TEXAS DEPARTMENT OF TRANSPORTATION

Master Plan for the Gulf Intracoastal Waterway in Texas

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A Master Plan for the Gulf Intracoastal Waterway in Texas

Issues, Opportunities, and Challenges

This document presents the issues surrounding the ongoing, unmet maintenance needs of the Texas portion of the Gulf Intracoastal Waterway (or GIWW-T). It also presents recommendations for next steps to address those needs. In short, increased coastal development—particularly in the energy sector resulting from development of the Eagle Ford Shale play in South/Central Texas—has made the GIWW-T more important than it has ever been to the economy of Texas. Though the U.S. Army Corps of Engineers (aka the Corps) is primarily responsible for maintaining the GIWW-T, reductions in federal funding have limited its ability to meet that responsibility. Over the long term, the net result of improperly maintaining the GIWW-T will be lost economic opportunity for Texas. Furthermore—beyond merely catching up in terms of maintaining the waterway—all indications are that the GIWW-T will need to accommodate an ever-increasing volume of goods (especially petroleum and petrochemicals) to keep up with the shipping demands of the private sector. Texas Department of Transportation (TxDOT) Project 0-6807, Texas Gulf Intracoastal Waterway Master Plan, has produced recommendations that will help the GIWW-T provide the capacity needed by the Texas economy in the coming decades. This document summarizes those recommendations.

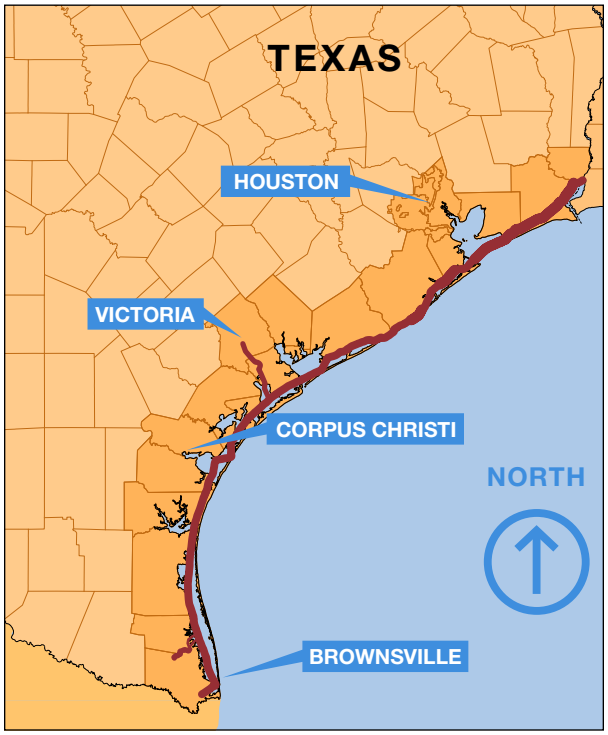


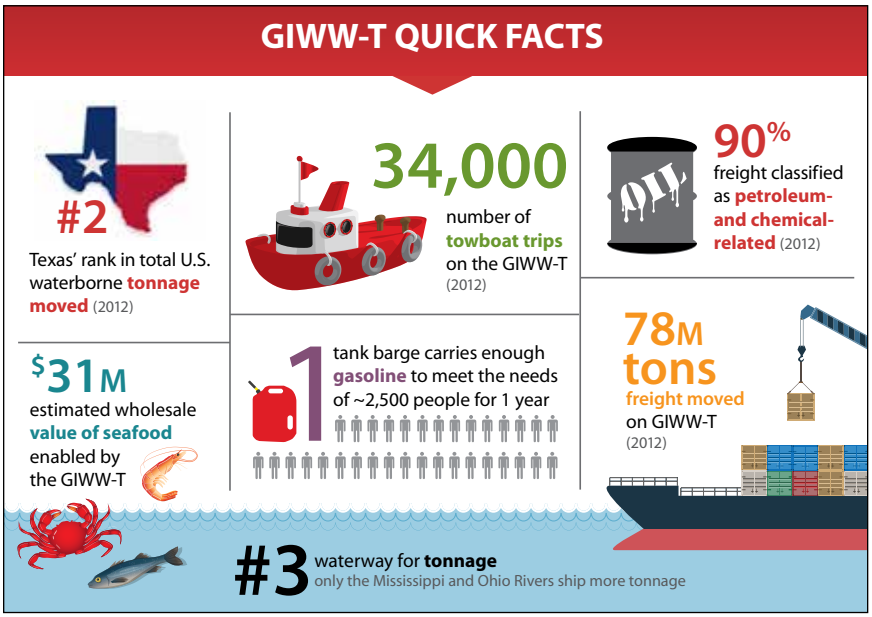
Figure 1. GIWW-T.
Source: Texas A&M Transportation Institute (TTI)

The Gulf Intracoastal Waterway in Texas

The Gulf Intracoastal Waterway (GIWW) is a 1,100-mile-long, shallow-draft, man-made, protected waterway that connects ports along the Gulf of Mexico from St. Marks, Florida, to Brownsville, Texas. As the nation's third busiest inland waterway, the GIWW is an essential component of the nation's transportation network. In addition to the economic benefits derived from the cargo carried on the GIWW, traffic on the waterway reduces highway and rail congestion and also decreases maintenance costs and extends the life of these systems. In addition, water transportation is the most fuel-efficient mode of transportation and produces the least emissions per ton of cargo carried.

Over the long term, the net result of improperly maintaining the GIWW-T will be lost economic opportunity for Texas.

The GIWW-T main channel covers 379 miles of Texas' coastline and handles 67 percent of the entire GIWW's traffic. Figure 1 above shows a map of the GIWW-T and the coastal counties that directly or indirectly benefit from the waterway. The GIWW-T links together 11 deep-draft ports (25 feet or deeper) and 13 shallow-draft channels. Though designed to be 125 feet wide and 12 feet deep, the waterway is not being maintained properly due to insufficient federal funding. The results are costly shipping inefficiencies for Texas businesses—with those expenses passed along to end consumers—and lost revenue for the state.



Source: Waterborne Commerce of the United States: 2012, Institute for Water Resources. U.S. Army Corps of Engineers; A Modal Comparison of Domestic Freight Transportation Effects on the General Public: 2001-2009, Texas A&M Transportation Institute

The maintenance of the GIWW is the responsibility of the Corps. In 1975, TxDOT was named the official non-federal sponsor for the GIWW-T through the Texas Coastal Waterway Act. TxDOT's primary responsibility under the act is to provide right-of-way and disposal areas for by-products of dredging operations and maintenance. The problem is that the gap between maintenance needs on the GIWW-T (e.g., dredging, lock maintenance, and other needs) and services provided by the Corps has widened as federal maintenance dollars have shrunk. The solution, to put it simply, is that either increased federal funding within the current appropriations process for the Corps will occur—which is unlikely—or a different solution is needed to improve the GIWW-T's capacity in order to meet the current and future shipping needs of Texas businesses.

Why Waterborne Freight Matters

Originally constructed to facilitate dry bulk commodity trade between Texas ports (and to facilitate defense during World War II), the GIWW-T

has become an integral component of the extensive supply chains of Texas petrochemical and manufacturing industries. The GIWW-T's importance to the Texas economy is reflected in its high levels of vessel traffic. In 2012, the Lone Star State ranked second in the nation in total waterborne tonnage transported, with 486 million tons (or 21 percent) of the total U.S. maritime freight volume on both deep- and shallow-draft waterways.

Numerous economic studies underline the significant role that the GIWW-T plays in facilitating commerce throughout the Texas Gulf Coast region by moving manufactured goods, farm products, machinery, petroleum and petroleum products, and chemicals. The GIWW-T is integral to some of the state's most important industries. In 2012, for example, nearly 78 million short tons were moved on the GIWW-T, 90 percent of which were petroleum and chemical products.

