Chapter XII: Origins of Ohio Valley Flood Control

Floods occurred in the Ohio Valley long before European explorers entered the region and before American pioneers denuded the region of its virgin forests. Fragmentary records indicated the flood of 1763 was the highest of record on the Upper Ohio River until 1936, and the flood of 1773 reached a height on the Lower Ohio probably not exceeded until 1937. These floods, because of the sparse population of the Ohio Valley, caused little property damage and human distress, but as settlements developed in the flood plain the consequences of each flood increased proportionately. The great floods of 1832, 1867, 1883, and 1884 on the Lower Ohio caused major damages, and after the flood of 1884 the Corps of Engineers was assigned its first limited flood control mission in the Ohio Valley.

Damages to the human environment resulting from floods in the twentieth century were so staggering that great public support developed for a comprehensive program of flood control. Planning studies were made from time to time by the Corps in the early part of the century, and in the 1920s the comprehensive "308 Reports" were commenced. After the calamitous Ohio River floods of 1936 and 1937, Congress committed the Unites States to a complete program of flood control and authorized construction of elements of the Ohio River Flood Control Plan. The Louisville Engineer District, as part of a nationwide Corps effort, launched construction in 1937 of the first elements of the program to provide substantial protection against flood disasters for citizens and industry in the Lower Ohio Basin.

Early Flood History

Thomas Hutchins, British Army Engineer, was stationed at Fort Pitt when floods occurred in 1762 and 1763. Hutchins and the British at Fort Pitt provided flood relief for victims — mostly Indians — of the flood of 1762, and during the flood of 1763 he and other British Army Engineers directed evacuation of the fortifications at Pittsburgh and completed doubtless the first flood-damage report in the Ohio River Basin — two lives were lost and a number of cabins destroyed.[1]

On the basis of historical records, it has been estimated that the 1773 flood on the Lower Ohio was as great as that of 1937; it crested at only 75 feet at the site of Cincinnati, while the flood of 1937 approached 80 feet, but it occurred before man-made structures encroached on the flood plain. It is also known that a major flood occurred in the Wabash Valley in the spring of 1779, because, it will be recalled, General George Rogers Clark had to contend with the flood in his historic march across Illinois to assault the British forces at Vincennes. But the heights of the earliest floods in the Lower Ohio Valley are matters of conjecture, and because of limited population and urban development at the time did not constitute major calamities. The first record of serious flood damages at Louisville was printed in the *Louisville Correspondent* on April 3, 1815:

> The extraordinary swell in the Ohio during the last week must have occasioned incalculable loss to persons owning property adjacent to the river. We understand that the valuable manufacturing

mill owned by Mr. Tarascon of Shippingport has been swept off, and a number of other mills in the vicinity of this place have been considerably damaged. It is said to be higher at this time than it has been known for the last twenty years.[2]

Flood of 1832

The flood of February, 1832, set records throughout the length of the Ohio River. It crested at 62.5 feet at Cincinnati; 44.5 feet at Louisville; and 63.6 feet below the Falls at New Albany — records which stood for fifty years. An eye-witness to the disaster at Cincinnati declared:

> It was painful to witness destruction on so vast a scale — some houses upset, others in imminent danger . . . Flatboats loaded with women and children, furniture, and live-stock, were busily engaged in Race, Vine, Elm, and Walnut streets.[3]

The fire-house at Marietta, Ohio, complete with fire engine and buckets, was swept down river and found at Louisville six days later. Flood damages were severe from Pittsburgh to New Orleans. A Louisville newspaper reported that only the church steeple at Lawrenceburg, Indiana, remained above water and that "millions can scarcely compensate for the damage that has been experienced."[4]

First Corps Studies of Ohio River Floods

When the flood of 1867 hit the extreme lower section of the Ohio River, W. Milnor Roberts, Superintendent of Ohio River Improvement for the Corps, was directed by the Chief of Engineers to study the flood and report on its effects. During these studies, Roberts computed the effects which the reservoir system proposed by Charles Ellet in 1850 might have had on its crest, and concluded that control of floods by reservoirs "by any human means attainable within the practicable limits of cost is impossible."[5]

In planning the Ohio River Canalization Project in the 1870s, Colonel William E. Merrill also reviewed the navigation-flood control system proposed by Ellet, and he also concluded the system had problems too complex for solution at that time. Land acquisition costs would be enormous; "terrible disasters" might result from improper reservoir management; and the engineering problems of constructing such reservoirs were, in the opionion of Colonel Merrill, beyond solution. He said:

> To build a dam 50 feet high in a running stream is excessively difficult. Reservoirs even built perfectly dry . . . sometimes burst, and even when you select your ground for the very purpose it is difficult to prevent water under such a heavy pressure of 50 feet . . . getting around the sides even if not going through the dam.[6]

Ohio River Floods of 1883 and 1884

The Ohio Valley suffered a flood in February, 1883, which surpassed the 1832 record at Cincinnati by over two feet and crested at Louisville about three feet above the previous record (44.8 on the upper gage at the Falls and 70.2 on the lower gage on February 16). Colonel Merrill reported a cofferdam at Davis Island Dam project was carried away and the flood breached the canal wall at the head of Louisville locks, but he supposed, like everyone else, that the flood of 1883 was the climax for at least one generation. But precisely a year later a greater flood ravaged the Valley.[7]

On Valentine's Day, 1884, the Ohio crested at Cincinnati at 71.1 feet, about four feet above the crest of 1883; on February 16 it reached 47.7 on the upper gage and 72 feet on the lower gage at Louisville. Flood damages were so catastrophic that Congress appropriated funds for the relief of flood victims (probably the first federal flood disaster relief provided for the Ohio Valley) and authorized the first

federal flood control projects in the Ohio Basin.[8]

First Ohio Valley Flood Control Projects

In 1884 *Engineering News* published an article asserting that, "in view of appalling and annual loss of life and property in the Ohio Valley from floods," Colonel Merrill and Corps of Engineers ought to be authorized to survey Ohio river tributaries for suitable flood control reservoir sites. The article concluded: "Against the flooding of cheap lands on the tributaries, look at the millions of property destroyed in the cities and towns below." Congress was not prepared to authorize such a study; however, it did order investigations of levee projects at Jeffersonville and Lawrenceburg, Indiana, and Shawneetown, Illinois.[9]

About 80% of the inhabitants of Jeffersonville had been forced to evacuate during the flood of 1884, and the transportation of military supplies from Jeffersonville Quartermaster Depot had been suspended for some time. Congress directed, on March 1, 1884, the Corps to report "as to the practicability and probable cost of constructing a levee to prevent the overflow of said city of Jeffersonville and the approaches to the quartermaster's depot." Colonel Merrill reported that a levee to protect the town and depot to a height two feet above the high water of 1884 would cost $50,000, and Congress provided that amount, the first federal appropriation for flood control in the Ohio Valley, in the Rivers and Harbors Act of July 5, 1884, for the "improvement of the navigation of the river at Jeffersonville, and the protection of the Government property." Flood control was not specifically mentioned in the act; Congress actually authorized not flood control, but the protection of the quartermaster depot and the improvement of navigation. Presumably, a levee would keep boats out of Jeffersonville during time of flood and provide a wharf for loading military supply shipments. Perhaps needless to say, "Padre" Merrill did not approve of the policy of providing for flood control under the guise of improving navigation; nevertheless, he performed his duty as directed.[10]

