MISSISSIPPI RIVER COMMISSION*

The Mississippi River Commission (MRC) was created by an act of Congress on Jun. 28, 1879. The Flood Control Act of May 15, 1928, authorized the Flood Control, Mississippi River and Tributaries (MR&T) Project. The Commission consists of three officers of the Corps of Engineers, one from the former Coast and Geodetic Survey (presently the National Oceanic and Atmospheric Administration), and three civilians, two of whom must be civil engineers. All members are appointed by the President with the advice and consent of the Senate.

During the fiscal year the Commissioners were: BG Edwin J. Arnold, Jr., appointed President, Oct. 1, 2001; Mr. Sam E. Angel, reappointment as member, Nov. 1999; Mr. R. D. James, civil engineer, member designee, appointed Dec. 1, 1981, with reappointment pending; Mr. William Clifford Smith, appointed Oct. 22, 1998; BG David A. Fastabend, Commander, Northwestern Division, member designee; BG Steven R. Hawkins, Commander, Great Lakes and Ohio River Division, member designee; RADM Nicholas A. Prahl, NOAA, member designee; and COL Thomas A. Holden Jr., Secretary of the Commission (non-voting position).

The MRC is charged, under direction of the Secretary of the Army and supervision of the Chief of Engineers, with prosecution of improvements for flood control of the Mississippi River and of its tributaries and outlets in its alluvial valley, so far as they are affected by Mississippi River backwater, between Head of Passes, LA (mile 0), and Cape Girardeau, MO (1,006 miles AHP-Lower Mississippi mileage terminates at mile 954 AHP), and with prosecution of improvements in the interest of navigation between Cairo, IL (954 miles AHP), and Baton Rouge, LA (234 miles AHP); and for stabilization of the lower 7 miles of the right bank of the Ohio River, to former mouth of Cache River. It also is charged with prosecution of certain flood control works on the Mississippi River and tributaries, as far as they are affected by backwater, between Cape Girardeau, MO, and Rock Island, IL (1,437 miles AHP), and with prosecution of improvements on designated tributaries and outlets below Cape Girardeau for flood control, navigation, major drainage, and related water uses. Authorized operations of the Commission below Cape Girardeau are conducted by District Engineers of New Orleans, Vicksburg, and Memphis Districts within the areas described below, in accordance with approved directives and programs and congressional appropriations therefore.

New Orleans District: Mississippi River project levees and river channel stabilization as required from Head of Passes, mile 0 to 320 AHP, construction of three salinity-control structures for fish and wildlife enhancement, two in lower Mississippi River Delta region, and one in the Mississippi-Louisiana Estuarine Area; Bonnet Carre and Morganza Floodways; maintenance and improvements of Mississippi River navigation channel from Baton Rouge, LA (mile 234 AHP), to mile 320; Baton Rouge Harbor (Devils Swamp); navigation improvement of Atchafalaya and Old Rivers from Mississippi River to Morgan City; control of Old and Atchafalaya Rivers; Atchafalaya Basin Floodways; flood control and drainage improvements in Bayou Cocodrie and tributaries, in Bayou des Glaises, and in Upper Pointe Coupee Loop area; and freshwater distribution from Atchafalaya River to Teche-Vermilion Basins.

Vicksburg District: Mississippi River project levees and river channel stabilization as required from upper limits of New Orleans District (mile 320 AHP) in vicinity of Black Hawk, LA, to Coahoma-Bolivar County line, MS (mile 620 AHP) on left bank, and to vicinity of mouth of White River, AR (mile 599 AHP), on right bank including south bank Arkansas River levee to vicinity of Pine Bluff, AR, and north bank levee to vicinity of Tucker on left bank of Plum Bayou, AR; bank stabilization in lower 36.1 miles of Arkansas River; maintenance and improvement of Mississippi River navigation channel between miles 320 and 599 AHP; Vicksburg and Greenville Harbors; specific fish and wildlife facilities in Tensas, Yazoo, and Big Sunflower Basins; a demonstration erosion control project in the Yazoo Basin; flood control and drainage improvements in Red River backwater area including leveed portions east and west of Black River and south of Red River; Jonesville, LA, Boeuf and Tensas Rivers, Bayou Macon Basins and tributaries, AR and LA, and Bayou Lafourche, LA; Yazoo River Basin, MS, including backwater area; Big and Little Sunflower Rivers, Deer Creek, and Steele Bayou, MS; and Grand Prairie Region and Bayou Meto Basin, AR, including provision for agricultural water supply.

* Authorizing legislation (Tables 41-D and 41-E) is listed at the end of this chapter. All other tables are referenced in text and also appear at the end of the chapter.

Memphis District: Mississippi River project levees and river channel stabilization as required, from upper limits of Vicksburg District to north bank of Little River diversion channel, MO (1,003 miles AHP), a few miles below Cape Girardeau, MO, on right bank, and to Cache River diversion channel (967 miles AHP) above Cairo, IL, on left bank, including levees and revetment on right bank of Ohio River, in Mounds-Mound City area, IL; except operations above Cairo, IL, do not include channel stabilization on the Mississippi River. Maintenance and improvement of Mississippi River navigation channel between mile 599 and 954 AHP and of Memphis Harbor, TN; specific fish and wildlife facilities in St. Francis Basin; levees in White River backwater area up to vicinity of Augusta, AR, and a pumping plant near mouth of White River; levees and pumping plants at De Valls Bluff and Des Arc, AR; channel improvements in Cache River Basin, AR; channel improvements in Big Creek and tributaries, AR; improvement works in St. Francis River Basin, MO and AR, including backwater area improvements in Belle Fountain Ditch and Drainage District No. 17, AR; Little River diversion channel, MO, and L—Anguille River, AR; Wolf River Basin, TN; Obion and Forked Deer River Basins, TN; Reelfoot Lake area, including channel improvement for Bayou du Chien and Lake No. 9, TN and KY; West Kentucky tributaries, KY; Mud Lake pumping station, TN; and pumping plants and outlet structures in the Cairo-Mounds-Mounds City area, IL. Channel improvements to Eight Mile Creek, Arkansas; Whiteman's Creek Ten Mile and Fifteen Mile Bayous in West Memphis, and vicinity Arkansas; Horn Lake Creek and Tributaries, Mississippi; and Nonconnah Creek, Tennessee and Mississippi. Navigation channel and harbor improvements to Helena Harbor and vicinity, Arkansas at Mississippi River, mile 652 AHP. Channel improvements and pumping station for Helena, Phillips County, and vicinity, Arkansas and St. Johns Bayou and New Madrid Floodway, Missouri.

Field operations of the commission restricted to levee construction under Sec. 6, 1928 Flood Control Act (local interests contributing one-third of costs and furnishing rights-of-way) are conducted within the following limits by two districts reporting directly to the Commission on matters within their jurisdiction—St. Louis District: Mississippi River (Sec. 6) levees from upper limits of Memphis District to Clemens Station, MO (1,254 miles AHP), on right bank, and Hamburg Bay, IL (1,215 miles AHP), on left bank, and Illinois River from its mouth to mile 120 at Havana, IL. Rock Island District: Mississippi River (Sec. 6) levees from upper limits of St. Louis District to Rock Island, IL (1,437 miles AHP). For work accomplished see Table 42-N, page 42-50, Annual Report for 1975.

MISSISSIPPI RIVER AND ALLUVIAL VALLEY BELOW CAPE GIRARDEAU, MO

Location and description. The Mississippi River rises in Lake Itasca, MN, and flows generally southerly for 2,340 miles through the central portion of United States to empty into the Gulf of Mexico 115 miles below New Orleans. It is improved for barge navigation for 1,832 miles to Minneapolis, MN. The Mississippi River and its major tributaries, the Missouri, Ohio, St. Francis, White, Arkansas, Yazoo, and Red-Old Rivers, drain 1,245,000 square miles in all or part of 31 states between the Rocky and Appalachian Mountains and part of two Canadian provinces. Below Cape Girardeau, MO, 53 miles above Ohio River, river bottomlands widen abruptly into an alluvial valley of 35,460 square miles which was originally subjected to flood overflow. A major part of the alluvial valley has been protected from floods by levees which confine floodflows within a floodplain having an average width of 5 miles. (See map of alluvial valley of Mississippi River, scale 1:500,000.) Observations made by Mississippi River Commission to Sep. 30, 1982, show approximate all-time maximum and minimum discharges between levees as follows: Cairo to White River, 2,000,000 and 70,000 cubic feet per second; thence to Red River, 2,150,000 and 90,000 cubic feet per second; thence to the Gulf of Mexico, 1,500,000 and 50,000 cubic feet per second in Mississippi River and 660,000 and 11,000 cubic feet per second in Atchafalaya River. As the 1927 floodflow was not con-fined between levees, maximum discharges recorded do not include entire flow of the 1927 flood, maximum of record below White River. High water and flood stages usually occur in late winter or early spring, but great floods such as that of 1937 occurred as early as January. Low water stages generally prevail from August to December. Extreme all-time high in stages recorded at representative gages (rounded to nearest foot) are 60 feet at Cairo, 49 feet at Memphis, 61 feet at Red River Landing, and 21 feet at New Orleans (Carrollton). The river is nontidal above Red River Landing where tidal amplitude rarely exceeds 0.1 foot during extreme low water.

Previous projects. For details see page 1944, Annual Report for 1932.

Existing project. The Mississippi River and Tributaries Project in the alluvial valley between Head of Passes, LA, and Cape Girardeau, MO, provides protection from floods by means of levees, floodwalls, floodways, reservoirs (in Yazoo and St. Francis Basins), bank stabilization, and channel improvements in and along the river and its tributaries and outlets insofar as affected by backwater of Mississippi River, including levee work on the main stem between Cape Girardeau

and Rock Island. When completed, 23,621 square miles will be protected from the Mississippi River project flood. The project also provides for a 12- by 300-foot navigation channel between Baton Rouge, LA, and Cairo, IL; for salinity-control structures; and for channel realignment and improvement including bank stabilization and dikes to reduce flood heights, control natural tendency of river to lengthen by meandering, and protect levees from being destroyed by caving banks. Locations of major main stem Mississippi River improvements are shown in Table 41-A and those for off-main stem tributaries are shown in Table 41-B. Pertinent data on dams and lakes are shown in Table 41-C. Authorizing and incorporating legislation are shown in Tables 41-D and 41-E. Summary of presently estimated Federal cost of authorized improvements is shown in Table 41-F. Construction of the existing project began in 1928 and has continued throughout ensuing years. Through Sep. 30, 2001, physical completion of the entire project is 87.1 percent.

Recommended modifications. None.

Local cooperation. The Flood Control Act of 1928, as amended, applies. Such requirements have, in general, been complied with by local interests.

Terminal facilities. See Port Series No. 21, 1990, for Ports of Baton Rouge and Lake Charles, LA; Port Series No. 20, 1990, for Port of New Orleans, LA; also folio of Flood Control and Navigation Maps of Mississippi River from Cairo, IL, to the Gulf of Mexico (59th edition), 1992.

Project cost. Total allotted for flood control, excluding maintenance charges through Aug. 18, 1941, chargeable under authorizations to Sep. 30, 2003, was $7,446,610,287 (See Table 41-V.) (See also Tables 41-U, 41-W, and 41-X for additional financial statements.

The 359th Session was held on Nov. 27, 2000, at the Mississippi River Commission Headquarters in Vicksburg, MS. Approximately 10 people were in attendance for this meeting that was open to the public for observation but not for participation. The meeting was for the Commission's consideration of the Final Feasibility Report and Final Environmental Impact Statement for the Wolf River, Memphis, Tennessee, project.

The 360th Session was held on Apr. 2-6, 2001, on board the Motor Vessel *Mississippi* en route on the Mississippi River from Caruthersville, MO, to New Orleans, LA. Bank protection works, levees and channel conditions were observed en route. Public meetings were held at Caruthersville, MO; Helena, AR; Vicksburg, MS; and New Orleans, LA, with approximately 415 people in attendance. Commission members visited the Birds Point to Commerce levee restoration project and discussed the need for continued construction work in that area. They received briefings by Corps staff and local interests on the Thompson Bend area improvements in addition to the St. Johns-New Madrid project in Missouri. Visits were made to the White River area in Arkansas for briefings on groundwater depletion problems and discussions with farmers on flooding problems in that vicinity. A tour was also made of the South Delta area in Mississippi, with a trip to the Yazoo Backwater Pump/Steele Bayou structure site, Mahanna Wildlife Refuge, and the Delta Wildlife and Forestry facility. This session was adjourned in New Orleans, LA, Apr. 6, 2001.

The 361st Session was held Aug. 13-24, 2001, on board the Motor Vessel *Mississippi*. Public meetings were held at LaCrosse, WI; Keokuk, IA; St. Louis, MO; Memphis, TN; Greenville, MS; and Morgan City, LA, with approximately 685 people in attendance. Commission members were taken on project site visits in Minnesota to tour the Gilmore Creek 205 project and Winona flood control project in addition to a tour of the Environmental Management Program habitat project at Trempealeau. While in the Iowa area, the members participated in tours and briefings regarding Lock and Dam 12, the Bellevue Section 14 project, and the Bellevue State Park in addition to touring the Nahant Marsh and several riverfront areas. Mr. Dominic Izzo, Principal Deputy Assistant Secretary of the Army for Civil Works, joined the Commission during the inspection trip and participated with the members and staff in visiting the Sny Island Levee and the Twin Rivers Marine and Day Use Recreation Area within the St. Louis District. Briefings and overviews were also given on the Holnan Land Swap, Clarksville Refuge, and Melvin Price Locks and Dam River Center. During the second week of the inspection trip, several Commissioners and staff participated in a canoe trip on the Atchafalaya River with members of the Sierra Club and Senator Mary Landrieu. This session adjourned Aug. 24, 2001, in Morgan City, LA.

Records of Proceedings of all sessions of the Mississippi River Commission are on file in the office of the President.

Alluvial Valley Mapping

General. Contoured quadrangles and general maps of the alluvial valley are available for departmental use and public distribution under prescribed regulations. Preparation, revision, and publication of quadrangle maps (scale 1:62,500) continued. Roadmap-type information brochures of principal portions of the overall project were published along with pamphlets on the subject of flood control and navigation. Maps and supplemental data sheets for active works were updated and published as required.

Approximately 222 flight-line miles of black-and-white aerial photography (various scales); 0 flight-line miles of color true photography; and 0 hours of oblique photography were flown along the Mississippi River and tributaries in the New Orleans District.

Work accomplished in the Districts: New Orleans District: The conversion of 1:62,500 scale quadrangle maps New Orleans, Hahnville, Lac Des Allemards, Thibodaux and Napoleonville from manual to digital form were completed in FY 03.

Memphis District—There were no revisions to series conversion of U.S. Geological Survey in FY 2002.

Vicksburg District—Series Published 1:62,500 scale quadrangle maps Lake Providence, LA-MS and Alsatia, LA-MS was completed in FY 00. Revision of Vicksburg, MS, LA is in progress. The conversion of 1:62,500 scale quadrangle map, Vicksburg, from manual to digital form was completed in FY 02.

Floods

Streamflow observations during the fiscal year follow:

Memphis District—Mississippi River crest stage of 54.9 feet at Cairo gage on May 19-20, 2002, and maximum discharge of 1,472,000 cubic feet per second occurred at Hickman, KY on May 24-25, 2002, a crest stage of 38.2 feet at Memphis on May 24-25, 2002, and a maximum discharge of 1,401,000 cubic feet per second at Memphis on May 24-25, 2002.

Vicksburg District—The Mississippi River in the Vicksburg District – Peak stages and discharges on the Vicksburg District's reach of the Mississippi River were as follows: Arkansas City, 40.2 feet on Jun. 1, 2002, and maximum discharge of 1,520,000 cubic feet per second; Vicksburg, 45.4 feet on Jun. 4, 2002, and a maximum discharge of 1,515,000 cubic feet per second; and Natchez, 51.5 feet on Jun. 4, 2002, and maximum discharge of 1,510,000 cubic feet per second.

New Orleans District—On the Mississippi River, the Red River Landing gage recorded a maximum stage of 54.9 feet NGVD on Jun. 4, 2002, and the New Orleans gage recorded a maximum stage of 15.5 feet NGVD on Jun. 6, 2002. On the Atchafalaya River, the Simmesport gage recorded a maximum stage of 35.4 feet NGVD on Jun. 7, 2002.

Studies and Investigations

General investigations. Surveys and reports, authorized by laws and by Senate and House committee resolutions, were made as required. Collection and study of basic data continued.

A June 2000 resolution of the Committee on Transportation and Infrastructure of the U.S. House of Representatives authorized a study to determine if improvements in the vicinity of Bono, AR, in the interest of flood control, recreation, water quality, water supply, restoration of fish and wildlife habitat, and related purposes are advisable. An initial assessment was completed under the Section 205 Flood Control Act of 1948, Small Flood Control Projects. The assessment indicated that a combination flood control and recreational reservoir desired by local interest as being economically justifiable but it did not meet the policy guidelines of the Section 205 Authority.

A July 1997 resolution of the Committee on Transportation and Infrastructure of the U.S. House of Representatives authorized a study of flooding and other problems in the area west of the Atchafalaya Basin Floodway between Alexandria, Louisiana, and the Gulf of Mexico. A reconnaissance study was initiated in FY 1998 and completed in FY 1999. Initiation of a Feasibility Study was delayed until April 2003 due to lack of non-Federal funds.

A May 1998 resolution of the Committee on Transportation and Infrastructure of the U.S. House of Representatives authorized a study of flooding and other problems in the area between Bayou Lafourche and the Mississippi River from Donaldsonville, Louisiana, to the Gulf of Mexico. A reconnaissance study was completed in FY 2000. Feasibility study was initiated in FY 2002, and continues in FY 2003.

An April 1992 resolution of the Public Works and Transportation of the U.S. House of Representatives Committee authorized a study of flooding and other problems east of the Atchafalaya Basin Floodway between Morganza, Louisiana, and the Gulf of Mexico. A

feasibility study was completed in FY 2003 recommending a Federal project. The Energy and Water Development Appropriation Act of 1995 and the Water Resources Development Act of 1996 directed an expedited study of a lock the Houma Navigation Canal under the authority of the Morganza, Louisiana, and the Gulf of Mexico study. An interim feasibility study on the lock was completed in FY 1997 and was approved for preconstruction engineering and design in FY 1999. A supplement to the report was prepared in 2003 adding work-in-kind, and Planning Engineering and Design on Houma Navigation Canal Lock and additional features continued in FY 2003.

A June 1998 resolution of the Committee on Environment and Public Works of the U.S. Senate authorized a study of the multipurpose flood control and agricultural water supply problems in the Boeuf-Tensas Basin of southeast Arkansas. A feasibility study was initiated in FY 2000.

Mississippi River and Tributaries Levees

Operations and results during fiscal year. This feature consists of construction of new, and enlargement of existing, levees to approved grade and section; construction and restoration of levee berms; and construction, repair, and maintenance of roads on levees. Work accomplished is summarized in Table 41-N and further broken down as follows:

New Orleans District—Continued construction of levees in the Main Stem System.

Vicksburg District—Continued construction of levees in the Main Stem System. See Table 41-L.

Memphis District—Continued construction of levees in the Main Stem System. See Table 41-M.

Condition as of Sep. 30. (See Tables 41-K, 41-L, 41-M, and 41-N.) There are 1,609.8 miles of levees authorized for the Mississippi River below Cape Girardeau, of which 1,603.0 are in place with 3,376.6 built to approved grade and section. The Main Stem Levee System consists of 2,215.7 miles, of which 2,208.9 are in place with 1,928.7 miles completed to approved grade and section. Included in this system are 85.4 miles of levees and structures along the south bank of Arkansas River miles (all completed); 59.2 along the south bank of Red River (all completed); and 449.2 miles in the Atchafalaya River Basin, with 449.2 miles in place and 395.4 miles completed to grade and section (see Table 41-N). Of the authorized 677.8 miles of berms and seepage control measures, 562.6 are complete. Graveled or hard-surfaced roads have been constructed on 2,094.8 miles of these levees.

There are an additional 1,511.0 miles of authorized tributary levees in the MR&T Project, of which 1,277.3 miles, are in place with 1,085.7 to approved grade and section. Berms have been completed on 15.3 miles and 970.1 miles of graveled or hard-surfaced roads have been constructed on the levees.

For summary of levee work Table 41-N.

Mississippi River and Tributaries—Channel Improvements

Operations and results during fiscal year. Dredging: Mississippi River Main Stem — (See Table 41-G.) Work included dredging 23,683.1 cubic yards for maintenance of channel and harbor improvements. Minimum channel depth of 9 feet was maintained. Dredging was done with the following plant: Vicksburg District, channel maintenance was performed by government-owned dredge *Jadwin*. Memphis District channel maintenance dredging was performed by the Government-owned dustpan dredge *Hurley* and leased dust pan dredge *Wallace McGeorge*.

The MR&T Harbors maintained in Memphis District was Helena Harbor, Phillips County, AR, and Memphis Harbor (McKellar Lake), by leased cutterhead dredge *Pontchartrain*. MR&T Harbors maintained in Vicksburg District were Greenville Harbor and Vicksburg by cutterhead dredge Marion.

Bank revetment and dikes: (See Table 41-H, 41-I, and 41-J.) Construction of 2.11 miles of new bank revetment and 125,219 squares of concrete mattress, for maintenance, along the Mississippi River was completed by Government plant and hired labor. Also, 2.29 miles of new dikes were constructed and required maintenance was performed.

Approximately 1.29 miles of new bank revetment was constructed on the Atchafalaya River.

Other work performed in the interest of navigation, supplementing maintenance dredging on Mississippi River between Cairo, IL, and Baton Rouge, LA, included removal of snags, wrecks, and obstructions; issuance of bulletins by the Vicksburg District providing information on available high-water velocities at selected locations; maintenance of bulletin boards showing daily gage readings at regular MRC gages; and contact pilot service furnishing navigation interests with latest information and advice on channel conditions and

navigation interests. Cost of this work is given in Table 41-U.

Condition as of Sep. 30. In carrying out authorized channel improvement program between Baton Rouge and Cairo, 16 cutoffs were developed between 1933 and 1942. These, combined with chute channel development and alignment improvements, decreased channel length between these cities by about 170 miles. However, current velocities increased the attack on the banks and the river began to regain its length. As a result, the net shortening between 1933 and 1962 was 114 miles of the theoretical 170-mile cutoff.

There are now in place 1,042.0 miles of operative bank revetment and 310.9 miles of dikes on the lower Mississippi River. This amount of channel stabilization should prevent the river from regaining much more of its length due to meandering. A navigation channel 9 by 300 feet is being accomplished by revetment and dikes and maintained by dredging as required during the low-water season. Due to growing effectiveness of channel improvement program, average maintenance dredging requirements are steadily being reduced, and an increase in navigable depth is being obtained. Approximately 143,4 miles of foreshore protection have been constructed along the lower Mississippi River.

There are 88.2 miles of revetment and 5.9 miles of dikes on tributary channels as listed in Tables 41-H, 41-I, and 41-J.

New Orleans District

ATCHAFALAYA BASIN, LA

Operations and results during fiscal year. New work by hired labor: Real estate activities and planning for construction were continued.

Construction of levee enlargements and floodwalls continued on the east and west protection levees, and levees west of Berwick.

In FY 32, two contracts were substantially completed for floodwalls at East Bayou Sale Gordy and Maryland. A levee and pumping station contract for the Todd levee was continued. Five contracts were initiated in FY 2003 as follows: Wax Lake West Drainage Structure, E69/E73, W52 2nd lift, W85 A&B, and Wax Lake Outlet West levee enlargements.

Maintenance by hired labor: Operation and maintenance of Bayou Boeuf, Berwick, and Bayou Sorrel Locks, Morganza Control Structure, condition and operation studies, and water control management activities were continued.

Condition as of Sep. 30. Construction was initiated Aug. 7, 1929, with commencement of the west protection levee from Bordelonville to Hamburg, LA. The project is 93 percent complete. The current estimated Federal cost is $1,790,000,000 and non-Federal cost is $11,000,000. Of the 449.2 miles of levees and floodwalls authorized for the Atchafalaya system, 388.4 miles are built to grade. See Table 41-K for status of levees.

Construction of the first 2.5 miles of the proposed 5 miles of channel was initiated in January 1958 and completed in July 1959, with 7,458,086 cubic yards excavated.

The remaining 2.5 miles were to be constructed when development of the initially constructed portion warrants expansion. Project expansion has not been necessary. Therefore, this feature was deauthorized on Nov. 2, 1979, under the provisions of Section 12, Public Law 93-251 (WRDA 74), as amended.

Major items remaining to be completed include completion of levees to grade and section, channel training works below Morgan City, modification of existing structures and construction of two freshwater distribution structures. Approximately 56.6 miles of bank stabilization have been placed as shown in Table 41-H.

Flood Control

ATCHAFALAYA BASIN FLOODWAY SYSTEM, LA

Location. The project lies in the lower part of the Atchafalaya Basin which is situated in south-central Louisiana. It lies in parts of Iberville, Iberia, Point Coupee, St. Martin, St. Mary and St. Landry Parishes. Further, it is limited to the part of the Atchafalaya River Basin that has been confined between protection or guide levees that are about 15 miles apart. The northern boundary, west of the Atchafalaya River, lies along the south right-of-way line for the Union Pacific Railroad near the south side of U.S. Highway 190 between the West Atchafalaya Basin Protection Levee (WABPL) and the west limits of the Town of Krotz Springs, thence southerly along the west limits of the town and easterly along the south limits of the town to the Atchafalaya River; east of the Atchafalaya River it lies along the southern right-of-way line for the Union Pacific Railroad. The eastern and western boundaries lie at the floodside toes of the East Atchafalaya Basin Pro-

tection Levee (EABPL) and WABPL, respectively. The area within these limits has been calculated at about 595,000 acres.

Existing Project. This project was authorized by the Supplemental Appropriations Act of 1985, Public Law 99-88. The project was reauthorized and amended by Section 601 of the Water Resources Development Act of 1986, Public Law 99-662 (hereafter WRDA 1986). The Corps of Engineers, New Orleans District, completed a comprehensive feasibility study report for the ABFS in January 1982 that recommended implementation for three separable elements including land acquisition, recreation, and water management units. Funding for the acquisition of the real estate feature made available by the Energy and Water Appropriations Bill of 1988, Public Law 100-202.

To date approximately 108,000 acres in developmental control and environmental easements have been acquired. 42,000 acres in additional easements are being negotiated leaving a balance of approximately 230,000 acres to acquire. Acquired 47,400 acres in fee, excluding minerals, from willing sellers. The recreational portion of the ABFS is cost-shared 50/50 between the Corps and the local sponsor. The recreation portion includes boat landings, canoe trails, 3-state type park facilities, project visitor center, primitive campgrounds, etc. Through FY 2003, planning had been initiated on several boat landings and one ABFS is constructed with 100% Federal funds and OMRR&R is cost shared 75% Federal and 25% non-Federal. Through FY 2003, planning and design had been significantly advanced for the Buffalo Cove Pilot Water Management Unit.

Local Cooperation. Various Design Agreements and PCA's will be required between the Corps and the non-federal sponsor for project implementation.

Condition as of Sep 30. Continuing Real Estate acquisition and negotiations and advancing design for Water Management with the construction of Buffalo Cove scheduled for FY 2004 and advancing the planning for recreational features with the construction of Myette Point Boat Landing scheduled for FY 2004.

BAYOU COCODRIE AND TRIBUTARIES, LA

Operations and results during fiscal year. Maintenance by hired labor consisted of water control management.

Condition as of Sep. 30. Construction was initiated in June 1946 and is 57 percent complete, based on the current estimated Federal cost of $20,400,000 and non-Federal cost of $323,000. See page 2031, Annual Report for 1961, for description of completed work.

Work required to complete the project consists of enlargement of 13.5 miles of upper Bayou Boeuf, channel improvement of 25.3 miles of Bayou Cocodrie, enlargement of Bayou Courtableau from Washington, LA, to the west protection levee, and additional culverts through the west protection levee at 100 percent Federal cost in lieu of the previously authorized diversion channel from Washington to the Bayou Courtableau drainage structure.

With the termination of the Eastern Rapides and South Central Avoyelles project, it has become necessary to provide an adequate outlet structure solely for the Bayou Cocodrie and Tributaries project. The economic effects of this change along with current benefits estimates have caused the benefit-cost ratio for the project to be less than unity. As a result, the project has now been classified as inactive. If economic conditions change, the project could be reactivated.

BONNET CARRE' SPILLWAY, LA

Operations and results during fiscal year. Maintenance by hired labor: Condition and operation studies, water control management, and ordinary maintenance of the control structure and spillway continued.

Condition as of Sep. 30. Construction of the spillway was initiated in FY 1929. The control structure was completed in 1931, levees were completed in 1932, and utility crossings were completed in 1936. The cost of the completed work is $14,212,200.

It was necessary to operate the structure to reduce flood stages in 1937, 1945, 1950, 1973, 1975, 1979, 1983 and 1997. The structure was operated in 1994 to transfer fresh water from the Mississippi River to Lake Pontchartrain. The structure was operated for one month from March 17-April 17, 1997, to reduce flood stages.

Needle replacement began in FY 96 with the purchase of about 625 needles for $80,000. The total replacement quantity required is approximately 7,000. An additional cable security system has been installed through needle eyes to prevent needles from dislodging during severe storms.

Natural Resources and Recreation Project Master Plan was approved and implemented in 1998. Operational Management Plan is under development. A staff of three Park Rangers are now stationed at the spillway

to implement the recreation and natural resource programs.

OLD RIVER, LA

Operations and results during fiscal year. Maintenance by hired labor consisted of operation and maintenance of the lock and control structures as required, condition and operation studies, water control management, maintenance of cleared areas, levee shaping, and engineering studies.

Natural Resources and Recreation Master Plan is under development. Operations and Maintenance Activity includes development of Old River Cooperative Visitor Center.

Condition as of Sep. 30. Construction began September 1955 and is complete at a Federal cost of $292,273,000. Principal items completed are as follows: Low-sill structure, June 1959; overbank structure, October 1959; auxiliary structure, September 1986; levees and levee enlargements, October 1963; inflow and outflow channels for the low-sill structure, February 1961; inflow and outflow channels for the auxiliary structure, August 1987; navigation lock completed December 1962 and opened to navigation March 1963, at which time Old River was closed to navigation with a rock and earthfill dam; highway approaches and bridge over the lock completed March 1965. Approximately 9.4 miles of bank protection have been constructed at the inflow and outflow channels. (See Table 41-H for details of bank protection.)

LOUISIANA STATE PENITENTIARY LEVEE, LOUISIANA

Location. The project is located near Angola, LA, in West Feliciana Parish, approximately 40 miles northwest of Baton Rouge, LA, and borders the Louisiana State Penitentiary along the Mississippi River and State of Mississippi state line.

Existing Project. The project provides for improving about 12 miles of existing levees along the Mississippi River which currently afford flood protection to the penitentiary on the left descending bank below Old River. The existing levees are owned and maintained by the State of Louisiana and are substandard with regard to Federal specifications. By improving the existing levees to Federal standards, the project will reduce the risk of flooding with its attendant property damage and threat to the lives of up to 5,100 inmates and about 1,750 employees and residents (527 reside on the penitentiary grounds). Funds to initiate preconstruction, engineering and design were appropriated in FY 97 and funds to initiate construction were appropriated in FY 98.

Local Cooperation. The limited Reevaluation Report was approved on July 2, 1999 and formed the basis for execution of the Project Cooperation Agreement which was approved on July 30, 1999. The local Sponsor, the Louisiana Department of Public Safety and Corrections has provided cash in the amount of $5,171,000 in addition to furnishing the lands and damages (including mitigation lands) necessary to support their share of the project cost.

Conditions as of Sep. 30. Construction was initiated in FY 99 with the award of three contracts in Sep. 1999. Two contracts are for the levee upstream of Camp C and the other is for replacement of the existing drainage structure. All three contracts were completed in FY 01. Also, the final contract to enlarge the levee from Camp C to the main gate was awarded in Apr. 01. The entire project was completed in FY 03.

Salinity Control Structures

MISSISSIPPI DELTA REGION, LA

CAERNARVON FRESHWATER DIVERSION STRUCTURE, BRAITHWATE, LA

Location. The Caernarvon structure is constructed in the Mississippi River Levee on the left descending bank at mile 81 AHP, just below the St. Bernard-Plaquemines Parish line.

Existing Project. The Caernarvon Freshwater Diversion Feature of the Miss. Delta Region Project is capable of diverting up to 8,000 cfs of River water into the Breton Sound Estuary for fish and wildlife habitat enhancement. River stages and the fresh water needs of the estuary, determined by monitoring data, establish the actual quantities to be diverted.

Local Cooperation. The Local Cooperation Agreement with the State of Louisiana was signed in June 1987. Cost sharing for initial construction and ongoing operations and maintenance is 75% Federal and 25% non-Federal. The project is operated and maintained by Plaquemines Parish, under the direction of the LA Department of Natural Resources.

Condition as of Sep. 30. Construction began in 1988 and was completed in 1991, at a Federal cost of $19,700,000 and a non-Federal cost of $6,500,000. Diversions have been ongoing, as needed, since August 1991. The goal of fish and wildlife habitat improvement has been met or exceeded, most notably in the areas of

seed oyster availability on the public oyster grounds, a large variety and volume of recreational fishing and duck hunting.

DAVIS POND FRESHWATER DIVERSION STRUCTURE, LA

Location. The Davis Pond structure is constructed in the Mississippi River Levee on the right descending bank at mile 118 AHP, in St. Charles Parish, two miles Luling, LA.

Existing Project. The Davis Pond Freshwater Diversion Feature of the Miss. Delta Region Project will be capable of diverting up to 10,650 cfs of River water into the Barataria Bay Estuary for fish and wildlife habitat enhancement. Fresh water needs of the estuary, determined by monitoring data, will establish the actual quantities diverted.

Local Cooperation. The Project Cooperation Agreement was signed in April 1993 with the State of Louisiana. Cost sharing for initial construction and ongoing operations and maintenance is 75% Federal and 25% non-Federal. The project will be operated and maintained by St. Charles Parish, under the direction of the LA Department of Natural Resources.

Condition as of Sep. 30. Construction began in 1996 and was substantially completed in 2002, at an estimated Federal Cost of $89,700,000 and a non-Federal cost of $29,900,000 for the Construction Phase of this Feature. Diversions have been ongoing, as needed, since August 2002. Due to the short period of time since diversions began, it is not possible to evaluate the goal of fish and wildlife habitat improvement quantitatively at this time. Final second lift levee construction and ongoing monitoring under the Construction Phase of this feature will continue into 2006.

MISSISSIPPI - LOUISIANA ESTUARINE AREAS, LA/MS

BONNET CARRE' FRESHWATER DIVERSION STRUCTURE, LA

Location. The Bonnet Carre' structure will be constructed in the upstream end of the Bonnet Carre Spillway structure, on the left descending bank of the Mississippi River at Mile 129 AHP, in St. Charles Parish, LA.

Existing Project. The Bonnet Carre Project will be capable of diverting up to 30,000 cfs of River water into the Lake Pontchartrain, Lake Borgne/Biloxi Marsh Estuarine Area for fish and wildlife habitat enhancement. Fresh water needs of the estuary, determined by monitoring data, will establish actual diversion quantities.

Condition as of Sep. 30. Before construction can proceed, a Project Cooperation Agreement must be signed with the States of Louisiana and Mississippi. Louisiana has withdrawn their support of the project until agreement between Louisiana and Mississippi can be reached on how the project will be operated. Federal cost of the Project is estimated to be $87,200,000. The construction, operation and maintenance of the Project will be shared as follows: Federal, 75 percent; La, 20 percent; MS, 5 percent.

Vicksburg District

LOWER ARKANSAS BASIN, AR

Condition as of Sep. 30. Arkansas River levees. A total of 56.2 miles of the 61.5 miles of north bank levees and all of the 85.4 miles of south bank levees have been completed to approved grade and section. These levees above mile 36.1 are protected by bank-protection works constructed as a feature of project for Arkansas River and tributaries, AR and OK. For present status of this work, see report of Little Rock District. Below mile 36.1, needed bank protection is constructed with project maintenance funds. Little Bayou Meto gates and lifting mechanism were replaced during FY 88. Big Bayou Meto Gate operating mechanisms replaced FY 94, 95, 96.

LOWER RED RIVER SOUTH BANK RED RIVER LEVEES, LA

Operations and results during fiscal year. New work by hired labor consisted of engineering studies. A Project Management Plan to address replacement of the drainage structure and pumping plant was approved in Aug 94. A major maintenance report was prepared and approved Sep. 95 recommending replacement of the drainage structure. Design of the replacement structure is complete. Construction is underway and scheduled for completion in March 2003.

Maintenance by hired labor consisted of water control management and economic studies.

Condition as of Sep. 30. Construction was initiated in FY 92 and is complete. All of the 59.2 miles of levees authorized are completed to approved grade and section.

TENSAS BASIN, AR AND LA

(a) **Boeuf and Tensas Rivers, and Bayou Macon, AR and LA.**

Operations and results during fiscal year. Planning and design on project features are complete. The Lake Chicot Pumping Plant and related features are complete and in operation. No further work on the Tensas River Project (Separable Element) will be initiated due to lack of commitment from a local sponsor to cost share remaining E&D and construction. This project has been placed in the "inactive" category.

Condition as of Sep. 30. Channel improvement has been accomplished on 741.7 miles of project streams, providing major drainage outlets for the tributary areas. Additionally, 61.0 miles of the Tensas River has been cleared and snagged. The GDM for the Tensas River Project, above mile 61, including Mill Bayou-Bayou Vidal is complete. However, no further work will be initiated due to lack of a local sponsor.

(b) **Red River backwater area.**

Operations and results during fiscal year. Planning and design continued on project features. All channel work required to get flows to the Tensas Cocodrie Pumping Plant and gravity structure is complete. The gravity structure and the pumping plant are complete and are being operated and maintained by contract. One mitigation item, the construction of two water control weirs, was completed in May 1988. Contracts for three additional mitigation features are complete. Construction of the Durham Prong mitigation feature is complete. Tensas-Cocodrie, Item 4-A, levee enlargement, 6.3 miles in length, was completed in September 1988, and Item 4-B, 2.4 miles of levee enlargement, was completed in October 1990. A contract for Item 2 was awarded in January 1991 and is physically complete. These contracts will complete the levee enlargement for all of the levee system, except 0.8 miles.

Work on the Below Red River Phase II GDM has been reclassified as inactive. Construction of the Sicily Island Area Levee project is complete.

Condition as of Sep. 30. Levees in Tensas- Cocodrie area are complete except for levee raising of 0.8 miles. The work comprised 93.1 miles of new levee, excluding 2.1 miles of high ground where no levees are required, and 86.9 miles of gravel road on levees. Construction of 63.4 miles of levee, Larto Lake to Jonesville levee system, has been completed. A levee grade reevaluation study for all levee systems in the Red River Backwater area was completed in Mar. 1985. The Sicily Island area project consists of 56 miles of new levee, 2 pumping plants, 11 miles of channel work, and structural mitigation features. Levee items 1C and 1D and Billy and Falcon Bayou were completed in FY 02 to complete the last items of construction.

YAZOO BASIN, MS

Operations and results during fiscal year.

(a) **Big Sunflower River, etc.** The Project is authorized by the Flood Control Acts of 1944, 1946, 1950, 1962, and 1965. Construction of channel improvements on Steele Bayou are underway. Construction on Steele Bayou Channel in the Swan Lake Area is being done in phases. Phase V was awarded in July 01. Main Canal and Black Bayou are complete.

Mitigation for Upper Steele Projects

Mitigation for the unavoidable environmental losses is now underway. Approximately 3,652 acres of cleared lands have been obtained in the Yazoo Basin to mitigate the environmental losses resulting from construction of the Upper Steele Bayou Projects. Mosf of this land has been reforested and will be managed for wetlands, and terrestrial resources. A total of 5,250 acres of mitigation will be acquired from willing sellers for this project.

(b) **Flood Control Reservoirs**

(1) **Arkabutla Lake.** (See Table 41-C.) The dam and appurtenant structures were maintained and operated. Clearing of tributary streams in the lake area was continued. Maximum pool elevation in the lake was 241.7 feet NGVD on Dec. 24, 2001, and storage in flood control pool was 648,200 acre-feet. Peak 24-hour inflow was 66,200 cubic feet per second on Oct. 11, 2002. On Sep. 30, 2002, the pool elevation was 228.5 feet NGVD, and storage in the flood control pool was 262,400 acre-feet.

(2) **Enid Lake.** (See Table 41-C.) The dam and appurtenant structures were maintained and operated. Rehabilitation of boat channels and snagging and clearing of tributary streams in the lake area continued. Maximum pool elevation in the lake was 268.0 feet NGVD on May 11, 2002, when storage in the flood control pool was 660,800 acre-feet. Peak 24-hour inflow was 34,200 cubic feet per second on Nov. 30, 2001. On Sep. 30, 2002, pool elevation was 252.5 feet NGVD and storage in the flood control pool was 312,400 acre-feet. 4,500 ac. ft. of storage in conser-

vation pool was reallocated to municipal and industrial water supply in June 1998.

(3) **Grenada Lake.** (See Table 41-C.) Construction of remaining public-use facilities has been deferred pending development of cost-sharing agreements with local interests for construction and non-Federal operation and maintenance, consistent with projects for which recreation facilities are being constructed under the provisions of the Federal Water Project Recreational Act of 1965 (Public Law 89-72), as amended. Maximum pool elevation in the lake was 224.6 feet NGVD on May 12, 2002, when storage in the flood control pool was 965,800 acre-feet. Peak 24-hour inflow was 65,100 cubic feet per second on Jan. 25, 2002. On Sep. 30, 2002, the pool elevation was 213.9 feet NGVD and storage in the flood control pool was 510,800 acre-feet.

(4) **Sardis Lake** (See Table 41-C.) The dam and appurtenant structures were maintained and operated. Clearing of tributary streams in the lake area continued. Maximum pool elevation in the lake was 280.5 feet NGVD on May 14, 2002, when storage in the flood control pool was 1,516,100 acre-feet. Peak 24-hour inflow was 62,700 cubic feet per second on Dec. 1, 2001. On Sep. 30, 2002, the pool elevation was 263.1 feet NGVD and storage in the flood control pool was 717,900 acre-feet. A construction contract was awarded for the seismic remediation of Sardis Dam utilizing driven pre-stressed concrete piling as a result of an extensive study and evaluation of the expected performance of the dam during a major earthquake in the New Madrid earthquake zone of the central United States.

(c) **Greenwood, Yazoo City and Belzoni protection works.** Contract forces continued operation and maintenance of levees, drainage facilities, and pumping plant.

(d) **Main stem.** Contract forces continued operation and maintenance of channels, levees, and drainage facilities.

(e) **Reformulation Study.** The uncompleted portions of the Yazoo Basin construction program are being reformulated. This reformulation study includes investigations of the engineering, economic, and environmental aspects of the basin and is being accomplished in 4 phases. These studies will evaluate reasonable arrays of alternatives to the project features that remained after construction of items that were budgeted and scheduled for award in FY 90. The Upper Steele Bayou and Upper Yazoo Project reports were approved on May 25, 1993 and Jun. 21, 1994, respectively. Concerning the final 2 phases, the Yazoo Backwater Reformulation Study began in FY 93 and the Tributaries Reformulation study began in FY 95. The Backwater Study includes nonstructural, structural, and combination plans. Nonstructural features include conservation and water management easements and reforesting of cleared agricultural lands. Structural features include an array of various capacity pumping stations and a levee alternative. A draft report was released for public review in Sep 2000 with a final report scheduled in FY 03. The Yazoo Tributaries Reformulation Study is evaluating flood control requirements on nine project features. Study efforts were suspended in 2000 until construction advances in the Upper Yazoo projects.

(f) **Demonstration Erosion Control.** The Demonstration Erosion Control Project (DEC), a joint project with the USDA NRCS was initiated by FY 85 appropriations as a continuation on streambank erosion control efforts. The purpose of the project is to demonstrate the applicability of a systems approach to the design of erosion, sedimentation, and flood control works by applying this approach to 16 demonstration watersheds in the Yazoo Basin hill area. During FY 02, work continued in the DEC toward development of the systems plans and implementation of a monitoring program. Cumulative through FY 02, the District has completed the construction of 195 low drop grade control structures, 189 miles of bank stabilization, 16 miles of channel improvement, 25 box culverts, 5 high drop grade control structures, 1,246 riser pipe grade control structures, 7 floodwater retarding structures, and 9 miles of levees.

(h) **Tributaries.** Construction:

Levees. Levee work associated with Pelucia Creek is complete.

(i) **Upper Yazoo Projects.** The first 12 items of channel improvement, approximately 87 miles, and nine drainage structures have been completed. This work extends from Yazoo City, Mississippi, Greenwood, Mississippi.

The Fort Pemberton Flood Control Structure was completed on Apr. 29, 1991.

Roebuck Lake and Fort Loring water control structures and Tchula Lake weirs were completed in FY 95.

Item 3A-2 levee was completed in FY 94. Channel Item 3A-1 was completed in FY 96. Item 3A-2 channel work was completed in FY 97. This item contains the first thin layer disposal site. Channel Item 3B-1 was completed in FY 99. Channel Item 3B-2 was completed

in FY 00. Channel Item 4A was completed in FY 01. Channel Item 4B was awarded in FY 01 and is scheduled for completion in FY 03.

Design efforts for Channel Item 6 are underway. Item 6A is scheduled for award in Jul. 04 and Item 6B for Sep. 04.

The Alligator-Catfish water control structure was completed in FY 98. This structure has been renamed the J. Tol Thomas Water Control Structure.

Mitigation for Upper Yazoo Projects. Mitigation for the environmental impacts is now underway. Approximately 8,815 acres of cleared, frequently flooded agricultural lands have been obtained in the Yazoo Basin area of Mississippi to mitigate the environmental losses resulting from construction of the Upper Yazoo Projects, Big Sand Creek, Pelucia Creek, and Ascalmore-Tippo Bayou construction projects. Most of this land has been reforested and will be managed for terrestrial aquatic, wetlands, and water fowl. A total of 17,000 acres of mitigation will be acquired from willing sellers for this projects.

(j) **Yazoo Basin backwater.** The Yazoo area backwater levees are complete, including the backwater levee from the Mississippi River levee to the west levee of the lower Auxiliary Channel, the Little Sunflower River drainage structure, and the connecting channel from the Steele Bayou drainage structure to the Big Sunflower River.

The Satartia area backwater levee is complete. Rocky Bayou area levee Items lA and 1B have been completed. Completed backwater levees will require raising to provide the degree of protection intended based on the project design flow line developed for the Mississippi River following the 1973 flood.

Four Greentree Reservoirs and pumping stations have been constructed to mitigate for the waterfowl impacts of the project.

Mitigation of the terrestrial impacts is now underway. Approximately 8,800 acres of cleared, frequently flooded, agricultural lands have been obtained in the Yazoo Backwater area of Mississippi to mitigate the terrestrial losses resulting from construction and operation of the Yazoo Area and Satartia Area levees projects. This land has been reforested and will be managed for terrestrial wildlife. An additional 3,617 acres of mitigation is being considered as part of the Yazoo Backwater Reformulation Project.

Condition as of Sep. 30. The first feature of Yazoo Basin project was started in 1936, and the total project is about 65 percent complete.

Memphis District

CACHE BASIN, AR

Location. The project is a flood control project located in the Cache River and Bayou DeView Basins in northeastern Arkansas.

Existing Project. The authorized plan of improvement consists of improving the channels of the Cache River and Bayou DeView to provide adequate drainage outlets and reduce the frequency, depth and duration of flooding. The work consists of clearing, cleanout, enlargement, and realignment on approximately 154 miles of the Cache River and 77 miles of Bayou DeView and the acquisition of up to 70,000 acres of land for fish and wildlife management, recreation and environmental purposes. The project has a benefit cost ration of 4.2 to 1.0.

Operations and results during fiscal year. No contracts were awarded or completed during the fiscal year.

Condition as of Sep. 30. Project was initiated during 1972 and is 4 percent complete. Construction of the authorized project was stopped in 1978 due to environmental opposition. Reevaluation studies of the authorized plan were initiated in June 1987 to provide a more environmentally balanced plan. The reevaluation effort was terminated on Dec. 15, 1994, due to a lack of local sponsorship. The Memphis District has initiated action to turn the acquired mitigation lands (7,959 acres) over to the U.S. Department of Interior.

CONSTRUCTION GENERAL

FRANCIS BLAND FLOODWAY DITCH (EIGHT MILE CREEK), ARKANSAS

Location. The project is located in the City of Paragould, AR.

Existing Project. The existing project consist of 12.5 miles of channel improvements. Eight miles of channel enlargement will occur in the rural downstream area of Paragould. Three and a half miles of enlargement will occur in the City of Paragould along with one mile of channel riprap/stabilization. The project will provide 100 year flood protection within the City of Paragould.

Local Cooperation. A project Cooperation Agreement (PCA) was assigned in June 1996.

Conditions as of Sep. 30. The contract work on the rural eight miles of channel has been completed. Construction on the first phase of the urban section of channel enlargement bagan in August 2002 with completion scheduled for April 2003. Construction of the second and final phase of urban channel enlargement is scheduled to start in Spring 2004.

HELENA AND VICINITY, AR

Location. The project is located in the City of Helena, AR.

Existing Project. The existing project consists of 1.41 miles of earthen and concrete channel enlargement within the city limits of Helena, AR. The concrete channel will be constructed primarily under streets while the earthen channel is in an undeveloped section of the city.

Local Cooperation. The Project Cooperation Agreement (PCA) was signed in August 1997.

Conditions as of Sep. 30. Construction on the concrete channel is progressing with completion scheduled for June 2003.

HORN LAKE CREEK AND TRIBUTARIES INCLUDING COW PEN CREEK, TENNESSEE AND MISSISSIPPI

Location. Horn Lake Creek is located in northwest Desoto County, MS and southwest Shelby County, TN.

Existing project. The project was approved for construction on Nov. 17, 1986, under authority of Title IV, Section 401 of the 1986 Water Resources Development Act. The project consists of 3.5 miles of drift removal and 2.75 miles of channel clearing on Horn Lake Creek; 2.1 miles of channel clearing on Rocky Creek and 0.62 miles of channel clearing and 1.85 miles of channel enlargement on Cow Pen Creek. The project will provide 1.1-year flood frequency protection on Horn Lake and Rocky Creeks and 25-year flood frequency protection on Cow Pen Creek. The construction is complete.

Local Cooperation. A Local Cooperation Agreement was executed with the Horn Lake Creek Watershed Drainage District on Feb. 26, 1992.

Condition as of Sep. 30. The final contract for work on Cow Pen Creek was awarded in Sep. 1997 and was completed in Sep. 1998. Floodplain mapping revisions are scheduled for completion in Feb. 2003.

HORN LAKE CREEK AND TRIBUTARIES, TENNESSEE AND MISSISSIPPI

Location. Horn Lake Creek is located in northwest Desoto County, MS, and southwest Shelby County, TN.

Existing project. A limited reevaluation report of the project for flood control, Horn Lake Creek and Tributaries, Tennessee and Mississippi, authorized by Section 401(a) of the Water Resources Development Act of 1986, to determine the feasibility of modifying the project to provide urban flood protection along Horn Lake Creek.

Local Cooperation. A Design Agreement for a reevaluation study was executed with the Horn Lake Creek Drainage District on Oct. 5, 2001.

Condition as of Sep. 30. Reevaluation studies were initiated in Oct. 2001 and scheduled for completion in Dec. 2004.

LOWER WHITE RIVER

Operations and results during fiscal year.

(a) **Augusta to Clarendon Levee.** There were no contracts awarded or completed during the fiscal year.

(b) **Clarendon Levee.** There were no contracts awarded or completed during the fiscal year.

(c) **White River Backwater Levee-Hudson's Landing to MRL.** There were no contracts awarded or completed during the fiscal year.