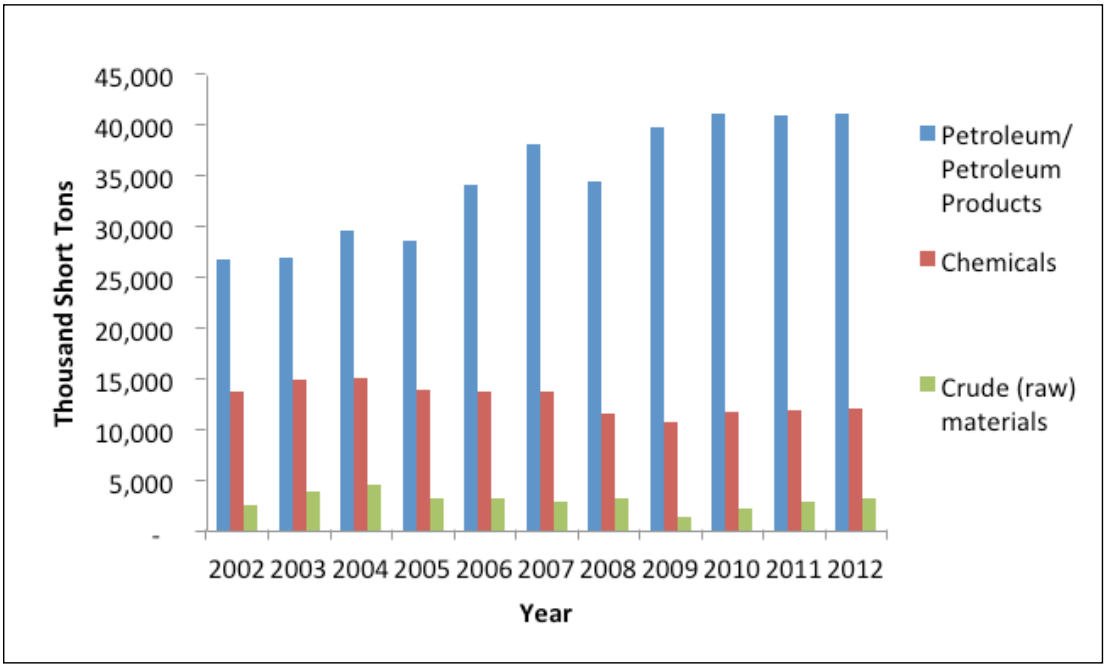


Figure 2. GIWW-T Top Three Commodities Transported 2002–2012. Source: Waterborne Commerce of the United States: 2012, Institute for Water Resources. U.S. Army Corps of Engineers

The ports of Texas are significant to the local, national, and international economies on a large scale largely because of the amount of petroleum processed through refineries located along the coast. In 2012, petroleum and petroleum products represented 67 percent of all commodity tonnage moved through the GIWW-T. Petrochemicals account for an additional 23 percent of tonnage moved.

From 2002 to 2012, the Corps Institute for Water Resources reported a 5 percent average annual increase in short tons of petroleum and petroleum products transported through the GIWW-T. Figure 2 illustrates commodity growth for the top three commodities shipped on the waterway between 2002 and 2012.

Other commodities transported in 2012 on the GIWW-T comprised 3.4 million tons collectively and represent only 4 percent of the 2012 totals. They include:

- Coal.
- Primary manufactured goods.
- Food and farm products.
- Manufactured equipment and machinery.
- Waste and scrap products.

Lastly, waterway transport has significant advantages over other modes of moving freight (i.e., rail and roadway). It does not add to traffic congestion and pavement damage on our streets and highways. In addition, as Figure 3 shows, waterborne transportation is safer, more fuel-efficient, and a better friend of the environment.

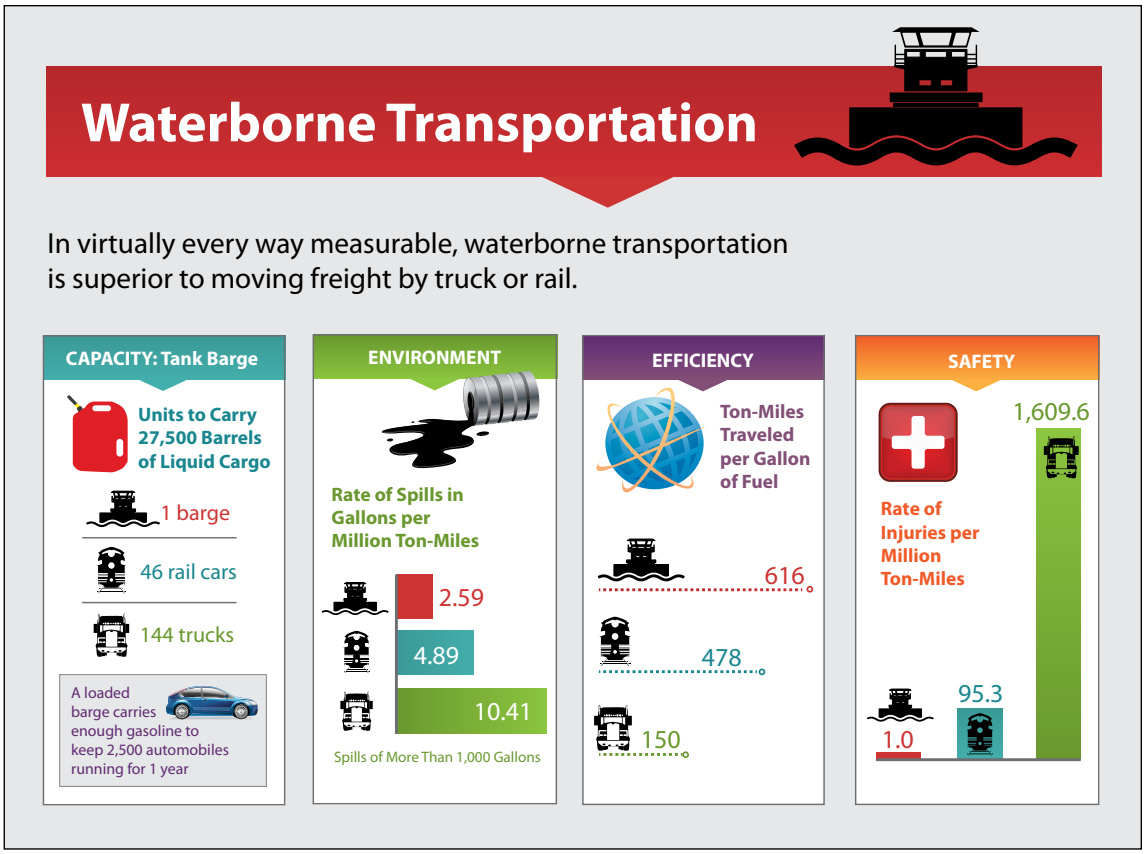


Figure 3. Waterborne Transportation Compared to Truck and Rail. Source: "A Modal Comparison of Domestic Freight Transportation Effects on the General Public: 2001–2009," Texas A&M Transportation Institute

Future Coastal Development Means Economic Opportunity for Texas

A vital GIWW-T working efficiently at full capacity has a positive impact all along the Texas coast. It generates real benefits for Texas, directly and indirectly, by facilitating efficient and effective freight movement and industrial production at all stages of the supply chain, from raw materials to finished products. As public demand for goods increases, production processes accelerate in order to meet it, and

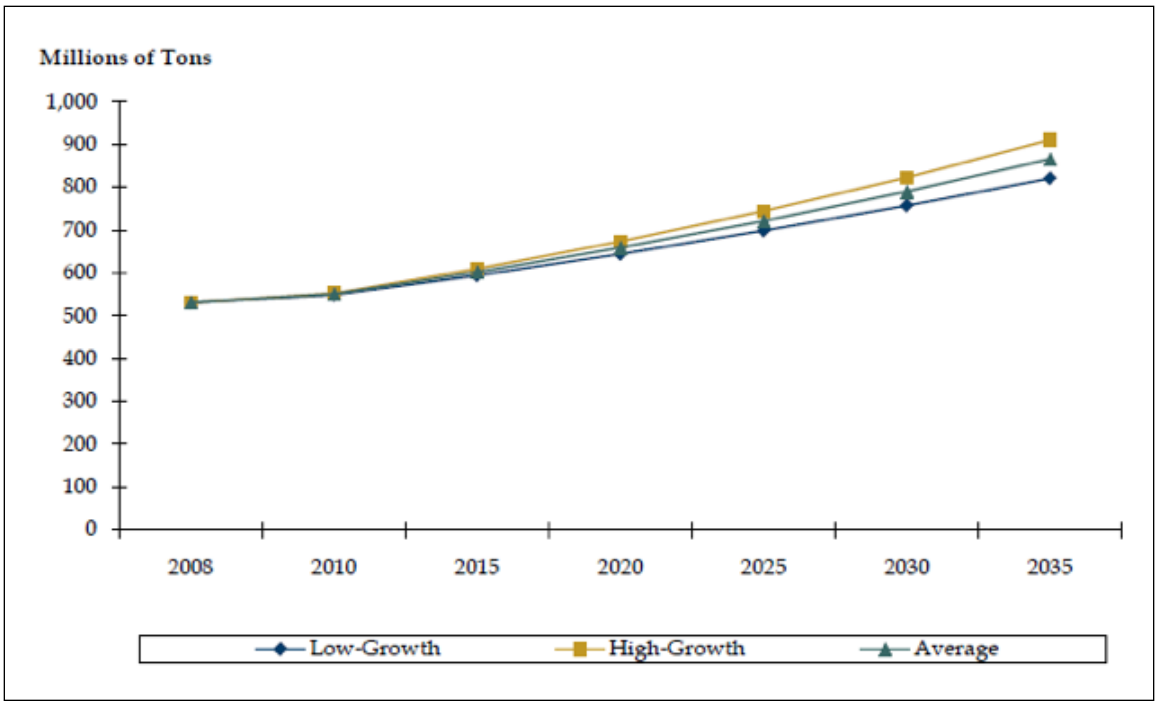


Figure 4. Statewide Waterborne Tonnage Forecasts to 2035. Source: Texas Waterborne Freight Corridor Study