The contract for construction of the levee was awarded to Joseph Coyne of Jeffersonville on April 30, 1885, and the work was completed in August, 1886. The levee was 5,818 feet long, contained about 44,000 cubic yards of earth, and was built to two feet above the crest of the record flood of 1884.[11]

Lawrenceburg, Indiana, and Shawneetown, Illinois, had suffered repeated flood damages, and municipal authorities, with aid from railroads with lines along the waterfront, had expended substantial sums constructing levees, but they were overtopped by the floods of 1883 and 1884. Colonel Merrill, at the direction of Congress, reported in 1884 that, though levee construction would not benefit navigation, both towns needed flood protection. Congress was not prepared to adopt a definite policy for flood control; nevertheless, Lawrenceburg and Shawneetown obtained appropriations for raising and strengthening their levee systems.[12]

Congress funded embankment construction at Lawrenceburg in 1886 to confine the Miami River during floods and prevent the formation of bars which might obstruct navigation; and Shawneetown received an appropriation in 1888 to raise its levees to "confine the waters of the river, in great floods to the general course of its channel." Additional funds were provided from time to time, and by the end of the century the Corps of Engineers

had expended about $60,000 at Lawrenceburg and $89,000 at Shawneetown to raise the levees to two feet above the crest of the 1884 flood. But these levees, constructed in sections by various agencies and raised on several occasions, did not prove satisfactory and were overtopped by several floods at a later date.[13]

Flood Control Controversy

President Theodore Roosevelt, 1901-1909, was the strongest advocate of improved waterways to occupy the White House since John Quincy Adams. In creating the Inland Waterways Commission in 1907 he directed that it should develop comprehensive plans for water resource development, including such features as navigation, flood control, and hydroelectric power generation.[14]

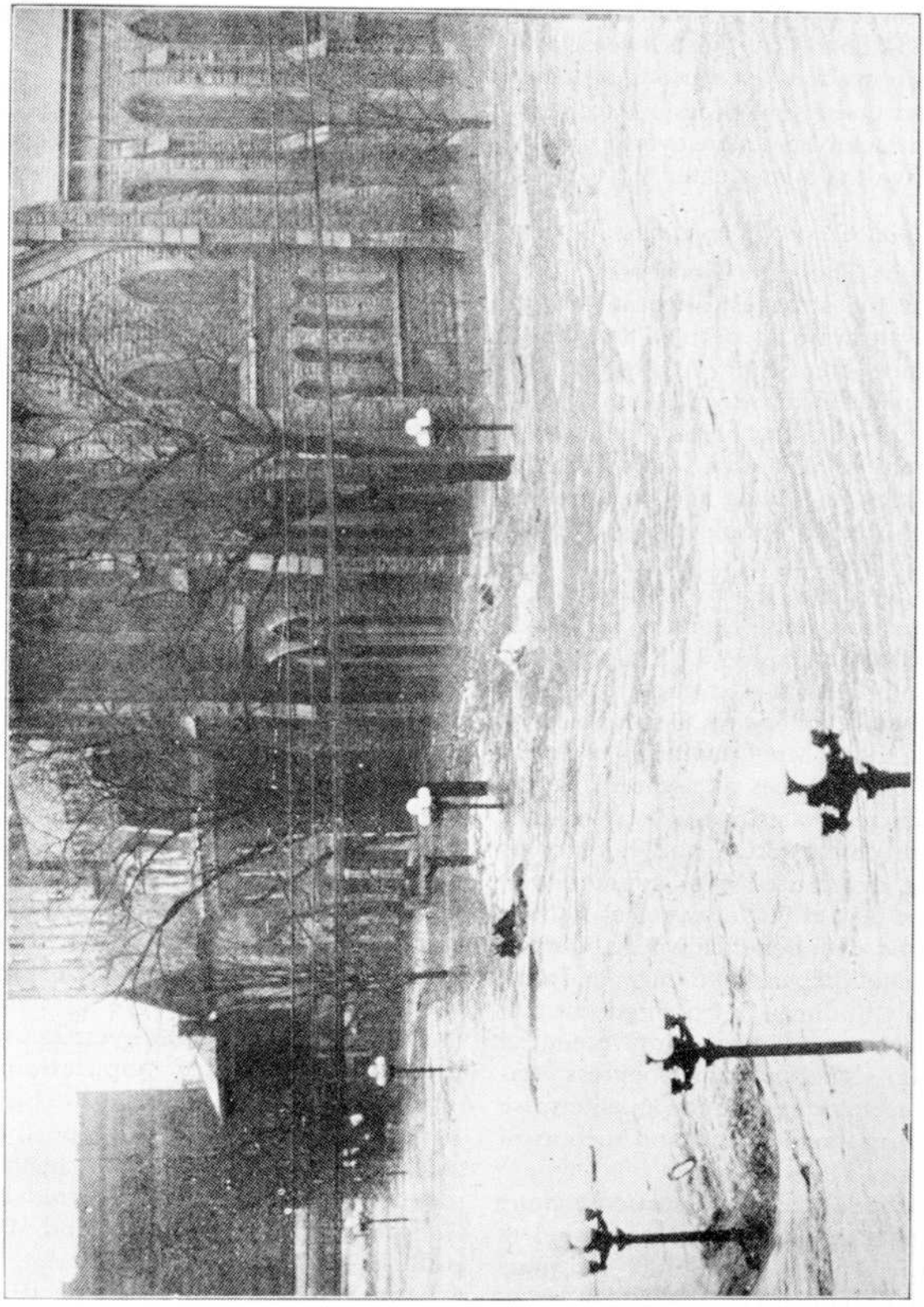
Colonel William H. Bixby, Central Division Engineer (ORD), and M. O. Leighton, Chief Hydrographer, U. S. Geological Survey, studied flood control reservoirs for the Inland Waterways Commission in 1907 and 1908. Mr. Leighton found that engineering advances since the 1870s had made safe resevoir construction feasible; that high construction and land costs could be distributed over a number of years; and that, ultimately, project costs, in comparison with benefits, would be nominal. Colonel Bixby agreed in general with Leighton's findings, but pointed out that federal law provided for improvement of navigation alone and that Congress "has been reluctant to enter upon an enterprise of such magnitude in cost and such great extension of Federal powers. . . ."[15]

An extended dispute ensued among professional engineers and personnel of the Corps about the feasibility and practicability of federal construction of reservoirs for flood control. In 1910 and 1911 the National Waterways Commission reviewed the issue, found that the system would have greater prospects of success in the Ohio Valley than elsewhere in the United States, but reported:

> The Federal Government has no constitutional authority to engage in works intended primarily for flood prevention or power development. Its activities are limited to the control and promotion of navigation and works incident thereto. The commission is one of the opinion that flood prevention is primarily a local problem . . . .[16]

Flood of 1913: the "Dayton Flood"

