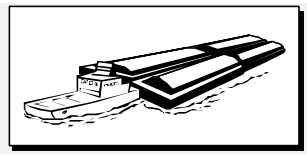


THE 1997 INLAND WATERWAY REVIEW: Executive Summary

PURPOSE AND APPROACH

This report provides an update of similar reviews of the waterway system previously published by the Corps Institute for Water Resources (IWR) (1988, 1992). This 1997 edition continues to focus on the inland waterways as a system and as a key element of the nation's water resources and intermodal freight transportation infrastructure.

The purpose of this report is to provide an overview of the inland waterway system, primarily the fuel taxed waterways, in terms of (1) structure, functions and economic values, (2) the inland waterway system, (3) historic and future projected inland waterway traffic, (4) inland waterway programs and funding and (5) emerging issues. Each of these topics is addressed in a separate chapter. In addition, appendices A through I provide supplementary statistics or analysis on the physical system, 1996 data from the Lock Performance Monitoring System (LPMS), historic and projected waterways traffic by commodity and waterway segment, the latest analysis of the Inland Waterways Trust Fund, the 1997 Annual Report of the Inland Waterways Users Board (IWUB), a listing of past and current members of the IWUB, and a glossary of commonly used terms.

The latest available data from the Lock Performance Monitoring System (through calendar year 1996) and Waterborne Commerce Statistics Center (through calendar year 1995), along with the Corps FY 1997 and 1998 budget data and status reports as presented to Congress and the Inland Waterways Users Board were used as the basis for much of the analysis herein. The report reflects revisions based on the review of the draft documents by U.S. Army Corps of Engineers District and Division offices in 1997 and 1998.

This executive summary is intended as a useful stand-alone document focusing on highlights and key statements from the overall report. It is generally organized parallel to the Review chapters.

DEFINING THE SYSTEM

A perennial problem in dealing with the inland waterway system is that it is perceived in many different ways by the various parties who are interested in it. Fundamentally it is a collection of water resources development projects which include inland navigation as a primary project purpose, sometimes along with other multi-purpose uses, that are the responsibility of the U.S. Army Corps of Engineers.

Congress provided a solution to the definition problem when it specified the 27 waterways subject to fuel tax, made those waterways eligible for improvement using the Inland Waterways Trust Fund, and exempted studies of improvements on those waterways from the cost-sharing requirement imposed on other Corps of Engineers civil works projects. Physically, these 27 fuel taxed waterways total approximately 11,000 miles of inland waterborne transportation routes. They are part of a larger waterway transportation system totaling nearly 25,000 miles in length, although Congress has identified the fuel taxed waterways to be a distinct national system (Figure ES-1). It is the recipient of most federal investment in inland waterways, and it accounts for almost all the contributions of inland waterways to U.S. transportation. The set of waterways subject to fuel taxation is a useful definition of the inland waterway system, and it is the definition used for the purposes of this Review.

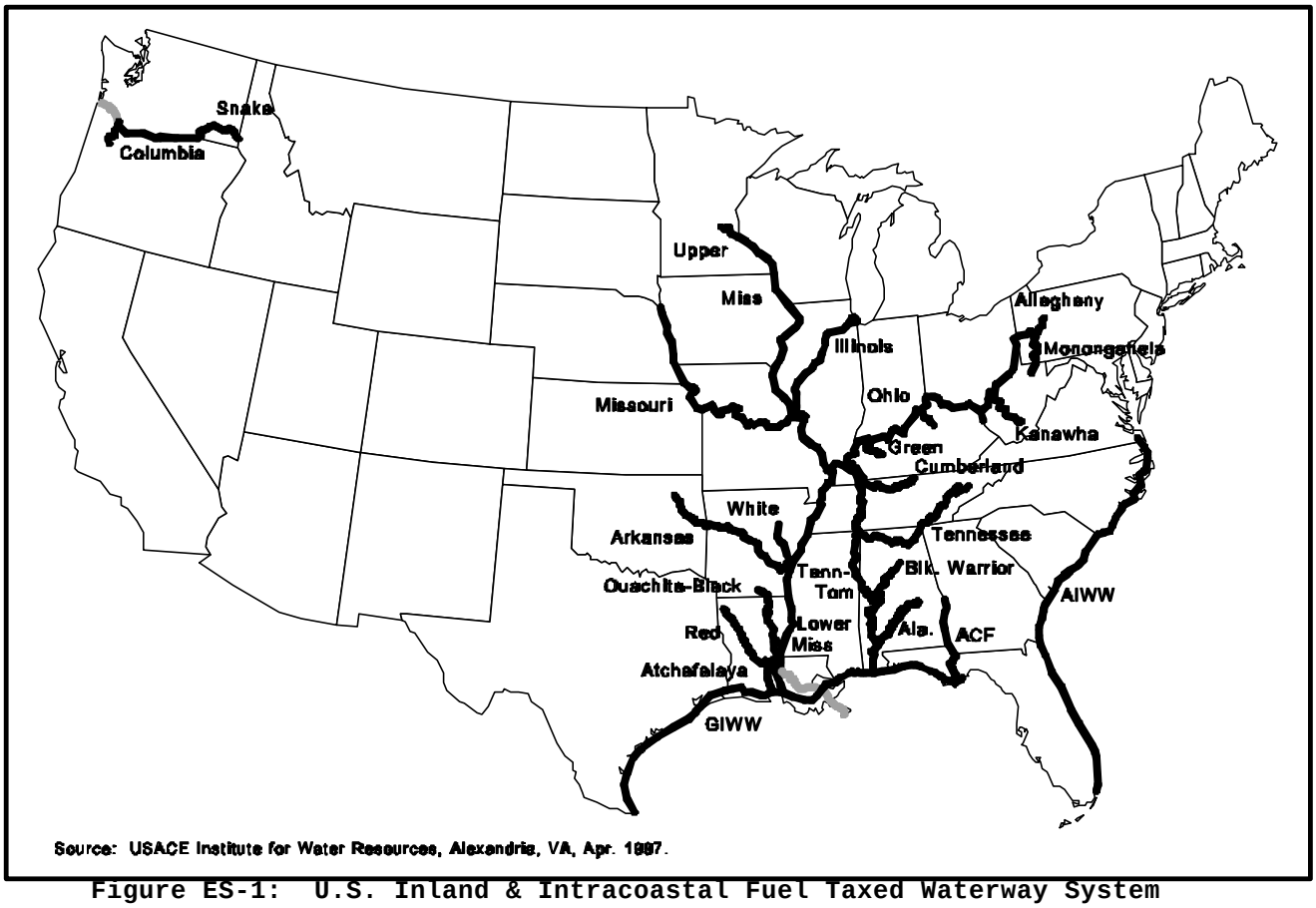


Figure ES-1: U.S. Inland & Intracoastal Fuel Taxed Waterway System

THE ROLE OF INLAND WATERWAY TRANSPORTATION SYSTEM

The role of the waterway system in water resources development and transportation is unique. To a greater degree than many other resource development projects, inland navigation projects provide immediate

commercial benefits. To a greater degree than other parts of the national transportation infrastructure, the waterways have high use and value for purposes other than transportation. These include municipal and industrial water supply, hydropower generation, recreation, and fish and wildlife. Along with other resource development projects and transportation modes, the fundamental purpose of waterways is economic development. The distinctive attributes of waterways are their multiple uses. A flaw in current waterway statistics is that they measure the value to waterways only in terms of freight transported. Statistics for additional uses are generally available only where there is competition for waterway use. The high degree to which multiple uses of the waterways are compatible with the freight transportation goal is understated, as is the military defense value of the waterways.

Measured only in freight transportation statistics, the waterways are one of the smallest components of the U.S. transportation system. They are one of the nation s oldest transportation modes, and still the most efficient in terms of resource inputs required to produce ton-miles. The waterways are ideal for transporting large tonnages over long distances. They still show growth in tonnage transported, although their freight transportation modal share is slipping as waterways are now just one of several transportation alternatives available to most shippers. However, for the shippers who can use the waterways system, it provides a low cost alternative to rail or highway. It is an important factor in assuring the Nation of a highly competitive and efficient transportation system. Comparative ton-miles for the waterways and other transportation modes are presented in Table ES-1.

TABLE ES-1: DOMESTIC INTERCITY FREIGHT TRAFFIC BY TRANSPORTATION MODE, SELECTED YEARS 1970-1995

	Ton-miles(billions)			
Type of Transport	1970	1980	1990	1995
Railroads	771	932	1,091	1,375
Highways	412	555	735	921
Waterways	156	227	292	306
Other Waterborne[1/]	439	693	540	500
Oil Pipelines	431	588	584	599
Air	3	5	10	13
Total	2,212	3,000	3,252	3,711

Source: Transportation in America, Fourteenth Edition; Supplement, 1996. Published by Eno Transportation Foundation, INC., Landsdowne, VA.

Footnote: [1/] Includes domestic coastwise and domestic Great Lakes Traffic.

INSTITUTIONAL INFRASTRUCTURE

The Federal Role

Although the Federal government is the largest single participant in the waterways system based on investment, the combined investments of other participants, predominantly private enterprises, are as great or greater on an annual basis. In this respect investment in the waterway system approximates a public-private partnership.