so do the demands on the GIWW-T. Shippers invest capital through expanding or developing new production, storage, and manufacturing facilities. They hire workers to operate those facilities, thus providing employment, further spending, and tax dollars to local communities.

Future Opportunity Will Create Increased Demands for the GIWW-T

Most forecasts predict that waterborne freight tonnage in Texas will increase dramatically. Figure 4 shows that by 2035, the average overall tonnage for Texas seaports is expected to grow by at least 50 percent to more than 800 million tons.

With regard to the GIWW-T, current forecasts also suggest that tonnage will increase. For example, a study completed in 2010 by Cambridge Systematics shows that total freight volumes could increase by 45 percent. It is expected that of the coastal developments currently under way, the Eagle Ford Shale play in South/Central Texas will have the most significant impact on GIWW-T traffic.

In 2014, oil and gas production in the United States is projected to match its peak production year of 1970, when it reached 9.6 million barrels per day.

Eagle Ford Shale

The U.S. energy sector has seen a recent boom brought about in part by recent advancements in oil and natural gas extraction technology. For example, in 2014, oil and gas production in the United States is projected to match its peak production year in 1970, when it reached 9.6 million barrels per day. By comparison, in 2008, U.S. oil production stood at 5 million barrels per day. By summer 2013, it had risen to 7.5 million.

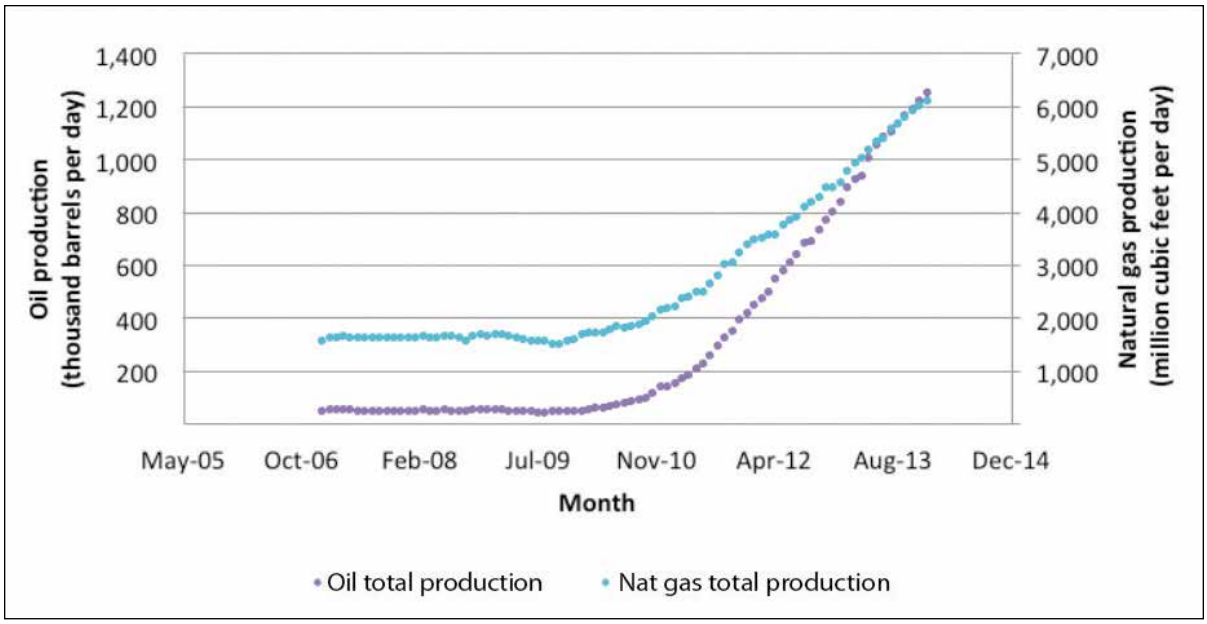


Figure 5. Daily Oil Production for the Texas Eagle Ford Shale Play. Source: Energy Information Administration

The increase in crude oil transported by barge from the Eagle Ford Shale play could result in the need to transport an additional 1.2 million tons or 445 barges annually on the GIWW-T by 2022.

The Eagle Ford Shale play is already an important catalyst for growth in the state's energy economy. As of January 2014, the reserve produced 1.2 million barrels of crude oil per day, representing an increase of 41 percent from just a year earlier. During this same period, natural gas production has seen similar growth, increasing by 34 percent (from 4.6 million to 6.1 million cubic feet per day). Figure 5 shows the production statistics for Eagle Ford Shale oil and natural gas.

While government forecasting data are currently unavailable, several firms with energy-sector expertise have offered independent projections for Eagle Ford Shale production. Jefferies & Company, an investment banking firm specializing in oil and gas data analytics, announced in October 2013 that it expects Eagle Ford oil production to peak in 2022 at 1.8 million barrels per day. Data obtained from the Energy Information Administration indicate that in 2012, approximately 4 percent of U.S. refinery receipts of crude oil were transported by barge. Assuming this percentage remains unchanged, the increase in crude oil transported by barge from the Eagle Ford Shale play could result in the need to transport an additional 1.2 million tons or 445 barges annually on the GIWW-T by 2022.

Capital Investment Initiatives Resulting from Eagle Ford Shale

As a result of this increased activity, companies are also increasingly investing in the Texas Gulf Coast. According to the American Chemistry Council, U.S. petrochemical companies recently proposed 100 new major projects worth a total of $71 billion. Many of those developments are planned along the Texas Gulf Coast. Table 1 provides a brief review of recently announced plans for investment along the Texas Gulf Coast.

Table 1. Recently Announced Plans for Texas Gulf Coast Investments.

Investor	Investment $	Projects/Locations
Chevron Philips	$5 billion	Project in Baytown, Texas, and received an air quality permit in January for a cracker plant in Cedar Bayou, Texas.
Cheniere Energy	$10 billion	Corpus Christi Liquefaction, LLC, will develop a liquefied natural gas (LNG) export terminal at one of its existing sites.
M&G Group	$900 million	One of the largest producers of thermoplastic resins used for packages and soft drink bottles has announced that it will invest in two facilities located in Corpus Christi.
Tianjin Pipe Corporation	$1 billion	Started construction on a Corpus Christi facility that will manufacture seamless pipes for the oil and gas industry.
Voestalpine	$700 million	Plans to invest in Corpus Christi to produce two million tons of iron and plans to use natural gas from the Eagle Ford Shale play to power the plant.
Kinder Morgan Energy Partners LP	$430 million at the company's Bostco site; $245 million at the company's Galena Park site	Crude oil expansion project currently under way at its Bostco site along the Houston Ship Channel. Kinder Morgan is investing $75 million to build five new tanks for refined products and $170 million to purchase 42 acres for new storage facilities in Galena Park.
Targa Resources Partners	$480 million	In the process of investing in increasing capabilities at its Galena Park site along the Houston Ship Channel.

What Is TxDOT's Role in the GIWW-T?

In 1975 TxDOT was named the official non-federal sponsor for the GIWW-T (running from the Sabine River to the Brownsville Ship Channel) in the Texas Coastal Waterway Act, which charges the department with administering legislation as specified in the act. The department's duties are regulated by Chapter 51 of the Transportation Code. The primary responsibility of TxDOT under the act is to provide right-of-way and disposal areas for byproducts of operations and maintenance. Table 2 summarizes the GIWW-T's major public agency stakeholders and their roles in managing and operating the waterway, including TxDOT.