While engineers debated the proper methods for flood control and politicians discussed the legality of a federal flood prevention program, the devastating floods which swept the northern sector of the Ohio Basin in the spring of 1913 precipitated some action. Madison, Indiana, where the Ohio crested at 62.8 feet, one foot above the 1884 record, was the only reporting station on the Ohio in the Louisville Engineer District which experienced a record flood in 1913, but many records were established on the Upper Ohio and damages on the Lower Ohio were extensive. Damages at Louisville were estimated at half a million dollars, and downstream communities, especially Tell City and Cannelton, Indiana, and Hawesville and Uniontown, Kentucky, suffered very heavy losses. At Uniontown, a few miles above the mouth of the Wabash, for example, every house was flooded, the entire population was evacuated, and human suffering was termed "indescribable." Property damages were heaviest and most of the 361 deaths due to flooding occurred in the Muskingum, Miami, Scioto, and Wabash valleys. Damages were so extreme in the Miami Valley that the flood of 1913 became known as the "Dayton (Ohio) Flood."[17]



The 1913 Flood at Dayton, Ohio

In the aftermath of the flood, former President Roosevelt took the occasion to chide Congress for expending millions for relief of flood victims, but "not one cent" for solving the flood problem. He recommended intensive river basin planning for multiple-purpose water resource development and flood prevention. "All this might be done," he insisted, "by one act of the Federal Congress. We can lift the rivers out of politics by enacting a single adequate measure, establishing a policy, and providing continuing funds, exactly as was done in the case of the Panama Canal."[18]

Miami Conservancy District

An immediate result of the flood of 1913 was the organization of the Miami Conservancy District to plan and construct a flood control project for the Miami River Basin. About 300 lives and property worth an estimated hundred million dollars had been destroyed in the Miami Basin by the flood of 1913, and residents were prepared to support a flood control project funded by assessments on property benefited by the project. The Conservancy District conducted comprehensive studies of the Miami River flood problem and completed a project which was the pioneer in its field, and which, as such, set many precedents which had enormous influence on subsequent federal flood control planning.[19]

The Miami Conservancy District selected Arthur E. Morgan, an exceptionally capable and original civil engineer, as Chief Engineer. Morgan and his staff made preliminary plans for flood control in the Miami Basin, and a consulting board of twelve members reviewed the plans and reported favorably.[20]

General Hiram Chittenden, the former Louisville District Engineer who had been forced to vacate a house for a political appointee at the Louisville canal in 1893, served as member of the consulting board. After departing Louisville District, Chittenden had surveyed routes for a canal linking the Ohio with Lake Erie, one of which followed the Miami River Valley, and then had supervised the development of Yellowstone National Park and projects on the Upper Missouri River for a number of years. In the latter service, he had become the Corps' foremost proponent of storage reservoirs for flood control. Army officers were required to prove their physical condition by completing a fifty-mile horseback ride during the administration of Theodore Roosevelt, and while taking this test General Chittenden had suffered an injury which confined him to a wheelchair. He accepted a position with the Port of Seattle Commission, but after seeing the work in the Miami Basin and recognizing its significance he accepted the position of consulting engineer with the Miami Conservancy District.[21]

When General Chittenden came to the project, he told Arthur Morgan that he realized he had not much longer to live and expected his work on the project to be his last. General Chittenden made his last days count, working as long as twelve hours a day, seven days a week. Accompanied by his wife, he motored to every project site, and, because he was confined to his wheelchair, up to a dozen men were constantly employed in arranging, classifying, and delivering data to his room. And when all his questions were resolved and all weaknesses in design corrected, he became an effective proponent of the project.[22]

The Miami Basin flood control plans for protecting the valley against floods 40% greater than that of 1913 chiefly involved improving the carrying capacity of the

Miami River channel by removing about five million cubic yards of materials and constructing earthen dams — Taylorsville, Lockington, Huffman, Germantown, and Englewood dams — with concrete outlets and spillways. The dams created "detention" reservoirs; that is, they did not create lakes except when flood conditions developed, and served principally to retard the flow of flood waters.[23]

General Chittenden thought plans for the project were well conceived. It was also his opinion that flood control reservoirs could have wider application if flood control were coordinated with water storage for other uses — that is, he advocated multiple-purpose reservoirs for flood control, power production, water supply, recreation, and allied purposes and publicized the concept through articles in magazines and journals. As General Chittenden expected, he died shortly after completing his studies for the Miami Conservancy district. Before his death he wrote a particularly perceptive essay on the problems confronting those who would implement comprehensive flood control plans. For instance, he warned:

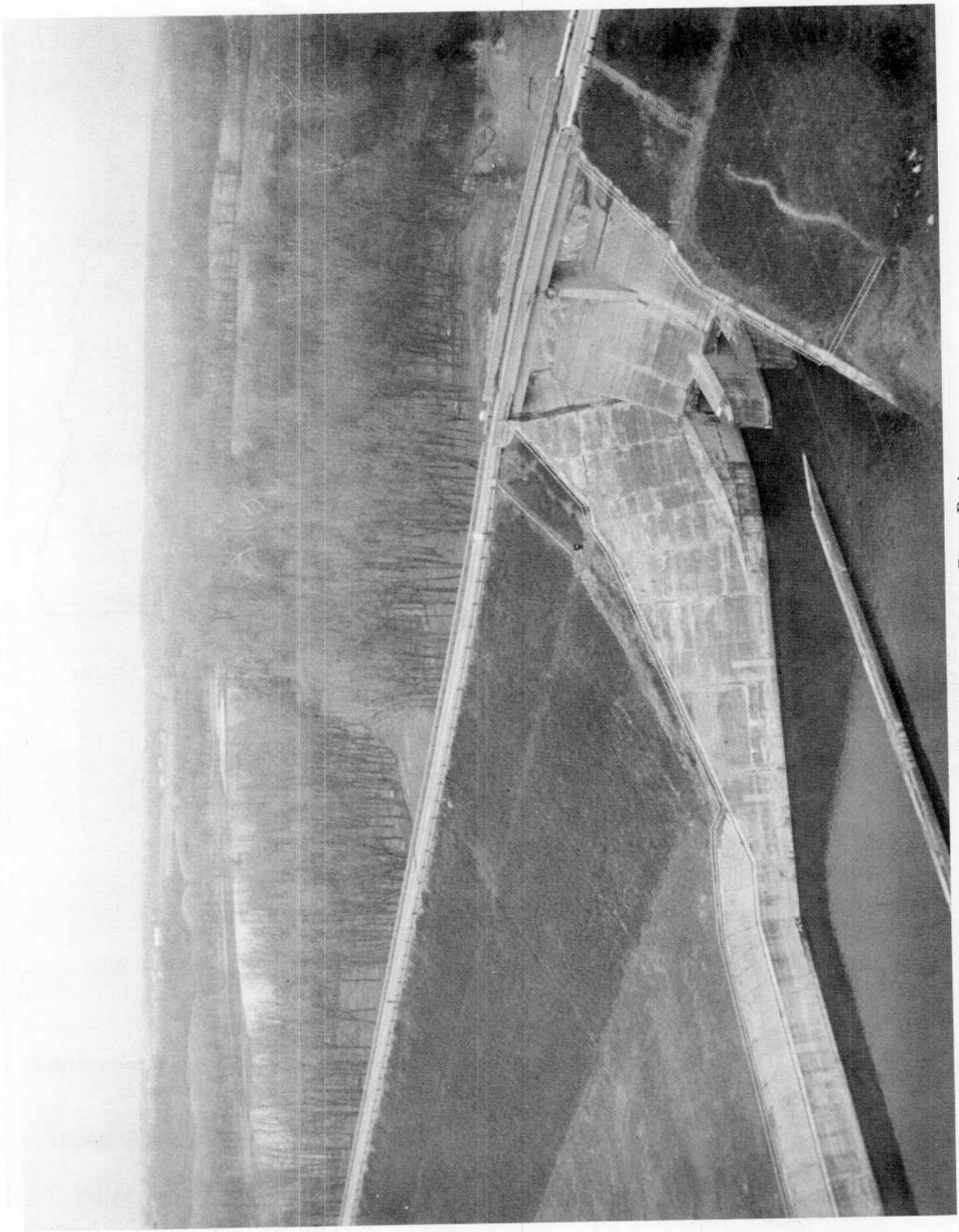
> The greatest obstacles that the promoters of public work have to overcome are not those of nature, but of man. Nature is sometimes a stubborn adversary, but she always acts in the open, without subterfuge or indirection. But human ignorance, prejudice and self-interest are handicaps of a different character. Ignorance is least important, because it may yield to instruction. Prejudice — that is, prejudgment of a case and then sticking to it regardless of facts — is immeasurably worst. But self-interest is the most insuperable obstacle of all. Public measures are judged by their effect on the private pocket-book, and the rarest phenomenon in the world is a willingness to subordinate personal interest to the public welfare.[24]

