

Spending Federal Flood Control Dollars:

Three Case Studies of the 1993 Mississippi River Floods

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Spending Federal Flood Control Dollars: Three Case Studies

It has been argued elsewhere (Philippi, 1994) that our national flood control programs are expensive and ineffective, largely because they encourage and reward the very behavior that produces and increases our national flood damages. Such increases in flood damages are undesirable because they reduce national economic output and cause the affected population to suffer, and because they increase the costs to the federal government, which pays for flood damage reduction, prevention and compensation programs. This original argument was developed in the context of the effects of and the federal response to the 1993 floods in the upper Mississippi River Basin, based on an examination of generally available data and national flood control program characteristics.

This paper, on the other hand, examines three specific units that were impacted by both the floods and the federal flood programs. It examines the extent to and the ways in which these three cases support the argument that current federal flood control policy is ineffective. There is no way of knowing, of course, the degree to which these cases are representative of broader populations—they may or they may not be typical. They pose, however, some interesting questions and they more than adequately support the arguments of the earlier paper.

Summary of Flood Control Policy

The intent of federal flood control policy is to reduce and avoid damages wherever possible and to compensate the victims of such damages as are unavoidable. Federal flood control programs fall into three categories:

1. **Structural programs** to reduce and avoid damages by preventing floodwaters from reaching existing development in flood hazard areas. Our major structural program is the construction of reservoirs and levees by the U. S. Army Corps of Engineers.
2. **Mitigation programs** to reduce and avoid damages by removing existing and preventing new development—even agricultural—in flood hazard areas. The

National Flood Insurance Program (NFIP) is designed to prevent new development in floodplains while the Federal Emergency Management Agency's (FEMA) Mitigation Program and the Department of Agriculture's Emergency Wetlands Reserve Program (EWRP) are essentially "buy out" programs. The FEMA program funds the removal of existing properties from flood hazard areas, while the EWRP pays farmers to discontinue farming activities in floodplains. Other programs, the Community Development Block Grant (CDBG) Program of the Department of Housing and Urban Development, in particular, provided substantial funds for mitigation activities after the 1993 floods.

3. **Aid programs** to reimburse victims for damages by making cash payments to individuals, families, local governments and corporations which incur flood damage. FEMA administers the Individual and Family Grants Program for private individuals and the Public Assistance Programs for local governments. The Department of Agriculture distributes disaster assistance to farmers, as well as payments from the highly-subsidized Federal Crop Insurance Program.

Selecting the Case Studies

Three cases were selected as units of study: a farm, a levee district and a county. All three were located in rural areas, since most of the Midwestern damages in 1993 were agricultural (USACE, 1994). The sites were chosen using no particular criteria other than having suffered flood damages in that year. Since the sets of data available to describe each of them are different, they are quite discrete cases and only limited conclusions can be drawn regarding their connections. The cases are:

1. A single farm, not in the traditional sense of acreage surrounding a homestead that is lived on and worked by its residents, but in the more modern and typical sense of a parcel of land owned by someone who lives and makes his living elsewhere, hiring a tenant farmer to work the land. The study looks at the financial impact of the flood and federal flood control programs on the owner, who provided the data on the condition that he remain anonymous.
2. The Hunt and Lima Lake Drainage District, in Adams and Hancock counties, Illinois, a large agricultural

levee and drainage district protected from the Mississippi River by a 33-mile long Corps' levee. The study describes the process by which the federal investments in this construction project and its maintenance have been made, their costs and their benefits.

3. Lyon County, Minnesota, a rural county in the southwestern part of the state. The study summarizes the impacts of the flood and the subsequent inflow of federal funds into the county as a whole, with some specific attention to its largest town and county seat, Marshall.

CASE #1: FARM

In the spring of 1993, a Midwestern businessman purchased 160 acres of cropland as a financial investment. It was located within an agricultural Drainage and Levee District, a political entity created by state law that has the power to assess and tax its members and to contract with other governments for drainage and levee improvements. The district abuts a major tributary of the Mississippi River and is protected from flooding by over 10 miles of levees: a primary levee along the main river and several flank levees containing drainage ditches which empty into that river.

