stabilize the barge. Almost all projects require some type of barge.

Tug/Tow/Push boats transport and guide barges to and from project sites.

Quarter boats provide living quarters for staff and laborers on the project site. They are used on projects that are far from shore, are only accessible by boat, and require that rather than commute each day, laborers stay on the job site.

Crew boats are used as water taxis to transport smaller equipment to the project site, and workers between the various vessels used on the project site.

Airboats are used to travel around very shallow marshlands near a project site that would be too shallow for a typical prop boat to navigate.

1) Mechanical machinery

Amphibious machinery (marsh and cargo buggies) are track-driven machines developed specifically for the marsh environment of the Mississippi Delta, able to float, maneuver over land, or, most important, drive across marsh (see Figure 3). Marsh buggies are pontoons mounted with industrial machinery such as excavators and cranes. They can be used for freshwater diversion projects that require cutting a crevasse in an existing levee, for example, or for marsh creation involving constructing dikes, or for shoreline protection requiring building rock walls. Cargo buggies are mounted with a flat platform to transport materials to and from a project site. They often transport geological soil boring instruments used to inform project planning.

Figure 3. Amphibious equipment: A marsh buggy (left) and a cargo buggy (right)

Source: Wilco Manufacturing, LLC and Marsh Buggies, Inc.

Mechanical dredges are heavy machinery, such as cranes or excavators, mounted on a barge and equipped with a dredge attachment for digging sediment (see Figure 4). A crane lowers and raises a bucket designed to scoop up the sediment, while an excavator directly shovels it out. In both cases, the sediment is taken from the excavation site and put on a barge to be transported to the placement site (Welp & Ray, 2011).

Figure 4. Mechanical dredges: crane (left) and excavator (right)

Source: USACE & Great Lakes Dredge and Dock

2) Hydraulic machinery

Hopper dredges consist of a self-propelled vessel with a centrifugal dredge pump connected to a drag-pipe that sucks sediment slurry and pumps it onboard into a hopper (see Figure 5). The sediment is then transported to the placement site, where it is either unloaded through a pipeline, or by gravity through a split hull or through bottom dump doors. Split hulls, unique to the U.S. fleet, enable vessels to enter shallow waters.

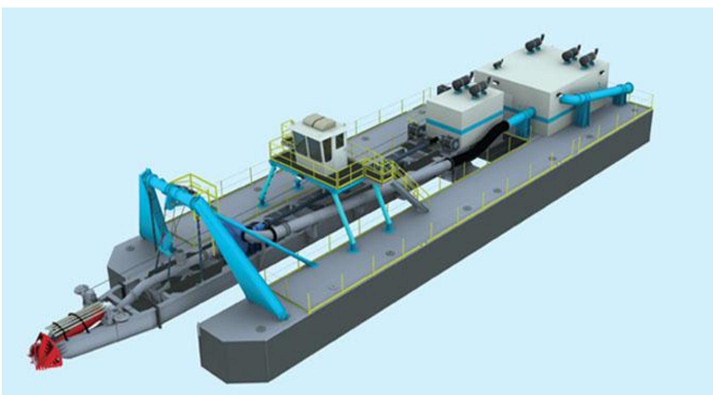
Pipeline dredges also use a centrifugal dredge pump, but instead of storing the sediment in a hopper, they transfer it directly to the placement site via pipeline (using booster pumps for longer distances). Deeper waters usually require a pipeline dredge with an ocean-certified barge. In shallower and hard-to-access areas, a self-propelled, small or mid-sized cutterhead dredge (also called a portable dredge) is ideal (see Figure 6). The cutterhead breaks up sediment into slurry. Whether the dredge is barge-mounted or portable, the discharge pipeline may consist of a floating rubber line, an overland steel or high density polyethylene (HDPE) line, or a combination of all three.

Booster pumps convey dredged sediment over long distances or up steep inclines. Requiring substantial fuel, booster pumps double the sediment transport cost for each four to five miles of pipeline. One or several booster pumps may be used along a pipeline, allowing sediment to be transported up to 40 miles (Dredge Source, 2011; Lopez, 2008).

Figure 5. Hopper dredge

Source: USACE

Figure 6. Pipeline dredge: midsize portable dredge (left) and cutter-head attachment (right).



Source: Dredgepoint and Dredge Source

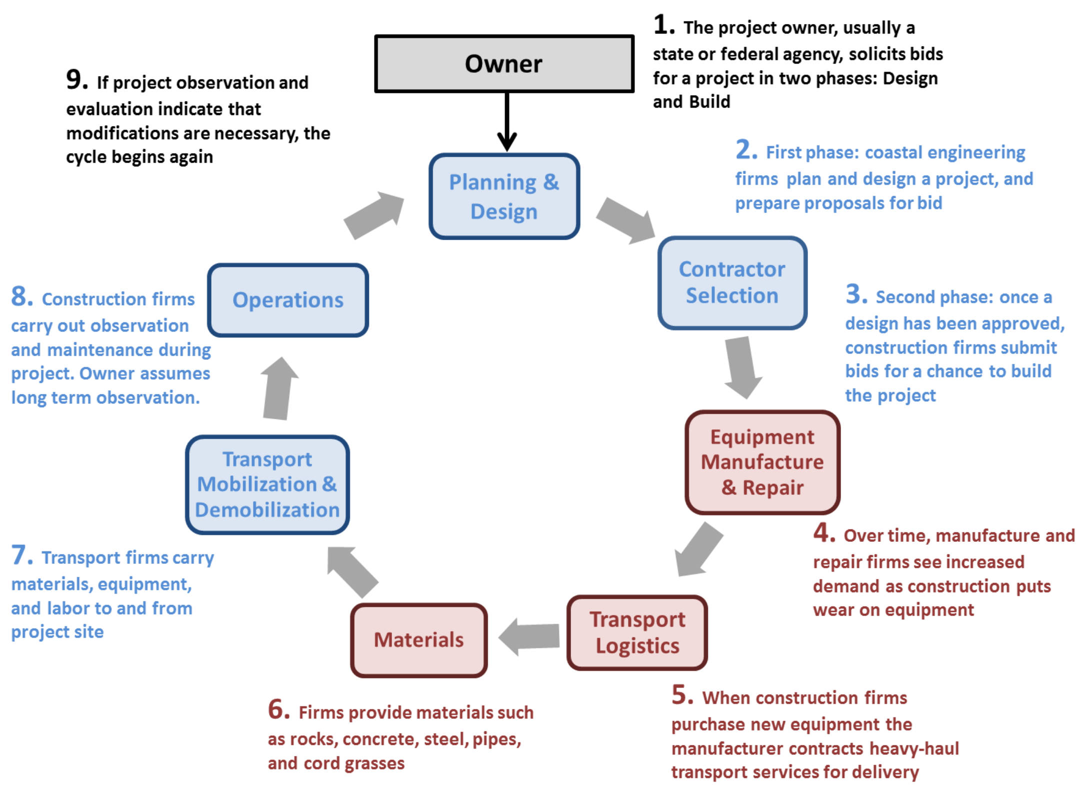
IV. U.S. value chain

Our depiction of the value chain for public projects to restore the Gulf Coast comprises a wide range of materials, equipment and services, along with firms that provide them. This analysis will map out the major players and organize them into eight categories. Before turning to the details of the value chain, however, it is useful to consider the chronology of how a coastal project cycle engages firms.

Coastal project cycle

Each stage of the project cycle for marine construction projects engages firms to varying degrees. A generic depiction of the project cycle is shown in Figure 7 and described below.

Figure 7. How a coastal project cycle engages firms



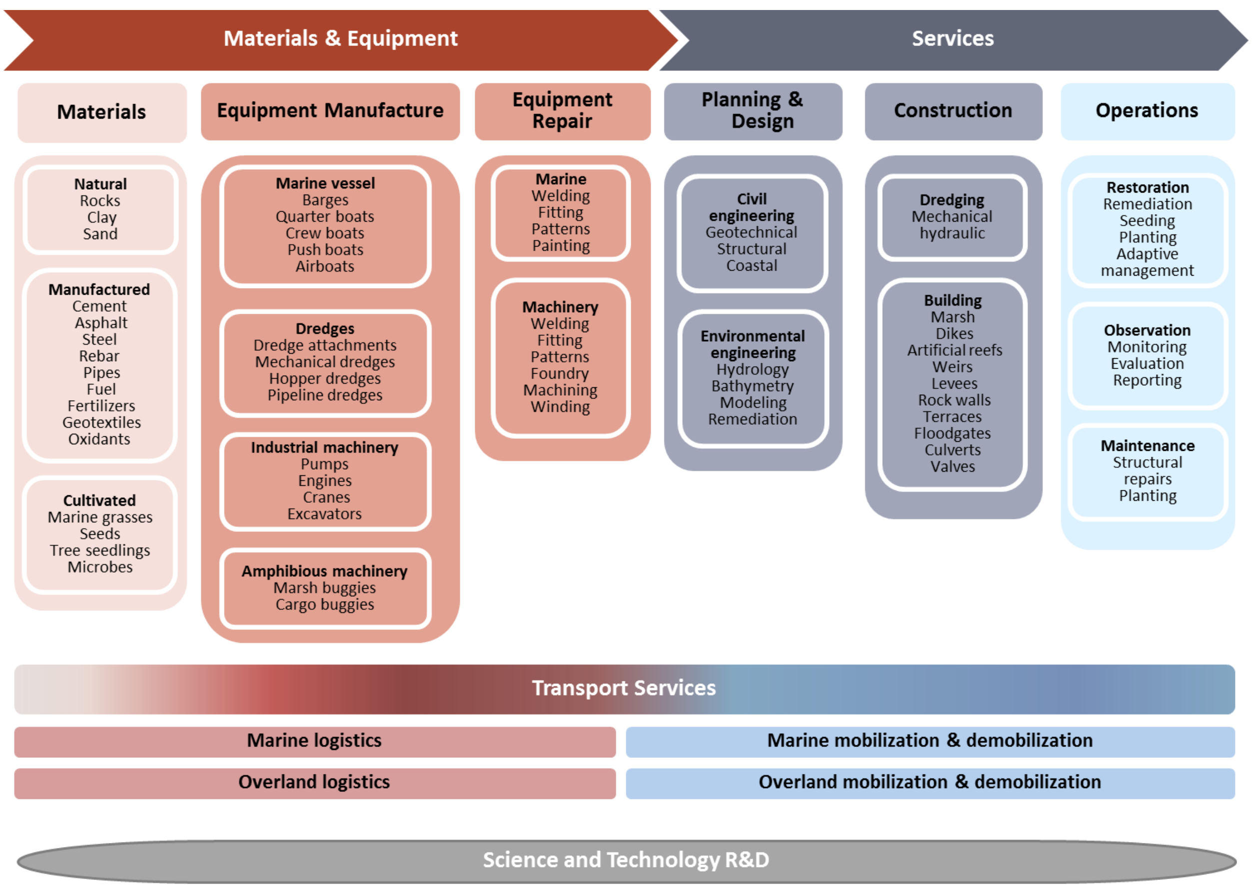
Notes: Red boxes denote equipment manufacture and repair firms. Blue boxes denote design and construction service firms.
Source: CGGC based on CWPPRA completion reports (CWPPRA, 2011c) and industry interviews

The cycle begins when the owner, usually a state or federal agency, solicits bids for a project in two phases: design and build. Upon learning of the first phase, engineering firms design cost-effective, high-quality projects. The owner then approves a design, and construction contractors bid for the opportunity to build the project. Over time, projects of any kind add to the wear and tear of a construction firm's equipment, which must eventually be repaired or replaced. This creates demand for new equipment manufacturers and repair firms, who must then hire heavy-haul transport firms to deliver large equipment to the buyer. Coastal restoration work creates demand for materials such as concrete, steel, rocks, pipes, valves, geotextiles, seedlings and cord grasses. These materials, along with the necessary equipment and labor, are then mobilized to the project site, which requires another transport firm. Finally, the construction firm must oversee the day-to-day project operations, observation, and maintenance. If post-project evaluations indicate that modifications are necessary, the cycle begins again.

Eight value chain categories

The value chain for coastal restoration projects is found in Figure 8. For this study, we have divided the value chain into two main sections: Materials & Equipment (in red), and Services (in blue). Broadly, the three columns under Materials & Equipment (materials, equipment manufacture, and equipment repair) serve as inputs to the three columns under Services (design, construction, and operations). At the bottom of the chart, spanning both main sections of the value chain, is a seventh category, Transport Services. These consist of Logistics to transport products to buyers, and Mobilization & Demobilization to transport materials, equipment, and labor to and from project sites. The eighth value chain category is Science and Technology R&D. Each category is described below.