Table 2. GIWW-T Major Stakeholders.

Stakeholder	Involvement in Texas GIWW
U.S. Army Corps of Engineers (Corps)	Conducts dredging of the GIWW-T and maintenance of the Brazos River Floodgates and the Colorado River Locks.
Texas Department of Transportation (TxDOT)	Acquires land for disposal of dredging material.
U.S. Coast Guard (USCG)	Polices traffic on the GIWW and ensures safe, secure operations.
Texas Railroad Commission (RRC)	Regulates the oil and gas companies that use the GIWW for transport of equipment and product.
Texas General Land Office (GLO)	Manages submerged lands and grants leases for residential and commercial shoreline developments.
Texas Commission on Environmental Quality (TCEQ)	Monitors water quality.
Texas Department of State Health Services (TDSHS)	Through its Seafood and Aquatic Life Group, ensures that activities in the state's waters will not adversely affect the health of consumers or recreational fishermen.
Texas Water Development Board (TWDB)	Ensures the continued availability of water supplies and the maintenance of the ecological health and productivity of Texas rivers, streams, reservoirs, bays, and estuaries.
Texas Department of Agriculture	Regulates the import/export of agricultural goods.
Texas Parks and Wildlife Department (TPWD)	Enforces policy for coastal fisheries.

Two TxDOT divisions have a role in TxDOT responsibilities for the GIWW: Maritime Division (MRD) and Right of Way (ROW). TxDOT's Maritime Division has the following responsibilities:

- Local sponsorship requirements for evaluation, planning, maintenance, preservation, enhancement, and future improvements of the GIWW-T.
- Evaluation and selection of sites for the disposal of dredged material.
- Coordination with the Corps and state and federal agencies for environmental impact studies.
- Conduct of public meetings and Texas Transportation Commission hearings.

The department's ROW Division is charged with the following duties:

- Negotiate site purchases for the disposal of dredged material in conjunction with the Maritime Division.
- Coordinate with owners of prospective dredged material placement sites. Specifically, these activities include identifying landowners, preparing right of entry request, and informing landowners of methods used in acquiring land for dredged material placement.

Could TxDOT Share Maintenance Duties with the Corps?

One of the options to help meet the needs of the GIWW-T in light of reduced federal maintenance dollars is for TxDOT to assume some of the underfunded duties of the Corps. Theoretically, TxDOT could take over maintenance/dredging activities under one of several operational scenarios. Current federal legislation would allow TxDOT to take on these responsibilities, though the Texas Legislature would need to amend state law to accommodate this opportunity in other ways (e.g., provide funding). These new duties would, of course, be in addition to TxDOT's current responsibilities as prescribed by the Texas Coastal Waterway Act. There are several approaches that could be taken to do this, each with its own set of legislative challenges. They are presented on the following pages with the most radical change first and the least radical last. None of these options has been specifically endorsed by TxDOT. They present a broad range of options and provide context for evaluating potential courses of action.

One of the options to help meet the needs of the GIWW-T in light of reduced federal maintenance dollars is for TxDOT to assume some of those duties currently unfulfilled by the Corps.

The symbiotic partnership option presents the fewest legislative obstacles to implementation, though it comes with its own challenges.

Option #1: TxDOT Takes Over Maintenance of the GIWW-T
Because federal law stipulates that (1) the GIWW-T is totally under federal control, and (2) the Corps is responsible for maintaining and improving the waterway, expanding TxDOT's role would require significant negotiations with the Corps as well as Congressional approval. The Corps' rulemaking structure would require several administrative and regulatory changes, and the Corps itself would require, at the very least, a nonstandard agreement to be in place. TxDOT's pursuing such an agreement would first need approval of the state legislature, and its implementation would require extensive coordination with several of the state and local agency stakeholders shown in Table 2.

Option #2: TxDOT Becomes a Subcontractor to the Corps
The Corps could subcontract GIWW-T maintenance to TxDOT. Legislative barriers to the subcontractor approach are not as formidable as those involving a full takeover, but challenges do exist. First, while subcontractors are currently legally permitted, contracting out all GIWW maintenance activities would be inefficient, according to the Corps. Most of the planning and preliminary engineering work required has already been undertaken by the Corps, which has reduced much of the work to a fairly routine level. TxDOT will need to evaluate whether the transfer of this knowledge and the Corps' work products can be accomplished effectively and efficiently. Also, TxDOT's authority for engaging as a subcontractor would require legislative approval and increased institutional capacity for conducting such work.

Option #3: The Symbiotic Partnership Approach is Applied
This option presents the fewest legislative obstacles. The Corps would retain primary responsibility for GIWW-T dredging and maintenance activities, but non-federal sponsors would provide a greater share of funding. This symbiotic approach is the focus of several key provisions in the recently passed Water Resources Reform and Development Act. It will be important for TxDOT to monitor how those provisions are implemented.

Applying This Approach in Texas

While the federal legislative framework for this type of agreement exists, Texas would still have to make legislative changes to implement this solution. For example, the Texas Coastal Waterway Act would need to be amended to broaden authority for TxDOT's partnering with the Corps in GIWW maintenance. Legislative action would also be required to provide state funding for maintaining the GIWW-T under a cost-sharing scheme.

For example, current state transportation funding mechanisms do not authorize spending for non-highway infrastructure. Article VIII, Section 7-a of the Texas Constitution requires that 75 percent of all net revenue generated by the motor fuel tax be used only for acquiring

rights-of-way; constructing, maintaining, and policing public roadways; or paying the principal and interest on certain road district bonds or warrants. The remaining 25 percent is dedicated to public education. Recently, the 83rd Texas Legislature passed HB 1, which will, pending voter approval, transfer a portion of revenues deposited in the Economic Stabilization Fund to the State Highway Fund. An additional constitutional amendment would be required for such a transfer to apply to navigable waterways.

At 2013 traffic levels, losing just one foot of draft would have increased the cost of doing business by roughly $58.7 million for carriers—or nearly 15 percent. These costs must, at some point, be passed on to end consumers.

Coordinating Partnerships with Port Authorities Is Key

Since the GIWW spans the entire Texas coast, creating a partnership scheme presents challenges regarding coordinating all the parties at the local, state, and national levels. Little precedent exists for such an approach in existing Texas statutes. An equitable funding agreement between all affected Texas ports and TxDOT would need to address how ports currently levy ad valorem taxes on nearby properties, and charge fees or create lease agreements for port facility use. Current state law requires these revenues to fund each port authority's local infrastructure. Also, enabling legislation would be needed to create a GIWW-T management district or other such cross-cutting oversight/governing body. Regardless of the approach, new or modified state and local legal statutes are required for such a program to function.

The GIWW-T's Most Pressing Maintenance Issues

Were TxDOT to take on more of the maintenance duties for the GIWW-T, the department would have a list of priority projects from day one. The most significant issues—from the need to bring the waterway's capacity back up to specification to the need to improve the safety and efficiency of the GIWW-T—are explained in this section. The reality is that as time passes and traffic volumes increase, these issues are only going to intensify.

Figure 6. Aerial View of the Brazos River Floodgates.

From 2002 to 2011, an average of 36 accidents per year occurred at the Brazos River Floodgates, resulting in an average annual damage cost of roughly $800,000 (more than $22,000 per accident). Research shows that the rate of accidents is increasing.

Light Loading: A Current, Costly Reality of Doing Business on the GIWW-T

Although the authorized dimensions of the GIWW-T are 12 feet deep and 125 feet wide, many portions of the channel are not being maintained to those specifications. A lack of funding has necessitated that the Corps prioritize—thus, limit—its maintenance practices.

As a result, carriers have to load barges at less than their rated capacities—or "light load" them—to ensure a deeper draft does not cause the barge to scrape bottom at any point during transit. This practice raises the cost of shipping goods on the GIWW-T on a per-unit basis because additional trips are required to move freight that could not be carried in one trip due to the shallow channel. Ultimately, the end consumer pays the final price hike resulting from this shipping inefficiency. At 2013 traffic levels, losing just one foot of draft would have increased the cost of doing business by roughly $58.7 million for carriers—or nearly 15 percent. These costs must, at some point, be passed on to end consumers.

The Brazos River Floodgates: The GIWW-T's #1 Problem

The Brazos River Floodgates (see Figure 6) present by far the greatest problem in terms of safety and efficiency along the entire GIWW. These floodgates:

- Improve navigational safety by controlling traffic flow and currents at the intersection of the GIWW-T and the Brazos River.
- Control flood flows from the river into the GIWW-T.
- Regulate sand and silt deposition into the GIWW-T by the river.