The levee district comprises over 10,000 acres of cropland, almost all planted in corn and soybeans. A few buildings, including the district pumping station and storage bins, are scattered across the bottomland. The property owners live elsewhere. Bluffs rise behind the district, marking the boundary of the floodplain. The Corps constructed the levees, in the first half of the century, to provide a 20-year level of protection (namely, protection against those flood crests of a height which have a 5% probability of occurrence at any given time). At one point in the last 30 years the Corps considered raising the levees, but its economic analysis concluded that the project was unfeasible, meaning that the improvements would not have provided enough economic benefits to justify the costs.

The businessman purchased the property from an investment institution, which had hired a bank to manage it. The bank, in turn, had contracted with a tenant farmer to work the land. At the time of the purchase, the 1993 crop (corn) had been planted and the insurance and other arrangements for the coming growing season had been

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completed. There was nothing left to do but watch the corn grow, harvest the crop and collect the money.

The new landowner inspected the crop in early summer and understood that the prospects were excellent for a good crop. He returned in late July, first to join in the sandbagging and, soon after, to watch the water overtop the levee and destroy his entire crop. He considered this first year of his investment to have been a total loss. That was before the government checks arrived. The unexpected generosity of the federal government led him to eventually conclude—writing tongue-in-cheek to a business associate—that 1993 would, in terms of profits, "...be the best year this farm has had in its past and foreseeable future."

the entire levee district, wiping out all the crops, destroying the pumping station and severely damaging the roads, some of the ditches and most of the structures within the district. Floodwaters also deposited some sand and sediment, although they did our particular landowner a favor by smoothing out five acres of formerly untillable ridge.

The river stage which did this damage, however, was almost 3 feet lower than the record stage for that stretch of the river. The actual watershed wherein the drainage district lies had not itself experienced excessive rainfall; its damages were the result of precipitation events which occurred elsewhere in the watershed and caused the swollen Mississippi to push the flow of this tributary back upstream and overtop the levee.

The Impact of the 1993 Flood

It was backwater from the Mississippi that actually broke this particular levee. The river poured over it, inundating

Table 1. Expected Financial Return from Farm

Total investment	
160 acres at \$1,100/acre	\$176,000
Expected profits, 1993	
Total expected revenues (\$2.20/bu x 120/acre x 155 acres)	\$40,920
Less planting expenses:	
Seed	3,600
Fertilizer	7,600
Herbicides	3,200
Taxes	1,400
Miscellaneous	200
Total planting expenses	16,000
Total expected net income	24,920
Investor' s share (50%)	12,460
Expected profit as % of original investment	7.1%

The Economics of the Farm

Tables 1 and 2 outline the investor's expected and actual financial return from the farm. The investor had paid a total of \$184,000: \$176,000 (\$1,100 per acre) for the land, plus another \$8,000 to cover the expense of putting in the 1993 corn crop. He made the investment with the expectation that the return would be greater than he would get from leaving the money in the bank which, at that time, was around 3%.

Based upon information received from the prior owner and the tenant farmer, he anticipated a per acre yield, if conditions were good, of 120 bushels, and a market price

Table 2. Actual Financial Return from Farm

Total investment	
160 acres at \$1,100/acre	\$176,000
Profits, 1993	
Total gross income	\$48,164
Crop insurance	27,990
Disaster assistance	20,174
Less planting expenses	16,000
Total net income	30,576
Investor' s share (50%)	15,289
Profit as % of original investment	8.7%

of \$2.20 per bushel, producing a gross income of \$40,920 for the 155 acres of tillable land. Since the contract with the tenant farmer required that the latter share equally in the expenses and the income, total expenses for the property would have been \$16,000, leaving a net profit of \$24,920, of which our businessman would have received half. He was hoping, therefore, to net \$12,460 on his \$176,000 investment in the first year, a return of 7%.

Instead the investor received two checks from the federal government: \$10,087 in disaster assistance and \$13,202 from the federally-subsidized crop insurance policy that the bank had taken out. His gross income from the flooded land, therefore, was \$23,289, which gave him a profit of \$15,289 after deducting the \$8,000 of his expenses, an 8.7% return on his original \$176,000 investment (Table 2). The return to the tenant farmer, who received the same federal payments, was \$15,289 for the spring planting effort—half of the work that he would normally do.