Construction of the Miami River Basin flood control project began in 1918; the dams were completed in 1921 and the channel enlargement in 1922 at costs of about $32,000,000. Construction costs were amortized in 1947, and by 1968 the dams of the project had retained flood waters 720 times, providing benefits in excess of costs by two to one. Its construction had considerable influence on national flood control policies and hydraulic engineering in general. General Chittenden's studies of multiple-purpose water resource development had also an unassessable but important influence in the evolution of the Corps program of water-use planning.[25]

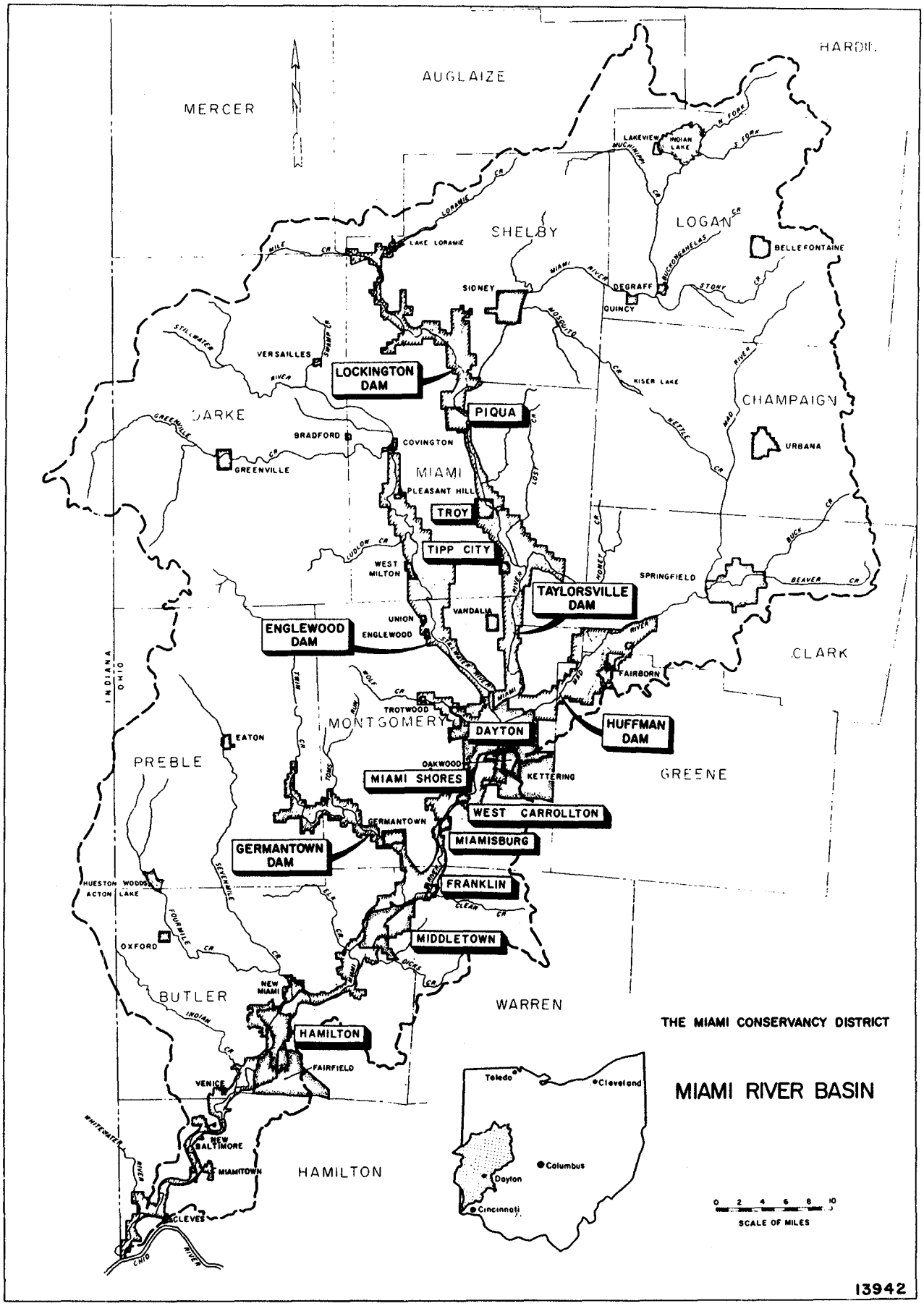
Ohio River Flood Board

While the Miami and other regional conservancy districts were planning flood control for smaller river basins, the Corps of Engineers was initiating comprehensive flood control planning at the national level. Just after the flood of 1913, the Chief of Engineers, in a confidential letter to Ohio Basin District Engineers, said it was his opinion that comprehensive planning for waterways improvement was in order, and, in advance of legislation to secure it, his office was requesting each Engineer District to make a confidential report on comprehensive project planning for streams in its jurisdiction. Each District in the Ohio Valley responded with reports of more or less completeness, but, in the absence of funding and staffing, the first comprehensive reports were quite limited in scope.[26]

The Secretary of War also directed the Chief of Engineers to appoint a special Board of Engineers to inquire into conditions in the flood-damaged areas of the Ohio Basin and "report upon the most practicable and effective measures for prevention of damage by floods to works constructed for the improvement of navi-



Huffman Dam—Miami River Basin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DAYTON
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SIDNEY
VERSAILLES
BRADFORD
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TROTWOOD
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KETTERING
GERMANTOWN
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OXFORD
NEW MIAMI
FAIRFIELD
VENICE
NEW BALTIMORE
MIAMITOWN
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gation, of interference with interstate commerce, and of other disastrous results thereof." Members of the Board, chiefly Ohio Valley District Engineers, inspected areas damaged by floods in 1913 and held public hearings. They could make no commitment to particular projects, but, as Major John C. Oakes, Louisville District Engineer, explained at a hearing at Fort Wayne, Indiana:

> There are forty-nine men at work in my office in Louisville, and I want to say that if plans for flood prevention are made and estimates supplied with all the needed data our men will go through them and make such recommendations as they think are necessary.[27]