Figure 8. U.S. value chain for coastal restoration projects



Source: CGGC based on CWPPRA completion reports (CWPPRA, 2011c) and industry interviews

1. Materials

The materials used in coastal restoration projects include natural, manufactured, and cultivated products. Natural materials are mostly derived from quarries such as clay, sand and rocks. Manufactured materials such as cement, asphalt, rebar, pipes, and culverts are used to build levees, floodgates, and other components most frequently used in freshwater diversions. Geotextiles are sewn into large "geo-tubes" filled with sand, which are used to reinforce shorelines. Steel is required for almost all industrial equipment. Fuel is one of the most significant material inputs, and can represent as much as 30 percent of the cost of a dredge project (Hanson, 2011; Wetta, 2011).

Some large construction firms own and operate materials manufacturing facilities. For example, Columbia, Illinois-based Luhr Bros., Inc. owns and operates its own quarries. Baton Rouge, Lousiana-based Shaw Group manufactures much of the high pressure steel pipe used in various industries, including hydraulic dredging (Malbrough, 2011).

Other manufactured items such as fertilizers and chemical oxidants are used only in selected types of restoration and remediation. Firms that provide or manufacture these materials tend to be specialized. Similarly, firms that supply cultivated materials such as marine cord grasses, seeds, and microbes are likely to specialize in remediation rather than supply a variety of project types.

2. Equipment manufacture

Equipment in this study comprises marine vessels, dredges, industrial machinery and amphibious equipment (see descriptions on pages 10-13). The value chain box for each is described below.

Marine vessels refer to barges, tugboats, crew boats, quarter boats, and airboats used in coastal restoration projects. Except for airboats, which are built almost exclusively by specialized firms, these vessels are typically manufactured in shipyards, some of which provide large numbers of well-paying jobs. For instance, marine vessel giant Huntington Ingalls' New Orleans-based Avondale shipyard employs 4,800 workers, making it the largest private employer in Louisiana (Ratnam, 2011).[8] Other shipyards in the region are BAE Systems Shipyards, Bollinger Shipyards, Crowley, Edison Chouest, Quality Shipyards, and VT Halter Marine.

Dredges come in three categories: mechanical, hopper, and pipeline. Mechanical dredges consist of industrial machinery (cranes, excavators) equipped with mechanical dredge attachments (clamshell buckets, blades) that dig material from the undersea floor. Hopper dredges are large ships equipped with a centrifugal pump and drag-pipe that hangs below to bring sediment slurry onboard into a hopper. The ship then transports the sediment to the placement site. Shipyards manufacture these by building the vessel and then assembling the hydraulic centrifugal pump and drag-head (Welp & Ray, 2011). Although U.S. fleets have added few large-class dredges in recent decades, dredging firm Weeks Marine recently ordered two new large dredges. They will cost $125 million, create 125 jobs,

[8] Avondale Shipyard is scheduled to close in 2013 due to reduced demand for Navy shipbuilding. The state is seeking ways to attract other heavy manufacturing to the site (Ratnam, 2011).

and will be the most advanced U.S. dredges in their category (Dredging News Online, 2011).[9] Pipeline dredges, sometimes called cutterhead dredges, convey sediment via a pipeline. While large pipeline dredges may be mounted on a barge, smaller portable dredges are self-propelled. Industry leaders suggest that portable dredge manufacture has the largest potential for future growth because it is versatile, transportable, affordable, and fuel efficient (Hanson, 2011). Leading manufacturers of portable dredges include Dredging Supply Company (DSC), Ellicott Dredges, IMS Dredges, SRS Crisafulli, and VMI.

Industrial Machinery refers to pumps, cranes, and excavators. Pumps are used to hydraulically dredge and convey sediment from the underwater floor. When material is conveyed over long distances, booster pumps are used to help push it along. Among the dozens of firms that manufacture various kinds of pumps, those that make pumps used in hydraulic dredging are Metso, Pearce Group, SPI Mobile Pulley, and Weir. Relevant crane and excavator manufacturers are Manitowoc, Terex, Young Corporation, Caterpillar, Deere, Hyundai and Hitachi.

Amphibious Machinery consists of marsh buggies and cargo buggies. Manufacturers design each buggy's pontoons according to the size of platform or excavator that will be mounted on it, with a capacity of four to 45 tons. Once designed, each buggy is patterned, cut and welded together using lightweight steel or aluminum alloy. The ultimate intended use of the machinery determines which material is used. For instance, while most amphibious machinery is made of a lightweight 10-mm steel, machines designed for work in floating marshes are made from a special ultra-light weight alloy (Auten, 2011; Wilson, 2011). Since the manufacture and use of amphibious machinery is unique to the Gulf Coast region, these firms will see considerable benefit from increased coastal restoration activity. Among the manufacturers in the area are Marsh Buggies, Inc., Wilco Marsh Buggies & Draglines, and Wilson Marsh Equipment.

3. Equipment repair

Equipment repair plays a crucial role in the coastal restoration value chain. It is often performed by manufacturers. Few firms provide equipment repair exclusively, and those that do cater primarily to the marine vessels industry. More common are firms that manufacture marine vessels, dredges, and industrial or amphibious machinery, and have expanded to provide repair. While some manufacturers limit their repair services to warranty work, others generate more than half their revenue providing equipment repair.

Three related factors contribute to the importance of equipment repair in the value chain: wear, cost and age. Wear from exposure to salt water and from pumping abrasive sediment makes it necessary to replace parts often. The cost of equipment is high; a new 30-inch hopper dredge, for instance, may cost

[9] One, a large hopper dredge, will be built in BAE Shipyard facilities in Mobile, AL (Dredging News Online, 2011). The other, a hydraulic cutter suction dredge, is being built at Corn Island Shipyard in Lamar, Indiana (IDR, 2011).

$60-$80 million (Dredging News Online, 2011; Prine, 2011). For most firms it is economical to operate dredges as long as possible and make repairs as necessary. As a result, nearly all large dredges in the United States are approaching the end of their service life, another cause for higher rates of repair (Prine, 2011). While all of these factors establish considerable value for equipment repair firms, they also suggest promising future demand for new equipment.

4. Planning and Design

Planning and designing of coastal restoration projects requires environmental as well as civil engineering. During the planning stage, engineering firms make environmental assessments of the soil, hydrology, bathymetry, waves, wind, and tides (USACE, 1989). Once these environmental assessments are established, engineers then determine the most appropriate structure configuration (dike, rock wall, weir, marsh, diversion, floodgate, etc.), and design it for the specific environment. Tasks such as determining proper cord grass species for marine reforestation, and long-term impact of the structural configuration, require further environmental engineering assessments (NRCS, 1992).

This process requires considerable time and resources. The engineering phase of CWPPRA projects averages 10 percent of total project cost, but it can be as high as 23 percent (CWPPRA, 2011b). Larger projects may take three to four years to engineer, costing millions of dollars (Wingate, 2011). Because the federal bidding process often requires companies to design first, then bid, then build, large firms such as Shaw Group may invest more than $1.5 million and pursue a project for over a year before even bidding (Malbrough, 2011). For all but the largest firms, the process can place large projects out of reach.

5. Construction

Construction firms create much of the direct demand for equipment and services from all other segments of the value chain. The Gulf Coast boasts a very high concentration of construction firms experienced in coastal restoration projects. For this report, we have divided construction firms into two categories: dredging and construction. Dredging refers to moving sediment from a dredge site to a placement site, and may be done through mechanical or hydraulic means. When that sediment is placed strategically to construct a marsh or a series of terraces, the activity becomes construction—a category that can also encompass the building of rock walls, weirs, dikes, and floodgates, and therefore is relevant to all three types of coastal restoration (shoreline protection, diversions, and marsh creation). While several firms are experienced in these types of construction, only a handful are capable of large-scale dredging. The largest are Great Lakes Dredge and Dock, Manson Construction, Mike Hooks, Orion Marine Group, and Weeks Marine.

6. Operations

A variety of auxiliary activities that take place throughout the project can be described as operations requiring restoration, observation, and maintenance. Restoration tasks include soil remediation, seeding, and planting. Observation—the monitoring, evaluation, and reporting of project progress—occurs during construction and after project completion. This area of operations may be most important, since the oversight allows for continuous improvements of both actual and future projects. Observation results determine any necessary maintenance activities, frequently requiring a return to the project design and construction phases. Many design firms, and some in construction, carry out maintenance activities themselves.

7. Transport

Transport services in this study are divided into two categories: logistics, and mobilization & demobilization. Logistics services are used by manufacturers to deliver materials and equipment to customers for their fleets and ongoing operations. The size of the machinery determines, and sometimes limits, transport options. For instance, marsh buggies 20 tons and smaller can be shipped overseas in containers for about $35,000, while anything larger requires more costly, specialized shipping. Overland logistics prove challenging as well. In Louisiana and Texas, marsh buggies may be transported fully assembled on flatbed trucks, but in surrounding states they must be disassembled into three sections and carried on three trucks (Auten, 2011). Logistics for a landlocked manufacturing facility such as Reserve, LA-based DSC Dredge require all machines to be transportable by truck, as with a 300-foot dredge that required 29 flatbed trucks (Wetta, 2011).

Mobilization & demobilization refers to the transport of materials, equipment, and labor to and from a project site. Typically this is accomplished over water via barges and quarter boats, and over land via flatbed trucks. Cargo buggies can provide “mob & de-mob” service across, land, water, or marsh.

8. Science and technology R&D

Relevant technology includes equipment used to monitor and collect information. Software for hydrodynamic, wave, and sediment transport modeling programs is applied in the engineering and design phases of projects. In the United States, much of this software is developed by universities with dedicated coastal engineering programs. Historically these programs have been concentrated in a few schools such as the University of Delaware, University of Florida, Georgia Tech, Oregon State University, and Texas A&M. In recent years the average size of the programs has dropped considerably (Hanson, 2011). One observer notes that this has compartmentalized research into pockets, as opposed to facilitating a collective exchange of ideas (Srinivas, 2011). Other sources of useful software are the USACE’s Coastal and Hydraulics Laboratory, and marine institutes such as Woods Hole Oceanographic Institute. Private software firms include Aquaveo and Tuflo. Coastal engineering relies on instruments that monitor natural underwater activities such as tidal fluctuations, water flows, and shoaling patterns. Louisiana State University has a well-developed program that deploys and monitors these devices (Luettich, 2011).

V. Firm-level data

This section focuses on the many types of firms that provide equipment or services to coastal restoration projects in the Gulf of Mexico. To construct the list of relevant firms, we reviewed documentation for projects already undertaken or completed to date.[10] Interviews with a number of these firms and their key suppliers identified additional firms throughout the value chain. The data analysis that follows is therefore based on a list that has been "ground-truthed" in order to eliminate a large number of firms that could engage in coastal restoration work because they have the needed capabilities and capacity, but may not have participated to date. Instead, only those for which we found confirmed links to coastal restoration work are included.

Even for our sample of 138 relevant firms, coastal restoration represents only a small business segment, comprising 25 percent or less of overall activity. For the largest, most diversified firms such as Shaw Group or Weeks Marine, the share may be less than five percent. This is not surprising, since to date, the total volume of coastal restoration projects has created a small amount of work at best. Many of the involved firms earn the bulk of their revenues by providing equipment or services to larger markets such as extractive industries, civil construction, navigational dredging, or naval shipbuilding—all of which entail work that requires machinery and capabilities easily transferable to coastal restoration. Restoration projects involve firms of all sizes, but they appear to be particularly important to small and medium-sized firms, providing a valuable stream of work in a fragile economy.