In 2000, the Corps performed a reconnaissance-level study to assess the state of the floodgates. (Reconnaissance studies are typically high-level investigations that define any issues that need addressing and determine whether it makes sense to pursue a detailed feasibility study, the next step in assessment.) While the Corps determined that a feasibility study was worthwhile, the federal government did not fund the study. Thus, no further action has been taken.

Navigational difficulties for tow operators—due to the narrow width of the lock and gate structures and the proximity of the structures to the river—account for most of the problems at the floodgates. The narrow structures force tows to stop, break down their barges (meaning operators must move barges one at a time), and make multiple trips across the river to get the entire tow—up to four barges—through. This results in significant time delays to get an entire tow through the floodgates. The angle of approach at the Brazos River Floodgates also makes navigation very difficult and results in a significant number of strikes by towboats and barges.

FACTS OF THE FLOODGATES

$800,000
average annual **damage cost** due to facility inadequacy

$11M
annual **cost of delays** due to facility inadequacy

36
average number of **accidents** per year

Delayed Action Means Prolonged, Higher Shipping Costs and Safety Concerns

Recent statistics show that between 2002 and 2011, an average of 36 accidents per year occurred at the floodgates. Indexing these damages to 2013 prices, the average annual cost of damage to the floodgates is approximately $800,000 (an average of more than $22,000 per accident). The accident rate has increased significantly since 2008. And since most of the commodities moving through the floodgates are petrochemicals, toxic spills could occur as a result of accidents. Further research is needed to determine why accidents have risen so dramatically since 2008.

Built in 1943, the floodgates were designed for barges pulled astern on a towline. Current practice involves a towboat pushing a string of barges, which makes navigation through the crossings unwieldy. Tows transiting the GIWW-T today usually consist of one to four barges, but the average tow size through the floodgates is 1.5 barges (loaded or empty). For tows with only loaded barges, the average is 2.4 barges per tow. Thus, the facility's antiquated design is forcing tow

operators to move freight below normal capacity, resulting in shipping inefficiencies. Moreover, the 75-foot gated thruway is too narrow to accommodate two tank barges side by side. Finally, the angle of approach makes it difficult for operators to line up their towboat and barge(s) with the floodgates and make a safe transit.

Researchers found that the additional annual operating costs (resulting from time delays) created when tow operators break up their tows to accommodate the facility is $11.4 million. If the cost of damages to the floodgates is added, the total annual cost due to the inefficient design of the floodgates is almost $12.2 million.

Recovering the costs to replace the Brazos River Floodgates is estimated to take 5 years or less, based on costs of similar projects in Louisiana.

There are additional costs, most notably due to the lost time and inefficiency caused by tying up towboats longer than they should be. If towboats can move through the floodgates faster, they can deliver their cargo and pick up the next load sooner. Over a year's time and across a fleet of towboats, this could easily allow an operator to use fewer towboats to deliver the same amount of cargo, or use the same number of towboats to deliver more cargo in the same time.

The Cost of Replacing the Floodgates

Researchers obtained a cost estimate of $60 million to replace a comparable lock facility from an ongoing feasibility study at the New Orleans District. If that estimate is accurate, it would take less than 5 years to recover replacement costs at current traffic levels. If traffic increases as expected due to Eagle Ford Shale activity and general economic trends, recouping investment dollars will take considerably less time.

Towboat and barge repairs are confidential and are, therefore, not subject to estimation; but if those costs are avoided and added into the calculation, the payback period will be further reduced. Also, by reducing inefficiencies caused by tying up towboats longer than necessary in order to navigate today's inadequate facilities, operators can make more efficient use of their fleet, which will hold down the shipper costs.

Traffic patterns, equipment, and the economy vary considerably over time. Thus, it would most likely be necessary for the Corps to restart the study process from scratch, assuming they could receive authorization to do so. Given the lack of political will and federal funding to proceed beyond that first step in the past (the reconnaissance-level study), it may be necessary for TxDOT and GIWW-T users to be actively involved in the study process and acquire funding for subsequent steps. If the Corps then receives authorization and funding to proceed to the next step (the feasibility study), that step would be a 36-month process. Even if both studies were conducted expeditiously, with the time it takes Congress to appropriate the funds, the total assessment process would, at best,

take an estimated 6 to 8 years to complete. Then detailed design, environmental studies, and construction could begin.

More Fleeting Areas Needed

Fleeting areas are holding areas for barges in between shipments; barges are cleaned, repaired, or simply stored in these areas. The lack of fleeting area capacity affects the safety and efficiency of barge operations on the GIWW-T. When fleeting areas are not available, operators simply park their barges wherever they can, which makes the waterway reach less safe and more difficult for other operators to transit. This problem appears to be especially acute in the Corpus Christi area. Fleeting areas are typically private operations, though port authorities can help construct or operate these facilities. For example, the Port of Corpus Christi Authority plans to have a barge fleeting area—estimated at $6 million—in operation by the end of 2014, which should help alleviate the port's current capacity problems.

Because each fleeting area is in a unique environment—both in terms of the ecology and the level of development around the site—characterizing an average fleeting area is difficult. There is at least one fleeting area in each major port complex. (In the cases of Houston and Corpus Christi, there are a number of such facilities.) One additional fleeting area in each of the four major port complexes in Texas (Beaumont/Port Arthur, Houston, Freeport, and Corpus Christi) would

lead to a significant improvement in operations along the GIWW-T. However, expanding fleeting capacity would require a capital investment of approximately $16 million, assuming that each site would cost approximately $4 million (at a modest length of 2,000 feet of bank space for each).

By expanding fleeting capacity, barges not in use at any time can be safely and efficiently "parked" and prepared for their next tow without affecting the ongoing navigation in the main channel.

Expedited Replacement of the Caney Creek Bridge

TxDOT is actively addressing one of the major safety concerns expressed by users—the replacement of the FM 457 swing bridge in Sargent, which TxDOT refers to as the Sargent Swing Bridge and industry calls the Caney Creek Bridge. According to the U.S. Coast Guard's Division 8 Bridge Program Office, the bridge is struck approximately once a month because of the inadequate space between the bridge columns in the river and the high level of development in the area (which prevents barges from being able to "pull over" and wait during inclement weather or difficult situations).

TxDOT has an active project to replace the swing bridge with a concrete bridge to provide access for residents on the south side of the waterway. The project, which is designed to accommodate navigation, is currently in the conceptual design/environmental study stage of development and currently scheduled to be advertised for bid in spring 2016. Construction is expected to take 2 years. It will be important to ensure that the project remains on schedule so TxDOT can expeditiously remove a navigational danger often cited by operators as the most serious obstacle after the Brazos River Floodgates.

Encroachment Is Further Limiting Operations on the GIWW-T

In August 2010, TxDOT published a report titled *Analysis and Recommendations on Protecting Waterways from Encroachment* (Texas Department of Transportation Report FHWA/TX-10/0-6225-1, August 2010, prepared by Texas A&M Galveston and Texas A&M Transportation Institute). In recent years, real estate developers have continued to infringe upon areas near the waterway, causing concerns for the efficiency of navigational operations. Researchers identified issues and developed recommendations in these areas:

- Zoning restrictions.
- Permitting requirements and enforcement.
- Better understanding the impacts of proximate real estate developments on the economy.
- Including the water transportation industry in the permitting process.
- Providing a developer guidebook to interested parties along the GIWW-T.
- Better coordinating developments with GIWW-T initiatives.

Many of the concerns and recommendations were addressed in a new permitting procedure instituted by the Corps in October 2013. By better managing encroachment, state and local officials can reduce the risk of serious injury or loss of life resulting from a barge or towboat striking an encroachment. This will also allow operators to navigate more efficiently since special procedures will not be needed to avoid encroaching objects.