There was other government assistance to the new landowner: FEMA provided a quarter million dollars to pump out the district; the Corps put up half a million dollars to repair the levee breaks and paid for three-quarters of the replacement cost for the pumping station. Roads were repaired with federal money and some land rehabilitation was done. The county provided a property tax break of 35% in 1993, based upon a reduction in assessed valuation which was to be partially reinstated in 1994 and only returned to pre-flood levels in 1995. In this first year of ownership, during which his investment had suffered what is commonly referred to as a natural disaster, the businessman had reaped profits above and beyond his original expectations.

Conclusions

The most obvious lesson learned from this case study is that agricultural disaster assistance programs can be a boon for the property owner, overcompensating for the damages incurred from a flood. This investor benefited from almost a 2% increase in yield on his investment as a result of the flooding, at a cost to the federal taxpayer of \$291 per acre. He benefited, as well, from the \$1 million repairs and other reimbursements from the state and federal government which, when averaged out over the 10,000 acres of the entire district, produced an additional \$100 per acre. As a final bonus, he received county property tax breaks which also applied to 1994, the biggest corn production year in history. Rather than discouraging development (in this case farming) in flood hazard areas,

such programs quite emphatically encourage it.

The agricultural levee which protects the district reduces the flood hazard, but it does not eliminate it. It was constructed by the Corps to protect the properties behind it from a 20-year flood; thus there remains, each year, a 5% chance that it will be overtopped. It performed as it was designed to, permitting the water to flood the district in this exceptional year. The economic analysis done to evaluate a proposal to provide greater protection, in the recent past, demonstrated that such additional cost could not be justified by the benefits it would provide.

CASE #2: DRAINAGE DISTRICT

The Hunt and Lima Lake Drainage District consists of 28,553 acres of contiguous cropland on the left bank floodplain of the Mississippi River just north of Quincy, Illinois. It began as two separate drainage districts: the Hunt Drainage and Levee District, containing 15,294 acres in Hancock County, Illinois, was formed in 1879; and the 13,259-acre Lima Lake Drainage and Levee District directly to its south, in Adams County, was organized the following year. They continue to exist politically as separate entities because they are in different counties, but the Corps treats them as a single district. There is no boundary between them and they function hydrologically as a single unit.

The broad bottomland is crisscrossed by farm roads, utility lines and drainage canals, with a scattering of storage bins, farmhouses and outbuildings. The agricultural activity in the combined district is divided almost equally between corn and soybeans, with less than 10% allocated to wheat production. Two residential areas fall within the district: a small undeveloped portion of Warsaw on the northern end, and the tiny town of Meyer in the southwest corner. Meyer's economy has been tied to the Mississippi River since its founding in 1890 when the main access was by water. Huge grain elevators rise between it and the river, and the ferry to Canton, Missouri, lies just beyond. At least one game preserve and two active airstrips exist within the district boundaries, as well as two pumping stations.

The Hunt and Lima Lake Drainage District is protected from the Mississippi by 33 miles of earthen levees. Most of its interior boundaries are lined with flank levees, which provide protection from Schuhart and Bear creeks, bounding it on the north and south, respectively, and from

the Rocky Run Diversion Channel, which was constructed along the district's inland boundary to carry off the runoff from the Warsaw bluffs rising up behind it to the east.

Corps Improvement Projects

Federal improvements were made separately to the two districts in the early 1900s. The Corps strengthened the levees of the Hunt Drainage District in 1922. Then between 1922 and 1930, the Lima Lake levees were upgraded under two separate Congressional authorizations.

The districts were first treated as a single project by the Flood Control Act of 1954, which authorized the improvement project that was implemented over the next 18 years according to three major design memoranda: the General Design Memorandum, July 10, 1957; the Rocky Run Diversion, October 30, 1963; and Jennifer Creek Reservoir, January 29, 1965.