The Ohio River Flood Board made its preliminary report in 1914. It stated that most flood control methods would have some application to meet variable conditions existing on different streams, and it strongly recommended that Congress authorize detailed basin flood-control planning, provide regional coordination for protection plans devised by various communities in the same river basin, and arrange a fair distribution of project costs. In the final report of 1916, the Board emphasized its opinion that flood control by the federal government should not be based "on the uncertain and indefinite benefits that may accrue to navigation, but on the certain and positive benefits that may accrue in the protection of life and property from loss and in the prevention of the interruption by floods of general interstate commerce and the interference with the mails."[28]

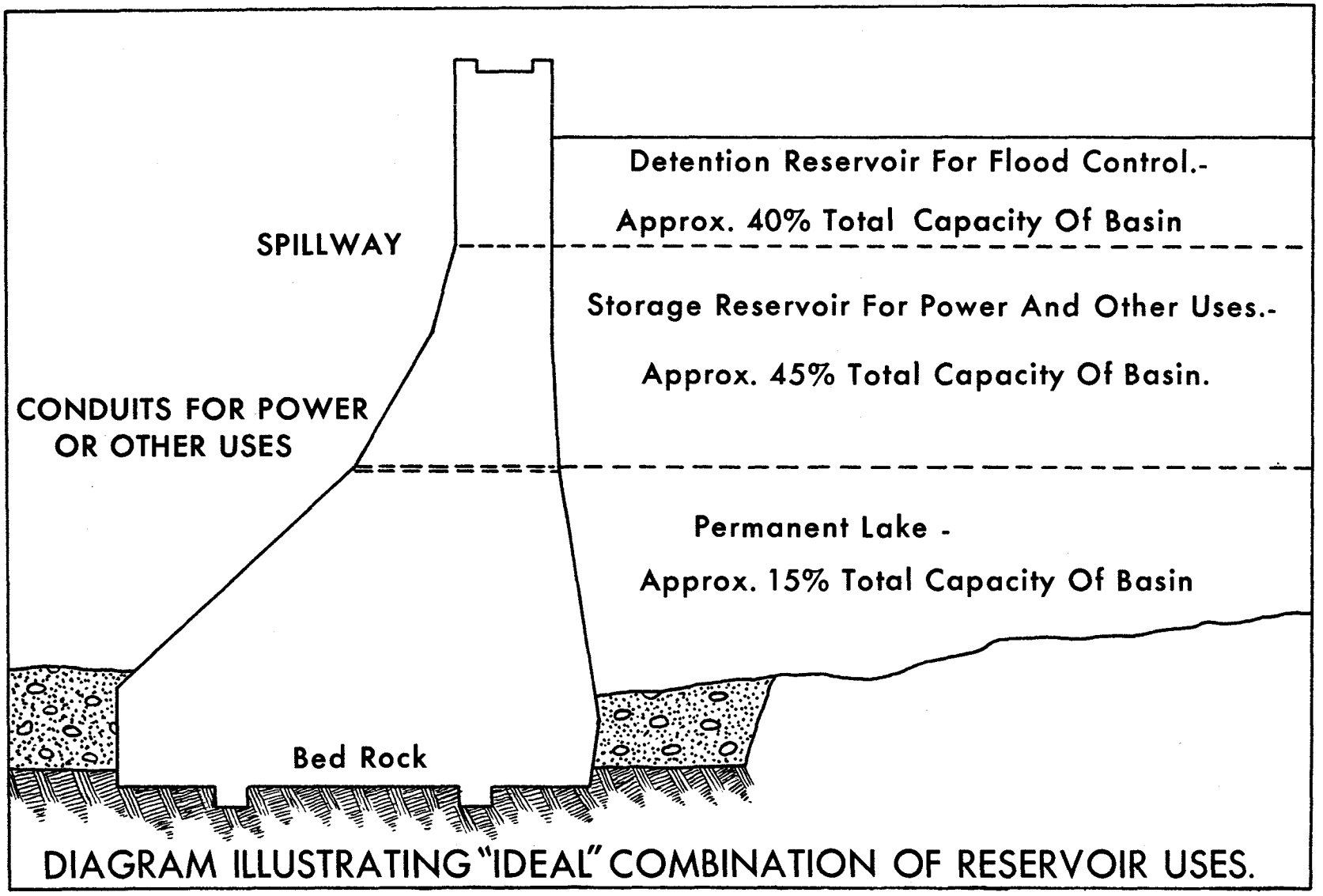
The "308 Reports"

Comgress was not prepared in 1916 to embark upon a national program of flood control, but resource surveys and planning for their utilization had many historic precedents. In 1917 Congress authorized flood control studies on the Mississippi River, and during the next decade authorized comprehensive surveys on a few other scattered streams. In 1925 Congress directed the Corps of Engineers and the Federal Power Commission to submit cost estimates for basinwide surveys of practically every major river in the United States to develop comprehensive plans for navigation improvement in conjunction with hydroelectric power generation, irrigation, and flood control. These cost estimates were printed in 1926 as House Document No. 308, 68th Congress, 1st Session, and the surveys which followed therefore became known as the "308 Reports."[29]

The studies recommended in House Document No. 308 were authorized on January 21, 1927, and the Corps of Engineers proceeded with what constituted an evaluation of the potential water resources of practically the entire United States; these represented the complete commitment of the Corps to the concept of multiple-purpose water resource development. The Engineers completed detailed surveys of each basin and then sought to determine the ultimate potential of the stream for navigation, irrigation, power production, flood control, and allied water uses; to determine what projects might be necessary, at what costs, and by what compromises between conflicting water-use interests. The Chief of Engineers said in 1930:

> The entire design may not be worked out in our lifetime or in our children's lifetime. But the entire design will be known to us now; and (subject to inevitable minor changes as the work progresses) the development of the river . . . will . . . be along the lines that will ultimately accomplish the greatest good for the greatest number.[30]

Louisville Engineer District completed "308 Reports" on a number of smaller ba-



DRAWING BY GENERAL HIRAM M. CHITTENDEN PRINTED IN HIS ARTICLE ADVOCATING MULTIPURPOSE RESERVOIRS. SEE CHITTENDEN, "DETENTION RESERVOIRS . . . ," TRANSACTIONS OF AMERICAN SOCIETY OF CIVIL ENGINEERS, LXXXII (1918), PAGE 1486.

sins, such as the Tradewater and Salt valleys, and directed major efforts toward completion of authoritative studies of the Lower Ohio, Wabash, and Green river systems.