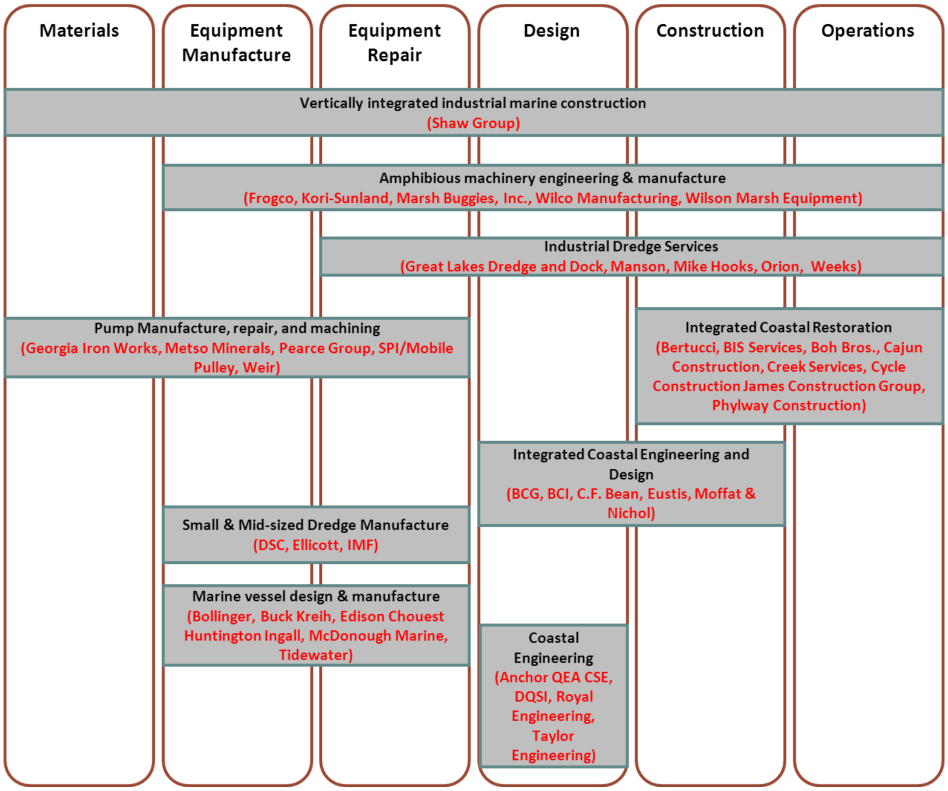
For the complete list of 138 firms and their characteristics, see the Appendix on page 36. Firm-level data derived from this sample yielded useful observations on the following: 1) capabilities of firms across the value chain, 2) size of firms, 3) age of firms, and 4) potential export markets.

Capabilities of firms across the value chain

We placed each firm in the category that corresponds to its primary role in the value chain. However, nearly every firm in the sample has some degree of vertical integration, providing equipment or services across two or more functional categories (see Figure 9). Examples are shipyards (Bollinger) and pump manufacturers (SPI/Mobile Pulley), which provide services for hydraulic dredge repair. Amphibious equipment manufacturers (Wilco Manufacturing, LLC, Marsh Buggies, Inc.) lease, refurbish, and sell used equipment, and manage construction divisions. Perhaps the only category that contains several firms whose role in coastal restoration is limited to a single activity is project design (Anchor, Royal Engineering, Taylor Engineering). In the case of Shaw Group, a Fortune 500 company based in Baton Rouge, LA, one firm's involvement stretches across the entire value chain.

[10] Sources: USACE contract award lists (USACE, 2011), CWPPRA project completion reports (CWPPRA, 2011c), information compiled by the OCPR, and company interviews.

Figure 9. Firms' capabilities across the U.S. coastal restoration value chain

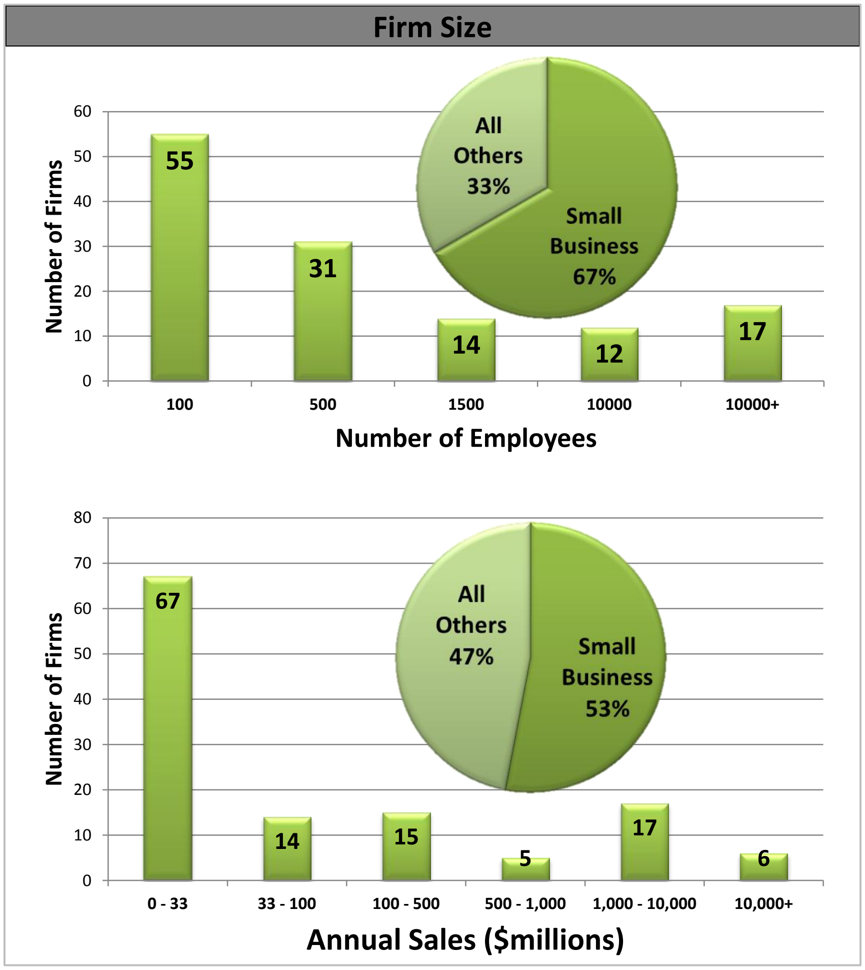


Source: CGGC, based on industry interviews, company websites, USACE contract award lists (USACE, 2011), and CWPPRA completion reports (CWPPRA, 2011c).

Size of firms

The majority of firms in our sample are small and medium-sized businesses (see Figure 10). The U.S. Small Business Administration (SBA) provides varying definitions of small businesses according to the characteristics of a given industry. For example, for a heavy civil construction firm to qualify as a small business, its annual income may not exceed $33 million, while that for an engineering services firm may not exceed $4.5 million (SBA, 2011). Over 53 percent of the sample firms meet the SBA's maximum sales criterion for the firm types studied. Measured by numbers of employees, 67 percent of the firms in our sample qualify as small businesses. Over 42 percent—or 55 of the 129 firms with employment data—have fewer than 100 employees. The incidence of small firms in our sample is in part attributed to relative project size. Many coastal restoration projects to date have been expressly designed to a modest scale. Larger firms with greater capacity maintain a broader scope of work, leading them to prefer larger projects that generate more revenue (Hanson, 2011; Malbrough, 2011).

Figure 10. Distribution of firms by size category, U.S. coastal restoration value chain



Source: CGGC, based on industry interviews, company websites, Hoover's database, and OneSource database.

The relative sizes of firm categories in our sample are shown in Table 2. Smallest firms include manufacturers of marsh buggies and dredge equipment, as well as services for mobilization, de-mobilization and equipment repair. Among these firms are family-owned, local businesses as well as dredge manufacturers based outside the Gulf region, many with fewer than 100 employees. Next are medium-sized firms that provide logistics or dredging services, with fewer than 1,000 employees and under $250 million in sales. Larger firms are found among the marine vessel manufacturers and construction and design firms. While on average these have fewer than 10,000 employees and less than $2.5 billion in sales, they encompass such large firms as Shaw Group, a construction firm that spans the entire value chain and has 27,000 employees and $7 billion in sales. Largest are the firms that manufacture cranes, pumps, excavators, and engines. Among these are such giants as Caterpillar, which makes many of the excavators used in coastal restoration, with more than 100,000 employees and over $40 billion in annual sales.

Table 2. Average size of firms by activity category, U.S. coastal restoration value chain

Type of Firm	Average Total Company Employees
Marsh buggies	30
Hydraulic dredges	50
Dredge attachments	54
Mob & de-mob	84
Repair	136
Logistics	550
Dredging	513
Marine vessels	5,179
Building	5,697
Design	7,497
Cranes	9,750
Pumps	12,496
Excavators	13,222
Engines	20,247

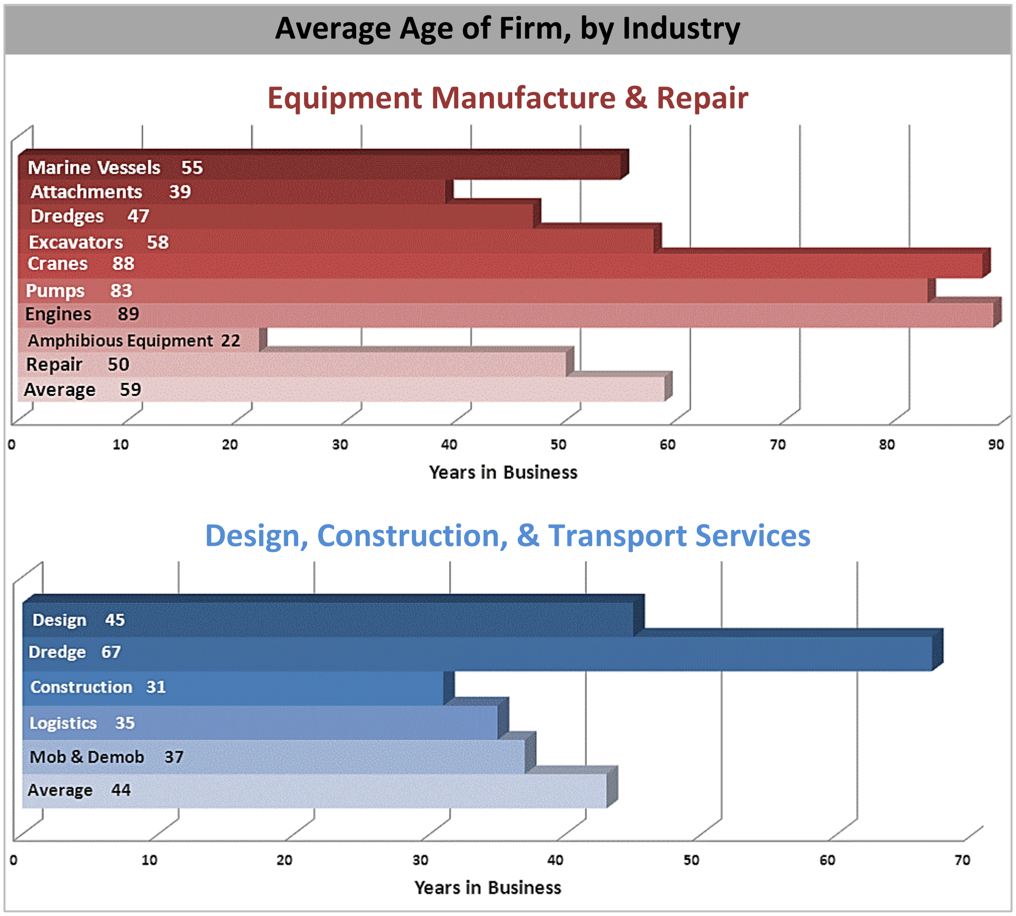
Type of Firm	Average Total Company Sales
Marsh buggies	6,123,333
Dredge attachments	7,532,000
Mob & de-mob	8,115,714
Hydraulic dredges	11,133,333
Repair	11,162,500
Logistics	69,964,286
Dredging	191,587,000
Building	657,094,783
Marine vessels	2,135,749,167
Design	2,281,213,500
Cranes	2,523,300,000
Pumps	2,639,511,111
Excavators	5,621,708,333
Engines	7,103,333,333

Source: CGGC, based on industry interviews, company websites, Hoover's database, and OneSource database

Age of firms

Firms identified in this study tend to be well established (see Figure 11). On the whole, equipment manufacturers are relatively old, founded on average 59 years ago, while service firms were founded on average 44 years ago. Many were established to serve growth industries of the 20th century—extractive industries, shipbuilding, and industrial civil construction. In order to remain competitive, they are seeking new markets. In interviews, several firm representatives noted that an increase in coastal restoration work supported by a dedicated funding stream would establish much-needed demand for their business, enabling them to utilize currently under-used resources.

Figure 11. Average age of firms by activity category, U.S. coastal restoration value chain



Source: CGGC, based on industry interviews, company websites, Hoover's database, and OneSource database.