Acquisition of Placement Areas: Sooner Rather Than Later

When dredging occurs on the GIWW-T, the dredged material must be stored in locations called placement areas (PAs). From 1998 to 2012, an average of 6.2 million cubic yards was dredged each year from the GIWW-T's main channel. Most of the dredged material was placed in open-water bay disposal sites and confined disposal facilities. As environmental regulations have become more stringent and special interest groups more vocal, obtaining new open-water disposal sites has become more difficult. In some cases, open-water disposal sites are situated in much deeper waters located farther offshore, and moving the dredged material the additional distance further increases costs. TxDOT is required to provide the real estate for placement areas that will accommodate the ongoing needs of the Corps' dredging program. Of the 218 main channel PAs currently available for the Corps' use, two—PA35 and PA86—have a remaining life of less than 25 years (24 and 12 years, respectively). All but five of the remaining active areas have an estimated remaining life of 40 years or more. Because of the lengthy process required for establishing new properties as

PAs, TxDOT should begin the acquisition process for PA86 as soon as possible, before its remaining capacity is exhausted. This will require coordination with the Corps' Galveston District personnel to determine the desired characteristics of the new site—especially its location—which must meet all legal and environmental requirements.

One way to ensure a safe and efficient GIWW-T is to secure a sustainable revenue stream while also taking advantage of possible one-time funding sources.

If the acquisition process for PA86 is not begun soon, the Corps could actually be precluded from dredging that reach of the GIWW-T. In a best-case scenario, the Corps would have to implement dredging practices that are far more expensive than today. This will reduce even further what the Corps can accomplish with its limited funding.

There does not appear to be a documented process for determining the need for TxDOT to initiate a real estate acquisition process. It would be advisable for the Corps and TxDOT to jointly prepare a procedure for identifying the need for a new placement area and the steps required to actually accomplish that acquisition.

Expanded Mooring Areas

Barge operators use mooring areas for shelter during inclement weather or other situations when it is unsafe to navigate the waterway. Mooring areas are distinguished from fleeting areas by the fact that they are only supposed to be used for a short time in response to unforeseen conditions, such as severe thunderstorms or high winds—they are not intended for use that lasts days. Mooring areas of the GIWW-T are shown in Figure 7.

The Corps is finalizing a study to determine the condition and adequacy of mooring areas along the GIWW-T. The Corps has found that current mooring areas must be rehabilitated and expanded to accommodate today's traffic, as well as expected future increases in traffic. The Corps' preliminary findings indicate that improving these areas will yield a high benefit-cost ratio, which allows for the alternatives with the maximum possible number of buoys to be recommended at each location. (The more buoys per location, the greater the number of tugs/barges that can safely park there rather than pulling over into less safe and secure locations.)

The following rehabilitation and expansion projects are likely to be funded by the federal government at a total estimated cost of $7,044,000:

- **Port Arthur Mooring Basin**—Estimated cost of $947,000.
- **Port Bolivar Mooring Basin**—Estimated cost of $947,000.
- **Pelican Island Mooring Basin**—Estimated cost of $1,824,000.
- **East Brazos Mooring Basin**—Estimated cost of $1,707,000.
- **West Brazos Mooring Basin**—Estimated cost of $1,619,000.

Figure 7. GIWW-T Mooring Areas.

These improvements will include the placement of 61 new buoys—used for delineating safe areas for operators—and the creation of an additional 8,115 linear feet of mooring space. By implementing these needed improvements, the Corps will be increasing the safety and efficiency of navigation operations on the GIWW-T.

Funding Strategies to Address the GIWW-T's Most Pressing Issues

As noted earlier, the primary reason the Corps has not been able to maintain the GIWW-T as needed is limited federal funding. This constraint forces the Corps to direct reduced resources toward critically urgent projects, thus leaving little money for a number of important but less urgent capital projects, notably those projects described elsewhere in this document.

One way to ensure a safe and efficient GIWW-T is to secure a sustainable revenue stream while also taking advantage of possible one-time funding sources. TTI evaluated alternative long-term funding sources using three criteria:

- **Feasibility.** What is the likelihood that this alternative could be reasonably implemented?
- **Sustainability.** Does this alternative provide long-term, sustainable funding?
- **Equity.** How is the funding burden shared by all parties?

Several of the sources evaluated cannot provide funding directly for GIWW-T maintenance. However, incorporating features that meet grant criteria and provide benefits for the GIWW-T may enable a project that enables the GIWW-T to qualify for funding. Researchers selected 12 funding strategies for evaluation. Three of these were clearly not feasible for TxDOT at this time. Each of the remaining nine strategies is further explained and explored next.

Strategy 1: Elevate the Priority of Economically Important GIWW-T Projects to the Corps and Congress

Texas could develop a tenable economic and environmental case justifying why increased federal funding should be directed toward strategic GIWW-T projects. The state could assist the Corps' Galveston District in developing cost-benefit analyses for projects, ranking projects based on priority, and recommending high-priority projects for funding. This would involve:

- Working with federal stakeholders to initiate or reinitiate the reconnaissance and feasibility study processes for key projects.
- Conducting (and funding) a feasibility study as a non-federal sponsor under Corps supervision.

The primary reason to pursue this alternative is to make funding available quicker than the regular appropriations process would and, commensurately, accelerate realization of the benefits expected from a project.

Another alternative for Texas is to monitor and participate in the activities of the Inland Waterways User Board (IWUB), the board charged with monitoring the Inland Waterways Trust Fund, and make recommendations on investment priorities to the Corps and Congress. By establishing a more proactive role with this board, Texas can help set funding priorities for waterway projects (e.g., elevating the priority of the Brazos River Floodgates replacement).

Evaluation

This alternative would be relatively easy to implement but would require close coordination and cooperation with federal and state elected leaders and the Corps. Elevating the priority of strategic Texas waterway projects could help ensure that capital projects, such as lock and dam replacement or rehabilitation projects, receive adequate funding in the years that follow. From an equity perspective, this alternative is an example of the exchange equity and fairness dimension of tax policy, where over the long run, government agencies provide adequate public goods and services to meet the needs of taxpayers and their families.

Strategy 2: Apply for Marine Highway (M-69 Corridor) Designation

This is a U.S. Department of Transportation Maritime Administration (MARAD)-led program to expand the use of navigable waterways to relieve landside congestion, reduce air emissions, and generate other public benefits by increasing the efficiency of the surface transportation system. Projects proposed under this program receive priority when they offer the promise of public benefit and long-term sustainability without requiring long-term federal operational financial support.

On May 27, 2014, MARAD initiated a new call for project applications. The window for submitting applications (Marine Highway Project Open Season) will close on September 30, 2016. There will be five project review sessions during the Marine Highway Project Open Season, and MARAD will continue to accept route designation recommendations at any time. Qualified projects will be announced shortly after the completion of each project review session. The application submittal deadlines for the review sessions are June 30, 2014; December 31, 2014; June 30, 2015; December 31, 2015; and June 30, 2016.

Though this program focuses on containers and trailers (rather than the liquid products that make up much of the GIWW traffic), if proponents can show that a Texas M-69 Corridor would enable traffic currently moved by truck to move by water, it might be a selling point to the review committee.

Evaluation

From a feasibility perspective, state leaders would be required to pursue the formal M-69 Corridor application process and apply for funding during the call for projects phase. For this option to result in funding for the GIWW-T, Congress will need to appropriate funds for a new round of grants. In any case, it should not be considered sustainable, since the project would have to be resubmitted for consideration each time a new call for projects is issued. From an equity perspective, this alternative is an example of the exchange equity and fairness dimension of tax policy: over the long run, governmental agencies provide adequate public goods and services to meet the needs of taxpayers and their families.

Strategy 3: Apply to Federal Discretionary Grant Programs

Some federal discretionary grants are available (e.g., the Transportation Investment Generating Economic Recovery [TIGER] grant program). TIGER awards sponsor, on a competitive basis, capital investment funds for surface transportation projects. In 2013, Texas submitted an unsuccessful application for a TIGER V discretionary grant to provide "crucial major restoration and modernization of the Texas GIWW infrastructure." TxDOT may be able to acquire funding for other GIWW-T-related projects in future grant cycles. Note that TIGER grants are limited to capital spending only (i.e., there is no funding for ongoing maintenance and operations).

Evaluation

Monitoring the grant application cycle and preparing grants (while learning from previous, unsuccessful grant application attempts) are the principal actions required. TIGER grants can provide significant one-shot funding but cannot be relied upon as sustainable. From an equity perspective, this alternative is an example of the exchange equity and fairness dimension of tax policy: over the long run, governmental agencies provide adequate public goods and services to meet the needs of taxpayers and their families.