The Hunt and Lima Lake improvement project was one of many on the upper Mississippi that was an outgrowth of the floods of 1944. In response to that flooding—and floods again in 1947—the United States Senate asked the Corps for a flood protection report on the portion of the Mississippi River within the Rock Island District of the Corps, between Guttenberg, Iowa, and Hamburg Bay, Illinois. The resulting “Guttenberg Report,” presented to Congress in January 1953, recommended 15 rural and four urban projects, concluding that “accomplishment of the local protection projects proposed in this report would eliminate in large measure the damages in that part of the Mississippi River Valley located within the Rock Island Engineer District.” This report, House Document 281, eventually spawned the Flood Control Act of 1954. The proposed Hunt and Lima Lake project, as described in the report, was expected to provide \$360,000 in average annual benefits by strengthening the levee to provide protection from the 50-year flood (which has a 2% probability of occurring in any given year).

The General Design Memorandum (the official plan) for the Corps project proposed strengthening and increasing the height of the 33 miles of Mississippi River levee and the lower 3.5 miles of the levee that protects the district from the Rocky Run Diversion Channel running along its eastern boundary. The improvements were designed to provide the 50-year protection at a federal cost of \$5.42 million.

A second and then a third design memorandum followed, however, to deal with an additional threat to Hunt and Lima Lake cropland: large amounts of silt from the

Table 3. Costs of Levee Repairs, Hunt and Lima Lake Drainage District, 1944-1993

Year	Cost	Adjustment Factor†	1993 Dollars
1944	\$112,000	16.737	\$1,874,544
1948	51,000	10.855	553,605
1950	105,000	9.812	1,030,260
1952	35,000	8.795	307,825
1953	27,000	8.340	225,180
1960	220,000	6.073	1,336,060
1968	13,000	4.333	56,329
1993	10,041,039	1.0	10,041,039
Total			\$13,901,775
† CCI Index			

uplands deposited by runoff onto the district and into its ditches. The second design memorandum proposed two reservoirs—one on Rocky Run Creek and one on Little Rocky Run Creek—primarily to capture the silt loads pouring into those channels from upland watersheds covering approximately 10.5 square miles. Fifty-two hundred acre feet of flood control and a pool providing for a 50-year accumulation of silt were constructed at a cost of \$600,000. The third project was another desilting reservoir, this one constructed on Jennifer Creek, and controlling a 2.5 square mile area of upland, at a federal cost of \$264,000. The three creeks were roughly parallel to each other and, as their flows descended from the bluffs, they were captured by the Diversion Channel and thus prevented from inundating the district.

Twelve years after the Jennifer Creek construction was completed, in March 1984, a Reconnaissance Report was prepared by the Corps for the Warsaw Bluffs Area, which was still plagued by problems from the uplands: flooding and deposition of sedimentation, both on the cropland and in the canals and ditches, by runoff from the one portion of bluff which did not drain into the Diversion Canal. The report concluded that neither of the two proposed solutions—nine upland reservoirs and two bottomland reservoirs—were economically feasible.

The Hunt and Lima Lake levees have been repaired

by the Corps on at least seven occasions since 1944 (in 1948, 1950, 1952, 1953, 1960, 1968 and in 1993), in the course of which the Corps has expended almost \$14 million in current dollars to keep the district dry (Table 3).

The Impact of the 1993 Flood

The drama of the 1993 flood began earlier in the Hunt and Lima Lake Drainage District than in most of the upper Mississippi River Basin. The Illinois State Water Survey Report (Bhowmik, 1993), quoting liberally from the *Quincy Herald Wigg*, tells the story nicely:

The fight to protect levees in the Quincy area actually began in early spring 1993, when the river was approaching its spring peak stage of 24 feet.... In mid-April a weak spot was noticed in the Lima Lake Levee near Meyer.... This weakness, caused by lateral erosion of the Mississippi River running alongside the levee, was reported to be a half-mile long. A major effort was launched to reinforce the levee and reduce the erosive impact of waves with heavy plastic and wooden fencing and sandbags. (QHW, April 25, 1993). On April 23, a team from the Corps came to inspect the levee which was found to be in critical condition, structurally weakened by years of erosion.