(d) **White River Navigation.** Annual dredging and snagging contract awarded on Jun. 20, 2002.

Condition as of Sep. 30.

(a) **Augusta to Clarendon Levee.** Project was initiated during 1946 and is 39 percent complete. There were no contracts awarded or completed this fiscal year.

(b) **Clarendon Levee.** There were no contracts awarded this year.

(c) **White River Backwater Levee.** There were no contracts awarded this year.

(d) **White River Navigation.** Dredging contract completed Nov. 2002.

NONCONNAH CREEK, MS AND TN

Location. The project is located in southern Shelby County and provides flood protection for approximately half of the city of Memphis, TN.

Existing Project. The project is made up of five separable elements, flood control, environmental preservation, recreation and conditionally authorized extensions to the flood control and recreation elements. The flood control element is under construction and consists of 18.2 miles of channel enlargement, grade stabilization, and vegetative cleanout. The environmental element consists of a 33-acre nature area. The recreation element consists of 8.8 miles of biking/ hiking trails. WRDA 2000 conditionally authorized extending the flood control element upstream about five miles and the recreational element from 8.8 to 27 miles, if the Secretary finds the work justified.

Local Cooperation. The project sponsor is the City of Memphis, TN, and the Project Cooperation Agreement (PCA) was signed on 23 July 1990. The PCA covers only the flood control features of the project.

Operations and results during fiscal year. No contracts awarded during this fiscal year.

Condition as of Sep. 30. Project construction was initiated during 1990 and is 60 percent complete. Item 1, channel completed on Jan. 8, 2001. The next item of construction, Item 1, Phase 2, is scheduled for award in Jul. 2003.

MISSISSIPPI RIVER LEVEES

Operations and results during fiscal year. Minor maintenance on levees is performed by the local interests and major maintenance is performed as required for slide repairs, road rehabilitation, and other similar work by the U.S. Army Corps of Engineers.

Mississippi River Levees Construction. Caruthersville, MO, relief wells, awarded Sep. 21, 2001, is 39 percent complete. Hillhouse, MS, relief wells, awarded Aug. 17, 2001, is 88 percent complete. Blue Lake. AR, relief wells, awarded Aug. 21, 2001, is 93 percent complete. Harmon Sewer, MO, culvert replacement, Aug 9, 2001 is 56 percent complete.

Mississippi River Levees Maintenance. Initiated and completed Hired Labor Slide Repairs at the Birds Point New Madrid Setback and Frontline Levee, MO and at Jointer, AR. Continued contracts for Culvert Replacement, Hwy 21, TN; and Culvert Replacement, New Madrid, Sta 0/22 MO. Completed contracts for Culvert Replacement, Kilgore, Cairo, IL; Culvert Replacement, Helena, AR, and a Slope Restoration, West Memphis, AR. Awarded new contracts for Culvert Replacement, New Madrid, Sta. 1/43, MO, and Slope Stabilization, LM9, Below New Madrid, MO.

Channel Improvement. Stone Dike Construction at Lookout Point, TN-AR Dike Construction, awarded Jul. 2001, completed February 2002. Cat Island, AR dike Construction awarded Aug. 2001, completed March 2002. Big Island, AR Bendway Weir Construction awarded Jul. 2001, completed Feb. 2002. Armstrong, TN Dike Construction awarded Jul. 2002, completed Sep. 2002. Peters, AR Dike Construction awarded Jul. 2002, 60 percent complete. Kate Aubrey, AR and Keyes Point, TN awarded Jul. 2002, 70 percent complete.

REELFOOT LAKE - LAKE NO. 9, TN AND KY

Operations and results during fiscal year. No contracts awarded or completed during this fiscal year.

Condition as of Sep. 30. Project was initiated during 1974 and is 95 percent complete.

ST. FRANCIS BASIN, AR AND MO

Operations and results during fiscal year.

Maintenance

Completed contracts for Huxtable Roof Repair, AR; Channel Cleanout, Lower Buffalo, AR; Channel Clearing, Ditch 66, MO; Channel Cleanout, Below Hwy 90, AR. Completed Delivery Order or Hired Labor work for Scour Repair, Mingo Bridges, MO; Scour Repair, Fisk, MO; Culvert Replacement, Elk Chute East Levee, MO; Culvert Replacement, 4 Culverts Elk Chute South Levee, MO; Scour Repair, Advance, MO; Scour Repair, St. Francis Town, AR; and Levee Slide Repairs, Elk Chute, MO and Mile 121, Below Huxtable, AR. Initiated contracts and Delivery Orders for Channel Cleanout, Ditch 81, MO; Channel Cleanout, Ditch 251 Unimproved, MO; Channel Cleanout, Ditch 251 Lower, MO; Channel Cleanout, Ditch 1 Lower, MO; Scour Repair, Block Hole, MO; Channel Cleanout, Ditches 10 & 12, AR; Channel Cleanout, Ditch 7, AR; Slope Restoration, Above Tulot, AR; Channel Cleanout, Belle Fountain West & State Line Outlet, AR & MO; and Scour Repair, Bridges 1, 2, & 3, Mad-Mar, AR.

Construction

Main and ditch 2, Item 2, Channel Enlargement, awarded May 30, 2000 is complete. Highway 90, channel restoration, awarded Sep. 12, 2000, 95 percent complete. Ditch 1 & 6, Channel Enlargement, MO., awarded Sept. 20, 2001, 15 percent complete. Honey Cypress, AR Channel Enlargement awarded 9 Aug 02 is 40% complete.

Condition as of Sep. 30. Project initiated 1937. Project is 90 percent complete.

ST. JOHNS BAYOU AND NEW MADRID FLOODWAY

Location. This flood control project is located in the bootheel of MO. It covers two drainage basins adjacent to the Mississippi River: the St. Johns Bayou Basin (450 sq mi) and the New Madrid Floodway (180 sq mi).

Existing Project. The First Phase of the authorized project includes 27.6 miles of channel improvements, pumping stations, all seasonal ponding easements, and appropriate mitigation features. The First Phase project has a benefit-cost ratio of 1.3 to one, with average annual benefits of $5,016,000. St. John Levee and Drainage District is the cost-sharing sponsor.

Condition as of Sep. 30. Construction on remaining items can not be initiated until NEPA processing is completed. Remaining construction work on the First Phase include approximately 23.3 miles of channel improvements and two pumping stations. Construction work scheduled in FY 02 was not initiated because of delays in compliance with NEPA.

WEST KENTUCKY TRIBUTARIES, KY

Location. The project is a flood control project located on the Obion Creek in Southwest Kentucky.

Existing Project. The drainage basin is 324 square miles of rural area. The approved plan of improvement consists of 42 miles of channel enlargement, the placement of excavated material embankment along 8.2 miles of the north bank below the valley mouth, and acquisition of 6,000 acres of mitigation land. The project has a benefit cost ratio of 1.4 to 1 with average annual benefits totaling $1,576,000. Project is currently inactive due to lack of local support; however, in the spring of 1996, locals have formally requested assistance in developing an environmentally sensitive plan of improvement. A preliminary time and cost estimate for a general reevaluation have been prepared.

Operations and results during fiscal year. No contract awarded or completed during fiscal year.

Condition as of Sep. 30. Project was initiated during 1978 and is 4 percent complete.

WEST TENNESSEE TRIBUTARIES, TN

Location. The project is a flood control project located along the Obion and Forked Deer Rivers and tributaries in west Tennessee, in Weakley, Madison, Gibson, Obion, Dyer, Crockett, Lauderdale and Haywood Counties.

Existing Project. The project consists of 225 miles of channel improvements on the Obion and Forked Deer Rivers and construction of 7.6 miles of levees to provide adequate drainage outlets and reduce flooding; 174 water control structures, 216 erosion control structures, 37 miles of water management connector channels to restore bottomland hardwoods and fisheries; and the acquisition of 32,000 acres of mitigation lands. Only 93 miles of the authorized channel improvements have been completed and 13,527 acres of the mitigation lands purchased.

Local Cooperation. The project sponsor is the state of Tennessee acting through the West Tennessee River Basin Authority (WTRBA).

Operations and results during fiscal year.

(a) **Forked Deer River and principal tributaries, TN.** Forked Deer River channel improvement is 14 percent complete.

(b) **Obion River and principal tributaries, TN.** Obion Rivers channel improvement is 68 percent complete.

(c) **Riprap Protection at four sites Dyer, Crockett, Haywood, and Lauderdale** awarded Aug. 29, 1996, is complete.

Riprap protection at 3 sites Dyer, Crockett, and Lauderdale counties awarded on Aug. 10, 1998, and was completed Aug. 18, 1999. Shutdown plan control structures at 3 sites, Dyer and Lauderdale counties awarded on Aug. 3, 1998, was completed Sep. 1999.

Condition as of Sep. 30. West Tennessee Tributaries Project is 60 percent complete.

TABLE 41-A MISSISSIPPI RIVER IMPROVEMENTS

Mileage Above Head of Passes	Locality	Improvement	Remarks
0-957[1]	Head of Passes, LA-Cairo, IL	Dredging, revetment, and contract work	--
10-81	The Jump-New Orleans, LA	Main line levee, right bank	--
11-25	Baptiste Collette-Bayou Ostrica, LA	Local levees, left bank	--
118	Davis Pond, LA (formerly Myrtle Grove, LA)	Salinity control structure, right bank	Authorized by Public Law 89-298 (HD 308/74/1). Included in MS Delta Region, LA feature. Postauthorization change report, approved June 1987.
81	Caernarvon, LA	Salinity control structure, left bank	Authorized by Public Law 89-298 (HD 308/74/1). Included in MS Delta Region, LA feature.
44-91	Bohemia, LA-New Orleans, LA	Main line levee and floodwall, left bank	--
81-96	New Orleans, LA	Main line levee, right bank	Authorized by Public Law 81-516.
91-104	New Orleans, LA	Main line levee and floodwall, left bank	Authorized by Public Law 81-516.
96-279	New Orleans-Morganza, LA	Main line levee, right bank	--
104-234	New Orleans-Baton Rouge, LA	Main line levee, left bank	--
127-129	Bonnet Carre' Floodway, LA	Regulating spillway, left bank	--
129	Mississippi-Louisiana Estuarine Areas, LA/MS (Bonnet Carre')	Salinity control structure, left bank	Authorized by Public Public Law 100-676
129-234	Bonnet Carre'-Baton Rouge, LA	Main line levee, left bank	--
235	Baton Rouge Harbor	Devils Swamp barge channel	Modified by Public Law 87-874.
279-287	Morganza Floodway, LA	Regulating spillway, right bank	--
287-303	Morganza-Old River, LA	Main line levee, right bank	Extends up south bank of Old River to Barbre Landing.
303-314	Old River, LA control	Levee closure and enlargement, low and high water spillway structures, navigation lock, and approach channels, right bank	Authorized by Public Law 83-780.
314-572	Old River-Cypress Creek, AR	Main line levee, right bank	Joins Arkansas River, south bank levee.
437	Vicksburg Harbor, MS	Harbor extension and industrial fill	Authorized by Public Law 70-391. Modified by Public Laws 79-526 and 83-780.
437-721	Vicksburg-Lake View, MS	Main line levee, left bank	--

TABLE 41-A (Continued) MISSISSIPPI RIVER IMPROVEMENTS

Mileage Above Head of Passes	Locality	Improvement	Remarks
490	Wilson Point, LA	Pumping Plant and drainage structure, right bank	Unpublished Vicksburg District's MRC report approved Apr. 14, 1966.[2]
537	Greenville Harbor, MS	Harbor improvements and port area	Authorized by Public Law 85-500.
646	Long Lake, Helena, AR	Culvert and floodgate, right bank	Authorized by Public Law 79-526.[2]
605-666	Henrico-Helena, AR	Main line levee and floodwall, right bank	--
672-993	St. Francis River-Commerce, MO[3]	Main line levee, right bank	--
722-725	Industrial levee (Ensley Bottoms)	Levee and pumping station	--
721-734	Memphis Harbor, TN	Closure of Tennessee Chute, industrial fill, levee, harbor channels, etc.	Authorized by Public Law 79-526.
803-873	Tiptonville-Obion River	Main line levee, left bank, levee extension, and diversion Obion River	Modified by Acts of Jul. 24, 1946 and Dec. 23, 1971.
857	Near Mud Lake, TN	Pumping station and adjacent channel improvements	Authorized Dec. 15 and 17, 1970 under Sec. 201 of Oct. 27, 1965 FC Act.
890	St. Johns Bayou, MO	Drainage floodgate and levee closure	Modified by Jul. 24, 1946 Act.
890	New Madrid Floodway, MO	Drainage floodgate and levee closure	Modified by Sep. 3, 1954 Act.
890-954	New Madrid-Birds Point, MO	Floodway, right bank	--
902-922	Slough Bend, Hickman, KY	Main line levee, left bank	--
922	Hickman, KY	Floodwall, left bank	--
946	Peafield, MO	Drainage floodgate	Authorized by Sep. 3, 1954 Act.
957[1]	Cairo, Cairo drainage	Floodwalls and levees district	--
957[1]	Cairo, Cairo drainage district, Mounds, Mound City, and vicinity	Floodwalls, levees, and pumping plant	--
	Thebes-Rock Island, IL	Levees, both banks	Intermittent (Sec. 6).
	Cape Girardeau, MO, to Rock Island, IL	Levees	Intermittent (Sec. 6).

1. Cairo, IL, is on Ohio River about 3 miles above its mouth (Mississippi River mile 954 AHP).
2. Also see Table 41-D, "Authorizing Legislation."
3. Commerce, MO, is on Upper Mississippi River, 39 miles above mouth of Ohio River.

TABLE 41-B MISSISSIPPI RIVER TRIBUTARY AND OUTLET IMPROVEMENTS

Mileage Below Head of Atchafalaya River	Locality	Improvement	Remarks
	ATCHAFALAYA BASIN, LA[1]		
	Atchafalaya Basin, Morganza and West Atchafalaya Floodways		
0-54	West Atchafalaya Floodway between Red River and Alabama Bayou	Floodway	--
27-54	Morganza Floodway between Mississippi River and Alabama Bayou	Floodway	--
54-117	Atchafalaya Basin Floodway between Alabama Bayou and Morgan City	Floodway	--
	East protection levee (Morganza and Atchafalaya Floodways)		
20-27	Lacour-Red Cross	Levee, upper Morganza guide	--
25-117	Morganza-Morgan City	Levee and Morgan City floodwall	Including lower Morganza Floodway guide levee.
27	Bayou Latenache	Drainage structure, Pointe Coupee, and channel enlargement	Through upper Morganza guide levee and enlargement of outlet channel.
0-27	Upper Pointe Coupee Loop area	Additional drainage facilities	Enlargement of Bayou Latenache. Approved Jun. 4, 1970. See Table 41-D.
31-57	Bayou Fordoche-Ramah	Drainage channel	Levee landside borrow pit.
80	Bayou Sorrel[1]	Lock	Alternate route, Gulf Intracoastal Waterway, Port Allen to Morgan City.
53-117	Bayou Sorrel Lock-Morgan City	Alternate navigation channel. Gulf Intracoastal Waterway	Gulf Intracoastal Waterway utilizes levee west side borrow pit channel.
117	Morgan City	Lock in Bayou Boeuf[1]	Gulf Intracoastal Waterway.
117-129	Below Morgan City	Channel relocation	Bypass route for Gulf Intracoastal Waterway.
117-129	Below Morgan City	Levee, floodwall	East of lower river.
	Atchafalaya Basin Floodway lower protection levee		
105	Calumet	Floodgate, east	Bayou Teche-Wax Lake Outlet.
105-120	Below Morgan City	Levees, floodwall, drainage structures, and pumping plants	Enclosed area between Wax Lake Lake Outlet and Berwick.
115	Berwick[1]	Lock	Lower Atchafalaya River.
116	Patterson	Water system	Adjustment to provide fresh water.
	West protection levee (Atchafalaya Basin and West Atchafalaya Floodways)		
5	Simmesport-Hamburg	Levee fuse plug	West Atchafalaya Floodway.

TABLE 41-B (Continued) MISSISSIPPI RIVER TRIBUTARY AND OUTLET IMPROVEMENTS

Mileage Below Head of Atchafalaya River	Locality	Improvement	Remarks
5-105	Mansura to Wax Lake Outlet	Protection levee	--
	Coulee des Grues	Levee enlargement and floodgate extension	--
29	West Atchafalaya Floodway	Railway	--
29	Morganza Floodway	Railway	--
40	Bayou Darbonne	Gated drainage structures	Through West Atchafalaya protection levee.
40	West Atchafalaya Floodway	Highway	--
40	Morganza Floodway	Highway	--
41	Bayou Courtableau	Gated drainage control structures and channels	--
41	West Atchafalaya Floodway	Railway	--
41	Morganza Floodway	Railway	--
94	Charenton	Floodgate and approach channels	Borrow pit channel to Grand Lake through West Atchafalaya protection levee.
94	Jaws-Lake Fausse Pointe	Outlet, Charenton drainage canal and protection levee	Restoration of drainage west of West Atchafalaya Basin protection levee.
105	Calumet	Floodgate, west	Bayou Teche and Wax Lake Outlet.
105	Wax Lake Outlet	Drainage canal-railway and highway bridges	To lower flood heights.
	Atchafalaya River		
0-54	Barbre Landing-Alabama Bayou	East bank, levee	--
5-6	Simmesport	Levee, ring, and drainage structure	--
5-66	Simmesport-Bayou Garofier	West bank, levee	--
28-30	Melville	Levee, ring	--
40-41	Krotz Springs	Levee, ring	--
54-117	Below Alabama Bayou	Channel enlargement	Increase channel capacities to decrease flood heights.
94-106	Mississippi River-Morgan City	12- by 125-foot navigation channel	Through Grand and Six Mile Lakes.
	TECHE-VERMILION BASINS, LA		
	Atchafalaya River to Teche-Vermilion Basins	Pumping station above Krotz Springs, conveyance channels, and appurtenant works	Freshwater distribution from Atchafalaya River to Teche-Vermilion Basins.

TABLE 41-B (Continued) MISSISSIPPI RIVER TRIBUTARY AND OUTLET IMPROVEMENTS

Mileage Above Mouth	Locality	Improvement	Remarks
	Courtableau Basin, LA, and outlets		
0-8	Charenton Canal	Drainage channel	Outlet to gulf
50-133	West Atchafalaya protection levee borrow pit channel	Drainage channel	Intercepting drainage channel.
96	Bayou Courtableau spillway	Drainage control structure	--
133	Bayou des Glaises	Diversion channel	--
	BAYOU COCODRIE AND TRIBUTARIES		
	Bayou Courtableau	Enlargement and additional culverts	Washington to west protection levee.
0-17	Bayou Cocodrie	Enlargement and realignment	--
17-40	Bayous Cocodrie-Boeuf diversion	New channel	--
40-51	Bayou Boeuf	New channel	--
51-60	Bayous Boeuf-Rapides diversion	New channel	--
17-42	Upper Cocodrie	Enlargement, clearing, and snagging	--
	Bayou Boeuf		
87-107	Bayou Lamourie to Kincaid	Enlargement, realignment, clearing, and snagging	--
	Structures		
40	Lecompte Control Structure	Fixed elevation weir	--
60	Bayou Rapides Control Structure	Gated drainage structure	--
87	Bayou Lamourie Control Structure	Gated drainage structure	--
	Various	Railway, highway, and local road bridges, and pipeline crossing	--
	LAKE PONTCHARTRAIN, LA		
	Lake Pontchartrain, Jefferson Parish, LA	Flood protection	([2,3])
	AMITE RIVER, LA		
	Amite River, LA	Bank protection	Authorized by Public Law 81-516. Eliminated by Public Law 89-298.
	LOWER RED RIVER, SOUTH BANK, RED RIVER LEVEES, LA		
82-145	Moncla-Hotwells	Levee, south bank	--
	Bayou Rapides Pumping plant and gravity structure	Levee, south bank	Senate Doc. (Public Law 84-99) Added to project by Public Law 101-514.
	Red River-Moncla to Lake Long	Levees	Intermittent (Sec. 6).

TABLE 41-B (Continued) MISSISSIPPI RIVER TRIBUTARY AND OUTLET IMPROVEMENTS

Mileage Above Mouth	Locality	Improvement	Remarks
	EASTERN RAPIDES AND SOUTH-CENTRAL AVOYELLES PARISHES, LA		
	Eastern Rapides and south-central Avoyelles Parishes, LA	Flood protection and drainage improvement	Authorized by Public Law 91-611.
	TENSAS BASIN, AR AND LA		
	Red River backwater area		
	Tensas-Cocodrie area	Levees, drainage channels, structures, and pumping plant	([4])
3-56	Larto Lake-Jonesville	Levees, drainage channels, and structures	([4])
	Sicily Island area	Levees, drainage channels, structures, and pumping plants	([4])
3-56	Below Red River area	Levees, drainage channels, structures, and pumping plants	([4])
	Black River, LA		
5	Six Mile Bayou area	Drainage structure and appurtenant channel works	Unpublished VXD-MRC Letter Report dated May 31, 1977, MR&T authority.[2]
56	Jonesville, LA	Levees, floodwall, pumping plant, and interior drainage	Portion of levee built under Sec. 6. Incorporated in MR&T by Public Law 81-516.[2]
	Ouachita River	Levees, drainage channels, and structures	Monroe to Sandy Bayou and Bawcomville (Sec. 6).
	Boeuf and Tensas Rivers and Bayou Macon, AR and LA		
	Boeuf River, AR and LA		
0-32	Below Bayou La Fourche	Clearing	([5])
0-56	Bayou La Fourche	Channel improvement and realignment	([5])
151-235	Boeuf River, AR and LA above Bayou La Fourche	Channel improvement	Authorized by Public Laws 78-534 and 79-526.[2,3]
210-286	Canal 19	Channel improvement	([5])
286-296	Canal 19 extension	Channel improvement	([6])
0-75	Big and Colewa Creeks	Channel improvement	Authorized by Public Law 78-534.[3]
	Tributaries of Boeuf River--Canal 19		
0-8	Fleschmans Bayou	Channel improvement	([6])
0-7	Caney Bayou	Channel improvement	([6])
0-33	Big Bayou	Channel improvement	([5])
0-10	Canal 18	Channel improvement	([6])
0-9	Kirsch Lake Canal	Channel improvement	([6])
0-14	Black Pond Slough	Channel improvement	([6])
	Bayou Macon, AR and LA		
0-170	Bayou Macon	Channel improvement	See Table 41-E
0-34	Canal 43	Channel improvement	([5])
0-35	Canal 81	Channel improvement	([5])

TABLE 41-B (Continued) MISSISSIPPI RIVER TRIBUTARY AND OUTLET IMPROVEMENTS

Mileage Above Mouth	Locality	Improvement	Remarks
Lake Chicot	Pumping plant and drainage structure	To divert flows from Lake Chicot	Authorized by Public Law 90-483.
	Tributary of Bayou Macon		
0-6	Rush Bayou	Clearing	([6])
	Tensas River, AR and LA		
0-165	Tensas River	Channel improvement	Authorized by Public Law 78-534.[3]
	Tributary of Tensas River		
0-22	Mill and Vidal Bayous	Channel improvement	Authorized by Public Law 89-298.
	Grant's Canal, LA		
0-0.2	Grant's Canal at Lake Providence	Filling canal	Authorized by Public Law 81-516.
	LOWER ARKANSAS RIVER, AR		
23-98	Yancopin-Pine Bluff	Levee, south bank	--
35-98	Fletcher Bend, AR, to Pine Bluff	Revetment	--
48-102	North Little Rock to Gillett (below Plum Bayou)	Levee, north bank	([5])
	GRAND PRAIRIE-BAYOU METO, AR		
	Grand Prairie Region and Bayou Meto Basin, AR	Aquifer protection. water supply and environmental improvements	Authorized by Public Law 81-516.
	YAZOO BASIN, MS		
0-75	Yazoo Backwater area	Levees and pumping plants	--
0-381	Yazoo River System below Arkabutla Lake	Channel improvement	Including Tallahatchie and Coldwater Rivers.
75-366	Yazoo River between Yazoo City and Prichard	Levees, right bank	Intermittent.
75-345	Yazoo River between Yazoo City and Askew	Levees, left bank	Intermittent.
45-109	Will M. Whittington Auxiliary Channel	Floodway channel	--
75	Yazoo City protection	Levee, drainage structure, and pumping plant	--
	Rocky Bayou area	Channel clearing and enlargement	Improvement of 7.8 miles was approved Apr. 29, 1970.
127	Belzoni protection	Levee and floodwall	--
185	Greenwood protection	Levees, channel improvement, drainage structures, and pumping plants	--
381	Arkabutla Lake	Flood detention and conservation	See Table 41-C.
0-64	Yalobusha River below Grenada Lake	Channel improvement	--
64	Grenada Lake	Flood detention and conservation	See Table 41-C.
0-24	Tallahatchie River-Little Tallahatchie River	Levees, Panola-Quitman Floodway	--
0-26	Little Tallahatchie River below Sardis Lake	Channel improvement	--

TABLE 41-B (Continued) MISSISSIPPI RIVER TRIBUTARY AND OUTLET IMPROVEMENTS

Mileage Above Mouth	Locality	Improvement	Remarks
26	Sardis Lake	Flood detention and conservation	See Table 41-C.
0-13	Yocono River below Enid Lake	Channel improvement	--
13	Enid Lake	Flood detention and conservation	See Table 41-C.
0-88	Cassidy Bayou below Old Coldwater River	Channel improvement	Including Moore's Bayou, Cutoff Bayou, Whiting Lake and outlet.
137-260	Upper Yazoo Projects	Floodway channel	--
75-381	Area between main stem and hills including Bobo Bayou	Levees and channel improvement	Authorized by Public Law 79-526.
	McKinney Bayou enlargement of pumping plant.	Channel improvement and	Authorized by Public Law 79-526.
0-8.3	Alligator-Catfish Bayous	Channel improvement	Authorized by Public Law 89-298. As modified in GDM in 1967.
0-23	Bear Creek	Channel improvement	Authorized by Public Law 89-298.
0-42	Whiteoak Bayou	Channel improvement	Authorized by Public Law 89-298.
275-290	Tallahatchie River, MS	Two road crossings of Panola-Quitman Floodway, MS, and for protection of Sheley Bridge	Authorized by Public Law 90-147.
	Big Sunflower River, etc.		
0-204	Big Sunflower River	Channel improvement	Authorized by Public Law 78-534.[3]
0-8	Hull Brake-Mill Creek Canal	Channel improvement	--
0-28	Hushpuckena River	Channel improvement	--
0-81	Quiver River	Channel improvement	--
	Gin and Muddy Bayous, MS	Channel improvement	Authorized by Public Law 87-874.
0-43	Bogue Phalia	Channel improvement	Authorized by Public Law 78-534.[3]
0-4	Ditchlow Bayou	Channel improvement	Authorized by Public Law 78-534.[3]
0-27	Little Sunflower River	Channel improvement	Authorized by Public Law 78-534.[3]
153-160	Deer Creek	Channel improvement	Authorized by Public Law 78-534.[3]
0-68	Steele Bayou	Channel improvement	Authorized by Public Law 78-534.[3] Modified in December 1970. See Table 41-D.
	Muddy Bayou	Water-control structure	Approved Mar. 3, 1970. See Table 41-D.
	LOWER WHITE RIVER AND BASIN, AR		
13-55	Laconia Circle-Old Town Lake	Levee, backwater including outlet	Mile 605-645 Mississippi River.
		Pumping plant	([6])
0-68	Big Creek and tributaries structures	Channel improvement and	Authorized by Public Law 89-298.

TABLE 41-B (Continued) MISSISSIPPI RIVER TRIBUTARY AND OUTLET IMPROVEMENTS

Mileage Above Mouth	Locality	Improvement	Remarks
99	Clarendon levee	Levee and outlet structures	Authorized by Public Law 89-298.
108-192	Augusta to Clarendon	Levees, outlet structures	([5])
122	De Valls Bluff	Levee, outlet structure, and pumping station	([5])
143	Des Arc, AR	Levee, outlet structure, and pumping station	Authorized by Public Law 81-516.
	CACHE BASIN, AR		
0-196	Cache River, AR	Channel improvement and structures	Authorized by Public Law 81-516.
0-90	Bayou DeView, AR	Channel improvement and structures	Authorized by Public Law 81-516.
	ST. FRANCIS RIVER AND BASIN, AR AND MO		
260	Inter-River Drainage District in Missouri	Channel improvement and two outlet structures	Authorized Dec. 16, 1975. See Table 41-D.
0-225	Mouth of St. Francis River-Wappapello Dam	Floodway, levees, drainage channels, and structures	--
225	Wappapello Lake	Flood detention and conservation	See Table 41-C.
0-105	Little River Basin	Floodway, levees, drainage channels, and structures	--
86	Marked Tree, AR	Marked Tree Siphon	--
0-36	Tyronza River	Channel improvement	--
0-29	Big Slough Ditch	Channel improvement	--
0-17	Mayo Ditch	Channel improvement	--
0-12	Cross County Ditch	Channel improvement	--
	Belle Fountain Ditch	Channel improvement	Authorized by Public Law 90-483.
	Drainage District No. 17	Channel improvement and pumping station	Authorized by Public Law 90-483.
	L'ANGUILLE RIVER, AR		
0-108	L'Anguille River and tributaries, Brushy and First Creeks	Channel improvement	Authorized by Public Law 80-858.
	WEST TENNESSEE TRIBUTARIES		
0-25	Wolf River and tributaries, TN	Channel improvement	([6])
	Obion River and tributaries, North, South, Middle, and Rutherford Forks	Channel improvement	Authorized by 1948 Flood Control Act.
	Forked Deer River and tributaries, North, Middle, and South Forks	Channel improvement	Authorized by 1948 Flood Control Act.
	Mud Lake Pumping Station, TN	Pumping plant	Authorized by Resolutions Dec. 15 and 17, 1970.[2]

TABLE 41-B (Continued) MISSISSIPPI RIVER TRIBUTARY AND OUTLET IMPROVEMENTS

Mileage Above Mouth	Locality	Improvement	Remarks
	Harris Fork Creek, TN and KY	Flood control improvements	Authorized by Water Resources Act of Oct. 22, 1976.[2] Section 102, 1976.[2]
	Porter Gap, TN	Construction to main-stem standards, levee and appurtenant structures for flood control	Section 183, 1976.[2]
	REELFOOT LAKE-LAKE NO. 9, TN AND KY		
0-20	Running Reelfoot Bayou, TN	Channel improvement	Authorized by Public Law 83-780.
0-15	Bayou du Chien and Lake No. 9, KY and TN	Channel improvements and pumping station	Authorized in December 1970. See Table 41-D.
	WEST KENTUCKY TRIBUTARIES, KY		
0-47	Obion Creek, KY	Channel improvement	Authorized by Public Law 89-298.
	LITTLE RIVER DIVERSION CHANNEL, MO		
	Delta to Ancell, MO	Levees	Mile 49 above Cairo.
	MISSOURI RIVER, MO		
0-28	Mouth to St. Charles, MO	Levees	Intermittent (Sec. 6).
	ILLINOIS RIVER, IL		
0-120	Mouth to Havana, IL	Levees	Intermittent (Sec. 6).
	OHIO RIVER, IL AND KY		
	Cairo to Mound City and Mounds, IL	Floodwall, levee, revetment, and pumping plant	

1. General data concerning Bayou Boeuf, Bayou Sorrel, and Berwick locks where Atchafalaya Basin protection levees cross Gulf Intracoastal Waterway, alternate route to Plaquemine, LA, and lower Atchafalaya River (extension of Bayou Tech Waterway), respectively, are in report of New Orleans District.
2. Also see Table 41-D, "Authorizing Legislation."
3. Public Law 81-516 modified requirements of local cooperation.
4. Authorized by Public Law 77-228. Modified by Public Law 89-298.
5. Authorized or incorporated in MR&T by Public Law 79-526.[3] See Table 41-D.
6. Authorized by Public Law 85-500.

TABLE 41-C MISSISSIPPI RIVER TRIBUTARY DAMS AND LAKES

Name[1]	Grenada Lake	Enid Lake	Sardis Lake	Arkabutla Lake	Wappapello Lake
River	Yalobusha	Yocona	Little Tallahatchie	Coldwater	St. Francis
Nearest town to damsite	Grenada	Enid	Sardis	Arkabutla	Wappapello
Drainage area, square miles	1,320	560	1,545	1,000	1,310
Conservation pool:					
Area, thousand acres	10	6	11	5	4
Volume, thousand acre-feet	86	58	108	31	31
Elevation, feet, NGVD	193.0	230.0	236.0	209.3	354.7
Flood control pool:					
Area, thousand acres	65	28	58.5	33	23
Volume, thousand acre-feet	1.252	602	1,462	494	582
Runoff, inches	17.8	20.2	17.7	9.3	8.4
Outlet gates:					
Number	3	2	4	3	3
Size, feet	7.5 by 14	8 by 16	6 by 12	8.5 by 19	10 by 20
Capacity, thousand cubic feet per second	10.7	9.4	10.0	10.0	18.0
Spillway:					
Type, uncontrolled	Chute	Chute	Chute	Chute	Gravity
Length, feet	200	200	400	300	740
Elevation, crest, feet, NGVD	231.0	268.0	281.4	238.3	394.7
Discharge capacity, thousand cubic feet per second	52	50	132	89	229
Surcharge pool:					
Area, thousand acres	106	41	90	63	32
Volume, thousand acre-feet	1,385	554	1,447	858	521
Runoff, inches	19.7	18.5	17.6	16.1	7.5
Elevation, feet, NGVD	247.5	284.0	301.0	256.3	413.7
Dam:					
Type, earthfill	Rolled	Rolled	Hydraulic	Rolled	Rolled
Length, thousand feet	13.9	8.4	15.3	11.5	2.7
Elevation, crest, feet, NGVD	256.0	293.0	311.4	264.3	419.7

1. Grenada, Enid, Sardis, and Arkabutla Lakes are in Yazoo River Basin, MS; Wappapello Lake is in St. Francis River Basin, MO.

TABLE 41-D AUTHORIZING LEGISLATION

Act or Authorization	Work Authorized	Document
May 15, 1928	Flood protection in alluvial valley of Mississippi River, revetment and contraction works and dredging to provide least channel depth of 9 feet and width of 300 feet below Cairo.	H. Doc. 90, 70th Cong., 1st sess.
Jun. 19, 1930	Provided for allotment of the balance of emergency rescue funds to reimburse levee districts and others for expenditures in flood-control works during the 1927 and subsequent floods.	Public Law 395, 71st Cong., 2d sess.
Feb. 15, 1933	Provided for ownership of lands in Bonnet Carre Spillway and Floodway with proviso for granting rights-of-way, easements, and permits, in said lands.	Public Law 351, 72d Cong.
Apr. 23, 1934	Authorized payment for purchase of, or to reimburse states and local levee districts for the cost of, levee rights-of-way for flood-control work in the Mississippi Valley, and for other purposes.	Public Law 171, 73d Cong.
Aug. 30, 1935	Improvement of Wolf and Nonconnah Rivers, TN (Nonconnah Creek is correct title). Improvement of Wolf River (Memphis Harbor), TN.	R&H Comm. Doc. 26, 72d Cong., 1st sess. R&H Comm. Doc. 45, 74th Cong., 1st sess.
Jun. 15, 1936	Modification of the 1928 Act to provide for: Construction of a backwater levee at mouth of White River, AR. Construction of Eudora floodway in lieu of Boeuf floodway; flood control, Yazoo River: construction of Morganza floodway; and an outlet to the Gulf of Mexico west of Berwick, LA, including a 6-year program for the improvement and regularization of the Mississippi River between Arkansas and Red Rivers, and Atchafalaya River; and construction of roads on levees and drainage adjustments incident to floodway levees.	 Unpublished report dated Apr. 2, 1925. H. Comm. on Flood Control, Doc. 1, 74th Cong., 1st sess.
Aug. 28, 1937	Provided for construction of floodwalls, levees, and revetments along Wolf River and Nonconnah Creek for protection of Memphis, TN. Modify the Yazoo River project to substitute a combined reservoir floodway and levee plan.	Unpublished report on record in OCE.
Jun. 28, 1938	Construction of Mounds to Mound City levee and control works along Cache River, IL. Modification of previous act pertaining to floodways and outlets and lands therein; including program for the improvement and regularization of the Mississippi River, between Cairo and Arkansas River, extension of levee road system; strengthening of levees.	H. Comm. on Flood Control, Doc. 1, 75th Cong., 1st sess. H. Comm. on Flood Control, Doc. 1, 75th Cong., 1st sess.
Aug. 18, 1941	Enlarge main line levees to offset abandonment of floodways between Arkansas and Red Rivers, flood-control works in backwater areas of Yazoo and Red Rivers, and in Bayous Rapides, Beouf, and Cocodrie, LA.	H. Doc. 359, 77th Cong., 1st sess.

TABLE 41-D (Continued) AUTHORIZING LEGISLATION

Act or Authorization	Work Authorized	Document
Dec. 22, 1944	Navigation channel 12 feet deep and 300 feet wide between Baton Rouge and Cairo; flood protection of Yazoo River Backwater Area in vicinity of Satartia, MS.	H. Doc. 509, 78th Cong., 2d sess.
	Continue prosecution of channel improvement and stabilization program, $200 million.	Public Law 534, 78th Cong., 2d sess.
Jul. 24, 1946	Flood control on the Big Sunflower, Little Sunflower, Hushpuckena, and Quiver Rivers and their tributaries, and on Hull Brake-Mill Creek Canal, Bogue Phalia, Ditchlow Bayou, Deer Creek, and Steele Bayou, MS.[1]	H. Doc. 516, 78th Cong., 2d sess.
	Improve Boeuf and Tensas Rivers and Bayou Macon, AR.[1]	S. Doc. 151, 78th Cong., 2d sess.
	Improve Bayou Lafourche, LA.	S. Doc. 191, 79th Cong., 2d sess.
	Improve Yazoo River tributaries.	H. Doc. 516, 78th Cong., 2d sess.
	North bank, Arkansas River levees(below Plum Bayou).[1]	H. Doc. 308, 74th Cong., 1st sess.
	Levees on White River (Augusta to Clarendon).[1]	H. Doc. 98, 76th Cong., 1st sess.
	Bayou des Glaises diversion channel, LA.[1]	H. Doc. 602, 79th Cong., 2d sess.
	Modify local cooperation requirements in St. Francis and Yazoo Basins.	Public Law 526, 79th Cong., 2d sess.
	Tiptonville-Obion levee and drainage improvements.[1]	H. Doc. 757, 79th Cong., 2d sess.
	Improvement of St. Johns Bayou, MO.	H. Doc. 138, 80th Cong., 1st sess.
	Big Sunflower River, etc.[1]	H. Doc. 516,78th Cong., 2d sess.
	Tennessee Chute (Memphis Harbor), TN.	S. Doc. 51, 80th Cong., 1st sess.
	Continue prosecution of project for flood control and channel improvement, $100 million.	Public Law 526, 79th Cong., 2d sess.
Jun. 30, 1948	Improve Mississippi River below Cape Girardeau, MO, with respect to West Tennessee tributaries.	H. Doc. 627, 80th Cong., 2d sess.
	Improve L'Anguille River, AR.	H. Doc. 651, 80th Cong., 2d sess.
	Baton Rouge Harbor (Devils Swamp), LA.[1]	H. Doc. 321, 80th Cong., 1st sess.
May 17, 1950	Flood protection at Des Arc, AR.	H. Doc. 485, 81st Cong., 2d sess.
	Improve St. Francis River and Basin, AR and MO.	H. Doc., 132, 81st Cong., 1st sess.
	Improve Cache River and Bayou DeView, AR and MO.	S. Doc. 88, 81st Cong., 1st sess.
	Improve Grand Prairie Region and Bayou Meto Basin, AR.	H. Doc. 255, 81st Cong., 1st sess.

TABLE 41-D (Continued) AUTHORIZING LEGISLATION

Act or Authorization	Work Authorized	Document
	Flood protection, Lake Pontchartrain, Jefferson Parish, LA.[1]	S. Doc. 139, 81st Cong., 2d sess.
	Filling Grant's Canal, Lake Providence, LA.	Public Law 516, 81st Cong., 2d sess.
	Additional protection to Red River Backwater Area.	Public Law 516, 81st Cong., 2d sess.
	Extend Federal jurisdiction to cover levees in Orleans Parish, LA.	Public Law 516, 81st Cong., 2d sess.
	Bank protection, Amite River, LA.	Public Law 516, 81st Cong., 2d sess.
	Continue prosecution of project for flood control and channel improvement, $200 million.	Public Law 516, 81st Cong., 2d sess.
	Jonesville, LA, levee, retaining wall, and drainage structure.[1]	S. Doc. 117, 81st Cong., 1st sess.
Oct. 30, 1951	Modify requirements for local cooperation in White River Backwater Area, AR.	Public Law 237, 82d Cong., 1st sess.
Sep. 3, 1954	Navigation improvement of Atchafalaya from Mississippi River to Morgan City, LA.	S. Doc. 53, 82d Cong., 1st sess.
	Modify project for Vicksburg-Yazoo Area (Harbor), MS.	H. Doc. 85, 83d Cong., 1st sess.
	Improve New Madrid Floodway, MO, including Peafield drainage floodgate.	H. Doc. 183, 83d Cong., 1st sess.
	Control of Old and Atchafalaya Rivers and a lock for navigation.	H. Doc. 478, 83d Cong., 2d sess.
	Improve Reelfoot Lake area, KY and TN.	S. Doc. 160, 83d Cong., 2d sess.
Jul. 3, 1958	Improve Greenville Harbor, MS.	S. Doc. 15, 86th Cong., 1st sess.
	Extensions to project for Boeuf and Tensas Rivers and Bayou Macon in Arkansas.	H. Doc. 108, 85th Cong., 1st sess.
	White River backwater area pumping plant.	S. Doc. 26, 85th Cong., 1st sess.
	Wolf River and tributaries for flood protection in Tennessee.	H. Doc. 76, 85th Cong., 1st sess.
Jul. 14, 1960	Continue prosecution of project for channel improvement--$50 million.	Public Law 86-645.
Oct. 23, 1962	Modification--Baton Rouge Harbor (Devils Swamp), LA.	Public Law 87-874.
	Construct improvements in Gin and Muddy Bayous, Yazoo River Basin, MS.	Public Law 87-874
	Replace 2 bridges with adequate floodway over Boeuf River and Big Bayou in Boeuf Basin, AR.	Public Law 87-874.
Jun. 18, 1965	Continue prosecution of project for flood control and channel improvement, $53 million.	Public Law 89-42.

TABLE 41-D (Continued) AUTHORIZING LEGISLATION

Act or Authorization	Work Authorized	Document
Oct. 27, 1965	Modify and expand levees and channel improvement features of main stem project.	H. Doc. 308, 88th Cong., 2d sess.
	Modify flood control improvements in following tributary areas and basins: Cairo-Mounds-Mounds City, St. Francis, Lower White, Boeuf-Tensas-Macon, Red River backwater, Yazoo headwater, Grand Prairie, and Bayou Meto.	H. Doc. 308, 88th Cong., 2d sess.
	Acquire any modified easements required in New Madrid Floodway as provided by Sec. 4 of May 15, 1928 act.	H. Doc. 308, 88th Cong., 2d sess.
	Operate and maintain pumping plant in Red River backwater area (Tensas-Cocodrie Pumping Plant).	H. Doc. 308, 88th Cong., 2d sess.
	Provide improvements in West Kentucky tributaries.	H. Doc., 308, 88th Cong., 2d sess.
	Provide fish and wildlife facilities in St. Francis and Big Sunflower Basins; Yazoo Headwater and Backwater Areas; and Mississippi Delta region.	H. Doc. 308, 88th Cong., 2d sess.
	Deauthorize Amite River, LA, project.	H. Doc. 308, 88th Cong., 2d sess.
	Modify St. Francis River, MO and AR, project within District No. 7, Poinsett County, AR.	S. Doc. 57, 89th Cong., 1st sess.
Apr. 14, 1966[2]	Provide pumping plant and drainage structure at Wilson Point, LA.	Unpublished Vicksburg District's MRC report. Approved Apr. 14, 1966.
Nov. 7, 1966	Construction of improvements to supplement freshwater supply in Teche-Vermilion Basins in Louisiana.	H. Doc. 524, 89th Cong., 2d sess.
	Bank revetment for protection of existing industrial facilities along Mississippi River below Baton Rouge, LA.	Public Law 89-789.
	Modification of West Tennessee tributaries feature to provide relocation of gas transmission lines at Federal expense.	Public Law 89-789.
Nov. 20, 1967	Continue emergency work, $87,135,000, which includes $100,000 for road crossing of Panola-Quitman Floodway, MS, and $80,000 for protection of Sheley Bridge, Tallahatchie River, MS.	Public Law 90-147.
Aug. 13, 1968	Improvements in Boeuf and Tensas Rivers and Bayou Macon Basin to divert flows that would otherwise enter Lake Chicot, AR.	H. Doc. 168, 90th Cong., 1st sess.
	Improvements in the Belle Fountain ditch and tributaries, MO, and Drainage District No. 17, AR.	H. Doc. 339, 90th Cong., 2d sess.
	Provide pumping plants and other drainage facilities in Cairo, IL, and vicinity.	Public Law 90-483.
Sep. 10, 1968[3]	Modification of Yazoo Headwater Project to include cleanout along David Bayou, MS.	Unpublished MRC report dated May 8, 1968.
Mar. 3, 1970[3]	Modify Yazoo Backwater feature to include a control structure in Muddy Bayou, MS.	Unpublished MRC report dated Feb. 2, 1970.

TABLE 41-D (Continued) AUTHORIZING LEGISLATION

Act or Authorization	Work Authorized	Document
Apr. 29, 1970[3]	Modification of Yazoo Headwater Project to include drainage structure and channel improvement on Rocky Bayou, MS.	Unpublished MRC report dated Mar. 6, 1970.
Jun. 4, 1970[3]	Provide for enlargement of Bayou Latenache from Pointe Coupee drainage structure to Alabama Bayou, LA.	Unpublished MRC report dated Sep. 22, 1969.
Dec. 31, 1970	Modify and expand project to include flood protection within the area of eastern Rapides and south-central Avoyelles Parishes, LA, that are drained by Bayou des Glaises diversion channel and Lake Long, and their tributaries.	S. Doc. 91-113, 2d sess.
	Modify the project for West Kentucky tributaries (Obion Creek), KY, to provide for all relocations, at Federal expense, of all transmission lines required by the project.	Public Law 91-611.
Senate and House Public Works Resolutions adopted Dec. 17 and 15, 1970, respectively.[4]	Report on Western Tennessee Tributaries, TN and KY, authorized: a. Modification of Reelfoot Lake feature to provide channel improvements on Bayou du Chien and Lake No. 9 in KY and TN. b. Modification of Mississippi levee feature to include a pumping station near Mud Lake floodgate and adjacent channel improvements.	H. Doc. 91-414, 2d sess.
	Modification of Big Sunflower Basin feature to provide additional improvements in Steele Bayou Basin, MS.	S. Doc. 91-74, 2d sess.
River Basin Monetary Act of Dec. 23, 1971	Continue prosecution of project for the comprehensive development of the basin, $97 million.	Sec. 1, Public Law 92-222.
	Modification of Tiptonville-Obion River levee feature to relieve local interests of all responsibility except that of providing maintenance.	Sec. 7, Public Law 92-222.
Jan. 19, 19732	Modification of the Mississippi levee feature to provide additional drainage facilities in Long Lake area, vicinity of Helena, AR.	Unpublished Memphis District's MRC report dated Oct. 4, 1972.
TITLE I Water Resources Development Act of 1974.	Projects recommended by four completed reports were authorized for accomplishment of Phase I design memorandum of advance engineering and design on:	Sec. 1, Public Law 93-251, Mar. 7, 1974.
	a. Greenville Harbor, Greenville, MS.	S. Doc. 93-38, 1st sess.
	b. East bank of Mississippi River, Warren to Wilkinson Counties, MS (Natchez area).	H. Doc. 93-148, 1st sess.
	c. East bank of Mississippi River, Warren to Wilkinson Counties, MS (Vicksburg-Yazoo area).	H. Doc. 93-148, 1st sess.
	d. Bushley Bayou Area of Red River Backwater Area, LA.	H. Doc. 93-157, 1st sess.
	Modification of West Tennessee tributaries feature (Obion and Forked Deer Rivers), TN, to acquire lands for fish and wildlife, recreation, and environmental purposes.	Sec. 3, Public Law 93-251.

TABLE 41-D (Continued) AUTHORIZING LEGISLATION

Act or Authorization	Work Authorized	Document
	Modification of the Yazoo Basin, MS, feature to provide for a streambank erosion control demonstration project for the delta and hill areas of basin.	Sec. 32, Public Law 93-251.
	Modification of project to provide that the Secretary of the Army, acting through the Chief of Engineers, can substitute authorized mitigation lands, not yet acquired and no longer suitable, for like acreage in the same or adjacent subbasins of the project area. This section provides the authority to substitute authorized mitigation lands in: a. Tensas Basin, LA and AR, feature (Red River backwater). b. St. Francis Basin, AR and MO, feature.	Sec. 42, Public Law 93-251.
	Modification of Bayou Cocodrie and tributaries, LA, feature, to provide for: enlargement of Bayou Courtableau from Washington to west protection levee; right-of-way and spoil disposal areas at Federal expense; and necessary additional culverts through west protection levee.	Sec. 87, Public Law 93-251.
	Modification of Cache River Basin, AR, feature to provide for: acquisition by fee easements of lands for fish and wildlife management, recreation, and environmental purposes.	Sec. 99, Public Law 93-251.
TITLE II River Basin Monetary Authorization Act of 1974	Continue prosecution of project for the comprehensive development of the basin, $211 million.	Sec. 201, Public Law 93-251. Mar. 7, 1974.
River Basin Monetary Act of Oct. 2, 1975	Continue prosecution of project for the comprehensive development of the basin, $158,000,000.	Sec. 1, Public Law 94-101.
Dec. 16, 1975[2]	Modification of St. Francis Basin, AR and MO, feature to provide relief from ponding of interior runoff in the Inter-River Drainage District of Missouri.	Unpublished Memphis District's MRC report dated Nov. 11, 1975.
TITLE II Public Works for Water and Power Development and Energy Research Appropriation Act, 1976.	Continue prosecution of project for comprehensive development during period Jul. 1-Sep. 30, 1976, $60,300,000.	Public Law 94-180, Dec. 26, 1975.

TABLE 41-D (Continued) AUTHORIZING LEGISLATION

Act or Authorization	Work Authorized	Document
TITLE II Public Works for Water and Power Development and Energy Research Appropriation Act, 1977.	Continue prosecution of project for flood control, rescue work, repair, restoration, and control of bank erosion, $231,497,000.	Public Law 94-355, Jul. 12, 1976.
Water Resources Development Act of 1976.	Sec. 101(a) authorized accomplishment of Phase I - Advanced Engineering and Design Memoranda-On: a. St. Johns Bayou and New Madrid Floodway, MO, project: Report of OCE - Sep. 26,1975. b. Nonconnah Creek, TN and MS, project: Report of OCE - Jun. 23, 1976, and as an independent part of the project: Improvements for flood control and allied purposes on Horn Lake Creek and tributaries, including Cowpen Creek, TN and MS. Modification of West Tennessee Tributaries feature (Obion and Forked Deer Rivers), TN, to: a. (Sec. 102) - Provide project for flood control for Harris Fork Creek, TN and KY: (H.D. 94-221) except that highway bridge relocations and alterations shall be at Federal expense. b. (Sec. 183) - Provide for construction of a levee and appurtenant works from mouth of Obion diversion channel to vicinity Highway 88 and thence to vicinity of Porter Gap, TN.	Public Law 94-587, Oct. 22, 1976.
TITLE II Public Works for Water and Power Development and Energy Research Appropriation Act, 1978.	Continue prosecution of project for flood control, rescue work, repair, restoration, and control of bank erosion, $253,081,000.	Public Law 95-96 Aug. 7, 1977.
Dec. 9, 1977, 5th Ind. on VXD May 31, 1977, Letter Report.[2]	Modification of the Tensas Basin Project, Red River Backwater Area, to include a drainage structure and appurtenant channel works in the Six Mile Bayou area of Concordia Parish, LA.	Unpublished Vicksburg District report dated May 31, 1977, on Cynthia and Six Mile Bayous, LA.
Jun. 28, 1980	The establishment of the Tensas River National Wildlife Refuge for the preservation and development of environmental resources and in lieu of mitigation acquisitions which otherwise would be required for certain water resources projects, within designated limits, in the basins of the Tensas, Boeuf, and Red Rivers in the State of Louisiana.	Public Law 96-285, Jun. 28, 1980.