Potential export markets

Interviews with equipment manufacturers indicated an increasing interest in serving export markets. In general, construction equipment manufacturing, like many industries, declined dramatically in the economic crisis of 2008-2009, losing 30 to 50 percent of its business (Leybovich, 2011). With domestic sales continuing to weaken, exports are an important source of new demand (Barbaccia, 2011). Several small and medium-sized firms in our sample are orienting increasingly to foreign markets. Manufacturers of small and mid-size dredges manufacturers, for instance, are responding to demand from foreign governments and private companies. Baltimore, MD-based Ellicott Dredges has arranged the export of several portable dredges, most notably to India (Dredging Today, 2010). Reserve, LA-based DSC Dredge, a 2008 President's "E" Award winner, has sold dredges in 45 countries. Exports now make up 50% of the company's annual sales (Wetta, 2011). Similarly, amphibious machinery manufacturers Wilco Manufacturing and Marsh Buggies, Inc. have each established several international clients associated with the oil and gas industry. Depending on the year, exports comprise 30-50 percent of their business (Auten, 2011; Wilson, 2011). These two firms are profiled below.

VI. Case study: Marsh buggies and cargo buggies

Marsh Buggies, Inc. and Wilco Manufacturing are two Louisiana companies that, having once worked solely for the oil and gas industry, now serve a growing share of customers involved in coastal restoration. Each company manufactures “marsh buggies” and “cargo buggies”—amphibious machines developed specifically for the marsh environment of the Mississippi Delta. Ideally suited to the work of restoring wetlands, marsh buggies and cargo buggies have helped local manufacturers faced with a long-time decline in oil and gas pipeline construction diversify their client base.

A marsh buggy is essentially a self-propelled platform on pontoons, upon which a machine is mounted, such as an excavator, for digging sediment. A set of moving steel tracks enables the marsh buggy to crawl tank-like through mud and marshes. To get to a project site, the marsh buggy is thus able to move across water, but then proceed across difficult, marshy terrain to do its work. A cargo buggy is similar to the marsh buggy, but its platform is used primarily for transporting materials and equipment. Marsh buggies and cargo buggies are capable of serving areas that are often not accessible with traditional equipment (see Figure 3 on page 11).

Marsh buggies played an integral role during the construction boom for oil and gas pipelines. Manufacturers provided not only the machines, but also the trench digging services necessary to put pipeline in place. For years, demand for this work was steady. Over time, however, pipeline expansion and repair declined along with U.S. oil production, which peaked in 1970 (Sorrell et al., 2009). Demand subsided and became more volatile, fluctuating with the global price of oil.

By the 1980s, awareness of Mississippi Delta wetland degradation emerged as a serious concern, and state agencies began working with engineers to design coastal restoration projects. They quickly recognized the usefulness of amphibious machinery. Marsh buggies are now used to build rock walls to control erosion, tear down levees to divert sediment, build terraces to protect barrier islands, assemble dikes to contain sediment for marsh creation, and move existing oil and gas pipelines. Cargo buggies transport materials to project sites and carry equipment, including soil boring tools used by geological teams during project design and evaluation.

Marsh Buggies, Inc. and Wilco Manufacturing each have a decades-long history and a business profile that encompasses contract construction and equipment rental and leasing (see Figure 12). Over the years, each firm has proven adept at identifying new markets and diversifying operations. In addition to pipeline and coastal restoration work, marsh buggies are used to install and maintain power lines over previously inaccessible marsh; to perform EPA remediation of superfund sites, and to do U.S. Navy environmental cleanup.

Figure 12. Profiles of Marsh Buggies, Inc. and Wilco Manufacturing

Marsh Buggies Inc.		Wilco Manufacturing	
Year founded	1969	*Year founded*	1974
Location	Belle Chasse, LA	*Locations*	Lafayette, LA Harvey, LA
Full-time employees	40	*Full-time employees*	150
Machines manufactured per year	8-10	*Machines manufactured per year*	40-50
Share of business--		*Share of business--*	
Manufacturing	50%	*Manufacturing*	60%
Rental	25%	*Rental*	20%
Construction	25%	*Construction*	20%

Source: (Auten, 2011; Wilson, 2011)

Looking ahead, both firms aim to identify opportunities to find new domestic and export markets. In the United States, coastal restoration is needed not just in the Mississippi Delta region but also in California, Florida, the Pacific Northwest and the Great Lakes. If U.S. markets expand, the firms that serve them will be well positioned to sell to international markets as they develop in the future. For example, several countries in Asia are developing integrated coastal management programs, and recently India, Bangladesh, Indonesia, and Vietnam have undertaken hundreds of millions of dollars' worth of coastal restoration projects[11]. These efforts could signal emerging export opportunities for Marsh Buggies Inc. and Wilco. Each company already exports machines to China, Indonesia, Peru, Russia, Nigeria, and others (selling primarily to pipeline construction firms). If international coastal restoration efforts expand in the future, they could represent an additional export market, enabling manufacturers to diversify beyond their customers in the petroleum industry, as they have in the United States.

VII. Coastal restoration and jobs

This study has laid out the value chain for coastal restoration work as a foundation for understanding the potential to create and save jobs. Rather than counting jobs, the analysis is intended to gain an understanding of the scope and nature of employment involved in coastal restoration projects. This

[11] (ADB, 2011; KOICA, 2011; Stephen Crooks, 2011; The World Bank, 2011; VOV, 2011)

section will address the following: 1) types of jobs; 2); geographic distribution of jobs; and 3) future jobs in the coastal restoration value chain.

Types of jobs

The firms described in this study represent a large number of occupations, the most important of which are listed in Table 3. Median wages in selected relevant occupations range from $57.34 per hour for engineering managers, to $32.80 for biological scientists, to $8.98 for nursery workers who plant trees and marsh grass. A number of engineering skills—mechanical, civil, electrical, environmental—are needed in equipment manufacture and repair, or in services, or both.

Table 3. U.S. median wages of important occupations linked to coastal restoration work

Occupation	Median Hourly Wage ($US)
Equipment Manufacture and Repair	
Electrical Engineers	40.65
Mechanical Engineers	37.58
First-Line Supervisors	28.44
Mechanical Engineering Technicians	24.09
Mechanical Drafters	23.46
Electricians	23.20
Pipefitters	22.43
Mobile Heavy Equipment Mechanics	21.55
Painters, Transportation Equipment	18.77
Machinists	18.52
Patternmakers, Metal and Plastic	17.88
Welders, Cutters, Solderers, and Brazers	17.04
Services	
Engineering Managers	57.34
Construction Managers	40.32
Environmental Engineers	37.86
Civil Engineers	37.29
Hydrologists	36.39
Health & Safety Engineers	36.26
Biological Scientists	32.80
Cost Estimators	27.82
Zoologists and Wildlife Biologists	27.61
Construction Equipment Operators	19.42
Surveying and Mapping Technicians	18.22
Construction and Related Workers	16.59
Dredge Operators	16.42
Forestry Workers	9.44
Nursery Workers	8.98

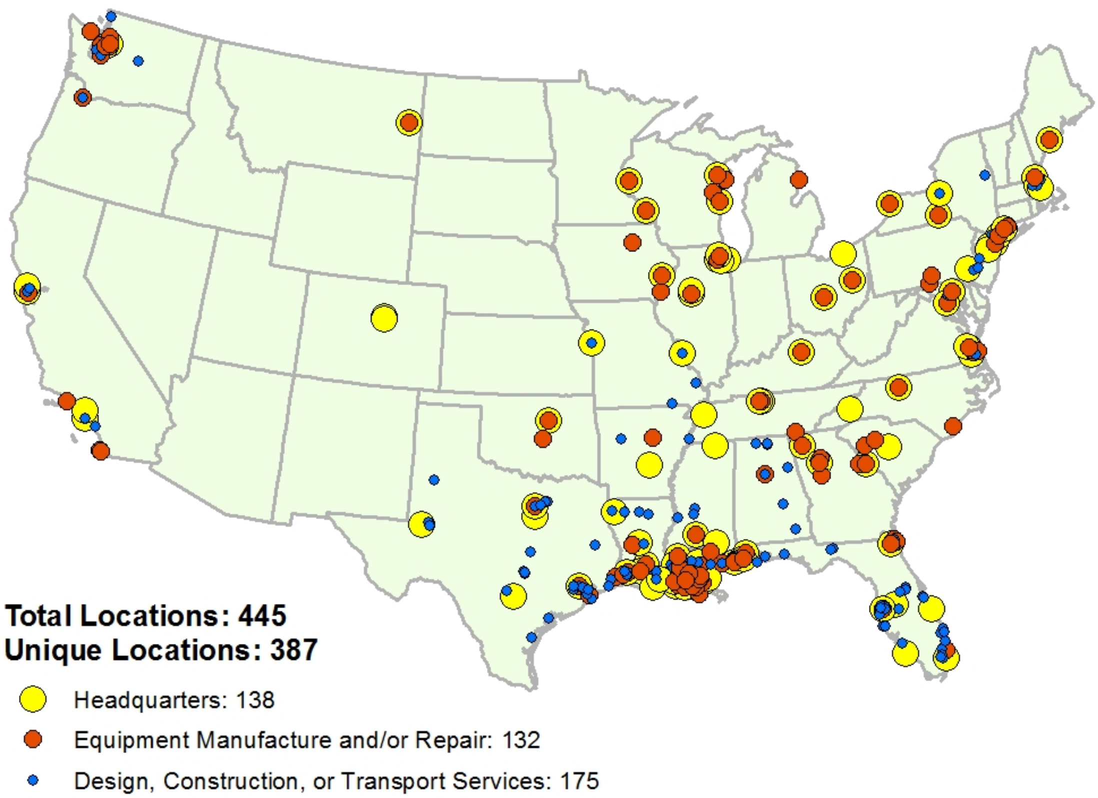
Source: (BLS, 2010)

In equipment, important occupations include skilled trades such as pipefitters, mechanics, machinists, patternmakers and welders. Interviews with equipment firms noted that it is increasingly difficult to find truly skilled craftsmen. One concern is that many qualified welders will retire in the next 5-10 years, and training programs are needed in order to ensure a supply of skilled people to replace them.

Geographic distribution of jobs

Maps of U.S. employee locations for firms involved in coastal restoration are found in Figure 13. The total number of firms identified is 138, each with one company headquarters. Adding locations for equipment manufacturing and repair (132) and those for design, construction or transport services (175) brings the total number of "unique" U.S. locations to 387, distributed across 37 states.[12]

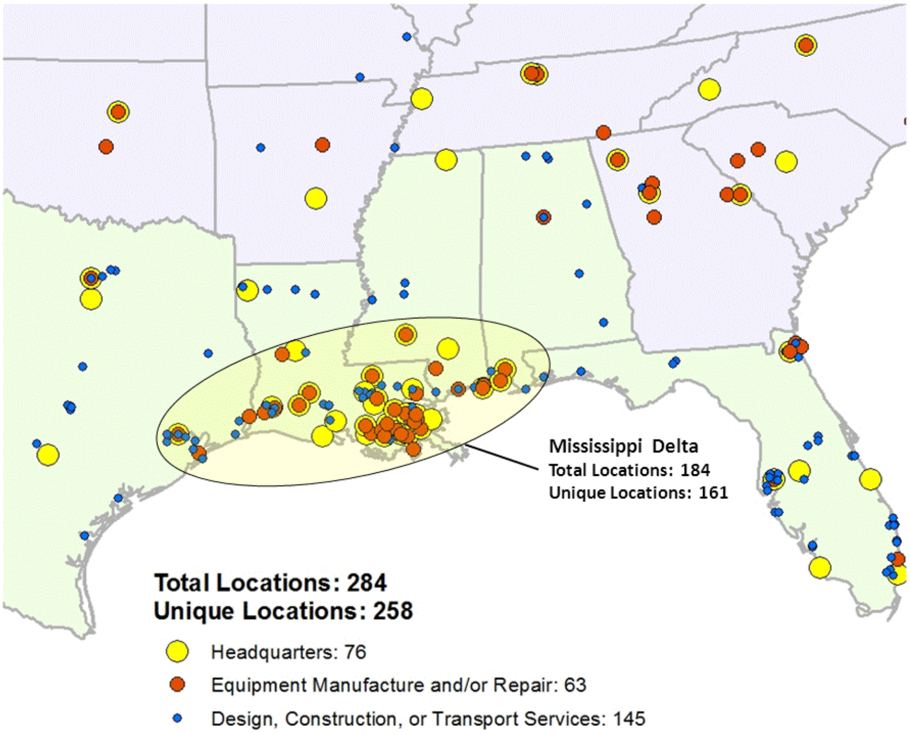
Figure 13. Relevant U.S. employee locations of firms linked to Gulf Coast restoration projects