Strategy 4: Explore Florida's Inland Navigation District Model for Texas

Texas could adopt a state-based model similar to the Florida Inland Navigation District (FIND) model. Authorized by the Florida Legislature in 1927, FIND has taxing authority in specific regions along the Florida coastline to perform the functions of the local sponsor of the Atlantic Intracoastal Waterway in Florida, a federal navigation project. The district provides all lands required for the navigation project, including rights-of-way and lands for the management of dredged materials. The Florida Legislature has granted additional authority to FIND over the years, resulting in FIND now contributing part of its tax revenues to the Corps to be used for maintenance of the waterway. If Texas were to consider a similar approach, Table 3 below illustrates the possible revenue this alternative might have raised had it been imposed in 2012, the last year property tax data were available for all 12 Texas coastal counties.

Evaluation

This alternative might prove more difficult to implement because it requires creating a new mechanism to collect a fee levied from coastal counties. A funding agreement among all 12 Texas coastal counties would have to be established. From a sustainability perspective, however, this would provide a long-term, reliable source of revenue. Once the agreement is established, dollars coming in from county governments would help cover ongoing operations and maintenance activities for GIWW-T dredging. From an equity perspective, this alternative represents the exchange equity and fairness dimension of tax policy, since individuals and corporations

Table 3. Estimated Annual Revenue Under FIND Scheme in Texas Based on 2012 Property Values.

Texas Coastal County	Total Taxable Value for County Property Tax Purposes—2012	Estimated Annual Revenue			
		0.01 mil*	0.05 mil	0.10 mil	1.00 mil
Jefferson	$25,252,988,514	$252,530	$1,262,649	$2,525,299	$25,252,989
Chambers	$6,854,774,065	$68,548	$342,739	$685,477	$6,854,774
Galveston	$21,052,203,761	$210,522	$1,052,610	$2,105,220	$21,052,204
Brazoria	$20,299,210,483	$202,992	$1,014,961	$2,029,921	$20,299,210
Matagorda	$4,561,847,750	$45,618	$228,092	$456,185	$4,561,848
Calhoun	$3,533,922,813	$35,339	$176,696	$353,392	$3,533,923
Aransas	$2,822,930,762	$28,229	$141,147	$282,293	$2,822,931
Nueces	$19,502,178,530	$195,022	$975,109	$1,950,218	$19,502,179
Kleberg	$1,383,215,815	$13,832	$69,161	$138,322	$1,383,216
Kenedy	$972,577,583	$9,726	$48,629	$97,258	$972,578
Willacy	$676,366,343	$6,764	$33,818	$67,637	$676,366
Cameron	$16,288,286,535	$162,883	$814,414	$1,628,829	$16,288,287
	Total	**$1,232,005**	**$6,160,025**	**$12,320,050**	**$123,200,503**

*Note: 1 mil is $1.00 for every $1,000 of assessed value.

in coastal counties would be expected to pay because they would receive the greatest benefit from a properly maintained GIWW-T.

Strategy 5: Consider Using CEPRA Funds

In 1999, the 75th Texas Legislature passed the Coastal Erosion Planning and Response Act (CEPRA), enabling the first-ever coastal-erosion program in Texas. The program seeks to implement coastal erosion-response projects and related studies to reduce the effects, and understand the processes, of coastal erosion. Under CEPRA, the Texas General Land Office implements erosion-response projects through collaboration, and matching-fund partnerships, with federal, state, and local governments, non-profits, and other potential project sponsors. Though the program does not directly relate to navigation, some GIWW-T-related projects could be eligible for funding. The deadline for the most recent biennial funding cycle has passed, but GLO has discretion to accept applications addressing an emergency situation.

Evaluation

Seeking dollars from CEPRA would require state leaders to formally apply for funding during the next cycle. As with other grant programs, this is likely a one-shot source of revenue, though funding could be applied for every 2-year cycle. This alternative is in line with the exchange equity and fairness dimension of tax policy, where over the long run, governmental agencies provide adequate public goods and services to meet the needs of taxpayers and their families.

Strategy 6: Explore Ending State Diesel Tax Exemptions for Certain GIWW-T Users

Currently, Texas Tax Code Section 153.222 allows a refund for taxes paid on excepted uses of diesel fuel. For example, a taxpayer may claim a refund for taxes paid for "any purpose other than propelling a motor vehicle on the public highways in the state." Also, since September 1, 2000, the Motor Fuels Tax Legislative Update allows that diesel fuel "retailers/deliverers may continue to sell dyed and undyed (clear) diesel fuel tax-free when they deliver the diesel fuel directly into the fuel supply tank or reefer units or other off-highway equipment, such as wielding units, auxiliary generators, boats, and off-highway equipment being transported on trailers." Restricting or ending altogether these exemptions could provide more tax revenue for maintenance needs of the GIWW-T, assuming the revenues generated were directed toward those needs.

Evaluation

Assuming the political will exists to end these tax exemptions, this alternative is administratively feasible and would provide a relatively sustainable, long-term source of revenue (if state diesel tax revenue collected from GIWW-T users was used for GIWW-T waterway purposes). The strategy is equitable from a user pays, user benefits perspective.

Strategy 7: Explore P3 Opportunities and Monitor Possibilities for Future Inland Waterway P3 Pilot Projects

To supplement the growing gap between transportation funding and infrastructure investment needs, public agencies are turning more to private-public partnerships (P3s), regardless of transportation mode. The agreements usually involve a government agency contracting with a private company to renovate, construct, operate, maintain, and/or manage a facility or system. In the context of waterway infrastructure, a P3 would likely take the form of a contractual agreement between a federal or state public-sector waterway-stakeholder agency (e.g., the Corps, the State of Texas) and a private-sector entity to deliver a public service. For the private sector to be willing to participate in a P3 approach, it must have a reasonable expectation that it will earn an acceptable return on the investment. In other words, a revenue stream is required for any P3 approach. The recently passed Water Resources Reform and Development calls for the implementation of a number of pilot P3 projects. TxDOT should closely monitor the implementation of these provisions to see if the GIWW-T might qualify for inclusion in the program.

Evaluation

This option is fairly simple to implement, although it might require regulatory changes and close coordination with federal, state, local, and industry stakeholders. Considering sustainability, the private sector usually requires a sustainable revenue stream, such as a lockage fee, dockage fee, annual license fee, etc. Finally, equity would depend primarily on the revenue stream used to pay back the private sector. For example, a lockage fee is an example of the exchange equity and fairness dimension of tax policy, where those who pay for the improvements also benefit most from that infrastructure.

Strategy 8: Explore Utilizing Texas Rainy Day Fund for Waterway Projects

SJR 1 is a constitutional amendment enacted during the 83rd Legislative Session that—if approved by Texas voters in November 2014—would divert 50 percent of oil and gas severance taxes above a 1987 baseline level from the Economic Stabilization Fund (ESF, commonly known as the Texas Rainy Day Fund) to the State Highway Fund. A fiscal impact analysis performed by the Legislative Budget Board estimates that $878 million could be transferred from the ESF to the State Highway Fund in 2015. However, for Texas to pursue this funding for the GIWW-T, TxDOT would have to work with lawmakers to enact legislation approving such a transfer. Most likely, another state constitutional amendment would be required to authorize this funding for GIWW-T projects.

Evaluation

This option is challenging since several legislative and administrative changes are required to pursue it. From a sustainability perspective, however, using these funds could provide a stable, long-term source of revenue for GIWW-T purposes. In terms of equity, this alternative would be an example of the exchange equity and fairness dimension of tax policy, where over the long run, governmental agencies provide adequate public goods and services to meet the needs of taxpayers and their families. Since the GIWW-T is heavily used by the Texas oil and gas industry, which pays in to the ESF, a case can be made that the waterway should receive a public benefit. The public benefit in this case could be having a properly maintained GIWW-T.

Strategy 9: Consider the Panama Canal Approach for Texas
Following the handover of the Panama Canal in 1999, Panamanian lawmakers established an authority, called the Panama Canal Authority (PCA), to oversee activities associated with the maintenance and dredging of the canal. The PCA embarked on an expansion project to increase shipping capacity that would, in turn, increase toll revenues. A toll policy that focuses on capturing the value the canal adds to each segment of its market is proposed to be put in place, and tolls are expected to be set in a manner that will double them within the next 20 years. The loans taken out to finance the construction of this proposal are expected "to be paid [back] rapidly—with investment costs expected to be paid back in less than 10 years."

Texas already has experience creating authorities to help meet infrastructure mobility needs for surface transportation projects, such as state-authorized regional mobility authorities. By law, these authorities can finance, design, construct, operate, maintain, and expand a wide range of transportation facilities and services. In practice, they are mostly used to deliver critically needed toll road projects to the state. A similar authority could help finance, design, construct, operate, and maintain the GIWW-T. The imposition of tolls on its users, the other approach the Panama Canal employs, is an approach that Texas could adopt as well.