TABLE 41-D (Continued) AUTHORIZING LEGISLATION

Act or Authorization	Work Authorized	Document
Energy and Water Development Appropriation Act. 1981	For expenses necessary for prosecuting work of flood control projects, rescue work, repair, restoration or maintenance of flood control projects threatened or destroyed by flood, $232,519,000: Provided, That not less than $250,000 be available for control of bank erosion of streams in the Yazoo Basin, including the foothill area. Provided further, That funds for the Tensas Basin Red River Backwater Area, be used for flood control, etc., for Sicily Island and Below Red River including pumping stations.	Public Law 96-367, Oct. 1, 1980.
Supplemental Appropriations Bill for FY Ending Sep. 30, 1985 (PL 99-88), and the Water Resources Development Act of 1986 (PL 99-662)	Authorizes and directs the Secretary of the Army acting through the Chief of Engineers to proceed with planning, design, engineering, and construction of 41 water resources projects, including Atchafalaya Basin Floodway System. For the Atchafalaya Basin Floodway Systems project, cost-sharing is only required for the recreation feature of the project. The flood control and environmental features are Federal costs.	FY 1985 Supplemental Appropriations Bill (PL 99-88), and Water Resources Development Act of 1986 (PL 99-662).
Water Resources Development Act, 1986	Sec. 104(a), Authorization of Projects - Authorization of Construction: Incorporation of the project for flood control, Louisiana State Penitentiary levee, Mississippi River, LA: Report of the Chief of Engineers, dated Dec. 10, 1982, at a total cost of $23,400,000, with an estimated first Federal cost of $17,600,000 and an estimated first non-Federal cost of $5,800,000. No acquisition of land for or actual construction of the project may commence until appropriate non-Federal interests shall agree to undertake measures to minimize the loss of fish and wildlife habitat lands in the project area. The work is unscheduled. a. Bushley Bayou, LA. Water Resources Development Act of 1986 authorized the project for flood control, Bushley Bayou, LA. b. Eight Mile Creek, Paragould, AR. Project entails channel improvement along the creek with miniparks and hiking/ biking trails. c. Helena and Vicinity, AR. The Helena Basin is an urban basin containing approximately 3,500 acres which frequently and severely floods the city of Helena. A pumping station and sump with channel enlargement and a gated culvert was recommended. d. West Memphis and Vicinity, AR. Channel improvements along Ten Mile Bayou and Fifteen Mile Bayou for a total of 23.86 miles, with limited revegetation of right-of-way to maintain environmental stability. e. St. Johns Bayou and New Madrid Floodway, MO. Flood control for urban and rural land.	Public Law 99-662, Nov. 17, 1986.

TABLE 41-D (Continued) AUTHORIZING LEGISLATION

Act or Authorization	Work Authorized	Document
	f. Nonconnah Creek and Johns Creek, TN and MS. Channel enlargement, recreation features with channel construction and environmental enhancement. g. Horn Lake Creek and Tributaries, TN and MS. This is an urban flood control project located in extreme northwest Mississippi and southwest Tennessee. The plan of improvement consists of 3.5 miles of selective drift removal on lower Horn Lake Creek and 2.6 miles of vegetative clearing on Horn Lake Creek, 2.1 miles on Rocky Creek and 0.6 miles of vegetative clearing and 1.8 miles of channel enlargement on Cow Pen Creek. Hike/bike trails are included along Rocky Creek and Cow Pen Creek. h. Atchafalaya Basin Floodway System, La. Not mentioned, but this Act authorized basic cost sharing principles for the project. In particular establishes that the fish and wildlife enhancement feature of the project is of national significance, and therefore, a 100 percent Federal cost.	
Energy and water Development Appropriation Act, 1994	i. Lower Atchafalaya Basin Reevaluation Study. Authority to, within available funds, investigate conditions at Wax Lake Outlet, Bayou Black, and other features, and recommend any modification desirable for flood protection navigation, and environmental program. Sec. 601(a) Authorization of Projects. Authorization of Construction: a. Yazoo Backwater Area, MS. Authorized the project for mitigation of fish and wildlife losses at the Yazoo Backwater Project, MS. The project shall include acquisition of 40,000 acres for mitigation of project-induced fish and wildlife losses. b. Greenville Harbor, MS. Authorized the project for navigation, Greenville Harbor, MS, as contained in the reports of Chief of Engineers, Nov. 15, 1977 and Feb. 2, 1982, at a total cost of $43,700,000 with an estimated first Federal cost of $28,000,000 and an estimated non-Federal first cost of $15,700,000. c. Vicksburg Harbor, MS. Authorized the project for navigation, Vicksburg Harbor, as contained in the report of the Chief of Engineers, Aug. 13, 1979, at a total estimated first Federal cost of $55,900,000 and an estimated non-Federal first cost of $23,300,000. d. Helena Harbor, Phillips County, AR. The recommended plan consists of dredging a navigation channel to provide access to 685 acres of landfill; construction of an overlook park; implementing landscaping and erosion control measures; and mitigation fish and wildlife losses. The project is scheduled to be constructed in two phases.	

TABLE 41-D (Continued) AUTHORIZING LEGISLATION

Act or Authorization	Work Authorized	Document
	e. White River Navigation to Batesville, AR. The plan of improvement recommended in the Feasibility Report provides for construction and maintenance to provide a 200-foot wide, 9-foot deep channel available 95 percent of the time from mile 10 (Arkansas Post Canal) to mile 254, two scenic overlooks, a primitive camping area, and acquisition of about 1,865 acres of woodlands for mitigation. However, section 52 of the Water Resources Development Act of 1988 deauthorized this project. f. Obion Creek, KY. To prevent headwater flooding along tributary streams and backwater flooding of alluvial lands. g. Memphis Harbor, Memphis, TN. This is a navigation project in the vicinity of Memphis, TN, which would consist of dredging and maintaining a 4.9 mile long, 500-foot minimum width, 9-foot deep general navigation channel with additional dredging as required and strategic placement of dredged material to create and provide navigation access to 1,000 acres to be developed as a waterfront industrial complex. Sec. 806. Reelfoot Lake, KY. This project is modified to provide that the Federal share of the cost of operating the pumping plant feature of such project shall be 50 percent. Sec. 836. Mud Lake, Western Tennessee Tributaries. This project is modified to provide that the requirements of local cooperation shall be (1) 50 percent of the value of the lands, easements, and rights-of-way, (2) to hold and save the United States free from damages due to the construction works, and (3) to maintain and operate all the works after completion.	
Jun. 4, 1987	Modification of Mississippi Delta Region project to construct salinity control structure at Davis Pond (mile 118) rather than at Myrtle Grove (mile 59).	Unpublished New Orleans District report, Nov. 1, 1984.
Water Resources Development Act, 1988	Sec. 3(a), Project Authorizations - Authorization of Construction: a. Mississippi-Louisiana Estuarine Area, MS and LA. Authorized the project for environmental enhancement, as contained in the report of Chief of Engineers, dated May 19, 1986, at a total cost of $59,300,000.	Public Law 100-676 Nov. 17, 1988
Water Resources Development Act, 1988	Section 4(b) West Memphis and Vicinity, AR. Modified the project by allowing that non-Federal cooperation may be provided by levee districts, drainage districts, or any unit of a state, county, or local government.	Public Law 100-676, Nov. 17, 1988

TABLE 41-D (Continued) AUTHORIZING LEGISLATION

Act or Authorization	Work Authorized	Document
Energy and Water Development Appropriation Bill, 1990	West Memphis and Vicinity, AR. Directed the Corps to develop the most cost-effective flood control plan for the City of West Memphis without regard to frequency of flooding, drainage area, and the amount of runoff.	Public Law 101-83, Jul. 25, 1989
Energy and Water Development Appropriation Bill, 1990	Bayou Rapides Drainage Structure and Pumping Plant Directed the Secretary of the Army to incorporate existing flood control features for the Bayou Rapides Drainage Structure and Pumping Plant into the Lower Red River, South Bank Levees portion of the MR&T Project.	Public Law 101-514, Nov. 5, 1990
Supplemental Appropriations Bill for FY Ending Sep. 30, 1985 (PL 99-83), and the Water Resources Development Act of 1986 (PL 99-662)	Atchafalaya Basin Floodway System, LA. Authorizes and directs the Secretary of the Army acting through the Chief of Engineers to proceed with planning, design, engineering, and construction of 41 water resources projects, including Atchafalaya Basin Floodway System. For the Atchafalaya Basin Floodway Systems project, cost-sharing is only required for the recreation feature of the project. The flood control and environmental features are Federal costs. This act authorized basic cost sharing principles for the project. In particular, establishes that the fish and wildlife enhancement feature of this project is of national significance and therefore a 100% federal cost.	FY 1985 Supplemental Appropriations Bill (PL 99-88), and Water Resources Development Act of 1986 (PL 99-662).
Water Resources Development Act, 1992	Whiteman's Creek, Arkansas. Directed the Secretary of the Army to implement flood control improvement, which essentially consist of 6.1 miles of channel enlargement along streams within the city limits of Jonesboro, Arkansas.	Public Law 102-580 Oct. 31, 1992
Water Resources Development Act, 1992	New Madrid Harbor, Missouri Directed the Secretary of the Army to assume responsibility for maintenance of the New Madrid County Harbor constructed by non-Federal interests before that date of the enactment of this Act in lieu of maintaining the existing Federal channel.	Public Law 102-580 Oct. 31. 1992
Water Resources Development Act, 1996	Grand Prairie and Bayou Basin, Arkansas The project for flood control, Grand Prairie Region and Bayou Meto Basin, Arkansas, authorized by section 204 of the Flood Control Act of 1950 (64 Stat. 174) and deauthorized pursuant to section 1001(b) of the Water Resources Development Act of 1986 (33 U.S.C. 579a(b)), is authorized to be carried out ground water protection and conservation, agricultural water supply, and waterfowl management if the Secretary determines that the change in the scope of the project is technically sound, environmentally acceptable, and economic, as applicable.	Public Law 104-303 Oct. 12, 1996

TABLE 41-D (Continued) AUTHORIZING LEGISLATION

Act or Authorization	Work Authorized	Document
Water Resources Development Act, 1996	White River, Arkansas The project for navigation, White river Navigation to Batesville, Arkansas, authorized by section 601(a) of the Water Resources Development Act of 1986 (100 Stat 4139) and deauthorized by section 52(b) of the Water Resources Development Act of 1988 (102 Stat. 4044), is authorized to be carried out by the Secretary.	Public Law 104-303 Oct 12, 1996
Water Resources Development Act, 1999	Memphis Harbor, Memphis, Tennessee Authorized to be carried out by the Secretary, if the Secretary determines that the project is technically sound, environmentally acceptable, and economically justified, as appropriate.	Public Law 106-53 Aug. 17, 1999
Water Resources Development	Tunica Lake Weir, Mississippi The Secretary shall conduct a study to determine the feasibility of constructing an outlet weir at Tunica Lake, Tunica county, Mississippi, and Lee County, Arkansas, for the purpose of stabilizing water levels in the lake. In carrying out the study, the Secretary shall include as part of the economic analysis the benefits derived from recreation uses at Tunica Lake and economic benefits associated with restoration of fish and wildlife habitat.	Public Law 106-53
Water Resources Development Acts, 1986, 1990 and 1999	Louisiana State Penitentiary Levee, Mississippi River, Louisiana Authorizes and directs the Secretary of the Army, acting through the Chief of Engineers to proceed with planning, design, engineering, and construction of improvements of 12 miles of existing levee along the Mississippi River which provides flood protection to the Louisiana State Penitentiary at Angola, LA. This act authorizes basic cost sharing principles, and establishes that the cost sharing will be shared on a 75%/25% basis with the state of Louisiana for this project. Authorizes the Secretary of the Army to consider credit for work performed by an non-Federal sponsor since project authorization.	Public Law 99-662 Nov. 17, 1986 Public Law 101-646 Nov. 28, 1990 Public Law 106-53 Aug. 17, 1999
Omnibus Consolidated and Emergency Appropriations For Fiscal Year 2001	Ten and Fifteen Mile Bayous, St. Francis River Basin, Arkansas Modified Section 204 of the Flood Control Act of 1950 to expand the boundaries of the project to include Ten- and Fifteen-Mile Bayous near West Memphis, Arkansas. Notwithstanding section 103(f) of the Water Resources Development Act of 1986, the flood control work at Ten- and Fifteen-Mile Bayous shall not be considered separable elements of the project.	House Report 4577 Dec 15, 2000

1. Incorporated into Mississippi River and tributaries project as shown in Table 41-E.
2. Date minor modification for blocked drainage was approved under delegated authority of the President, Mississippi River Commission, and in accordance with Sec. 10(p) of the 1946 Flood Control Act (Public Law 79-526).
3. Date minor modification was approved under discretionary authority of Chief of Engineers contained in May 15, 1928, Flood Control Act, as amended.
4. Projects approved under the provisions of Sec. 201 of Flood Control Act of Oct. 27, 1965.

TABLE 41-E INCORPORATING AND AUTHORIZING LEGISLATION

Act of Incorporation	Public Law No.	Authorizing Act	Description	For Last Full Report See Annual Report for
Jul. 24, 1946	79-526	Jun. 22, 1936	Tiptonville-Obion levee and drainage improvements, TN	1941, p. 943
Jul. 24, 1946	79-526	Jun. 22, 1936	Bayou des Glaises diversion ditch, LA	1946, p. 1029
Jul. 24, 1946	79-526	Jun. 22, 1936	From North Little Rock, AR, to Gillett, AR, on north bank of Arkansas River (portion below Plum Bayou)	1946, p. 1053
Jul. 24, 1946	79-526	Aug. 18, 1941	White River levees, Augusta to Clarendon and De Valls Bluff, AR	1946, p. 1083
Jul. 24, 1946	79-526	Dec. 22, 1944	Boeuf and Tensas Rivers and Bayou Macon, LA	1945, p. 982
Jul. 24, 1946	79-526	Dec. 22, 1944	Big Sunflower River, etc.	1946, p. 1061
Jun. 30, 1948	80-858	Jul. 24, 1946	Devils Swamp barge channel at Baton Rouge, LA (Baton Rouge Harbor)	1948, p. 1059
May 17, 1950	81-516	Jun. 22, 1936	Jonesville, LA	1953, p. 773
May 17, 1950	81-516	Jul. 24, 1946	Lake Pontchartrain-Jefferson Parish, LA	1953, p. 737

TABLE 41-F SUMMARY OF PRESENTLY ESTIMATED FEDERAL FIRST COST OF AUTHORIZED IMPROVEMENTS

Project Title	Estimated Cost[1] Fiscal Year 2002
Completed features[2]	$ 339,236,000
Mississippi River levees	2,121,000,000
Mud Lake Pumping Station, TN	5,460,000[3]
Sec. 6 levees, 1928 Flood Control Act	4,000,000[3]
Channel improvement	3,964,000,000
Atchafalaya Basin, LA	1,790,000,000
Atchafalaya Basin Floodway System, LA	202,000,000
Bayou Cocodrie and Tributaries, LA	20,400,000[3]
Old River, LA	292,273,000
Lower Red River--South Bank Red River levees, LA	23,500,000[3]
Eastern Rapides and South-Central Avoyelles Parishes, LA	50,000,000[3]
Mississippi Delta Region, LA	107,600,000
Tensas Basin, AR and LA	477,631,000
Lower Arkansas River, AR	29,676,000[3]
Grand Prairie Region, AR	208,000,000
Yazoo Basin, MS	1,876,632,000
Lower White River, AR (All except Big Creek & Tribs.)	16,802,000[3]
Lower White River, AR (Big Creek & Tribs.)	55,900,000[3]
Cache River Basin, AR	155,000,000
St. Francis Basin, AR and MO	409,600,000
Francis Bland Floodway Ditch (Eight Mile Creek), AR	10,800,000[3]
L'Anguille River, AR	15,100,000[3]
West Tennessee Tributaries, TN	156,700,000
Harris Fork Creek, TN and KY	14,300,000[3]
Reelfoot Lake-Lake No. 9, TN and KY	(11,000,000)[3]
Reelfoot Lake, TN and KY (Completed)	440,000
Reelfoot Lake-Lake No. 9, TN and KY	10,560,000[3]
West Kentucky Tributaries, KY	26,100,000[3]
Sardis Dam (Dam Safety Assurance), MS	29,200,000
St. Johns Bayou and New Madrid Floodway, MO	64,600,000[4]
Nonconnah Creek, TN and MS	18,975,000[4]
Horn Lake Creek and Tributaries, TN and MS	3,870,000[4]
Wappapello Lake, MO (RAMP)	585,000
Greenville Harbor, MS	32,400,000[3,4]
Memphis Harbor (Ensley Berm), TN	23,100,000[4]
Helena Harbor, Phillips County, AR	32,156,000[4]
Helena, AR, and Vicinity	9,400,000[3,4]
West Memphis, AR, and Vicinity	11,600,000[4,6]
Louisiana State Penitentiary Levee, LA	18,800,000[4,7]
Hickman Bluff, KY	17,510,000[3]
Whiteman's Creek, AR	3,300,000
Reelfoot Lake, TN and KY (Ecosystem Restoration)	20,800,000[3,8]

TABLE 41-F (Continued)

SUMMARY OF PRESENTLY ESTIMATED FEDERAL FIRST COST OF AUTHORIZED IMPROVEMENTS

Project Title	Estimated Cost[1] Fiscal Year 2002
Mississippi — Louisiana Estuarine Areas, MS and LA	80,200,000[5]
Bayou Meto, AR	125,000,000
Lower White River:	(14,401,000)
Clarendon Levee, AR	1,800,000
Augusta to Clarendon, AR	12,601,000
Wolf River, TN	6,110,000
Morganza, LA, to Gulf of Mexico	442,000,000
Memphis Harbor, Memphis, TN	38,400,000
TOTAL	$13,375,117,000

1. Inflation projected through the construction period. Harbors; Lake Pontchartrain; Wolf River; completed roads.
2. Includes Bonnet Carre□, Morganza, and New Madrid Floodways; Memphis, Greenville, and Vicksburg on main stem levees; channel construction works; Atchafalaya River and Basin; Wax Lake Outlet; Charenton Canal; Bayou des Glaises diversion channel, Boeuf Basin levees; Grant's Canal; De Valls Bluff, Jonesville, and Des Arc protection works; Baton Rouge Harbor; and miscellaneous features; Teche-Vermilion Basins, LA; Tensas National Wildlife Refuge, LA.
3. Incremental (not projected through the construction period).
4. Authorized by Water Resources Development Act of 1986, Public Law 99-662, Nov. 17, 1986.
5. Authorized by Water Resources Development Act of 1988, Public Law 100-676, Nov. 18, 1988.
6. Locals built their own project.
7. Authorized by Water Resources Development Act of 1999, Public Law 106-53, Aug. 17, 1999.
8. Authorized by Water Resource Development Act of 1999, Public Law 106-53, Aug. 17, 1999 and Report of the Chief of Engineers, Dec. 23, 1999.
9. Reauthorized by Water Resources Development Act of 1999, Public Law 106-53, Aug. 17, 1999.
10. Authorized by Water Resources Development Act of 2000, Public Law 106-541, Dec. 11. 2000.

TABLE 41-G MISSISSIPPI RIVER MAIN STEM CHANNEL IMPROVEMENTS

Location		Operations in 1,000 Cubic Yards Fiscal Year 2003		
District	Mileage Above Head of Passes	Channel Construction	Maintenance	Total
New Orleans				
Baton Rouge Harbor (Devils Swamp)	235	--	96.1	96.1
Main stem channel (Smithland and Wilkinson Pt Crossings)	234-320	--	304.7	304.7
Atchafalaya Basin			1,564.4	1,564.4
Berwick Bay Harbor			0	0
Three Rivers				
Old River Lock Forebay and Tailbay	304		0	0
Vicksburg				
Main stem channel	322-600	--	1,725.3	1,725.3
Vicksburg Harbor	437	--	85.0	85.0
Greenville Harbor	537	--	488.9	488.9
Memphis				
Main stem channel	600-954	--	21,650,467	21,650,467
Helena Harbor, Phillips County	653	--	230,577	230,577
Memphis Harbor, McKellar Lake	725	--	1,268.226	1,268.226
TOTAL		--	23,153.5	23,153.5

TABLE 41-H BANK REVETMENTS, DIKES, AND FORESHORE PROTECTION: NEW ORLEANS DISTRICT (FISCAL YEAR 2003)

Location	Above Head of Passes (Miles)	Bank R or L	Operations This FY Construction: New Work: Extension (Linear Feet)	New Work: Lap (Linear Feet)	New Work: (Squares)[1]	Reinforcement (Linear Feet)	Reinforcement (Squares)[1]	Maintenance (Squares)[1]	Non-Operative Since Prior FY (Linear Feet)	Operative Thru This FY (Linear Feet)
MISSISSIPPI RIVER										
Standard Revetment:										
Venice, LA	12	R	--	--	--	--	--	--	--	49,552
Olga, LA	19	L	--	--	--	--	--	7,756	--	19,053
Lower Childress-Fort Jackson, LA.	22	R	--	--	--	--	--	--	--	15,430
Neptune, LA	23	L	--	--	--	--	--	--	--	14,399
Buras, LA	25	R	--	--	--	--	--	--	--	17,283
Tropical Bend, LA	30	R	--	--	--	--	--	--	--	25,012
Bayou Lamoque, LA	33	L	--	--	--	--	--	--	--	21,505
Port Sulphur, LA	39	R	--	--	--	--	--	--	--	36,995
Nestor, LA	41	L	--	--	--	--	--	--	--	14,192
Point Michel, LA	44	R	--	--	--	--	--	--	--	22,932
Bohemia, LA	46	L	--	--	--	--	--	--	--	16,455
Diamond, LA	49	R	--	--	--	--	--	--	--	11,600
Gravolet, LA	51	L	--	--	--	--	--	--	--	23,874
Junior, LA	54	R	--	--	--	--	--	--	--	23,599
Harlem, LA	56	L	--	--	--	--	--	--	--	15,148
Myrtle Grove, LA	59	R	--	--	--	--	--	8,918	--	17,435
Monsecour, LA	61	L	--	--	--	--	--	--	--	13,340
Alliance, LA	62	R	--	--	--	--	--	--	--	17,265
Belair, LA	65	L	--	--	--	--	--	--	--	26,111
Jesuit Bend, LA	68	R	--	--	--	--	--	--	--	24,978
Linwood, LA	71	L	--	--	--	--	--	--	--	14,643
Oak Point, LA	72	R	--	--	--	--	--	--	--	16,426
Scarsdale, LA	75	L	--	--	--	--	--	--	--	17,825
English Turn, LA	78	R	--	--	--	1,493	7,433	--	--	21,845
Poydras, LA	82	L	--	--	--	--	--	--	--	45,864
Twelve Mile Point, LA	84	R	--	--	--	--	--	--	--	9,979
Cutoff, LA	88	R	--	--	--	--	--	--	--	23,234

TABLE 41-H (Continued)

BANK REVETMENTS, DIKES, AND FORESHORE PROTECTION: NEW ORLEANS DISTRICT (FISCAL YEAR 2003)

Location	Above Head of Passes (Miles)	Bank R or L	Operations This FY Construction: New Work: Extension (Linear Feet)	New Work: Lap (Linear Feet)	New Work: (Squares)[1]	Reinforcement (Linear Feet)	Reinforcement (Squares)[1]	Maintenance (Squares)[1]	Non-Operative Since Prior FY (Linear Feet)	Operative Thru This FY (Linear Feet)
Standard Revetment:										
Third district reach, LA	93	L	--	--	--	--	--	--	--	28,372
Algiers Point, LA	95	R	--	--	--	--	--	--	--	12,238
Gouldsboro, LA	96	R	--	--	--	--	--	--	--	4,960
Gretna Bend, LA	97	R	--	--	--	--	--	--	--	10,340
Greenville Bend, LA	100	R	--	--	--	--	--	--	--	22,045
Carrollton Bend, LA	104	L	--	--	--	--	--	--	--	16,262
Avondale Bend, LA	109	R	--	--	--	--	--	--	--	28,409
Kenner, LA	114	L	--	--	--	--	--	6,457	--	45,492
Luling, LA	119	R	--	--	--	--	--	3,335	--	44,893
Destrehan, LA	102	L	--	--	--	--	--	--	--	5,409
Good Hope, LA	126	L	--	--	--	--	--	--	--	24,531
Waterford, LA	128	R	--	--	--	--	--	--	--	23,106
Montz, LA	132	L	--	--	--	--	--	--	--	17,502
Lucy, LA	136	R	--	--	--	--	--	--	--	19,450
Reserve, LA	138	L	--	--	--	--	--	--	--	23,234
Willow Bend, LA	141	R	--	--	--	--	--	--	--	13,227
Angelina, LA	145	L	--	--	--	--	--	--	--	32,762
Vacherie, LA	148	R	--	--	--	--	--	--	--	26,025
Belmont, LA	152	L	--	--	--	--	--	--	--	25,575
Rich Bend, LA	157	R	--	--	--	--	--	--	--	38,498
Romeville, LA	161	L	--	--	--	1,460	9,913	--	--	33,986
St. Alice, LA	165	R	--	--	--	--	--	--	--	31,130
Burnside, LA	170	L	--	--	--	--	--	--	--	29,304
Aben, LA	172	R	--	--	--	--	--	8,152	--	11,700
St. Elmo, LA	174	L	--	--	--	--	--	--	--	12,014
Smoke Bend, LA	177	R	--	--	--	--	--	--	--	18,792
Marchand, LA	180	L	--	--	--	--	--	--	--	19,603
Philadelphia Point, LA	183	R	--	--	--	--	--	--	--	5,379
New River Bend, LA	185	L	--	--	--	--	--	--	--	45,672

TABLE 41-H (Continued)

BANK REVETMENTS, DIKES, AND FORESHORE PROTECTION: NEW ORLEANS DISTRICT (FISCAL YEAR 2003)

Location	Above Head of Passes (Miles)	Bank R or L	Operations This FY Construction: New Work: Extension (Linear Feet)	New Work: Lap (Linear Feet)	New Work: (Squares)[1]	Reinforcement (Linear Feet)	Reinforcement (Squares)[1]	Maintenance (Squares)[1]	Non-Operative Since Prior FY (Linear Feet)	Operative Thru This FY (Linear Feet)
Standard Revetment:										
White Castle, LA	193	R	--	--	--	--	--	9,802	--	45,968
St. Gabriel, LA	201	L	--	--	--	--	--	--	--	33,292
Plaquemine Bend, LA	209	R	--	--	--	--	--	--	--	45,012
Manchac, LA	215	L	--	--	--	--	--	--	--	38,976
Missouri Bend, LA	222	R	--	--	--	--	--	2,957	--	30,437
Arlington, LA	227	L	--	--	--	--	--	--	--	18,050
Port Allen, LA	231	R	--	--	--	--	--	--	--	17,627
Scotlandville, LA	234	L	--	--	--	--	--	--	--	1,623
Allendale, LA	238	R	--	--	--	--	--	--	--	29,520
Springfield Bend, LA	244	L	--	--	--	--	--	--	--	25,690
Arboth, LA	250	R	--	--	--	--	--	--	--	23,526
Faulkner Lake, LA	253	L	--	--	--	--	--	--	--	18,807
Grand Bay, LA	258	R	--	--	--	--	--	--	--	24,909
Bayou Sara, LA	265	L	--	--	--	--	--	--	--	29,722
Red Store, LA	269	R	--	--	--	--	--	--	--	18,464
Arrow Bend, LA	272	L	--	--	--	--	--	--	--	13,600
Boies Point, LA	275	R	--	--	--	--	--	--	--	16,094
Morganza, LA	279	R	--	--	--	--	--	--	--	20,513
Iowa Point, LA	282	L	--	--	--	--	--	--	--	15,477
Brunette Point, LA	285	R	--	--	--	--	--	--	--	14,335
Greenwood Bend, LA	289	L	--	--	--	--	--	--	--	26,032
Hog Point, LA	296	R	--	--	--	--	--	--	--	37,516
Carr Point, LA	304	R	--	--	--	--	--	--	--	20,725
Above Old River, LA	305	R	--	--	--	--	--	--	--	9,958
Fort Adams, MS	308	L	--	--	--	--	--	--	--	24,206
Point Breeze, LA	313	R	--	--	--	--	--	--	--	13,565
Coochie, LA	317	R	--	--	--	--	--	--	--	17,150

TABLE 41-H (Continued)

BANK REVETMENTS, DIKES, AND FORESHORE PROTECTION: NEW ORLEANS DISTRICT (FISCAL YEAR 2003)

Location	Above Head of Passes (Miles)	Bank R or L	Operations This FY Construction: New Work: Extension (Linear Feet)	New Work: Lap (Linear Feet)	New Work: (Squares)[1]	Reinforcement (Linear Feet)	Reinforcement (Squares)[1]	Maintenance (Squares)[1]	Non-Operative Since Prior FY (Linear Feet)	Operative Thru This FY (Linear Feet)
Palmetto, MS	322	L	--	--	--	--	--	--	--	34,650
Total Revetment New Orleans District, Mississippi River			-- (0.0 Miles)	--	--	2,953	17,346	47,377	--	1,911,328 (361.99 Miles)
Dikes:										
Profit Island Chute Closure, LA	252	L	--	--	--	--	--	--	--	4,315
Hog Point, LA	299	L	--	--	--	--	--	--	--	6,850
Hog Point Chute Closure	300	R	--	--	--	--	--	--	--	900
Total Dikes New Orleans District, Mississippi River			--							12,065 (2.29 Miles)
OLD RIVER CONTROL										
Standard Revetment:										
Inflow channel	315	L	--	--	--	--	--	--	--	2,415
Inflow channel	315	R	--	--	--	--	--	--	--	4,365
Outflow channel	315	L&R	--	--	--	--	--	--	--	19,891
Auxiliary inflow channel	312	L&R	--	--	--	--	--	--	--	17,200
Auxiliary outflow channel	312	L&R	--	--	--	--	--	--	--	5,790
Total Standard Revetment, Old River			--	--	--	--	--	--	--	49,661 (9.41 Miles)

TABLE 41-H (Continued)

BANK REVETMENTS, DIKES, AND FORESHORE PROTECTION: NEW ORLEANS DISTRICT (FISCAL YEAR 2003)

Location	Below Confluence of Red and Atchafalaya Rivers (Miles)	Bank R or L	Operations This FY Construction					Maintenance (Squares)[1]	Non-Operative Since Prior FY (Linear Feet)	Operative Thru This FY (Linear Feet)
			New Work			Reinforcement				
			Extension (Linear Feet)	Lap (Linear Feet)	(Squares)[1]	(Linear Feet)	(Squares)[1]			
ATCHAFALAYA RIVER										
Standard Revetment:										
Mile One, LA	1	L	--	--	--	--	--	--	--	4,150
Coville Bayou, LA	3	R	--	--	--	--	--	--	--	6,550
Legonier, LA	4	L	--	--	--	--	--	--	--	8,940
Simmesport, LA	6	R	--	--	--	--	--	3,607	--	12,491
Kuhlman Bayou, LA	7	L	--	--	--	--	--	--	--	5,565
Odenburg, LA	9	R	--	--	--	--	--	--	--	5,375
Jacoby, LA	10	L	2,879	422	9,509	--	--	--	--	10,269
Cason, LA	12	R	--	--	--	--	--	--	--	10,798
McCrea, LA	13	L	--	--	--	--	--	--	--	6,572
Woodside, LA	14	R	--	--	--	--	--	--	--	13,002
Provosty, LA	17	L	--	--	--	--	--	--	--	9,111
Crooked Bayou, LA	18	R	--	--	--	--	--	--	--	17,254
Mercier, LA	22	L	2,522	539	11,374	--	--	--	--	13,000
Barberton, LA	23	R	--	--	--	--	--	--	--	3,592
Evans Point, LA	24	L	--	--	--	--	--	--	--	6,668
Goudeau, LA	26	R	--	--	--	--	--	--	--	3,938
Morris Bayou, LA	27	L	--	--	--	--	--	--	--	5,440
Goodwood, LA	28	R	--	--	--	--	--	--	--	8,505
Red Cross, LA	29	L	--	--	--	--	--	--	--	9,608
Melville LA	30	R	--	--	--	--	--	--	--	5,660
Cross Bayou, LA	31	L	--	--	--	--	--	--	--	6,065
Melville South, LA	33	R	--	--	--	--	--	--	--	13,340
Toles, LA	35	L	--	--	--	--	--	--	--	7,302
Petite Prairie, LA	36	R	--	--	--	--	--	--	--	8,381
Three Mile Bayou, LA	37	R	--	--	--	--	--	--	--	6,330

TABLE 41-H (Continued)

BANK REVETMENTS, DIKES, AND FORESHORE PROTECTION: NEW ORLEANS DISTRICT (FISCAL YEAR 2003)

Location	Below Confluence of Red and Atchafalaya Rivers (Miles)	Bank R or L	Operations This FY Construction: New Work: Extension (Linear Feet)	New Work: Lap (Linear Feet)	New Work: (Squares)[1]	Reinforcement (Linear Feet)	Reinforcement (Squares)[1]	Maintenance (Squares)[1]	Non-Operative Since Prior FY (Linear Feet)	Operative Thru This FY (Linear Feet)
Standard Revetment:										
Holloway Lake, LA	37	L	--	--	--	--	--	--	--	7,085
Bayou Sherman, LA	38	L	--	--	--	--	--	--	--	5,200
Krotz Springs, LA	40	R	--	--	--	--	--	--	--	7,925
Sherburne, LA	43	R	--	--	--	--	--	--	--	10,960
Bayou Big Graw, LA	45	R	--	--	--	--	--	--	--	14,164
Coswell Bayou, LA	48	L	--	--	--	--	--	--	--	6,490
Courtableau, LA	49	R	--	--	--	--	--	--	--	5,374
Alabama Bayou, LA	50	L	--	--	--	--	--	--	--	9,410
Indian Bauyou	52	R	--	--	--	--	--	--	--	7,098
Happy Town, LA	53	L	--	--	--	--	--	--	--	7,285
Otis Landing, LA	54	R	--	--	--	--	--	--	--	5,251
Morgan City, LA	115	L	--	--	--	--	--	--	--	3,410
Berwich South	12	R	1,428	--	5,426	--	--	245	--	1,428
Total Standard Revetment Atchafalaya River			6,829 (1.29 Miles)	961	26,282	--	--	--	3,852	298,986 (56.63 Miles)
Dikes:										
Ten Mile Dikes	10	R	--	--	--	--	--	--	--	2,500 (.47 Miles)
LOWER RED RIVER	**Below Confluence of Old River Outflow Channel and Red River (Miles)**									
Standard Revetment:										
Long Lake, LA	10	R	--	--	--	--	--	--	--	6,652
Naples, LA	7	R	--	--	--	--	--	--	--	6,190
Turnbull Island, LA	9	L	--	--	--	--	--	--	--	11,038
Total Standard Revetment			--	--	--	--	--	--	--	23,880 (4.52 Miles)

TABLE 41-H (Continued)

BANK REVETMENTS, DIKES, AND FORESHORE PROTECTION: NEW ORLEANS DISTRICT (FISCAL YEAR 2003)

Location	Above Head of Passes (Miles)	Bank R or L	Operations This FY Construction: New Work: Extension (Linear Feet)	New Work: Lap (Linear Feet)	New Work: (Tons of Stone)	Reinforcement (Linear Feet)	Reinforcement (Tons of Stone)	Maintenance (Tons of Stone)	Non-Operative Since Prior FY (Linear Feet)	Operative Thru This FY (Linear Feet)
Dikes:										
None										
MISSISSIPPI RIVER										
Foreshore Protection:										
Port Allen	228.3	R	--	--	--	--	--	--	--	7,500
Cottage Plantation	222.6	L	--	--	--	--	--	--	--	2,000
Upper Plaquemine Point	210.5	L	--	--	--	--	--	--	--	4,350
Lower Plaquemine Point	207.0	L	--	--	--	--	--	--	--	2,935
Point Pleasant	201.7	R	--	--	--	--	--	--	--	5,221
Upper Point Clair	196.0	L	--	--	--	--	--	--	--	0
Point Clair	191.0	L	--	--	--	--	--	--	--	10,251
Belle Grove	189.9	R	--	--	--	--	--	--	--	0
Eighty-One Mile Point	176.0	L	2,890	--	23,387	--	--	--	--	2,890
Donaldsonville	174.2	R	--	--	--	--	--	--	--	0
Point Houmas	168.9	R	--	--	--	--	--	--	--	5,400
Sunshine	167.4	L	--	--	--	--	--	--	--	900
Union	166.3	L	--	--	--	--	--	--	--	6,500
Convent	158.3	L	--	--	--	--	--	--	--	11,900
Oak Alley	153.4	R	--	--	--	--	--	--	--	7,800
Lutcher	148.6	L	--	--	--	--	--	--	--	8,910
Wallace	145.5	R	--	--	--	--	--	--	--	10,390
Garyville	140.4	L	--	--	--	--	--	--	--	0
Edgard	138.2	R	--	--	--	--	--	--	--	12,410
Reserve	136.0	L	--	--	--	--	--	--	--	2,200
Waterford	129.0	R	--	--	--	--	--	--	--	500
26 Mile Point	122.8	L	--	--	--	--	--	--	--	1,320
Destrehan	121.0	L	--	--	--	--	--	--	--	0
St. Rose	120.8	L	--	--	--	--	--	--	--	9,830
Lower St. Rose	116.6	L	--	--	--	--	--	--	--	7,050
Ama	115.0	R	--	--	--	--	--	--	--	0

TABLE 41-H (Continued)

BANK REVETMENTS, DIKES, AND FORESHORE PROTECTION: NEW ORLEANS DISTRICT (FISCAL YEAR 2003)

Location	Above Head of Passes (Miles)	Bank R or L	Operations This FY Construction: New Work: Extension (Linear Feet)	New Work: Lap (Linear Feet)	New Work: (Tons of Stone)	Reinforcement (Linear Feet)	Reinforcement (Tons of Stone)	Maintenance (Tons of Stone)	Non-Operative Since Prior FY (Linear Feet)	Operative Thru This FY (Linear Feet)
Foreshore Protection:										
American Cyanamid	114.8	R	--	--	--	--	--	--	--	4,788
Willswood	113.2	R	1,550	--	11,600	--	--	--	--	3,980
Avondale	109.4	R	--	--	--	--	--	--	--	6,500
Twelve Mile Point	108.9	L	--	--	--	--	--	--	--	4,580
Avondale	105.5	R	--	--	--	--	--	--	--	2,070
Nine Mile Point	105.0	R	--	--	--	--	--	--	--	1,760
Greenville	100.0	R	--	--	--	--	--	--	--	6,900
Snowdrift	97.6	R	--	--	--	--	--	--	--	8,450
Gretna-Gouldsboro	96.7	R	--	--	--	--	--	--	--	1,683
Algiers	95.4	R	--	--	--	--	--	--	--	1,548
Holy Cross	92.2	L	--	--	--	--	--	--	--	1,915
Arabi	91.9	L	--	--	--	--	--	--	--	6,130
Quarantine	91.5	R	--	--	--	--	--	--	--	3,805
Huntlee	90.4	R	--	--	--	--	--	--	--	3,139
Chalmette	90.2	L	--	--	--	--	--	--	--	1,260
Norman	90.0	R	--	--	--	--	--	--	--	2,968
Brou	89.5	L	--	--	--	--	--	--	--	3,030
Auora	89.3	R	--	--	--	--	--	--	--	3,700
Blythe Blvd	88.6	R	--	--	--	--	--	--	--	4,345
Upper Stanton	86.5	R	--	--	--	--	--	--	--	12,890
Saxonholm-Docville	86.0	L	--	--	--	--	--	--	--	1,060
Pecan Grove-Story	85.8	L	--	--	--	--	--	--	--	1,910
Story-Allo	84.5	L	--	--	--	--	--	--	--	5,400
Delacroix	84.2	R	--	--	--	--	--	--	--	8,220
Twelve Mile Point	83.5	R	--	--	--	--	--	--	--	1,300
Merrit	83.0	L	--	--	--	--	--	--	--	7,800
Saxonholm-Docville	82.5	L	--	--	--	--	--	--	--	7,700
Naval Depot	82.5	R	--	--	--	--	--	--	--	3,096
Caernarvon	81.2	L	--	--	--	--	--	--	--	13,200

TABLE 41-H (Continued)

BANK REVETMENTS, DIKES, AND FORESHORE PROTECTION: NEW ORLEANS DISTRICT (FISCAL YEAR 2003)

Location	Above Head of Passes (Miles)	Bank R or L	Operations This FY Construction: New Work: Extension (Linear Feet)	New Work: Lap (Linear Feet)	New Work: (Tons of Stone)	Reinforcement (Linear Feet)	Reinforcement (Tons of Stone)	Maintenance (Tons of Stone)	Non-Operative Since Prior FY (Linear Feet)	Operative Thru This FY (Linear Feet)
Foreshore Protection:										
English Turn	79.3	L	--	--	--	--	--	--	--	7,500
Little Rock	78.8	R	--	--	--	--	--	--	--	9,268
St. Claire	78.8	L	--	--	--	--	--	--	--	1,025
Fort St. Leon	78.2	R	--	--	--	--	--	--	--	10,700
Scarsdale	75.5	L	--	--	--	--	--	--	--	16,611
Belle Chase	75.5	R	--	--	--	--	--	--	--	11,500
Stella-Delcour	73.6	L	--	--	--	--	--	--	--	6,405
Oak Point	73.3	R	--	--	--	--	--	--	--	13,766
Promised Land-Woodlawn	70.5	L	--	--	--	--	--	--	--	15,495
Augusta-Live Oak	70.5	R	--	--	--	--	--	--	--	13,135
Jesuit Bend	69.2	R	--	--	--	--	--	--	--	16,454
Fanny-Belair	66.8	L	--	--	--	--	--	--	--	12,400
Sara-Star	66.3	R	--	--	--	--	--	--	--	2,100
Star	65.8	R	--	--	--	--	--	--	--	5,470
Bayhi	64.0	R	--	--	--	--	--	--	--	11,190
Burbridge	63.2	L	--	--	--	--	--	--	--	12,335
Beau-Carlisle	62.3	L	--	--	--	--	--	--	--	6,258
Alliance	62.0	R	--	--	--	--	--	--	--	4,300
St. Rosalie	61.4	R	--	--	--	--	--	--	--	6,976
Monsecour-Poverty Point	60.3	L	--	--	--	--	--	--	--	7,380
Irontown	60.0	R	--	--	--	--	--	--	--	2,298
Myrtle Grove-Woodpark	58.8	R	--	--	--	--	--	--	--	8,450
Harlem	57.0	L	--	--	--	--	--	--	--	15,550
Wood Park-Deer Range	56.0	R	--	--	--	--	--	--	--	17,650
Nero	54.7	L	--	--	--	--	--	--	--	4,450
Deer Range	54.1	R	--	--	--	--	--	--	--	4,220
Upper Point-A-La-Hache	53.5	L	--	--	--	--	--	--	--	9,101
Junior	53.5	R	--	--	--	--	--	--	--	7,811
Point Celeste	52.2	R	--	--	--	--	--	--	--	3,300

TABLE 41-H (Continued)

BANK REVETMENTS, DIKES, AND FORESHORE PROTECTION: NEW ORLEANS DISTRICT (FISCAL YEAR 2003)

Location	Above Head of Passes (Miles)	Bank R or L	Operations This FY Construction: New Work: Extension (Linear Feet)	New Work: Lap (Linear Feet)	New Work: (Tons of Stone)	Reinforcement (Linear Feet)	Reinforcement (Tons of Stone)	Maintenance (Tons of Stone)	Non-Operative Since Prior FY (Linear Feet)	Operative Thru This FY (Linear Feet)
Foreshore Protection:										
Davant	51.5	L	--	--	--	--	--	--	--	10,795
St. Thomas	50.0	L	--	--	--	--	--	--	--	6,430
Woodland	50.0	R	--	--	--	--	--	--	--	14,800
Point-A-La-Hache	48.1	L	--	--	--	--	--	--	--	23,030
Nolan	47.2	R	--	--	--	--	--	--	--	13,400
Socola	46.5	R	--	--	--	--	--	--	--	8,255
Point Michel	44.2	R	--	--	--	--	--	--	--	7,350
Happy Jack	43.0	R	--	--	--	--	--	--	--	18,785
Port Sulphur	39.7	R	--	--	--	--	--	--	--	6,430
Little Texas	39.0	R	--	--	--	--	--	--	--	300
Home Place	37.6	R	--	--	--	--	--	--	--	13,250
Nairn	34.5	R	--	--	--	--	--	--	--	5,915
Sixty Mile Point	32.1	R	--	--	--	--	--	--	--	0
Tropical Bend	31.2	R	--	--	--	--	--	--	--	5,775
Bowers	30.8	R	--	--	--	--	--	--	--	3,836
Empire	29.7	R	--	--	--	--	--	--	--	2,865
Anderson	29.2	R	--	--	--	--	--	--	--	6,100
Fredrick	27.5	R	--	--	--	--	--	--	--	3,820
Buras	26.0	R	--	--	--	--	--	--	--	13,495
Lower Buras	24.0	R	--	--	--	--	--	--	--	8,900
Triumph	22.5	R	--	--	--	--	--	--	--	5,220
Fort Jackson	21.9	R	--	--	--	--	--	--	--	16,690
Grand Prairie	19.2	L	--	--	--	--	--	--	--	1,350
Upper Commander	18.2	R	--	--	--	--	--	--	--	3,180
Commander	18.0	R	--	--	--	--	--	--	--	22,232

TABLE 41-H (Continued)

BANK REVETMENTS, DIKES, AND FORESHORE PROTECTION: NEW ORLEANS DISTRICT (FISCAL YEAR 2003)

Location	Above Head of Passes (Miles)	Bank R or L	Operations This FY Construction: New Work: Extension (Linear Feet)	New Work: Lap (Linear Feet)	New Work: (Tons of Stone)	Reinforcement (Linear Feet)	Reinforcement (Tons of Stone)	Maintenance (Tons of Stone)	Non-Operative Since Prior FY (Linear Feet)	Operative Thru This FY (Linear Feet)
Foreshore Protection:										
Boothville-Commander	16.0	R	--	--	--	--	--	--	--	1,824
Upper Venice	12.0	R	--	--	--	--	--	--	--	14,800
Total Foreshore Protection New Orleans District, Mississippi River			4,440 (0.84 Miles)	--	34,987	--	--	--	--	757,309 (143.43 Miles)

1. Gross squares articulated concrete mattress (100 square feet).

TABLE 41-I BANK REVETMENTS AND DIKES: VICKSBURG DISTRICT (FISCAL YEAR 2003)

Location	Above Head of Passes (Miles)	Bank R or L	Operations This FY Construction: New Work: Extension (Linear Feet)	New Work: Lap (Linear Feet)	New Work: (Squares)[1]	Reinforcement (Linear Feet)	Reinforcement (Squares)[1]	Maintenance (Squares)[1]	Non-Operative Since Prior FY (Linear Feet)	Operative Thru This FY (Linear Feet)
MISSISSIPPI RIVER										
Standard Revetment:										
Bougere Bend, LA	329	R	--	--	--	--	--	--	--	26,055
Dead Mans Bend, MS	335	L	--	--	--	--	--	--	--	33,220
Glasscock Cutoff, MS-LA	342	R	--	--	--	--	--	--	--	26,083
Railroad Landing, MS	346	L	--	--	--	--	--	--	--	16,291
St. Catherine Bend, LA	350	R	--	--	--	--	--	--	--	29,108
Morville, LA	356	R	--	--	--	--	--	--	--	16,917
Natchez Island, MS	357	R	--	--	--	--	--	--	--	2,180
Carthage, MS	361	L	--	--	--	--	--	--	--	20,350
Vidalia Casting Field	363	L	--	--	--	--	--	--	--	2,670
Natchez Front, MS	364	L	--	--	--	--	--	--	--	6,510
Giles Cutoff, LA-MS	366	R	--	--	--	--	--	--	--	12,020
Gibson, LA	371	R	--	--	--	--	--	--	--	--
Ashland, LA-MS	374	L	--	--	--	--	--	--	--	33,427
Kempe Bend, LA	383	R	--	--	--	--	--	--	--	30,087
Browns Field, LA	389	R	--	--	--	--	--	--	--	9,280
Goldbottom, MS	392	L	--	--	--	--	--	--	--	30,250
Hardscrabble, LA	398	R	--	--	--	--	--	--	--	22,530
Grand Gulf, MS	403	L	--	--	--	--	--	--	--	57,318
Point Pleasant, MS-LA	413	R	--	--	--	--	--	--	--	32,345
Togo Island, LA	415	R	--	--	--	--	--	--	--	7,080
Lake Karnac, LA-MS	419	L	--	--	--	--	--	--	--	19,260
Diamond Point, LA-MS	423	R	--	--	--	--	--	--	--	19,310
Oakbend, MS	425	L	--	--	--	--	--	--	--	5,342
Reid-Bedford, LA	429	R	--	--	--	--	--	--	--	18,392
Racetrack, MS	433	L	1,582	--	6,949	--	--	2,391	--	15,517
Barge Line Terminal, MS	437	L	--	--	--	--	--	--	--	3,040
Vicksburg Harbor, MS	437	L	--	--	--	--	--	--	--	7,350
Delta Point, LA	437	R	--	--	--	--	--	--	--	7,650

TABLE 41-I (Continued)

BANK REVETMENTS AND DIKES: VICKSBURG DISTRICT (FISCAL YEAR 2003)

Location	Above Head of Passes (Miles)	Bank R or L	Operations This FY Construction: New Work: Extension (Linear Feet)	New Work: Lap (Linear Feet)	New Work: (Squares)[1]	Reinforcement (Linear Feet)	Reinforcement (Squares)[1]	Maintenance (Squares)[1]	Non-Operative Since Prior FY (Linear Feet)	Operative Thru This FY (Linear Feet)
Standard Revetment:										
King's Point—Opposite Delta Point, LA-MS	439	L	--	--	--	--	--	--	--	19,330
False Point, LA	443	R	--	--	--	--	--	--	--	16,360
Marshall-Brown's Point, LA-MS	446	L	--	--	--	--	--	--	--	19,580
Milliken Bend, LA	453	R	--	--	--	--	--	--	--	46,140
Belle Island, LA-MS	460	L	--	--	--	--	--	--	--	24,160
Goodrich, LA	467	R	--	--	--	--	--	--	--	40,765
Cottonwood Bar, MS	470	R	--	--	--	--	--	--	--	18,580
Filter-Cottonwood, MS	474	L	2,108	--	6,885	--	--	8,648	--	44,220
Hagaman, LA	481	R	--	--	--	--	--	--	--	37,756
Ben Lomond, MS	486	L	--	--	--	--	--	--	--	10,235
Baleshed Towhead-Stack Island, LA-MS	488	R	--	--	--	--	--	--	--	53,214
Lake Providence, LA	489	R	--	--	--	--	--	--	--	11,600
Mayersville, MS	497	L	--	--	--	--	--	8,423	--	34,992
Sarah Island-Opossum Point, LA-MS	501	R	--	--	--	--	--	--	--	26,815
Carolina, MS	507	L	--	--	--	--	--	--	--	11,080
Cracraft, AR	511	R	--	--	--	--	--	--	--	22,210
Worthington, MS-AR	514	R	--	--	--	--	--	--	--	8,350
Walnut Point Kentucky Bend, MS	519	L	--	--	--	--	--	--	--	45,653
American Cutoff, MS-AR	526	L	--	--	--	--	--	--	--	2,980
Sunnyside-Lakeport, AR	530	R	--	--	--	--	--	--	--	33,685
Vancluse, AR	534	R	--	--	--	--	--	--	--	13,016
Island 84, AR-MS	535	L	--	--	--	--	--	--	--	13,475
Warfield Point, MS	537	L	--	--	--	--	--	--	--	4,320
Leland-LaGrange, AR-MS	538	L	--	--	--	--	--	--	--	14,150