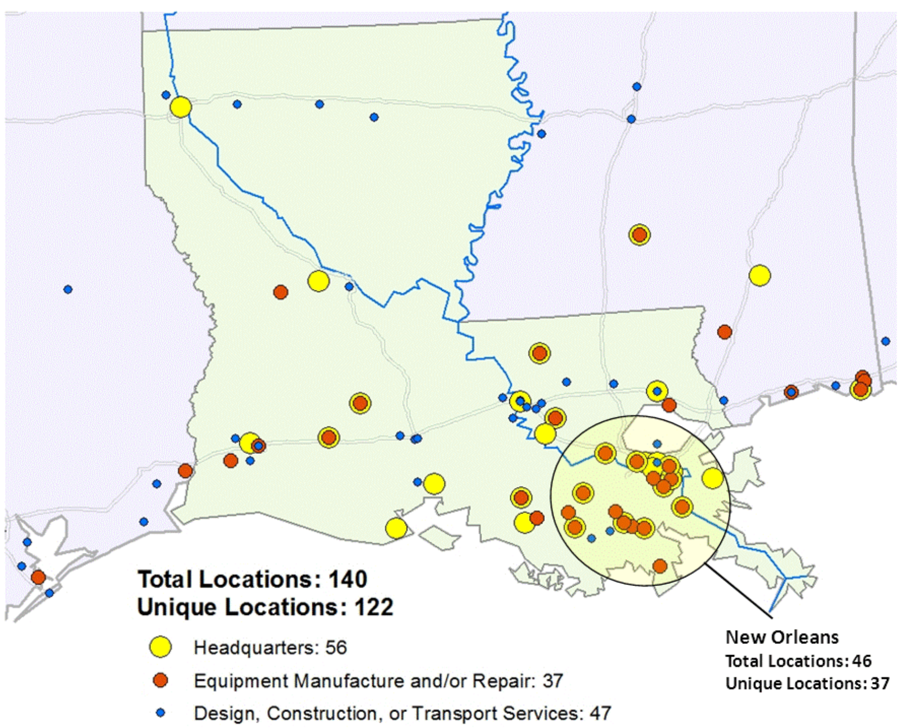
Source: CGGC, based on industry interviews, company websites, Hoover's database, and OneSource database.

[12] A number of firms in the equipment manufacture and repair category perform these activities at the firm's headquarter location. For this reason, our "unique" count is lower than the sum of the three location categories.

Gulf Coast States



Louisiana



Source: CGGC, based on industry interviews, company websites, Hoover's database, and OneSource database.

As noted earlier, this analysis includes only firms confirmed to be linked to Gulf Coast restoration work in current and past projects. It is thus no surprise that the heaviest concentration of overall locations is in the Gulf Coast region. Of the total 387 locations nationwide, 258 locations, or 67 percent, are in the five Gulf states of Texas, Louisiana, Mississippi, Alabama and Florida. Additional, though smaller, concentrations of firms are found in the Pacific Coast (32 locations) and the Midwest (25 locations).

Within the Gulf Coast region, Louisiana stands out clearly in all three location categories (headquarters, equipment and services). Louisiana has the highest concentration of headquarters, with 56 sites, or 41 percent of the national total. Among the state's identified locations, the New Orleans area alone has 11 manufacturing sites and 16 services sites.

The distribution of location types yields the following observations, as shown in Table 4:

Headquarters. The 138 identified firms are divided relatively evenly between equipment firms and service firms. Each firm has one headquarters, with 66 headquarters for the equipment category and 72 headquarters for the service category. The highest regional concentration for total headquarters is the Gulf Coast (76 locations), with smaller concentrations in the Midwest (21), Northeast (13), and Pacific Coast (9). Top states are Louisiana (56), Florida (8), Illinois (9), New York (5), Washington (5), and Wisconsin (5). Top cities include the greater New Orleans area, LA (21), Baton Rouge, LA (5), and Seattle, WA (4).

Equipment Manufacture and/or Repair. The 132 identified manufacturing and repair locations appear across 30 states. The highest concentration is in the Gulf Coast (63), with smaller regional concentrations in the Pacific Coast (16) and Northeast (11). Top states are Louisiana (37), Mississippi (10), Washington (9), Georgia (7), and Wisconsin (7). Top cities include greater New Orleans (11) and San Diego, CA (4).

Design, Construction or Transport Services. The 175 identified service locations are less dispersed than equipment facilities, concentrating in only 18 states. The highest concentration is in the Gulf Coast (145), with much smaller concentrations in the Northeast (13) and Pacific Coast (10). Top states are Louisiana (47), Florida (42), and Texas (36).

Table 4. Distribution of firm locations linked to Gulf Coast restoration

	Total "Unique" Locations		U.S. Headquarters		Relevant Manufacturinng Facilities		Relevant Service Employee Locations	
Total Number of Locations		**387**		**138**		**132**		**175**
Total Number of States		**37**		**32**		**30**		**18**
Top Regions	Gulf Coast	**258**	Gulf Coast	**76**	Gulf Coast	**63**	Gulf Coast	**145**
	Pacific Coast	**32**	Midwest	**21**	Pacific Coast	**16**	Northeast	**13**
	Midwest	**25**	Northeast	**13**	Midwest	**18**	Pacific Coast	**10**
			Pacific Coast	**9**	Northeast	**11**		
Top States	Louisiana	**119**	Louisiana	**56**	Louisiana	**37**	Louisiana	**47**
					Mississippi	**10**		
	Florida	**54**	Florida	**8**	Washington	**9**	Florida	**42**
	Texas	**46**	Illinois	**9**	Georgia	**7**		
	Mississippi	**20**	New York	**5**	Wisconsin	**7**	Texas	**36**
	Alabama	**16**	Washington	**5**	Alabama	**6**		
	Washington	**16**	Wisconsin	**5**	Florida	**6**	Alabama	**11**
Top Cities	*New Orleans, LA	**39**	*New Orleans, LA	**21**	*New Orleans, LA	**11**	*New Orleans, LA	**16**
							Houston, TX	**10**
			*Baton Rouge, LA	**5**	San Diego, CA	**4**	Tampa, FL	**8**
	*Baton Rouge, LA	**8**			Amelia, LA	**3**	Baton Rouge, LA	**7**
			Seattle, WA	**4**	Mobile, AL	**3**	Austin, TX	**5**
					Pascagoula, MS	**3**	*Jacksonville, FL	**5**

Source: CGGC, based on industry interviews, company websites, Hoover's database, and OneSource database.
** Includes larger metropolitan area*

Future jobs

As in any industry, job creation in coastal restoration is tied to demand for the product. But unlike most industries, demand for coastal restoration work comes entirely from government-funded projects. One overarching theme observed in interviews with our sample firms is the unsteady nature of this demand—in part because of uncertainties and delays in funding mechanisms, and in part because the overall volume of funding falls well below the level needed to adequately restore and protect the Gulf Coast.

Federal funding for coastal restoration in the Mississippi Delta to date has consisted of four major programs, each of which has been marked by delays and uncertainty, and only two of which have funded actual projects to date.

1. **Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA)**, established in 1991. CWPPRA has provided $30 - $80 million annually and completed over 151 projects

(CWPPRA, 2011a, 2011b). Although CWPPRA has proved to be the most effective model for implementing coastal restoration projects in Louisiana, its continued funding is not guaranteed.

2. **Coastal Impact Assistance Program (CIAP),** a four-year program (2008-2012) intended to contribute funds totaling $496 million from the offshore oil and gas industry. Much of the program period has already elapsed, but only a fraction of the funds have been distributed. Even though CIAP was established to compensate for the petroleum industry's negative impact on the coast, the funds may also be used to build infrastructure such as new roads that may provide access to refineries (CIAP, 2011).

3. **Gulf of Mexico Energy Security Act (GOMESA)**, passed in 2006. GOMESA is intended to share revenues with the four oil-producing Gulf States by taking a share of federal taxes on offshore oil and gas and diverting them to the relevant states. Phase I of the program started small in 2008, funding Alabama, Louisiana, Mississippi, and Texas a combined $29 million in the period 2008-2010 (BOEMRE, 2011).[13] Anticipated total payments under Phase 2, scheduled to begin in 2017, are expected to increase to an estimated $200 million annually for the first 10 years and up to a cap of $500 million annually for the following 10 years—again, to be distributed among all four states (GAO, 2007).

4. **Louisiana Coastal Area (LCA) program**, established in 2003 to fortify CWPPRA's work. LCA relies on Water Resources Development Act (WRDA) funding, which must be authorized by Congress (USACE, 2004). Although LCA has approved six project designs, Congress has yet to allocate WRDA funding sufficient to carry out the construction (Peyronnin, 2011).

With so much delay and uncertainty in these four programs, funding continues to fall significantly short of what is needed. According to the 2007 Louisiana Master Plan, based on years of coastal research and lessons learned from Katrina and other hurricanes, preventing further rapid land loss along the Louisiana coast will cost more than $50 billion over three decades (GAO, 2007). Clearly, even full funding from the four federal programs in place today will not be adequate.

The 2010 BP oil disaster in the Gulf of Mexico may result in two new potential sources of funding. First, under the Natural Resource Damage Assessment (NRDA) process, BP and other responsible parties are required to pay monetary damages to the U.S. and state governments for the direct damage to natural resources. These monetary damages will provide funding for projects to restore the ecosystem to its state before the oil spill. Second, for each barrel of oil spilled, BP and others will pay fines under the Clean Water Act—fines that could total from $5 to $21 billion (Robertson, 2011). Legislation introduced by bipartisan Congressional leaders in the House and Senate would put the Clean Water Act fines into a trust fund dedicated to Gulf restoration. Of these two potential sources of oil-spill-related

[13] $29 million figure reflects the total allocations from 2008 ($25.2 million), 2009 ($2.7 million), and 2010 ($.87 million) documented in each of the annual "GOMESA Revenue-Sharing Allocations" fiscal year reports; see BOEMRE, 2011.

funding, only the first category—the natural resource damages—will clearly be devoted to ecosystem restoration. How much funding this represents is yet to be determined. As for the second category of potential funding, the Clean Water Act fines, several uncertainties remain: how much the total dollar amount of fines will be, what portion would be dedicated to a trust fund for restoration, and whether Congress will in fact pass legislation to do so. If this critical bi-partisan bill is indeed signed into law, important restoration projects already identified across the Gulf region will be able to move forward.

In any case, restoring the Gulf Coast will require not just a one-time infusion of significant funding, but rather a higher volume of continuous, steady funding from a source that is not vulnerable to the delays and uncertainty that have plagued the effort to date. If an appropriate dedicated funding source is established—perhaps with the oil spill penalties as a start—restoration can proceed on the scale required to save wetlands and the benefits they provide to the regional and national economy. This, according to many of the firms interviewed for this study, is also critical for building a job-creating coastal restoration industry.

VIII. Conclusion

Gulf Coast wetlands provide habitat for commercial fish and shellfish, protect against flooding, bring revenue from recreation and tourism, and provide an important reservoir of soil carbon. Restoring wetlands is therefore critical not just to the environment but also to the regional and national economy.

Undertaking coastal restoration on the scale needed to reverse decades of wetlands loss presents a challenge and an opportunity. The challenge is to make an adequate funding commitment. Realizing the many projects that have already been identified requires steady resources, without which the agencies and firms charged with carrying out the work cannot achieve the stability they need in order to be effective. Strategic plans have already been made and federal programs established, but these need to be integrated and fully funded in the short term, as well as for decades to come.

The opportunity posed by coastal restoration is to grow an important segment of the marine construction industry at a time when its traditional markets are declining or undependable. Restoring wetlands can provide an alternative for well-established firms, including many small businesses, to save and create jobs by diversifying into an activity that protects the environment, benefits other industries and represents a critical investment in the future.

The Mississippi River Delta is unique in combining one of the world's largest and most productive river deltas with the most industrialized economy. The Gulf region, having experienced the potentially destructive effects of development on the very ecosystems that feed its economy, may have lessons for similar delta regions in Asia, Africa, and Latin America. U.S. agencies and firms are developing techniques and products that may be in increasing demand in the future. In the long term, as countries face threats to their wetlands from development and from sea level rise, the Gulf region's evolving capabilities in coastal restoration could make it a future leader in similar efforts in the world's threatened coastal regions.

