4.21 Navigation

4.21.1 Introduction

Resource Issues
▶ Cargo transport
▶ Channel depth

The Tennessee River and its tributaries provide navigation from Knoxville downstream to Paducah (where the system is linked to the Ohio River); these waterways are key components of the nation's inland waterway system. The river also provides access to the Tennessee–Tombigbee Waterway and connects the Tennessee–Tombigbee Waterway to the Ohio River system. The Tennessee River system shown in Figure 4.21-01 is the study area for the discussion of navigation.

The Tennessee River navigation system provides for a year-round channel with a minimum depth of 11 feet between Knoxville and Paducah and on several tributaries. The 11-foot channel provides the 9-foot navigation depth mandated by the TVA Act plus a 2-foot margin of safety. This depth accommodates the tug and barge fleet developed for use on the system. The Tennessee–Tombigbee Waterway has a minimum channel depth of 10 feet. The upper Ohio River (above Smithland Dam) has a minimum channel depth of 10 feet. The lower Ohio River has a minimum depth of 12 to 13 feet when the wicket gates are in an upright position at Locks and Dams 52 and 53.

Future planned improvements to the system include the replacement of Locks and Dams 52 and 53 with the Olmsted Lock and Dam, a replacement lock at Chickamauga Dam, and a lock addition at Kentucky Lock. The expected completion date for the Olmsted Lock and Dam is 2010. The improvement will provide 12.5 feet of channel depth at the tailwater of the Kentucky Dam. The Kentucky Lock addition estimated completion date is 2014. The improvement will include a 110- by 1,200-foot lock with a lower sill elevation of 285 feet. A 110- by 600-foot chamber at Chickamauga Dam has been authorized for construction, and preliminary design work has begun.

Changes in the reservoir operations policy may increase or decrease the timing and depth of navigation channels in TVA reservoirs and thus enhance or impede navigation along the Tennessee River system as follows:

- Existing cargo movements on the Tennessee River may be increased or decreased; and,
- Highway and rail cargo volumes may change as river cargo volumes change.

In 2000, barge traffic on the Tennessee River and its navigable tributaries totaled 49.7 million tons and ranked fourth among 17 national waterways. Commodities moved by barge are typically high-bulk, non-time-sensitive materials such as aggregates, chemicals, coal, coke, grains, iron and steel, ores and minerals, and petroleum fuels.