Wabash River Basin "308 Report"

Because of limited funding, the great size of the Wabash Basin, and the need for speedy completion of the surveys, the Louisville District adopted aerial photography, employing stereoscopic methods to delineate contour lines on mosaics of the photographs. This was one of the pioneer uses of this topographic mapping method which eliminated much of the slow, expensive, and laborious work of ground surveying. In a report on aerial methods, the District, emphasizing the close correlation of military and civil works missions, recommended aerial photography for Corps-wide topographic functions:

> It is desired to call attention to the feasibility of the use of the stereoscopic method with limited control and less refinement for making maps of enemy country in time of war, maps for our own troops in rear areas, and coast defense maps not available at the beginning of hostilities. Unless the stereoscopic method is developed in time of peace, on large mapping projects with maps of various scales and contour intervals and diversity of terrain, the method will not be at its best in a period of emergency.[31]

Private interests and local governmental units had constructed earthen levees along the Wabash and its tributaries from the earliest days of settlement, and in the "308 Report" on the Wabash Basin, completed in 1933 and printed as a House Document in 1934, the Louisville District recommended levees as an effective flood control method for the Valley and also listed six acceptable sites for reservoirs for flood control. Because Congress at that date had not authorized construction of flood control projects with federal aid and funds, it was originally expected that local and state government would finance and construct the projects, with the Louisville District providing overall supervision and the necessary engineering expertise for planning purposes. But the Depression of the 1930s had bankrupted many governmental entities, and funds for construction were simply not available. Colonel Gilbert Van B. Wilkes, Louisville District Engineer, met with the Governor of Indiana in 1935 and was informed that the State of Indiana could only offer its "moral support" to projects in the Wabash Basin. Colonel Wilkes reported that in the face of economic and political problems: "It seems self evident that the construction of the Wabash levees . . . is going to be complicated."[32]

In the Wabash Basin, as elsewhere in the United States, it became evident in the 1930s that if effective flood control were to be achieved the federal government would have to provide funds to aid actual construction in addition to planning. The Corps and many members of Congress had recognized this fact by 1936. Congresswoman Virginia E. Jenckes, representative of a Wabash Basin constituency, in testimony before the House Committee on Flood Control in early 1937, pointed out that floods in the Wabash Valley were destroying property worth two million dollars annually, destituting farmers and forcing farm hands to join relief rolls; she recommended that plans of the Louisville District for flood control in the Wabash Basin be adopted by Congress and that federal funds be provided for project construction.[33]

Green River Basin "308 Report"

The Louisville District's "308 Report" on the Green River and its tributaries,

submitted to Congress and printed in 1933, estimated that flood damages in the Green River Basin approached two million dollars annually, but, unlike the Wabash, the topography and hydrology of the Green River Basin were not generally suitable for flood control through levee construction. The District located seven feasible reservoir sites — three on the Barren River; two on the mainstream of the Green; and one each on the Nolin and Rough rivers — and asserted: "The best method of protection from floods would be the construction of a system of reservoirs . . . "[34]

The Commonwealth of Kentucky and local government in the Green River Basin lacked the financial resources necessary for the construction of flood control reservoirs, and probably would not have constructed them in any case, for the costs of the projects exceeded potential benefits unless the benefits derived by reductions in flood crests on the Lower Ohio and Mississippi rivers, outside state jurisdiction, were also included in project economic computations. Several reservoir sites in the Green Valley were suitable for multipurpose projects for flood control and hydroelectric power production, and the addition of power generation as a project feature could have made the reservoirs economically feasible, but a market for the power did not exist at that time. Thus, as on the Wabash, flood control in the Green River Basin would not be possible for many years, perhaps never, unless the United States government was prepared to provide federal funds for the projects.[35]

Ohio River Basin "308 Report"

The "308 Report" on the Ohio River, commmenced in 1929 and completed in 1933, was based on the principle of flexibility; that is, the utilization of all appropriate flood control methods which were found desirable for economic and engineering reasons. The report listed many possible reservoir sites on tributaries, which could afford protection for tributary valleys and provide appreciable control over the mainstream of the Ohio, but a basic problem revealed by the study was that the effects of tributary reservoirs on mainstream flood crests decreased on the Lower Ohio. During major floods, the reservoir system might reduce crests at Cincinnati by as little as five feet and even less at Louisville and downstream communities.[36]

The hydraulic regimen of the Ohio River was not often conducive to the method of channel enlargment to increase flood-carrying capacity; topographic factors prevented utilization of diversion channels, or floodways, like those planned on the Lower Mississippi River; and the costs of flood control reservoirs on the mainstream of the Ohio would substantially exceed potential benefits. The Army Engineers therefore proposed in the "308 Report" to achieve flood protection in the Ohio Valley chiefly by the construction of reservoirs on tributaries in combination with levees and floodwalls around highly-developed urban and industrial areas.[37]

In the "308 Report," the Corps recommended fourteen flood control reservoirs on tributaries — nine above Pittsburgh; three in the Kanawha Basin; and two on the Licking River — for immediate construction, but the same problem encountered in the Green and Wabash basins existed: there were few local and state government agencies capable or willing, to cooperate in financing and constructing the projects. Why, state and local authorities asked, should projects whose benefits cross political boundaries and ex-

tend to regions, sections, and to the nation be built with taxes on those who would receive only a portion of the benefits?[38]

Flood Control Act of 1936

The Corps had completed most "308 Reports" by 1936, had recommended, and was ready to undertake, a number of high-benefit flood control projects. But funds for construction were unavailable. Then came the flood disasters of early 1936. About 200 lives were lost and property damages aggregated hundreds of millions of dollars as a result of widespread flooding in the northeastern United States in March, 1936. Floods ravaged the Potomac, Susquehanna, Delaware, and other valleys along the East Coast, and the Upper Ohio Valley experienced its greatest flood of record.[39]

In Congress, where the issue of full federal participation in a national program for flood control had been debated for several years, the floods of 1936 galvanized support and Senator Royal S. Copeland of New York introduced a bill to affirm that flood control was a proper activity of the United States government and that flood control projects would be constructed in the interest of the general welfare of the nation. The historic Flood Control Act of June 22, 1936, incorporated these principles and committed the United States to a national flood control program, initially authorizing about 270 flood control projects.[40]

No reservoir projects in the Louisville District were authorized in 1936, but several levee projects in the Wabash Basin were approved. By the end of 1936, the District had construction underway, chiefly with funds provided by the Depression Era recovery and relief agencies, on levee projects at Indianapolis, Anderson, Muncie, and Terre Haute, Indiana. Studies were also underway preparatory to commencing construction of several projects on the mainstream of the Ohio River when the greatest flood of record on the Lower Ohio occurred in 1937.[41]

Superflood of 1937

The "Superflood" of 1937 crested on the Lower Ohio at nine, ten, and eleven feet above the records set in 1884. Paschal N. Strong, deputy to Ohio River Division Engineer (perhaps better known to the public as an author of adventure novels), said: "Rare meteorological conditions had created this calamitous inundation of almost Biblical proportions." But the cause was simple. It rained. Hard.[42]

Rainfall equal to about half the normal yearly precipitation average fell in the Ohio Valley during January, 1937, resulting in by far the highest flood of record at every point on the Ohio River in the Louisville Engineer District. The Ohio was above flood stage at Louisville from January 16 to February 7, twenty-three days, cresting at 57.15 feet on the upper gage on January 27, about 10.4 feet above the 1884 crest.[43]

The Cincinnati waterfront and Mill Creek Valley were mostly underwater for nineteen days. On "Black Sunday" gasoline tanks exploded, causing a two million dollar fire. The Ohio crested at 79.99 feet at Cincinnati, about nine feet above the 1884 record, on January 26. The crossriver towns of Newport and Covington, Kentucky, suffered proportionately. At Lawrenceburg, Indiana, a few miles below Cincinnati, damages were described as "prodigious." A citizen of Lawrenceburg later testified before a congressional committee that damages were far more than monetary:

> The record refers to the horror and personal shock

> sustained by the citizens, to the unprecedented suddenness and height of the water, to the trapping of people in their homes and upon roofs in winter with no heat, no light, no communication, the noises around them of rushing water and disintegrating buildings . . . These are, it is true, intangible losses, but none the less terrible and expensive.[44]