Appendix: Full set of firm-level data

Employees		$US Millions	
1-100	☺	0 - 33	$
101-500	☺☺	33 - 100	$$
501-1500	☺☺☺	100 - 500	$$$
1501-10000	☺☺☺☺	500 - 1,000	$$$$
10000+	☺☺☺☺☺	1,000 - 10,000	$$$$$
		10,000+	$$$$$$

Company Name	U.S. Headquarters		Relevant U.S. Manufacturing Locations		Company Size
Manufactured Equipment & Repair					
Marine Vessel Manufacture					
BAE Systems (United Kingdom) 1986	Arlington	VA	Mobile	AL	☺☺☺ $$
			San Diego	CA	
			San Francisco	CA	
			Jacksonville	FL	
			Pearl Harbor	HI	
			Moss Point	MS	
			Norfolk	VA	
Bath Iron Works 1884	Bath	ME	Mobile	AL	☺☺☺☺☺ $$$$
			San Diego	CA	
			Washington	DC	
			Mayport	FL	
			Pearl Harbor	HI	
			Bath	ME	
			Pascagoula	MS	
			Norfolk	VA	
			Everett	WA	
Bollinger Shipyards 1946	Lockport	LA	Amelia	LA	☺☺☺☺ $$$
			Golden Meadow	LA	
			Harvey	LA	
			Larose	LA	
			Lockport	LA	
			Mathews*	LA	
			New Orleans	LA	
			St. Rose*	LA	
			Sulphur	LA	
			Texas City	TX	

Company Name	U.S. Headquarters		Relevant U.S. Manufacturing Locations		Company Size
Marine Vessel Manufacture (cont'd)					
Conrad Industries 1948	Morgan City	LA	Amelia	LA	☺☺☺ $$$
			Morgan City	LA	
			Orange	TX	
Derecktor Shipyards 1947	Mamaroneck	NY	Bridgeport	CT	☺☺ $
			Dania	FL	
			Mamaroneck	NY	
Edison Chouest 1960	Cut Off	LA	Tampa	FL	☺☺☺ $$
			Cut Off	LA	
			Fourchon	LA	
			Gulfport	LA	
			Houma	LA	
			Larose	LA	
			Leesville	LA	
			Mandeville	LA	
			Schriever	MS	
			Houston	TX	
Fincanteiri Marine Group (Italy) 1968	Marinette	WI	Green Bay	WI	☺☺☺ N/A
			Marinette	WI	
			Sturgeon Bay	WI	
Huntington Ingalls Industries 1996	Newport News	VA	San Diego	CA	☺☺☺☺☺ $$$$$$
			Avondale	LA	
			New Orleans	LA	
			Gulfport	MS	
			Pascagoula	MS	
			Newport News	VA	
			Virginia Beach	VA	
Leevac Industries 1913	Jennings	LA	Jennings	LA	☺☺ $$
			Lake Charles	LA	
Main Iron Works 1947	Houma	LA	Houma	LA	☺☺ $
Tidewater, Inc. 1956	Amelia	LA	Oxnard	CA	☺☺☺☺ $$$$$
			Amelia	LA	
			Houma	LA	
			Houston	TX	

Company Name	U.S. Headquarters		Relevant U.S. Manufacturing Locations		Company Size
Marine Vessel Manufacture (cont'd)					
Vigor Industrial **1977**	Seattle	WA	San Diego	CA	☺☺ $$$$$
			Portland	OR	
			Bremerton	WA	
			Everett	WA	
			Port Angeles	WA	
			Seattle	WA	
			Tacoma	WA	
VT Halter Marine **2002**	Pascagoula	MS	Escatawpa	MS	☺☺ $$$
			Moss Point	MS	
			Pascagoula	MS	
Dredge Attachments					
Anvil Attachments **1969**	Slaughter	LA	Slaughter	LA	☺ $
Atlas Manufacturing Company **1998**	Monticello	MS	Monticello	MS	☺ $
Caterpillar ***(See Excavators)***					
Deere-Hitachi Construction Machinery Corporation ***(See Excavators)***					
Gensco Equipment **(Canada)** **1987**	Decatur	GA	Decatur	GA	N/A
Gradall ***(See Excavators)***					
Hawco **1968**	Slaughter	LA	Slaughter	LA	N/A
Heiden Inc. **1958**	Manitowoc	WI	Manitowoc	WI	☺ $
Hyundai Construction Equipment ***(See Excavators)***					
Mack Manufacturing **1942**	Theodore	AL	Theodore	AL	☺ $
PSM, LLC **1984**	Woodinville	WA	Woodinville	WA	☺ $
SPI/Mobile Pulley Works ***(See Pumps)***					
Volvo Construction Equipment ***(See Excavators)***					
Valby Grapples	Spencer	NY	Spencer	NY	N/A

Company Name	U.S. Headquarters		Relevant U.S. Manufacturing Locations		Company Size
Dredge Attachments (cont'd)					
Young Corporation *(See Excavators)*					
Cutterhead/Pipeline Dredges					
American Marine and Machinery Company 1959	Hendersonville	TN	Hendersonville	TN	☺ $
Dredging and Marine Company, LLC 1986	Millersville	TN	Millersville	TN	☺ $
Dredging Supply Company 1992	Reserve	LA	Reserve Greenbush Poplarville	LA MI MS	☺ N/A
Ellicott Dredges 1885	Baltimore	MD	Baltimore	MD	☺ $$
IMS Dredge 1986	New Richmond	WI	New Richmond	WI	☺ $
MudCat Dredges	New Richmond	WI	New Richmond	WI	N/A
SRS Crisafulli 1966	Glendive	MT	Glendive	MT	☺ $
VMI Inc. 1972	Cushing	OK	Cushing	OK	☺ $
Excavators					
Badger Equipment Company *(See Cranes)*					
Caterpillar 1925	Peoria	IL	Peoria	IL	☺☺☺☺☺ $$$$$$
CNH America 1966	Carol Stream	IL	Calhoun Burlington Carol Stream	GA IA IL	☺☺☺☺☺ $$$$$$
Deere-Hitachi Construction Machinery Corporation (U.S. - South Korea) 1988	Kernersville	NC	Kernersville	NC	☺☺ $$$
Gradall Excavators 1941	New Philadelphia	OH	New Philadelphia	OH	☺☺ $$$
Hyundai Construction Equipment (South Korea)	Elk Grove Village	IL	Norcross Elk Grove Village	GA IL	☺ $$

Company Name	U.S. Headquarters		Relevant U.S. Manufacturing Locations		Company Size
Excavators (cont'd)					
Kobelco Construction Equipment (Italy) 1982	Calhoun	GA	Calhoun	GA	☺☺ $$$
Komatsu America Corp. (Japan) 1970	Rolling Meadows	IL	Newberry	SC	☺☺☺☺ $$$$$
			Chatanooga	TN	
Link-Belt Construction Equipment Company (Japan) 1974	Lexington	KY	Lexington	KY	☺☺☺ $$$
Liebherr Mining and Construction Company *(See Cranes)*					
Terex Corporation *(See Cranes)*					
Volvo Construction Equipment, North America (Sweden) 1984	Asheville	NC	Shippensburg**	PA	☺☺ $$$
Young Corporation 1902	Seattle	WA	Seattle	WA	☺ N/A
			Woodenville	WA	
Cranes					
Badger Equipment 1945	Winona	MN	Winona	MN	☺ $
Caterpillar *(See Excavators)*					
Komatsu America Corp. *(See Excavators)*					
Liebherr Mining and Construction Company (Switzerland) 1970	Newport News	VA			☺☺ $$
Link Belt Construction Equipment Company *(See Excavators)*					
Manitowoc Company, Inc 1902	Manitowoc	WI	Shady Grove	PA	☺☺☺☺☺ $$$$$
			Manitowoc	WI	
Terex Corporation	Westport	CT	Westport	CT	☺☺☺☺☺ $$$$$
			Waverly	IA	
Pumps					
Buffalo Pumps 1887	North Tonawanda	NY	North Tonawanda	NY	☺☺☺ $$

Company Name	U.S. Headquarters		Relevant U.S. Manufacturing Locations		Company Size
Pumps (cont'd)					
Carver Pump Company **1939**	Muscatine	IA	Muscatine	IA	☺ $
Eaton Corporation **1911**	Cleveland	OH	Searcy	AR	☺☺☺☺☺ $$$$$
			Cleveland	OH	
			Shawnee	OK	
			Greenwood	SC	
Ellicott Dredges *(See Dredges)*					
Georgia Iron Works (GIW) **1891**	Grovetown	GA	Grovetown	GA	☺☺ $$
			Thomson	GA	
Lawrence Pumps, Inc. **1909**	Lawrence	MA	Lawrence	MA	☺☺ $$
Metso **(Finland)** **1999**	Columbia	SC	Birmingham	AL	☺☺☺☺☺ $$$$$$
Pearce Group	Prairieville	LA	Prairieville	LA	☺ $
SPI/Mobile Pulley **1982**	Mobile	AL	Mobile	AL	☺☺ $$
SRS Crisafulli *(See Dredges)*					
The Weir Group **(United Kingdom)** **1871**	Odessa	TX	Ft. Worth	TX	☺☺☺☺☺ $$$$$
VMI Inc. *(See Dredges)*					
Engines					
Caterpillar *(See Excavators)*					
Cummins **1913**	Columbus	IN			☺☺☺☺☺ $$$$$$
Hyundai *(See Excavators)*					
John Deer *(See Excavators)*					
Perkins Engines, LTD (England) **1963**	Mossville	IL	Griffin	GA	☺☺☺☺ $$$$$
Wärtsilä Corporation (Finland) **1914**	Houston	TX			☺☺☺☺☺ $$$$$

Company Name	U.S. Headquarters		Relevant U.S. Manufacturing Locations		Company Size
Amphibious Equipment					
Frogco Amphibious Equipment 2001	Houma	LA	Houma	LA	☺ $
Kori-Sunland-Kori Services 2000	Eunice	LA	Eunice	LA	☺ $
Marsh Buggies, Inc. 1969	Belle Chasse	LA	Belle Chasse	LA	☺ $
Wetland Equipment Company 2002	Thibodaux	LA	Thibodaux	LA	☺ $
Wilco Marsh Buggies 1974	Harvey	LA	Harvey	LA	☺ $$
Wilson Marsh Equipment 1989	Marrero	LA	Marrero	LA	☺ $
Repair					
BAE Systems *(See Marine Vessels)*					
Boland Marine and Industrial Services 1866	New Orleans	LA	New Orleans	LA	☺ $
Bollinger Shipyards *(See Marine Vessels)*					
B&A Marine 1966	Brooklyn	NY	Brooklyn	NY	☺ $
Buck Kreihs 1993	New Orleans	LA	New Orleans	LA	☺☺ $$
Cashman Equipment Company *(See Mobilization & Demobilization)*					
Conrad Industries *(See Marine Vessels)*					
Cross Group Inc. *(See Mobilization & Demobilization)*					
Derecktor Shipyards *(See Marine Vessels)*					
Edison Chouest, LLC *(See Marine Vessels)*					
Fincantieri Marine Group (FMG) *(See Marine Vessels)*					
Huntington Ingalls Industries *(See Marine Vessels)*					
J.R Grey Barge Inc. *(See Mobilization & Demobilization)*					
LEEVAC Industries LLC *(See Marine Vessels)*					
Main Iron Works LLC *(See Marine Vessels)*					
North Florida Shipyards 1970	Jacksonville	FL	Jacksonville Mayport	FL FL	☺☺ N/A

Company Name	U.S. Headquarters		Relevant U.S. Manufacturing Locations		Company Size
Repair (cont'd)					
Pierce Pump Supply, Inc. ***(See Pumps)***					
Southern Services & Equipment, Inc. ***(See Construction)***					
Signal Ship Repair **2010**	Mobile	AL	Mobile	AL	☺ $
Tidewater, Inc. ***(See Marine Vessels)***					
Vigor Industrial LLC ***(See Marine Vessels)***					