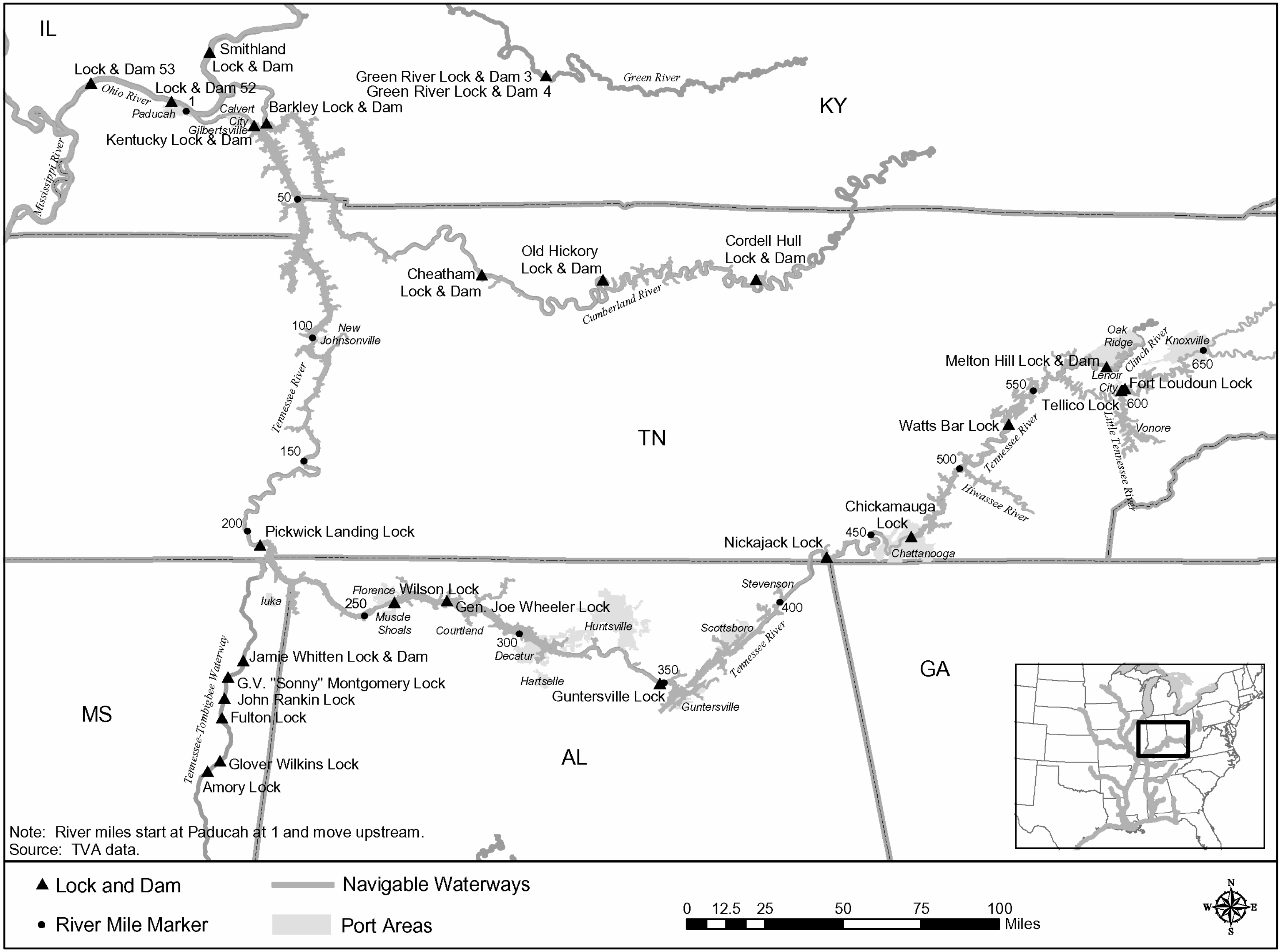

Figure 4.21-01 Inland Navigation System for the Tennessee River and Connecting River Systems

Existing key constraints to navigation on the system include the tailwater depths at the Pickwick and Kentucky Dams and their relation to the Barkley Reservoir, shallow access channels to various terminals, and restrictions on the upper Tennessee River in the Fort Loudoun Reservoir.

Shipper savings are costs that shippers avoid by moving cargo via barge versus rail or highway. Shipper savings are realized when navigation channels are deepened, or when available depth is sustained at consistent levels. The savings result when barges can be loaded with greater tonnages but can move on the system with roughly the same cost—that is, towboat operating costs will rise only marginally when pushing a somewhat deeper draft barge. Savings realized by reduced transportation costs will, to some extent, be passed on to the shipper, increasing the competitiveness of barge transportation.

The existing 11-foot navigation depth limits barge drafts to approximately 9 feet at low water conditions. When waterway depth increases sporadically—for example, due to floods or reservoir operations—no change in shipping economics is likely based on two factors. First, the overall barge fleet is generally designed for the year-round condition—in this case, a depth of 9 feet. Second, when increased channel depth is available only sporadically, there is not enough time for planning and initiating the use of greater barge loads. If greater navigation depth is consistently available, however, the barge fleet can be designed to handle greater loads, or the existing fleet can carry more capacity.

Use of larger barges would be possible for internal or local traffic on the Tennessee River. Use of larger barges for the connecting traffic would require that connecting waterways also be able to provide additional depth on a predictable basis.

4.21.2 Regulatory Programs and TVA Management Activities

The TVA Act requires TVA to operate the dams and reservoirs on the Tennessee River and its tributaries to provide a 9-foot navigation channel from Knoxville to Paducah. The responsibilities of maintaining safe navigation on the Tennessee River are divided among three federal agencies. TVA has custody of and control over the physical structures in the water and releases water to provide sufficient depth for navigation. TVA also has responsibility for navigation aids in the secondary channels. The USACE operates the locks and is responsible for periodic dredging to maintain channel depth. The U.S. Coast Guard installs and maintains the navigation aids in the main channels.

4.21.3 Cargo Movements on the Tennessee River

Existing Conditions

Cargo moving on the river navigation system can be reviewed by origin and destination as well as by type of cargo. Table 4.21-01 breaks out origin and destination data among entering (entering or destined for river ports); leaving (leaving river ports); through (using the river for access to another water, such as the Tennessee–Tombigbee Waterway); and local (the cargo originates and terminates at river ports) traffic for 1991 and 2000.