Evaluation
This is a complex option requiring extensive federal and state legislative changes to enable such an authority. Changes authorizing waterway fees would also be required. From a sustainability perspective, however, the Panamanian model would provide a stable, long-term revenue stream. Similar to how the PCA mostly self-funds improvements needed for maintaining and operating the Panama Canal, this option represents one of the few opportunities for a stable and elastic source of funding. From an equity perspective, this approach best represents the exchange equity and fairness of tax policy, where those who pay for the services are also the ones who benefit most from that infrastructure.

The Choices Are Many, But Inaction Is the Most Expensive Option
Alternatives for funding improvements and maintenance for the GIWW-T present both opportunities and challenges for Texas policymakers (see Table 4 for a comparative summary of these options). Some alternatives—favored by the GIWW-T stakeholder working group—would be easy to implement because they involve simply monitoring and applying for discretionary grant program opportunities for which GIWW-T needs qualify.

The cost of not finding a solution will be felt by every Texas business—particularly the petrochemical industry—that relies on the GIWW-T to move its goods, as well as every Texan who buys them.

Table 4. A Summary of Strategic Funding Options for the GIWW-T.

#	Strategy	Feasible?	Sustainable?	Equity type?
1	Elevate GIWW-T Priority	Yes. Requires close coordination with federal, state, Corps leaders.	Potentially. Greater awareness can help establish ongoing funding.	Exchange Equity and Fairness
2	Secure Marine Highway Designation	Yes, though state leaders would need to formally pursue M-69 status.	No. Reapplication process required.	Exchange Equity and Fairness
3	Pursue Federal Discretionary Grant Program Funds	Yes. Monitor program, apply for funds in cycle.	No. One time only.	Exchange Equity and Fairness
4	Consider the Florida Model	Potentially. Requires a new tax-levying mechanism.	Yes.	Exchange Equity and Fairness
5	Pursue CEPRA Funds	Yes. Monitor program, apply for funds in cycle.	No. One time only.	Exchange Equity and Fairness
6	End Diesel Tax Exemption	Yes, though political will must be mustered to end exemptions.	Yes.	User Pays, User Benefits
7	Establish Public-Private Partnerships	Yes, though it would require regulatory changes and close coordination with stakeholders.	Yes, though profit incentives for the private sector must be present.	Exchange Equity and Fairness
8	Use the Texas Rainy Day Fund	Potentially. Requires legislative, administrative changes.	Yes.	Exchange Equity and Fairness
9	Consider the Panama Canal Model	Potentially. Requires extensive federal, state legislative changes to enable the authority.	Yes.	Exchange Equity and Fairness

Several of these options tend to be both unreliable and unsustainable, since they are grant related. Grants are typically funded through appropriations from the general fund, which is a highly unreliable process. Grants are not “free money,” either—in effect, U.S. taxpayers would share the burden of funding improvements to the GIWW-T under an approach that requires dedicating appropriations toward rehabilitating, operating, and maintaining the GIWW-T.

User-based funding options (e.g., tax- or fee-based options)—while less popular with the GIWW-T stakeholder working group—tend to provide a more sustainable, long-term revenue stream. While these options would require GIWW-T users to carry a major share of the financial burden of maintaining the GIWW-T, these users would also be the primary beneficiaries in terms of time and productivity gains from a properly maintained waterway. These efficiency benefits would most likely be passed on to other critically important Texas industries (such as petrochemical and manufacturing) and, ultimately, to end consumers in the form of lower shelf prices.

Selecting the most appropriate alternative (or combination of alternatives) to pursue is a matter for policymakers. This analysis can help frame the discussion by providing a set of evaluation criteria and a review of each alternative's potential benefits and limitations. One thing is clear, however: given that increased federal funding for the Corps to address the GIWW-T's needs is extremely unlikely, Texas leaders must decide how those needs can best be met by the state. The cost of not finding a solution will be felt by every Texas business—particularly the petrochemical industry—that relies on the GIWW-T to move its goods, as well as every Texan who buys them.

Recommendations

This research established that no funding mechanisms are readily accessible to TxDOT that will provide a predictable and reliable long-term funding source for GIWW-T construction and maintenance. Any such funding streams will most likely require significant legislative changes and may be politically difficult to implement.

The recommendations provided here focus on expediting and enhancing existing programs and taking advantage of "one-off" funding sources and other measures to improve the GIWW-T without requiring a long-term funding commitment on TxDOT's part. There are also non-financial strategies TxDOT can pursue to enhance the value of the GIWW-T. The researchers recommend the action items shown in Table 5. Some of these recommendations are more easily implemented and can be accomplished more quickly than others. TxDOT may determine that some are not feasible, but they are all worthy of further consideration as TxDOT more clearly defines its role in the maintenance and improvement of the GIWW-T.

Table 5. Recommended Actions for Improving the GIWW-T.

Action Item	What's Needed	Potential Benefit(s)
Request expedited feasibility study for the Brazos River Floodgates	Make a formal request to the Corps and lobby Congress to fund the study. With the recently passed Water Resources Reform and Development Act, TxDOT could even consider funding the study itself. Once the study is underway, TxDOT should investigate the feasibility of funding all or part of the floodgates replacement structure. This will most likely involve a concerted effort to prioritize the floodgates replacement project for funding from the Inland Waterways Trust Fund.	• Reduce accidents and associated costs to barge operators resulting from outdated facility design. • Reduce repair costs to the floodgates associated with current accidents (currently $800,000 annually). • Save at least $11million in delays annually.
Make funding arrangements for the Brazos River Floodgates replacement	Once the studies have been completed and approved by Congress, TxDOT may want to look at using some of the funding options described in this document to contribute to the cost of replacing the floodgates. This would enable the federal government to move more quickly toward a full replacement.	• Accelerate the full replacement of the floodgates.
Combine efforts with environmental and conservation groups to place revetments along placement areas	Shore up placement areas, possibly extending their useful life. Reduce maintenance dredging necessitated by the sloughing of placement area retaining dikes. The Corps can provide insight as to where such projects would yield the greatest benefit.	• Reduce the amount of material sloughing into the channel, thereby reducing the need/frequency for dredging. • Increase the capacity/stability of placement areas with adjacent erosion abatement structures.
Provide funding assistance to create new fleeting areas open to all barge traffic	TxDOT may want to invest directly in fleeting areas or provide some type of grant assistance. This would require legislative action to authorize this activity.	• Prepare barges not currently in use safely and efficiently for their next tow. • Facilitate GIWW-T traffic by keeping unused barges safely out of the way.
Stay actively involved in reviewing permit applications for development along the GIWW	Avoid further encroachment on the GIWW. Include GIWW stakeholders in the permitting process when real estate developers build near waterway infrastructure.	• Avoid degradation of waterway safety and/or efficiency. • Help protect needed existing and future placement areas. • Improve navigational efficiency by removing encroachments.
Keep replacement of the Caney Creek Bridge on the fast track	Remove safety hazards caused by the bridge's narrow span and nearby development, both of which prevent barges from "pulling over" until it's safe to proceed.	• Reduce/eliminate collisions with the bridge and the resulting repair costs/injuries. • Facilitate traffic passing under the bridge.
Explore real estate options for PA86 (12-year remaining life) in Brazoria County	Initiate the extensive real estate acquisition process (e.g., environmental assessment), and extensive coordination with other agencies, with enough lead time to be ready when the Corps needs the site.	• Provide storage capacity for dredged material from the GIWW-T's main channel. • Expedite economic returns from more efficient navigation on GIWW-T by expediting dredging.
Set up a web presence to periodically update and publish selected performance metrics	Keep stakeholders, including the public, apprised of GIWW-T conditions and safety metrics. A group such as the Port Authority Advisory Committee could advise TxDOT on which metrics to track and how frequently to update them.	• Provide transparency/accountability for both TxDOT's maintenance activities and the GIWW-T's benefits to the Texas economy. • Encourage ongoing maintenance by providing a public record of performance measures.
Continue pursuing funding through the USDOT's TIGER grant program	As it has already done, TxDOT should apply for TIGER grant funding for GIWW-related projects. The application submitted in 2013 serves as a starting point.	• Acquire funding for GIWW-T maintenance that does not come from state coffers.
Apply for Marine Highway project designation	Apply to the U.S. Maritime Administration for this designation for the GIWW-T.	• Place the GIWW-T in line for future Marine Highway grants. • Elevate the profile of the GIWW-T on a national level.

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