TABLE 41-I
(Continued)

BANK REVETMENTS AND DIKES: VICKSBURG DISTRICT
(FISCAL YEAR 2003)

Location	Above Head of Passes (Miles)	Bank R or L	Operations This FY Construction: New Work: Extension (Linear Feet)	New Work: Lap (Linear Feet)	New Work: (Squares)[1]	Reinforcement: (Linear Feet)	Reinforcement: (Squares)[1]	Maintenance (Squares)[1]	Non-Operative Since Prior FY (Linear Feet)	Operative Thru This FY (Linear Feet)
Standard Revetment:										
Spanish Moss, AR	539	R	--	--	--	--	--	--	--	4,580
Tarpley Island, MS	542	R	--	--	--	--	--	--	--	2,000
Miller Bend, MS	544	L	--	--	--	--	--	--	--	29,360
Island 82, AR	546	R	--	--	--	--	--	--	--	3,080
Ashbrook Island, MS	549	R	--	--	--	--	--	--	--	3,455
Arkansas City-Yellow Bend, AR	553	R	--	--	--	--	--	--	--	48,386
Huntington Point, MS	556	L	--	--	--	--	--	--	--	21,205
Pair O'Dice, AR	561	R	--	--	--	--	--	--	--	9,095
Eutaw-Mounds, MS	563	L	--	--	--	--	--	--	--	40,188
Cypress Bend, AR	568	R	--	--	--	--	--	--	--	34,405
Catfish Point, MS	573	L	--	--	--	--	--	--	--	20,075
Ozark, AR-MS	578	R	--	--	--	--	--	--	--	22,015
Prentiss, AR-MS	582	L	--	--	--	--	--	--	--	20,315
Rosedale Bend, AR	585	L	3,202	--	8,411	--	--	--	--	8,022
Riverton, MS	586	L	--	--	--	--	--	--	--	12,500
Klondike, AR	588	R	--	--	--	--	--	--	--	25,295
Victoria Bend-Terrene, MS	593	L	--	--	--	--	--	--	--	29,245
Lake Concordia, MS	596	L	2,267	--	8,087	--	--	--	--	11,583
Big Island, AR	598	R	--	--	--	--	--	--	--	16,515
Smith Point, MS	601	L	--	--	--	--	--	--	--	18,185
Dennis, MS	611	L	--	--	--	--	--	--	--	25,195
Cessions, MS	615	L	--	--	--	--	--	--	--	10,910
Total Revetment, Vicksburg District, Mississippi River			9,159 (1.73 Miles)	--	30,332	--	--	31,892	--	1,523,857 (288.60 Miles)

TABLE 41-I (Continued)

BANK REVETMENTS AND DIKES: VICKSBURG DISTRICT (FISCAL YEAR 2003)

Location	Above Head of Passes (Miles)	Bank R or L	Operations This FY Construction: New Work: Extension (Linear Feet)	New Work: Lap (Linear Feet)	New Work: (Squares)[1]	Reinforcement (Linear Feet)	Reinforcement (Squares)[1]	Maintenance (Squares)[1]	Non-Operative Since Prior FY (Linear Feet)	Operative Thru This FY (Linear Feet)
Dikes:					[2]			[3]		
Jackson Point, MS	330	L	--	--	--	--	--	--	--	4,306
Buck Island, MS	339	L	--	--	--	--	--	--	--	6,334
Opposite Warnicott Ldg., MS	352	L	--	--	--	--	--	--	--	10,791
Natchez Island, LA-MS	358	R	--	--	--	--	--	--	--	14,608
Opposite Rifle Point, MS	369	L	--	--	--	--	--	--	--	3,214
Rifle Point, LA	369	R	--	--	--	--	--	--	--	4,197
Waterproof Bar, LA	379	R	--	--	--	--	--	--	--	14,580
Spithead Towhead, MS	386	L	--	--	--	--	--	--	--	9,681
Browns Field, LA	388	R	--	--	--	--	--	--	--	11,557
Cottage Bend, LA-MS	389	L	--	--	--	--	--	--	--	14,049
Bondurant Towhead, LA	394	R	--	--	--	--	--	--	--	6,029
Coffee Point, LA	405	R	--	--	--	--	--	--	--	11,925
Yucatan, MS	410	R	--	--	--	--	--	--	--	13,932
Togo Island, LA	416	L	--	--	--	--	--	--	--	8,256
Newtown Bend, LA	420	R	--	--	--	--	--	--	--	6,739
Diamond Cutoff, MS	423	L	--	--	--	--	--	--	--	6,711
Below Racetrack, MS	430	L	--	--	--	--	--	--	--	19,378
Racetrack Towhead, MS	431	R	--	--	--	--	--	--	--	15,270
Delta Point, LA	439	R	--	--	--	--	--	--	--	2,326
False Point, LA	441	R	--	--	--	--	--	--	--	5,675
Marshall Cutoff, LA	448	R	--	--	--	--	--	--	--	5,166
Below Grand Gulf, MS	399	L	--	--	--	--	--	--	--	4,783
Fritz Island, LA	338	R	--	--	--	--	--	--	--	4,160
Forest Home Towhead, LA	449	L	--	--	--	--	--	--	--	15,873
Willow Cutoff, LA	462	R	--	--	--	--	--	--	--	5,197
Tennessee Bar, MS	465	L	--	--	--	--	--	--	--	8,166
Arcadia Point, MS	470	L	--	--	--	--	--	--	--	9,463
Cottonwood Bar, MS	471	R	--	--	--	--	--	--	--	2,406
Point Lookout, LA	478	R	--	--	--	--	--	--	--	2,751

TABLE 41-I (Continued)

BANK REVETMENTS AND DIKES: VICKSBURG DISTRICT (FISCAL YEAR 2003)

Location	Above Head of Passes (Miles)	Bank R or L	Operations This FY Construction: New Work: Extension (Linear Feet)	New Work: Lap (Linear Feet)	New Work: (Squares)[1]	Reinforcement (Linear Feet)	Reinforcement (Squares)[1]	Maintenance (Squares)[1]	Non-Operative Since Prior FY (Linear Feet)	Operative Thru This FY (Linear Feet)
Dikes:					(2)		(3)			
Ajax Bar, MS	482	L	--	--	--	--	--	--	--	28,152
Ben Lomond, MS	488	L	--	--	--	--	--	--	--	24,667
Baleshed Ldg., MS	493	L	--	--	--	--	--	--	--	15,721
Wilson Point, LA	500	R	--	--	--	--	--	--	--	8,423
Corregidor, MS	505	L	--	--	--	--	--	--	--	6,730
Carolina, AR	509	L	--	--	--	--	--	--	--	2,897
Cracraft Lower, AR	510	R	--	--	--	--	--	--	--	10,329
Cracraft, AR	513	R	--	--	--	--	--	--	--	3,809
Leota, MS	514	L	--	--	--	--	--	--	--	7,571
Island 86, AR	520	R	--	--	--	--	--	--	--	18,477
Seven Oaks, AR	523	R	--	--	--	--	--	--	--	5,829
Walnut Point, MS	525	L	2,280	--	--	--	--	--	--	7,005
Anconia Chute, AR	527	R	--	--	--	--	--	--	--	7,159
Refuge, MS	528	L	--	--	--	--	--	--	--	19,695
Island 84, AR	532	L	--	--	--	--	--	--	--	12,475
Vaucluse, AR	533	R	--	--	--	--	--	--	--	7,114
Warfield Point, AR	535	L	--	--	--	--	--	--	--	2,020
Leland Bar, AR-MS	538	R	--	--	--	--	--	--	--	15,086
Leland Neck, AR-MS	540	L	--	--	--	--	--	--	--	4,315
Tarpley Cutoff, MS-AR	540	R	--	--	--	--	--	--	--	10,478
Island 82-Miller Bend, AR-MS	544	R&L	--	--	--	--	--	--	--	13,646
Ashbrook-Miller Bend, AR-MS	547	L&R	--	--	--	--	--	--	--	13,015
Ashbrook Cutoff, MS	549	L	--	--	--	--	--	--	--	8,728
Chicot Ldg., AR	564	R	--	--	--	--	--	--	--	22,381
Catfish Point, MS	571	L	--	--	--	--	--	--	--	5,290
Below Prentiss, MS	580	L	--	--	--	--	--	--	--	12,413
Above Ozark, AR-MS	580	R	--	--	--	--	--	--	--	5,545
Malone Field, AR	585	R	--	--	--	--	--	--	--	7,549

TABLE 41-I (Continued)

BANK REVETMENTS AND DIKES: VICKSBURG DISTRICT (FISCAL YEAR 2003)

Location	Above Head of Passes (Miles)	Bank R or L	Operations This FY Construction: New Work: Extension (Linear Feet)	New Work: Lap (Linear Feet)	New Work: (Squares)[1]	Reinforcement (Linear Feet)	Reinforcement (Squares)[1]	Maintenance (Squares)[1]	Non-Operative Since Prior FY (Linear Feet)	Operative Thru This FY (Linear Feet)
Dikes:					(2)	(3)				
Terrene, MS	590	L	3,104	--	--	--	--	--	--	11,025
White River Landing, AR	591	R	--	--	--	--	--	--	--	2,201
Montgomery Towhead, AR	592	R	--	--	--	--	--	--	--	8,647
Victoria Bend, AR	596	R	--	--	--	--	--	--	--	6,736
Smith Point, MS	600	L	--	--	--	--	--	--	--	7,617
Island 70, MS	608	L	--	--	--	--	--	--	--	26,355
Total Dikes, Vicksburg District, Mississippi River			5,384 (1.02 Miles)	--	--	--	--	--	--	628,735 (119.08 Miles)
	Miles Above Mouth									
ARKANSAS RIVER[4]										
Standard Revetment:										
Menard Bend, AR	31	L	--	--	--	--	--	--	--	11,770
Como, AR	34	R	--	--	--	--	--	--	--	11,720
Morgan Bend, AR	36	L	--	--	--	--	--	--	--	5,250
Yancopin, AR	24	R	--	--	--	--	--	--	--	2,800
Total Standard Revetment, Arkansas River			--	--	--	--	--	--	--	31,540 (5.97 Miles)
Dikes:					(2)	(3)				
Hopedale Cutoff, AR	30	R	--	--	--	--	--	--	--	1,848
Morgan Bend, AR	36	L	--	--	--	--	--	--	--	3,658

TABLE 41-I (Continued)

BANK REVETMENTS AND DIKES: VICKSBURG DISTRICT (FISCAL YEAR 2003)

Location	Above Confluence with Miss. River (Miles)	Bank R or L	Operations This FY Construction: New Work: Extension (Linear Feet)	New Work: Lap (Linear Feet)	New Work: (Squares)[1]	Reinforcement (Linear Feet)	Reinforcement (Squares)[1]	Maintenance (Squares)[1]	Non-Operative Since Prior FY (Linear Feet)	Operative Thru This FY (Linear Feet)
Dikes:					[2]	[3]				
Fletcher Bend, AR	39	R	--	--	--	--	--	--	--	2,187
Total Dikes, Arkansas River			--	--	--	--	--	--	--	7,693 (1.46 Miles)
RED RIVER[4]										
Standard Revetment:										
Dupre, LA	69	R	--	--	--	--	--	--	--	2,690
Bringol, LA	73	R	--	--	--	--	--	--	--	4,000
Egg Bend, LA	75	R	--	--	--	--	--	--	--	2,400
Colonel Bend, LA	77	R	--	--	--	--	--	--	--	650
Roxana, LA	83	R	--	--	--	--	--	--	--	3,325
Ryland, LA	88	R	--	--	--	--	--	--	--	3,925
Whittington, LA	89	R	--	--	--	--	--	--	--	2,900
Smith, LA	91	R	--	--	--	--	--	--	--	2,700
Latanier, LA	93	R	--	--	--	--	--	--	--	2,460
Hudson, LA	99	R	--	--	--	--	--	--	--	1,458
Robert, LA	102	R	--	--	--	--	--	--	--	5,500
Alexandria Front, LA	105	R	--	--	--	--	--	--	--	5,280
Callahan, LA	110	R	--	--	--	--	--	--	--	4,000
Cotton, LA	116	R	--	--	--	--	--	--	--	14,700
Rapides, LA	119	R	--	--	--	--	--	--	--	1,030
Boyce, LA	125	R	--	--	--	--	--	--	--	4,548
Total Standard Revetment, Red River			--	--	--	--	--	--	--	61,566 (11.66 Miles)

TABLE 41-I (Continued)

BANK REVETMENTS AND DIKES: VICKSBURG DISTRICT (FISCAL YEAR 2003)

Location	Above Confluence with Miss. River (Miles)	Bank R or L	Operations This FY Construction: New Work: Extension (Linear Feet)	New Work: Lap (Linear Feet)	New Work: (Squares)[1]	Reinforcement (Linear Feet)	Reinforcement (Squares)[1]	Maintenance (Squares)[1]	Non-Operative Since Prior FY (Linear Feet)	Operative Thru This FY (Linear Feet)
Dikes:[6]					(2)			(3)		
Choctaw Bayou Bend, LA	71	R	--	--	--	--	--	--	--	2,000
Bringol (Egg Bend), LA	73	R	--	--	--	--	--	--	--	2,477
Egg Bend, LA	75	R	--	--	--	--	--	--	--	900
Cologne Bend, LA	77	R	--	--	--	--	--	--	--	1,850
Echo, LA	78	R	--	--	--	--	--	--	--	1,900
Richardson, LA	79	R	--	--	--	--	--	--	--	2,700
Alexandria, LA	105	R	--	--	--	--	--	--	--	--
Bertrand, LA	122	R	--	--	--	--	--	--	--	7,630
Dismal Swamp, LA	24	L	--	--	--	--	--	--	--	1,411
Total Dikes, Red River			--	--	--	--	--	--	--	20,868 (3.95 Miles)

1. Gross squares articulated concrete mattress (100 square feet).
2. Linear feet of dike which were raised.
3. Linear feet of dike on which repairs were made.
4. See report on Arkansas River and tributaries, AR and OK, under Little Rock District.
5. Mileages based on 1967 hydrographic survey.
6. Includes all types of dikes and retards.
7. Stone paving only.

TABLE 41-J

BANK REVETMENTS AND DIKES: MEMPHIS DISTRICT (FISCAL YEAR 2003)

Location	Above Head of Passes (Miles)	Bank R or L	Operations This FY Construction: New Work: Extension (Linear Feet)	New Work: Lap (Linear Feet)	New Work: (Squares)[1]	Reinforcement: (Linear Feet)	Reinforcement: (Squares)[1]	Maintenance (Squares)[1]	Non-Operative Since Prior FY (Linear Feet)	Operative Thru This FY (Linear Feet)
MISSISSIPPI RIVER										
Standard Revetment:										
Big Island, AR	598	R	--	--	--	--	--	--	--	5,938
Scrubgrass Bend, AR	600	R	--	--	--	--	--	--	--	7,315
Henrico, AR	606	R	--	--	--	--	--	--	--	33,310
Cessions Towhead, AR	615	L	--	--	--	--	--	--	--	11,465
Island 67, MS	621	L	--	--	--	--	--	--	--	9,630
Island 68 Bar— Knowlton, AR	622	R	--	--	--	--	--	--	--	26,710
Ludlow, AR	626	R	--	--	--	--	--	--	--	10,390
Chute of island 64, AR-MS	628	R	--	--	--	--	--	--	--	4,180[7,9]
Rescue Land, AR-MS	629	L	--	--	--	--	--	--	--	27,020
Fair Landing, AR	632	R	--	--	--	--	--	--	--	27,515
Burke Landing, MS	637	L	--	--	--	--	--	--	--	19,070
Island 62, AR	638	R	--	--	--	--	--	--	--	9,030
Island 63, MS	639	L	--	--	--	--	--	--	--	11,514
Island 63 Bar, MS	639	L	--	--	--	--	--	--	--	3,795
Oldtown Bend, AR	644	R	--	--	--	--	--	--	--	26,860
Horseshoe, MS	647	L	--	--	--	--	--	--	--	16,385
Westover, AR	650	R	--	--	--	--	--	--	--	15,640
Delta-Friars Point, MS	665	L	--	--	--	--	--	--	--	30,090
Helena, AR	660	R	--	--	--	--	--	4,725	--	36,460
Helena Towhead, AR	664	R	--	--	--	--	--	--	--	3,690
Trotters Landing, MS	665	L	--	--	--	--	--	--	--	38,685
Flower Lake, MS	667	L	--	--	--	--	--	--	--	16,385
St. Francis, AR	672	R	--	--	--	--	--	--	--	24,663
Harbert Point, MS	675	L	--	--	--	--	--	4,208	--	9,065
Walnut Bend, AR	680	R	--	--	--	--	--	--	--	31,070
Mhoon Bend, MS	685	L	2,030	--	6,421	--	--	6,726	--	46,390
Peters, AR	692	R	--	--	--	--	--	--	--	33,760
Commerce, MS	695	L	--	--	--	--	--	--	--	29,085

TABLE 41-J
(Continued)

BANK REVETMENTS AND DIKES: MEMPHIS DISTRICT
(FISCAL YEAR 2003)

Location	Above Head of Passes (Miles)	Bank R or L	Operations This FY Construction: New Work: Extension (Linear Feet)	New Work: Lap (Linear Feet)	New Work: (Squares)[1]	Reinforcement (Linear Feet)	Reinforcement (Squares)[1]	Maintenance (Squares)[1]	Non-Operative Since Prior FY (Linear Feet)	Operative Thru This FY (Linear Feet)
Standard Revetment:										
Porter Lake, AR	700	R	--	--	--	--	--	--	--	34,155
Pickett, MS-AR	703	R	--	--	--	--	--	--	--	12,575
Seyppel, AR	709	R	--	--	--	--	--	--	--	4,830
Norfolk-Star, MS	711	L	--	--	--	--	--	4,019	--	39,505
Cow Island Bend, AR	714	R	--	--	--	--	--	--	--	22,274
Cow Island Bend (Upper), TN	716	R	--	--	--	--	--	--	--	8,623
Coahoma, TN	717	L	--	--	--	--	--	--	--	9,270
Ensley, TN	723	L	--	--	8,717[9]	--	--	8,984	--	46,256
Dismal Point, AR	724	R	--	--	--	--	--	--	--	7,200
Bauxippi-Wyanoke, AR	730	R	--	--	--	--	--	--	--	24,530
Presidents Island, TN	733	L	--	--	--	--	--	--	--	12,755
Hopefield Point, AR-TN	736	R	--	--	--	--	--	--	--	10,360
Loosahatchie-Memphis, TN	737	L	--	--	--	--	--	--	--	31,293
Loosahatchie Bar, TN	740	R	--	--	--	--	--	--	--	2,070
St. Clair, AR	742	R	--	--	--	--	--	--	--	2,930
Island 40, TN-AR	744	R	--	--	--	--	--	--	--	30,750
Brandywine, AR-TN	750	R	--	--	--	--	--	--	--	18,010
Shelby Forest, TN	753	L	--	--	--	--	--	--	--	9,545
Dean Island, AR	756	R	--	--	--	--	--	--	--	7,555
Cedar Point-Densford, TN	759	L	--	--	--	--	--	--	--	20,190
Chute of Island 35, TN	764	R	--	--	--	--	--	--	--	30,930
Richardson Ldg, TN	769	L	--	--	--	--	--	--	--	1,415
Lookout Bar, TN	772	R	--	--	--	--	--	--	--	2,990
Lookout, TN	774	R	--	--	--	--	--	--	--	5,005
Sunrise Towhead, TN	776	R	--	--	--	--	--	--	--	18,440
Driver Bar, TN	780	L	--	--	--	--	--	--	--	4,850

TABLE 41-J
(Continued)

BANK REVETMENTS AND DIKES: MEMPHIS DISTRICT
(FISCAL YEAR 2003)

Location	Above Head of Passes (Miles)	Bank R or L	Operations This FY Construction					Maintenance (Squares)[1]	Non-Operative Since Prior FY (Linear Feet)	Operative Thru This FY (Linear Feet)
			New Work			Reinforcement				
			Extension (Linear Feet)	Lap (Linear Feet)	(Squares)[1]	(Linear Feet)	(Squares)[1]			
Standard Revetment:										
Lower Bullerton, AR	782	R	--	--	--	--	--	--	--	28,350
Kate Aubrey Towhead-Island 30, TN	786	R	--	--	--	--	--	--	--	30,808
Osceola, AR	786	R	--	--	--	--	--	--	--	1,350[3]
Osceola, AR	786	R	--	--	--	--	--	--	--	5,823
Ashport-Keyes Point, TN	791	L	--	--	--	--	--	--	--	44,232
Kate Aubrey, TN	793	R	--	--	--	--	--	--	--	2,500
Island 26, TN	798	R	--	--	--	--	--	--	--	15,690
Bend of Island 25, TN	803	L	--	--	--	1,814	6,175	17,288	--	32,385
Barfield, AR	808	R	--	--	--	--	--	--	--	52,335
Obion-Tamm, TN	819	L	--	--	--	--	--	--	--	53,831
Huffman-Hickman, AR-TN	826	R	--	--	--	--	--	--	--	29,764
Heloise, TN	831	L	--	--	--	--	--	--	--	15,770
Island 18, MO	836	R	--	--	--	--	--	--	--	30,490
Linwood Bend, TN	841	L	--	--	--	--	--	--	--	14,850
Blaker Towhead, TN	845	L	--	--	--	--	--	--	--	18,562
Bells Point, MO	845	R	--	--	--	--	--	--	--	5,420
Gayoso-Caruthersville, MO	848	R	--	--	--	--	--	--	--	25,600
Island 15, TN	851	L	--	--	--	--	--	--	--	3,630
Hathaway Landing, TN	852	L	--	--	--	--	--	--	--	1,000
Robinson Bayou, MO	852	R	--	--	--	--	--	4,348	--	22,630
Fritz Landing, TN	857	L	--	--	--	--	--	--	--	15,670
Lee Towhead, MO	859	L	--	--	--	--	--	--	--	9,640
Bend of Island 14, TN	859	L	--	--	--	--	--	--	--	15,830
Above Lee Towhead, TN	861	L	--	--	--	--	--	--	--	4,943
Little Cypress, MO	864	R	--	--	--	--	--	5,822	--	40,140

TABLE 41-J
(Continued)

BANK REVETMENTS AND DIKES: MEMPHIS DISTRICT
(FISCAL YEAR 2003)

Location	Above Head of Passes (Miles)	Bank R or L	Operations This FY Construction: New Work: Extension (Linear Feet)	New Work: Lap (Linear Feet)	New Work: (Squares)[1]	Reinforcement: (Linear Feet)	Reinforcement: (Squares)[1]	Maintenance (Squares)[1]	Non-Operative Since Prior FY (Linear Feet)	Operative Thru This FY (Linear Feet)
Standard Revetment:										
Merriwether-Cherokee, TN	869	L	--	--	--	1,100	3,451	6,936	--	41,058
Linda, MO	876	R	--	--	--	--	--	8,494	--	20,000
Below Toney's Towhead, TN	879	L	--	--	--	--	--	--	--	20,895
Toney's Towhead, KY-TN	882	L	--	--	--	--	--	9,336	--	13,640
Kentucky Point, KY	887	L	--	--	--	--	--	--	--	7,960
New Madrid Bar, KY	888	R	--	--	--	--	--	13,098	--	16,825
New Madrid Bend, MO	889	R	--	--	--	--	--	--	--	43,262
La Forge, MO	892	R	--	--	--	--	--	--	--	24,930
Slough Landing Neck, TN-KY	899	L	--	--	--	--	--	--	--	37,520
Winchester Towhead, MO	900	R	--	--	--	--	--	--	--	5,540
Island 9, KY-TN	905	L	--	--	--	--	--	--	--	33,585
Milton Bell, MO	908	R	--	--	--	--	--	--	--	16,600
Chute of Island 8, KY	913	L	--	--	--	--	--	--	--	12,620
Bend of Island 8, MO	914	R	--	--	--	--	--	--	--	39,945
Island 8, KY	914	R	--	--	--	--	--	--	--	18,515
Hickman-Reelfoot, KY	919	L	--	--	--	--	--	--	--	46,399
Hickman Bar, KY	921	L	1,940	--	5,141	--	--	--	--	1,940
Beckwith Bend, MO	924	R	--	--	--	--	--	--	--	18,203
Williams, KY	927	L	--	--	--	--	--	--	--	10,015
Wolf Island, KY	934	R	--	--	--	--	--	--	--	22,495
Columbus, KY	937	L	--	--	--	--	--	--	--	7,395
Belmont, MO	938	R	--	--	--	--	--	--	--	5,785
Island 3 and 4, KY	940	R	--	--	--	--	--	--	--	19,970
Campbell, KY	943	L	--	--	--	--	--	--	--	6,865
Pritchard, MO	948	R	--	--	--	--	--	--	--	15,045

TABLE 41-J
(Continued)

BANK REVETMENTS AND DIKES: MEMPHIS DISTRICT
(FISCAL YEAR 2003)

Location	Above Head of Passes (Miles)	Bank R or L	Operations This FY Construction: New Work: Extension (Linear Feet)	New Work: Lap (Linear Feet)	New Work: (Squares)[1]	Reinforcement (Linear Feet)	Reinforcement (Squares)[1]	Maintenance (Squares)[1]	Non-Operative Since Prior FY (Linear Feet)	Operative Thru This FY (Linear Feet)
Standard Revetment:										
Mayfield Creek, KY	949	L	--	--	--	--	--	--	--	8,935
Wickliffe, KY	953	L	--	--	--	--	--	--	--	16,150
Cache-Cairo, IL (Ohio River)	958	R	--	--	--	--	--	--	--	29,927
Total Revetment, Memphis District, Mississippi River			2,030 (0.38 Miles)	--	15,138	1,814	6,175	45,950	--	2,066,625 (391.44 Miles)
Dikes:					([8])			([6])		
Big Island, AR	600	R	--	--	--	--	--	--	--	4,105
Henrico, AR	603	R	--	--	--	--	--	--	--	9,080
Below Knowlton, AR	616	R	--	--	--	--	--	150	--	21,810
Island 67, MS	621	L	--	--	--	--	--	--	--	4,320
Below Ludlow, AR	624	R	--	--	--	--	--	--	--	5,040
Sunflower, AR	627	L	--	--	--	--	--	--	--	5,520
Island 64, AR	630	R	--	--	--	--	--	--	--	7,330
Rescue Landing, MS	631	L	--	--	--	--	--	--	--	2,530
Island 62, AR	638	R	--	--	--	--	--	--	--	23,180
Island 63 Bar, MS	639	L	--	--	--	--	--	--	--	2,600
Island 63, MS	640	L	--	--	--	--	--	--	--	5,640
Kangaroo Point, AR	649	R	--	--	--	--	--	--	--	6,580
Friars Point, MS	652	L	--	--	--	--	--	--	--	6,870
Montezuma Bar, MS	657	L	--	--	--	--	--	600	--	17,970
Montezuma Towhead, AR	656	R	--	--	--	--	--	--	--	6,700
Prairie Point, AR	668	R	--	--	--	--	--	--	--	10,391
Flower Lake, MS	668	L	--	--	--	--	--	700	--	11,060
Walnut Bend, AR	681	R	--	--	--	--	--	--	--	6,390
St. Francis Towhead, MS	671	L	--	--	--	--	--	--	--	3,380

TABLE 41-J
(Continued)

BANK REVETMENTS AND DIKES: MEMPHIS DISTRICT
(FISCAL YEAR 2003)

Location	Above Head of Passes (Miles)	Bank R or L	Operations This FY Construction: New Work: Extension (Linear Feet)	New Work: Lap (Linear Feet)	New Work: (Squares)[1]	Reinforcement (Linear Feet)	Reinforcement (Squares)[1]	Maintenance (Squares)[1]	Non-Operative Since Prior FY (Linear Feet)	Operative Thru This FY (Linear Feet)
Dikes:					([8])			([6])		
Below Walnut Bend, AR	676	R	--	--	--	--	--	--	--	8,340[2]
Bordeaux Point, MS	681	L	--	--	--	--	--	100	--	10,730
Peters, AR	693	R	--	--	1,235	--	--	--	--	7,830
Commerce, MS	694	L	--	--	--	--	--	--	--	10,745
Basket Bar, AR	696	R	--	--	--	--	--	--	--	5,810
Buck Island, MS	700	L	--	--	--	--	--	500	--	4,705
Porter Lake, AR	701	R	--	--	--	--	--	2,375	--	23,115
Pickett, MS	704	L	--	--	--	--	--	415	--	10,080
Seyppel, AR	706	R	--	--	--	--	--	--	--	16,230
Cat Island, AR	710	R	--	--	--	--	--	300	--	16,355
Coahoma, TN	718	L	--	--	--	--	--	--	--	4,640
Armstrong, AR-TN	720	R	--	--	--	--	--	--	--	21,240
Below Ensley, TN	721	L	--	--	--	--	--	--	--	915
Dismal Point, AR	724	R	--	--	--	--	--	--	--	30,950
Engineers Bar, AR	734	R	--	--	--	--	--	--	--	4,155
Hopefield Point, AR	736	R	--	--	--	--	--	--	--	5,350
Memphis Front, TN	736	L	--	--	--	--	--	--	--	6,300
Robinson Crusoe, TN	738	R	--	--	--	--	--	--	--	21,939
Loosahatchie Bar, TN	739	R	--	--	--	--	--	--	--	3,950
Sycamore Chute, AR-TN	741	R	--	--	--	--	--	--	--	6,725
Above Loosahatchie, TN	742	L	--	--	--	--	--	--	--	12,295
Redman Point, AR	743	R	--	--	--	--	--	--	--	7,750
Randolph Point, TN	747	L	--	--	--	--	--	--	--	16,940
Poker Point, AR	748	R	--	--	--	--	--	--	--	8,060
Shelby Forest, TN	751	L	--	--	--	--	--	--	--	5,540
Corona Bar, TN-AR	755	R	--	--	--	--	--	--	--	9,400
Densford, TN	757	L	--	--	--	--	--	--	--	7,780
Cedar Point, TN	759	L	--	--	--	--	--	--	--	2,890
Below Richardson Landing, TN	767	L	--	--	--	--	--	--	--	5,950

TABLE 41-J
(Continued)

BANK REVETMENTS AND DIKES: MEMPHIS DISTRICT
(FISCAL YEAR 2003)

Location	Above Head of Passes (Miles)	Bank R or L	Operations This FY Construction: New Work: Extension (Linear Feet)	New Work: Lap (Linear Feet)	New Work: (Squares)[1]	Reinforcement (Linear Feet)	Reinforcement (Squares)[1]	Maintenance (Squares)[1]	Non-Operative Since Prior FY (Linear Feet)	Operative Thru This FY (Linear Feet)
Dikes:					([8])			([6])		
Lookout, TN-AR	771	R	--	--	--	--	--	--	--	16,665
Hatchie Towhead, TN	773	L	3,300	--	--	--	--	--	--	3,300
Plum Point, TN	784	L	--	--	--	--	--	300	--	10,195
Lake Neark, AR	786	R	--	--	--	--	--	--	--	2,545
Island 30	787	R	--	--	--	--	--	--	--	5,485
Kate Aubrey, TN	791	R	990	--	--	--	--	--	--	12,260
Keyes Point, TN	791	L	1,380	--	--	--	--	--	--	31,210
Ashport-Goldust, TN-AR	795	R	--	--	--	--	--	--	--	17,330
Forked Deer, TN	798	L	--	--	--	--	--	--	--	8,550
Island 25, AR	804	R	--	--	--	--	--	--	--	5,450
Nebraska Point, TN	808	L	--	--	--	--	--	--	--	12,149
Below Tamm Bend, TN	813	L	--	--	--	--	--	--	--	8,300
Wrights Point, AR	820	R	--	--	--	--	--	400	--	34,775
Island 21, Chute, TN	824	L	--	--	--	--	--	--	--	3,170
Head of Island 21, TN	828	L	--	--	--	--	--	300	--	15,540
Island 20, MO-TN	831	R	--	--	--	--	--	50	--	21,969
Island 18, TN	837	L	--	--	--	--	--	--	--	8,670
Tennemo, TN	842	L	--	--	--	--	--	50	--	8,240
Blaker Towhead, TN	843	L	--	--	--	--	--	--	--	4,080
Caruthersville-Linwood Bend, MO	844	R	--	--	--	--	--	--	--	30,590
Opposite Carthersville, TN	846	L	--	--	--	--	--	--	--	3,300
Sandy Hook, TN	850	R	--	--	--	--	--	--	--	2,350
Island 15, TN	851	L	--	--	--	--	--	--	--	8,830
Robinson Bayou, MO	853	R	--	--	--	--	--	--	--	10,768
Hathaway, TN	854	L	--	--	--	--	--	300	--	27,355
Island 15 Neck, TN	854	L	--	--	--	--	--	--	--	21,100
Above Lee Towhead, TN	859	L	--	--	--	--	--	--	--	1,300
Below Cherokee, TN	866	L	--	--	--	--	--	--	--	6,230
Stewart Towhead, MO	871	R	--	--	--	--	--	--	--	19,440

TABLE 41-J
(Continued)

BANK REVETMENTS AND DIKES: MEMPHIS DISTRICT
(FISCAL YEAR 2003)

Location	Above Head of Passes (Miles)	Bank R or L	Operations This FY Construction: New Work: Extension (Linear Feet)	New Work: Lap (Linear Feet)	New Work: (Squares)[1]	Reinforcement (Linear Feet)	Reinforcement (Squares)[1]	Maintenance (Squares)[1]	Non-Operative Since Prior FY (Linear Feet)	Operative Thru This FY (Linear Feet)
Dikes:					([8])			([6])		
Ruddles Point, MO	874	R	--	--	--	--	--	600	--	8,130
Island 11, MO	882	R	--	--	--	--	--	--	--	14,330
New Madrid Bend, MO	887	R	--	--	--	--	--	--	--	1,715
Kentucky Point, KY	887	L	--	--	--	--	--	--	--	15,610
Morrison Towhead, MO	890	R	--	--	--	--	--	--	--	1,070
Hotchkiss Bend, MO	895	R	--	--	--	--	--	--	--	14,208
Slough Landing, KY	896	L	--	--	--	--	--	1,050	--	5,065
Below Island 9, TN	901	L	--	--	--	--	--	300	--	21,989
Donaldson Point, MO	905	R	--	--	--	--	--	500	--	22,975
Island 9, KY	906	L	--	--	--	--	--	--	--	7,010[5]
Island 7 - Island 8, MO-KY	917	R	550	--	2,700	--	--	100	--	15,345
Below Williams, KY	925	L	--	--	--	--	--	--	--	3,640
Moore Island, KY-MO	929	R	--	--	--	--	--	720	--	7,925
Above Williams, KY	930	L	--	--	--	--	--	--	--	1,150
Wolf Island Bar, KY	933	L	--	--	--	--	--	--	--	12,260
Campbell, KY	942	L	--	--	--	--	--	--	--	2,610
Pritchard, MO	944	R	--	--	--	--	--	--	--	9,390
Island 1, KY	948	L	480	--	--	--	--	--	--	17,825
Total Dikes Memphis District, Mississippi River			6,700 (1.27 Miles)	--	3,935	--	--	9,810	--	1,000,598 (189.51 Miles)

1. Gross squares articulated concrete mattress (100 square feet).
2. Changed to correct previous errors.
3. Lumber mattress revetment.
4. Rock Groins.
5. Linear feet of triangular frame retards and pile dikes.
6. Linear feet of dike on which repairs were made.
7. Stone paving only.
8. Linear feet of dike which were raised.
9. ACM placed at location previously reported as stone paving only. No new length.

TABLE 41-K

PROJECT LEVEES: NEW ORLEANS DISTRICT
(FISCAL YEAR 2003)

Location	Levees and Floodwalls (Miles)					Berm[1] (Miles)				Surfaced Roads on Levees (Miles)			
		Built to Approved Grade and Section											
	Authorized for System	Total in Place This FY	This FY	Total Thru This FY	Currently Under Construction	In System When Completed	Built This FY	Complete Thru This FY	Currently Under Construction	In System When Completed	Built This FY	Total Complete Thru This FY	Currently Under Construction
MAIN STEM LEVEES													
Mississippi River Levees													
Fifth Louisiana Levee District	(16.8)	(16.8)	(--)	(13.3)	(--)	(--)	(--)	(--)	(--)	(15.5)	(--)	(15.5)	(--)
Levees	15.5	15.5	--	12.0	--	--	--	--	--	15.5	--	15.5	--
Old River structures and levees	1.3	1.3	--	1.3	--	--	--	--	--	--	--	--	--
Atchafalaya Basin Levee District	(126.3)	(126.3)	--	(126.3)	(--)	(1.0)	(--)	(1.0)	(--)	(118.7)	(--)	(118.7)	(--)
Levees	118.7	118.7	--	118.7	--	1.0	--	1.0	--	118.7	--	118.7	--
Morganza structure and levee	0.8	0.8	--	0.8	--	--	--	--	--	--	--	--	--
Morganza forebay levee	6.7	6.7	--	6.7	--	--	--	--	--	--	--	--	--
Port Allen lock	0.1	0.1	--	0.1	--	--	--	--	--	--	--	--	--
Lafourche Basin Levee District Levees	61.7	61.7	--	61.7	--	0.1	--	0.1	--	61.7	--	61.7	--
Plaquemines West Levee District Levees	37.9	37.9	--	37.9[2]	--	--	--	--	--	37.9	--	37.9	--
Buras Levee District	(34.1)	(34.1)	--	(27.8)	(--)	(--)	(--)	(--)	(--)	(34.0)	(--)	(34.0)	(--)
Levees	34.0	34.0	--	27.7[2]	--	--	--	--	--	34.0	--	34.0	--
Empire lock	0.1	0.1	--	0.1	--	--	--	--	--	--	--	--	--
Baton Rouge front levees	2.1	2.1	--	1.9	--	--	--	--	--	2.1	--	2.1	--
Ponchartrain Levee District	(124.9)	(124.9)	(--)	(121.3)	(--)	(0.1)	(--)	(--)	(--)	(110.8)	(--)	(110.8)	(--)
Levees	110.8	110.8	--	107.2	--	0.1	--	--	--	110.8	--	110.8	--
Bonnet Carre′ guide levees	11.3	11.3	--	11.3	--	--	--	--	--	--	--	--	--
Bonnet Carre′ forebay levee	1.3	1.3	--	1.3	--	--	--	--	--	--	--	--	--
Bonnet Carre′ structure	1.5	1.5	--	1.5	--	--	--	--	--	--	--	--	--
East Jefferson Levee District Levees	11.6	11.6	--	10.8	--	--	--	--	--	11.6	--	11.6	--
West Jefferson Levee District	(20.0)	(20.0)	--	(20.0)	(--)	(--)	(--)	(--)	(--)	(19.9)	(--)	(19.9)	(--)
Levees	19.8	19.8	--	19.8	--	--	--	--	--	19.8	--	19.8	--
Floodwalls	0.1	0.1	--	0.1	--	--	--	--	--	0.1	--	0.1	--
Harvey Canal Lock	0.1	0.1	--	0.1	--	--	--	--	--	--	--	--	--

TABLE 41-K
(Continued)

PROJECT LEVEES: NEW ORLEANS DISTRICT
(FISCAL YEAR 2003)

Location	Levees and Floodwalls (Miles)					Berm[1] (Miles)				Surfaced Roads on Levees (Miles)			
		Built to Approved Grade and Section											
	Authorized for System	Total in Place This FY	This FY	Total Thru This FY	Currently Under Construction	In System When Completed	Built This FY	Complete Thru This FY	Currently Under Construction	In System When Completed	Built This FY	Total Complete Thru This FY	Currently Under Construction
Orleans Levee District	(27.2)	(27.2)	(--)	(24.9)	(--)	(--)	(--)	(--)	(--)	(18.4)	(--)	(18.4)	(--)
Left descending, east bank	(13.3)	(13.3)	(--)	(11.0)	(--)	(--)	(--)	(--)	(--)	(4.6)	(--)	(4.6)	(--)
Levees	4.6	4.6	--	2.3	--	--	--	--	--	4.6	--	4.6	--
Floodwalls	8.6	8.6	--	8.6	--	--	--	--	--	--	--	--	--
IHNC lock	0.1	0.1	--	0.1	--	--	--	--	--	--	--	--	--
Right descending, west bank	(13.9)	(13.9)	(--)	(13.9)	(--)	(--)	(--)	(--)	(--)	(13.8)	(--)	(13.8)	(--)
Levees	13.8	13.8	--	13.8	--	--	--	--	--	13.8	--	13.8	--
Algiers Canal lock	0.1	0.1	--	0.1	--	--	--	--	--	--	--	--	--
Lake Borgne Basin Levee District Levees	11.6	11.6	--	11.6	--	--	--	--	--	11.6	--	11.6	--
Grand Prairie Levee District Levees	37.4	37.4	--	37.4	--	--	--	--	--	37.4	--	37.4	--
Total Mississippi River	511.6	511.6	--	494.9	--	1.2	--	1.1	--	479.6	--	479.6	--
Other Levees Included in Main Stem													
Louisiana State Pen Levee	12.1	12.1	4.8	12.1	--	--	--	--	--	--	--	--	--
Atchafalaya Basin													
Atchafalaya River and Bayou des Glaises	(148.4)	(148.4)	(--)	(143.9)	(--)	(--)	(--)	(--)	(--)	(148.4)	(--)	(148.4)	(--)
East Bank Atchafalaya River	52.5	52.5	--	52.5	--	--	--	--	--	52.5	--	52.5	--
Bayou des Glaises	7.9	7.9	--	7.9	--	--	--	--	--	7.9	--	7.9	--
West bank Atchafalaya River	60.1	60.1	--	55.6	--	--	--	--	--	60.1	--	60.1	--
Simmesport Ring	1.6	1.6	--	1.6	--	--	--	--	--	1.6	--	1.6	--
Melville Ring	4.1	4.1	--	4.1	--	--	--	--	--	4.1	--	4.1	--
Krotz Springs Ring	1.7	1.7	--	1.7	--	--	--	--	--	1.7	--	1.7	--
Mansura Hills to Hamburg	20.5	20.5	--	20.5	--	--	--	--	--	20.5	--	20.5	--
West protection levee, Hamburg to Berwick drainage canal via Calumet	128.7	128.7	--	110.9	--	--	--	--	--	128.7	--	128.4	--
Levees west of Berwick, Berwick drainage canal to Charenton drainage canal	56.5	56.5	7.0	36.0	4.0	--	--	--	--	56.5	--	56.5	--
Morganza upper guide levee	8.9	8.9	--	8.9	--	--	--	--	--	8.9	--	8.9	--

TABLE 41-K
(Continued)

PROJECT LEVEES: NEW ORLEANS DISTRICT
(FISCAL YEAR 2003)

Location	Levees and Floodwalls (Miles)					Berm[1] (Miles)				Surfaced Roads on Levees (Miles)			
		Built to Approved Grade and Section											
	Authorized for System	Total in Place This FY	This FY	Total Thru This FY	Currently Under Construction	In System When Completed	Built This FY	Complete Thru This FY	Currently Under Construction	In System When Completed	Built This FY	Total Complete Thru This FY	Currently Under Construction
East Protection levee, Morganza to Cutoff Bayou, including 19.5 miles of Morganza lower guide levee	106.7	106.7	--	95.7	2.0	--	--	--	--	105.0	--	86.0	--
Total Atchafalaya Basin	449.2	449.2	7.0	395.4	11.9	--	--	--	--	447.5	--	428.2	--
Total Other Levees Included in Main Stem	461.3	461.3	11.8	407.5	11.9	--	--	--	--	447.5	--	428.2	--
Total-Main Stem Leaves	972.9	972.9	11.8	902.4	11.9	1.2	--	1.1	--	927.1	--	907.8	--
TRIBUTARY LEVEES IN MR&T PROJECT													
Lake Ponchartrain, LA	(17.4)	(17.4)	(--)	(17.4)	(--)	(--)	(--)	(--)	(--)	(17.4)	(--)	(17.4)	(--)
Item A levees	5.0	5.0	--	5.0	--	--	--	--	--	5.0	--	5.0	--
Item B levees	10.1	10.1	--	10.1	--	--	--	--	--	10.1	--	10.1	--
Item C levees	2.3	2.3	--	2.3	--	--	--	--	--	2.3	--	2.3	--
Total Tributary Levees in MR&T Project	17.4	17.4	--	17.4	--	--	--	--	--	17.4	--	17.4	--
GRAND TOTAL	990.3	990.3	11.8	919.8	11.9	1.2	--	1.1	--	944.5	--	925.2	--

1. Landside seepage berms only.
2. Changed to correct previous error.

TABLE 41-L

PROJECT LEVEES: VICKSBURG DISTRICT
(FISCAL YEAR 2003)

Location	Levees and Floodwalls (Miles)					Berm[1] (Miles)				Surfaced Roads on Levees (Miles)			
		Built to Approved Grade and Section											
	Authorized for System	Total in Place This FY	This FY	Total Thru This FY	Currently Under Construction	In System When Completed	Built This FY	Complete Thru This FY	Currently Under Construction	In System When Completed	Built This FY	Total Complete Thru This FY	Currently Under Construction
MAIN STEM LEVEES													
Mississippi River Levees													
East bank in Mississippi	178.3[4]	178.3	7.6	116.7	24.4	156.9	--	135.0	--	174.2	7.6	174.2	24.4
Greenville Harbor dikes	7.8	7.8	--	7.8	--	--	--	--	--	2.7	--	2.7	--
West bank in Arkansas	75.6	75.6	--	55.0	--	61.3	--	54.3	--	75.4	--	75.4	--
West bank in Louisiana (above Red River)	198.7	198.7	6.0	94.7	11.4	91.0	--	74.9	--	197.8	6.0	197.8	11.4
Total Mississippi River Levees	460.4	460.4	13.6	274.2	35.8	309.2	--	264.2	--	450.1	13.6	450.1	35.8
Other Levees Included in Main Stem													
Lower Red River-South Bank Red River levees	(59.2)	(59.2)	(--)	(59.2)	(--)	(--)	(--)	(--)	(--)	(59.2)	(--)	(59.2)	(--)
Hotwells to Moncla, LA, levees	59.2	59.2	--	59.2	--	--	--	--	--	59.2	--	59.2	--
Arkansas River, South Bank	85.4	85.4	--	85.4	--	24.7	--	24.7	--	84.1	--	81.1	--
Total Other Levees Included in Main Stem	144.6	144.6	--	144.6	--	24.7	--	24.7	--	143.3	--	140.3	--
Total-Main Stem Levees	605.0	605.0	13.6	418.8	35.8	333.9	--	288.9	--	593.4	13.6	590.4	35.8
TRIBUTARY LEVEES IN MR&T PROJECT													
Arkansas River, North Bank	61.5[5]	56.2	--	56.2	--	8.3	--	8.3	--	47.4	--	47.4	--
Red River Backwater Levees	263.6	246.9[7]	--	246.9[7]	--	--	--	--	--	246.9[7]	--	246.9[7]	--

TABLE 41-L
(Continued)

PROJECT LEVEES: VICKSBURG DISTRICT
(FISCAL YEAR 2003)

Location	Levees and Floodwalls (Miles)					Berm[1] (Miles)				Surfaced Roads on Levees (Miles)			
		Built to Approved Grade and Section											
	Authorized for System	Total in Place This FY	This FY	Total Thru This FY	Currently Under Construction	In System When Completed	Built This FY	Complete Thru This FY	Currently Under Construction	In System When Completed	Built This FY	Total Complete Thru This FY	Currently Under Construction
Yazoo River Basin	624.1)	(427.4)	(--)	(237.6)	(--)	(--)	(--)	(--)	(--)	(624.1)	(--)	(338.9)	--
Headwater	527.5	375.8	--	186.0	--	--	--	--	--	527.5	--	299.9	--
Backwater	96.6	51.6	--	51.6	--	--	--	--	--	96.6	--	39.0	--
Total Tributary Levees in MR&T Project	949.2	730.5	--	540.7	--	8.3	--	8.3	--	918.4	--	633.2	--
GRAND TOTAL	1,554.2	1,335.5	13.6	945.9	35.8	342.2	--	297.2	--	1,511.8	13.6	1,223.6	35.8

1. Landside seepage berms only.
2. Levee that has adequate freeboard based on the refined 1973 MR&T project flood flow line for the Mississippi River. Levees with more than 2 feet of freeboard are considered adequate.
3. Subject to change as planning progresses. Does not include existing berms which need restudy.
4. Includes 1.4 miles of concrete floodwall and 0.3 mile of levee on Vicksburg city front.
5. Includes 5.3 miles for Gillett new levee.
6. Relief wells used in place of berms.
7. Changed to correct previous error.