Table 4.21-01 Tennessee River Tonnages by Traffic Category

Traffic Category	2000 (tons)	1991 (tons)
Entering	17,961,619	12,723,461
Leaving	12,760,178	8,841,817
Through	11,110,763	9,260,397
Local	7,830,919	11,337,997
Total	**49,663,479**	**42,163,672**

Source: USACE 2000.

Local traffic could benefit the most from an increased depth or an increased depth for more months per year because the tugs and barges used could be designed or loaded to take full advantage of such improvements. All other traffic is constrained by the depths available and the equipment used on the connecting waterways: the Ohio River, Mississippi River, Tennessee-Tombigbee Waterway, and potentially others.

Table 4.21-02 shows total system tonnages by commodity group for 1991 and 2000, and includes a forecast of tonnage for 2030. This table confirms that the river traffic is dominated by dry bulk cargoes.

Table 4.21-02 Tennessee River Tonnages by Commodity Group

Commodity	1991 (tons)	Percent of Total	2000 (tons)	Percent of Total	2030 Forecast (tons)	Percent of Total
Coal and coke	20,773,434	49.27	18,881,050	38.02	14,451,698	25.56
Aggregates	8,520,175	20.21	11,196,098	22.54	17,025,592	30.11
All other	2,962,966	7.03	4,502,692	9.07	3,127,475	5.53
Iron and steel	1,163,249	2.76	3,630,829	7.31	6,038,859	10.68
Grains	3,558,992	8.44	3,588,008	7.22	5,267,935	9.32
Chemicals	2,458,868	5.83	2,935,479	5.91	5,076,332	8.98
Ores and minerals	1,182,924	2.81	2,915,782	5.87	3,474,664	6.15
Petroleum fuels	1,543,064	3.66	2,013,547	4.05	2,073,810	3.67
Total	**42,163,672**	**100**	**49,663,479**	**100**	**56,536,633**	**100**

Sources: USACE Waterway Commerce Statistics Center 2000, 1991.

Movements of cargo that directly benefit the region are counted as Regional Economic Development (RED)[1] benefits. Cargoes that pass through the river navigation system are not counted. RED commodity movements for 2000 are provided in Table 4.21-03. These cargo tonnages provide the basis for future projections and the analysis of shipper savings in the ROS and this EIS.

Table 4.21-03 Regional Economic Development Tennessee River Tonnages by Commodity Group

Commodity	2000 (tons)	Percent of Total
Coal and coke	12,949,615	33.79
Aggregates	9,970,553	26.02
All other	3,035,090	7.92
Iron and steel	2,852,132	7.44
Grains	3,305,014	8.62
Chemicals	2,591,761	6.76
Ores and minerals	2,034,838	5.31
Petroleum fuels	1,585,204	4.14
Total tons	**38,324,207**	**100**

Source: TVA, Navigation and Hydraulic Engineering Department 2003.

Future Trends

Several methodologies are available to project future cargo movements on the river navigation system. The first approach is to examine the historical growth of the system. Table 4.21-02 shows the 1991 and 2000 tonnages by commodity type and the forecasted 2030 tonnages. The growth from 42.16 to 49.66 million tons over a 9-year period represents an annual growth rate of 2 percent. Note that the growth was somewhat uniform over all commodities, with only coal and coke showing a decline in tonnage and grains essentially showing no growth over the period.

In addition, river traffic forecasts for the period from 2004 through 2030 were developed at the Wharton School of Business Administration for the Institute of Water Resources of the USACE. The forecasts were based on an average growth rate for the period 2004 through 2020 and a low growth rate for the period 2021 through 2030.

Future commodity movements on the Tennessee River system depend on many interacting factors, including socioeconomic changes, public policy, and technological developments. The

[1] Economic analysis of federally funded regional projects requires only that economic effects accruing to the region be counted. These are called Regional Economic Development (RED) benefits.

river navigation system is important to energy production. Should technological developments lead to a sharp decline in coal consumption, coke and coal shipments would decline. The system also plays an important role in agricultural production, which is expected to maintain steady growth.

Of the cargo transport options, the lowest environmental and safety impacts are associated with waterborne transportation. In Europe, strong initiatives have developed to switch cargo to waterways in order to relieve roadway congestion. In the United States, some effort is being made to shift cargo from highways to waterways, especially on the East Coast. Substantial shifts from rail or highway to waterway transport require infrastructure investment and incentives that may require a change in public policy. If such support materializes in the United States, the Tennessee River could experience an increase in barge movement of commodities.