The basic reason for federal participation in the waterway system is to encourage commerce and to enhance the public's well-being by facilitating transportation. Federal participation is limited to developing, funding and operating the waterways, or vessel routes. Private carriers provide towboats and barges, and various combinations of non-federal public and private organizations develop, fund and operate the inland ports. In this respect, the waterways are similar to the U.S. highway and airway systems. Unlike the other two transportation modes, however, federal participation is largely provided through the water resources development programs of the U.S. Army Corps of Engineers and the Tennessee Valley Authority. The U.S. Department of Transportation's Coast Guard and Maritime Administration are responsible for navigation safety and encouraging development of waterway vessels and port facilities, respectively.

The Corps' responsibility is the improvement and operation of the waterways. Its responsibilities account for most of the federal expenditures on the system, and its waterway improvements largely determine how well the system will function. The Corps also provides a variety of other improvements, the most important of which are bank stabilization and river training works. The latter are wing dams and similar structures which help the natural channelization process and reduce the dredging needed to maintain navigation. The Corps improvements and operations are spread over virtually all 11,000 miles of system. The cumulative investment in the improvements is approximately $12 billion. The current replacement cost is estimated to be about $40 billion. Corps expenditures on the system in FY 1996 were about $190 million for construction and $476 million for operations and maintenance (both amounts in actual 1996 dollars). About one-third of the 1996 construction costs were funded from the Inland Waterways Trust Fund.

The Private Sector Role

Private enterprise is the second largest participant in the waterway system, and largest by some measures. It is responsible for providing and operating all of the vessels and most of the port and cargo terminals and facilities. State and local authorities have provided some port facilities. The enterprises involved span a wide range of sizes and activities. Firms ranging widely in size are directly engaged in vessel

operations, but pressures to improve efficiency are concentrating waterway operations in fewer but larger firms. Over the past decade, the number of towing firms declined by about 30 percent. The largest operators include coal, grain, and utility companies, as well as transportation enterprises. A large number of small firms provide the support services for vessel operations, including: fueling, repair and construction of vessels, and cargo terminal operations. The total number of individuals involved in vessel operation and supporting services is estimated to be about 50,000. Total private sector employment associated with the waterway system is estimated to be about 175,000.

The waterways vessel fleet in the private sector includes about 30,000 barges and 5,000 tugs and towboats. There are about 2,500 cargo facilities on the waterway system; most of these have been provided by private enterprises. The actual investment in waterway vessels and cargo facilities is unknown, but replacement costs have been estimated at $7-15 billion for vessels, and $15 billion for facilities. The economic life of the vessels and terminal equipment is significantly shorter than the federal government s structural improvements to waterways. Actual annual replacement or expansion of the fleet and facilities has varied widely depending on trade conditions and profit prospects. However, based on the economic life of the vessels and facilities, the average annual expenditures required for replacement would be about $550 million and $300 million, respectively. That compared with an average annual federal expenditure on the waterway system of approximately $857 million by the Corps (combined capital and O&M amounts) during the 1990's.

National Defense and the Inland Waterway System

Over the last 30 years, the Army has relied on military convoys over highways and railroads for moving equipment, ammunition and ordnance. Recently, however, Army National Guard and Army Reserve units also have used the inland waterway system to move military vehicles and equipment during exercise.

For example, active duty Army units have moved military equipment down the Ohio and Mississippi Rivers to the Port of Alexandria, Louisiana on the Red River for exercises at Fort Polk, Louisiana. In another example, active duty Army units from Fort Campbell, Kentucky successfully moved heavy equipment to Belize in Central America, via the Tennessee River and Tennessee-Tombigbee Waterway to Mobile and then across the Gulf of Mexico.

Inland Waterways Users Board

Over the last ten years the Inland Waterways Users Board has become a major participant in establishing investment priorities on the waterway system as a result of the Water Resources Development Act of 1986. The Act created the Board to serve as a voice for those waterway users paying fuel taxes. The Board is charged with advising Congress of

the users' priorities for waterways improvements. The Board annually publishes a report to Congress documenting its investment priorities. The Board's recommendations reflect its view of the waterways as a transportation system, while Congress has to balance a much broader array of concerns. The Board's concern with transportation efficiency has also been successfully incorporated into the Corps planning and construction programs through joint efforts on small scale improvements, innovative design and construction techniques, and cost-savings programs.

The Project Planning Process

Inland waterway projects are formulated and evaluated to maximize net national economic development (NED) benefits and to satisfy all applicable environmental laws and standards. In this regard, the Corps follows the procedures required by the *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (P&G)*. For the case of inland navigation projects the benefits are primarily those reductions in transportation costs which would accrue to shippers choosing barge transportation over alternative modes. When locks become congested, a major part of transportation cost reduction benefits come from reduction in delays.

Benefits are estimated using system models which account for net delays on each shipment throughout the inland navigation network with and without capacity addition at the project being studied. Project costs include any costs associated with the mitigation of potential adverse impacts to fish and wildlife habitat caused by project construction, operations (dredging and other activities) or commercial navigation tows moving on the waterways. There also may be other benefits and costs attributed to the project which are included in the analysis.

THE INLAND WATERWAY SYSTEM

The inland navigation system consists of three geographical groupings of waterways that function more-or-less independently of each other. Each regional subsystem has certain distinctive characteristics. These groupings are:

(1) *Mississippi River, its tributaries and the Gulf Intracoastal Waterway (GIWW) and the rivers that intersect it.* This interconnected network of waterways accounts for about 86 percent of the route length of the overall system and 97 percent of the system s overall tonnage. These waterways are a highly developed transportation system, with large and diverse commodity movements, and economies of scale through use of a large, modular, fleet of vessels. Predominantly the commerce is domestic, but the waterways also carry foreign trade that moves through Gulf Coast ports. The network generally provides a minimum 9-foot

navigation channel throughout the Mississippi River and tributaries. The GIWW has 12-foot authorized depth.

(2) *The Atlantic Intracoastal Waterway (AIWW)* is the second largest regional subsystem in terms of route length, with about 11 percent of the system total mileage, but carrying less than one percent of the overall systems waterway commerce tonnage. The rivers that intersect this waterway are relatively short, and waterway traffic is predominantly domestic commerce moving north or south. The AIWW links seaports from Miami to Norfolk, and basically it is an alternative to deep-draft coastwise navigation. The AIWW has authorized depths ranging from 9 to 12 feet.

(3) *The Columbia-Snake Rivers System* in the Pacific Northwest is the smallest subsystem in length, but it shares many attributes of the Mississippi River system. It has its own unique sizes and style of waterway vessels, and links deep water ports on the Lower Columbia River with inland ports in Washington, Oregon, and Idaho. To a much greater degree than the other regional systems, its commerce is export-import oriented. It accounts for approximately two percent of the overall systems commerce (in terms of tons). The Columbia-Snake system has a 14-foot authorized depth.

Virtually all waterways in the system have been improved to facilitate navigation. These improvements include channel straightening and training works in open rivers such as on the Missouri and Lower Mississippi, dams to regulate water levels on most of the riverine waterways, and new waterways or canals to provide connecting links between waterways (such as the Tennessee-Tombigbee).

Lock Characteristics

Locks are required at inland dams and at certain river intersections on the coastal waterways. These locks, and the dams associated with them, represent most of the federal investment in waterways improvements. The locks also have the most impact on how the system operates. The dimensions and numbers of lock chambers influence tow sizes, and usually determine system throughput capacity.

The fuel taxed inland waterways system has a total of 215 lock chambers at 171 lock sites. The great majority of these are on the Mississippi-GIWW system, 200 lock chambers and 160 lock sites, respectively. The number of chambers exceeds lock sites because more than one chamber is provided at some locations for additional or reserve capacity, typically main and auxiliary chambers of unequal size. In general, locks of 1200 feet in length can pass tows of 15-17 barges in a single lockage. Locks of 600 feet require a large tow to be divided or cut in order to pass, requiring two or more lockages for the passage of a single tow.

While lock age does not always correlate with performance, it is a macro-level indicator of system obsolescence. The ages of system lock chambers range from the new chamber at Winfield Locks and Dam on the Kanawha River to the 150+ year old locks on the Kentucky River. The median age for all chambers is about 35 years. By the year 2000 about 40 percent of the projects will have exceeded their 50 year design lives, including many heavily used locks on the Upper Mississippi River and Illinois Waterway.

Lock Performance

For the commercial waterway operator, the time a tow spends underway in channels converts directly to ton-miles. The time spent at locks is an expense, regardless of whether the tow is waiting or processing through the lock. Delay costs are in the range of $250 to $350 per hour, based on a 15 barge tow pushed by a 2,200 to 4,400 horsepower towboat. The time lost and related expense is a prime concern of the vessel operator.

The controlling considerations in lock performance are condition, capacity, and the degree to which the facility constrains present and projected navigation traffic. The overall effectiveness of the waterway system primarily depends on the performance of its individual locks, the ability of the Corps to maintain channel depths, and the ability of vessel operators to use the locks and channels efficiently.