TABLE 41-M

PROJECT LEVEES: MEMPHIS DISTRICT
(FISCAL YEAR 2003)

Location	Levees and Floodwalls (Miles)					Berm[5] (Miles)				Surfaced Roads on Levees (Miles)			
		Built to Approved Grade and Section											
	Authorized for System	Total in Place This FY	This FY	Total Thru This FY	Currently Under Construction	In System When Completed	Built This FY	Complete Thru This FY	Currently Under Construction	In System When Completed	Built This FY	Total Complete Thru This FY	Currently Under Construction
MAIN STEM LEVEES													
Mississippi River													
Mounds, IL	3.9	3.9	--	3.9	--	0.5	--	0.5	--	3.6	--	3.6	--
Mound City, IL	2.7	2.7	--	2.7	--	2.5	--	2.5	--	1.1	--	1.1	--
Cairo Drainage District, IL	13.8[2]	13.8	--	7.8	--	1.6	--	--	--	8.5	--	8.5	--
City of Cairo, IL	6.2	6.2	--	2.2[4]	--	4.4	--	2.0	--	4.0	--	3.5	--
Little River Drainage District, MO	19.3	19.3	--	19.3	--	9.7	--	4.9	--	19.3	--	19.3	--
Levee District No. 2, Scott County, MO	13.8	13.8	--	13.8	--	4.8	--	4.8	--	13.8	--	13.8	--
Levee District No. 3, Mississippi County, MO	26.0	26.0	--	26.0	--	12.9	--	4.9	--	26.0	--	26.0	--
St. Johns Levee and Drainage District, MO	59.0[3]	58.7	--	58.2	--	9.2	--	--	--	46.9	--	46.1	--
St. Francis Levee District of MO	55.7	55.7	--	48.7[4]	--	23.0	--	12.0	--	55.1	--	55.1	--
City of Hickman, KY	1.4	1.4	--	1.4	--	--	--	--	--	0.5	--	--	--
Board of Levee Commissioners Fulton, County, KY	16.7	16.7	--	16.7	--	15.1	--	11.4	--	16.3	--	16.3	--
Reelfoot Levee District of Lake and Obion Counties, TN	4.5	4.5	--	4.5	--	0.6	--	0.3	--	4.5	--	4.3	--
Madrid Bend Levee District, Lake Co., TN	5.2	5.2	--	5.2	--	--	--	--	--	5.2	--	5.2	--
Lake County Levee and Drainage District, TN	17.0	17.0	--	17.0	--	9.6	--	9.4	--	17.0	--	17.0	--
Dyer County Levee and Drainage District No. 1, TN	21.3	21.3	--	21.3	--	1.3	--	0.4	--	21.3	--	21.3	--
Tipton-Obion levee extension	6.5	--	--	--	--	--	--	--	--	6.5	--	--	--
St. Francis Levee District of AR	156.7	156.7	--	153.2	--	89.2	--	88.4	--	156.7	--	156.7	--
Helena Improvement District No. 1, AR	5.3	5.3	--	5.3	--	2.4	--	2.4	--	4.7	--	4.2	--
Cotton Belt Levee District No. 1, AR.	23.9	23.9	--	23.9	--	19.4	--	19.4	--	23.9	--	23.9	--

TABLE 41-M
(Continued)

PROJECT LEVEES: MEMPHIS DISTRICT
(FISCAL YEAR 2003)

Location	Levees and Floodwalls (Miles)					Berm[5] (Miles)				Surfaced Roads on Levees (Miles)			
		Built to Approved Grade and Section											
	Authorized for System	Total in Place This FY	This FY	Total Thru This FY	Currently Under Construction	In System When Completed	Built This FY	Complete Thru This FY	Currently Under Construction	In System When Completed	Built This FY	Total Complete Thru This FY	Currently Under Construction
Laconia Drainage and Levee District Phillips County, AR	20.5	20.5	--	20.5	--	11.5	--	11.5	--	20.5	--	20.5	--
Laconia Levee District No. 1 of Deshna County, AR	18.1	18.1	--	18.1	--	12.6	--	9.2	--	16.5	--	16.5	--
Laconia Circle Special Drainage District of Deshna County, AR	6.6	6.6	--	6.6	--	--	--	--	--	--	--	--	--
Yazoo-Mississippi Delta Levee District, MS	93.6	93.6	--	93.6	--	88.6	--	88.6	--	93.6	--	93.6	--
Madrid Bend L.D., Fulton Co., KY .	4.8	4.8	--	4.8	--	--	--	--	--	4.8	--	4.8	--
Birds Point-New Madrid setback levee, MO	35.3	35.3	--	35.3	--	23.8	--	--	--	35.3	--	35.3	--
Total Mississippi River	637.8	631.0	--	607.5	--	342.7	--	272.6	--	605.6	--	596.6	--
TOTAL MAIN STEM LEVEES	637.8	631.0	--	607.5	--	342.7	--	272.6	--	605.6	--	596.6	--
TRIBUTARY LEVEES IN MR&T PROJECT													
St. Francis River	(308.2)	(302.9)	--	(302.9)	--	--	--	--	--	(301.0)	--	(133.5)	--
East bank	159.5	156.2	--	156.2	--	--	--	--	--	156.7	--	94.7	--
West bank	148.7	146.7	--	146.7	--	--	--	--	--	144.3	--	38.8	--
Little River	(130.1)	(130.1)	--	(130.1)	--	--	--	--	--	(128.9)	--	(94.5)	--
East bank (left)	40.7	40.7	--	40.7	--	--	--	--	--	40.7	--	40.1	--
West bank	35.1	35.1	--	35.1	--	--	--	--	--	35.1	--	23.7	--
Elk Chute	39.9	39.9	--	39.9	--	--	--	--	--	39.7	--	17.3	--
West Basin and middle valley	14.4	14.4	--	14.4	--	--	--	--	--	13.4	--	13.4	--
Lower White River	(95.6)	(85.9)	--	(84.1)	--	--	--	--	--	(94.0)	(--)	(81.0)	--
White River backwater levee	40.2	40.2	--	40.2	--	--	--	--	--	38.8	--	38.8	--
Augusta to Clarendon	49.2	39.5	--	39.5	--	--	--	--	--	49.2	--	36.2	--
Clarendon levee	6.2	6.2	--	4.4	--	--	--	--	--	6.0	--	6.0	--

TABLE 41-M
(Continued)

PROJECT LEVEES: MEMPHIS DISTRICT
(FISCAL YEAR 2003)

Location	Levees and Floodwalls (Miles)					Berm[5] (Miles)				Surfaced Roads on Levees (Miles)			
		Built to Approved Grade and Section											
	Authorized for System	Total in Place This FY	This FY	Total Thru This FY	Currently Under Construction	In System When Completed	Built This FY	Complete Thru This FY	Currently Under Construction	In System When Completed	Built This FY	Total Complete Thru This FY	Currently Under Construction
Memphis Harbor	10.5	10.5	--	10.5	--	7.0	--	7.0	--	10.5	--	10.5	--
Total Tributary Levees in MR&T Project	544.4	529.4	--	527.6	--	7.0	--	7.0	--	534.4	--	319.5	--
GRAND TOTAL	1,182.2	1,160.4	--	1,135.0	--	349.7	--	279.6	--	1,140.0	--	916.1	--

1. Subject to change as planning progresses.
2. Includes 5.1 miles of Cache River levee. This levee was enlarged to 1928 grades with Federal funds, but since that time has been classified as a secondary levee.
3. Includes 12.1 miles of Farrenburg levee. This levee was enlarged to 1928 grades with Federal funds, but since that time has been classified as a secondary levee.
4. Deficient in freeboard as a result of 1996 Revised Project Design Flood flowline.
5. Landside seepage berms only.
6. Changed to correct previous error.

TABLE 41-N

RECAPITULATION
PROJECT LEVEE TABLES 42-K, -L, AND -M
(FISCAL YEAR 2003)

Location	Levees and Floodwalls (Miles)					Berm[5] (Miles)				Surfaced Roads on Levees (Miles)			
		Built to Approved Grade and Section											
	Authorized for System	Total in Place This FY	This FY	Total Thru This FY	Currently Under Construction	In System When Completed	Built This FY	Complete Thru This FY	Currently Under Construction	In System When Completed	Built This FY	Total Complete Thru This FY	Currently Under Construction
MAIN STEM LEVEES													
Mississippi River													
New Orleans District, Table 41-K	511.6	511.6	--	494.9	--	1.2	--	1.1	--	479.6	--	479.6	--
Vicksburg District, Table 41-L	460.4	460.4	13.6	274.2	35.8	309.2	--	264.2	--	450.1	13.6	450.1	35.8
Memphis District, Table 41-M	637.8	631.0	--	607.5	--	342.7	--	272.6	--	605.6	--	596.6	--
Total Mississippi River	1,609.8	1,603.0	13.6	1,376.6	35.8	653.1	--	537.9	--	1,535.3	13.6	1,526.3	35.8
Other Levees Included in Main Stem													
Atchafalaya Basin Floodway--NOD	449.2	449.2	7.0	395.4	11.9	--	--	--	--	447.5	--	428.2	--
Louisiana State Pen Levee--NOD	12.1	12.1	4.8	12.1	--	--	--	--	--	--	--	--	--
Lower Red River-South Bank--VXD	59.2	59.2	--	59.2	--	--	--	--	--	59.2	--	59.2	--
Arkansas River-South Bank--VXD	85.4	85.4	--	85.4	--	24.7	--	24.7	--	84.1	--	81.1	--
Total Other Levees Included in Main Stem	605.9	605.9	--	552.1	11.9	24.7	--	24.7	--	590.8	--	568.5	--
Total Main Stem Levees	2,215.7	2,208.9	25.4	1,928.7	47.7	677.8	--	562.6	--	2,126.1	13.6	2,094.8	35.8
TRIBUTARY LEVEES IN MR&T PROJECT													
Lake Pontchartrain, LA,--NOD	17.4	17.4	--	17.4	--	--	--	--	--	17.4	--	17.4	--
Yazoo River Basin—VXD	624.1	427.4	--	237.6	--	--	--	--	--	624.1	--	338.9	--
Arkansas River-North Bank--VXD	61.5	56.2	--	56.2	--	8.3	--	8.3	--	47.4	--	47.4	--
Red River Backwater—VXD	263.6	246.9	--	246.9[4]	--	--	--	--	--	246.9[4]	--	246.9[4]	--
St. Francis River—MD	308.2	302.9	--	302.9	--	--	--	--	--	301.0	--	133.5	--

TABLE 41-N
(Continued)

RECAPITULATION
PROJECT LEVEE TABLES 42-K, -L, AND -M
(FISCAL YEAR 2003)

Location	Levees and Floodwalls (Miles)					Berm[5] (Miles)				Surfaced Roads on Levees (Miles)			
		Built to Approved Grade and Section											
	Authorized for System	Total in Place This FY	This FY	Total Thru This FY	Currently Under Construction	In System When Completed	Built This FY	Complete Thru This FY	Currently Under Construction	In System When Completed	Built This FY	Total Complete Thru This FY	Currently Under Construction
Little River--MD	130.1	130.1	--	130.1	--	--	--	--	--	128.9	--	94.5	--
Lower White River—MD	95.6	85.9	--	84.1	--	--	--	--	--	94.0	--	81.0	--
Memphis Harbor--MD	10.5	10.5	--	10.5	--	7.0	--	7.0	--	10.5	--	10.5	--
Total Tributary Levees in MR&T Project	1,511.0	1,277.3	--	1,085.7	--	15.3	--	15.3	--	1,470.2	--	970.1	--
Grand Total in Project	3,726.7	3,486.2	25.4	3,014.4	47.7	691.2	--	577.9	--	3,596.3	13.6	3,064.9	35.8

1. Landside seepage berms only.
2. Subject to change as planning progresses.
3. 1996 Revised Project Design Flood flowline identified freeboard deficiences.
4. Changed to correct previous error.
5. Relief wells have been used in lieu of seepage berms in some reaches of the Miss. River Levees.

TABLE 41-O CHANNEL IMPROVEMENTS: NEW ORLEANS DISTRICT (FISCAL YEAR 2003)

Location	Year Initiated	In System When Completed	Built This FY (Miles)	Total Complete Thru This FY	Percent Complete	Currently Under Construction
Bayou des Glaises diversion channel	1938	6.0	--	6.0	100	--
Bayous Rapides, Boeuf, and Cocodrie	1946	92.6	--	63.4	75	--
Charenton drainage and navigation canal	1939	6.3	--	6.3	100	--
Wax Lake Outlet	1938	15.7	--	15.7	100	--
Atchafalaya Basin Floodway	1933	244.2	--	186.4	76	--
Morganza Floodway	1941	3.3	--	3.3	100	--
Old River outflow channel	1956	8.3	--	8.3	100	--
Old River inflow channel	1960	2.3	--	2.3	100	--
Old River lock approach channels	1961	2.2	--	2.2	100	--
Baton Rouge Harbor (Devils Swamp)	1958	2.5	--	2.5	100	--
Teche-Vermilion Water Supply	1977	6.3	--	6.3	100	--
Old River Auxiliary Control Structure inflow channel	1986	1.9	--	1.9	100	--
Old River Auxiliary Control Structure outflow channel	1988	0.9	--	0.9	100	--
Caernarvon Freshwater Diversion channel	1988	1.7	--	1.7	100	--

TABLE 41-P CHANNEL IMPROVEMENTS: VICKSBURG DISTRICT (FISCAL YEAR 2003)

Location	Year Initiated	In System When Completed	Built This FY (Miles)	Total Complete Thru This FY	Percent Complete	Currently Under Construction
BIG SUNFLOWER RIVER, ETC., MS						
Big Sunflower River	1947	199.1	--	199.1	100	--
Quiver River	1947	69.6	--	69.6	100	--
Deer Creek	1947	7.0	--	7.0	100	--
Steele Bayou	1947	54.9	--	54.9	100	--
Steele Bayou[1]	1965	71.2	--	71.2	100	--
Main Canal	1959	21.1	--	21.1	100	--
Main Canal[2]	1993	26.7	--	26.7	100	--
Black Bayou	1992	36.5	--	36.5	100	--
Big Sunflower River tributaries	1957	227.2	--	227.2	100	--
Quiver River tributaries	1960	35.4	--	35.4	100	--
YAZOO BACKWATER						
Yazoo Backwater	1960	39.9	--	39.9	100	--
YAZOO BASIN HEADWATER, MS						
Upper Yazoo Project	1976	179.0	11.0	91.5	51	8.0
Coldwater River	1941	54.6	--	54.6	100	--
Arkabutla Canal	1948	0.4	--	0.4	100	--
Tallahatchie Canal	1940	74.8	--	73.5	98	--
Little Tallahatchie River and Panola-Quitman Floodway	1939	48.0	--	48.0	100	--
Greenwood protection works	1971	2.9	--	2.9	100	--
Yacona River	1952	1.8	--	1.8	100	--
Bobo Bayou	1944	16.1	--	16.1	100	--
Cassidy Bayou	1934	69.0	--	69.0	100	--
Cassidy Bayou[3]	--	26.0	--	--	--	--
Bear Creek Diversion	--	4.8	--	--	--	--
Lake Cormorant	--	20.9	--	--	--	--
Hurricane Bayou	--	2.5	--	--	--	--
Opossum Bayou	--	20.8	--	--	--	--
Abaica Creek	--	7.7	--	--	--	--
Chicopa Creek	--	7.0	--	--	--	--
Bear Creek	--	23.3	--	--	--	--
Rocky Bayou	--	7.8	--	--	--	--
Whiteoak Bayou	--	55.9	--	--	--	--
Miscellaneous ditches	--	12.3	--	--	--	--
Yalobusha River	1939	46.0	--	46.0	100	--
Yazoo River	1940	160.2	--	160.2	100	--
Whittington Auxiliary Channel	1956	30.8	--	30.8	100	--
Tchula Lake	1964	26.4	--	26.4	100	--
David-Burrell Bayou	1957	40.4	--	40.4	100	--
McKinney Bayou	1960	3.5	--	3.5	100	--

TABLE 41-P (Continued)

CHANNEL IMPROVEMENTS: VICKSBURG DISTRICT (FISCAL YEAR 2003)

Location	Year Initiated	In System When Completed	Built This FY (Miles)	Total Complete Thru This FY	Percent Complete	Currently Under Construction
YAZOO BASIN HEADWATER, MS (Continued)						
Hillside Floodway	1964	11.0	--	11.0	100	--
Yazoo City protection works	1953	1.6	--	1.6	100	--
Ascalmore-Tippo Bayous	1975	30.2	--	15.1	50	--
Alligator-Catfish Bayou	1973	8.3	--	8.3	100	--
Pelucia Creek	1975	11.7	--	11.7	100	--
BOEUF & TENSAS RIVERS, ETC., LA AND AR						
Bayou Lafourche	1949	45.3	--	45.3	100	--
Bayou Lafourche[4,7]	1972	43.0	--	4.4	10	--
Big & Colewa Creeks	1947	81.4	--	81.4	100	--
Big & Colewa Creeks[5,7]	1965	86.8	--	51.5	60	--
Tensas River	1947	96.5	--	96.5	100	--
Tensas River[6]	1968	165.0	--	61.0	37	--
Boeuf River, AR and LA	1953	103.9	--	103.9	100	--
Fleschmans Bayou, AR	1963	6.6	--	6.6	100	--
Caney Bayou, AR	1964	7.4	--	7.4	100	--
Canal 18, AR	1963	10.3	--	10.3	100	--
Big Bayou, AR	1952	33.3	--	33.3	100	--
Black Pond Slough, AR	1962	14.3	--	14.3	100	--
Bayou Macon, AR and LA	1959	150.8	--	150.8	100	--
Rush Bayou, AR	1964	6.7	--	6.7	100	--
Canal 19, AR	1957	50.2	--	50.2	100	--
Canal 43, AR	1956	34.5	--	34.5	100	--
Canal 81, AR	1957	32.7	--	32.7	100	--
Mill Bayou-Bayou Vidal-Bayou Vidal Cutoff	--	17.1	--	--	--	--
Kirsch Lake Canal	--	9.3	--	--	--	--
Canal 19 Extension	1964	9.4	--	9.4	100	--
Lake Chicot Pumping Plant	--	2.5	--	2.5	100	--
Mill Bayou	1955	4.8	--	4.8	100	--
RED RIVER BACKWATER, LA						
Tensas-Cocodrie Pumping Plant	1976	6.9	--	6.9	100	--
Six Mile Bayou, LA	--	1.5	--	1.5	100	--

1. Includes further work on 54.9 miles and adds 16.3 miles of channel to the project.
2. Includes further work on 21.1 miles and adds 1.1 miles of channel to the project.
3. Includes further work on 26.0 miles.
4. Includes further work on 38.6 miles and adds 4.4 miles of channel to the project.
5. Includes further work on 75.3 miles and adds 11.5 miles of channel to the project.
6. Includes further work on 96.5 miles and adds 68.5 additional miles of channel to the project.
7. Further work on these items has been deferred due to local oppositions and withdrawal of sponsorship by the levee district.

TABLE 41-Q CHANNEL IMPROVEMENTS: MEMPHIS DISTRICT (FISCAL YEAR 2003)

Location	Year Initiated	In System When Completed	Built This FY (Miles)	Total Complete Thru This FY	Percent Complete	Currently Under Construction
BIRDS POINT-NEW MADRID FLOODWAY						
Birds Point-New Madrid Intercepting Ditch Enlargement, Samos and Vicinity, MO	1952	9.6	--	9.6	100	--
ST. FRANCIS BASIN						
Little River Drainage, MO	1963	298.9	--	298.9	100	--
St. Francis River, MO and AR	1953	658.0	--	580.4	88	--
West Memphis Drainage, AR	1951	19.8	--	19.8	100	--
Big Slough and Mayo Ditch, AR	1960	28.0	--	28.0	100	--
Tyronza River, AR	1939	12.7	--	12.7	100	--
L'Anguille River, AR	([1])	95.0	--	--	--	--
LOWER WHITE RIVER BASIN, AR						
Cache River Basin, AR	1972	231.5	--	7.2	3	--
Big Creek and tributaries, AR	([1])	103.8	--	--	--	--
WEST KENTUCKY TRIBUTARIES						
Obion Creek, KY	([1])	41.7	--	--	--	--
WEST TENNESSEE TRIBUTARIES						
MS River, Western TN tributaries (Backwater Areas) (1946 Act)	1952	34.3	--	34.3	100	--
Obion River Diversion Channel, TN (1946 Act)	([1])	9.3	--	--	--	--
Reelfoot Lake-Lake No. 9, KY and TN	1974	15.8	--	3.0	19	--
Running Reelfoot Bayou, TN	1955	19.7	--	19.7	100	--
MS River Below Cape Girardeau: West TN tributaries (1948 Act)	1961	225.0	--	93.0	41	--
Wolf River and tributaries, TN	1960	24.7	--	24.7	100	--
NONCONNAH CREEK, MS AND TN						
Nonconnah Creek, MS and TN	1990	18.2	--	1.26	7	--
HELENA HARBOR, PHILLIPS COUNTY, AR						
Helena Harbor, AR[(2)]	1989	2.25	--	2.25	100	--

1. Not started.
2. Data for Stage 1 only.

TABLE 41-R PUMPING STATIONS: NEW ORLEANS DISTRICT (FISCAL YEAR 2003)

Name	Authorized Size (CFS)	Percent Complete Thru This FY	Year Complete (Schedule/ Actual)	Rehabilitation Status (If Applicable) Year Initiated	Percent Complete Thru This FY	Year Complete (Schedule/ Actual)
Bayou Yokely	489	100	1955	1990	100	1991(A)
Bayou Yokely Enlargement	568	100	1963	1990	100	1991(A)
Centerville	332	100	1964	1991	100	1992(A)
Ellerslie	136	100	1953	--	--	--
Franklin	144	100	1958	1992	100	1993(A)
Franklin Enlargement	144	100	1978	1992	100	1993(A)
Gordy	238	100	1964	--	--	--
Maryland	136	100	1957	1991	100	1992(A)
North Bend	52	100	1962	--	--	--
Tiger Island	75	100	1955	--	--	--
Wax Lake East	1,008	100	1961	1990	100	1992(A)
Wax Lake West	496	100	1965	1990	100	1992(A)
Teche Vermilion	1,300	100	1982	--	--	--
Pointe Coupee	1,500	100	1983	--	--	--
David Pond	570	100	2000	--	--	--
TOTAL	6,618					

TABLE 41-S

PUMPING STATIONS: VICKSBURG DISTRICT (FISCAL YEAR 2003)

Name	Authorized Size (CFS)	Percent Complete Thru This FY	Year Complete (Schedule/ Actual)	Rehabilitation Status (If Applicable) Year Initiated	Percent Complete Thru This FY	Year Complete (Schedule/ Actual)
Chauvin Bayou, LA	250	100	1994	1991	100	
Bawcomville	270	100	1955	1992	100	1993
Jonesville	180	100	1952	--	--	--
Natchez Port	100	--	--	--	--	--
Wilson Point	50	--	--	--	--	--
Greenwood - Lee Street	90	100	1953	1952	--	--
Greenwood - Wilson Street	67	100	1953	1952	--	--
Greenwood - Walker Lake	675	100	1949	1952	--	--
Yazoo City	540	100	1954	1957	--	--
Columbia	45	100	1939	--	--	--
Calion	200	100	1959	--	--	--
McKinney Bayou, MS	250	100	1962	1961	--	--
Lake Chicot	6,500	100	1987	--	--	--
Tensas Cocodrie	4,000	100	1986	--	--	--
Yazoo Backwater	10,000	--	--	--	--	--
Natchez Area	300	--	--	--	--	--
Bushley Bayou	300	--	Indef[1]	--	--	--
Bushley Bayou	20	--	Indef[1]	--	--	--
Sicily-HAHA Bayou	750	100	2000	--	--	--
Sicily - Fool River	300	100	2000	--	--	--
Pelucia Creek - Rising Sun #1	10	100	1992	--	--	--
Pelucia Creek - Rising Sun #2	15	100	1992	--	--	--
Pelucia Creek Pump	75	100	1993	--	--	--
Below Red River	500	--	Indef[1]	--	--	--
Bayou Rapides	222	100	1936	--	--	--
Ouachita Parish, River Styx Bayou, LA	500	100	2000	--	--	--
Total	25,709					

[1] This project has been placed in the inactive category.

TABLE 41-T PUMPING STATIONS: MEMPHIS DISTRICT (FISCAL YEAR 2003)

Name	Authorized Size (CFS)	Percent Complete Thru This FY	Year Complete (Schedule/ Actual)	Rehabilitation Status (If Applicable) Year Initiated	Percent Complete Thru This FY	Year Complete (Schedule/ Actual)
Devall's Bluff	215	100	1949	1987	100	1989
Des Arc, Ark.	30	100	1954	--	--	--
Ensley	900	100	1966	--	--	--
DD #17, Station #1	375	100	[1]	--	--	--
Huxtable Pumping Plant	12,000	100	1977	--	--	--
Graham Burke	1,500	100	1964	--	--	--
Finley Street	100	100	1978	--	--	--
Dyersburg	26	100	1961	--	--	--
Cotton Slough	50	100	1964	--	--	--
West Hickman	190	100	1976	--	--	--
Cypress Creek	3,000	100	1944	--	--	--
Fairfax	53.5	100	1950	--	--	--
Goose Pond	110	100	1976	--	--	--
Marble Bayou	220	100	1952	--	--	--
Workhouse Bayou	520	100	1950	--	--	--
Nonconnah	1,620	100	1944	--	--	--
L&DD #3 Peafield	400	100	[1]	--	--	--
Treasure Island	150	100	1976	--	--	--
Lake No. 9	500	100	1981	--	--	--
Cairo 10th Street	65	100	1981	--	--	--
Cairo 28th Street	65	100	1981	--	--	--
DD #17, Station #2	700	100	1981	--	--	--
Drinkwater Sewer	150	100	1979	--	--	--
May Street	5	100	1948	--	--	--
Cairo 22nd Street	37	100	[1]	--	--	--
Gayoso Bayou	1,500	100	1915	--	--	--
Mud Lake	200	--	--	--	--	--
Madison	25	--	--	--	--	--
Cache River	200	--	--	--	--	--
New Madrid	1,500	--	--	--	--	--
St. John's Bayou	1,000	--	--	--	--	--
Drinkwater #2	150	100	2001	--	--	--
TOTAL	27,556.5					

[1] Unknown constructed by local interest.

TABLE 41-U COSTS DURING FISCAL YEAR 2003

Item	Construction	Maintenance	Other
FEDERAL FUNDS			
Flood control, Mississippi River and tributaries:			
St. Louis District:			
St. Francis Basin-Wappapello Lake	$ --	$ 7,787,702	$ 0
Subtotal		7,787,702	0
Memphis District:			
Cache Basin, AR	--	--	--
Channel improvement	16,518,438	24,918,822	--
Eastern Arkansas Region (Comp)	166,348	--	--
Francis Bland Floodway Ditch (Eight Mile)	2,925.197	--	--
General investigations	--	--	1,514,100
Helena & Vicinity	1,644,709	--	--
Helena Harbor, Phillips County		464,899	--
Hickman Bluff, KY	66,656	--	--
Horn Lake Creek & Tribs	--	--	--
Horn Lake Creek Modification, MS	277,533	--	--
Inspection of Completed Works	--	766,831	--
L'Anguille River, AR	--	--	--
Mapping	--	430,378	--
Memphis Harbor (McKeller Lake)	--	2,162,012	--
Nonconnah Creek, TN & MS	1,369,952	--	--
Nonconnah Creek, Environmental Enhancement	13,729	--	--
Nonconnah Creek, Flood Control Extension	118,937	--	--
Nonconnah Creek, Recreation Extension	23,846	--	--
Mississippi River Levees	13,410,145	4,797,095	--
St. Francis River & Tributaries, AR	3,808,199	15,162,639	--
St. Johns Bayou & New Madrid	177,566	--	--
West Tennessee tributaries	90,549	--	--
White River Backwater	--	1,387,612	--
Subtotal	40,611,804	50,090,289	1,514,100
Vicksburg District:			
Channel Improvement	14,926,215	15,407,796	--
General investigations	--	--	1,297,884
Inspection of completed works	--	325,014	--
Lower Arkansas – South Bank	--	124,877	--
Lower Arkansas River – North Bank, AR		84,681	--
Lower Red River--South Bank Red River Levee	--	2,647,512	--
Mapping	--	365,548	--
Mississippi River levees	19,476,314	2,095,250	--
Tensas Basin	271,831	12,871,362	--
Yazoo Basin Tribs	41,493,311	20,357,844	--
Greenwood Less Greenwood Protection	--	714,654	--
Greenville Harbor	--	321,224	--
Grenada Lake	--	6,541,567	--
Sardis Lake	--	8,408,098	--
Sardis Dam	1,595	--	--
Vicksburg Harbor	--	306,000	--
Subtotal	76,169,265	70,571,428	1,297,884

TABLE 41-U (Continued) COSTS DURING FISCAL YEAR 2003

Item	Construction	Maintenance	Other
New Orleans District:			
Atchafalaya Basin	22,366,304	13,276,247	--
Atchafalaya Basin Floodway System	6,796,997	1,745,341	--
B. R. Harbor Devil Swamp	--	670,834	--
Bayou Cocodrie and Tributaries	--	49,513	--
Bonnet Carre Spillway	--	2,410,636	--
Channel Improvement	4,646,936	14,252,152	--
General Investigations	--	--	4,964,606
Inspection of Completed Works	--	358,752	--
Louisiana Penitentiary Levee	2,245,784	--	--
Mapping	--	285,933	--
Mississippi & LA Estuarine	2,636	--	--
Mississippi Delta Region	1,894,914	602,473	--
Mississippi River Levees	3,308,281	1,747,568	--
Old River	--	9,805,608	--
Subtotal	41,261,852	45,205,057	4,964,606
Total Federal Funds	**$158,042,921**	**$173,654,475**	**$7,776,590**
CONTRIBUTED FUNDS			
Memphis District			
Bayou Meto			177,194
Helena & Vicinity, AR			
Helena-West Helena – Phillips County		563,326	
Horn Lake Creek Modification, MS		15,298	
Nonconnah Creek, Flood Control Extension		78,337	
Nonconnah Creek Recreation Extension		7,944	
Nonconnah Creek, TN & MS Flood Control			
Reelfoot Lake TN & KY	--	--	4,309
White River Basin			17,419
Wolf River	--	--	74,886
Vicksburg District			
Southwest Arkansas			500,403
Southeast Arkansas Feasibility			468,856
New Orleans District:			
Morganza, LA to Gulf of Mexico			356,443
Atchafalaya Basin			375,330
Louisiana Penitentiary Levee	--	504,400	--
Mississippi Delta Region		-20,445	--
Old River	--	59,431	--
Total Contributed Funds	**0**	**1,208,290**	**1,974,841**
Grand Total, Federal and Contributed Funds	**158,042,921**	**174,862,765**	**9,751,430**

TABLE 41-V STATEMENT OF ALLOTMENTS AND ACCRUED EXPENDITURES FOR FLOOD CONTROL, MISSISSIPPI RIVER AND TRIBUTARIES, FROM MAY 15, 1928, THROUGH SEP. 30, 2003

District or Installation and Class of Work	Allotments	Accrued Expenditures	Unexpended Balance Sep. 30, 2003
ALLOTMENTS AND ACCRUED EXPENDITURES CHARGEABLE AGAINST FLOOD CONTROL ACT LIMITATIONS:			
COMPLETED WORKS:			
Waterways Experiment Station	$ 874,000	$ 874,000	$ --
Office, Chief of Engineers	19,158	19,158	--
Rock Island District:			
S. G. & O. prior to Aug. 18, 1941	14,010	14,010	--
St. Louis District:			
S. G. & O. prior to Aug. 18, 1941	169,352	169,352	--
Subtotal	1,076,520	1,076,520	--
Memphis District:			
Des Arc, AR	178,925	178,925	--
Contraction works	8,692,791	8,692,791	--
DeValls Bluff, AR	231,215	231,215	--
Mapping	1,450,337	1,450,337	--
Memphis Harbor	18,736,432	18,736,432	--
New Madrid Floodway	6,521,543	6,521,543	--
Wolf River and tributaries	1,723,620	1,723,620	--
Roads on levees (Mississippi River levees)	12,426	12,426	--
S. G. & O. prior to Aug. 18, 1941	1,998,766	1,998,766	--
Subtotal	39,546,054	39,546,054	--
Vicksburg District:			
Boeuf Basin levees	2,764,605	2,764,605	--
Channel realignment, Arkansas River	125,074	125,074	--
Contraction works	1,972,183	1,972,183	--
Eudora Floodway	826,235	826,235	--
Vicksburg Harbor	4,664,515	4,664,515	--
Greenville Harbor	2,864,516	2,864,516	--
Grants Canal (Mississippi River levees)	7,070	7,070	--
Mapping	1,531,021	1,531,021	--
Jonesville, LA	172,950	172,950	--
Tensas National Wildlife Refuge, LA	3,980,000	3,980,000	--
Roads on levees	105,660	105,660	--
S. G. & O. prior to Aug. 18, 1941	2,350,201	2,350,201	--
Subtotal	57,184,031	57,184,031	--

TABLE 41-V (Continued) STATEMENT OF ALLOTMENTS AND ACCRUED EXPENDITURES FOR FLOOD CONTROL, MISSISSIPPI RIVER AND TRIBUTARIES, FROM MAY 15, 1928, THROUGH SEP. 30, 2003

District or Installation and Class of Work	Allotments	Accrued Expenditures	Unexpended Balance Sep. 30, 2003
New Orleans District:			
Baton Rouge Harbor, LA	699,185	--	--
Atchafalaya River and Basin, LA	3,375,492	--	--
Bonnet Carre Spillway, LA	14,212,198	14,212,198	--
Contraction works	1,258,916	1,258,916	--
Mapping	1,112,967	--	--
Roads on levees	540,838	540,838	--
S. G. & O. prior to Aug. 18, 1941	2,701,566	2,701,566	--
Wax Lake Outlet and Charenton Canal	10,098,817	10,098,817	--
Morganza Floodway and structure	35,992,117	35,992,117	--
Lake Pontchartrain	5,513,110	5,513,110	--
Teche Vermilion Basin Water Supply	34,506,000	34,506,000	--
Old River	292,274,000	292,274,000	--
Atchafalaya Basin, rights-of-way and flowage, Bayou des Glaises setback	387,917	387,917	--
Subtotal	402,673,123	402,673,123	--
All other completed items:			
Surveys under Sec. 10, Flood Control Act of 1928	4,995,215	4,995,215	--
Impounded savings	1,593,097	1,593,097	--
Plant transferred to revolving fund	24,924,578	24,924,578	--
OCE (portion of allotment transferred to revolving fund, Washington Dist.)	19,882	19,882	--
Subtotal	31,532,772	31,532,772	--
TOTAL COMPLETED WORKS	532,012,500	532,012,500	--
UNCOMPLETED WORKS:			
Rock Island District:			
Levees under Sec. 6, Flood Control Act of 1928	579,462	579,462	--
St. Louis District:			
Levees under Sec. 6, Flood Control Act of 1928	1,897,980	1,897,980	--
Subtotal	2,477,442	2,477,442	--
Memphis District:			
Mississippi River Levees	270,763,601	270,378,165	385,436
New Madrid	98,000	98,000	--
Channel improvement:			
Revetments	472,300,306	472,232,166	68,140
Dredging	58,566,439	58,566,439	--
Dikes	270,867,942	270,832,944	34,998

TABLE 41-V (Continued) STATEMENT OF ALLOTMENTS AND ACCRUED EXPENDITURES FOR FLOOD CONTROL, MISSISSIPPI RIVER AND TRIBUTARIES, FROM MAY 15, 1928, THROUGH SEP. 30, 2003

District or Installation and Class of Work	Allotments	Accrued Expenditures	Unexpended Balance Sep. 30, 2003
Memphis District: (Continued)			
Reelfoot Lake	439,434	439,434	--
Reelfoot Lake, Lake No. 9, TN-KY	7,896,000	7,896,000	--
St. Francis Basin:			
Wappapello Lake	9,019,908	9,019,908	--
St. Francis River and tributaries	320,826,412	320,689,882	136,530
Big Slough and Mayo Ditch	965,429	965,429	--
Little River Drainage	52,486,092	52,485,397	695
Lower White River:			
Clarendon Levee	652,115	652,115	0
Augusta to Clarendon, AR	1,788,846	1,788,846	--
White River backwater levee, AR	10,624,501	10,624,501	--
Horn Lake Creek & Tribs	2,195,300	2,187,930	7,370
Horn Lake Creek Modification, MS	509,000	505,740	3,260
Hickman Bluff, KY	17,339,600	17,293,035	46,565
Memphis Harbor Ensley Berm	3,510,000	3,510,000	--
Nonconnah Creek, Flood Control Ext.	280,000	279,544	456
Nonconnah Creek Recreation Facility	10,910	10,900	10
Nonconnah Creek Environmental Enhancement	61,510	61,479	31
Nonconnah Creek, TN & MS	14,855,399	14,808,061	47,338
Nonconnah Creek, Recreation Extension	24,000	23,846	154
West Memphis and Vicinity	571,000	571,000	--
Whiteman's Creek, Ar	1,895,500	1,895,010	490
Levees under Sec. 6, Flood Control Act of 1928	108,651	108,651	--
West Tennessee Tributaries	54,299,255	54,297,752	1,503
Helena Harbor, Phillips County, AR	14,473,700	14,473,700	0
Helena & Vicinity, AR	6,941,478	6,502,830	438,648
Cache Basin, AR	10,850,000	10,849,291	709
West Kentucky Tributaries	1,440,000	1,440,000	0
Mud Lake Pumping Station, TN	100,000	100,000	0
L'Anguille River	237,432	236,840	592
Eight Mile Creek	3,896,000	3,895,161	839
St. Johns Bayou & New Madrid Floodway	5,261,847	5,249,447	12,400
Eastern Arkansas Reg (Comp)	36,674,361	36,673,606	755
St. Francis Bland Floodway Ditch (Eight Mile Creek)	4,977,789	4,976,403	1,386
Wolf River, Memphis, TN	5,000		5,000
Subtotal	1,657,812,757	1,656,619,452	1,193,305
Vicksburg District:			
Mississippi River Levees	364,665,977	364,362,126	303,851
Section 6 Levees	9,000	9,000	--
Lower Arkansas River:			
North Bank	7,049,414	7,049,414	--
South Bank	15,676,286	15,676,286	--
Tensas Basin:			
Lake Chicot Pumping Plant	95,639,986	95,639,945	41
Tensas River	41,505,235	41,505,235	--
Red River Backwater:			
Below Red River	639,400	639,400	--

TABLE 41-V (Continued) STATEMENT OF ALLOTMENTS AND ACCRUED EXPENDITURES FOR FLOOD CONTROL, MISSISSIPPI RIVER AND TRIBUTARIES, FROM MAY 15, 1928, THROUGH SEP. 30, 2003

District or Installation and Class of Work	Allotments	Accrued Expenditures	Unexpended Balance Sep. 30, 2003
Red River Backwater Levee, LA	137,460,254	137,437,714	22,540
Tensas Cocodrie Pumping Plant	56,071,200	56,071,167	33
Lower Red River South Bank Red River Levees	756,300	756,300	--
Channel improvement:			
Revetments	554,503,704	554,484,337	19,368
Dredging	23,919,516	23,919,516	--
Dikes	197,601,175	197,585,292	15,882
Levees under Sec. 6, Flood Control Act of 1928	958,175	958,175	--
Ouachita River Levees	400,000	400,000	--
Yazoo Basin:			
Sardis Lake	26,502,400	26,502,400	--
Enid Lake	21,292,400	21,292,400	--
Arkabutla Lake	16,000,700	16,000,700	--
Grenada Lake	45,401,494	45,401,494	--
Greenwood	11,543,000	11,543,000	--
Belzoni	316,656	316,656	--
Yazoo City	2,205,611	2,205,611	--
Will M. Whittington auxiliary channel	10,950,966	10,950,966	--
Big Sunflower, etc.	102,996,592	102,939,777	56,815
Main Stem	34,675,248	34,675,220	28
Upper Yazoo Projects	198,524,646	198,333,027	191,619
Yazoo Basin--Tributaries			
Tributaries (Except Ascal-Tippo-Opossum Bayous)	107,497,582	107,480,891	16,691
Tributaries--Bank Stabilization	612,484	612,484	--
Ascalmore-Tippo-Opossum Bayous	23,977,200	23,977,200	--
Yazoo Basin Backwater			
Yazoo Backwater less Rocky Bayou	57,037,435	57,029,560	7,875
Rocky Bayou	3,401,500	3,401,500	--
Yazoo Backwater Pumping Plant	22,649,724	14,969,566	7,680,158
Muddy Bayou	5,145,200	5,145,200	
Yazoo Backwater, F&WL Mitigation	6,415,500	6,415,405	95
Yazoo Basin Reformulation	30,313,143	30,289,926	23,217
Streambank Erosion Control, Eval. and Demo.	14,767,000	14,767,000	--
Yazoo Basin, Demonstration Erosion Control	309,273,741	308,733,487	540,254
Dam Safety Assurances-Sardis Dam	23,235,000	23,235,000	0
Subtotal	2,571,590,845	2,562,712,378	8,878,467
New Orleans District:			
Bayou Cocodrie and Tributaries	5,008,008	5,008,008	--
Miss. & LA Estuarine	4,634,591	4,634,585	6
Channel Improvement:			
Dredging	35,945,266	35,945,266	--
Revetments	1,073,944,792	1,073,856,909	87,884
Louisiana Penitentiary Levee	18,104,502	18,048,724	55,778
Lower Red River (South Bank Levees)	18,056,600	18,056,600	--

TABLE 41-V (Continued)

STATEMENT OF ALLOTMENTS AND ACCRUED EXPENDITURES FOR FLOOD CONTROL, MISSISSIPPI RIVER AND TRIBUTARIES, FROM MAY 15, 1928, THROUGH SEP. 30, 2003

District or Installation and Class of Work	Allotments	Accrued Expenditures	Unexpended Balance Sep. 30, 2003
New Orleans District (Continued):			
Levees Under Sec. 6, Flood Control Act of 1928	200,680	200,680	--
Mississippi River Levees	375,362,524	375,338,811	23,713
Mississippi Delta Region	96,198,143	96,015,402	182,740
Atchafalaya Basin Floodway:			
Atchafalaya Basin	937,342,961	937,069,219	273,742
Atchafalaya River Navigation	303,463	303,463	--
Atchafalaya Basin Floodway System	102,864,814	98,290,988	4,573,825
Subtotal	2,667,966,344	2,662,768,655	5,197,689
TOTAL UNCOMPLETED WORKS	6,899,847,382	6884,577,920	15,269,461
ADVANCE ENGINEERING AND DESIGN (CONSTRUCTION)			
Memphis District:			
L'Anguille River Basin, AR	150,000	150,000	--
Reelfoot Lake, Lake No. 9	30,000	30,000	--
Cache River	420,000	420,000	--
Big Creek and Tributaries, Lower White River	365,000	365,000	--
Clarendon Levee, Lower White River	65,000	65,000	--
West Kentucky Tributaries	175,000	175,000	--
Mud Lake Pumping Station, TN	350,000	350,000	--
Harris Fork Creek, KY & TN	540,000	540,000	--
Subtotal	2,095,000	2,095,000	--
Vicksburg District:			
Yazoo Basin, Big Sunflower River, Steele Bayou	29,700	29,700	--
Tensas - National Wildlife Refuge, LA	200,000	200,000	--
Subtotal	229,700	229,700	--
New Orleans District:			
Mississippi Delta Region (EP 309)	69,753	69,753	--
Teche Vermilion Basin-Water Supply	1,109,000	1,109,000	--
East Rapides & S. Central Avoyelles Parishes	965,247	965,247	--
Subtotal	2,144,000	2,144,000	--
TOTAL ADVANCE ENGINEERING AND DESIGN	4,468,700	4,468,700	--
TOTAL COMPLETED WORKS, UNCOMPLETED WORKS AND ADVANCE ENGINEERING AND DESIGN	7,092,188,627	7,084,648,067	7,540,560

TABLE 41-V (Continued) STATEMENT OF ALLOTMENTS AND ACCRUED EXPENDITURES FOR FLOOD CONTROL, MISSISSIPPI RIVER AND TRIBUTARIES, FROM MAY 15, 1928, THROUGH SEP. 30, 2003

District or Installation and Class of Work	Allotments	Accrued Expenditures	Unexpended Balance Sep. 30, 2003
RECREATION FACILITIES--COMPLETED PROJECTS			
Eight-Year Project Funds			
St. Louis District:			
Wappapello Lake, MO	2,405,300	2,405,300	--
Wappapello Lake, MO, Rockwood Landing	203,286	203,286	--
Subtotal	2,608,586	2,608,586	--
Vicksburg District:			
Sardis Lake	1,584,339	1,584,339	--
Enid Lake	2,268,209	2,268,209	--
Arkabutla Lake	2,189,280	2,189,280	--
Grenada Lake	1,631,281	1,631,281	--
Subtotal	7,673,109	7,673,109	--
Total Eight-Year Program Funds	10,281,695	10,281,695	--
Total chargeable against Flood Control Act Limitations excluding flood control emergencies	7,446,610,287	7,431,340,822	15,269,465
Total maintenance since Jul. 18, 1941	3,858,101,003	3,856,380,225	1,720,779
Total rehabilitation	31,113,000	31,113,000	--
Total flood control emergencies	14,900,300	14,900,300	--
Total general investigations	149,373,640	148,946,903	426,737
Total flood control, MR&T appropriations	11,500,098,230	11,482,681,249	17,416,981
Appropriations in addition to flood control, MR&T			
Other appropriations itemized in footnote (1), pp. 2068-69, Annual Report for 1953	32,068,909	32,068,909	--
Grand total appropriated to Sep. 30, 2003	11,532,167,139	11,514,750,158	17,416,981

Note: Preauthorization study costs chargeable to the MR&T authorization have been transferred to completed work. Costs not chargeable have been excluded from this report.

TABLE 41-W

COST AND FINANCIAL STATEMENT

Project	Funding	FY 00	FY 01	FY 02	FY 03	Total Sep. 30, 2003
Mississippi River and tributaries						
(Regular Funds)[1]	General investigations:					
	Allotted	4,298,200	9,326,826	7,960,700	7,323,000	149,373,640
	Cost	4,343,534	8,815,991	7,985,147	8,325,015	148,946,904
	Construction (includes advance engineering and design):					
	Allotted	180,682,819	193,639,344	182,406,588	161,733,375	7,266,427,388
	Cost	181,928,513	191,326,010	178,368,141	158,042,921	7,251,157,929
	Maintenance					
	Allotted	124,434,981	156,492,122	155,624,712	173,121,625	3,858,101,003
	Cost	123,983,756	155,041,146	156,017,523	173,655,475	3,856,380,204
	Rehabilitations					
	Allotted	--	--	--	--	31,113,000
	Cost	--	--	--	--	31,113,000
	Flood control emergencies (Maintenance)					
	Allotted	--	--	--	--	14,885,992
	Cost	--	--	--	--	14,885,992
(Contributed Funds)	New Work:					
	Contributed	--	--	--	--	34,339,413
	Cost	--	--	--	--	33,270,005
	Maintenance					
	Contributed	6,127,991	1,977,852	4,326,000	1,391,824	20,408,034
	Cost	7,675,222	2,022,470	2,955,166	2,416,581	17,897,372

1. Appropriations were as follows:

Appropriations chargeable against Flood Control Act authorizations:		
Flood Control, MR&T except for emergencies (excludes Maintenance allotments Aug. 18, 1941, through Sep. 30, 2003):		
Net total allotted for works under Mississippi River Commission:	7,435,908,816	
Eight-Year Program Funds, Construction General:	10,281,695	
Surveys under Sec. 10, Flood Control Act of 1928 (not under MRC):	4,995,215	
Transferred to revolving fund:	24,944,460	
Impounded savings:	1,593,097	7,477,723,283
Flood control emergencies:		
Net total allotted:	14,885,922	
Impounded savings:	14,378	14,900,300
Additional funds not chargeable against Flood Control Act authorizations:		
Appropriations for Flood Control, MR&T, except for flood control emergencies:		
General investigations:	149,373,640	
Maintenance allotments Aug. 18, 1941, through Sep. 30, 2001	3,858,101,003	4,007,474,643
Appropriations in addition to appropriations for Flood Control, MR&T (itemized in footnote (1), pp 2068-69, Annual Report for 1953):	32,068,909	
Budgetary and OCE Reserves:		
Grand total:		11,532,167,139

TABLE 41-W
(Continued)

COST AND FINANCIAL STATEMENT

Project	Funding	FY 00	FY 01	FY 02	FY 03	Total Sep. 30, 2003
	Reconciliation of appropriations and allotments:					
	Total allotted to Sep. 30, 2002				11,500,619,989	
	Transferred to revolving fund:				24,944,460	
	Surveys under Sec. 10, Flood Control Act of 1928 (not under MRC):				4,995,215	
	Impounded savings withdrawn by Chief of Engineers:				1,607,475	
	Total Appropriations to Sep. 30, 2001:					11,532,167,139
	Appropriations for past four reporting periods were as follows:					
	FY 98: $296,212,000	FY 00: $309,416,000				
	FY 99: $323,636,541	FY 01: $359,458,292				

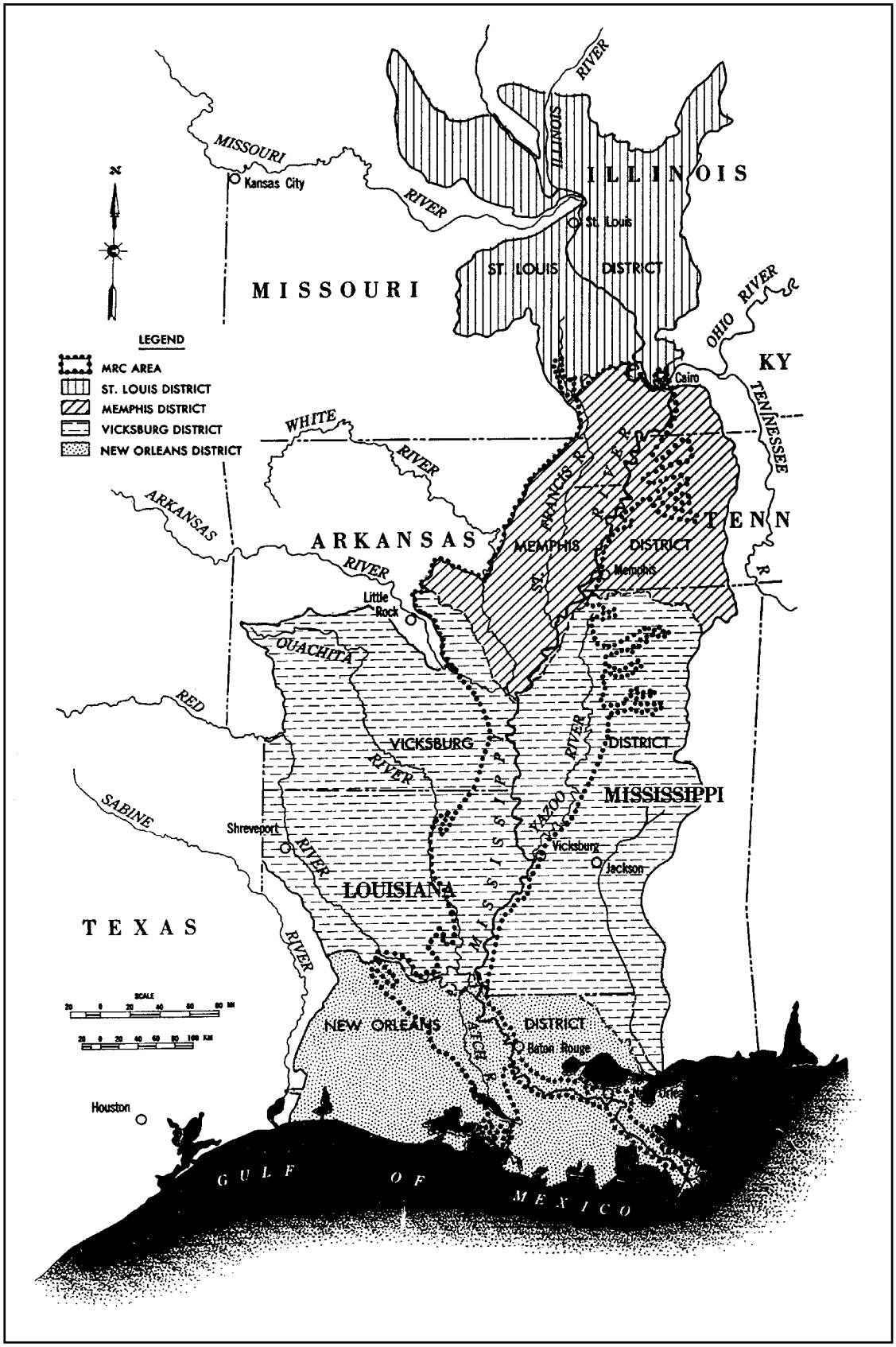
2. Totals for General Investigations include four projects transferred from Construction totals per DAEN-CWB-W, Aug. 4, 1978, teletype.