This inspection led to a Congressional quarter million dollar appropriation, passed on June 18, to study whether the Mississippi River levees needed fixing. It came too late.

...on the night of June 30 a thunderstorm dropped large amounts of rain along the Mississippi River Valley near Quincy, including a record-high 6.06 inches at Quincy. The river was forecast to reach a record stage of 30 feet as a result of these rains. Officials of the Lima Lake Levee District ordered residents to evacuate at 5 a.m. the next morning and the Corps warned that the levee was in imminent danger of failing.

...[T]he Lima Lake (Meyer) Levee broke on July 9, ending an intense 10-day struggle to keep the water out. The river stage had risen above 30 feet, and water had been pushing over the top of the levee in several locations throughout that day. Ironically, the levee broke at one of the assumed "strong" spots while workers were busy shoring up what they thought was a weak spot. The Hunt Levee District,

north of Lima Lake, was also being inundated because no levee separated it from the Lima Lake District. It took little more than 24 hours to inundate the 28,600 acres belonging to both levee districts.

Seventy people were evacuated from the town of Meyer, and when it was all over, 17,600 lineal feet of levee was gone, water levels within the district had risen to the top of the utility poles, buildings roads and ditches had been washed away, and the two pumping stations had been destroyed.

The Federal Response

The main losses from the flood were suffered by the residents of Meyer and the property owners of the agricultural lands behind the levee. The town had an official population of 80 people, living in two to three dozen houses, all of which were damaged by the flood. Applications were quickly approved for funding from the FEMA Mitigation Program to elevate eight homes and to buy out another 25 homes within the levee district, including Meyer. By late fall of 1994, however, only one home had been elevated, none of the property owners had agreed to sell, and several new buildings were under construction.

Land ownership in the district is distributed among a large number of small property owners and a small number of large ones. Several corporations own thousands of acres each, and the small parcels are distributed among what appear to be many members of the same family—at least two family names are repeated for well over a thousand acres each. More than 80% of the district is owned by less than 25 families or corporations.

The Rock Island Corps District office made two official applications (PL 84-99 reports) for funding to repair the Hunt and Lima Lake levee. The first, in April 1994, proposed to do all the levee repairs and to replace the two pumping stations at an estimated cost of \$8 million. The supplemental report, submitted in September 1994, requested another \$2 million for additional levee repairs to compensate for new physical conditions created by the flood itself.

Economic Analysis

The PL 84-99 reports, like most Corps funding requests, must contain an economic justification for the work—namely, a demonstration that the benefits, which are the

annualized flood damages that would accrue without the project, do not exceed the annualized costs of the project. The ratio of the former to the latter, the benefit/cost or B/C ratio, must be greater than 1.0 before the work can be considered for funding. The 1993 PL 84-99 reports proposing repairs on the Hunt and Lima Lake levee included the following information:

1. The B/C ratio for the repairs was 1.1 to 1, calculated by dividing the average annualized benefits of \$911,900 by the average annualized costs of \$820,800.
2. The average annual benefits of \$911,900 were calculated by assuming that there were 27,100 acres of tillable agricultural land in the entire levee district, planted 50% in soybeans and 50% in corn. It is the loss of income from these crops, which property owners would suffer in flood years if the levee was not repaired, that is the basis for calculating the benefits of the project.¹ The values used in the economic analysis were \$253.50/acre (the average of \$300/acre for corn and \$207/acre for soybeans) producing, for the 27,100 acres, total damages of \$6,883,400 annualized to \$911,900.
3. The \$820,800 of annualized costs was calculated from the total \$10,041,039 cost using an 8% discount rate.

In addition to the calculation of the B/C ratio, to satisfy various economic constraints which have been put on the Corps' projects by Congress, the analysis pointed out that:

1. the number of beneficiaries of the repair was 25;
2. the average annual benefits were less than 5% of the cropland value²; and
3. the net cash income per acre exceeded the benefit per acre for both crops. The cash income per acre, estimated from data in Doane's Agricultural Reports, is \$95 for corn and \$132 for soybeans, which exceeds the \$40 and \$24 of benefits per acre.