The lock performance of 184 main and auxiliary chambers was analyzed based on 1996 LPMS data. There are a number of measures that can help identify problems in the system, but no one indicator provides conclusive results. Three main indicators were chosen and analyzed: time utilization, average delay, and lock unavailability. There were 76 locks with ten million or more tons of traffic, and 32 of them experienced major or minor problems in lock performance related to delays (average delay time equal or greater than two hours) and/or utilization (time utilization of at least 60 percent). In addition, thirteen of those locks with performance problems were in below average condition based on 1994 summary condition indices.

Over eighty-five percent of the LPMS locks had an average delay per vessel of one hour or less in 1996. The system wide average delay was 0.8 hours in 1996, compared to the 1990 average of 0.9 hours. Tows were delayed an average of four or more hours at five main chamber locks, from two to four hours at another nine locks, and from one to two hours at eight main chamber locks. A primary reason for delay at 14 of the 22 main chamber locks with more than one hour delay was high time utilization, where 60 to 100 percent of the time involved processing or unavailability. Processing time of 60 percent or more occurred at 15 of the 22 locks, while unavailable time at six high delay locks reached as much as 5 to 19 percent. Five of the fourteen locks with high delay and time utilization also used 50 percent or more of their estimated physical

capacity. High average delay times at many of the locks can generally be attributed to peaking capacity problems rather than lock outages, except for those locks with relatively high unavailability percentages.

Appendix B includes 1996 statistics on average delay time per vessel (for all vessels), average processing time, total delay time, unavailable time, utilization rate, and total traffic for all 184 main and auxiliary chambers for which LPMS data is available.

Commercial Fleet

The Mississippi-GIWW region employs about 88 percent of all barges in the U.S., and over 62 percent of all towboats. The barges on the Mississippi-GIWW system are highly standardized as to size, predominantly 195 long by 35 feet wide, and the variety in towboat sizes enables operators to match horsepower with the tow sizes used on individual waterways.

The Columbia-Snake system fleet is also highly standardized, including tow and towboat sizes and a unique barge size, because almost all lock dimensions are the same. The Atlantic Intracoastal Waterway fleet is a mixture of barge and tug/towboat sizes because many vessels operate in harbors and coastal waters as well as in inland waterways.

Dry cargo hopper and tank barge construction have been forecasted to recover and hit record levels during the period 1990 through 2014 due to increasing retirements, traffic growth and utilization patterns. The medium level forecast for hopper barge construction was 1,130 per year in 2000-2004 and 1,470 in 2005-2009. Both would be records compared to 1975-1979. Tank barge construction was projected to top the 1975-1979 record based on the medium level forecast of 165 to 180 per year for 1995-2009. However, for the first seven years, (1990-1996) of the 25 year forecast period actual hopper barge construction was running behind its medium level forecast and tank barge construction was lagging behind its low level forecast.

Utilization of dry cargo and liquid cargo barges and towboats and tugboats in the Mississippi-GIWW region recovered by 1995 to levels of 1980 or earlier or set new records. Utilization had plummeted due to heavy fleet construction in the 1970s and reduced levels of traffic in the early and middle 1980s. Dry cargo barges in 1995 moved about 18,000 tons per barge and 12 tons per ton of capacity. At the same time they hauled a record 10.4 million ton-miles per barge and 7,200 ton-miles per ton of capacity. Liquid cargo barges in 1995 transported 17.3 million ton-miles per barge and 7,700 ton-miles per ton of capacity. Towboats and tugboats in 1995 moved a record 95 million ton-miles per boat and 55,000 ton-miles per unit of horsepower.

Inland and Ports

There are 18 shallow draft inland waterway ports handling over a

million tons of commerce. Five of these ports (Pittsburgh, St. Louis, Huntington, Cincinnati, and Memphis) handled more than 10 million tons in 1995. Between 1980 and 1995 total commerce at the 18 major inland ports increased 21 percent from 145 to 183 million tons. Approximately 30 percent of the waterway traffic occurs at these ports. Traffic at twelve of the ports has increased since 1980. At the two largest inland ports in the nation, Pittsburgh and St. Louis, traffic increased by 33 percent and 23 percent respectively. Coal was the leading commodity at the major inland ports with 80 million tons followed by crude petroleum products with 32 million tons.

INLAND WATERWAY TRAFFIC

TABLE ES-2: 1995 TONNAGE OF WATERWAY COMMODITIES FOR **SELECTED YEARS (MILLION OF SHORT TONS)**

Commodity Group	1965	1975	1985	1990	1995
Coal	92.4	125.3	147.1	188.8	173.7
Petroleum Products	78.2	109.5	100.4	116.0	111.8
Farm Products	22.2	46.1	70.6	89.5	94.0
Nonmetallic Min\Prod	63.4	72.7	75.6	81.2	88.3
Crude Petroleum	42.0	47.6	40.9	50.6	42.7
Industrial Chemicals	15.9	23.8	29.6	34.6	41.2
Metallic Ore\Prod\Scrap	13.3	14.0	14.1	20.6	29.3
Forest Products	19.4	23.4	17.6	18.9	19.1
Agricultural Chemicals	1.9	6.5	11.2	11.4	12.2
All Other	21.0	35.1	27.5	11.0	8.6
Total	369.7	504.0	534.6	622.6	620.2

Source: USACE, Waterborne Commerce Statistics Center, Waterborne Commerce of the United States, annual.

Over 620 million short tons of commerce were moved on the inland and intracoastal waterway system in 1995, the third highest amount of cargo recorded (623 million tons were moved in 1990 and 621 tons were moved in 1992). The 1995 tonnage was 68 percent greater than the level of traffic in 1965 and 16 percent greater than the level of traffic recorded in 1985 (Table ES-2).

In 1995, the 27 fuel taxed waterways accounted for 88 percent of the tonnage and 89 percent of the ton-miles of inland navigation traffic, as defined by the Corps of Engineers Waterborne Commerce Statistics Center. Most of the 1995 traffic was composed of liquid and dry bulk commodities, such as petroleum and petroleum products, coal, grain and other farm products, sand, gravel and other nonmetallic minerals, and industrial and agricultural chemicals, forest products, and metallic ores and products.

The inland waterways system transports about half of the U.S. grain exports and one-sixth of the coal produced. By moving large volumes of these commodities at a low unit cost per ton, the waterway system helps to keep U.S. export prices competitive with products produced by other

TABLE ES-3: U.S. INLAND WATERWAY TON-MILES BY COMMODITY GROUP FOR SELECTED YEARS (MILLIONS OF TON-MILES)

COMMODITY GROUP	1965	1975	1985	1990	1995
Farm Products	21,788	48,780	70,706	93,132	94,942
Coal	18,776	35,349	63,152	83,198	77,358
Petroleum Products	26,135	35,809	29,668	35,485	32,046
Nonmetallic Min/Prod	9,127	12,760	17,780	21,065	30,944
Metals	9,713	12,429	13,280	20,718	29,389
Industrial Chemicals	8,766	15,766	18,710	19,027	21,199
Agricultural Chemicals	2,008	6,070	9,503	9,364	10,495
Crude Petroleum	9,948	8,536	6,368	5,783	4,947
Forest Products	1,291	1,733	1,885	2,558	3,959
ALL OTHER	1,699	3,163	1,655	2,084	1,040
TOTAL	109,251	180,395	232,707	292,414	306,319

SOURCE: USACE, Waterborne Commerce Statistics Center, Waterborne Commerce Of The United States, annual.

countries and domestic energy costs low.

Several commodity groups comprise the vast majority of tonnage moving on the inland waterways. The major commodities and their percent shares in both tons and ton-miles are depicted on Figure ES-2. Between 1965 and 1995, tons and ton-miles for eight of these ten commodity groups increased (Tables ES-2 and ES-3). Farm products and agricultural chemicals lead in percentage increase of tons and ton-miles between 1965-95, while coal and farm products showed the greatest increase in tonnage.

TABLE ES-4: TRAFFIC PROJECTIONS OF TOTAL INLAND WATERWAY COMMODITY MOVEMENTS (MILLION OF TONS)

Commodity Group	Wtd Avg	2000			2010			Ann. Avg. Growth to 2010		
	90-94	Low	Med	High	Low	Med	High	Low	Med	High
Farm Products	88.4	97.3	103.2	105.1	123.7	127.1	135.2	1.9%	2.0%	2.4%
Metals	22.9	20.1	22.0	23.9	20.0	24.4	28.8	-0.7%	0.4%	1.3%
Coal	181.5	195.3	199.3	203.2	213.6	221.4	234.8	0.9%	1.1%	1.4%
Crude Petroleum	45.4	37.8	42.5	44.9	28.9	37.7	42.7	-2.5%	-1.0%	-0.3%
Nonmetallic Minerals	85.6	81.3	90.4	99.6	92.8	101.6	110.4	0.4%	1.0%	1.4%
Forest Products	18.7	19.3	22.3	22.6	21.3	26.2	27.8	0.7%	1.9%	2.2%
Industrial Chemicals	36.1	39.0	41.6	44.1	44.3	50.4	56.5	1.2%	1.9%	2.5%
Agricultural Chemical	12.4	11.6	13.5	14.0	14.8	15.3	17.5	1.0%	1.2%	2.0%
Petroleum Products	115.8	125.9	127.9	131.0	133.1	144.1	152.0	0.8%	1.2%	1.5%
Other	7.2	9.4	10.1	10.5	10.4	11.5	12.3	2.1%	2.6%	3.0%
Total	613.9	637.1	672.9	698.9	705.3	759.8	818.1	0.8%	1.2%	1.6%

Source: CEWRC-IWR staff calculations.