About three-quarters of Louisville was flooded; 175,000 residents were evacuated; 90 flood-related deaths occurred; and property damages amounted to about $50,000,000. Martial law was declared in the city and troop units were called in. Among them were the Fifth U. S. Engineers, who provided water-purifying equipment and built floating bridges. Some remarkable ingenuity was displayed in the construction of a floating bridge across Beargrass Creek — empty whiskey kegs were used as flotation devices.[45]

The Indiana towns across the Falls were flooded and evacuated; about 76 square miles of Jefferson County outside Louisville were flooded; and below Louisville the only towns on the banks of the Ohio which escaped serious flooding were Henderson, Kentucky, and Newburg and Mount Vernon, Indiana. The towns where large numbers of buildings were washed away included Leavenworth, Indiana; West Point and Uniontown, Kentucky; and Shawneetown and Mound City, Illinois. A log kept by the lockmaster at Lock No. 44 near Leavenworth tersely, but effectively, told the story:

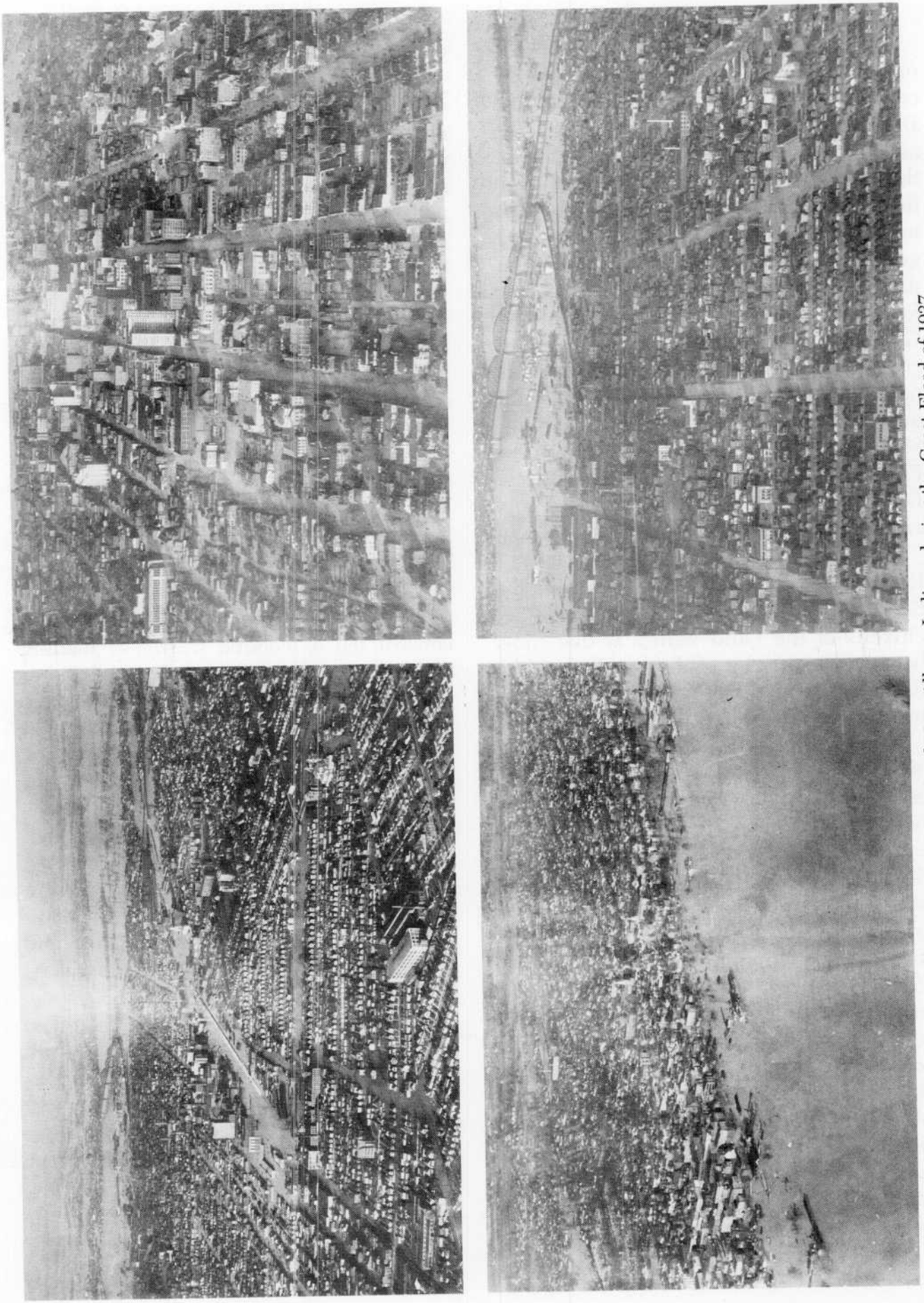
Jan. 21 Dam all down
Jan. 22 Began snowing 5 p. m
Jan. 23 Depth of snow 5 in.
Jan. 24 Oil house gone
Jan. 25 Garage gone
Jan. 26 Maneuver boat 252 gone
Jan. 27 Warehouse gone
Jan. 28 Most of Leavenworth gone
Jan. 29 Leavenworth still leaving[46]

About the only thing dry in Paducah, Kentucky during the height of the flood was a cemetery. At the Irvin S. Cobb Hotel, a half mile from the river, water stood four feet deep in the second story — its upper floors served as a communication center for emergency operations. Paducah was 93% underwater, and 33,000 residents were evacuated.[47]

Direct flood damages were estimated conservatively at four hundred million dollars; more than half a million people were driven fron their homes in the dead of winter; flood-related deaths numbered in the hundreds; communication and transportation lines were severed; and normal business and industrial activities were suspended for weeks. The War Department spent more than five million dollars for flood relief and about the same amount for emergency work to protect existing structures. And the cost of relief activities of the American Red Cross aggregated more than seven million dollars. In the Louisville Engineer District alone, 1,986,000 acres of land were inundated; 156 towns flooded; 52 people died by drowning and flood-related accidents, and property damages approached a hundred million dollars.[48]

Corps Flood Emergency Operations

The seriousness of the flood situation was not at first recognized at Corps headquarters in Washington — there were no record stages on the Upper Ohio where records had been established the previous year. Captain B. B. Talley, a photogrammetry expert at Wright Field (Wright-Patteson AFB), was ordered to fly over the flood, make photographic record, and report; and he alerted OCE to the fact that flood reports were not at all exaggerated. Photographic coverage of the flood continued throughout its duration to provide data for future planning.[49]



Four views of Louisville and New Albany, Indiana during the Great Flood of 1937

Ohio River Division at Cincinnati opened an emergency communications center on the top floor of the *Enquirer* Building and began round-the-clock disaster coordination efforts. At Louisville, the District office building was cut off by flood waters, and District Engineer Dabney O. Elliott established a flood emergency headquarters at Evansville, Indiana, which also served as headquarters for Red Cross, Coast Guard, and National Guard units. On the lower river, the Golconda Flood District (Golconda, Illinois, near Lock No. 51), commanded by Colonel Charles P. Gross from the Engineer School at Fort Belvoir and Major F. F. Frech, military assistant from Huntington District, supervised emergency operations.[50]

Each individual who was part of the Louisville District organization during the flood emergency of 1937, like most other citizens of the Ohio Valley at that time, has vivid memories of the long hours, the hazards, the amusing and not-so-amusing incidents of that flood fight.