¹Calculations of average benefits take into account the varying effects of floods of differing risk potential; in other words, the hydrographic curve that applied to the district.

²The annual benefits per acre were \$40 for corn and \$24 for soybeans, just under 3% of the value of the cropland, which was \$1,250 per acre.

Conclusions

The Hunt and Lima Lake Drainage District suffers from the natural processes which made it what it was and will always strive to be again—a floodplain. Its maintenance can be expected to require continual surveillance and repair. It is under constant pressure from the Mississippi River on the west and the uplands to the east. The levee which protects it from the river had been repaired seven times since 1944, when it was discovered to have a weakness in the spring of 1993. Even then, when it blew in July, it was in another location altogether, not in the known weak spot.

Likewise, the efforts to protect the district's cropland from the silt and sediment loads pouring off of the bluffs are unending. They began with construction of the Rocky Run Diversion Channel and later its improvements; next the Rocky Run and Little Rocky Run Reservoirs were built and, finally, the Jennifer Creek Reservoir. Yet a sediment problem still exists today, as described in the Warsaw Bluffs Reconnaissance Report. It is unreasonable to expect, as the Guttenberg Report did in the 1960s, that protection projects such as this one bring an end to flood damages. It is, instead, a constant and costly struggle against natural forces, which sometimes, as in 1993, will get the upper hand.

It is expensive to maintain such a levee district, and that expense is largely a federal one. Levees and reservoirs have been built, maintained and repaired. Although each project, independently, is justified by calculation of a B/C ratio which weighs the loss of income to the district's property owners against the cost of doing the project (and the \$10 million repair job after the 1993 flood squeaked through with a 1.1 to 1 B/C ratio), never is it calculated backward or forward to determine if all the work and all the cost is worth the effort in terms of value to the property owners within the district. It is, after all, the value of the private property that is being protected by these federal projects. The rich agricultural bottomland in this district, for example, is owned by a handful of people—thousands of acres within single ownerships. There is nothing in these protection programs to discourage them from farming there.

If the property owners within this district received benefits from the Crop Insurance and Disaster Assistance programs on the same scale as the investor in the single farm case history, the federal aid payments of \$300–400 per acre would add another \$10 million dollars to the taxpayers' bill. Data on such payments, however, is not organized by levee district and thus was not available for comparison.

CASE #3: COUNTY

Lyon County, in the southwest corner of Minnesota, contains 453,072 acres, of which 87% is farmland. The population is 24,789, 12% of whom are farmers. Per capita income for the county is \$11,000, about 25% below the U.S. average. The county seat and major city, Marshall, with a population of 12,000, sits in the center of the county and is bisected by the Redwood River, a major tributary to the Minnesota River, which itself enters the Mississippi at Minneapolis.

The flooding of 1993 began early in Lyon County, with a May 7 rainstorm that was confined to the portion of the Redwood River Basin upstream of Marshall. Although it affected only a small area of the watershed, this high-intensity storm of short duration produced the worst flood (50-year frequency) of the season in the city. A second storm (15-year frequency), this time centered in the portion of the basin downstream of Marshall, affected a wider area, including the city, on June 16-17. The third and least intense (10-year frequency) rainfall covered the entire basin on July 3 (Table 4). All three produced overbank flooding within the city of Marshall, extending into hitherto unflooded areas, inundating a trailer park and hundreds of homes. The high river levels also caused heavy damage from storm sewer backup into residential basements. Seventy people were evacuated from their homes on May 8. Groundwater levels rose across the county; streams and drainage ditches overflowed; fields lay under water and roads were impassable.