PROJECTED COMMODITY TRAFFIC

Traffic forecasts for the inland waterways system were developed by commodity and by segment for the period 2000 through 2010. A top-down approach for these projections was adopted for its consistency and relative simplicity for the comprehensive national level perspective of this review. Statistically, these projections are most meaningful at the national level. Commodity projections are shown in Table ES-4. Detailed projections of commodity levels by waterway are presented in

Chapter 3 and Appendix E.

These projections are based on industrial sector growth rates from commercial forecast services and other federal agencies. For national level traffic forecasts, regression analyses were performed using historic relationships between waterway traffic and an industrial sector index (e.g. coal use by utilities, corn and soybean exports, etc.). Projected growth rates for these industrial sectors were then used to develop estimates of waterborne traffic using the resulting regression equations. Multiple sources were used when available to develop low, medium and high growth rate scenarios.

National level projections by commodity were then disaggragated into segment level projections based on historic share. Weighted averages for the period 1990-94 were used as a base, with 1995 estimates

included if available. Note that the averages were adjusted for anomalies, such as the Midwest Flood of 1993 and its effect on the Upper Mississippi River, and that growth rates by commodity were further adjusted at the segment level if recent trends were observed indicating a

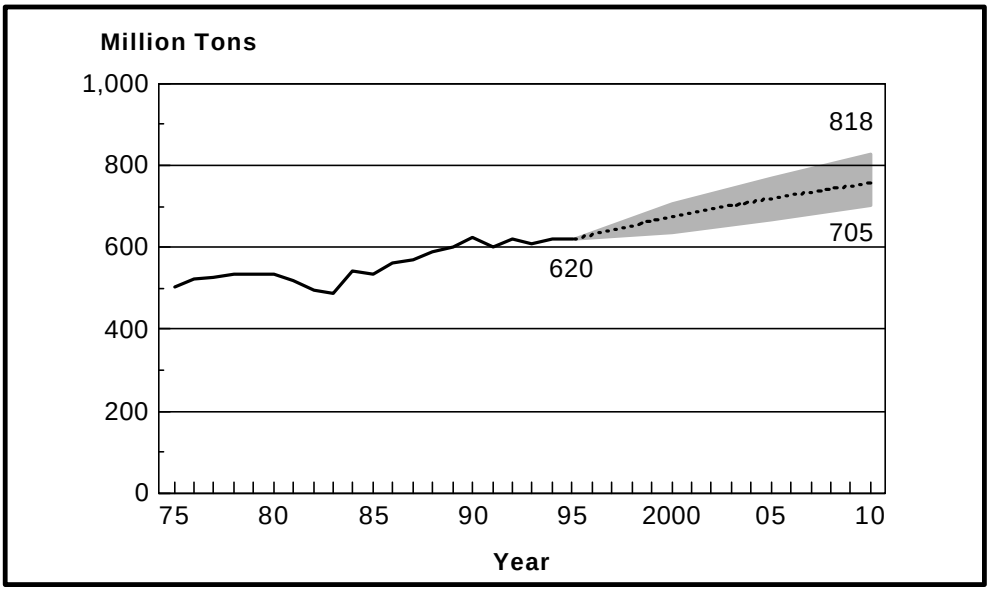


Figure ES-3: U.S. Inland Waterway Traffic Historic and Projected 1975-2010

significant change in traffic share. Projections have assumed the same competitive relationship between transportation modes that is in the place as of the base time period, and are unconstrained to the extent that no attempt was made to analyze or address any capacity constraints beyond those governing modal split in the base period.

Forecast results are summarized in Table ES-4. Total system traffic is projected to grow by 0.8 percent annually under low growth assumptions, by 1.2 percent under medium growth assumptions, and by 1.6 percent annually under high growth assumptions through 2010. This results in total traffic increasing from 620 million tons in 1995 to between 705 and 818 million tons by 2010 (also see Figure ES-3).

Commodities which are forecasted to exhibit above average growth include farm products (1.9 to 2.4 percent), industrial chemicals (1.2 to 2.5 percent) and agricultural chemicals (1.0 to 2.0 percent), while commodities which are forecasted to exhibit below average growth include forest products (0.7 to 2.2 percent) and petroleum products (0.8 to 1.5 percent). Crude petroleum is the only commodity forecasted to show a decline in waterborne movements across all projections (-0.3 to -2.5 percent).

The relatively high growth for farm products is based largely on export projections for grain, especially corn and soybeans. Factors

impacting the level of grain exports include a growing demand for grain products in east and south Asia and in the Middle East, limited supplies from other exporting nations, and the effects of recent trade accords which will reduce market distorting farm subsidies, particularly in the European Union (EU). Some increase in domestic demand is also likely due to the increasing variety of uses for corn and other grains. The relatively high growth for farm products contributes in turn to higher demand for agricultural chemicals, which also provide backhaul opportunities.

Emerging new movements have not been captured in this analysis, since the traffic base is 1990-94. This is particularly evident for metallic ores and products, as can be seen in Table 3-1 and Figure 3-19. The dramatic surge in metal movements on the waterways beginning in 1994 already exceeds out-year projections. This traffic is largely due to a surge in metal imports via the Lower Mississippi and it is not yet clear if this is temporary phenomenon or a sustained new movement. See Chapter 3 for additional details.

PROJECTED WATERWAY TRAFFIC

Projections by waterway are driven by growth rates for the principal commodities handled and by trends in share. Growth rates above the national level are projected for many waterway segments (Table ES-5). This is due primarily to two factors. The national total includes significant traffic (about 80 million tons in 1995) moving outside the fuel taxed waterway system, particularly crude petroleum and petroleum products, in such areas as Delaware Bay, Chesapeake Bay, and New York Harbor. This dampens the national growth rate because these are forecast to be low- or no-growth commodities. Segment growth rates can also be higher due to longer hauls moving on multiple waterways, represented here by trends toward increased share.

Projections for the Upper Mississippi and Illinois were developed by Jack Fawcett Associate (JFA) in October 1996 for the UMR-IWW Navigation Study. Projections for the remaining segments were developed by IWR staff consistent with past Reviews.

TABLE ES-5: U.S. INLAND FUEL TAXED WATERWAY TRAFFIC PROJECTIONS OF TOTAL COMMODITY MOVEMENTS BY SEGMENT (MILLION OF TONS)

Waterway Segment Traffic	Wtd Avg 90-94	2000			2010			Ann. Avg. Growth to 2010		
		Low	Med	High	Low	Med	High	Low	Med	High
Upper Mississippi*	79.9	87.0	95.0	103.0	95.0	107.9	121.0	1.0%	1.7%	2.4%
Middle Mississippi	107.5	117.1	124.3	128.3	141.1	146.7	157.8	1.5%	1.7%	2.2%
Missouri	6.6	5.7	6.3	6.8	6.6	7.1	7.8	0.0%	0.4%	0.9%
Lower Mississippi	191.9	202.5	214.8	222.6	238.7	251.0	271.1	1.2%	1.5%	1.9%
Arkansas	9.6	8.9	9.8	10.3	10.6	11.3	12.4	0.6%	0.9%	1.4%
Illinois Waterway*	46.2	46.0	50.7	55.0	51.0	57.3	64.0	0.9%	1.6%	2.3%
Ohio River System	262.0	243.8	254.5	263.8	270.5	286.4	307.2	0.2%	0.5%	0.9%
Ohio River Mainstem	228.8	230.8	240.7	249.6	256.7	271.1	290.7	0.6%	0.9%	1.3%
Monongahela	35.6	39.0	40.1	41.2	42.7	44.6	47.5	1.0%	1.3%	1.6%
Kanawha	22.0	22.7	23.5	24.2	25.0	26.2	28.0	0.7%	1.0%	1.3%
Cumberland	14.5	15.2	16.2	17.1	16.9	18.1	19.6	0.9%	1.2%	1.7%
Tennessee	47.0	46.2	48.7	50.8	51.8	55.1	59.3	0.5%	0.9%	1.3%
GIWW - Total	113.3	114.5	121.3	127.1	120.3	134.7	146.9	0.3%	1.0%	1.5%
GIWW - N.O./Mobile	23.7	24.4	25.6	26.6	26.2	28.6	30.9	0.6%	1.0%	1.5%
GIWW - N.O./Texas	66.5	65.7	70.1	73.7	67.7	76.8	84.2	0.1%	0.8%	1.3%
Morgan City/Port Allen	25.3	25.9	27.6	29.2	28.2	31.6	34.8	0.6%	1.2%	1.8%
Black Warrior/Tombigbee	23.2	23.0	24.7	25.5	24.9	27.8	30.0	0.4%	1.0%	1.4%
AIWW	3.8	4.4	4.9	5.1	5.1	5.6	6.2	1.6%	2.1%	2.7%
Columbia	14.2	14.9	16.2	16.8	17.5	19.1	20.4	1.2%	1.7%	2.0%
Inland System Total	613.9	637.1	672.9	698.9	705.3	759.8	818.1	0.8%	1.2%	1.6%

*Upper Mississippi and Illinois projections adapted from Jack Faucett Associates "Waterway Projections for the Upper Mississippi River Basin, Volume I: Summary," prepared for the Corps of Engineers Institute for Water Resources and Rock Island District, Oct. 1996.
All other commodity and waterway projections developed by the Corps of Engineers, Institute for Water Resources, 1996.

