The Lesson of the 1993 Flood: Restore the Army Corps Tradition

by Richard Freeman

This article highlighting the neglected infrastructure of the Upper Mississippi region and its relation to the devastating 1993 flood, was first published in 21st Century Science and Technology*, Winter 1993-94.*

The U.S. Army Corps of Engineers is one of a handful of the most important institutions in the history of America's development over the last 200 years. Its name is synonymous with dirigistic economics, infrastructure development, and the spawning and transmission of science and engineering. . . . The Corps participated in well over 2,500 infrastructure projects in the 20th Century. It built nearly every lock and canal system in America, including the ground-breaking Chesapeake and Ohio, Erie and Pennsylvania Canals and the St. Lawrence Seaway; and it operates every major lock and canal today. It deepened, dredged, or built all the nation's 250 deep-draft and more shallow ports, and all its harbors; and it manages all of them today. It supervised nearly every major river improvement project, including those for the Mississippi, Missouri, and Ohio River system, which constitutes the third-longest integrated river and tributary system in the world, at 1.2 million miles. It also performed similar operations for numerous other river systems, such as the Tennessee and the Sacramento Rivers.

In the 1930s, the Army Corps of Engineers built most of the nation's major dams, including the majestic Bonneville and McNary dams in the Pacific Northwest; it built and operates more than 400 dams. It supervised and built the Tennessee Valley Authority flood control/reclamation/hydro-electrification program, one of the wonders of the world. It engineered, graded, and built scores of the country's railroads, including the Baltimore and Ohio and the Western Railroad of Massachusetts. It conducted almost every major geographical survey in America. And, finally, the Army Corps built the nation's network of highways, starting with the original Cumberland, or National Road, from Cumberland, Maryland to Vandalia, Illinois. (This road never quite reached the Mississippi River, the original goal.)

These are the projects that enabled America to become a prosperous industrial giant—and that are under attack today by those who want to return to a preindustrial era. In fact, today, under pressure from the Congress and environmentalists, a portion of the Corps, along with its mission, is becoming "green," with projects to "restore" the Everglades, move spawning salmon upstream by boat on the Columbia River past the many hydroelectric dams, and reflood previously drained swamps to create "wetlands," under Environmental Protection Agency orders.

The Infrastructure Lesson

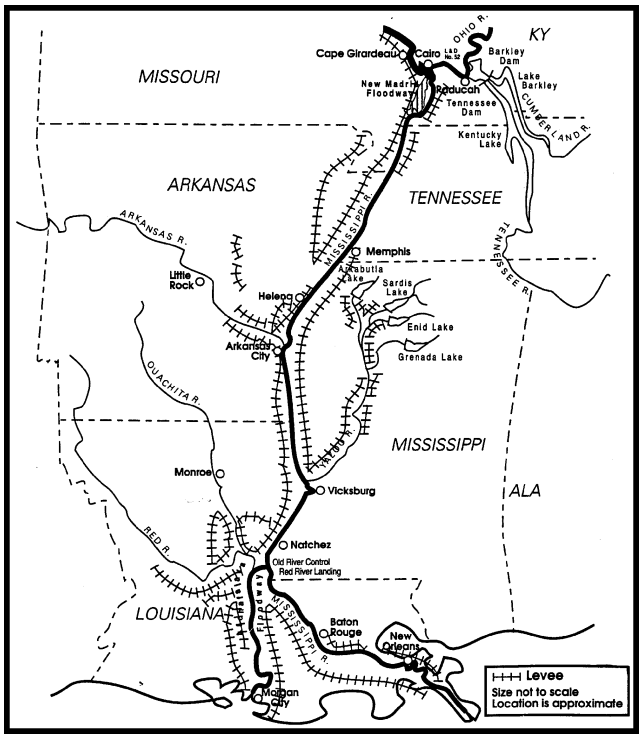
After basic scientific and technological discovery, investment in infrastructure is the most essential element required for the functioning of an economy. Infrastructure makes the alterations of nature—with respect to water management, energy generation, transportation—that drive forward the development of an educated work force and make possible manufacturing, agriculture, mining, and construction. The development of infrastructure sharply refutes the insanity of the Adam Smith school of "free enterprise," which paints infrastructure as a wasteful "pork-barrel."

The followers of this school of so-called free enterprise have no idea how an economy works. Yes, infrastructure requires large capital outlays that are financed more than half—and sometimes entirely—by Federal or state and local governments. The individual infrastructure project, in and of itself, often yields zero profit. Then why is it beneficial?