Table 4. Intensity of Rainfall and Flooding in Marshall, Minnesota, 1993

Date	Rainfall Frequency	Flooding Frequency
May 7	50 yr	50 yr
June 15– 16	15 yr	25 yr
July 3	10 yr	20 yr

The May 7 flood was the second largest in Marshall's history, a larger, 80-year flood having occurred in 1969. A 35-year flood event in 1957 was the only other one larger than the floods on both June 16 and July 3, 1993. The

Corps has described the flooding (USACE, 1994, Appendix A) in Marshall:

The Wayside Park area was completely submerged.... Flood waters were also crossing over County Road 7.... The city constructed a half-mile long emergency levee.... One of the worst hit areas of the city was in the northeast where the Camelot Trailer Park...was completely submerged.... Downstream of the diversion channel flow had broken out on the right bank,...water had also backed up Village Drive to the south.... Marshall's wastewater system, that normally pumps three million gallons per day, was handling as much as 10–11 million gallons per day for three days following the heavy rains.... It was estimated that at least 360 homes in Marshall were damaged from the weekend storm as the result of floodwaters, basement flooding from interior drainage problems and large hail. Floodwaters from the Redwood River crested above its banks early Sunday morning, May 9 (Mother's Day) at the U. S. Geological Survey streamflow gaging station at an elevation of 1205.24 feet, approximately three feet above flood stage.

Rainfall occurring throughout the night of Wednesday June 16 resulted in Marshall city officials declaring an emergency at 5 a.m. on June 17. Heavy rains occurred over an already saturated basin, causing the Redwood River to spill out of its banks in Marshall for the second time within six weeks. A total of 6.35 inches of rain fell at Marshall over a 24 hour period, with over three inches in a few hours. Residents and businesses filled sandbags, pumped water from basements and attempted to salvage items from floodprone areas. Several industries...ceased operation. The Marshall wastewater treatment plant was inundated as water entered the system through manhole covers and infiltrated sewer lines. Significant flooding occurred through the 100-unit Camelot Trailer Home Park, the Tiger Lake area, Independent Park and other areas. Several city streets were flooded in northeastern Marshall.... [T]he Redwood River crested at the USGS gaging station at an elevation of 16.25 feet.... [T]he fourth largest flood of record, with a return interval of approximately 25 years.

Nearly three inches of rain fell quickly over Marshall [on July 3].... [T]he city re-established the emergency levee along County Road 7. Thousands of sandbags were filled to bolster existing emergency dikes at the Camelot Trailer Park and to

create dikes around other homes throughout the city. However, waters once again rose within the trailer park, lapping at the foundations of more than half of the 100 units.

The Corps also described the flooding (USACE, 1994, Appendix A) in other communities and rural areas:

Several major rural roads in Lyon County were flooded [on June 16–17] and became impassable.... Many area farms sustained widespread flooding due to breakout flows from the Redwood River and its tributaries. Tens of thousands of acres of farmland were under water throughout Lyon and Redwood Counties.

Federal Financial Assistance

The State of Minnesota has estimated that the 1993 floods caused damages of \$1.167 billion across the state, of which 83% was agricultural, 13% was private nonagricultural and 4% was public. The Corps' estimate of federal payments into the state was \$427.3 million, including agricultural Crop Insurance and Disaster Payments; Emergency Conservation & Watershed Programs; Food Stamps, Business Loans and FMHA Loans and Grants (USACE, 1994, Appendix A).

At least \$17.5 million of federal money was allocated to Lyon County (Table 5) from programs run by at least five federal agencies: the Public Assistance, Individual and Family Grants and National Flood Insurance Program administered by FEMA; the Department of Agriculture's Disaster Assistance and Crop Insurance programs; the Department of Housing and Urban Development's Community Development Block Grant Program (CDBG); the Economic Development Administration (EDA) in the Department of Commerce; and the Small Business Administration (SBA).

Eighty-three percent of Lyon County's federal aid, \$14.5 million, went to farmers in the form of Crop Insurance and Disaster Assistance payments. Eleven percent went to local governments: \$1.077 million through the Public Assistance program, \$641,775 in CDBG grants and \$138,000 from EDA. The remaining 6% of federal funds was distributed to private citizens: \$370,602 in Individual and Family grants, \$685,200 in SBA loans and \$26,153 in flood insurance payments.

Agricultural Disaster Aid Programs—Two programs provided aid to farmers: crop insurance and disaster aid. The disaster assistance program is an unrestricted grant program, while roughly one-third of crop insurance payments are paid for by premiums (Hoffman, 1994). There are 947 farms in Lyon County, covered by 1,222 Crop Insurance policies (a farmer is required to take out a separate policy for each crop). Out of 395,023 acres of cropland, 171,240 acres (43%) were insured in 1993 and almost \$10 million in payments were made. In addition, the Department of Agriculture paid out \$4,936,000 in straight disaster assistance payments to 496 recipients.