TABLE 41-X MISSISSIPPI RIVER AND TRIBUTARIES ACTIVE GENERAL INVESTIGATIONS (96X3112)

Item and CWIS Number	FISCAL YEAR COST Federal	Non-Federal	Total
SURVEYS (Category 110)			
Flood Damage Prevention (112)			
New Orleans District			
Morganza, LA to the Gulf of Mexico-012875	900,324	875,890	1,776,214
Subtotal	900,324	875,890	1,776,214
Vicksburg District			
Mississippi Delta, MS-12803	0	0	0
Southeast Arkansas Feasibility - 12756	299 401	0	299,401
Subtotal	299,401		299,401
Memphis District			
Reelfoot Lake, TN - 12394	0	0	0
Subtotal	0	0	0
Total (Category 112)	1,212,231	905,505	2,117,736
Flood Damage Prevention-Recon Study (113)			
St. Louis District			
MS River, Alex City, IL - 010462	77,668	0	77,668
New Orleans District			
Alexandria, LA to the Gulf of Mexico - 81308	525	0	525
Donaldsonville, LA to the Gulf of Mexico - 013510	295,036	0	295,036
Subtotal	295,561	0	295,561
Memphis District			
Wolf River, Memphis, TN - 13157	1,967	0	1,967
Millington and Vinicity, TN - 81375	29,933	0	29.933
Fletcher Creek, TN - 81409	29,568	0	29,568
Subtotal	61,468	0	61,468
TOTAL (Category 113)	413,246	179,485	592,731
Flood Damage Prevention – Feasibility Study (114)			
Memphis District			
Germantown, TN – 081361	190,750	0	190,750
TOTAL (Category 114)	190,750	0	190,750
Special Reconnaissance Study (115)			
Vicksburg District			
Spring Bayou, LA – 081338	114,506	0	114,506
TOTAL (Category 115)	114,506	0	114,506
TOTAL (Category 110)	1,739,982	1,084,990	2,824,973

TABLE 41-X (Continued) MISSISSIPPI RIVER AND TRIBUTARIES ACTIVE GENERAL INVESTIGATIONS (96X3112)

Item and CWIS Number	FISCAL YEAR COST Federal	Non-Federal	Total
COLLECTION AND STUDY OF BASIC DATA (Category 120)			
New Orleans District – Surveys, Gages & Observations – 81900	27,552	0	27,552
Vicksburg District - Surveys, Gages & Observations - 81900	233,882	0	233,882
Memphis District - Surveys, Gages & Observations - 81900	169,033	0	169,033
TOTAL (Category 120)	362,221	0	362,221
CONTINUATION OF PLANNING & ENGINEERING (Category 140)			
Flood Control Projects (140)			
Memphis District			
Reelfoot Lake, TN & KY, - 012394	55,003	0	55,003
Wolf River, Memphis, TN – 013157	169,556	0	169,556
TOTAL (Category 140)	224,559	0	224,559
PRE-CONSTRUCTION ENGINEERING & DESIGN (Category 160)			
Flood Control Projects (162)			
Memphis District			
Bayou Metro Basin, AR - 81307	2,074,477	0	2,074,477
Eastern Arkansas Region (Comp) - 081266	0	0	0
St. Johns Bayou & New Madrid Fdwy – 077005	0	0	0
Subtotal	2,074,477	0	2,074,477
New Orleans District			
Morganza, LA to Gulf of Mexico - 012875	320,019	0	320,019
Subtotal	320,019	0	320,019
TOTAL (Category 160)	2,212,268		2,212,268
GRAND TOTAL MR&T GENERAL INVESTIGATIONS	4,343,533	1,084,990	5,428,523



Mississippi River Commission

U.S. ARMY ENGINEER RESEARCH AND DEVELOPMENT CENTER

BACKGROUND

The research and development laboratories of the U.S. Army Corps of Engineers have served the Corps, the Army, and the Nation with technical accomplishments in a variety of engineering and scientific fields for more than 70 years. From beginnings in 1929 as a small hydraulics laboratory established to assist in developing a comprehensive plan for flood control of the Mississippi River to the 1999 establishment of the Engineer Research and Development Center (ERDC) consolidating the research and development efforts of the laboratories under the leadership of a single center, Corps' laboratories have been solving civil engineering and environmental quality challenges. ERDC offers a centrally managed center of seven laboratories that is the largest and most diverse civil and environmental research and development organization in the world.

During FY03, ERDC had 1,948 employees of whom 1,059 are highly trained engineers and scientists. The professional staff encompassed 301 Ph.D.'s and 438 Masters' degrees.

ERDC executed a Civil Works program totaling $116 million; of this total, $51 million was executed in direct allotted R&D Programs. The remaining $65 million was executed in support of USACE District and Division offices and non-Corps customers.

LABORATORIES

The diverse civil engineering and environmental quality research and development center consists of seven centrally managed laboratories located at Alexandria, VA; Champaign-Urbana, IL; Hanover, NH; and Vicksburg, MS. With world-renowned expertise and facilities, each laboratory adds a unique perspective and set of capabilities to the overall ERDC team.

Coastal and Hydraulics Laboratory

The Coastal and Hydraulics Laboratory (CHL) is the Nation's center for engineering and scientific research and development in the coastal, hydraulic, and hydrologic engineering and sciences. It conducts research and supports the Corps of Engineers in conducting it's navigation, flood and coastal storm damage reduction, environmental restoration, and military engineering missions. CHL is comprised of nationally and internationally recognized experts that perform research and site-specific investigations in the fields of rip-rap design; navigation engineering; pump station design; fisheries engineering; sediment transport; estuarine engineering; dredging; hydrodynamics; groundwater, watershed, and surface water modeling; coastal storm and flood damage protection; harbor design and modification; coastal and hydraulic structures; physical processes associated with water resources; environmental problems; military logistics-over-the-shore; wave climatology; and hydroinformatics.

Cold Regions Research and Engineering Laboratory

The Cold Regions Research and Engineering Laboratory (CRREL) maintains the finest research and engineering staff and facilities in the world for the study of cold regions science and technology. CRREL's experience spans nearly 60 years, starting with the Boston District's Soils Laboratory work on frozen soils in the early 1940s. The creation of CRREL began in 1961 with the merger of the Arctic Construction and Frost Effects Laboratory and the Snow, Ice, and Permafrost Research Establishment. This merger put the Department of Defense principal cold regions expertise in one place. In 1971 a long-term program by the Corps of Engineers to investigate ways of extending navigation on the Great Lakes-St. Lawrence Seaway throughout the winter also marked the beginning of Civil Works research at CRREL.

CRREL is recognized for its internationally known experts in the field of ice jam flooding and ice-hydraulics; ice control at locks, dams and other navigation channels; snowmelt modeling & simulation; and other areas ranging from geotechnical aspects of frozen ground to new admixtures for placing concrete in the winter. CRREL's specialized research facilities include a complex of cold rooms, an Ice Engineering Facility housing three special-purpose research areas; a large

low-temperature towing tank, a refrigerated flume for modeling rivers, and a large hydraulic-model room. CRREL is also home to the U.S. Army Corps of Engineers Center of Expertise for Civil Works Remote Sensing/Geographic Information Systems.

Construction Engineering Research Laboratory

The Construction Engineering Research Laboratory was chartered over 30 years ago to provide construction research that would address the entire spectrum of issues within military construction. This research is in support of sustainable military installations and encompasses construction, operations, and maintenance as well as environmental and safety concerns. These technologies have universal application and are of extreme value in the Civil Works arena as well. Civil Works efforts historically have been in the areas of corrosion control, high performance protective coatings (including over-coating of lead-based paint), management tools for Operation and Maintenance optimization, and environmental sustainment.

Environmental Laboratory

ERDC's Environmental Laboratory is the acknowledged international leader in environmental quality and environmental restoration research. Solving problems in these two areas has involved the Environmental Laboratory in the following activities:

- Evaluating and mitigating the consequences of water resources development, navigation, and dredging on the environment.
- Regulating and restoring wetlands and inland and oceanic water quality.
- Stewardship of natural resources.
- Managing cleanup of contaminated groundwater sediments and soils.

For over 30 years, an interdisciplinary staff of peer-recognized professionals, augmented with the finest network of academic and private scientists and engineers in the country, have provided the environmental quality and environmental restoration technology necessary to further the Corps' missions.

Notable examples of recent accomplishments include technology input to an ocean pollution treaty (London Convention), natural resource management to guide Corps stewardship at projects; improved techniques for stream and riparian restoration; research to accelerate growth of desirable, non-problem vegetation; distribution of the first-ever expert system/information manual on using biological control agents to manage nuisance aquatic plants; risk-based contaminated sediment and soil toxicological assessment protocols; and providing guidance to the field on controlling zebra mussel infestations using anti-foulant coatings (paints, thermal metal sprays, etc.), development of an upland disposal testing and assessment manual for dredged material, and continuous backwash filter systems for intakes that supply irrigation systems, water supply, and other low-flow requirements.

Geotechnical and Structures Laboratory

The Geotechnical and Structures Laboratory (GSL) was formed in October 2000, by consolidation of the Geotechnical Laboratory, established in 1931, and the Structures Laboratory, formed in 1983 by combination of the Concrete Laboratory and the Weapons Effects Laboratory. The Concrete Laboratory had existed at WES since 1946, when it was transferred from Mt. Vernon, NY. Formation of GSL was undertaken to capitalize on research synergies that had been developing over the years involving prediction of behavior of structures built in or with earth materials and the effects of weapons and explosives on earth materials or earth construction.

GSL conducts research in soil and rock mechanics, earthquake engineering and geophysics, tunneling and trenchless technology, engineering geology and seismology, vehicle mobility and trafficability, unexploded ordnance detection, and pavement technology. The Laboratory also researches the response of structures to weapons effects and other loadings, investigates methods for making concrete and other materials more durable and economical, studies the application of explosives technology to military and civilian engineering, and investigates the behavior of earth/structure systems subjected to blast loading and projectile penetration. GSL is a world leader in research on effects of earthquakes on embankment dams and the evaluation, maintenance, and rehabilitation of mass concrete, steel and reinforced structures.

Information Technology Laboratory

The Information Technology Laboratory (ITL) serves the U.S. Army and the Nation by advancing, applying, and delivering information technologies (IT) that address a wide range of engineering,

scientific, and management challenges. As the lead in delivering end-to-end solutions across the IT spectrum, ITL provides the underlying, enabling technologies needed to solve problems and assists in the transition and infusion of products to the customer. ITL ensures the integration, synergy, and leveraging of IT and closely related technologies across ERDC and facilitates R&D program development, management, integration, and marketing with particular emphasis in the areas of (a) information science, interoperability, and assurance and (b) computational science and engineering.

ITL manages one of the four High Performance Computing Major Shared Resource Centers formed under the auspices of the DoD High Performance Computing Modernization Program; and the CADD/GIS Technology Center for Facilities, Infrastructure, and Environment, a multi-agency vehicle to coordinate CADD/GIS activities within DoD and with other government agencies (one of two Corps of Engineers Enterprise Infrastructure Services Processing Centers). The Laboratory also has one of the largest high-bandwidth, high-speed data communication networks in the world, and one of the finest civil engineering libraries in the Federal Government.

ITL is also highly recognized for its expertise in the areas of Facilities Management technologies required by Army Civil Works projects; computer-aided interdisciplinary engineering and analysis; computer science applications; scientific visualization (including virtual reality); support to R&D and application efforts requiring sensors, graphic arts and publishing; and collaborative technologies.

Topographic Engineering Center

The Topographic Engineering Center (TEC) provides new topographic capabilities in geospatial science to the Civil Work's community to ensure superior implementation of the nation's civil and environmental initiatives through research, development, and application of remote sensing, geographic information, global positioning, topographic, hydrographic and information technologies. TEC scientists and engineers continue to develop faster, more accurate, and cost-effective ways to use new remote sensing technologies to describe, characterize, and analyze the surface of the earth. Remote sensing technologies form an essential part of a new national approach to infrastructure engineering and environmental stewardship.

Remote sensing tools can accurately characterize different surface characteristics, conditions, and future states, including certain types and conditions of vegetation, soils, and surface water. With further development, this will provide support in an effort to monitor and predict changes in the biosphere. These tools provide indicators for the location of point and non-point pollution sources as well as advise of impending negative or positive trends.

ARMY CIVIL WORKS R&D PROGRAMS

Army Civil Works research and development efforts cover virtually the entire spectrum of technology and problem areas in the Army's Civil Works arena.

Infrastructure Engineering Research Area

The focus of the Infrastructure Engineering Research Area is to provide new or enhanced technologies to extend the life and reduce life-cycle costs of Corps' Civil Works facilities in an environmentally friendly and sustainable manner. These technologies are produced by aggressively developing high-performance materials and systems, with major emphasis in reducing rehabilitation and maintenance costs; refining material characterization; and improving analytical procedures to assess the adequacy of aging facilities and design/analyze rehabilitation measures.

The research will furnish the Corps with improved analysis technologies to ensure a continued high level of safety and reliability, technologies to more economically design and construct required remedial and rehabilitation improvements, and technologies to conduct this work with minimum ecological impact, positive environmental support, and using sustainable methods and materials. The results of R&D efforts are posted on the web to assist rapid dissemination and updating as progress is made.

Infrastructure Technology Research Program. This program represents the reformulation of earlier Civil Works research programs (Earthquake Engineering, Geotechnical Engineering, and Concrete and Structural Engineering) into a new continuing program that addresses infrastructure-related issues involving all business areas within the Corps within an environmentally sustainable framework. Research activities under this program are focused on the development of technologies that

enable the Corps to: 1) enhance existing infrastructure to extend its functional life, improve operational efficiency, ensure a high level of reliability, produce a minimum of pollution, and avoid or repair environmental damage; 2) reduce operation and maintenance costs of existing water-resource infrastructure while supporting environmental sustainability; 3) provide innovative design and construction technologies to allow faster, more economical water-resource infrastructure construction and reduce the environmental impact of construction projects; 4) capture corporate knowledge to maintain corporate expertise and promote effective technology infusion into the field. FY03 accomplishments include:

- Developed computer tools with enhanced capabilities for erosion stability assessment of unlined rock-surface spillways/ channels.

- Developed guidance for safe and durable, but also sustainable, infrastructure repair and construction materials, design, construction and application procedures. Developed materials specifications for the improvement of concrete workability and testing methods for problem field cases. Investigated causes of adverse material interactions.

- Reviewed available techniques and methodologies applicable to the strengthening of damaged concrete in hydraulic structures for effective temporary repairs as well as for rapid execution of permanent repairs to extend their service life. Collected and analyzed data related to durability of concrete beams and updated web-accessible database and gained knowledge on how exposed materials perform under natural weathering cycles.

- Evaluated and compared load strength design factors used in design guidelines for reinforced concrete hydraulic structures (EM1110-2-2104) with current design building codes (ACI 318-02) using typical design cases. Developed a sensitivity analysis study of NISA (Nonlinear Incremental Structural Analysis) material parameters for preliminary design.

- Developed guidelines for high-performance bushing materials for tainter gates. Tested methodology for greaseless bushings to evaluate coefficients of friction and wear, both wet and dry, and for swell (or shrinkage) in water and to evaluate long-term creep. Provided a bearing rating system for use by the hydropower industry. Developed test methodology for greaseless bushings suitable for ASTM standard adoption.

- Developed finite-element models of typical connections on hydraulic steel structures to quantify stress concentration at girder downstream flange connections. Developed preliminary criteria and procedures on fitness for purpose analysis of hydraulic steel structures.

- Developed a nondestructive evaluation method for the condition assessment of lock and dam tainter gate anchors to measure the tensile stress in the tendons and to determine the degree of corrosion that is present. Developed ASTM standards for acoustic interrogation of embedded steel for the determination of tension and degree of corrosion on steel members surrounded by a concrete matrix with only a single exposed end.

- Developed tools to assure life-safety from earthquake damage to Corps' dams and reservoir control structures. Assessed existing and potential retrofit solutions for intake/outlet structures, which included the development of evaluation procedures for comparison of pre- vs. post-retrofit performance alternatives. Improved evaluation procedures for the assessment of the global (sliding and overturning) stability of concrete gravity dams.

- Developed guidance for performance evaluation of modified structures and assessment of relative technical merits of alternative remediation solutions. Developed guidance for evaluation, assessment and implementation of retrofit alternatives for intake/outlet structures.

- Developed guidance related to type, amount, and location of damage of earth embankments on weak foundations, including most appropriate remediation alternatives for various dam scenarios.

- Developed engineering procedures and computer tools for seismic sliding analysis of earth-retaining structures with permanent displacements. Developed simplified procedures for seismic response spectra based soil-structure interaction analysis of rock-founded massive concrete lock retaining walls with seismically induced rocking. Developed engineering procedures and computer tools for seismic

rotation analysis of earth-retaining structures with pool and partially submerged backfill. Developed guidance on seismic rehabilitation procedures for the backfill, foundation and structural elements of earth-retaining structures.

- Initiated the development of a field deployable, prototype acoustic imaging system that provides real-time, high-resolution 3D acoustical images of underwater objects that can be transferred to 3D software COTS programs.

- Modified coding and added features that extend the applicability of CASE (Computer Aided Structural Engineering) tools and documents by leveraging existing common delivery framework functionality and improved product transfer.

High-Performance Materials and Systems Program. This program concluded in FY03. The purpose of this program was to develop new and improved materials and technologies that will enable the Corps to significantly reduce project delivery times and operations, maintenance, and rehabilitation costs.

This program included results from many initiatives. Some of the overall advances include:

- Development of procedures for materials selection and mixture proportioning for a family of low-cost, high-performance concrete
- Evaluation to quantify the effects of moist curing on the strength and durability of concrete repairs; performance criteria for polymer-modified cement repair materials were developed
- Screening tests on shrinkage reducing admixtures were completed
- Evaluations of various combinations of cement, silica fume, fly ash, and blast-furnace slag for strength and resistance to freeze-thaw cycles.
- Evaluation of air entrainment effects on durability was completed
- Preparation of an evaluation matrix and field evaluation of self-lubricating bushings for lock machinery applications was completed and an evaluation of the performance of self-lubricating bushings for floating mooring bitts and culvert valves was completed
- Evaluation of recyclable steel abrasive to determine the amount of rounding that occurred from reuse as well as the rounding effects on the adhesion of both organic zinc primers and metallized coatings

FY03 accomplishments under this program include:

- Published report that provides guidance and field assistance in the proper selection, specification, inspection and performance of coating systems. The report also includes evaluations of the following products and effects:
    - New environmentally acceptable coatings.
    - Commercial products to replace SSPC Paint 25
    - Products to replace TT-P-38
    - The effect of recycling steel-grit blast abrasives on overall coating performance, the working parameters of metallizing equipment, and moisture cure urethane paint systems

- Published report documenting the evaluation of, and installation procedures for self-lubricating lock machinery such as lock gate pintle bearings.

- Completed laboratory tests with a follow-on field test demonstrating the capability of the Electro Osmotic Pulse (EOP) technology for controlling seepage in hydraulic structures. An EOP system was installed at the old lock house at Dresbach lock and dam, which provided a dry environment in what had previously been an area with ongoing moisture problems.

- Developed a method to provide entrained air in critical portions of roller compacted concrete (RCC) to improve the durability of RCC by making it more resistant to possible freeze-thaw damage.

- Tested ABC cement for durability including resistance to ASR, sulfate attack, and scaling due to deicing salts.

Risk Analysis for Dam Safety Program. The focus of the Risk Analysis for Dam Safety Program is to provide aid in allocating investments to improve the safety of Corps' dams. All Federal and state agencies responsible for the design, construction, operation, or regulation of water resource projects have recognized the need for making sound investment decisions regarding dam safety.

The USACE is responsible for managing risks for its 569 dams and protecting the public from the devastation that could be caused by catastrophic failure. While many of the USACE civil works

projects have not been subjected to their maximum design conditions, 65 Corps' dams have been identified as being hydrologically or seismically deficient. Developing and implementing risk analysis methods will enable the Corps to prioritize dams requiring initial investigations and subsequent analyses; prioritize funding for critical repairs, rehabilitation, or modifications; select and justify the optimal plan to protect human life, reduce property damage, and mitigate environmental damage; minimize the disruptions of service; and maximize effectiveness of infrastructure investments.

A multi-agency, multi-national workshop evaluated the current use of risk analysis for dam safety and provided an assessment of the research program to ensure it will meet USACE's future needs. To date accomplishments include, a well-calibrated engineering risk-based analysis framework for performing site-specific risk assessments and portfolio prioritization, along with guidance for estimating loss of life and economic consequences. Several demonstration projects were completed which document the development and fine-tuning of risk analysis procedures for a single dam site and for a regional portfolio of dams. A variety of models and procedures (estimate of annual probability of rare flood, simplified approach for uncertainty of dam stability caused by uplift pressures in foundation, prediction model for unlined spillway seepage and piping), which provide input for this framework, are being finalized. This process has led to the formation of a cadre of Corps personnel experienced in execution of these engineering risk studies.

FY03 accomplishments included completion of a Portfolio Risk Analysis of Huntington District and Baltimore District dams, and development of draft Guideline For Conducting Dam Safety Portfolio Risk Assessments For Corps Districts.

Navigation Research Area

The Corps of Engineers' navigation mission is to provide safe, reliable, efficient, effective, and environmentally sustainable waterborne transportation systems (channels, harbors, and waterways) for movement of commerce, national security needs, and recreation. The U.S. Marine Transportation System (MTS) consists of over 300 ports, 1,000 harbor channels, and 25,000 miles of navigation channels, and is an integral part of both the U.S. economy and national security system. The MTS contributes more than $700 billion per year to the gross domestic product, produces $150 billion per year in federal taxes, and employs more than 13 million people. It supports rapid deployment of military forces and movement of equipment and supplies from strategic ports. Despite its importance, the MTS is under serious strain. The Congressionally-mandated interagency MTS task force and maritime industry report that commercial navigation will double by 2020; yet the MTS is already operating at near-full capacity in many areas and is being challenged by new vessel designs and traffic loads which exceed its channel, harbor, and lock capacities. Eighty-three Corps' locks are older than their 50-year design life, and 11 of them are over 80 years old.

In light of these pressing national needs, this research and development program area provides tools and technology for the Corps of Engineers to improve the navigation system's functional performance, preserve and enhance the environmental quality of waterways, reduce unit costs, and improve safety. Specific objectives of this research are to develop engineering technologies that increase the effectiveness and reduce the per project costs of harbor and channel projects that provide deep-draft and shallow-draft navigation for domestic and international commerce.

Navigation Systems Program. This program includes specific shallow-draft and deep-draft (including the Great Lakes) focused R&D research in coastal and inland channel design; sedimentation and dredging; and structure evaluation and design. Under this program, engineering tools, computer models, and design guidance are developed for defining and managing water levels and currents that affect navigation and sedimentation, waves that impact coastal structures and drive sedimentation processes, sediment that settles in navigation channels and harbors, impacts of ice and debris on locks, and vessel transits within navigation channels and inland locks. Other engineering tools, computer models, and design guidance are developed to enable rapid and economical navigation facility design, construction, repair, and rehabilitation. This research program balances efforts on critical present-day problems facing the Corps of Engineers with those that prepare the Corps to meet U.S. navigation system needs of the future.

FY03 accomplishments of the Navigation Systems Program include:

- Development of Risk based guidance for design of navigation channels pertaining to required under keel clearance for deep-draft vessels in entrance channels. With increasing vessel drafts

and continued improvements in bulk carrier and intermodal transportation efficiencies, more accurate channel design guidance will enable greater capacity in existing navigation channels and optimize maintenance dredging costs

- Development of a hydrodynamic model as a screening tool in designing lock approaches and evaluating various wall types to ensure safe, efficient, navigation conditions, and minimize unnecessary costs. Improvements to lock approaches have a high potential for reducing traffic delays on the inland waterway system and increasing the capacity of existing locks.

- Improved wave and littoral transport models, by incorporating more realistic physics and a standard graphical user interface. Extensive field data sets were used to improve the models' formulations and verify their reliability. These tools will collectively provide the Corps with more effective management of coastal navigation projects with less impact on adjacent shorelines and improved estimates of channel infilling and dredging costs.

- Incorporated a state-of-the-art hydrodynamic model with a discrete element model (DEM) for simulating ice and debris flows through locks. This combined model will allow more accurate simulations of ice and debris fields at locks, thus providing the ability to develop more effective methods to reduce impacts of ice and debris. These developments will increase throughput at locks impacted by debris during floods, and at locks on the Great Lakes, Illinois, Mississippi, and Ohio River that experience ice problems.

Regional Sediment Management (RSM) Program. The ERDC laboratories and the Institute for Water Resources, along with partners from federal, state, and regional governments and academia, are pursuing a rigorous investigation of a regional sediment management approach to solving sediment related problems. The RSM program is developing tools and knowledge necessary to understand the effects of sediment management actions at both local and regional scales. The program is developing methods and procedures to design regional sediment plans. The studies include all landscapes, from the upper watershed to the coastline.

The major products resulting from the research include a watershed sediment budget tool that can be used to rapidly assess the impacts of upstream watershed activities on downstream channels; morphology modeling systems for coast and river systems that predict long-term, large-scale morphology changes; and a framework for developing RSM plans and implementing RSM in the field. RSM Focus Areas include (a) River-basin morphology modeling and management, (b) Coastal morphology modeling and management, (c) Sediment processes and assessment, and (d) Sediment management methods. The work areas fall into five categories; (a) Basic sediment processes, (b) Engineered solutions, (c) RSM tools, (d) Informatics, and (e) Technology transfer and insertion.

The RSM Demonstration Program showed that managing sediment on a regional scale results in significant cost savings and increased benefits. The Demonstration Program also showed that extensive and intensive partnerships and stakeholder involvement are necessary for successful regional sediment management. Because 'regions' may extend beyond the limits of Corps projects and, at times, beyond District boundaries, many stakeholders with varied objectives and disciplines must become involved. Often, the Corps is the facilitating agency in developing regional sediment management plans, as is the agency with the technological skill and capability to assess the impact of alternative plans.

Research accomplishments to date include identification of the information requirements (e.g., computational models, inputs/outputs of the models, sources of data, etc.) necessary for performing regional sediment management. An 'as-is' information model was developed and further analyzed to determine areas where data collection and dissemination processes could be streamlined to improve the interoperability of the computational models, reduce the development costs, eliminate or reduce the need for manual data manipulation processes, and allow RSM to leverage with other USACE efforts. This analysis resulted in a 'to-be' information model.

RSM management also proceeded with establishing the administrative and communications frameworks needed to keep all stakeholders informed about the state of the science investigated under the RSM programs. FY03 accomplishments of the Regional Sediment Management Program include:

- Sediment Impact Assessment Model, for quick and comprehensive analysis of upstream sediment supply change impacts on downstream conditions

- HEC-RAS sediment transport and morphology change computation capability added to the Corps' premier 1-D river hydraulics model.
- Computational library for sediment modules, including subroutine ONCE
- ADH adaptive-grid hydrodynamics model developed for river applications
- GSSHA overland sediment transport module added to multi-dimensional watershed model
- CASCADE model and toolbox developed for multi-project coastal region (e.g., inlets and adjacent beaches) simulations to cover decades of shoreline evolution
- Science and engineering data browser developed to interrogate web-served data sources, and to determine data type and availability for a specified geographic region
- RSM portal as an information source and communication forum for Corps RSM researchers and field personnel
- RSM website to provide information to the public on research activities, products, news, calendar events, and related research
- Product Life-Cycle Planning approach to formulating requirements for R&D to serve field needs, including identification of steps and proponents for developing capabilities and sustaining capabilities after development

Flood and Coastal Protection Research Area

The Corps of Engineers' flood and coastal storm damage reduction mission is to provide safe and reliable projects that reduce damages to property and prevent loss of life from both inland and coastal flooding. The Corps maintains over 8,500 miles of levees and operates 383 major lakes and reservoirs to reduce flood damages. In spite of the completed projects and in-place infrastructure, there are over $4 billion in flood damages annually. The overall objectives of this research in these areas are to develop new flood and coastal storm damage reduction technologies to enhance the effectiveness of projects, develop innovative techniques to reduce flood and coastal storm damages, and allow the integration of analysis tools to accelerate the study and design process for both inland flood damage reduction and coastal shore protection. Engineering tools, computer models, and design guidance are developed for flood and storm damage analysis, channel restoration evaluations, improvements in ice engineering, and evaluation and improvement of multi-dimensional hydrodynamic modeling.

Flood and Coastal Storm Damage Reduction Program. Technologies must be continually advanced for inland flood protection, coastal storm protection, beach nourishment, and the unique flood damage reduction demands of urbanized settings, to ensure that each project is sustainable. In the inland area, there is a shifting focus for new projects from large flood damage reduction projects towards watershed management and smaller flood damage reduction systems. This requires an emphasis on the development of appropriate design guidance and planning and engineering technology to accelerate the process of restoring channels in a more cost-effective and environmentally sound manner. The sedimentation response of flood-control channels, bank protection methods for flood-control and navigation channels, ice impacts on flood-control and navigation channels and structures, and impacts of climate change on hydrologic events must be addressed.

Historically, the focus of the Corps' efforts has been on the construction of large infrastructure projects for flood control and navigation, with an emphasis on sociological and environmental goals in the past several decades. The implementation of risk analysis in the planning of Corps projects has allowed a quantitative evaluation of the benefits and costs associated with different levels of protection. Future flood damage reduction projects in urbanized inland and coastal areas will require innovative planning, design, construction, operation and maintenance, and emergency response methods to provide adequate protection for current and projected growth.

As new and innovative technologies and methodologies are developed, it will be critical to transfer information about these innovations to the Corps, other Federal, state, and local agencies, and to the public as quickly and efficiently as possible so that they can be effectively applied. It is equally important to validate the applicability of the innovative technologies through demonstrations at Corps projects. There has been a new focus on development of innovative technologies for existing flood damage infrastructure, especially levees. New technologies are needed to ensure existing levees provide the authorized level of protection and to

assist with flood fighting operations. Innovative use of remote sensing for detection of weakened levees, satellite linked GIS/GPS laptops to assist with onsite flood fighting, and improved flood forecasting capabilities must be integrated.

While the emphasis for new types of projects is shifting, concurrently, existing projects must be kept optimally consistent with authorized purposes. Improved analysis methods for decision support of reservoir operations are needed. Also, watershed and riverine analysis methods need improvement to take advantage of new real-time data sources, such as precipitation radar, to accurately forecast real-time flow and stages. In addition, advanced statistical methods are needed to better understand project inflows and performance.

Increased research emphasis is being undertaken to develop new technologies for reducing flood damages in urban areas that include both structural as well as non-structural alternatives. Urban development in the inland areas, as well as the coastal areas, requires new technologies to reduce the flood damages. Innovative methods must be developed to reduce flood damages, protect vital urban infrastructure, and restore damaged urban channels.

FY03 accomplishments of the Flood and Coastal Storm Damage Reduction Program include:

- Released HEC-HMS Version 2.2.2 with applications guide and HEC-ResSim Version 2.0, a reservoir operation simulator
- Expanded features in HEC-GeoHMS and HEC-GeoRAS, by adding digital dozer and grid utilities
- Released 'alpha' version of HEC-FDA, Flood Damage Assessment tool.
- Grade control structure analyses at (a) Burney Branch, MS, (b) Blue Creek, IL, (c) Brush Creek, KN, (d) Blue River, CO, (e) Hotopha Creek, MS, (f) Little Snake River, CO, (g) South Fork Little Snake River, Co, (h) Middle Ford Worsham Creek, MS, and (i) Perry Creek, MS
- Numerical model SIAM validated for grade control siting
- Developed and tested method of combined ice and open-water stage frequency, and accepted by FEMA
- Designed and tested new ice motion detector, and tested new ice jam stage alarms
- Fully integrated the DSPM snowmelt modeling capability in HEC-HMS Version 3.0
- Improved GUI for SNOW to include expanded spatial modeling capabilities, and made it compatible with other USACE models (e.g., HMS, XMS, etc.)
- Successfully tested Electro-expulsion de-icing panel successful Starved Rock Lock
- CRREL and Bridgestone USA developed a new inflatable de-icer design
- Updated Engineering Manuals
- Published Technical Reports, Technical Notes, Conference Papers, and refereed Journal Articles

Technologies and Operational Innovations for Urban Watershed Networks (TOWNS) Program. The largest population growth areas in the United States are urban areas, particularly those near the coastlines and along rivers. More than 54 percent of the US population lives within 50 miles of a coast. Over the years, stream systems in the United States have been significantly altered by natural events and human activities. The construction of dams, levees, diversion structures, and the straightening, widening, deepening, and clearing of channel systems have been typical techniques for improving channel systems for a variety of purposes that include flood control, navigation, water supply, sediment management, irrigation, recreation, hydropower, mining, and fish and wildlife habitat improvement. Urbanization patterns in our nation's watersheds have also affected their hydrology, changing flood characteristics such as peak stage and time to peak. The cumulative impacts of these types of activities, combined with watershed changes such as deforestation, have significantly disrupted the dynamic equilibrium of stream systems and the ecosystems of which they are a part. To achieve effective flood damage reduction in urbanized inland and coastal areas, innovative planning, design, operation and maintenance, construction, and emergency response methods are required to provide adequate protection for current and projected growth.

The objectives of the TOWNS research program are to develop an improved understanding of urban flooding processes, both coastal and inland, and to apply this knowledge to the development of innovative and improved methods for the planning, design, construction, maintenance, operation, and monitoring of urban flood damage reduction projects to maximize benefits in a manner that is morphologically, environmentally, socially, and economically sustainable.

Three broad focus areas are identified within this strategic plan: (a) Urban Flood Damage Decision Support; (b) Sustainable Urban Flood Damage Reduction; and (c) Expedient Emergency Measures. Each of these basic research areas is divided further into individual subtasks. The topic areas and their subtasks are all interrelated and will be integrated through effective technology transfer to provide the tools necessary to meet the objectives of the TOWNS program. A web portal system for communication with field personnel was designed and implemented.

FY03 accomplishments of the TOWNS program include:

- Completed a geospatially-based analytical tool for the prediction of piping and seepage, as well as a workshop with the Corps Committee on Piping and Seepage to identify critical research area needs.

- Conducted second workshop to discuss identification of, and remedial approaches to, beach renourishment project hot spots. This workshop had 29 participants from Atlantic, Gulf of Mexico, Great Lakes, and Pacific coastal Districts, Divisions, HQ, and ERDC. The group discussed field experience related to project vulnerabilities from hot spots, and nine Districts presented 20 case studies. The workshop was summarized in a Technical Note that provides information on suspected causes and remedial approaches to erosion hot spots along with engineering guidance and analysis procedures.

- Defined the numerical modeling requirements and procedures necessary to develop a Shore Response Database (SRD) required by the CE-Shore Monte Carlo simulation model for economic evaluation of Storm Damage Reduction Project.

- Nonstructural flood damage reduction methods were addressed through the development of a design document for upgrades to HEC-FDA. Implementation was begun.

- As part of the integrated urban decision support system, a prototype for calculating damage with flood inundation boundary maps was developed, and integration in HEC-FIA has begun. A web-based reporting system was demonstrated for direct input of HEC-RAS inundation maps, and HEC-FIA damage and impact tables and coverages, into EngLink.

- The initial integrated messaging system among the levee warning system, (CWMS and EngLink) was implemented.

- A preliminary inland coincident frequency analysis method considering correlated frequencies was developed for use in risk and uncertainty analyses.

- In other modeling improvements, the SIAM model developed under RSM was modified for implementation in HEC-RAS. The user interface to enter all data for SIAM was completed, and SIAM was joined to HEC-RAS so that annual sediment budget computations can now be performed from within HEC-RAS. Several graphics and tables for showing SIAM output were developed.

- Progress on the evaluation of innovative structures for raising levee height was made on several fronts. A test protocol was developed for laboratory testing of methods and technologies. The laboratory facility was completed and tested, and all data collection programming was re-written and improved. A new system for tracking seepage flow was developed and implemented. The database of innovative flood-fighting technologies was updated and improved. A draft report on sandbag testing was completed.

- Developed initial user interface, image annotation, and real-time projection capabilities for the expedient documentation system.

- Constructed and tested a towed rapid geophysical survey system (RaGSS) with single frequency electromagnetic induction (EMI), multi-frequency EMI, total field magnetometer (TFM), capacitively-coupled resistivity, and DC resistivity, on a homogenous levee.

Environmental Technologies Research Area

The Corps operates and maintains 25,000 miles of inland and coastal navigation waterways, 562 reservoirs (5,500,000 surface acres), 237 navigation locks, 926 harbors, 75 hydropower projects, 879 flood control projects, and thousands of acres of adjacent lands as part of its water resource mission. Wide-ranging environmental stewardship is an integral part of Corps water resource management. Moreover, recent U.S. figures have estimated $16 billion per year in damages caused by point- and non-point-source pollution and up to 1 billion tons per year of eroded soils and industrial and agricultural contaminants deposited in the Nation's waterways. Over 12,000 miles of streams and rivers are directly impacted by acid mine drainage from an estimated 200,000-500,000 abandoned mines. These impacts are severely affecting multiple project uses, impeding navigation, and negatively affecting human and ecological health. A critical part of the Corps mission is to ensure that project planning, construction, operation, and maintenance activities address critical environmental problems and incorporate environmental stewardship and sustainability considerations, while ensuring economic viability.

The Environmental Technologies Research Area addresses the highest priority technical problems with state-of-the-science, cost-effective technologies for managing natural resources at Corps projects including: the development of system-wide modeling, assessment, and restoration technologies; ecosystem management and restoration; wetlands functional values; habitat management techniques for biota, including threatened and endangered species; assessment and management of water quality problems; and the identification, assessment, and management of contaminated sediments. This Area is providing scientifically proven and demonstrated economical solutions to the Corps' highest priority environmental problems, reducing unnecessary regulatory burdens, and providing environmental stewardship with a very high return on taxpayer investment.

Environmental Modeling and System-wide Assessment Center (EMSAC). ERDC's Coastal and Hydraulics, Environmental, and Information Technology Laboratories partnered to create the Environmental Modeling and System-wide Assessment Center (EMSAC). EMSAC is chartered to develop and apply tools for managing impacts in complex environmental systems across multiple media and over broad spatial scales. EMSAC advances system-wide applications of predictive environmental modeling, assessment, and management tools for the Corps of Engineers, the Army, Department of Defense, and the Nation in the following four focus areas:

- Technically complex environmental research and development integrating hydrodynamics, hydrology, ecology, and related disciplines.
- Effective applications of technology, modeling and informatics for alternatives analysis and decision-making.
- Comprehensive environmental management systems that integrate products from R&D Programs into significant studies.
- Broad national research and development needs to achieve environmental sustainability.

Meeting the technology needs of the Corps requires capability in areas such as watershed and basin modeling, ecosystem modeling coupled with expanding investigations such as groundwater modeling and surface water – groundwater flow and transport, require ever-increasing levels of technical interaction and teaming between ERDC laboratories. EMSAC relies on a matrix of ERDC elements to form technical teams of engineers and scientists to solve complex, system-level environmental problems. Additionally, EMSAC will team with sister Federal agencies, different levels of government, academic institutions, the private sector, and stakeholders, as necessary, to execute studies in the fully partnered context typically required of large studies. Through EMSAC, the ERDC is able to achieve the level of enhanced coordination required to address national challenges in sustainable development.

Aquatic Nuisance Species Research Program (ANSRP). Aquatic nuisance species (ANS) are serious threats decreasing biodiversity, impacting human health, and imposing enormous costs on eradication and management efforts. Increased trade, tourism, transport, and travel have enhanced the introduction and spread of invasive aquatic species allowing them to easily move beyond natural geographic barriers and inhabit new sites. By altering species diversity, hydrology, nutrient cycling, and other ecosystem processes, ANS can change whole ecosystems and irreparably damage natural resource industries. Aquatic nuisance species are of concern for Corps of Engineers missions and seriously impact maintenance of harbors, waterways, locks and dams, flood control, and ecosystem restoration efforts. The Aquatic Nuisance Species Research Program

(ANSRP) benefits Corps projects by minimizing adverse impacts and maximizing control opportunities with respect to invasive aquatic nuisance species.

The major objective of the ANSRP is to conduct interdisciplinary research on the prevention, control, and management of ANS that impact Corps projects and public facilities. Significant accomplishments in FY03 included:

- Development of management technologies that prohibit the establishment of zebra mussels in confined systems.
- Investigation of innovative large-scale barrier technologies to inhibit the spread of ANS.
- Examination of the potential for zebra mussel predation by fishes.
- Testing of a passive low-velocity filtration strainer for use in excluding zebra mussel larvae from water intake systems.
- Distribution of over 10,000 copies of the computer-based "Zebra Mussel Information System – ZMIS" and dissemination of key ANS profiles that include information on management technologies for use by operational personnel.

SMART Program. The System-wide Modeling, Assessment, and Restoration Technologies (SMART) Program embodies a holistic approach to providing tools and technologies to the Corps and its partners for system-wide assessment, management, and restoration of water resources related ecosystems. The program crosses all business areas in the CE. This program is fundamental to meeting Corps objectives of sustainability and the seven Environmental Operating Principles:

- Principle 1. SMART provides enhanced tools for decision-making that allows evaluation of operation, management, and restoration alternatives with balanced considerations for effects on associated environmental, social, and economic assets of the affected system over multiple scales.
- Principle 2. A major effort in SMART is to link hydrodynamic/physical models to ecological/biological (including social) models to allow for balanced analysis of alternatives.
- Principle 3. The use of stakeholder input from planning to implementation, guidance from IWR/HQ policy studies, and effective communication with other agencies and NGOs throughout the development of SMART tools and applications provides tools agreed to and accepted by consensus.
- Principle 4. Applications with SMART tools takes into account corporate responsibility/accountability from the onset and contains opportunities for evaluating the continued viability of natural systems. Implementing a Product Life Cycle plan to monitor milestones, products, and applications provides a system of metrics to evaluate product development and use.
- Principle 5. SMART is designed to allow system-wide assessments that deal with issues of multiple scales and multiple projects within a system (including projects built/operated by others). EPA has already recognized the value of this approach for assessing and mitigating for cumulative impacts and the approach in SMART is parallel to their outlined method for cumulative impact assessment and adds a means for quantification.
- Principle 6. SMART was developed using an integrated, multidisciplinary approach providing access to the primary knowledge bases within the Corps. SMART tempers development with practical input from MSCs and districts, and incorporates the knowledge and expertise in other agencies and organizations to provide increased understanding of our work.
- Principle 7. SMART applications incorporate this philosophy from the beginning of process research, through the development of tools and technologies, and throughout the implementation and infusion of developed products including effective technology transfer to end-users with appropriate training.

FY03 accomplishments included:

- Identified information gaps, interagency coordination needs, input from the MSC's and districts, and the initiation of collaborative efforts with MSC's and their sponsors for the development of prototype system-wide applications.
- Developed an iterative process to provide feedback from end-users (i.e., MSC's and districts) and between the research focus areas and related R&D Programs.
- Linked a lumped-parameter watershed model (HSPF) that is currently used extensively in

establishing TMDLs, to a very powerful, two-dimensional water quality model (CE-QUAL-W2) to allow assessing responses in receiving water bodies associated with changes in watershed land uses.

- Refined process-based information that is critical to the development of the next generation of watershed models (e.g., distributed models such as GSSHA).

- Prepared various guidance documents for tool implementation. These documents describe methods for developing conceptual models for system-wide assessments, state of the art for ecological modeling, and details for specific numerical model applications for watershed assessments.

Environmental Technologies Program. The Corps has many small and large-scale water resource development projects that include ecosystem restoration and enhancement opportunities authorized under WRDA Sections 1135 & 206 and other specific GI authorities. The broad scope of these environmental projects, in addition to changing legislative mandates, requires sound science-based research and development (R&D) to provide new and expanding technologies that reduce costs and provide fully functional / environmentally sustainable projects.

Environmental technologies R&D efforts are in direct support of the Corps' Environmental Operating Principles. Potential ROI through application of these tools/guidance is conservatively estimated at 100:1 based on the large costs often associated with Corps water resource projects. Leveraging R&D dollars through cooperative agreements with other Federal, state, local agencies and stakeholders ensures continued access to cutting-edge technology with savings to the taxpayer.

The objective of the Environmental Technologies Program is to provide rapid, cost-effective technologies that support the Corps' Environmental Business Program and its associated performance measures. This quick-response R&D program is directed at developing project-level/user-oriented engineering, design, and planning guidance for ecosystem restoration and environmental stewardship activities, but it also provides critical components for the development of larger-scale watershed modeling capabilities. Current research focus areas include:

- Stream and riparian restoration.
- Aquatic habitat evaluation.
- Wetlands and special aquatic site restoration.
- Ecological effects of dam removal.

Products provide cost-effective, science-based solutions to address Corps performance measures as well as the R&D needs of other Federal, state, local agencies, and stakeholders. These products give "how-to's" for low-cost / innovative techniques that reduce overall manpower requirements and improve environmental performance / sustainability - without compromising other project objectives. They also advance the Corps' environmental leadership role and promote multi-agency approval of Corps-developed techniques. FY03 products include:

- A handbook of tools and techniques for ecological restoration and management of urban streams.

- A guidance document for reestablishing riparian hardwood ecosystems in arid and semi-arid regions.

- Design guidance/models for constructing small floodplain pools as habitat for fishes and amphibians.

- Community index templates for assessing terrestrial, coastal, and aquatic ecosystem functions.

- A review of approaches to coastal wetland restoration in Northern Gulf of Mexico.

- Hydrogeomorphic (HGM) functional assessment guidebooks for:
  - Tidal Fringe Wetlands of Gulf of Mexico.
  - Intermontaine Prairie Potholes of Northern Rocky Mountains.
  - Wet Pine Flats of Gulf Coast Plains.
  - Flats Wetlands of Everglades.
  - Riverine Wetlands of Western Tennessee.
  - Riverline Floodplains of Northern Rocky Mountains.
  - Riverine Wetlands of Peninsular Florida.

Long-term Effects of Dredging Operations (LEDO) Program. The LEDO Program has supported dredging and contaminated sediments programs involving the Corps water resources development mission, as well as cleanup and restoration activities for about 20 years. The LEDO Program was terminated at the end of FY03 due to GI program funding constraints. The effects of high-profile, new toxic substances and pathogen microbes in contaminated sediments are not well-known.

Identification, assessment, and interpretive techniques are underdeveloped. Environmental, legislative, and public interest groups' concerns are intense and result in a plethora of laws, regulations, and litigation to address their concerns. Disposal management includes aquatic, wetland, and upland disposal alternatives and addresses environmentally important classes of toxic substances associated with these sediments and their acute, chronic, and sublethal tools and procedures to quantify the effects and exposure components of the risk and support implementation of the CE/EPA Technical Framework, associated manuals, and legal requirements. Restoration needs are addressed through WRDA, Superfund, and Congressional initiatives. LEDO objectives were to:

- Provide a cost-effective, yet environmentally sound, risk-based approach (including effects assessment, exposure assessment, risk characterization, and risk management) to managing sediments contaminated with high-profile toxics and microbial pathogens. This will allow the Corps to meet its dredging and environmental constraints in a cost-effective manner.
- Support environmentally sustainable restoration.
- Reduce or eliminate unnecessary constraints.

The LEDO Program work units encompass ecological and human health effects in three environmental impact areas: aquatic, wetlands, and upland management. Current research emphasizes development and/or refinement of risk-based procedures for effects and exposure assessment (chronic/sublethal/genotoxicity), exposure assessment (bioaccumulation, geochemistry, volatiles, pathogenic microbes, surface runoff), and risk characterization (interpretative guidance).

Major accomplishments for FY03 included technical notes and journal articles on the following subjects:

- PAH and Heavy Metal Extraction with Artificial Invertebrate Gut Fluids.
- Using Geosensors to Screen for Toxic Effect of Contaminated Sediments on Population of Marine/Estuarine Organisms.
- Using a Toxicological Challenge Protocol to Assess PCB Bioaccumulation by Aquatic Organisms.
- Bioavailability and Thermal Release Energy of Hydrophobic Organic Compounds in Contaminated Sediments.
- Toxicity of Contaminated Sediment Extractable Fractions in Relation to Bioassay Response.
- Assessment of the Origin of Human Health Pathogens Found in Contaminated Sediments Through DNA Analyses.

Geospatial Technologies Area

The Geospatial Technology Area comprises Survey and Mapping, Remote Sensing, and Geographic Information Systems (GIS) and a Common Delivery Framework. Activities in this area focus on geospatial data collection, management, analysis, and exploitation techniques for information tied to the earth's surface and subsurface. To reduce costs for developing and applying science and engineering technologies, a new framework approach for managing software guidance, capabilities, and resources for model/application developers in a consistent, corporate context is being developed. Typical data types include bathymetric and topographic survey, digital elevation models, dredge cuts, placement sites, sub-bottom compositions, soil types, wetlands, land cover, endangered species and their habitat, stream and tide gages, cross sections, training structures, levees, dam deformation, HTRW sites, permits, piezometers, archeological sites, snow water content, Corps projects, relief wells, damage from disasters, recovery activities, mission status, etc.

Data may be collected for and analyzed for projects at specific sites or as part of systems: from sub-basins to large river systems, from individual beaches to large coastal segments. Other objectives of this Area include automated presentation capability, improved QA/QC, improved data retention and longer data life, reduced re-collection costs, increased data sharing, and improved, more defensible decision making. These efforts support decision makers in all Corps business areas: navigation, flood control, hydropower, regulatory, environmental, emergency management, recreation, water supply, and work for others. Each business area requires accurate and reliable geospatial data for effective project planning, design, construction, operation, maintenance, and rehabilitation. Annual expenditures for these data average $200M, thus significant savings from more effective and efficient data collection and management technologies, data analysis, and data exploitation will be realized.

Remote Sensing and Geographic Information Systems Center (RS/GISC). The RS/GISC is the Corps' Center of Expertise for Civil Works remote

sensing and GIS and is the principal catalyst for the evolution and application of emerging remote sensing and geographic information systems technologies in execution of the Corps' Civil Works planning, engineering, operations, and maintenance activities. As the Corps' "One door" to ERDC geospatial capabilities, the Center provides cost-effective technology transfer and applications development in support of Corps mission responsibilities in all business areas: navigation, flood and coastal storm damage reduction, hydropower, regulatory, environment, emergency management, recreation, water supply, and work for others. Continuing interaction with other researchers and practitioners throughout the Corps, government, the private sector, and academia assures knowledge of evolving trends that are important for the Corps and that duplication of effort is avoided.

The RS/GISC manages the Corps' geospatial research and development program, remote sensing and GIS research and development programs, and the HQUSACE Enterprise GIS (CorpsMap). The Center provides emergency management RS/GIS support, supports RS/GIS activities in the Corps' Water Control Data System (WCDS) Software Modernization Program, GIS support for the national management of Formerly Used Defense Sites (FUDS) cleanup, GIS Support for emergency operations command and control system (EngLink); GIS and remote sensing assistance in the delineation and mapping of wetlands. The RS/GISC also acts as the principal technology assistance hub for new applications of RS/GIS technologies for the Corps district offices across the nation.

Geospatial Technologies Research Program. Based in the RS/GIS Center, Remote Sensing and Geographic Information Systems research programs support the Army's civil works mission by improving methods for acquisition, image processing, and development; management; and analysis of geospatial data. An enterprise approach to corporate geospatial data and the integration of all geospatial data (data from GIS, RS, survey and mapping, and CADD), and the development of applications meeting the needs of Corps civil works business areas are critical focus areas.

The Remote Sensing/GIS Center executed over 100 distinct research, development, and technology transfer programs during FY03. Significant accomplishments include:

- Serving as the key resource and technology point of contact for the US Army Corps of Engineers for Civil Works remote sensing and GIS; acquired and distributed enterprise geospatial data to all Corps entities and evaluated Corps geospatial data requirements.
- Continued technology transfer through training courses, briefings, technical papers, technical demonstrations, pilot programs, and conferences
- Evaluating Corps geospatial data requirements with Corps headquarters; providing the venue for and teaching eight Corps PROSPECT GIS training courses for over 200 students each year and developing and teaching a PROSPECT remote sensing course.
- Provided State-of-the-art remote sensing, image processing, and geospatial data systems support to the Corps' Civil Works Program through management of the remote sensing and GIS R&D programs.
- Support was also provided to Corps' district offices for the development of implementation plans for geospatial data management, including development of enterprise geospatial data approaches.
- Maintained a 2-terabyte library of geospatial data available for all Corps business practice applications and reviewed work in all Corps civil works research and development programs to assure non-duplication of geospatial efforts.
- Participated in development of Future Operating Capabilities and a redefined strategic approach to Civil Works R&D.
- Sponsored and participated in program development of national and international remote sensing and GIS conferences, expanding the capability of Corps-wide GIS viewers for common data.
- Developed and transferred improved techniques for the integration of snowmelt into water control activities.
- Conducted analyses of ordinary high water mark indicators and flood volume-duration-frequency in the southwestern United States.
- Developed advanced satellite-tracking hardware and software for sensitive cargo.

- Revised the USACE Manual of Remote Sensing.
- Released a publicly accessible GIS for Formerly Used Defense Sites.

- Supported the Army Civil-Military Emergency Planning program in Georgia, Armenia, and Azerbaijan.

- Developed the Iraq reconstruction tracking system; a web based geospatial information system for monitoring and managing reconstruction activities in Iraq.