Alexander Hamilton, one of the founders of the American System of national dirigistic economics and this nation's first treasury secretary, correctly emphasized in the historic *Federalist* papers and in his 1791 "Report on Manufactures" that infrastructure's "profitability" derives from its capacity as the precondition enabling manufacturing and agriculture to operate and exist. A business without water, electricity, and a transport system to move its goods, will wither and die. By improving infrastructure, an economy increases its productivity and real wealth-generation, and thus enlarges the resulting tax base many times greater than the initial cost of infrastructure capital outlay.

However, if the expenditures for maintenance and improvement of infrastructure are not made, or are sacrificed to shortsighted budget-cutting, the productivity of the physical economy plummets, its output contracts, and the overall loss

Lower Mississippi River



Source: U.S. Army Corps of Engineers

Missouri-Upper Mississippi Rivers

The U.S. Army Corps of Engineers flood-control levee system is extensive for the Lower Mississippi (left), and completely prevented flooding and damage in that region in the huge Flood of 1993. But on the Upper Mississippi (right), such Army Corps infrastructure was never funded and remains to be built; it is there that the 1993 flood caused casualties and devastated towns, industry, and farmlands.

is enormously greater than any momentary gain from the budget cuts.

The Mississippi-Missouri flood of 1993 demonstrates this principle with a vengeance. The record flooding in the Mississippi River system in the Summer of 1993 caused between $15 billion and $25 billion of damage. This damage was not evenly distributed along the Mississippi River and its tributaries but was overwhelmingly concentrated in the Upper Mississippi system, north of Cairo, Illinois. The reason for this inequality of damages is related entirely to infrastructure: The majority of construction funds for flood-control projects over the past 60 years was expended on the Lower Mississippi, which suffered almost no damage. The U.S. Army Corps of Engineers spent $8 billion in flood control on the Mississippi River system, 69% of it on well-conceived projects on the Lower Mississippi.

The Upper Mississippi went relatively unprotected because of restrictions imposed by financiers and environmentalists from the outside, which prevented the Army Corps of Engineers from implementing water control plans for the Upper Mississippi system. For this reason, 97% or more of all the damage from the flood of 1993 occurred on the Upper Mississippi. It was not a question of an act of nature; it was a question of man's deliberate decision not to build infrastructure.

All told, during the past 60 years, the U.S. Army Corps of Engineers has spent $8 billion constructing flood control projects on the Mississippi River system, including its tributaries, the Missouri, Ohio, Illinois, Arkansas, Des Moines, Raccoon, and other rivers; and another $3.25 billion on operations and maintenance of the projects. Of the $8 billion spent on construction, $5.5 billion, or 69%, of the funds were spent on the Lower Mississippi, and only $2.5 billion, or 31%, on the Upper Mississippi.

The importance of investment in and maintenance of economic infrastructure was recognized early on in the country's history with regard to the development of the Mississippi and all water management. On Jan. 14, 1819, U.S. Secretary of War John C. Calhoun wrote in his "Report on Roads and Canals to the Congress of the United States": "A judicious system of roads and canals, constructed for the convenience of commerce and the transportation of the mail only, without

any reference to military operations, is itself among the most efficient means for the more complete defense of the United States."

On Feb. 6, 1816, the Roads and Canals Committee in the Senate, appointed by the President, issued a report that included this formulation: "That a view of the extent of territory, the number and magnitude of navigable lakes, rivers, and bays; the variety of climate, and consequent diversity of productions embraced by the United States, cannot fail to impose the conviction, that a capacity exists in this country to maintain an internal commerce. The variety of productions peculiar to the several parts, invites to the prosecution of a most interesting kind. . . . Any practicable scheme, therefore, for the improvement of roads and inland navigation . . . has strong claims to the . . . aid of a government constituted to promote the general welfare."

Granted, not all damage from a catastrophe can be prevented. But frequently, much of it can be. The Mississippi River itself, its ports and harbors, the river's depth, its floodplain, its system of diversionary escarpments, and their development and improvement over the last 175 years at the hands of the best infrastructure-building agency in America, the Army Corps of Engineers, is proof positive that much damage from such catastrophes can be prevented or minimized.