Growth on the **Upper and Middle Mississippi River** is driven largely by the forecasted increase in farm products, nearly 90 percent of which is for export. Traffic is projected to grow on the Upper Mississippi River to between 95 and 121 million tons by 2010. On the **Middle Mississippi River**, traffic is projected to increase from a base average of 107.5 million tons to between 141 and 158 million tons. The mix of traffic on the **Lower Mississippi River** is more diverse and projections are affected by farm products, coal, nonmetallic minerals and petroleum. Traffic is forecast to increase to between 237 million tons to 293 million tons in 2010.

The **Illinois Waterway** is also dominated by farm products, but carries significant amounts of coal, petroleum and nonmetallic minerals. Traffic on the Illinois Waterway is projected by JFA to grow between 51 and 64 million tons by 2010.

Projections for the Ohio, Monongahela and Kanawha Rivers are driven primarily by coal. The **Ohio River** mainstream carries the most traffic of any segment. It is forecast to grow from a base average of 229 million tons to between 257 and 291 million tons by 2010. Traffic on the **Monongahela River** is forecast to grow more slowly because the demand for the high sulfur coal of the region is relatively flat due to Clean Air Act compliance by utilities. Traffic on the Monongahela River is forecast to grow from 36 million tons to between 43 and 47.5 million tons by 2010. Traffic on the **Kanawha River** has been growing more rapidly because of an increased demand for low sulfur coal, but growth also hampered by undersized locks. Kanawha River traffic is forecast to grow from 22 million tons to between 25 million and 28 million tons by 2010.

The **Cumberland** and **Tennessee Rivers** are both dominated by coal and nonmetallic minerals. Traffic on the Cumberland River is expected to increase from 14.5 million tons to between 17 and 20 million tons, while Tennessee River traffic grows from 47 million tons to between 52 million and 59 million tons by 2010.

Traffic on the **Gulf Intracoastal Waterway (GIWW)** is mixed, dominated by petroleum products, industrial chemicals, crude petroleum and nonmetallic minerals. Traffic on the GIWW is forecast to grow from 113 million tons in the base period to between 120 million and 147 million tons in 2010.

Traffic on the **Black Warrior/Tombigbee** is dominated by coal, forest products, and metals, and it is expected to grow from 23 million tons in the base period to between 25 million and 30 million tons by 2010.

On the west coast, the **Columbia River** traffic is dominated by farm products, forest products, nonmetallic minerals, and petroleum products. Traffic on the Columbia River is forecasted to grow from 14 million tons in the base period to between 17.5 million and 20.4 million tons by 2010.

INLAND WATERWAY PROGRAMS AND FUNDING

Federal funding for carrying out activities associated with the inland waterway system is derived from the Civil Works appropriations. In particular, three Civil Works accounts: Operation and Maintenance, General (O&M), Construction, General (CG), and General Investigations (GI), fund the majority of on-going activities of the Corps with respect to the inland waterway system. A fourth account, Mississippi River and Tributaries (MR&T), includes consolidated funding for planning, engineering and design, construction, and operations and maintenance activities for the Mississippi River and its tributaries. Fifty percent of the funding for the construction or major rehabilitation of inland waterway projects is recovered from the Inland Waterways Trust Fund for projects that are part of the fuel taxed system.

Operations and Maintenance

Total operations and maintenance (O&M) expenditures by the Corps have grown steadily (in actual dollars) due to an increase in the number of projects which have to be operated/maintained, the increasing age of the projects in the Corps inventory, and inflation. However, real cost growth within the Corps overall Civil Works O&M account has been small. The increase in actual dollars spent on O&M has been able to keep up with inflation resulting in operations and maintenance expenditures as measured in *constant* dollars holding steady at about $1.5-$1.6 billion annually since the late 1970's.

Between 1980 and 1996, O&M expenditures for the inland waterway system has represented between 26 percent and 32 percent of total operations and maintenance expenditures. Within the Operation and Maintenance account, actual expenditures on the inland waterway system have increased from $220 million in 1980 to $476 million in 1996, a 116 percent increase (Table ES-6). Total actual expenditures for O&M increase from $849 million in 1980 to $1.75 billion in 1996, a 106 percent increase. Thus expenditures for the inland portion of operations and maintenance has increased a bit more than overall operations and maintenance expenditures. Measured in constant dollars, inland waterway operations and maintenance expenditures have ranged between $400 million and $500 million for the last 20 years.

Construction

From an overall standpoint, construction expenditures have declined since 1965 even when measured in constant dollars. The average annual expenditure from the Construction, General account during the late 1970's to the early 1980's was approximately $1.5 billion versus $1.0-$1.2

TABLE ES-6: FEDERAL INLAND WATERWAYS AND CIVIL WORKS INVESTMENT 1980-1996 (MILLIONS OF ACTUAL DOLLARS)

	Inland Waterways				Civil Works					
Fiscal Year	Const $ 1/	Const IWTF $	O&M $	Total $	Const $	Inland %	O&M $ 2/	Inland %	Total $	Inland %
1980	427	--	220	647	1660	26	849	26	2509	26
1981	422	--	242	664	1594	26	903	27	2497	27
1982	432	--	249	681	1430	30	1008	25	2438	28
1983	359	--	296	655	1508	24	1024	29	2532	26
1984	314	--	351	665	927	34	1185	29	2112	31
1985	301	--	338	639	948	32	1305	26	2253	28
1986	246	--	339	585	880	28	1320	26	2200	27
1987	304	25	392	696	1149	26	1340	29	2489	28
1988	414	62	418	832	1200	35	1400	30	2600	32
1989	417	63	438	855	1180	35	1370	32	2550	34
1990	473	117	400	873	1084	44	1398	29	2482	35
1991	505	149	382	887	1143	44	1451	26	2594	34
1992	508	123	454	962	1284	40	1538	30	2822	34
1993	480	75	397	877	1260	38	1652	24	2912	30
1994	514	76	482	996	1401	37	1689	29	3090	32
1995	246	68	490	736	984	25	1646	30	2630	28
1996	190	60	476	666	785	24	1750	27	2535	26

SOURCES: USACE, CECW-BD, U.S. Army Corps of Engineers Appropriations for Civil Works, January 1997, for Civil Works funds. (O&M amount excludes Regulatory Functions.) USACE FY CIVIL Works Justification Data Congressional Submission for Waterways construction allocations. USACE Navigation Cost Recovery Data Base System for O&M expenditures, including the MR&T account.

NOTES: 1/ Inland Waterways construction column include costs for all projects on fuel taxed waterways, including expenditures from the Inland Waterways Trust Fund (which is also separately displayed). Waterways construction excludes other waterway projects for environmental purposes or bridge replacement, whose amounts totaled (Mil): FY 91-$67, FY 92-$81, FY 93-$89, FY 94-$88, FY 95-&74, and FY 96-$124.

2/ Civil Works total O&M costs include expenditures recovered from the Harbor Maintenance Trust Fund.

billion from the late 1980's to the early 1990's. This represents about a 33 percent reduction over that period. Most significantly, beginning in 1984, the Corps annual O&M expenditures have surpassed construction spending for the Civil Works program, and have remained greater each year since that time. Actual construction expenditures for inland waterway projects trended downward in the period from 1980 to 1986. With the passage of the Water Resources Development Act of 1986 and the authorization of a number of projects for construction, funding levels increased between 1986 and 1992 by 106 percent (from $246 million in 1986 to $508 million in 1992). This increase in construction outlays was mirrored by an increase in spending recovered from the Inland Waterways Trust Fund, which rose from $25 million in 1987 to a peak of $149 million in 1991.

Construction funding continued at approximately the 1992 level in

1993 and 1994 before further declining in 1995 and 1996. Funding recovered out of the Inland Waterways Trust Fund declined by about half between 1992 and 1996, to a level of $60 million in 1996.

Reflective of the increase in construction expenditures in the post WRDA 1986 period was the completion of six of projects authorized by that Act which were cost shared with the Inland Waterway Trust Fund. Figure ES-4 display the projects effectively completed subsequent to 1986, including those where 50 percent of construction costs were not recovered from the Trust Fund.

Five ongoing construction projects include cost recovery from the Trust Fund are displayed in Figure ES-5, along with the non-Trust Fund projects currently under construction.

In addition, the Corps is also continuing construction activity on five major environmental restoration projects, along with several other environmental studies which are underway (Figure ES-6): the Columbia River (scheduled for completion in 2007); the Lower Snake River (scheduled for 2002); The Upper Mississippi River (to be completed between 1998 and 2002); the Missouri River (scheduled for 2006); and the Tennessee-Tombigbee Waterway (scheduled for completion in 1998).