- Revised coordinate conversion routines to enable accurate geoid conversions between GPS derived ellipsoid heights and ground elevations.

- Continued development of Long Range Real-Time High Accuracy 3-D positioning from Nationwide Differential GPS sites, through partnership with Federal Highway Administration and U.S. Coast Guard to establish and operate test sites.

- Collaborated with industry to develop new software capabilities that would allow the exchange of Corps map data layers, vector features, and imagery for display on any map browser. National data from other government agencies can also be used with this capability.

- Published an open standard for LIDAR data for standardized data storage and archiving, and better data interchange, which will lead to robust off-the-shelf commercial capability to enhance the use and re-use of existing LIDAR data for future Civil Works projects.

Common Delivery Framework. The Common Delivery Framework (CDF) is an ongoing research and development (R&D) initiative that focuses on improving reuse and integration of science and engineering (S&E) tools, models, and data. The CDF defines the guidance, standards, and conventions as well as the sharable functionality through common software libraries and Web services needed to improve how technology is delivered and inserted.

USACE developers, contractors, and partners use the Web accessible library of software resources and technical guidance provided in the CDF to develop specific S&E applications and suites of applications. The CDF provides the operational platform to achieve cost reductions and improved customer service through integration of technical approaches, managed reuse of component capabilities, and interoperability of data and tools. The objectives of the CDF are to:

- Develop a framework that meets USACE S&E objectives.
- Ensure the security, integrity, and availability of S&E functionality and information.
- Provide guidance to support the exploitation of the CDF.
- Cultivate coordination and collaboration within USACE programs.
- Support life-cycle management of USACE S&E information and technologies.
- Provide a common technology baseline.
- Provide common access to both internal and external data sources.
- Provide a common information/functionality baseline.
- Enable sharing of technology and products across research or program areas.

CDF products to date include:

- CDF Web Services. Provide programmatic access to functionality and information
- CDF Technical Notes. Technical guidance documentation that describes “how to” develop and consume CDF services, set up a CDF development environment, etc.
- CDF Web Service Registry. Provides a searchable Web-accessible catalog of all services contained within the CDF, metadata describing how to use the service, and guidance for developing and registering new Web services.
- S&E Data Browser provides access to common layer model data, via the DataNet, for a specified geographic area based on the Information Architecture.
- S&E DataNet. Provides a Web-centric framework for acquiring, managing, and sharing S&E data.
- XMDF Technical Reference Document. Provides technical implementation details for software developers as well as background information, motivation, and an overview of the eXtensible Model Data Format.
- EasyHPC. Web-based client application that provides easy, secure access to high performance computing platforms.
- Content Services. Repositories of S&E information available via the Web, designed to improve locating, sharing, delivery, and reuse of S&E information

- On-Line Knowledge Centers. Web portals that consist of reusable components that deliver content (information) and serve as gateways to computational and data resources.

FY03 Accomplishments

- Developed CDF Web Service Registry accessible via the CDF portal.

- Developed CDF Web Services to deliver the following sources of data for programmatic consumption by S&E models and/or decision support tools:
    - USGS National Elevation data
    - USGS Landuse/Landcover data
    - USGS stream flow data
    - NOAA estuarine bathymetry
    - USACE National Inventory of Dams
    - USDA STATSGO (soils)
    - CWMS realtime gage data
    - CWMS dss data
    - METAR current surface condition data

- Developed beta version of the S&E Data Browser tool to provide access to common layer model data via the CDF Web Services

- Extended CDF security services to include AKO as an authentication source and user profiles as an authorization vehicle.

- Developed eXtensible Model Data Format (XMDF) Technical Reference Document and Version 1 of the XMDF

- Prepared technical notes for the following topics:
    - Service for User Authentication
    - Service for Content Publishing and Retrieval
    - Embedding the CDF .NET Database Connectivity Libraries in Code to Create a Database Web Service
    - Understanding the NED Data Service: How to Retrieve USGS NED Data Using SOAP Attachments with .NET and Java-AXIS
    - User Profiling Implementation within the Common Delivery Framework
    - An E-Mail Service for Use in Automated Systems
    - Using SOAP with Attachments in .NET and Apache Axis

- Established Web Farm as the operational platform for CDF

Other Research Areas

Aquatic Plant Control Research Program (APCRP). The APCRP is the Nation's only federally authorized research program providing the technology to manage invasive aquatic plant species. The objective of the program is to develop cost-effective, environmentally compatible aquatic plant management technologies, which address national needs and priorities in water resources management. Research is conducted on the biology, ecology, and management of invasive aquatic plants and on developing biological, chemical, ecological, and integrated control methods. The APCRP provides water resources managers with the tools needed to restore aquatic ecosystems to achieve sustainable benefits provided by a healthy and diverse aquatic plant community dominated by native aquatic plant species. Annual cost savings resulting from application of APCRP research results nationwide are estimated at $30 to $40 million.

APCRP accomplishments for FY03 include:

- Development, in cooperation with industry, of the first microbial formulation for cost-effective control of hydrilla.

- Obtained national labels for two new aquatic herbicides (triclopyr and imazapyr).

- Developed new mass-rearing techniques for insect biocontrol agents of hydrilla.

- Produced an endothall herbicide polymer formulation that has significantly reduced human health hazards.

- Continuing technology transfer of research results using innovative traditional and non-traditional mechanisms, including the dissemination of over 10,000 copies of the computer-based "Aquatic Plant Information System - APIS."

Dredging Operations and Environmental Research (DOER) Program. The DOER Program is an extremely important effort that combines engineering, operational, and environmental components of waterways management to address issues impacting our ability to maintain a safe, reliable, environmentally sustainable, and

economically efficient navigation system. The program has validated the nearshore placement of mixed-grain sediments that, coupled with the recently developed knowledge of chronic turbidity on fishery resources, will allow for environmentally acceptable aquatic disposal of dredged material at minimal cost and positive impacts.

Using DOER research results and in conjunction with the National Research Council, guidance was prepared to help lessen the negative impacts of environmental windows (seasonal restrictions) through a thorough knowledge of various impact categories and use of operational guidelines. Guidance is being developed to fully assess bioremediation, solids separation, and phytoreclamation of contaminated dredged material in traditional confined disposal facilities for beneficial reuse of the material. A PC-based human health and ecological risk assessment program was completed that provides a quick and accurate decision support tool for evaluating dredged material disposal and management alternatives. Innovative dredging and placement technology and operations and management techniques that will reduce cost, take less time, and are environmentally friendly (e.g., silt wing, super dust pan dredges, and telescoping weirs) are being demonstrated at typical navigation projects. The DOER Program won first place in the USACE National Product Delivery Team award in 2001.

Accomplishments for FY03 included continuing research in the following four programmatic areas to address the navigation dredging and environmental protection mission:

- Dredged material to include development and validation of numerical models, software tools, and guidance documents to assess efficient, environmentally sound, and cost-effective methods for dredging, handling, transport, and placement of dredged material.
- Risk to include contaminated sediment characterization, management, and treatment (reduce costs, increase options) and environmental risk assessment and management for dredged sediments (factors economics, engineering, human health, and ecological and comparative risk).
- Environmental resource protection to include nearshore/aquatic placement of dredged material (in coastal, estuarine, and river waters) and environmental windows for dredging operations (assure environmental sensitivity as well as realistic controls based on facts).
- Innovative technologies to include cost-effective application of innovative technologies (includes contracting and other dredging activities).

DOER accomplishments for FY03 also included the following:

- Developed guidelines for environmentally acceptable methods of aquatic placement of mixed (fine and coarse grained) sediments, along with a database of dredged material geotechnical properties that can be used for modeling and related design. Released improved models for predicting sediment resuspension at different types of dredges.

- Conducted research on field validation of chronic/sublethal testing, CDF effluent treatment, manufactured soil, biomarker analyses, runoff test, environmental effects in CDF's, and biomarker analyses.

- Continued environmental windows research with an emphasis on collaborative interagency studies of physical monitoring of suspended and settled sediments and associated effects on sensitive biota in support of science-based determination of windows for effective protection while maintaining necessary navigation in an economically efficient manner.

- Completed risk assessment PC-based decision support tools for all environments for rapid automated field use and completed theoretical bioaccumulation potential uncertainty analyses.

- Pursued innovative (off-the-shelf) technologies that can be applied to Corps navigation projects. Alternatives to traditional dredging were evaluated to determine the feasibility of extending periods between required channel maintenance. High priorities were innovative dredging and placement equipment, operations, and management techniques to reduce costs, take less time, and are environmentally friendly.

- Initiated instrumentation research on developing improved sensors to measure dredged material loads removed by hopper dredges, and silent inspection for scows and barges.

Recreation Management Support Program (RSMP). The RMSP conducts research and provides related technical assistance in support of the Civil Works Recreation Business Area. The program is

divided into three major elements: management studies, management assistance, and information exchange. The following RMSP major activities occurred in FY03:

- The knowledge management Website (the NRM Gateway) www.CorpsLakes.us that was deployed in April of 2001 has now received more than 5 million hits, 2.9 million alone in FY03. This site provides Corps natural resource managers with over 25,000 pages of information.

- Recreation trends affecting the Corps' recreation program were monitored. Results were integrated into a Corps recreation program strategic plan.

- A process to define national goals for the Corps' recreation program was facilitated in collaboration with the Recreation Leadership Advisory Team.

- Customer satisfaction recreation visitors to Corps lakes were monitored as a part of the American Customer Satisfaction Index.
- National trends in recreation activity participation were monitored under a collaborative project organized by the American Recreation Coalition.
- Technical assistance was provided to field staff on the use of the Visitation Estimation and Reporting System and Automated Use Permit System.

Aquatic Nuisance Species Research Program (ANSRP). Aquatic nuisance species (ANS) are serious threats decreasing biodiversity, impacting human health, and imposing enormous costs on eradication and management efforts. Increased trade, tourism, transport, and travel have enhanced the introduction and spread of invasive aquatic species allowing them to easily move beyond natural geographic barriers and inhabit new sites. By altering species diversity, hydrology, nutrient cycling, and other ecosystem processes, ANS can change whole ecosystems and irreparably damage natural resource industries. Aquatic nuisance species are of concern for Corps of Engineers missions and seriously impact maintenance of harbors, waterways, locks and dams, flood control, and ecosystem restoration efforts. The Aquatic Nuisance Species Research Program (ANSRP) benefits Corps projects by minimizing adverse impacts and maximizing control opportunities with respect to invasive aquatic nuisance species.

The major objective of the ANSRP is to conduct interdisciplinary research on the prevention, control, and management of ANS that impact Corps projects and public facilities. Significant accomplishments in FY03 included:

- Development of management technologies that prohibit the establishment of zebra mussels in confined systems.

- Investigation of innovative large-scale barrier technologies to inhibit the spread of ANS.

- Examination of the potential for zebra mussel predation by fishes.

- Testing of a passive low-velocity filtration strainer for use in excluding zebra mussel larvae from water intake systems.

- Distribution of over 10,000 copies of the computer-based "Zebra Mussel Information System – ZMIS" and dissemination of key ANS profiles that include information on management technologies for use by operational personnel.

Water Operations Technical Support (WOTS) Program. The WOTS Program provides comprehensive and interdisciplinary technology transfer and technology application to all Corps water resource projects. WOTS is managed to maximize cost-effectiveness and ensure broad dissemination and implementation of technology and information. The program provides effective environmental and water quality engineering technology to address a wide range of water resource management problems at Corps reservoir and waterway projects, and in the river systems affected by project operations nationwide. In addition, WOTS provides technology to address problems occurring from the presence of zebra mussels and other non-indigenous aquatic species, tail-water fisheries at pump-back hydropower projects, water quality impacts of shoreline erosion control and reservoir sedimentation, and other project operations related to environmental and water quality issues.

Since its inception, the WOTS Program has successfully responded to over 1,200 requests for direct technical assistance and over 2,000 one-stop service requests from all Corps districts throughout the Nation. These requests have significantly improved water resources uses, benefits, and operations. The program annually publishes numerous copies of manuals, bulletins, notes, and reports. WOTS

annually conducts specialty workshops, training personnel on the latest environmental and water quality management techniques. WOTS continually endeavors to coordinate with water quality elements of other Federal agencies such as the Environmental Protection Agency, Tennessee Valley Authority, Bureau of Reclamation, Fish and Wildlife Service, and the Bonneville Power Administration. These efforts have involved watershed management activities, problems on the spread of zebra mussels, the impacts of hydropower facilities, and cold water releases. In FY03, the WOTS program conducted eight technology demonstration efforts to verify management strategies and techniques, five training workshops on environmental and water quality management techniques, and prepared ten technical publications for distribution to the field.

Dredging Operations Technical Support (DOTS) Program. The DOTS Program fosters a "one-door-to-the-Corps" concept by providing comprehensive and interdisciplinary technology transfer, technology application, and training opportunities in a number of formats for all stakeholders in the Corps' navigation mission. DOTS serves as both an archive for, and gateway to Corps technology; for example, through Web-based information databases. The program's major objective is to maximize access to existing and newly developed technology in as cost-efficient a manner as possible. The program also fulfills many requirements associated with consistent implementation of National policies and laws.

DOTS has adopted a strong emphasis on optimized accessibility through Internet tools and resources, and the program's Website receives thousands of visits from navigation stakeholders on a monthly basis. The DOTS-sponsored navigation outreach site has become the most heavily visited of all Corps websites. The DOTS Program serves as a storehouse of information on state-of-the-art technologies, relevant applications, and completed and ongoing research addressing problems identified by field offices. Emerging engineering and environmental issues sometimes cause uncertainty in administration of the Corps' navigation dredging program.

To satisfy an important need for up-to-date technological solutions, DOTS provides a ready response mechanism, including necessary training for Corps personnel and other government and public stakeholders. Short-term work efforts to solve generic Corps-wide technical problems for maintaining navigable waterways are major features of the DOTS Program. Transfer of new and emerging technologies for application at Corps and stakeholder navigation maintenance projects is an important DOTS activity. In response to ever-expanding, complex research thrusts, and continuing personnel turnover, the DOTS Program will continue to seek improved and innovative forms of technology transfer.

DOTS emphasizes transfer of technology developed by the Corps, but also establishes links to proven technology of international origin, with particular reference to maintenance and management of navigation structures and navigable waterways. Typical technology transfer and training includes management of contaminated dredged material, application of innovative risk-based technologies to contaminated dredged material, maintenance of coastal inlets and adjacent shorelines, shoreline stabilization and river training activities, assessment and management protocols for beneficial uses of dredged material, channel realignments, protection of endangered species, equipment selection, science-based application of dredging environmental windows, lock and dam maintenance needs, channel and harbor maintenance activities, and ship simulation activities.

A key feature of the program is effective, annual workshops and seminar forums for training of Corps staff, navigation stakeholders, and others who have regulatory authority over Corps navigation maintenance activities on the latest environmental and engineering techniques. The program also supports joint USACE and USEPA activities dealing with environmental aspects of the national navigation program.

FY03 accomplishments include:

- Transfer of technology dealing with maintenance and management of navigation structures and navigable waterways, including the following specific topics:
  - Management of contaminated dredged material.
  - Application of innovative risk-based technologies to contaminated dredged material.
  - Maintenance of coastal inlets and adjacent shorelines.
  - Shoreline stabilization and river training activities.
  - Assessment and management protocols for beneficial uses of dredged material.
  - Channel realignments.
  - Protection of endangered species.

- Equipment selection.
- Rational application of dredged windows.
- Lock and dam maintenance needs.
- Channel and harbor maintenance activities.
- Ship simulation activities.

- Training of Corps staff and others having regulatory authority over Corps navigation maintenance activities.

- Development and preparation of manuals with EPA that implement the inland and ocean disposal programs.

- Completion of short-term work efforts to address generic, Corps-wide technical dredging and dredged material management problems, as well as other technical problems at navigation projects.

CUSTOMER SUPPORT

Increasingly, ERDC expertise and products developed in R&D programs are being requested to solve challenges in critical areas of concern.

Examples of Customer Support:

Cleanup Efforts at Lake Washington. Lake Washington is a large lake that drains a heavily urbanized watershed including Seattle Washington. The lake has been undergoing clean-up efforts for decades and is a major success story in terms of eutrophication abatement via nutrient load reduction. ERDC is furthering the clean-up effort through application of the combined CH3-D, CE-QUAL-ICM hydrodynamic/eutrophication model package. To our knowledge, this is the first application of a combination of three-dimensional hydrodynamics, eutrophication kinetics, and sediment diagenesis models to a lake. This technology has been often applied to estuaries but never to a large, freshwater system. The application provides numerous challenges, especially with regard to transfer of the estuarine hydrodynamic model to a lake.

ERDC also provided the framework for a toxics model of the system. Basic kinetics for an organic toxicant and an inorganic toxicant are being added to the model. A training workshop was held at which ERDC scientists and engineers instructed the sponsor and interested parties on the application of the modeling package. The sponsor will apply Corps' models to two adjacent lakes, Lake Sammamish and Lake Union. The completed model provides the sponsor with state-of-the-art capability to manage the three-lake drainage system.

Investigation of Chemical Contaminants for Aberdeen Proving Grounds. ERDC team members from the Environmental and Coastal and Hydraulics Laboratory investigated the fate of chemical contaminants in the upper Chesapeake Bay for the Aberdeen Proving Grounds. Simulations were made with TOXI, a three-dimensional toxics water quality model, for the purpose of determining sediment and water column concentrations of various chemicals resulting from the breakdown of UXO. Numerous long term simulations were performed using different loading assumptions to investigate potential fate and transport of contaminants.

Modifying Effluent Treatment Facilities at Chicago CDF. ERDC personnel assisted the Chicago District in identifying possible modifications to effluent treatment facilities at the Chicago Area Confined Disposal Facility (CDF). The District approached ERDC with questions about what steps could be taken to increase the effluent treatment system's capacity to facilitate hydraulic dredging. ERDC personnel developed a study plan for the Chicago District and provided guidance for them as they determined whether the current CDF was capable of supporting hydraulic dredge material operations.

ENVVEST Project at Puget Sound Naval Shipyard. ERDC team members from the Environmental and Coastal and Hydraulics Laboratory, and the U.S. Navy, and Concurrent Technologies Corporation personnel collaborated to develop watershed water quality models for the Sinclair and Dyes Inlet drainage areas of the Puget Sound. The ENVVEST Project's goal is to quantify the nutrient and contaminant loadings entering into the Sinclair and Dyes Inlet with the goal of determining alternative land management scenarios for the drainage areas. Another goal of the project is to determine the eco-risk of the existing nutrient and contaminant loads to the waterbodies as well as to determine the benefit of decreased loadings to the eco-risk of the system.

San Jacinto Watershed Water Quality Analysis. ERDC team members from the Environmental and the Coastal and Hydraulics Laboratories, worked with Los Angeles District personnel to develop watershed water quality models for the San Jacinto Watershed. This work is intended to be a start in developing a model that can help to answer TMDL questions as well as can assist

ecologists in developing better methods to measure the health of riparian areas found within the watershed.

Numerical Fish Surrogate to support design of bypass systems for endangered salmon in the Columbia and Snake Rivers. Efficient bypass systems, along with other measures, will help restore populations of threatened and endangered salmon. ERDC staff were requested to develop a comprehensive software package to aid design of fish bypass systems at CE Snake and Columbia River Dams so that juvenile outmigrating salmon would be routed around the hydropower turbines. To meet this need, ERDC developed the Numerical Fish Surrogate (NFS). It uses advanced mathematical methods to couple a computational fluid dynamics model with a fish behavior model to create an agent-based modeling system. The NFS creates a virtual representation of both fluid flow and fish response to a specific hydraulic design of sufficient accuracy that performance of the bypass system can be assessed during the design phase instead of during post construction monitoring. In addition to being an advancement in modeling technology, it also has the potential to save many millions of dollars by improving design in a virtual context and thereby minimize endangering valuable stocks of salmon during testing to improve system design. The system is presently being used to guide fish bypass design and operation at Lower Granite and Ice Harbor Dams on the Snake River, is being developed for the Dalles Dam on the Columbia River, and is being discussed as a preferred technology for private sector dams. This work was performed in collaboration with scientists at the University of Washington (fish behavior) and University of Iowa (computational fluid dynamics).

St. Paul District: Devils Lake Study Review. The St. Paul District had been tasked by Congress to develop plans for developing an emergency outlet from Devils Lake that releases into the Sheyenne River in order to relieve rising lake levels in the lake. Two models , 5-Box Model and HEC-5Q, were used to look at future conditions in Devils Lake and the Sheyenne River when the emergency outlet was operating. The MVP requested ERDC to review the HEC-5Q modifications and application to the Devils Lake project. The ERDC also provided recommendations for future modeling needs to simulate impacts of project operations on higher trophic levels (several algal groups, benthos, fish, etc.).

Insect Biological Control Work - Lower Rio Grande Valley. Work is progressing on the management of both hydrilla and waterhyacinth along the lower Rio Grande Valley using insect biological control agents through a project funded by the Bureau of Reclamation with supplemental support by the Aquatic Plant Control Research Program (APCRP). These invasive plants continue to impact irrigation operations and public municipalities as infestations disperse and expand. Some relief was experienced as increased rainfall has removed a large proportion of the waterhyacinth. Unfortunately, hydrilla continues to increase. Surveys conducted as part of the project and in conjunction with the U.S. Border Patrol, Texas Game Wardens, and Mexican officials have revealed several new and potentially damaging hydrilla infestations close to the International Amistad Reservoir. In addition, several other invasive plants were identified including giant cane, elephant ear, salt cedar, and large infestations of Eurasian watermilfoil, all of which can rapidly become serious. Additional releases of the leaf-mining flies of over 500,000 immatures from rearing facilities at various ERDC facilities were accomplished during FY03 in some of the larger hydrilla infestations. In addition, monitoring has revealed significant decreases in hydrilla likely caused by the feeding action of the leaf-mining hydrilla flies released over the last two years. Releases and supplemental monitoring are planned for 2004.

Noxious and Nuisance Plant Management Information System (PMIS): A large number of introduced and naturalized terrestrial, aquatic, and wetland plant species cause serious problems in many areas of the United States including many U.S. Army Corps of Engineers' installations. Developing effective management strategies is directly dependent on access to pertinent and up-to-date information on plant identification, biology, ecology, and applicable management technologies. Unfortunately, because of the tremendous number of plant species and associated management techniques, access to pertinent and up-to-date information can be a daunting requirement. While traditional methods of technology transfer (including technical reports, scientific papers, oral presentations, posters, etc.) are adequate more rapid and efficient access is warranted.

Toward this goal, the ERDC has developed a computer-based information/expert system that provides rapid access to current information on the various management and control methods available for over 100 terrestrial, aquatic, and wetland plant

species. This system is entitled the "Noxious and Nuisance Plant Management Information System" (PMIS). The systems are PC-based and operate under the entire Windows operating system family, which ensures a high degree of portability for a wide variety of different computer configurations. The systems' technology core was developed in-house. Access to the information is accomplished via an easy to use graphical interface known as the information manager through the use of in-depth textual information, maps, videos, illustrations, as well as numerous photographic quality diagrams and images.

Information contained in the systems includes plant biology, ecology, introduction history, distribution, identification, basic management concepts, and specific management strategies. System use is enhanced through sophisticated programming algorithms that allow for user-friendly identification of invasive plant species and associated management options based on site-specific characteristics. The information systems are distributed via CD-ROM's, which allow for user access in many different locations and on various computer systems. However, recognizing the need for rapid updates, these systems are linked to specific Web pages, allowing for quick updates as information content evolves and changes.

This hybrid computer and Web-based system has proven to be a viable and highly useful technology transfer mechanism. The PMIS has been updated numerous times and is now in its sixth printing (Version 5.3). As a testament of the utility of these systems, in less than a year, close to 10,000 copies of the Aquatic Plant Information System and Noxious and Nuisance Plant Management Information System (version 5) have been distributed in the Unites States and ten foreign countries. These systems are highly recommended at all levels and are being used by many Federal and state agencies as the foundation document in their training classes and actual operations. For example, both the Bureau of Reclamation and the Armed Forces Pest Management Board (AFPMB) utilize these CD's exclusively as training aids for invasive plant management. The AFPMB uses the PMIS as the official invasive plant management guide for the entire Department of Defense (DOD). Many state and local noxious weed boards also use the systems' as training and operational guides. Numerous Federal agencies and Federal funding sources have contributed to the developmental effort so they can have plants added that are of particular concern. These include, DOD's Legacy program, the Department of Interior, National Highway Administration, National parks Service, and Bureau of Reclamation. Additionally, numerous college and high school instructors have requested copies to enhance instruction in their classes. PMIS was recently updated to version 5.3 with the enhancement of many of the graphics, addition of new plant species, and review of existing information. PMIS can be accessed online at http://www.wes.army.mil/el/pmis

Coast 2050/Louisiana Coastal Area (LCA) Comprehensive Study. Louisiana has been losing approximately 25-35 square miles of coastal marsh for the last several decades. This loss has become increasingly disconcerting because of its threat to local infrastructure and human health and welfare and to national concerns for energy production, navigation, and fisheries harvests. The threat of significant hurricane damage to cities and human populations in the coastal zone has also increased as the storm- buffering capacity of coastal marshes has declined, further heightening concerns.

Since 1990 Federal legislation has provided funds for coastal marsh protection. However, an analysis of the effectiveness of the program was conducted in the late 1990's and found that, although the rate of loss had declined, significant losses continue. Therefore, the New Orleans District, working with the state of Louisiana, the Mississippi River Division, and Headquarters, U.S. Army Corps of Engineers initiated efforts for a more comprehensive approach to address this major threat to a national treasure, the Louisiana coastal marshes. An interagency team was formed and established in the New Orleans District to develop the plan and submit it for inclusion in the WRDA 04 budget. The plan is expected to require approximately 30 years and bear a $14-billion price tag.

Two scientists from the ERDC Environmental Laboratory were assigned to the collocated team to make available all the technical resources throughout ERDC and to assist in developing the plan. Points of Contact and alternates were established in all ERDC labs and provided the network for which the New Orleans District, could access ERDC expertise. At the request of the New Orleans District, ERDC established a National Technical Review Committee composed of 10 internationally known scientists representing different technical disciplines to review interim products and provide technical recommendations as the District proceeds through the planning process. ERDC scientists serve on small working groups to develop tools for ecosystem modeling for assessment of different alternatives and

to develop criteria for assessing project benefits. ERDC scientists also work with staff from the Governor's Office to aid in developing a comprehensive river management study to examine sediment and water budgets in the Mississippi River and to assess the feasibility of reconnecting the river to the coastal marshes for marsh restoration. ERDC has also provided technical training in dredging and dredged material disposal and in ecosystem modeling.

Making the Classroom Connection with K-12 Educational Outreach. The Dredging Operations Technical Support Program (DOTS) has taken the lead in developing the Corps Education Center (http://education.usace.army.mil/) for K-12 outreach. Website objectives are to:

- Promote understanding of the USACE
- Create a Corps classroom connection
- Spark interest in applied sciences.

The Corps Education Center provides a wealth of printable or online lesson materials for educators. Students can use the resources for online learning activities, interactive educational games, and schoolwork resources. Corps employees can utilize the resources when conducting classroom outreach or assisting teachers. New Corps employees can also use the lessons as an orientation tool. The Corps Education Center has four main components:

- Young Engineers' Club
- Classroom Resources
- Corps Classroom Connection
- USACE Mission Lessons

The "Young Engineers' Club" is designed for kindergarten through early elementary ages and features Corps-related activities, puzzles, reading materials, and more. The "Classroom Resources" are not specific to USACE but provide related links and lessons. The "Corps Classroom Connection" provides USACE-related resources and lessons categorized by classroom subject. The "USACE Mission Lessons" provides mission- specific unit lessons, classroom activities, interactive quiz games, puzzles, glossaries, links, and good news stories. Each of these four components will continue to be updated or developed further.

A highlight of the site is the "Fun Science Experiments," which includes over 250 experiments and demonstrations in 30 topic categories. Each illustrates a science or engineering principle using inexpensive and simple household materials. These are easy for educators and students to reproduce and create eye-catching outreach programs. They are a fun way to illustrate Corps-related concepts.

Currently, the navigation section is more developed than the other mission areas within the "USACE Mission Lessons" due to the funding focus by DOTS. Navigation lessons and activities include:

- Navigation and the USACE
- Modern Transportation on Ancient Highways
- ImPORTance of Ports
- Navigation Channels-Our Underwater Highways
- Hydrographic Surveys-Keeping our Underwater Highways Safe
- Dredging-Keeping our Underwater Highways Open
- Beneficial Uses of Dredged Material
- Planning a Dredging Project.

Lessons and activities for the other mission areas will be developed similarly.

Contributions of educational materials, links, and good news stories are being solicited throughout the Corps. This is a chance to highlight the outreach being done throughout the Corps and pool the educational outreach resources. One such contribution received is the "Mississippi River Adventure" developed by the Public Affairs Offices of the Mississippi Valley Division. This is an interactive quiz in a video game format for ages 8-14 and can be found in the "USACE Mission Lessons."

The Corps Education Center can be accessed online at http://education.usace.army.mil/. The site was launched on 13 April 02 and receives over 12,000 hits per day. In FY03, the site received more than 2.5 million hits. The site is one of the most popular websites for the entire Corps, and generates large volumes of requests from students, teachers, parents, and other general public.

Great Lakes and Ohio River Division (LRD): Lock Extensions and Navigation Improvements. ERDC is assisting LRD in the development of navigation improvements for many of their projects. Design alternatives for the J. T. Myers lock extension project located in the Louisville District are being evaluated using physical hydraulic models. A study using a 1:100-scale navigation model of approximately 2 miles both upstream and downstream of the dam, including both the dam and

the locks was used during FY 03. Study results were used to improve navigation conditions in the upper and lower lock approaches after installation of the proposed 600-ft Auxiliary Lock extension. The model was also used to determine the minimum length of additional approach walls in the upper and lower lock approaches that would be necessary. The maximum design length developed during feasibility studies was estimated to be approximately 1/3 of the total cost of the project. The use of the physical navigation model and involvement of the towing industry in the evaluations of the wall lengths has reduced the total wall length needed by approximately 40 percent, providing significantly reduced construction cost and adequate navigation conditions.

A study using a 1:25-scale model of the lock filling and emptying system for J. T. Myers was completed in early FY03 and another 1:25-scale model of the lock discharge outlet is presently being used to finalize the outlet design. An innovative filling and emptying system was developed for the lock extension and consisted of a through-the-sill intake, an in-chamber culvert system and a landside outlet diffuser. The challenge for a lock extension project is to provide the most cost effective and hydraulically efficient filling and emptying system for the new lock extension and at the same time minimize down time for the main chamber during the construction of the lock extension. Placing the lock outlet diffuser on the landside allows construction to take place without interfering with the main chamber traffic. A unique angled-vane type manifold and outlet basin were developed that provided good energy dissipation of the lock discharges during emptying and directed the discharge away from the river bank. The outlet design will help prevent scour of the river channel and banks and reduce sediment deposition in the lower approach.

ERDC is also using a 1:25-scale physical hydraulic model of the filling and emptying system for the Greenup Lock Extension in the Huntington District (LRH) to evaluate and verify the design. The filling and emptying system developed by LRH uses split laterals that deliver water to the lock chamber during filling and remove the water during emptying. Due to site constraints, the intake for the lock extension filling and emptying system was located near the left bank and the culvert feeding the laterals in the lock extension had to be located landward of the existing culvert. The model experiments verified that the system performed quite well hydraulically. Experiments are currently underway to evaluate the landside outlet diffuser for the lock extension. ERDC is working with the Detroit and Huntington Districts to develop the filling and emptying system design for the lock replacement proposed for the Soo Lock Project. Innovative through-the-sill intakes and outlets with multiple in-chamber culverts are under evaluation using a 1:25-scale physical hydraulic model. The 1200-ft lock will replace two of the smaller existing locks at the project. Initial experiments showed that strong vortices occurred in the upper lock approach during lock filling. The face of the intakes was changed slightly and the upper bulkhead sill was modified to produce more streamlined flow into the intakes and reduce vortex formation. Initial evaluation of the lock filling system indicated excessive surface turbulence was present and large hawser forces were measured on a ship moored in the chamber. Design changes are underway to develop a filling and emptying design that will produce the target filling times with acceptable hawser forces.

Shoreline Erosion Evaluation for Sabine Pass to Galveston Bay, Texas. The Galveston District is currently developing and evaluating approaches to abate severe shoreline erosion, and to manage coastal sediment resources, on a 140-km reach of open coast between Sabine Pass and San Luis Pass, Texas. The study area includes a variety of settings, including cohesive and non-cohesive sediment beaches, structured and unstructured coastal inlets, and coastal wetlands. ERDC is providing engineering support to the District by developing and executing computational and analytical models that characterize hydrodynamic and sediment transport processes in the area. Wave climate, wave transformation, storm surge, cross-shore and alongshore sediment transport, and sediment budget models were developed, validated, and executed by ERDC personnel. Processes are characterized at both regional and project-level scales. Model results are used to develop project design parameters and assess with and without project alternatives. Specifically, these tools are used to evaluate shoreline erosion on a storm event-related basis, and to evaluate long-term shoreline change. Due to the large spatial scales encompassed by the models, project alternatives are evaluated in the context of Regional Sediment Management.

Grays Harbor, Washington, North Jetty Study. Grays Harbor, located in southwest Washington state, is one of the largest estuaries in the continental U.S., with a correspondingly large tidal prism. Facing the northwest Pacific Ocean, the entrance to Grays Harbor experiences the most extreme wave climate in the continental U.S.

Changes occur in the tidal channel locations and topographic features at all spatial and temporal scales.

Congress authorized the Grays Harbor entrance and navigation channel in 1896. Since that time, the Corps has developed, built, and maintained two rubble-mound jetties, a deep-draft navigation channel, and other navigational features in Grays Harbor. The North Jetty was originally constructed during the period 1907-1913. Its functions are to block southward transport of sediment, and to protect and maintain an entrance navigation channel. The north jetty has decreased in effectiveness as a result of subsidence and deterioration. Sediment is being transported into the channel and on to neighboring shoals, potentially increasing the need for maintenance dredging. Recently, the North Beach has exhibited a tendency to erode, reversing a historic trend of advance. Issues of concern include future channel maintenance requirements, jetty maintenance if the North Beach recedes, sediment supply to the environmentally sensitive Damon Point from the bypassed sediment, and impacts of the navigation project on the beach to the north.

Recently, the Corps and non-federal entities have constructed or considered spur attachments to jetties as an innovative means of reducing channel and jetty maintenance. Limited data and experience are available to evaluate the functioning and design requirements of a spur. A study was completed in FY03 or the U.S. Army Engineer District, Seattle (NWS) by ERDC to identify and evaluate engineering alternatives for reducing annual maintenance for the Federal navigation channel by reducing the amount of sand bypassing the north jetty. A secondary benefit to this study was protection of north jetty from scour and undermining during times of beach erosion and shoreline recession. The work included field, numerical, and physical model studies that are reported in ERDC technical reports. The study revealed many wide-area processes controlling sedimentation in and around Grays Harbor.

The scale of change in the southward-directed bypassing of sediment expected to occur after construction of any of the evaluated alternatives was found to be small compared to scale of transport at the Grays Harbor entrance from sources originating outside the entrance or by being reworked and redistributed in the entrance. Modification of the north jetty is one of relatively few options for controlling sedimentation in the outer navigation channel; others include channel realignment and modifications to the south jetty.

Navigation Improvements at Colorado River and Gulf Intracoasal Waterway Intersection. ERDC performed a numerical model study of hydrodynamics, including currents, salinity, and sediment changes associated with the plan to open Parker's Cut and/or Southwest Cut in Matagorda Bay, Texas. The study investigated whether opening the cuts would improve the navigation currents at the Gulf Intracoastal Waterway (GIWW) intersection with the Mouth of Colorado River Bypass Channel for the existing GIWW configuration. Special attention was given to potential impacts on salinity in Matagorda Bay and sedimentation in the area, specially the old Colorado River channel and river delta, to assist in making environmental determinations. The effect of allowing some flow from the Colorado River to the old river channel through the diversion dam was also evaluated.

The two-dimensional model contained the intersection between the GIWW and the Colorado River, as well as an extensive area beyond it, including all of East and West Matagorda Bay. The model was calibrated and verified successfully, which enabled the evaluation of several proposed alternatives.

A number of scenarios and their different combinations were modeled in an attempt to cover the several possibilities available to alleviate navigation currents at the GIWW/Colorado River intersection. Parker's Cut and Southwest Cut were analyzed at various dimensions to evaluate whether the cut's size would effect a reduction in current velocities. Also, analyzing combinations of these options allowed for a clearer determination of which alternative produces greater benefits.

The largest reduction in peak currents at the GIWW-Bypass Channel intersection was between 8 and 9 percent for a Parker's Cut configuration at 4 ft deep by 350 ft wide and a Southwest Cut configuration of 5 ft deep by 100 ft wide. This reduction, combined with the study's other findings, did not support the implementation of either cut as a navigation improvement to the intersection. However, one of the scenarios modeled, the implementation of a Diversion Dam Cut at a 4 ft deep by 50 ft wide configuration, appeared desirable for safety reasons to allow small craft navigation between the Old Colorado River channel and the Colorado River Bypass Channel without having to navigate through the GIWW locks. This option does

not impact the system adversely in terms of salinity. Currently, ERDC is evaluating this alternative more closely to assist the design and implementation process of this scenario.

Breakwater Repairs at Lajes Air Force Base, Lajes, Azores. Two-dimensional and three-dimensional physical model studies are continuing from FY03 to study repair scenarios for the breakwater at Lajes Air Force Base, Lajes, Azores. In addition, wave transmission into the lee of the breakwater is being measured for various breakwater repair scenarios. The intent of the study is to determine the optimum breakwater repair plan.

The Azores islands are located in the mid-Atlantic Ocean. Praia da Vitoria is a bay located on the eastern coast of the island of Terceira in the Azores. The harbor has direct exposure to severe open Atlantic Ocean storms from the east. A breakwater was constructed in 1963 on the north side of the bay entrance to provide safe refuge and port for U.S. ships arriving at Lajes Air Force Base. A wharf is located directly in the lee of the breakwater. The breakwater was originally armored with 15-ton tetrapods. The armor layer has sustained significant damage beginning during initial construction. Repairs to the structure were undertaken in 1963, 1964, 1966, 1970, 1973, 1985, 2002, and 2003. The structure continues to deteriorate. In 2001, the U.S. Air Force employed the U.S. Navy to develop a permanent repair for the structure.

At the request of the U.S. Navy, two 1:56-scale physical hydraulic models were designed and constructed at ERDC to study repair scenarios. One model of a breakwater section was built in a 1.5-m-wide by 61-m-long flume. A second model was also constructed, being a 3-D model of the breakwater and bay covering a region roughly 2 km by 2 km in a directional wave basin. A 27.4-m-long multidirectional, spectral wave generator, an automated data acquisition and control system, and capacitance-type wave gauges are being used in model operation. Modifications to the breakwaters are being tested that include a CORE-LOC® and antifer cube armor layer with an optional fronting berm of mobile stone. The design CORE-LOC® weight is 31.6 ton. The tested options appear to be entirely stable. Investigations continue to identify the least cost option.

Saluda Dam, South Carolina, direct shear test program. The Federal Energy Regulatory Commission (FERC) recently identified Saluda Dam near Columbia, South Carolina as susceptible to failure during an earthquake. The FERC has required that action be taken to avoid a catastrophic event under severe seismic loading. Saluda Dam is owned and maintained by South Carolina Electric and Gas Co. (SCE&G). The dam also includes a hydroelectric generating plant. The dam was constructed in the 1920's and at that time, was one of the largest embankment dams in the world. It remains a significant dam in the Columbia, South Carolina area.

SCE&G has proposed construction of a roller-compacted concrete (RCC) dam immediately downstream of the existing dam. Due to the limited space between the existing dam and the powerhouse, the footprint for the RCC dam will be less than has been typical of existing RCC dams. The FERC has evaluated the proposed RCC structure and determined that extensive cracking along the RCC lift joints would likely occur during a seismic event. If failure of the RCC lift joints were to occur, then the residual strength of the lift joints would ultimately determine whether the dam remained stable.

ERDC performed direct shear tests on the lift joints of 120 blocks of RCC, cut from test sections, to evaluate different RCC mixtures, joint bedding procedures, and joint maturity levels. The results of the failure envelope profiles were developed for each of the different test scenarios.

The primary purpose of this test program was to determine residual sliding resistances on pre-cracked RCC lift joints through shear displacements of up to 0.5 in. The results of the test program ultimately allowed for the determination of the proposed dam's ability to remain stable in the case of a maximum probable earthquake. In addition, because of the difficulty in performing these tests, little work has been done in this area. The results of this work will stand as a major source of data for use in analyzing the stability of any RCC dam that may be subjected to unusual or non-static loadings such as earthquakes.

Vicksburg District: Hydrilla study, Lake Ouachita, Arkansas. Using remote sensing techniques, the ERDC assessed the extent and density of infestation of the submerged aquatic weed hydrilla in Lake Ouachita, Arkansas, at the request of the Vicksburg District. The proliferating weed threatens fish species that are the source of the economically critical sport fishing industry. ERDC obtained and analyzed Quickbird panchromatic and multispectral imagery to determine extent and density of infestation. The results enabled better coordination

with state offices and effective use of resources to reduce the infestation

Satellite and Airborne Remote Sensing. The ERDC-TEC Imagery Office serves as the Army's Commercial/Civil Imagery acquisition monitor, repository of selected data, and interface with military sources and commercial satellite imagery vendors. In FY03, imagery products were delivered to 15 Corps district, division, Headquarters and ERDC offices for various applications, from disaster relief to terrain analysis, resulting in a cost avoidance of over $600,000.

GPS Tides. ERDC continued development of a GPS-based tide level measurements system in support of hydrographic surveying and dredging. With this technology, a survey vessel or dredge can measure tide level in real-time, eliminating the need for gauge readings or vessel squat measurements. Such a system provides savings in survey and dredging costs, and leads to more consistent survey results among in-house and contractor vessels. In FY03, this system was installed in Charleston; the fourth district to implement the technology.

Inland Electronic Navigation Charts (IENCs). ERDC continued development and publication of large-scale, accurate, and up-to-date digital charts of inland waterways. IENCs enable commercial on-board electronic chart systems that provide accurate and real-time display of vessel position relative to waterway features, and greatly enhance voyage planning and monitoring, training for new personnel, and display of radar, and Automatic Identification Systems. This project, coordinated by ERDC and involving Corps districts, divisions, and contractors, resulted in 2,900 miles of electronic river charts on the Mississippi and Ohio Rivers and some tributaries in FY03, that are available to the public on the web. The ERDC also coordinated with the U.S. Coast Guard and National Oceanic and Atmospheric Administration, as well as a European consortium, by developing similar river charts on the Danube and Rhine.

Coastal Navigation Channel Data. ERDC began a project to coordinate chart and geospatial data products on coastal and Great Lakes navigation channels. The first phase involves development of a channel framework (left-right boundaries, centerline) of all Corps channel projects, which will provide a common and consistent reference nationwide. Data from eight districts covering 28 ports was collected, and coordination began with the National Oceanic and Atmospheric Administration to develop a common corporate reporting process for channel condition data.

Missouri River Watershed snow water equivalent estimation method. A total snow water equivalent (SWE) estimation method over the Missouri River Watershed between Fort Randall MT and Sioux City, IA was developed and demonstrated. This involved estimating snow-covered area and volume from remotely sensed sources combined with on-the-ground measurements to provide gridded estimates of SWE for use in runoff predictions.

Frazil ice blockage studies. Several reimbursable studies were carried out to evaluate and provide mitigation measures for frazil ice blockage of cooling water intake screens at nuclear power plants. When this occurs, the plant must be shut down, initiating a nuclear incident report and decrease in available power supply.

Detroit and Huntington Districts. The ERDC reviewed ice congestion problems at the new Soo Locks and provided technical advice on techniques to avoid similar problems with the new locks now in design.

New England District emergency management support. The ERDC provided emergency management support to the New England District in the form of monitoring and technical support for ice jam mitigation during winter 2003-2004. This support included aerial and field monitoring of ice conditions, the installation of ice motion detectors, mitigation advice to state and local emergency managers, and updates to the Ice Jam Data Base.

Ice Boom Evaluations. The ERDC evaluated ice booms for the Portland and Pittsburgh Districts: the Deschutes River ice boom was evaluated for effectiveness and numerical modeling was used to develop solutions to increase operational effectiveness; operation of the Oil City ice boom was evaluated and alternatives were provided for a replacement boom with lower initial and operating and maintenance costs. The ERDC also provided ice melt estimates for varying reservoir discharges to clear ice form navigation and developed a method to estimate benefits for ice control structures

Upper Connecticut River Study. The ERDC conducted an ice-affected hydraulic analysis for the Upper Connecticut River in support of the FEMA Map Modernization Program. The study entailed obtaining historical ice records used in the simulation of ice jams along a 70-mile river reach to develop

ice-affected stage-frequency curves. These curves were then combined with open-water stage-frequency curves to provide all-seasons stage-frequency data for the reach.

Remediation and Restoration of Abandoned Mine Lands Engineer Manual. The ERDC developed a new Engineer Manual with support from HQUSACE for use in the remediation and restoration of abandoned mine lands. The Engineer Manual is currently in review.

Paint Technology Center (PTC). The ERDC Paint Technology Center provides Corps districts with a center of expertise for all paint related issues. The Center conducts research on high performance coatings for hydraulic structures including surface preparation, application, and performance. Services also include failure analysis, QA paint testing, and both in-house and on-site consultation services and training. Corps districts have been provided guidance on the paint selection for dam and bridge restoration projects as well as guidance in paint specification and inspection. The PTC's paint testing capability has helped over 20 Corps districts avoid construction delays. A test report is provided for each sample, which provides testing results and final recommendation for the approval or refusal of the sample. In a typical year over 200 paint/coating samples are tested and over 600 telephone inquiries for paint information are answered. In FY03, the PTC provided the Little Rock District with on-site paint training at their Ozark dam. The training was based on Little Rock District's current painting contract and was attended by both district and painting contractor personnel. The paint training stressed compliance and inspection of the contract provisions and included an evaluation of the on-going painting project.

Super-computer-based Watershed Analysis. Developing integrated, distributed, super-computer based watershed management simulation models to test the long-term hydrologic impact of proposed regional plans and policies. Test application in development with Rock Island District to evaluate urban growth possibilities in the Chicago Metro growth area.

INSTITUTE FOR WATER RESOURCES

The Institute for Water Resources (IWR) is a field operating activity under the staff supervision of the Deputy Commander for Civil Works, Headquarters, U.S. Army Corps of Engineers (HQUSACE). The Center consists of the Hydrologic Engineering Center, the Institute for Water Resources, the Navigation Data Center, and support elements. It is located at the Humphreys Engineer Center, Alexandria, Virginia, with satellite elements at other locations, including the Hydrologic Engineering Center in Davis, California; and the Waterborne Commerce Statistics Center, part of the Navigation Data Center, in New Orleans, Louisiana.

The accomplishments of WRSC during FY03 are listed by division.

HYDROLOGIC ENGINEERING CENTER (HEC)

Summary: FY 2003 was a busy and productive year for the Hydrologic Engineering Center. HEC fielded new versions of it's flagship NexGen software products; devoted substantial resources to the implementation of the initial version of the Corps Water Management System to the 30 Corps offices; and continued with the development of future versions of CWMS. HEC's third full year as an organization within the 'new' Institute for Water Resources was a smooth one, with the new alignment benefiting both HEC and the previous organizations within the 'old' IWR - a good match. All in all, 2003 was a busy, productive, and interesting year.

NexGen Software: HEC-HMS (Version 2.2.2) was released. This version of the Corps standard watershed model includes a moisture accounting loss algorithm and several improved display and interface features. An Applications Guide is now available. The guide provides detailed information on the application of the program to a wide variety of studies. Study types that are addressed include urban flooding, flood frequency, flood-loss reduction, flood warning system planning, reservoir spillway adequacy, and environmental restoration. Intensive work is underway on the next version that will replace the user interface with newly designed functionality, and completes the transition from the proprietary user interface platform of the past. The companion GIS utility package (HEC-GeoHMS) has been updated and new features added. This utility provides substantial capability to effectively use national terrain data sets to rapidly develop HEC-HMS models. HEC-RAS (Version 3.1.1) was released in March. New features include mixed flow regime for unsteady flow, navigation dam simulation, pumps, and additional hydraulic design functions such as uniform flow analysis, stable channel design, and sediment transport capacity computations. The companion GIS utility package (HEC-GeoRAS) has also undergone improvements and was released simultaneously with HEC-RAS Version 3.1.1. New HEC-GeoRAS features include a cross section plotting tool; ineffective flow areas theme; levee alignment theme; storage areas theme; and water surface profile results processing. The major flood damage and risk analysis software package, HEC-FDA, continues to be improved, with progress made in integrating the event program HEC-FIA, nonstructural measures and GIS capabilities into the risk analysis program HEC-FDA. The new stand alone NexGen software package HEC-ResSim was successfully released after undergoing significant testing. This is the successor to the legacy reservoir systems program HEC-5. The new reservoir simulation model, HEC-ResSim version 2.0 had its initial release in 2003. HEC-ResSim features a map-based schematic development environment, simulation of multiple dams and outlets, and an operations scheme to define the reservoir's operating goals and constraints in terms of pool zones and zone dependent rules. Important capabilities include operation of multiple reservoirs for a common downstream control (while balancing storage among reservoirs), configurable plots, integration with HEC-DSSVue, and a familiar Window look and feel.

CWMS: The project to modernize the Water Control Data System (WCDS) software began in FY 1997 and the initial version is now completed and deployed. Because the modernized system is much more than a data system, it was renamed to the Corps Water Management System (CWMS). The CWMS is the decision support Automated Information Systems (AIS) that supports the Corps water management mission. It embodies data acquisition, validation, transformation and management; forecasting, simulation and decision support analysis; and information dissemination. Modernizing and deploying

the corporate software for CWMS was a six-year, $7.6 million PRIP funded, Corps AIS improvement project managed under the Corps Life Cycle Management of Information Systems (LCMIS) process. Deployment began in FY 2002 and was concluded in December 2002. CWMS Version 1.2 is now installed in all Corps field offices. Improvements to the system continue via a field-prioritized betterments program. The improved CWMS will be released for upgrading existing field installations in calendar year 2004. Improvements include the addition of snow-melt modeling, several new features in HEC-ResSim, the capability of storing, retrieving, and editing rating table information, upgraded data stream processing, new security features, and visualization scaling. The management and funding structure provides for a modest field-directed betterments program that will be ongoing throughout the life cycle of CWMS. Information about CWMS and other HEC software is available on the HEC Web site: http://www.hec.usace.army.mil/cwms/.

Training: HEC continued the training program rebound by presenting eleven week-long PROSPECT courses and five field workshops that totaled an additional five weeks of training. The courses covered several hydrologic engineering and planning analysis topics including HEC-RAS, HEC-HMS, GIS applications, watershed/river and wetlands restoration courses, and advanced courses in unsteady flow and HMS applications. Attendance averaged about 25 students per course. The on-site workshops focused on HEC software such as HEC-RAS, HEC-HMS and HEC-DSSVue.

Technical Assistance/Reimbursable Projects: Reimbursable project work was undertaken for Corps field offices as well as HQUSACE Civil Works Planning and Engineering, Engineering Research and Development Center – Coastal and Hydraulics and Environmental Labs, the Federal Emergency Management Agency, the National Institute for Building Sciences, and the US Bureau of Reclamation. Projects include watershed and reservoir system modeling, water quality, risk analysis, river hydraulics, wetlands hydrology, water control management, regional statistical analysis, flood damage analysis, flood warning response systems, GIS applications in hydrology and hydraulics, groundwater modeling and water supply in support of the CALFED investigations.