Had the extraordinary flood of 1993 occurred 50 years ago, before the Corps had instituted certain improvements, the level of the damage and loss of life could have been 30-50 times greater. On the other hand, if over the last 10 years, in the clutches of "budget-balancing ideology," the Congress had not nickel-and-dimed the Army Corps and the Mississippi River Commission to death, one-third to four-fifths of the current damage could have been prevented. To achieve this savings, the Corps would have had to spend perhaps $3-5 billion more than it did on further improvements on the Upper Mississippi River System flood control and navigation plan, and on such projects as expanded water diversion programs and a mandatory standardized levee system.

The Army Corps of Engineers documents from its records that it has spent $8 billion on flood control on the Mississippi, of which the lion's share, $5.5 billion, was spent on a brilliantly designed, unified flood control plan for the Lower Mississippi below Cairo, Illinois. That plan prevented $125 billion in damages on the Lower Mississippi in the last 40 years. That is, every $1 spent on flood control infrastructure saved $23 in preventable damages.

The Military's Role in Infrastructure

In 1802, the Army Corps of Engineers was established by the same Act of Congress that established the U.S. Military Academy at West Point, part of a project of founding father and nation-builder Alexander Hamilton and others. The Corps of Engineers and the Military Academy were in fact the same institution: The Military Academy was the nation's first engineering school and remained under the direction of the Corps of Engineers until 1866. Before 1875, nearly every engineering college founded in America attempted to obtain members of its faculty from, and base its curriculum upon, that of the Army Corps of Engineers and West Point.

The history of the Corps goes back to the Army Engineers of the American Revolution, established in 1775. Richard Gridley, the ranking engineer at the Battle of Bunker Hill in Massachusetts, became the Continental Army's first chief engineer in April 1775. The Corps of Engineers was formally established in May 1779, and the first head of the Corps was Louis Duportail, a Frenchman. The French scientific tradition is prominent throughout the history of America's Corps of Engineers. Duportail had been recruited in France and sent to America in 1777, with other engineers, by France's minister of war, Comte de St. Germain, and France's Foreign Minister M. Vergennes. The arrangement was secretly organized under the direction of Benjamin Franklin, the American ambassador to France and the intellectual author of the Revolution.

A key person in the U.S. Army's Revolutionary War engineer corps was the Polish republican freedom-fighter Thaddeus Kosciusko, who was the favorite of Commander-in-chief George Washington, and later, during the southern campaign, of Gen. Nathanael Greene. Kosciusko built the fortifications at West Point, and the huge chain across the Hudson River there that prevented the British from linking up their forces and supplies in New York City with those in northeastern Canada. After the Revolutionary War, Kosciusko went back to fight for his native Poland's freedom from Russia.

Kosciusko, along with every French engineer and many other foreign engineers in America, had studied at the Ecole Militaire in Mézières, France. The Ecole had been founded in 1749 based on the teachings of the formidable engineer and master of siegecraft, Sébastien le Prestre de Vauban (1633-1707). The Ecole Militaire was later transmuted into the celebrated Ecole Polytechnique, which is associated with the great geniuses of constructive geometry and warfare, Gaspard Monge and Lazare Carnot. Carnot saved the nation of France through his scientific projects, but his science had a still greater influence on the U.S. Corps of Engineers. . . .

Transforming the Mississippi River

Flood control projects were a major mission of the Army Corps of Engineers. The 1993 flooding of the Mississippi was not the only major flood in this country's history. In 1692, a flood occurred on the Delaware River in Trenton, New Jersey, which, if repeated today in the same unprotected circumstances, would be disastrous. In 1763, the "Point" at Pittsburgh, Pennsylvania was submerged by a flood. In 1861, some 700 people died in a deluge on the Sacramento River in California. In 1869, at Johnstown, Pennsylvania, uncontrolled waters killed 2,209 persons and destroyed more than $10 million in property. Floods on the unruly Colorado River in 1905 broke into the Imperial Valley in California. The uncontrolled flow into the valley for over a year created the

Salton Sea. The nation's previous most devastating flood occurred on the Mississippi in 1927; and in 1937, the Ohio River Valley suffered its worst flood in history, in which 500,000 people were driven from their homes, with damage estimated at $400 million.

The first works for the control of floodwaters developed on the Mississippi in 1712, at the lower end of the river. The young engineer Blond de la Tour was given the task of planning a levee (from the French word, *lever,* to rise) system so that the town that was to become New Orleans could be built. By 1727, the French had built a levee over one mile long and 3-4 feet high, along with a system of drainage ditches. This was part of a series of piecemeal, largely ineffective efforts for the next 120 years.