Oren H. Bellis, who later became Chief of Operations Division of the District, recalled walking the Pennsylvania Railroad bridge from Louisville to Jeffersonville to evacuate his family. The U. S. Coast Guard shipped its fast picket boats, used to enforce prohibition on the Great Lakes, by rail to Jeffersonville, and Mr. Bellis joined one of them in patrols of the Ohio. Each picket boat had a crew of three and one Louisville District employee assigned to it. Mr. Bellis had the assignment of locating sandbags which might be used in the flood-fight and ascertaining the needs of isolated down-river communities. Getting down river was easy, but returning to Louisville at night under fog and ice conditions, with such debris as empty rail tankcars bobbing downstream on end like corks, was somewhat hazardous.[51]

In the District office on the fourth floor of the Federal Building such staff as could get to the office was working without light or heat. Lanterns were procured, and folding cots were set up. On one of his river patrols, Mr. Bellis acquired some small coal oil heaters at Leavenworth, Indiana, for use in the office.[52]

John H. Kurrasch, who subsequently had responsibility for developing District flood emergency plans and other planning activities, boarded a steamboat with a load of typhoid vaccine bound for the Lower Ohio. After delivery of medical supplies had been accomplished, he returned to emergency headquarters at the McCurdy Hotel in Evansville, Indiana. The hotel was accessible by road at the rear, and steamboats tied up to railings in front of the building. Kurrasch, Tony Fleming, and other Corps personnel at the scene constructed a wooden trestle as loading ramp for wheeling Red Cross disaster supplies onto the boats for distribution. Mr. Kurrasch recalled, with considerable amusement, loading such items as straw hats and white shoe polish on the relief boats. It appears the Red Cross determined that a typical country store contained all items which might be needed by flood refugees and purchased entire store stocks, rather than submit to delays necessitated by taking inventories and separating vital articles from those less useful.[53]

Other Engineer bases were located at Tell City, Indiana, and Owensboro and Paducah, Kentucky, from which daily patrols were made by the Engineer fleet to aid in evacuation and provide other assistance as requested. The Engineer fleet transported flood refugees, Red Cross workers, volunteer flood-fighters, and military units, and moved relief supplies

to sites where needed. The Paducah Disaster Committee estimated the Engineer fleet saved no fewer than 5,000 lives in the Paducah area, and H. W. Richardson, editor of *Engineering News-Record* who was on the scene, wrote:

> Conditions on this river are simply hell. The people simply refuse to evacuate ahead of the time of serious danger, and then the rescue load comes all at once. The army engineers stepped into this strange job of rescue and evacuation in great style. They are doing all that is humanly possible to bring order out of chaos: I have seen it happen right here today.[54]

The collection of hydrologic data on the flood of the century was vital to future planning for flood control. On January 21, the Division Engineer telegraphed the District Engineer:

> REQUEST STUDY EFFECT OF PROPOSED GREEN AND WABASH RIVER RESERVOIRS ON PRESENT OHIO RIVER FLOOD STOP STUDY SHOULD BE CARRIED ON COINCIDENT WITH FLOOD SO THAT AS NEAR ACTUAL OPERATING CONDITIONS AS PRACTICABLE MAY BE DEMONSTRATED STOP IT SHOULD COVER DAILY OPERATION SCHEDULED AND EFFECTS THEREOF ON OHIO RIVER STAGES STOP RESULTS SHOULD BE SUBMITTED TO THIS OFFICE AT EARLIEST CONVENIENT DATE[55]

Reaction to the Superflood

As the above telegram indicated, the Corps expected the 1937 Superflood to generate additional public support for flood control measures. It did. President Franklin Roosevelt, members of Congress, and the Corps of Engineers received hundreds of letters expressing support and suggesting possible solutions to the flood problem. One citizen complained that the thousands of Civilian Conservation workers "turned loose in the Ohio valley" with picks and shovels had done their work well — the CCC drainage improvement projects had caused rapid runoff and resulted in flood havoc. Another proposed the War Department organize a contest, as it had done for snag-removal in 1824, and offer a prize for the best plan to control Ohio River floods. The President also received a somewhat enigmatic telegram on January 30, 1937, which read: "HAVE THE OHIO FLOOD PROBLEM SOLVED STOP WILL WRITE YOU STOP WILL START ON THE MISSISSIPPI PROBLEM NEXT WEEK."[56]

Civic, fraternal, and other organizations resolved their support for flood control, and one particularly interesting resolution asserted that flood control was also a "civil rights" measure in a sense. The Greater New York Federation, National Negro Congress, declared that Negroes, living in shacks on river banks because of segregation and economic disadvantages, suffered disproportionately because of the flood, asserted that over half the dead and homeless were black, and urged blacks throughout the nation to support flood control measures, resolving that "neither money nor governmental machinery be spared to carry through a comprehensive program" for controlling floods.[57]

The House Committee on Flood Control resolved on February 10, 1937, that plans for the Ohio Basin be reviewed and updated to better provide flood protection for the communities of the Valley. The Corps completed a review within sixty days and recommended construction of levees, floodwalls, and channel improvement projects for the protection of 155 communities in the Ohio Basin, plus the construction of 45 reservoirs on tributary streams. The Chief of Engineers, in testimony concerning the revised plan before the House Committee on Flood Control, said that, while each project would be

fully justified from the standpoint of economics (benefit-cost ratio) before construction, he would not hesitate to recommend construction of the proposed projects on the basis of the "saving of human life and suffering, and in the prevention of the disturbance of the affairs of the Nation brought about by a flood disaster."[58]

The Flood Control Act of August 28, 1937, provided nearly twenty-five million dollars for initial construction of projects selected by the Chief of Engineers from those listed in the Ohio Valley Flood Control Plan (published as Flood Control Document No. 1, 75th Congress, 1st Session). With funds provided by this appropriation, the major flood-control project construction program in the Louisville District and other Districts in ORD was launched. The Louisville Engineer District established a Flood Control Division in 1937, initially directed by Captain Miles Reber and Assistant Chief Samuel M. Bailey, the engineer who devised the concrete and steel "I" form floodwall to protect urban areas without the expensive land acquisition costs of earthen levees. By the outbreak of the Second World War in 1941, the Louisville District had nearly twenty flood control projects — levee and floodwall types — under construction.[59]

Summary

The earliest efforts to develop some measure of flood protection in the Ohio Valley were implemented by private interests and municipal governments, in some instances with state aid, to permit the utilization of low-lying agricultural property and avert damages at communities located in the flood plains. Repeated flood disasters, notably that of 1884 in the Lower Ohio Basin, brought federal aid for a few scattered levee projects in the Valley, and after the flood of 1913 the Corps recommended that comprehensive planning for flood control be authorized.

During the 1920s, the Miami Conservancy District completed a precedent-setting flood protection program in the Miami River Basin and the Corps of Engineers initiated comprehensive planning on a nationwide basis. The Corps "308 Reports" on the nation's waterways indicated what might be accomplished in developing water resources and preventing floods; and after the shocks of the record Ohio River floods of 1936 and 1937 Congress acted decisively, committing the United States to a national program of flood control and providing adequate funding for implementation of the Ohio River Flood Control Plan. In 1937 the Louisville Engineer District began construction of projects designed to prevent a repetition of the disaster of 1937. Flood control project construction thus became, in addition to navigation improvement, a major mission of the Louisville Engineer District.