For several years, HEC has managed a project to update the model geometry for the Mississippi Basin Model System (MBMS) to reflect more recent mapping and to develop an inundation-mapping component based on the new mapping. The significant work includes cutting the new river section geometry, integrating these new digital map-based geometry sections into the UNET models, re-calibrating the models, and preparing final reports. Work was essentially completed early in FY 2002. HEC also continued support in modeling the Sacramento and San Joaquin river basins for flood control operations with a task to adapt the HEC-5 models to the new HEC-ResSim, The GIS-based package coined 'Ecosystem Functions Model,' developed for the comprehensive study, is intended to assist in regional-scale environmental evaluation of alternatives, continues to be developed by HEC for applications elsewhere. Some work continued on application of reservoir optimization models to study reservoir storage utilization in support of improved flood operation for the American River below Folsom Dam. Groundwater modeling work was undertaken in the Lake Tahoe Basin, Ft. Huachuca Arizona, and Santa Claus Alaska. Reimbursable funding paid for improvements to HEC-RAS (internal boundary condition for MVP), and HEC-HMS (dam safety for FEMA). Jefferson Parish - Existing UNET unsteady flow models were converted to HEC-RAS for compatibility with current floodplain management studies. HEC provided a detailed review of the models and advised the district of necessary changes; Anacostia H&H – HEC developed the baseline hydrology using HEC-HMS and the baseline hydraulics using HEC-RAS. Frequency-based estimates were made for flow and stage at all locations; Tooele Army Depot Ground Water – A ground water model was developed and calibrated for this waste disposal site; Susquehanna River Flood Warning System – a river hydraulics model was developed using HEC-RAS and flood damage analysis was performed with HEC-FDA. A GIS based flood warning system was developed to predict flooded areas and damages for real time monitoring and response actions. Savannah River Drought Contingency Study – HEC developed new hydropower simulation capabilities in HEC-ResSim to support system hydropower operations, pump-back storage operation, period average operation goals, and numerous other capabilities needed for the drought study and an on-going comprehensive study of the

Savannah watershed. The total reimbursable project program was about $1.0 million with individual projects ranging from a few thousand dollars to upwards of $150,000.

HEC is in a position to undertake new reimbursable work this year. HEC is especially interested in applying new methods and tools to Corps and others water resource problems, and in developing new or adapted tools as would be helpful in project studies and water control management.

Overview 2004: The HEC program for FY2004 will continue FY2003 efforts as reflected at the end of the year. HEC will continue developing and fielding new versions of the NexGen software packages HEC-RAS, HEC-HMS, HEC-ResSim, and HEC-FDA and companion GIS utility software. Version 1.3 of CWMS will be released to Corps offices. HEC is excited about entering into an agreement with The Nature Conservancy to build products and work collaboratively on Sustainable River Projects throughout the country. We expect far reaching benefits to the Corps, both districts and HEC, and TNC. HEC is also advancing our Corps planning capabilities by participating in the Corps' Planning Associates Program. PROSPECT training is expected to remain high, continuing at about the same rate as FY 2003. It is expected that civil works Research and Development funding, the base funding for improvement in methods that enhance the NexGen software family, may continue to decline along with the overall decline of the Corps R&D budget, and software maintenance and support will stay about the same to slightly increase, CWMS modernization, maintenance and funding will stabilize (as planned) at about half what it was at its peak two years ago, and reimbursable technical assistance and special projects will be about $1.5 million. On balance, with the constrained Federal budget for FY 2004, the coming year is expected to be a challenge for HEC to maintain a vigorous work program.

DECISION METHODOLOGIES DIVISION

The Decision Methodologies Division **mission** is to develop tools to help people make better, more informed decisions in water resources. The Division team accomplishes this mission through research, studies, corporate service, and field support.

The traditional core of the Division's work is in conducting **research and studies** related to decision-making methodologies. Division products include IWR-MAIN, a water demand forecasting software, IWR-HydroRepair, a tool for evaluating major rehabilitation investments for hydropower plants, IWR-HarborSym and IWR-NavSym, which are tools for evaluating the economic benefits of navigation improvements, IWR-PLAN, a program for conducting cost effectiveness and incremental cost analyses for ecosystem restoration, and ABS_Cube, a multi-dimensional analysis tool for the Corps Civil Works O&M budget. FY03 research programs and work units were:

- Investment and Management Decision Making Research Sub-Program, including continuing work focused on a multiple criteria decision making (MCDM) software module to aid in the formulation of multiple purpose/objective plans.
- Principal Investigator for the national Flood Damage Data Collection Program.
- Technical Support for the Corps' O&M Automated Budget System (ABS)

The Division's **corporate service** work results in wide-ranging applications throughout the Corps. Much of this work is performed for the Corps' Headquarters, and in FY03 included the following assignments:

- Support of the Planning Excellence Program, including:
    - Support to the new Planning Associates (PA) Program, including membership on the Program Steering Committee; and project management of the PA Kick-Off Session, the two-week Washington Experience session, and the Program Graduation session.
    - Development and updating of the Roster of Planning Technical Specialists ("Technical 13s, 14s and 15s") in the Corps' Districts, Divisions and Headquarters.

  - Development and distribution of the Planner's Reference CD.
  - Co-Chair and staff participation in the Planning Models Improvement Program Task Force including writing the task force report.
  - National survey to identify models being used by the agency.
  - Initiating update of the NED manual series.
  - Initiating development of an electronic version of Management Measures
- Assessing the use of air quality benefits in project evaluation.
- OMB questionnaires: The Division is responsible for maintaining OMB approval for civil works questionnaires and providing technical support to districts for implementing the surveys.
- Assisting the project delivery team for the Corps' P2 software for project management
- Technical Support for the Corps' O&M Automated Budget System (ABS)
- Support and presentations to the National Academies of Science team studying Corps' policies and practices pursuant to Section 216 of the Water Resources Development Act of 2000.
- Presentation and other support for training that develops and maintains essential technical capabilities, including training in:
  - Cost Effectiveness and Incremental Cost Analysis (IWR workshop).
  - Planning Principles and Procedures (Planning Core Capability Course).
  - Economic Considerations in Planning (Planning Core Capability course).
  - Economics Analysis for Water Resources Planners (PROSPECT course).
  - Risk Analysis in Water Resources Planning and Management (PROSPECT course).
  - Ecosystem Restoration Planning and Evaluation (PROSPECT course).
  - Regulatory I – Basic Regulatory Functions (PROSPECT course).
  - Regulatory IIA – Policy and Procedural Issues (PROSPECT course).
  - Regulatory IIB – Decision-Making (PROSPECT course).
  - Regulatory Executive Seminar.

The Decision Methodologies Division has a strong collection of **field support** activities that assist studies being conducted by Corps' Districts and Divisions. These activities range from free one-stop visits to discuss the specifics of a project to becoming intimately involved in study execution on a cost reimbursable basis. FY03 field support activities included:

- Membership on the National Technical Review Committee for the Louisiana Coastal Area Feasibility Study, with the New Orleans District.
- Application of IWR-HarborSym to the Sabine-Neches Navigation Feasibility Study, with the Galveston District.
- Application of IWR-HarborSym to the Tampa Bay General Reevaluation Report with the Jacksonville District.
- Application of IWR-NavSym to the Colorado River locks study, with Galveston District.

Products of the Decision Methodologies Division in FY03 included:

- "Planning References CD, January 2003, IWR CD-03-1

PLANNING, AND POLICY STUDIES DIVISION

INSTITUTE FOR WATER RESOURCES

The Planning and Policy Studies Division carries out its mission in support of the Director of Civil Works by conducting policy analysis, planning and studies of national and regional scope.

Since 1976, the program has contributed to the development of numerous policies and programmatic initiatives within the Civil Works Directorate as well as several important national and regional studies.

The program continues to serve the Corps by assessing and evaluating changing national and regional water resources issues; natural resources uses and management; and related public works infrastructure management needs as they affect Corps Civil Works missions, policies, practices, legislative mandates, and executive directives. During FY03 the division provided direct support to the HQ Planning and Policy Division through the Policy Studies Program. In addition to work within this program, special studies of national and regional scope were undertaken that built on the policy directives and research tools, which were developed at IWR.

Among the noteworthy national and regional special studies undertaken in FY03 were:

- National Shoreline Management Study
- Texas Water Assessment
- Corps Environmental Database Development
- Upper Mississippi River Flow Frequency Study: Climate Change and Variability
- Examination of Consistency within the Northwest Division Regulatory Program
- International Joint Commission Support for Lake Ontario Study
- Distribution of Shore Protection Benefits (for OMB)

Among the specific policy studies conducted during FY03, the following subjects and issues were included to support the development of legislation, policies, directives and guidelines for various activities within the Corps Civil Works (CW) program:

- Improving Environmental Benefits Analysis
- Integrated Water Resources Management and the Conserving Species at Risk
- National Water Demand and Availability
- Advanced Measures Forecasting (PL84-99)
- Integrated Technical Assistance for Flood Damage Reduction
- Regional Sediment Management Policy Issues
- Water Resources Adaptations to Climate Change
- Water Supply Study
- Revitalization of Corps of Engineers Projects
- Off-site Alternatives Permit Review
- Water Resources Development Implications for Freshwater Biodiversity
- Flood Hazard Mitigation (Disaster Mitigation Act 2000)

During the year, permanent staff personnel were joined by visiting scholars from leading universities in the country. Visiting scholars work full time in the division office or visit from time to time during their appointments. In FY03, Dr. Peter Rogers joined IWR as a Maass-White Scholar. Dr. Rogers is a Gordon McKay Professor of Environmental Engineering and Professor of City Planning at Harvard University. He contributed to discussions on numerous policy and special studies, including those related to integrated water resources management, governance issues, retaining National water resources planning expertise into the future IWR Maass-White visiting scholars contribute to a large number of policy and special studies and upon their return to teaching; their academic programs are enriched by exposure to information they learn while working for the Corps. Overall, the division staff and visiting scholars have a significant influence on the state of current knowledge, from papers presented at various workshops and conferences, as well as publications in peer-reviewed journals.

NAVIGATION AND WATER RESOURCES APPLICATIONS DIVISION

The Navigation and Water Resources Applications Division provides support for HQUSACE and field divisions and districts for project and system studies of navigation improvements and other water resources issues. The division conducts national and special studies as directed by HQUSACE. It also performs

recurring national-level analyses, such as the update of vessel operating costs for waterways and harbors, development of harbor and waterway commodity traffic and fleet forecasts, and analysis of the recovery of navigation costs. The division also provides program management and technical support for the Inland Waterways Users Board (IWUB), manages the U.S. Section of the International Navigation Association (PIANC), and supports overall Corps coordination with the Transportation Research Board (TRB) of the National Academy of Sciences. The division manages and conducts research in the Navigation Economic Technologies (NETS) and the Risk Analysis for Water Resources Investments R&D programs.

Major activities include the following projects and studies:

Continuing Support Activities: The foundation for evaluation of navigation projects, both waterways and deep draft harbors, is the comparison of transportation costs with and without proposed improvements. As part of the USACE Transportation Systems Program, the division maintains and verifies current data on ocean and waterway vessel operating costs, the dimensions of these vessels, the distribution of ocean vessel sizes in the world fleet, and the configuration of barge tows on waterways. This information is transmitted by HQUSACE to all Corps districts as CW planning guidance.

Coordination of Waterway Construction and Studies: The IWUB, created by the Water Resources Development Act of 1986, is charged with advising Congress on priorities for improving inland waterways. To provide technical information desired by the IWUB and the Army, the division performs ongoing analysis of construction and studies funding schedules for projects on the fuel-taxed waterway system. This analysis incorporates the USACE and IWUB priority evaluations of projects in accordance with the budget constraints imposed by the Trust Fund.

Research Activities: Navigation economic and risk analysis and research are designed to provide information and support for investment decisions. The NETS program was planned in FY 2002 and began in FY 2003 to advance the state of the practice in Corps navigation studies. Areas of focus include methods applied to waterways and harbors. Risk and associated uncertainties can provide vital information about project engineering and economic performance. Research in this area develops tools and methods to assist Corps district offices. These are transmitted to districts in the form of reports and software tools. Additionally, training is provided on risk analysis methods and specific applications to Corps business processes.

Ongoing Studies:

- Continuing Support Activities
  - Update and distribution to field of transportation cost models for barges, rail, and trucks
  - Update of both ocean and inland vessel operating and replacement costs
  - Enhancing a software package for customizing deep draft vessel operating costs
  - Development of national and regional commodity and fleet forecasts for use in planning studies
  - Analysis of waterway benefit categories, including regional economic benefits and non-traditional benefits such as reduction in air emissions, accident and congestion.
  - Assist in the development of the navigation component of the Value to the Nation website
  - Assist Savannah District with reanalysis of economic impacts from deepening
  - Savannah Harbor to include multi-port analysis
  - Hurricane preparedness and evacuation strategies for coastal and island communities

- Coordination of Waterway Construction and Studies
  - Program management support on activities of the IWUB
  - Analysis of waterway project schedules and financial status of the Inland Waterways Trust Fund

- Research Activities: Navigation Economic Technologies (NETS) R&D
  - Development and testing of four methods to estimate demand elasticity for waterway transportation services
  - Investigation and development of a spatial equilibrium model for evaluation of waterway investments
  - Development of a multiport analysis tool with emphasis on container traffic
  - Inland navigation models symposium to direct future inland navigation research and specify methods for peer review of models

- Research Activities: Risk Analysis for Water Resources Investments R&D

- Development of risk-based methods to apply to the evaluation of deep draft navigation projects
- Development and field application of risk analysis, event-based IWR-HarborSym software tool for evaluating harbor improvements
- Development and field application of risk analysis, event-based hurricane and storm damage reduction software tool
- Extension of the use of scenario analysis for making decisions under uncertainty

Recent Products:

- **Continuing Support Activities**
- National Dredging Needs Study (Section 402 of the WRDA of 1992)
- Evaluation of economic benefits of cruise ships
- Annual Report to Congress on the Status of the Harbor Maintenance Trust Fund
- Financing practices for international dredging of port and harbors
- Information Brochure: Inland Navigation Value to the Nation
- Projected and Actual Traffic on Waterways
- The Role and Value of Tributary Waterways
- Study of Data Needs for Low Commercial Use Harbors
- Development of alternative future scenarios for the Upper Mississippi and Illinois
- Waterway Study
- Economic Evaluation of North Carolina Beaches after Hurricane Fran

PROGRAM ANALYSIS DIVISION

The Program Analysis Division develops and carries out assigned program analysis and evaluation studies to assist HQUSACE in Civil Works program development, defense and execution. The Division also provides analytical support to HQUSACE and Corps field offices to describe, evaluate and improve the performance of the Civil Works program.

Major activities undertaken in FY 03 include the following:

- **Civil Works Planners Training and Development**. The Program Analysis Division continued to provide primary analytic and contract management support to this high priority Civil Works effort to improve planner capability. During FY 03 the division launched the Master's Degree in Water Resources Planning and Management. During this period students attended Johns Hopkins, Southern Illinois, and University of Arizona. It continued to develop course materials and plans of instruction for two of the seven "core curriculum" training courses for planners: a training course in plan formulation, and a course in public involvement. During this period the division staff also launched the planners' resource web site.

- **UNESCO Support**. The Program Analysis Division sent a representative to Delft, the Netherlands for several weeks to implement signed agreements between the Corps, the Institute for Hydraulic Engineering (IHE) and the United Nations Educational, Scientific and Cultural Organization (UENSCO). During this period IHE became one of the UNESCO learning organizations (UNESCO-IHE). The purpose of the agreement is to promote training and research exchanges, and IWR continues to actively engage in that process. Close working relations were also established with the Dutch Rijkswaterstaat through technical exchange trips and participation on a World Water Forum panel.

- **Civil Works Strategic Plan.** The division continued with the development of the Civil Works Strategic Plan. This plan lays out a future direction for the civil works program stressing the adoption of a watershed perspective in all aspects of water resources planning and management activities. The plan provides goals, objectives, and performance measures that will be used to evaluate program performance in Navigation, Flood and Coastal Storm Damage Reduction, Environmental Stewardship and Restoration, Water Supply, Recreation, Hydropower, Regulatory, and Emergency Management business lines. The plan was sent out for public review and commend during fiscal year 2002. In fiscal year 2003 comments received from the public and other agencies were addressed in a revised draft plan, which was then coordinated with the Office of Management and Budget. The plan was also briefed to many audiences within the Corps as well as at several public forums during the year.

- **Value to the Nation Initiative**. The purpose of this initiative is to call attention to the value the Nation receives from its investment in the Civil Works program. Products from this initiative include a web-site and a series of brochures focused on Corps project results. In FY03, the web-site, which provides users with information about Corps projects and their contributions to the Nation's economic, social and environmental well-being, was updated and enhanced. In addition, Value to the Nation brochures describing the value created and delivered by several Civil Works programs were completed, including the navigation, environment, emergency management and regulatory programs.

THE NAVIGATION DATA CENTER (NDC)

Waterborne Commerce and Vessel Statistics

Under the authority of the River & Harbors Act of 1922, as amended, and codified in 33 U.S.C. 555 the Corps is to collect, process, distribute, and archive commercial vessel trip and cargo data. These data and statistics are used to analyze the feasibility of new water transportation projects and activities; to set priorities for new investment and rehabilitation; and for management of the operations and maintenance of existing projects.

Under Federal law, vessel operating companies must report domestic waterborne commercial vessel movements directly to the Corps. The types of vessels include: dry cargo ships and tankers, barges (loaded and empty), towboats (with or without barges in tow), tugboats, crew boats and supply boats to offshore locations, and newly constructed vessels from the shipyards to the point of delivery. Vessels remaining idle during the monthly reporting period are also reported.

U. S. Foreign waterborne import, export, and in-transit cargo and vessel movement data are provided to the Corps by the U. S. Customs Service, the Bureau of the Census, and the Port Import Export Reporting Service.

Movement data acquired by the Waterborne Commerce Statistic Center of NDC is primarily for the use of the Corps and other governmental agencies; however, summary statistics, which do not disclose movements of individual companies are also released to private companies and to the general public.

The Waterborne Commerce Statistics Center's standard publication, **Waterborne Commerce of the United States**, is issued in five parts (Atlantic Coast, Mississippi Valley and Gulf Coast, Great Lakes, Pacific Coast, and a National Summary). For the 2002 data year, published in 2003, the new trip ton-mile performance measure was incorporated into these publications. Trip ton-miles measures the total contribution a specific inland waterway or inland port makes to the national waterway system. Also available is **The Public Domain Database** that contains aggregated origin to destination information of foreign and domestic waterborne cargo movements.
Transportation Lines of the United States in three volumes contains a national summary of U.S. vessels, listings of domestic vessel operators, plus details their equipment and references their service areas.

Most data are available in both hard copy and electronic form.

Ports and Waterways Infrastructure

This information supports the Corps Federal Central Collection Agency responsibility for documenting the nation's commercial port infrastructure served by Federal channels. In FY 2003, five of the 56 volume Ports Series Reports were completed, distributed, and available for sale. PS No. 20A – Mississippi River Ports Below and Above New Orleans, LA; PS No. 25 – The Port of Corpus Christi, TX; PS No. 26 – Ports of Freeport, Point Comfort/Port Lavaca, Brownsville and Ports along the Gulf Intracoastal Waterway, TX; PS No.35 – The Ports of Tacoma, Olympia, and Grays Harbor, WA; and PS No. 38 – Ports of Southeast Alaska. In addition to the completed reports, field surveys were conducted and data entered into the Ports and Waterways Information Management System (PWIMS) for the following: PS No. 39 – The Ports of Southwest and Western Alaska; PS No. 65 – Ports on the Illinois Waterway (Miles 0-291, Grafton to

Lockport); PS.No.69 – Ports of Minneapolis-St. Paul, MN and Ports on Upper Mississippi River (Miles 300-860 AOR); PS No. 72 – Ports of Natchez, Vicksburg, and Greenville, MS; and Ports on the Lower Mississippi River (Miles 255-620 AHP); and PS No. 11 – The Ports of Hampton Roads and Ports on the James and York Rivers, VA. In addition to the printed reports, data for the 9,280 individual docks are available in summary from and as data files on the Internet. These data are updated and posted as each port area is re-surveyed and verified as current. The data are also of interest and use by the coast Guard in their homeland security mission.

Lock Performance and Characteristics

The lock performance database provides the Corps access to individual lock near real-time information. The Coast Guard in their homeland security mission also uses the data. The database has improved in accuracy with the addition of selected rules and edits. A national data warehouse that will provide all Corps users direct access to current and historical data and summaries has been designed and is under construction. Lock characteristics, the physical descriptions of all the Corps owned/operated locks, are available on the web to all users. The lock databases are feeder systems to the Operations and Maintenance Business Information System (OMBIL) decision support system.

Dredging Statistics

This web-based ORACLE database is successful in supplying information on all Corps performed and contracted dredging to the Corps, industry and private users. Data entry and report generation is accomplished via the Corps Intranet and enables all Corps members access to the information in the central system. The data have also been used by other federal agencies (GAO, AAA) in their investigations of dredging practices and participants. Database modifications have been made to enhance the data and to address certain GAO suggestions. Biweekly reports are posted on the public web site to inform the industry and public of Corps and contracted dredging activities. Standard reports and summaries plus custom queries and reports are quickly generated to meet Corps and user needs. The use of the information by Corps and industry has resulted in improved bidding competition and a more efficient utilization of dredging equipment. The dredging database is a feeder system to the Operations and Maintenance Business Information Link (OMBIL) decision support system.

Integrated Civil Works Products

NDC's production databases provide water resources facility inventories, outputs, and activities for the Civil Works businesses of navigation, hydropower, recreation, environmental compliance, natural resources and regulatory. These data are combined and internally distributed through OMBIL decision support system to support a variety of Corps management initiatives, as well as federal and public data requirements.

In support of the Civil Works business performance measurements, NDC extracts expenditure data from CEFMS and combines it with the different business output data to generate efficiency and effectiveness measurements. These measurements are for both internal use in the Corps https://ombil.usace.army.mil and submission to higher authority including OMB. Also, NDC data supports and is a source for the Corps "Value to the Nation" and the federal government's recreation access site "rec.gov".

The navigation data has been integrated with CorpsMap that provides an intranet web-based GIS interface. This web site includes many of the Corps other data layers such as Digital Project Notebook, Inventory of Dams, Bridge Inventory Database, Division and District Boundaries and Real Estate Holdings plus many standard layers such as state, county, congressional district, zip codes and etc.

All of NDC's publicly available navigation and water transportation data is available via a single gateway at http://www.iwr.usace.army.mil/ndc or on its annual CD-ROM. The site also provides links to other Corps, Federal and public sites related to the navigation business. NDC continues to strive to provide single site portals related to various management views for accessing all data and information

INTERNATIONAL NAVIGATION ASSOCIATION (PIANC)

The International Navigation Association (PIANC) is an organization consisting of approximately 40 national members. From its headquarters in Brussels, Belgium, it acts as a clearinghouse of technology and experiences relating to ocean and inland navigation improvements which are exchanged among engineers, scientists, port operators, and marina and vessel owners, to name a few. Its objective is to advance, on a worldwide basis, the sustainable development of all kinds of navigation through the exchange of technical information on port and waterway development. The objective of the Association is met by holding International Congresses and by publishing technical bulletins and special reports. Special reports are published describing the results of the work of international research teams, or working groups, composed of those national members interested in the particular subject under study. The organization also serves as an excellent source of identifying individual and corporate expertise throughout the world on PIANC-related subjects. Personal interchange of ideas and information also is promulgated by members attending the International Congresses held once every four years, and technical working group meetings held several times each year.

The business affairs of the Association are managed by the Annual General Assembly (AGA). It is composed of delegates who represent each member government. The number of delegates is determined by the size of the national membership, but may not exceed 11 per country.

The United States (U.S.), which has been a member of PIANC since 1902, provides an annual appropriation for the support and maintenance of the organization. This includes an annual subvention to PIANC International and payment of a portion of the travel expenses of officially appointed national delegates (Commissioners) of the United States to meetings of the AGA and Congresses. Total annual appropriation for the U.S. Section, PIANC is currently $45,000, including the annual subvention of approximately $15,000.

The U.S. Section is administered by law, under the auspices of the Department of the Army (Corps of Engineers). It is located in the Institute for Water Resources (IWR), Casey Building, Humphreys Engineer Center. The U.S. Section is composed of both individual and corporate members who pay membership dues. Membership of the U.S. Section on September 30, 2003, totaled 271, consisting of 220 individual members, 50 corporate members and 1 student member.

United States National Commission

The United States National Commission constitutes the governing body of the National Section. In 2003 the ex-officio officers of the U.S. National Commission were: Chairman, John P. Woodley, Jr., Assistant Secretary of the Army (CW)); President, MG Carl A. Strock, Director of Civil Works); and Secretary, Mr. Ronald R. Conner an employee of IWR.

In 2003, U. S. National Commissioners were: Mr. Robert D. Nichol, President, Moffatt and Nichol Engineers; Mr. Kurt J. Nagle, President, American Association of Port Authorities; Mr. Charles C. Calhoun, Jr., Vice President representing the Central Region and consultant; Dr. Robert H. Randall, Texas A&M University; Mr. Joseph H. Pyne, President, Kirby Corporation; Ms. Doris J. Bautch, Director, Great Lakes Region, Maritime Administration, U.S. Department of Transportation; Mr. Shiv Batra, Vice President representing the Western Region and President, INCA Engineers, Inc.; and Mr. Thomas H. Wakeman, III, Vice President representing the Eastern Region and General Manager, Waterways Development Division, Port Commerce Department, Port Authority of New York and New Jersey.

In September of 2003, MG Carl A. Strock replaced MG Robert H. Griffin as Director of Civil Works for the U.S. Army Corps of Engineers and also assumed the position of President of the U.S. Section. Mr. John P. Woodley, Jr., also was appointed as Assistant Secretary of the Army (Civil Works) in September of 2003, and thus assumed the position of Chairman, U.S. Section PIANC.

The Treasurer is Captain James R. Carman, (retired) who formerly served as Chief, Division of Port and Intermodal Planning, Office of Port and Domestic Shipping in the Maritime Administration.

Activities

The U.S. Section PIANC Annual Meeting, Roundtable on Port Security Issues, and Technical Workshops on Wetlands Restoration and Passing Vessel Issues was held in Portland, Oregon October 28-30, 2003. Events included an evening social, boat tour of the Willamette River hosted by the Port of Portland, a plenary session, and the technical

workshops. The U.S. Section Commissioners also held a meeting during this event.

The U.S. Section PIANC also co-sponsored (along with the American Society of Civil Engineers) a New York Harbor Dredging Tour on September 24, 2003. This event featured an on-water briefing and field inspection of current harbor-wide dredging activities in the Port Jersey, Kill Van Kull, Arthur Kill, and Newark Bay reaches of New York Harbor. Commissioner Tom Wakeman was one of the organizers of this tour.

Another event was the Breakfast in Seattle on February 26, 2003. Commissioner Shiv Batra was the driving force behind this activity, which provided an informative presentation by Col.. Ralph Graves, the Seattle District Engineer, and a networking opportunity for PIANC members and others in the Pacific Northwest region.

In May of 2003, a U.S. Delegation composed of MG Robert H. Griffin, Mr. Ronald Conner, Mr. Thomas Wakeman, Ms. Doris Bautch, Mr. Walt Ritchie, Mr. Harry Cook, Mr. James Goldston, Mr. Robert Nichol, and LTG Vald Heiberg (ret) attended the Annual General Assembly in Bergen, Norway. MAJ Tim Holman, Executive Officer to MG Griffin also attended, as did Dr. Robert Engler and Mr. Thomas Ballentine. The major resolution arising from the Bergen meeting was entitled "The Waterway is the Better Way: Sustainable development requires increased efforts for waterborne transport."

In September of 2003, Ms. Doris Bautch, U.S. Commissioner, made a presentation on PIANC to the Organization of American States Inter-American Committee on Ports in Merida, Mexico. Her efforts resulted in a resolution promoting the development of a cooperative relationship between the Inter-American Committee on Ports and the U.S. Section PIANC.

The first U.S. Section PIANC Scholarship was awarded to Brajesh Kumar, a Graduate Student in Ocean Engineering at Texas A & M University.

The U.S. winner of the 2004 DePaepe-Willems Award was Mr. David Gordon of the U.S. Army Corps of Engineers, St. Louis District. His paper was entitled "Chronic Dredging on the Upper Mississippi River Remedied with Innovative River Training Structures."

Representatives to Committees and Commissions

The principal business of PIANC is the sponsorship of technical working groups. The U.S. Section is represented by Principal and Co-Principal members of the Commissions that manage the activities of the technical working groups. The representatives were:

Environmental Commission – Dr. Robert Engler, Engineer Research and Development Center.

International Cooperation Commission -- Dr. Anatoly B. Hochstein, National Ports and Waterways Institute, University of New Orleans and Mr. Shiv Batra, INCA Engineers.

Inland Navigation Commission -- Dr. Sandra K. Knight, P.E., USACE, Engineer Research and Development Center, Waterways Experiment Station; Co-Principal, Mr. Tim Parker, Parker Towing Company.

Maritime Navigation Commission – Mr. E. Dan Allen, Moffatt & Nichol Engineers.

Recreational Navigation Commission -- Mr. Richard B. Dornhelm, Vice-President, Moffatt & Nichol Engineers; Co-Principal, Jack C. Cox, PBS&J.

New Technical Working Groups

In 2003, nine new Working Groups were formed. The groups are listed below along with the name of the Principal U.S. Representative.

MarCom WG 46 – Maritime Freight Transshipment, Ms. Doris Bautch

MarCom WG 47 – Criteria for the Selection of Breakwater Types and their Optimum Damage Level, Dr. Jeffrey A. Melby.

MarCom WG 48 – Guidelines for Port Constructions, related to Bowthrusters, Mr. Marcel Hermans and Mr. Gary Greene.

EnviCom WG 12 – Sustainable Waterways within the Context of Navigation and Flood

Management, Dr. Craig Fischenich and Mr. John D. Clarkson.

EnviCom Experts Group 2 – Environmental Benefits of Waterborne Transport, Dr. David A. Moser.

EnviCom WG 13 – Best Management Practices Applied to Dredging and Dredged Material Disposal Projects for Protection of the Environment, Mr. Thomas Wang and Dr. Douglas Clarke.

EnviCom WG 14 – Dredged Material Beneficial Use Options and Constraints, Mr. Richard F. Gorini.

RecCom WG 16 – Protecting Water Quality in Marinas, Mr. Jack Cox and Mr. David Dykstra.

RecCom WG 17 – Guidelines for Marina Design, Mr. Dennis P. Kissman.

Working Group Reports Published in 2003:

MarComWG 28, Breakwaters with Vertical and Inclined Concrete Walls

MarCom WG 40, State-of-the-Art of Designing and Constructing Berm Breakwaters

MarCom WG 41, Guidelines for Managing Wake Wash from High Speed Vessels

EnviCom WG 6 – Guidelines for Sustainable Inland Waterways and Navigation

EnviCom WG 7 – Ecological and Engineering Guidelines for Wetlands Restoration in Relation to the Development, Operation and Maintenance of Navigation Infrastructures.

Active Working Groups and the names of the U. S. Representatives :

InCom WG 21, **Economic Studies of Inland Waterways**. Organized February 1996. Mr. David Grier, USACE, Institute for Water Resources.

InCom WG 22, Safety in Inland Navigation. Organized November 1996. RADM William T. McMullen, Texas A&M, Galveston, Texas.

InCom WG 23, Technical and Economic Problems of Channel Icing. Organized December 1997. Mr. Claude Strauser, USACE District, St. Louis. Report is being reviewed and should be published in 2004.

InCom WG 24, Vessel Traffic Management in the Inland Waterways. Organized March 1998. Mr. J. Michael Sollosi, U. S. Coast Guard. This working group completed their report and provided a technical brief on River Information Systems. This is the first PIANC working group to become a standing committee due to evolving trends in river management and information systems. The committee will be restructured for additional membership in 2004.

InCom WG 25, Maintenance and Renovation of Navigation Infrastructure. Organized July 1999. The group has met 5 times and is progressing on their report. Dr. James McDonald, USACE-ERDC (retired) was the U.S. representative and chaired the committee. Mr. James Blanchar, USACE-MVR (retired) served as corresponding member.

InCom WG 26, Design of Control Structures Used on Navigable Waterways: Controllable Weirs and Gates. Organized June 2002. Mr. Dale Miller, INCA Engineers and Dr. Richard Stockstill, USACE-ERDC. The most recent meeting of this group was sponsored by the U.S. members and held in Pittsburgh, Pennsylvania. The meeting included a field trip to the Braddock Dam.

InCom WG 27, Guidelines for Environmental Impacts of Vessels. Organized June 2002. Dr. Thomas Keevin, USACE-St. Louis District.

MarCom WG 36, Catalogue of Precast Elements. Organized October 1996. Dr. Billy L. Edge, Texas- A&M University.

MarCom WG 39, Monitoring of Breakwaters. Organized January 1998. Mr. James D. Prehn, RLS, Spacial Data Survey.

MarCom WG 42, Life Cycle Management of Port Structures – Implementation Manual. Organization 2000. Dr. Valery M. Buslov, Hans-Padron Associates.

MarCom WG 43, Minimizing Harbor Siltation. Organized July 2002. Dr. John Headland, Moffatt & Nichol.

MarCom WG 44, Accelerated Low Water Corrosion. Organized July 2002. Dr. Ashok Kumar, USACE-ERDC.

MarCom WG 45, Post Earthquake Actions for the Restoration of Port Structures. Organized July 2002. Dr. Stephen Dickenson, Oregon State University.

RecCom WG 9, Regeneration of Harbour Areas for Sport and Pleasure Navigation Use. Organized July 1995. Mr. Jack C. Cox, PBS&J Consultants.

RecCom WG 13, Dredging of Marinas. Organized July 1999. Mr. R. W. Lofgren, Lofgren Imagineering & Construction Company.

RecCom WG 14, Access to Sport and Recreation Boating for Persons with Disabilities. Organized February 2001. Mr. Daniel Natchez, Daniel S. Natchez and Associates, Inc.

RecCom WG 15, The Use of Alternative Materials in Marina Construction. Organized July 2002. Mr. Terrence Browne, Collins Engineering.

EnviCom WG 8, Generic Biological Assessment Guidance for Dredged Material. Organized January 2001. Todd S. Bridges, Ph.D., USACE-ERDC and Mr. Thomas H. Schadt, Anchor Environmental, LLC.

EnviCom WG 9, Environmental Impacts of Polar Marine Activities. Organized January 2001. Jon E. Zufelt, Ph.D., USACE, Cold Regions Research and Engineering Laboratory.

EnviCom 10, Environmental Risk Assessment in Dredging and Dredged Material Management. Organized June 2002. Dr. Jerome Cura, Menzie-Cura & Associates.

EnviCom 11, Management, Dredged Material Re-use and Transformation of Existing Confined Disposal Facilities. Organized June 2002. Dr. Michael Palermo, USACE-ERDC.

INTERNATIONAL BOUNDARY WATERS BOARDS

In order to carry out United States obligations under international agreements, the Office of the Chief of Engineers and several Corps divisions and districts with jurisdiction over areas bordering Canada have representation on numerous international boards, committees, and other groups. The majority of these boards were established by the International Joint Commission (IJC) as empowered in accordance with the provisions of the Boundary Waters Treaty of 1909 between the United States and Great Britain (for Canada). IJC boards fall into two broad categories: boards of control, which are more or less permanent and supervise compliance over an IJC order; and engineering, technical, or study boards, which are usually dissolved after completing and reporting on an investigation assignment.

In addition to boards created by the Commission, other international boards and committees are created by treaties or other arrangement in matters concerned with the water resources of joint interest, and the members report directly to the Governments or establishing agency. International boundary waters boards and committees having Corps of Engineers memberships during the fiscal year are listed in Table 45-1. For an explanation of the constitution of the various boards and committees, see the annual reports, Volume II for fiscal years 1977 and 1980.

In recent years the IJC has adopted an ecosystem approach for its Boards with a view toward amalgamating a number of its Boards, where it makes sense to do so, as a first step in the development of international watershed Boards. This approach stemmed from the Commission's recommendations in its 1997 report to the governments of the United States and Canada. This report was provided at the request of governments for a proposal on how the IJC might best assist them to meet the environmental challenges of the 21st century. Subsequently, governments asked the Commission, in a reference dated November 19, 1998, to further define the framework for operation of international watershed boards as recommended by the IJC in its 1997 report. The IJC provided governments with a December 2000 status report on the matter and several of its boards have been amalgamated since 1998.

TABLE 45-1
International Boundary Waters Boards Having Corps of Engineers Members

BOARD NAME	YEAR ESTABLISHED	UNITED STATES REPRESENTATION
1. Int. Lake Superior	1914	* Division Engineer, Great Lakes and Ohio River Division -- Chicago District Engineer -designated Alternate
2. Int. St. Croix River**	1915	*District Engineer, New England District
3. Int. Lake Memphremagog	1920	*District Engineer, New York
4. Int. Lake of the Woods Control Board	1925	*District Engineer St. Paul
5. Int. Lake Champlain	1937	*District Engineer, New York
6. Int. Kootenay Lake	1938	*1. District Engineer, Seattle 2. Dept. of Interior, USGS, Boise, ID
7. Int. Rainy Lake Board of Control	1941	*District Engineer, St. Paul
8. Int. Osoyoos Lake	1943	1. District Engineer, Seattle 2. *Dept. of Interior, USGS, Tacoma, WA 3. Washington State Parks & Recreation Commission, Olympia, WA

BOARD NAME	YEAR ESTABLISHED	UNITED STATES REPRESENTATION
9. Int. Red River Board ***	2000	1. District Engineer, St. Paul 2. * Dept. of Interior, USBR, Billings, MT 3. Dept. of Interior, EPA, Denver, CO 4. Dept. of Interior, USGS, Bismarck, ND 5. Mayor, City of Fargo, ND 6. ND State Water Commission, Bismarck, ND 7. MN Pollution Control Agency, Detroit Lakes, MN 8. MN Dept. of Natural Resources, Bemidji, MN 9. ND Dept. of Health, Bismarck, ND
10. Int. Niagara	1953	1. *Division Engineer, Great Lakes and Ohio River Division -- Chicago District Engineer -designated Alternate 2. Dept. of Energy, FERC, Wash., D.C.
11. Int. St Lawrence River	1953	1. *Division Engineer, Great Lakes and Ohio River Division Chicago District Engineer-designated Alternate 2. Civil Engineer, Retired 3. Mechanical Engineer, Retired 4. Rochester Institute of Technology 5. Atlantic Philanthropies
12. Coordinating Committee on Great Lakes Basic Hydraulic and Hydrologic Data	1953	1. * Great Lakes and Ohio River Division 2. Dept. of Commerce, Ann Arbor, MI
13. Int. Niagara Committee	1955	*Division Engineer, Great Lakes and Ohio River Division
14. Int. Souris River Board ****	2001	1. District Engineer, St. Paul 2. *ND State Engr., Bismark, ND 3. Dept. of Interior, USGS, Bismarck, ND
15. Columbia River Treaty Entities	1964	1. Division Engineer, Northwestern Division 2. *Bonneville Power Admin., Portland, OR
16. Columbia River Treaty	1964	1. *HQUSACE, CECW-ZB, Wash., D.C. 2. Department of Energy, Tucson, AZ
17. Int. Champlain-Richelieu	1975	1. *New York Dept. Environmental Conservation 2. District Engineer, New York 3. Vermont Environmental Conservation. Agency 4. New England River Basins Commission, Staff Associate 5. Dept. of Interior F&WS, Boston, MA
18. Lake Ontario - St. Lawrence River Study Board	2001	1. * Institute for Water Resources (IWR) 2. NY Department of Environmental Conservation 3. Cornell University 4. Rochester Institute of Technology 5. Saint Regis Mohawk Tribe 6. 6. Private Citizens (2)

* Signifies U.S. Section Chairman

** In September 2000, the International Joint Commission formally combined its existing International St. Croix River Board of Control and its International Advisory Board on Pollution Control - St. Croix River and established the International St. Croix River Board.

*** Amalgamated Board Comprised of Former Int. Red River Pollution Board and Red River Portion of Former Int. Souris-Red Rivers Engineering Board

**** Amalgamated Board Comprised of Former Int. Souris River Board of Control and Souris River Portion of Former Int. Souris-Red Rivers Engineering Board

Comprehensive Study on Regulating Water Levels on Lake Ontario and in the St. Lawrence River,

In FY2001, the International Joint Commission formed the Lake Ontario - St. Lawrence River Study Board to undertake a comprehensive five-year study to assess and evaluate the current criteria used for regulating water levels on Lake Ontario and in the St. Lawrence River. The Study Board engaged by the IJC is a bi-national group of diverse experts from government, academia, native communities, and interest groups representing the geographical, scientific and community concerns of the Lake Ontario - St. Lawrence River system. The U.S. Director of the Study is from IWR. The Corps of Engineers leads 5 of the 9 Technical Work Groups, and participates on 2 others.

The Mission of the Study is to consider, develop, evaluate and recommend updates and changes to the 1956 criteria for Lake Ontario-St. Lawrence River water levels and flow regulation, taking into account how water level fluctuations affect all interests and changing conditions in the system including climate change, all within the terms of the Boundary Waters Treaty. The Study Board is undertaking studies to provide the IJC with the information it needs to evaluate options for regulating levels and flows in the Lake Ontario-St. Lawrence River system in order to benefit affected interests and the system as a whole. These studies include:

a. Reviewing the operation of the structures controlling the levels and flows of the Lake Ontario-St. Lawrence River system in the light of the impacts of those operations on affected interests, including the environment;

b. Assessing whether changes to the Order of Approval or regulation plan are warranted to meet contemporary and emerging needs, interests and preferences for managing the system in a sustainable manner; and

c. Evaluating any options identified to improve the operating rules and criteria governing the system.

The Study Board will provide options and recommendations for the IJC's consideration. The Study Board will integrate as many relevant considerations and perspectives into its work as possible, including those that have not been incorporated in previous assessments of Lake Ontario-St Lawrence River regulation, to assure that all significant issues are adequately addressed.

INVESTIGATION OF PROJECTS UNDER FEDERAL POWER ACT

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REGULATORY, SUNKEN VESSEL REMOVAL AND NATIONAL EMERGENCY PREPAREDNESS ACTIVITIES

1. Regulatory Activities

Authorities. The following authorities charge the Corps of Engineers with the regulation of various construction related activities in U. S. waters and wetlands: Sections 9 and 10 of the Rivers and Harbors Act of 1899 (structures in waterways and the alteration of waterways); Section 103 of the Marine, Protection, Research, and Sanctuaries Act of 1972 (Ocean Dumping); and Section 404 of the Clean Water Act (discharge of dredged or fill material).

Work Completed. During FY 2003, the Corps reviewed and authorized approximately 86,000 permit activities, 88 percent of which were approved within 60 days. About 7300 projects were issued individual permits, and another 79,000 activities were reviewed and approved under regional or nationwide general permits. General permits are issued to the public at large and define types of minor activities with no more than minimal adverse effects on the aquatic environment, which do not usually require the extensive review necessary for projects authorized by individual permits. Use of general permits provides significant relief to the regulated public by avoiding red tape for small projects with minimal environmental impacts. The Corps denied approximately 200 permits during FY 2003 since most projects which might otherwise have been denied a permit were either modified or conditioned to meet Corps requirements, scaled down to qualify for approval under general permits, or withdrawn. About 4,500 permit applications were either withdrawn or canceled. Under the regulatory program, the Corps made over 78,000 jurisdiction determinations in FY 2003, many of which were made in response to requests from landowners who were not applying for permits

The Corps investigated approximately 5,700 alleged illegal activities, most of which were violations of Section 404 of the Clean Water Act. Under the permit program in FY 2003, the Corps authorized the filling of approximately 21,000 acres of wetlands but required the restoration, enhancement, or creation of approximately 43,000 wetland acres.

On January 9, 2001 the U.S. Supreme Court invalidated a Corps permit denial by the Chicago District for the filling of isolated waters associated with a landfill by the Solid Waste Agency of Northern Cook County (SWANCC). The Court determined that the Corps long established protocol of asserting section 404 jurisdiction based on use of waters by migratory birds was not supported by the Clean Water Act. This called into question other Section 404 jurisdictional criteria. The Corps and EPA published an Advanced Notice of Proposed Rule Making (ANPRM) on SWANCC jurisdictional issues in January, FY 2003. Subsequent review of the public comments to the ANPRM resulted in the decision not to conduct a rule-making and concentrate on improving consistency issues with regard to jurisdictional determinations nationwide.

TABLE A
GENERAL REGULATORY FUNCTIONS

Obligations		
Unobligated Balance - 30 Sep 02	$	7,168,285
Allotments	$	141,090,753
Total Funds Available	$	148,259,038
Obligations	$	141,289,383
Unobligated Balance- 30 Sep 03	$	6,969,655
Expenditures		
Unexpended Balance - 30 Sep 02	$	12,022,952
Allotment	$	141,090,753
Total Funds Available	$	153,113,705
Expenditures	$	140,663,293
Unexpended Balance - 30 Sep 03	$	12,450,412

Investigation and Removal of Sunken Vessels

Under the authority of Sections 19 and 20 of the River and Harbor Act of 1899, the Corps of Engineers investigated sunken vessels in navigable waters and removed those obstructing navigation.

For obligation expenditures, see Table B (next page)

TABLE B
REMOVAL OF SUNKEN VESSELS
($000)

Obligations	
Unobligated Balance - 30 Sep 02	$ 16.1
Allotment	$ 475.9*
Total Funds Available	$ 492.0
Obligations	$ 577.6**
Unobligated Balance - 30 Sep 03	$ 10.0
Expenditures	
Unexpended Balance - 30 Sep 02	$ 16.1
Allotment	$ 475.9*
Total Funds Available	$ 492.0
Expenditures	$ 577.0**
Unexpended Balance - 30 Sep 03	$ 0.6

* $500 less O&M Savings and Slippage
** $85.6 Reprogrammed Into This Program During FY 2003

2. National Emergency Preparedness Activities

Authority. Executive Orders 10480 and 12656 and the Federal Emergency Management Agency (FEMA) under the Robert T. Stafford Disaster Relief and Emergency Assistance Act, 42 USC 5121 et seq. are the basis of the Federal Response Plan. The cited executive directives assign significant responsibilities for such preparation (planning, training, research and testing) to the Corps. This includes responsibility for development of comprehensive national level preparedness plans and guidance for response to all regional/national emergencies, whether caused by natural phenomena or acts of man, plans for response(s) to acts of terrorism, and the local preparedness necessary to support Corps continuity of operations. The Corps provides engineering and construction support to state and local governments in response to catastrophic natural/technological disasters. Rapid response to disasters of a regional/national magnitude requires that extensive pre-emergency planning and preparedness activities be conducted to assure the availability of a work force capable of shifting from routine missions to crisis operations and the organizational command and control structure(s) necessary to provide a coordinated and comprehensive response in the critical early stages of a catastrophic disaster.

Status. During FY 2003, the Corps of Engineers continued its effort to improve the command's readiness posture and its ability to respond to various national/regional catastrophic disasters to include terrorists attacks. Emphasis has been on those activities to prepare for catastrophic natural and technological disasters requiring major Federal support of state and local governments overwhelmed by a disaster event, and for national level emergency water planning. The primary focus during FY 2003 was to provide support to two major national level civil planning areas: (a) support to the nation's ability to mobilize national assets to meet national/regional level emergencies and (b) support to continuity of government and continuity of operations during national emergencies. Lessons learned from past hurricanes, floods, earthquakes, and events of September 11, 2001 as well as more recent events such as Hurricane Isabel, the National Capitol Region workshop, the Alaskan Hurricane CPX and the evolving New Madrid earthquake scenario, clearly indicate that the current system does not adequately provide for a response to catastrophic disasters that is sufficiently timely or comprehensive. In this regard, the Corps has initiated a program that uses the

deliberate planning process to develop scenario specific catastrophic disaster plans. This will result in more detailed planning and should provide for a more comprehensive response to national/regional catastrophic disasters to include terrorist attacks. More extensive coordination with Federal, state and local entities will be incorporated into plan development. In this regard, following FEMA's program focus, USACE continues to play a key role in national security planning such as supporting Homeland Security strategic planning efforts, development of the National Capitol Region Response Plan and other plans as the New Madrid Earthquake, the South Florida Hurricane, the Southern California Earthquake, the New Orleans Hurricane and other contingencies with national implications. Additional efforts focus on continuing to strengthen COOP readiness. Exercises, involving federal, state and local officials, contribute to a more timely and effective execution of Corps responsibilities during disasters that have national impacts. In November 2003, a U.S. Army Corps of Engineers Regional Response Workshop was held in Anchorage Alaska. This workshop served to validate the Anchorage Earthquake Catastrophic Disaster Response Plan (CDRP), serve as a means of addressing the unique requirements of a CDRP occurring in an extremely harsh environment, and to set the stage and planning for a related Command Post Exercise (CPX). A North Atlantic Division Weapons of Mass Destruction Regional Readiness Workshop was conducted in the Washington DC area in April 2003. This workshop served to provide an understanding of U.S. Army Corps of Engineers (USACE) roles and responsibilities under the Federal Response Plan, particularly by examining the evolving USACE and ESF #3 role in relation to the department of Homeland Security and the National Capitol Region Weapons of Mass Destruction Incident Contingency Plan. Major efforts have been made since September 11 for continued inter-jurisdictional collaboration in planning, training, and exercising to improve preparedness for a terrorist event in the NCR. A regional response to a WMD incident requires intense intergovernmental and inter-jurisdictional collaboration and cooperation, as was evidenced by the response at the Pentagon 9/11 incident. Continuing to capitalize on existing planning efforts and forums, and taking advantage of the current atmosphere of urgency regarding emergency preparedness will advance preparedness among all levels of government to improve response and ensure the health and safety of citizens, workers, and visitors in the metropolitan Washington region. A HQUSACE Table-Top Exercise (TTEX) was held on 6 May 2003 in Washington, DC. The TTEX explored the ramifications of a multi-strike terrorism event while a hurricane was impacting the east coast, particularly the National Capital Region. Portions of Virginia, Maryland, and New Jersey were impacted by high winds and flooding before the storm moved back out into the Atlantic. During the TTEX, besides the hurricane response, USACE staff also had to work around depleted resources from the ongoing War in Iraq, while also responding to terrorists events in California and Virginia. Participants examined decisions made by Federal, state, and local agencies throughout the course of the disaster. Scenario briefings described the progress of events, as well as Federal, state, and local activities that would be underway. Special topic briefings were presented to educate participants and clarify new concepts. The exercise involved response, recovery, and preparedness efforts surrounding a multi-disaster event from the Federal, state, local, and regional perspectives. Also discussion involved contingency planning, resource availability, and interagency coordination to successfully meet short and long term needs resulting from the disaster. Recurring themes were COOP, including plans and alternate headquarters responsibilities, staffing shortfalls, and resources. Senior leaders were required to conceptualize operations under which the priorities, capabilities, and needs of all partners and customers in a disaster operation are synchronized over the operational continuum. While the HQTTEX scenario opened the door on a large number of topics, the focus of the exercise was the plan of action for the Federal Response Plan's (FRP) Emergency Support Function (ESF) #3 – Public Works and Engineering, for which USACE is designated the operating agent for Department of Defense (DOD). For National Emergency Preparedness fiscal year obligations and expenditures, see Table C.

TABLE C
NATIONAL EMERGENCY PREPAREDNESS

Obligations	
Unobligated Balance - 30 Sep 02	$ 1,507,472
Appropriations FY 03	$ 4,000,000
Total Funds Available	$ 5,507,472
Obligations FY 03	$ 3,508,868
Unobligated Balance - 30 Sep 03	$ 1,517,710
Expenditures	
Unexpended Balance - 30 Sep 02	$ 2,461,011
Appropriations FY 03	$ 4,000,000
Total Funds Available	$ 6,461,011
Expenditures FY 03	$ 3,382,071
Unexpended Balance - 30 Sep 03	$ 2,598,047