In 1824, provisions of the U.S. Constitution were interpreted to permit and affirm improvements for navigation of America's river systems. But the Federal government remained hamstrung in assisting localities and states in reducing flood damage. According to the "free enterprise users' fee" argument used against Federal intervention, because the people who lived near or on the riparian plain were the ones who needed flood control, they alone should pay for it. Starting in 1819, the state of Mississippi authorized construction of levees and provided for collection of taxes from riparian plain settlers. In 1846, the state began to tax the backlands, to help the landowners on the river. Louisiana did essentially the same. The problem with this system was that it often bankrupted farmers and those living on the plains, but had little serious effect in preventing floods. The flooding of the Mississippi in 1849 and again in 1850 was devastating.

In 1866, the Senate directed the chief engineers in the Corps of Engineers to investigate repairs necessary to prevent extensive damage to agriculture along the river. The resulting report recommended Federal intervention to build flood protection. Although the report was favorably received, the "free enterprisers" blocked action. Finally, in 1879, Congress created the Mississippi River Commission. After a giant Mississippi flood wrecked a levee line along the Mississippi in 1882, nearly wiping out the financial credit of the impoverished districts, Congress enacted the Rivers and Harbors Act of that year, which placed responsibility for building levees and maintaining them into the hands of the Army Corps of Engineers. This authority was not given in the name of flood protection directly, but for providing ease and safety of river navigation.

The bankruptcy of halfway measures was again demonstrated in 1927, when the most disastrous flood in American history struck, as the Mississippi surged and swelled. Just to give one example of its dimensions: On the night of April 15, New Orleans had a deluge of almost biblical dimensions—14.01 inches. By the time the waters receded, 200 people were dead and 700,000 had been driven from their homes, while property losses alone totaled $200 million.

The 1928 Rivers and Harbors Act, sometimes called the "Flood Emancipation Act," finally authorized the Army Corps of Engineers to develop a flood control system in its own name. The Act dealt a devastating setback—that could have been permanent—to the "free-enterprise budget balancers" in the Congress and Wall Street. However, the openings represented by the new Act were applied only to the lower half of the Mississippi—a major mistake.

The Mississippi has two distinct flood control systems, divided at Cairo, Illinois, located at the latitude of 37.5 north. The Mississippi arises about 150 miles north of Minneapolis-St. Paul, Minnesota, at approximately the 46th parallel, and runs down to New Orleans, where the river empties into the Gulf of Mexico at approximately the 30th parallel.

Working from the "Comprehensive Flood Control Plan" during the 1930s, the Army Corps of Engineers and the Mississippi River Commission developed methods for flood control that are generally used in combination: levees; floodways, diversion channels, and other outlets; dams and reservoirs; bank and channel stabilization; cutoffs; and contour plowing and reforestation. This approach was not systematically applied to the Upper Mississippi, however, because of so-called conservationists, the Morgan-bank-controlled railroads and utilities that were powerful in the first half of this century, as well as the budget balancers on Wall Street and in the Congress.

Developing the Lower Mississippi

But a magnificent engineering feat was achieved for the Lower Mississippi, as the Corps of Engineers built a unified, system-wide flood control plan. It shows that infrastructure-building, not nature as such, determines why calamities occur. The development of the Mississippi is an example of the Army Corps' skill and tradition at its best.

During the 1930s, the Army Corps of Engineers first built a working hydraulic scale model of the Lower Mississippi, covering several acres at its Water Experiment Station at Vicksburg, Mississippi. It was calculated how the Mississippi River would handle "a 100-year projected flood"—a hypothetical flood that would be the greatest in 100 years. Hydraulic pressure, sediment flow, and other readings were taken on each part of the Lower Mississippi. The hydrodynamic effect of each part of the river upon the whole, and of the whole upon each part, was carefully measured and projected.

Next, the Corps applied various methods for flood control developed in the "Comprehensive Flood Control Plan." These included:

Levees. These are earthen embankments or ramparts, frequently composed of sand and clay, placed on either or both banks of a river to prevent it from overflowing. They can be 10-15 feet high, or in some cases, they can be as high as 60 feet. The Lower Mississippi has 1,608 contiguous miles of levees on the main stem of the river from Cairo to the Gulf of Mexico. When the tributaries are included, there are 2,700 largely contiguous miles of levees. This includes levees on the Arkansas River, the Red River, the Yazoo River, the Ouachita

River—any place where there could be trouble.