Company Name	U.S. Headquarters		Other Relevant U.S. Employee Locations		Company Size
Services					
Design					
ABMB Services **1985**	Baton Rouge	LA	New Orleans	LA	☺ $
			Jackson	MS	
			Madison	MS	
			Vicksburg	MS	
AECOM Technology Corporation **1980**	Los Angeles	CA	Birmingham	AL	☺☺☺☺☺ $$$$$
			Huntsville	AL	
			Saint Petersburg	FL	
			Tampa	FL	
			New Orleans	LA	
			Houston	TX	

Company Name	U.S. Headquarters		Other Relevant U.S. Employee Locations		Company Size
Design (cont'd)					
Anchor QEA **1997**	Seattle	WA	Anchorage	AK	☺☺ $
			Mission Viejo	CA	
			San Francisco	CA	
			Andover	MA	
			Beverly	MA	
			Cambridge	MA	
			Columbia	MD	
			Ocean Springs	MS	
			Montvale	NJ	
			Glens Falls	NY	
			Syracuse	NY	
			Portland	OR	
			Newtown	PA	
			Swarthmore	PA	
			Austin	TX	
			Houston	TX	
			Bellingham	WA	
			Gig Harbor	WA	
			Kirkland	WA	
			Wenatchee	WA	
Arcadis **1982**	Highlands Ranch	CO	Mobile	AL	☺☺☺☺☺ $$$$$
			Montgomery	AL	
			Orange Beach	AL	
			Boca Raton	FL	
			Fort Myers	FL	
			Jacksonville	FL	
			Maitland	FL	
			Miami	FL	
			Pensacola	FL	
			Plantation	FL	
			Sarasota	FL	
			Tallahassee	FL	
			Tampa	FL	

Company Name	U.S. Headquarters		Other Relevant U.S. Employee Locations		Company Size
Design (cont'd)					
Arcadis (cont'd) **1982**	Highlands Ranch	CO	West Palm Beach	FL	☺☺☺☺☺ $$$$$
			Baton Rouge	LA	
			Metairie	LA	
			New Orleans	LA	
			Baltimore	MD	
			Austin	TX	
			Dallas	TX	
			Fort Worth	TX	
			Houston	TX	
			Lubbock	TX	
			Lufkin	TX	
			Midland	TX	
			Nederland	TX	
			San Antonio	TX	
BCG Engineering & Consulting, Inc.	Metairie	LA	Baton Rouge	LA	☺ $
			Vicksburg	MS	
BCI Engineers and Scientists	Lakeland	FL	Lakeland	FL	N/A
Bechtel **1898**	San Francisco	CA	Houston	TX	☺☺☺☺☺ $$$$$$
			Sugar Land	TX	
Black & Veatch **1915**	Overland Park	KS			☺☺☺☺ $$$$
C.F. Bean, LLC *(See Construction)*					
CH2M Hill **1946**	Englewood	CO			☺☺☺☺☺ $$$$$
Coastal Science and Engineering **1984**	Columbia	SC			☺ $
Coastal Tech **1984**	Vero Beach	FL	Melbourne	FL	☺ $
			Sarasota	FL	
			Austin	TX	
			Galveston	TX	
Conti Federal Services **1989**	Edison	NJ	Jacksonville	FL	☺☺ $
			New Orleans	LA	
			Concord	MA	

Company Name	U.S. Headquarters		Other Relevant U.S. Employee Locations		Company Size
Design (cont'd)					
DQSI 1989	Covington	LA	New Orleans	LA	☺ $
			Stennis Space Center	MS	
Eustis Engineering 1946	Metairie	LA	Scott	LA	☺ $
			Gulfport	MS	
GOTECH, Inc. 1981	Baton Rouge	LA			☺ $
HDR, Inc. 1917	Omaha	NE	Athens	AL	☺☺☺☺ $$$$$
			Fort Myers	FL	
			Niceville	FL	
			Pensacola	FL	
			Sarasota	FL	
			Tampa	FL	
			Lafayette	LA	
			Metairie	LA	
			Corpus Christi	TX	
			Dickinson	TX	
			Houston	TX	
Moffatt & Nichol 1945	Long Beach	CA	Jacksonville	FL	☺ $
			Orlando	FL	
			Tampa	FL	
			Baton Rouge	LA	
			Vicksburg	MS	
			Houston	TX	
Odebrecht *(See Construction)*					
Royal Engineering 2006	New Orleans	LA			☺ $
Royal Haskoning (The Netherlands) 1980	New Orleans	LA			☺☺☺ $$$$
Shaw Group *(See Construction)*					
Taylor Engineering 1983	Jacksonville	FL	Tampa	FL	☺ $
			West Palm Beach	FL	
			Baton Rouge	LA	

Company Name	U.S. Headquarters		Other Relevant U.S. Employee Locations		Company Size
Dredging					
Great Lakes Dredge & Dock 1890	Oak Brook	IL			☺☺☺ $$$$
Jay Cashman, Inc. (Cashman) 1994	Quincy	MA			☺☺ $$
Dutra Group 1973	San Rafael	CA			☺☺ $$$
Inland Dredging Company 1997	Dyersburg	TN			☺ $$
Javeler Construction Company	New Iberia	LA			☺ $
Manson Construction 1905	Seattle	WA	Richmond Long Beach Jacksonville Houma	CA CA FL LA	☺☺ $$
Norfolk Dredging Company 1899	Chesapeake	VA			☺ $
Pine Bluff Sand and Gravel 1913	White Hall	AR	Delaware Columbia Alexandria Baton Rouge	AR IL LA LA	☺☺ N/A
Mike Hooks 1946	West Lake	LA			☺☺ $$
Orion Marine 2003	Houston	TX	Tampa Lake Charles Port Lavaca Tacoma	FL LA TX WA	☺☺☺ $$$
Weeks Marine 1919	Cranford	NJ	Bourg Covington Houma Camden Jersey City Houston	LA LA LA NJ NJ TX	☺☺☺ $$$$
Construction					
ABMB Services *(See Design)*					
Aquaterra Contracting 1999	Cleburne	TX	Corpus Christi New Orleans	TX LA	☺ $

Company Name	U.S. Headquarters		Other Relevant U.S. Employee Locations		Company Size
Construction (cont'd)					
B.I.S. Services, LLC **1998**	Kenner	LA			N/A
BCG Engineering & Consulting, Inc. *(See Design)*					
Bertucci Industrial Services **1993**	Jefferson	LA			☺ $$
Black and Veatch *(See Design)*					
Boh Bros. **1909**	New Orleans	LA	Hammond	LA	☺☺☺☺ $$$
			Baton Rouge	LA	
Cajun Constructors **1973**	Baton Rouge	LA	Houston	TX	☺ $$
			Port Arthur	TX	
CDM *(See Design)*					
C.F. Bean, LLC **1999**	Belle Chasse	LA			☺☺ $$
CH2M Hill *(See Design)*					
Circle, Inc. **1960**	Belle Chasse	LA			☺ $
Conti Federal Services, Inc. *(See Desgin)*					
Creek Services **2003**	Gretna	LA	Morgan City	LA	☺ $
			Doniphan	MO	
Cycle Construction, LLC **2000**	Kenner	LA			☺ $
DQSI *(See Design)*					
Hill Brothers Construction Co. **1978**	Falkner	MS			☺☺☺ $
Integrated Pro Services **2005**	New Orleans	LA			☺ $
James Construction Group **1998**	Baton Rouge	LA	Bartow	FL	☺☺☺ $$
			Ruston	LA	
			Lafayette	LA	
			Belton	TX	
			Houston	TX	
			Pasadena	TX	

Company Name	U.S. Headquarters		Other Relevant U.S. Employee Locations		Company Size
Construction (cont'd)					
L&A Contracting **1947**	Hattiesburg	MS			☺☺ $$
Luhr Bros., Inc. **1939**	Columbia	IL	Alexandria	LA	☺☺ $$$
			Lafayette	LA	
			Lake Charles	LA	
			New Orleans	LA	
			Port Allen	LA	
			Cape Girardeau	MO	
M.R. Pittman Group **2005**	Point Harahan	LA			N/A
Odebrecht **(Brazil)** **1945**	Coral Gables	FL	New Orleans	LA	☺☺☺☺☺ $$$$$
Phylway Construction **1992**	Thibodaux	LA			☺☺ $$
Progressive Construction **1995**	Boyce	LA			☺ $$
Quality Enterprises **1970**	Naples	FL	New Orleans	LA	☺ $
			Gulfport	MS	
			Chesapeake	VA	
Shaw Group **1987**	Baton Rouge	LA	Fort McClellen	AL	☺☺☺☺☺ $$$$$
			Fort Rucker	AL	
			Hunstville	AL	
			Mobile	AL	
			Boca Raton	FL	
			Melbourne	FL	
			Miami Lakes	FL	
			Palm Beach Gardens	FL	
			St. Petersburg	FL	
			Tampa	FL	
			Winter Garden	FL	
			Addis	LA	
			Baton Rouge	LA	
			Delcambre	LA	

Company Name	U.S. Headquarters		Other Relevant U.S. Employee Locations		Company Size
Construction (cont'd)					
Shaw Group (cont'd) **1987**	Baton Rouge	LA	Houma	LA	☺☺☺☺☺ $$$$$
			Lake Charles	LA	
			Metairie	LA	
			New Orleans	LA	
			Prairieville	LA	
			Shreveport	LA	
			Sulphur	LA	
			Walker	LA	
			West Monroe	LA	
			Austin	TX	
			Dallas	TX	
			Houston	TX	
			La Porte	TX	
			Midland	TX	
			San Antonio	TX	
Southern Services **1996**	Saint Bernard	LA			☺ $
Vistas Construction of Illinois **2000**	Chicago	IL			☺ $
Walsh Group **1983**	Chicago	IL	Tampa	FL	☺☺☺☺ $$$$$
			Atlanta	GA	
			Arlington	TX	
Weston Solutions **1951**	West Chester	PA			☺☺☺☺ $$$
WRS Infrastructure & Development, Inc. **1985**	Tampa	FL	Jacksonville	FL	☺☺ $$
			Miami	FL	
			Tallahassee	FL	
			West Palm Beach	FL	
			Austin	TX	
Logistics					
Acme Truck Line **1960**	Harvey	LA			☺☺☺☺ $$$
American Machinery Movers **1930**	Jefferson	LA			☺ $

Company Name	U.S. Headquarters		Other Relevant U.S. Employee Locations		Company Size
Logistics (cont'd)					
Bengal Transportation Services, LLC 1995	Geismar	LA			☺ $
LTA Logisitics	Miami	FL			N/A
Lonestar Transportation. LLC 1988	Fort Worth	TX			☺☺ $$$
Riccelli Enterprises 1991	Syracuse	NY	New Orleans	LA	☺☺ $$
R.J. Langely, Inc.	Reserve	LA			☺ $
Tango Transport 1991	Shreveport	LA	West Memphis	AR	☺☺☺ $$$
			Sibley	LA	
Mobilization & Demobilization					
Broussard Brothers 1947	Abbeville	LA			☺☺ $
Cashman Equipment Companies 2007	Morgan City	LA			☺ $
Central Boat Rentals 1964	Berwick	LA			☺☺ $
Cross Group Inc. 2001	Houma	LA			☺ $
J.R Grey Barge Inc. 1940	Houma	LA			☺ $
Lafayette Workboat Rentals 2006	Broussard	LA			☺ $
Magnolia Quarterbarges Inc.	Saint Rose	LA			N/A
McDonough Marine Service 1945	Metairie	LA			N/A
Zito Co., LLC 1980	New Orleans	LA			☺☺ $

***Logistic/support and R&D locations**

****To be open in 2014**

IX. References cited

AAPA. (2009). Port Industry Statistics. *American Association of Port Authorities.* Retrieved November 8, 2011 from http://www.aapa-ports.org/Industry/content.cfm?ItemNumber=900&navItemNumber=551.

ADB. (2011). Asian Development Bank - Preparing the Climate Reslilient Infrastructure Improvement in Coastal Zone Project: Bangladesh. *Projects.* Retrieved July 20, 2011, from http://pid.adb.org/pid/TaView.htm?projNo=45084&seqNo=01&typeCd=2.

Auten, Kim. (2011). Owner, Marsh Buggies, Inc. Personal communication with CGGC research staff. July 13, 2011.

Barbaccia, Tina. (2011). Total U.S. Construction Machinery Exports at Midyear-2011 at $11 Billion. *Equipment World.* August 29, 2011.Retrieved September 18, 2011 from http://www.equipmentworld.com/total-u-s-construction-machinery-exports-at-midyear-2011-at-11-billion/.