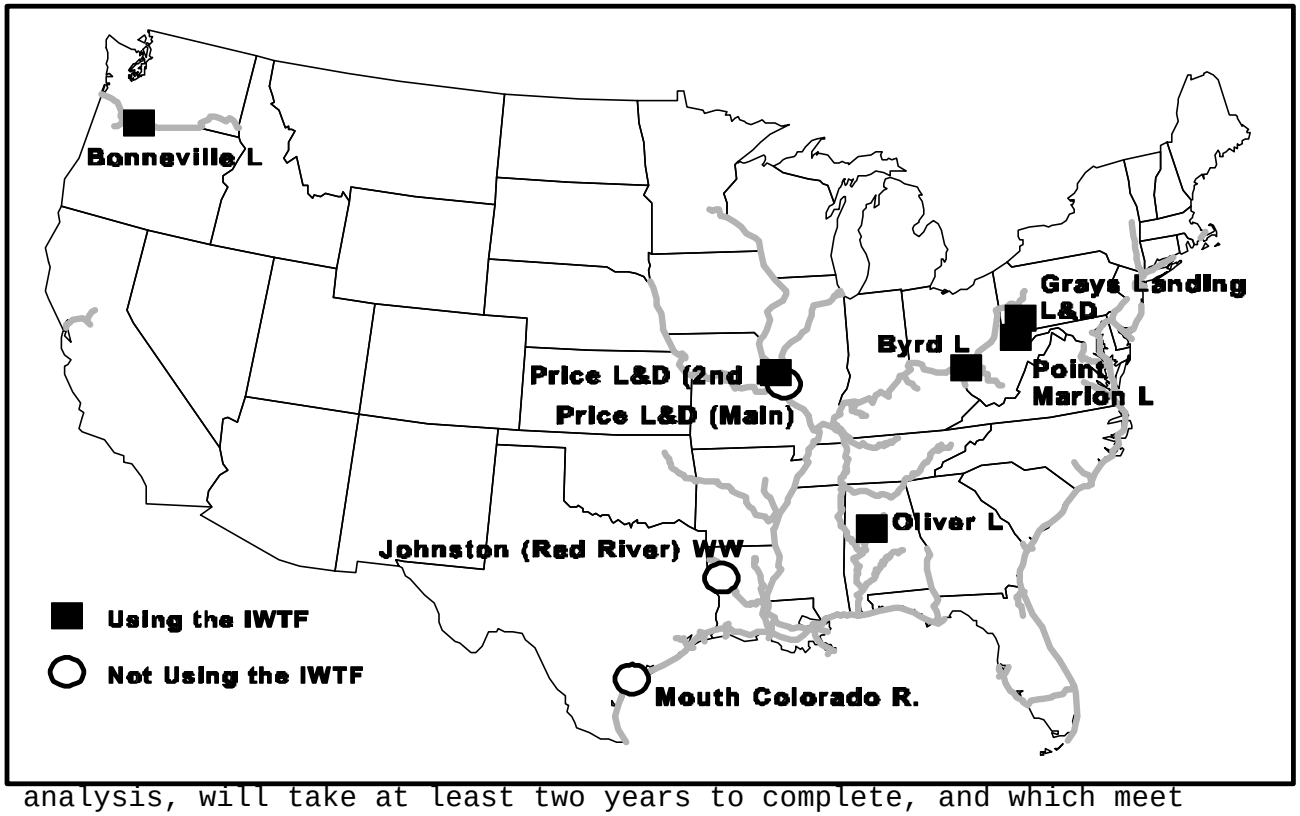
Small Scale Improvements

Small scale improvement measures can play an important role in enhancing the overall efficiency and safety of barge traffic on the inland waterway system and can also provide marginal increases in capacity at individual locks. The Inland Waterways Users Board endorsed the use of small scale improvements in their 1995 and 1996 annual reports, and the Board is continuing to work with the Corps and the U.S. Coast Guard on the implementation of such measures. The Board s small scale improvements working group unanimously agreed that capacity and safety should be the major goals of the program, with environmental impacts also being addressed.

The Corps is implementing small scale improvements on a site specific basis throughout the system. In particular, the Corps has identified an extensive array of small scale improvement options for locks on those two segments. These options include industry self-help measures, the use of helper and switch boats, dolphins and buoys, powered traveling kevels, guidewall and/or guardwall extensions, dikes, mooring cells, tow-haulage equipment, and a variety of channel improvement measures and other modernization features.

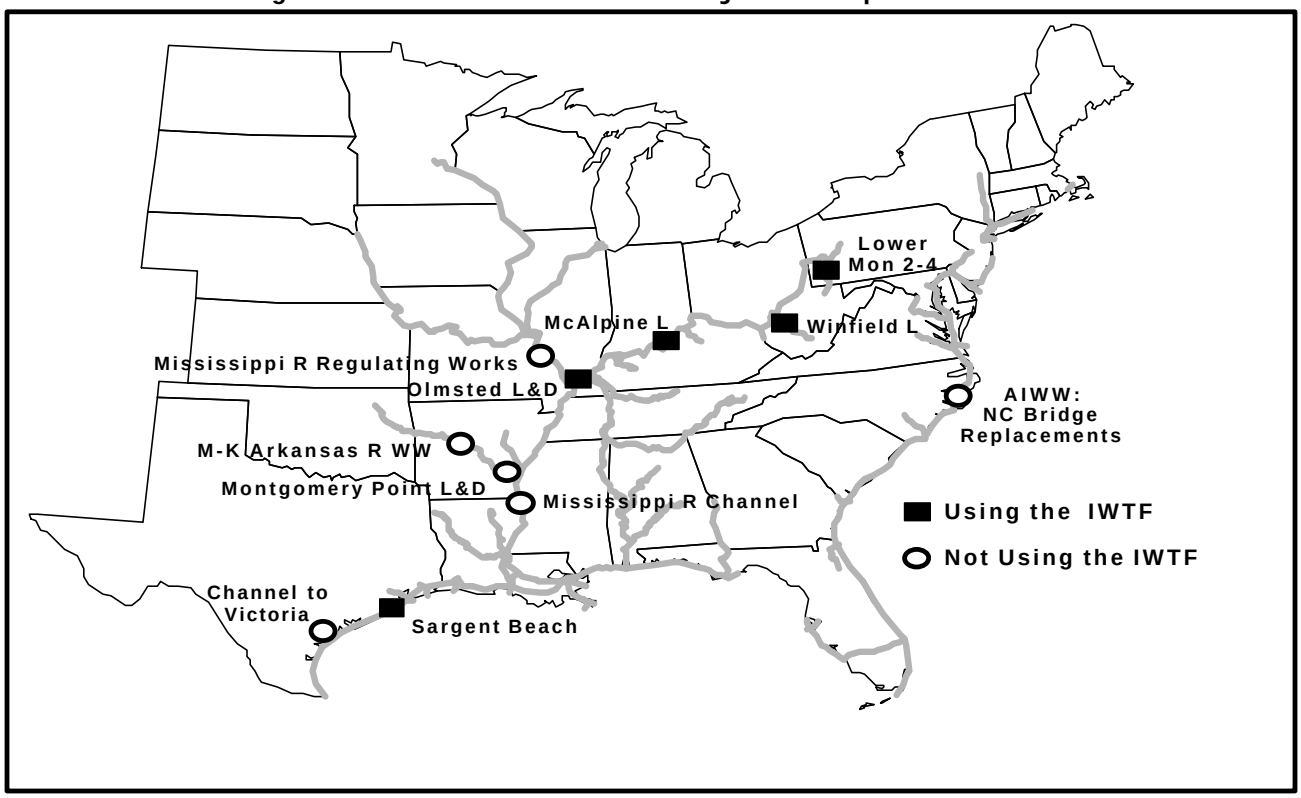
Major Rehabilitation

Section 206 of the Water Resources Development Act of 1992 defined major rehabilitation as the restoration of an inland navigation project feature consisting of structural work which significantly extends the physical life of the feature, is economically justified by benefit-cost



analysis, will take at least two years to complete, and which meet

Figure ES-4: Construction Projects Completed Since WRDA'86.