Levees were only partially developed on the Upper Mississippi. Starting at the head of the Mississippi, north-northwest of Minneapolis-St. Paul, and following its flow southward, *there are no significant levee systems for 260 miles, until Dubuque, Iowa.* Levees were not built on the tributaries of the Upper Mississippi: the Missouri, Illinois, Raccoon, Des Moines, and Iowa rivers. In fact, of the 1,576 levees built on the Upper Mississippi, 85 percent of them were built on a "free enterprise" first-come, first-serve basis—not by the Corps. Some are well constructed; most are small and inadequate. They are not standardized as they are on the Lower Mississippi. During the flood of 1993, only two Corps of Engineers levees were breached or disintegrated, whereas hundreds of others gave way.

Floodways and spillways. These are diversion channels or outlets that relieve the Mississippi's alluvial region of excess water. An opening called a spillway is created, and then the water is diverted through the channel, called a floodway. The floodway can be short or long and will usually lead into another body of water that either already exists, like Lake Pontchartrain in Louisiana, or is man-made. In the case of the Atchafalaya River, into which a floodway from the Mississippi pours excess water, the floodway system takes that excess water more than 100 miles to the south and dumps it safely into the Gulf of Mexico.

The Lower Mississippi is lined with a series of continuous major floodways—the Bonnet Carré, Birds Point-New Madrid, Boeuf, Eudora, and Atchafalaya—for constantly relieving pressure and overconcentration of water. The floodways can take water flow that is traveling at 3 million acre-feet per second and divide it in two; the result is that only 1.5 million acre-feet per second would then flow on the main-stem Mississippi, and the remainder would flow through the floodway into the alternative channel—much like the functioning of an electrical parallel circuit.

One of the most famous achievements by the Corps of Engineers is the Bonnet Carré Floodway and Spillway, which, when necessary, can carry 1.5 million cubic feet of water per second out of the river and through Lake Pontchartrain to the sea, sidestepping New Orleans and saving it from flooding. The Bonnet Carré Spillway and Floodway was built as part of the great flood control infrastructure-building project of the 1930s. An author described its test under fire in the great flood of 1937:

> In 1937 . . . the largest flood of historical times poured down the Mississippi. The Army was ready to evacuate a million people if the levees broke. . . . The river was three miles wide at Memphis and climbing into the town [of New Orleans]. The Bonnet Carré Spillway, completed only two years before, was opened, a gate at a time. . . . It was a near thing. In many places, the water was levee-high. . . . But the levees held, and through the Bonnet Carré enough water was drawn off to cover 1,250,000 acres 10 feet deep. *This lowered the river level for more than a hundred miles,* and New Orleans was safe.

By contrast, the Upper Mississippi does not have a single major spillway to divert water.

The results are startling. The Lower Mississippi, for its entire expanse, can now handle floodwaters traveling at the stupendous flow levels of 2.5-3 million cubic feet per second. The upper limit that most of the Upper Mississipi can handle is floodwater speeds of 250,000 cubic feet per second, and many stretches cannot handle maximum flows of more than 100,000. Yet the floodwaters in 1993 flowed at 500,000-800,000 cubic feet per second. For the Upper Mississippi, this spelled disaster: $15-25 billion of damage.

If the correct projects had been built on the Upper Mississippi, *at least one-third, and most likely, four-fifths or more of the damage would have been prevented.* . . . It was not a question of an act of nature; this was a question of man's deliberate decision not to build infrastructure.

River Navigation, Harbors, and Reservoirs

Over the years, on all the major rivers of the United States, the Army Corps of Engineers was put in charge of flood control, along with navigation, port and harbor development, dam construction, and so on. Since the 1928 Rivers and Harbors Act, the Corps of Engineers has completed about 3,400 projects with flood control benefits. This includes more than 400 dams and reservoirs in 42 states. The reservoirs created by the Corps of Engineers store hundreds of millions of acre-feet of water. The man-made lakes created by Corps of Engineers' flood control dams have become such popular recreational spots that twice as many vacationers visit them, than visit our national parks. The Corps today operates 460 hydroelectric installations, most of which it built, and these produce one-third of the nation's hydro-generated electric energy. . . .

Over the last decade, the Congress, in particular, has put a straitjacket on the Army Corps with concepts of budget-cutting and balancing and with retrogressive environmental regulations. Many upgrades and improvements on the Mississippi River and other river systems, as well as other infrastructure projects, were not done, with the catastrophic results we now see.