BLS. (2010). Bureau of Labor Statistics - May 2010 National Occupational Employment and Wage Estimates, United States. *Occupational Employment Statistics* Retrieved September 9, 2011, from http://www.bls.gov/oes/current/oes_nat.htm#11-0000.

BOEMRE. (2011). Gulf of Mexico Energy Security Act (GOMESA). *Bureau of Ocean Energy Management, Regulation and Enforcement.* Retrieved October 5, 2011, from http://www.boemre.gov/offshore/GOMESARevenueSharing.htm.

CIAP. (2011). February 2011 Program Update. *Coastal Impact Assessment Program - Louisiana.* Retrieved August 10, 2011, from http://www.lacpra.org/assets/docs/CIAP%20News%20Letter%20February%202011.pdf.

Couvillion, Brady R., John A. Barras, Gregory D. Steyer, William Sleavin, Michelle Fischer, Holly Beck, Nadine Trahan, Brad Griffin, and David Heckman. (2011). Land Area Change in Coastal Louisiana from 1932 to 2010. Reston, Virginia: U.S. Geological Survey. http://pubs.usgs.gov/sim/3164/downloads/SIM3164_Pamphlet.pdf.

CPRA. (2008). Integrated Ecosystem Restoration and Hurricane Protection: Louisiana's Comprehensive Master Plan for a Sustainable Coast. Baton Rouge, LA: Baton Rouge, LA. pp. 140. http://coastal.louisiana.gov/index.cfm?md=pagebuilder&tmp=home&nid=24&pnid=0&pid=28&fmid=0&catid=0&elid=0.

---. (2011). Louisiana's Coast Ecosystem Restoration & Flood Protection: Projects. Retrieved June 7, 2011, from http://www.coastal.la.gov/index.cfm?md=pagebuilder&tmp=home&nid=78&pnid=0&pid=97&catid=0&elid=0.

CWPPRA. (2011a). About CWPPRA. *Coastal Wetlands Planning, Protection and Restoration Act* Retrieved September 21, 2011, from http://lacoast.gov/new/About/Default.aspx.

---. (2011b). CWPPRA Projects. *Coastal Wetlands Planning, Protection and Restoration Act: Managing Agencies.* Retrieved August 11, 2011 from http://lacoast.gov/new/Projects/List.aspx.

---. (2011c). Project Reports. *Coastal Wetlands Planning, Protection and Restoration Act: Publications.* Retrieved June 7, 2011, from http://lacoast.gov/new/Pubs/Reports/project.aspx.

Dredge Source. (2011). Dredge Source. *Dredges.* Retrieved June 13, 2011, from http://www.dredgesource.com/dredgeinfo.aspx.

Dredging News Online. (2011). Weeks Marine to Build Two New Dredgers - IHC Merwede Provides Design for Hopper Dredger. *Sand and Gravel*. Retrieved August 17, 2011, from http://www.sandandgravel.com/news/article.asp?v1=14641.

Dredging Today. (2010). India: Government to Import Ellicott's Dredgers. *Dredging Today*. Retrieved August 18, 2011, from http://www.dredgingtoday.com/2010/11/30/india-government-to-import-ellicotts-dredgers/.

EIA. (2011). Gulf of Mexico Fact Sheet: Energy Data. Retrieved November 8, 2011 from http://www.eia.gov/special/gulf_of_mexico/data.cfm#year_end_crude_ngl_reserves.

Entergy. (2010). Building a Resilient Energy Gulf Coast: Executive Report. Washington, DC: America's Wetland Foundation. http://www.entergy.com/content/our_community/environment/GulfCoastAdaptation/Building_a_Resilient_Gulf_Coast.pdf.

GAO. (2007). Coastal Wetlands: Lessons Learned from Past Efforts in Louisiana Could Help Guide Future Restoration and Protection. Washington, DC: Government Accountability Office. December 2007.

Gordon, Kate, Jeffrey Buchanan and Phillip Singerman. (2011). Beyond Recovery: Moving the Gulf Coast Toward a Sustainable Future. Washington, DC: Center for American Progress and Oxfam America. February 2011. http://www.americanprogress.org/issues/2011/02/beyond_recovery.html.

Gulf Restoration Network. (2010). Wetland Importance. *Wetlands*. Retrieved August 5, 2011 from http://healthygulf.org/our-work/wetlands/wetland-importance.

Hanson, William. (2011). Vice President U.S. Business Development. Personal communication with CGGC research staff. July 8, 2011.

IDR. (2011). News & Updates. *International Dredging Review*. Retrieved September 7, 2011, from http://www.dredgemag.com/news-updates.php.

Ko, Jae-Young and John Day. (2004). "Wetlands: Impacts of Energy Development in the Mississippi Delta." *Encyclopedia of Energy, 6*: 397-408.

KOICA. (2011). Korea International Cooperation Agency - Korean Government Grants 3 Million US Dollars to Support the Indonesian Government in Building Coastal Protection and Management Policy. *Building Coastal Protection and Management Policy*. Retrieved July 20, 2011, from http://koicaindonesia.org/press-release/116-building-coastal-protection-and-management-policy.

Leybovich, Ilya. (2011). Construction Equipment Manufacturing to Grow in 2011. *Thomasnet Industry Market Trends*. January 6, 2011.Retrieved September 18, 2011 from http://news.thomasnet.com/IMT/archives/2011/01/construction-equipment-manufacturing-to-grow-in-2011.html.

Lopez, John A. (2008). Use of Natural Gas for Coastal Restoration in Coastal Louisiana. New Orleans: Lake Pontchartrain Basin Foundation. http://www.saveourlake.org/PDF-documents/our-coast/Nat-Gas-Coastal%20Restoration-Final-Nov2010.pdf.

Luettich, Richard. (2011). Professor of Marine Sciences, UNC Chapel Hill. Personal communication with CGGC Research Staff. August 23, 2011.

Mabus, Ray. (2010). America's Gulf Coast: A Long Term Recovery Plan after the Deepwater Horizon Oil Spill. Washington, DC. September 2010. http://www.restorethegulf.gov/release/2010/09/28/america%E2%80%99s-gulf-coast-long-term-recovery-plan-after-deepwater-horizon-oil-spill.

Malbrough, Oneil. (2011). Central Gulf District Manager, Shaw Group. Personal communication with CGGC research staff. July 11, 2011.

NMFS. (2011). Gulf of Mexico Regional Ecosystem Restoration Strategy (Preliminary). Washington, DC: National Marine Fisheries Service. pp. 1; 6. October 5, 2011. http://www.epa.gov/gcertf/pdfs/gcertfenlishver.pdf.

NOAA. (2010). Oil and Gas Exploration. *National Oceanic and Atmospheric Administration.* Retrieved November 8, 2011 from http://oceanexplorer.noaa.gov/explorations/06mexico/background/oil/oil.html.

---. (2011). The Gulf of Mexico at a Glance: A Second Glance. Washington, DC: U.S. Department of Commerce. http://stateofthecoast.noaa.gov/gulfreport.html.

NRCS. (1992). Wetland Restoration, Enhancement, or Creation. In United States Department of Agriculture (Ed.), *Engineering Field Handbook* (pp. 13.11-13.77). Washington, DC: United States Department of Agriculture.

Oxford Economics. (2010). Potential Impact of the Gulf Oil Spill on Tourism (Report prepared for the U.S. Travel Association). Oxford, UK: Oxford Economics. http://www.scribd.com/doc/34776206/Gulf-Oil-Spill-Analysis-Oxford-Economics-710.

Peyronnin, Steven. (2011). Executive Director, Coalition to Restore Coastal Louisiana. Personal communication with CGGC research staff. August 9, 2011.

Prine, Bill. (2011). Vice President, SPI/Mobile Pulley. Personal communication with CGGC Research Staff. July 8, 2011.

Ratnam, Gopal. (2011, August 11, 2011). Huntington Ingalls Seeks Alternatives to Closing Avondale. *Bloomberg.* Retrieved November 8, 2011 from http://www.bloomberg.com/news/2011-07-06/huntington-ingalls-seeks-alternatives-to-closing-avondale-1-.html.

Robertson, Campbell. (2011). Beyond the Oil Spill, the Tragedy of an Ailing Gulf. *The New York Times*. April 20, 2011, p. A17. Retrieved September 20, 2011, from http://www.nytimes.com/2011/04/21/us/21spill.html?_r=1&scp=4&sq=BP%20Clean%20Water%20Act%20Fines&st=cse.

SBA. (2011). Table of Small Business Size Standards Matched to North American Industry Classification System Codes. *U.S. Small Business Administration: What is SBA's definition of a small business concern?* Retrieved September 7, 2011, from http://www.sba.gov/sites/default/files/Size_Standards_Table.pdf.

Schleifstein, Mark. (2011). Louisiana is Losing a Football Field of Wetlands an Hour, New U.S. Geological Survey Study Says. *nola.com, Louisiana Environment and Flood Control.* Retrieved August 3, 2011 from http://www.nola.com/environment/index.ssf/2011/06/louisiana_is_losing_a_football.html.

Sorrell, Steve, Jamie Speirs, Roger Bentley, Adam Brandt, and Richard Miller. (2009). Global Oil Depletion: An Assessment of the Evidence for a Near-term Peak in Global Oil Production: UK Energy Research Centre. August 2009. http://www.ukerc.ac.uk/support/Global%20Oil%20Depletion.

Srinivas, Rajesh. (2011). Vice President, Taylor Engineering. Personal communication with CGGC Research Staff. August 12, 2011.

Stephen Crooks, Dorothée Herr, Jerker Tamelander, Dan Laffoley, and Justin Vandever. (2011). Mitigating Climate Change through Restoration and Management of Coastal Wetlands and Near-shore Marine Ecosystems: Challenges and Opportunities. Washington, DC: World Bank. pp. 19-21. March, 2011.

http://siteresources.worldbank.org/ENVIRONMENT/Resources/MtgtnCCthruMgtofCoastalWetlands.pdf.

The World Bank. (2011). Integrated Coastal Zone Management. *Projects & Operations.* Retrieved July 20, 2011, from http://web.worldbank.org/external/projects/main?pagePK=64283627&piPK=73230&theSitePK=40941&menuPK=228424&Projectid=P097985.

Twilley, Robert. (2007). Coastal Wetlands & Global Climate Change: Gulf Goast Wetland Sustainability in a Changing Climate: Pew Center on Global Climate Change. http://www.pewclimate.org/docUploads/Regional-Impacts-Gulf.pdf.

USACE. (1989). Environmental Engineering for Coastal Protection. Washington, DC: United States Army Corps of Engineers.

---. (2004). Louisiana Coastal Area (LCA) Ecosystem Restoration Study (No. I): United States Army Corps of Engineers. pp. 223-224. http://www.crcl.org/new_web/LCA/LCA_Near_Term_Ecosystem_Restoration%20_Study_and_DPEIS%20_7_04/Vol__1/Main_Report.pdf.

---. (2011). HSDRRS Construction Contractors Contract Awards. *U.S. Army Corps of Engineers - New Orleans District* Retrieved May 31, 2011, from http://www.mvn.usace.army.mil/hps/ConstructionContractorsContractAwards.pdf.

VOV. (2011). Voice of Vietnam - Germany and Austrailia help Vietnam cope with climate change. *Society* Retrieved July 20, 2011, from http://english.vov.vn/Home/Germany-and-Australia-help-Vietnam-cope-with-climate-change/20116/127189.vov.

Welp, Timothy and Dr. Gary Ray. (2011). Application of Long Distance Conveyance (LDC) of Dredged Sediments to Louisiana Coastal Restoration. Vicksburg, MS: United States Army Corps of Engineers. http://el.erdc.usace.army.mil/elpubs/pdf/tr11-2.pdf.

Wetta, Bob. (2011). President, DSC Dredge. Personal communication with CGGC research staff. July 12, 2011.

Wilkins, James G., Rodney E. Emmer, Dennis Hwang, George Paul Kemp, Barrett Kennedy, Hassan Mashriqui, and Bruce Sharky. (2008). Louisiana Coastal Hazard Mitigation Guidebook. Baton Rouge, LA: Louisiana Sea Grant College Program. http://www.lsu.edu/sglegal/.

Wilson, Dean. (2011). Vice President, Wilco Marsh Buggies & Draglines. Personal communication with CGGC research staff. June 29, 2011.

Wingate, Mark. (2011). Branch Chief, New Orleans District, United States Army Corps of Engineers. Personal communication with CGGC research staff. July 29, 2011.