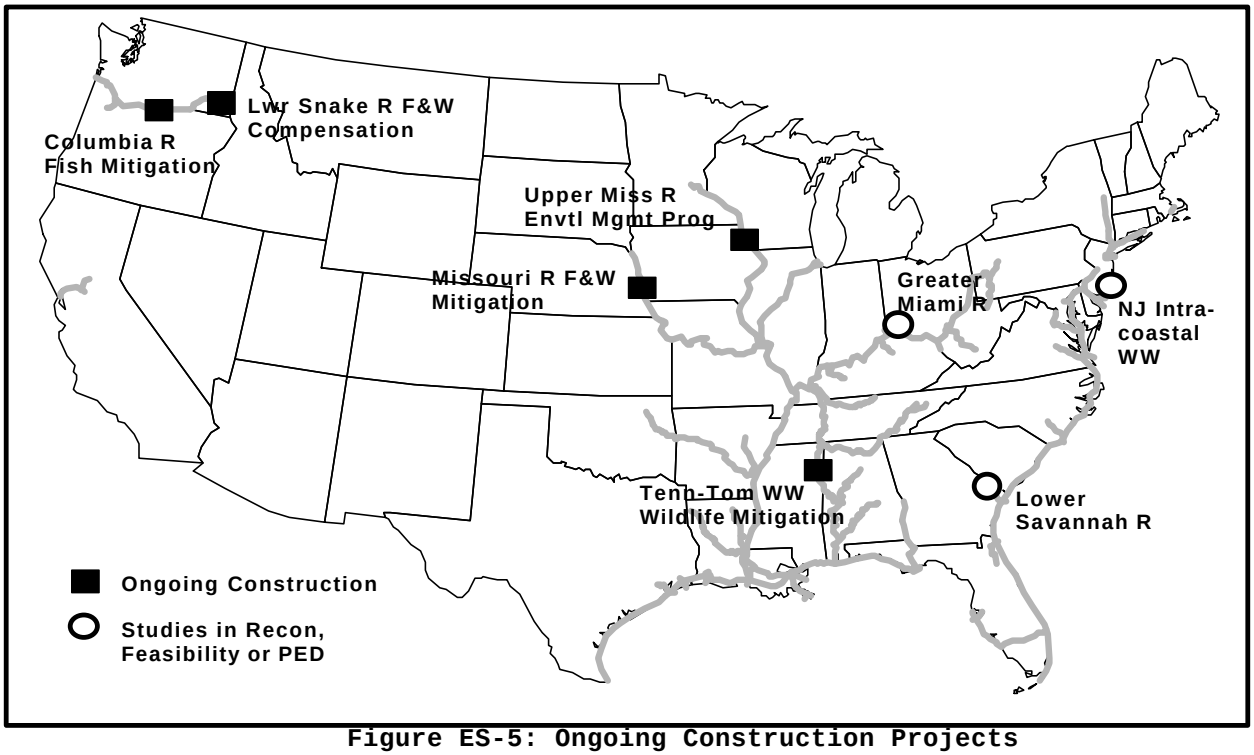


Figure ES-5: Ongoing Construction Projects

Figure ES-6: Ongoing environmental Restoration, Mitigation, and Management Projects and Studies on Inland Waterways

certain cost thresholds. Since the FY 1992 budget the funding of major rehabilitation projects has moved from the Operations and Maintenance, General account to the Construction, General appropriations account. All new major rehabilitation projects are now funded as new construction starts, with one half of the funding for such work derived from the Inland Waterways Trust Fund. However, continuing major rehabilitation projects started prior to FY 1992 are being completed with O&M funds.

Four major rehabilitation projects initiated after FY 1992 (and thus using the Inland Waterways Trust Fund) were completed during 1995 and 1996 at a cost of $77.2 million. These included the four locks on the Illinois River (Brandon Road, Dresden Island, Marseilles, and Lockport) treated as one major rehabilitation project; Lock and Dam 13 on the Mississippi River; Lock and Dam 15 on the Mississippi River; and the Brazos River Floodgates project on the Gulf Intracoastal Waterway in Texas.

At present four projects are being carried out under the auspices of the major rehabilitation program - Lock and Dam 14; Lock and Dam 24; Lock and Dam 25; and Locks and Dams 3, 5A, 6, 7, 8, and 9. All of these locks and dams are located on the Mississippi River. Rehabilitation work at Locks and Dams 3, 5A, 6, 7, 8, and 9 began prior to FY 1992 and are funded out of the O&M account. The scheduled completion dates for these projects is between August 2000 and September 2005.

One additional major rehabilitation project, Lock and Dam 3 on the Mississippi River, has been proposed for funding in the FY 1998 budget, at an estimated cost of $12.4 million, and would use the IWTF to recover 50 percent of this cost.

Studies Leading to Navigation Projects

The focus of the Corps investigative studies is both broad in scope and geographic orientation. The types of studies undertaken by the Corps range from investigations of localized issues involving a few miles of inland waterway or coastal area to large waterway system investigations involving hundreds of miles of waterway and numerous structures. In essence, the Corps General Investigations planning activity establishes the framework for future operations and maintenance and construction activities, and lays the foundation for the Corps response to future problems facing the Nation s inland and coastal waterways.

There are three stages of investigations which a project proceeds through: (1) Reconnaissance, (2) Feasibility and (3) Preconstruction Engineering and Design. Reconnaissance level investigations determine if a problem exists which warrants further investigation by the Corps. Feasibility level investigations determine in greater detail the scope of the problem and the potential solution proposed by the Corps. Preconstruction Engineering and Design (PED) investigations outline in detail the exact specifications of the projects to be implemented.

Nine studies are underway in the PED phase, three of which involve the replacement, addition of, extension to and/or rehabilitation of existing lock structures (see Figure ES-7; the Lower Savannah River Environmental Restoration PED is displayed on Figure ES-6). Two PEDs involve the construction of additional locks at existing lock sites, Marmet Locks on the Kanawha River in West Virginia and Kentucky Lock on the Tennessee River in Kentucky. Both studies are due to be completed in September 1998, and both projects were authorized for construction in the Water Resources Development Act of 1996. The PED for the Inner Harbor Navigational Canal replacement lock in New Orleans is scheduled to be completed sometime after the year 2000.

There are five Feasibility or special studies underway that are scheduled for completion between 1997 and 2000 (Figure ES-8), and six Reconnaissance level studies are underway and are scheduled for completion in 1997 or 1998.

1.8.5 Inland Waterways Trust Fund

The Inland Waterways Revenue Act of 1978 (P.L. 95-502) imposed waterways user fuel taxes on the waterways specified therein, and authorized creation of the Inland Waterways Trust Fund to provide a vehicle to utilize the tax revenues to pay for waterways improvements. The Trust Fund was actually established in February 1981, with the initial transfer of tax revenues.

The Water Resources Development Act of 1986 (P.L. 99-662) extended the power within Congress to authorize use of the Trust Fund to

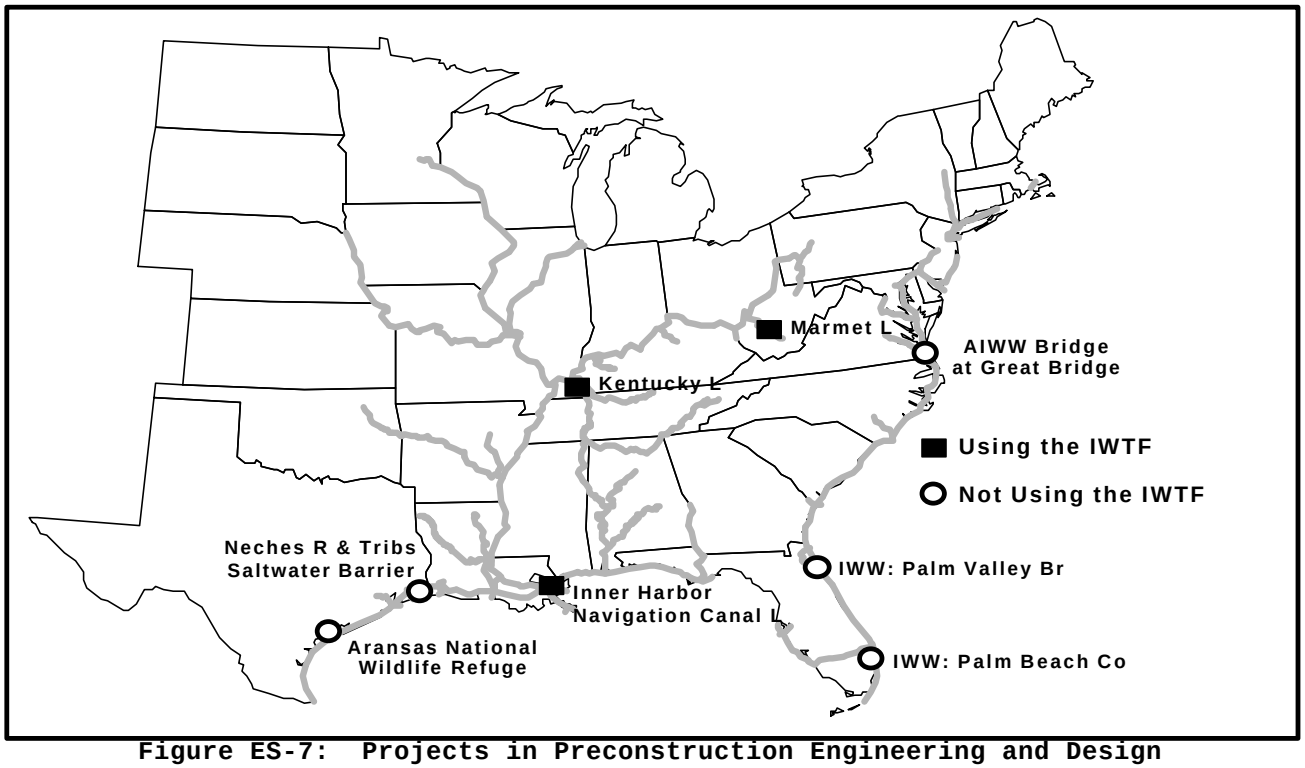


Figure ES-7: Projects in Preconstruction Engineering and Design

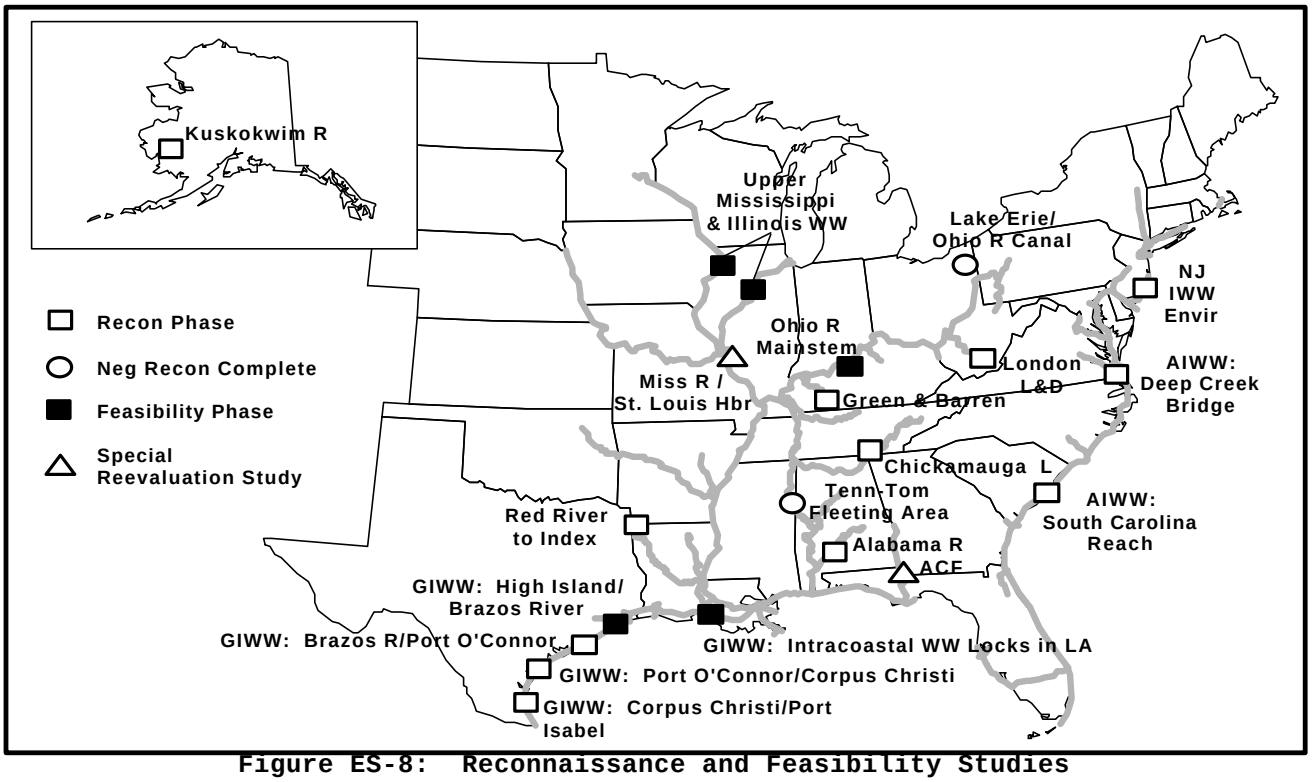


Figure ES-8: Reconnaissance and Feasibility Studies

appropriations committees in addition to public works committees. The Act set a precedent for recovering 50 percent of project costs from the Trust Fund, with the remaining 50 percent from the General Fund. It also extended fuel taxes to the Tennessee-Tombigbee Waterway. Total tax revenues through FY 1996 were $913.7 million. Total withdrawals from the Fund through FY 1996 were $868.5 million.

The Inland Waterways Trust Fund is an invested fund. Any unexpended balance in the Trust Fund is invested in interest bearing obligations, and Fund revenues are a combination of taxes and interest earnings. The Treasury Department is responsible for administration of the Fund, including investment of revenues and accounting for receipts and expenditures. The Corps of Engineers is responsible for determining the timing and amount of Trust Fund expenditures, and preparation of the annual budget submission to the Office of Management and Budget and to Congress.

As of 1997, use of the Inland Waterways Trust Fund has been authorized for 14 new or replacement lock construction projects and ten major rehabilitations. Eight construction projects and seven major rehabs are at or near completion. Another three construction projects and three major rehabs are underway, while the remaining three construction projects are authorized but not yet started. An analysis of the construction schedules of inland waterway projects cost shared with the Trust Fund yields projected expenditures to the year 2010. To identify the funding limits of the Trust Fund, five additional projects now in the PED phase and which could be new construction starts within the same time frame were also analyzed. While all authorized projects can be constructed, the analysis shows that funding could be a constraint on implementing more than four to six major improvement projects per decade, depending on actual tax receipts and construction cost inflation. There will likely be a maximum of $200 to $300 million per year, or $2 to $3 billion per decade, of improvements that can be funded, assuming a 50 percent share is drawn from the Trust Fund.

Of more immediate concern for the construction of authorized projects not yet under construction is the impact of federal deficit reduction efforts and the resulting budget ceilings on agencies, including the Corps. As currently programmed, complying with the budget ceilings will require foregoing new construction starts for authorized projects not yet underway until after 2007. Projects currently under construction would face stretched schedules and potentially higher construction costs under these ceilings.

A comparison of the impact to project construction schedules of the Inland Waterways Trust Fund and of the Corps proposed budget ceilings can be found in the presentation given to the Inland Waterways Users Board at their July 31, 1997 meeting in St. Louis (Appendix F).

EMERGING ISSUES

Many of the issues facing the fuel taxed system are framed by the dilemma that an aging infrastructure will likely require increasing resources to maintain even existing levels of service just at a time that future spending is being curtailed. Some of the key emerging issues are:

Trust Fund Capability. The current fuel tax rate is limited to 20 per gallon and is not adjustable with respect to inflation, although project costs are. If no adjustment in the fuel tax is made or no new sources of revenue obtained, the replacement rate will gradually slow, even if the federal budget ceilings are eased. As the buying power of the Trust Fund decreases and the system continues to age while traffic grows, capacity will become more limited at key locations.

Cost Savings Measures. Cost savings measures include the use of small-scale improvements, innovative design and construction techniques, improved demand management particularly of low-use waterways, reorganization of the Corps, and changes in the way the Corps does business including the National O&M Plan of Improvement effort.

A new civil works research program called Innovations for Navigation Projects (INP) is scheduled to begin in FY 1998. INP will investigate innovations to reduce construction costs without resulting in unacceptable service levels or causing hazardous conditions for users. Implementing the new technologies could reduce the cost of future navigation improvements by 15 percent without reducing the inland waterways system s reliability.

Revenue Generating Measures. Currently, only the commercial barge industry pays a users fee via the fuel tax for construction and rehabilitation of navigation projects. Potential revenue generating measures that may receive renewed attention in the future could include: the consideration of additional users fees (i.e., an increased fuel tax, lockage fees, congestion fees, etc.) for construction and/or recovery of operations and maintenance costs, implementing user fees for other users of the system that currently receive benefits (e.g., recreational, boats, passenger vessels, etc.).

Navigation Mission Policy Changes. Potential policy changes related to the Corps commercial navigation mission could include refocusing investment efforts on maintaining the existing fuel taxed system infrastructure or adjusting service levels at lower use segments or facilities. More drastic changes could include privatizing part of the system and maintaining only the mainstream segments as a federal system, or even privatizing all of the inland waterways.

Operations and Maintenance Spending. Analysis of traffic and cost patterns for the waterways in the fuel-tax system indicate that some waterways have relatively low traffic density and/or relatively high unit

costs of operation. Past, present, and future traffic and O&M costs patterns are important elements of an information base necessary for developing strategies to adjust to stringent federal budgets. Within this context some key questions which remain to be addressed include:

(1) Is the current annual O&M expenditure of $450-500 million too much, too little or about the right level of spending on the inland waterways in light of the age and utilization levels of the system?
(2) What can be projected for future O&M spending as facilities continue to age?
(3) Can the facilities whose physical condition are most threatened be identified and how much is being spent on their O&M?
(4) What are the general trends of O&M spending versus age of facilities between waterway segments?
(5) Can the Corps afford to maintain existing levels of service in the future for all elements of the fuel taxed system?
(6) Should service levels be periodically reexamined and adjusted to identify inefficiencies and potential cost savings?
(7) Can service be further reduced on lower use segments of the inland waterways system? Is it feasible to further reduce the number of shifts working on a low-use facility or otherwise limit the number of hours a lock is open for business?
(8) If levels of service are adjusted, what would be the impacts to waterway operations and users, and U.S. consumers?
(9) Is performance so inefficient (i.e., commercial traffic so low relative to O&M expenditures) on any system elements that the federal role should be re-examined?
(10) How can the Corps best work in partnership with the Inland Waterways Users Board, waterway operators, other users, and stakeholders to address these issues?

Environmental Impacts. The environmental impacts associated with reduced levels of service or from closing low-use facilities also need to be analyzed. This may entail following up an analysis completed by MarAd (*Environmental Advantages of Inland Barge Transportation,* Final Report, August 1994) by analyzing how many additional truck and rail trips potentially would be generated, the impacts of the large diversions on freight prices, highway traffic, air pollution, etc. The regional economic impacts of such reduced levels of inland waterways service or divestments need to be examined.