The Environmental Working Group (Hoffman, 1994) estimates that \$11 million in disaster payments has been made in Lyon County over the last nine years, of which 10% has gone to 3.5% of the recipients. The average payment for all 496 of the disaster assistance recipients, over this time, has been \$1,259. Fifty-four of these farms, however, have flooded in four or five of the seven years and their average payments have been approximately \$25,000. The largest single recipient during this period received as much as \$207,873; the next largest \$130,436.

FEMA Disaster Aid Programs—FEMA funds represent less than 10% of the federal dollars going into Lyon County after the 1993 floods. The agency used its public assistance money for repairs to county roads and bridges and to the Marshall sewage treatment system. Individual and family grants went mainly for temporary housing. Mitigation funds are being allocated, according to priorities set by the state of Minnesota, to upgrading local infrastructure.

Other Federal Programs—HUD's Community Development Block Grant program is investing substantial amounts of money in Lyon County for post-flood activities that not only repair, but also upgrade damaged facilities. Pending grants are for \$184,275 for housing rehabilitation and \$457,500 for sanitary sewer lift stations in Marshall. EDA is also investing \$138,000 in upgrading the nearby town of Ghent's infrastructure.

The Flood Insurance Program. Lyon County contains seven municipalities which have been identified by the National Flood Insurance Program as containing flood hazard areas. Six of those communities have elected to participate; the seventh, Taunton, has not. Within the six participating communities and the unincorporated areas of Lyon County which are also in the program, the NFIP has identified 276 homes and eight other structures in the flood hazard areas. Sixty-five are covered by current

Spending Federal Dollars

Table 5. Summary of Federal Disaster Aid to Lyon County, Minnesota, 1993

Aid	Sub-Total	Sub-Total	Amount
Agricultural			\$14,538,682
Crop insurance		\$9,602,682	
Disaster aid		4,936,000	
Family/Individual			370,602
Housing (192 applicants)		319,658	
Individual & Family (72 apps.)		50,944	
Personal prop.	38,661		
Housing Repairs	11,287		
Transportation	237		
Flood ins.	592		
Other	217		
Public Assistance			1,076,983
Debris removal		12,532	
Protective measures		222,758	
Roads/bridges		590,659	
Water control		35,432	
Public bldgs.		40,992	
Public utilities		116,639	
Other		20,348	
Administrative		37,623	
Small Business Administration Loans			685,200
Real property		545,700	
Personal prop.		139,500	
National Flood Insurance Program Payments			26,153
Comm. Dev. Block Grant (under consideration)			61,775
Economic Development Administration			138,000
Total			\$17,477,395

policies; 61 in the city of Marshall and four in the unincorporated area. After the 1993 flood 27 claims were made under these policies, of which only seven have qualified for payment paid. Of this total payment of \$26,153, \$16,121 went to two policy holders in the unincorporated area (one of them receiving a total of \$14,342) and \$10,032 to three policy holders in Marshall. For the longest period of available record keeping, 1979 to the present, a total of \$44,013 has been paid for losses in all of

Lyon County, whose policy holders have, in turn, paid premiums of \$19,038 (43%) back into the program.

Conclusions

The lion's share (83%) of Lyon County disaster aid went to farmers, and once again it could be argued that the payments were excessively generous. Although this \$14.5 million in 1993 disaster payments went to only 496 recipients, the total net cash income of Lyon County's 947 farmers the year before (Farm Census, 1992) was \$21.1 million. In spite of the \$9.6 million in Crop Insurance payments, however, Lyon County participation in the program is low: 43% in contrast to the 52% participation across Minnesota and 57% throughout the nine-state flooded Midwest region.

The National Flood Insurance Program played an almost nonexistent role in the 1993 floods in Lyon County, contributing less than two-tenths of 1% of the total disaster assistance. In the county as a whole, where 276 structures were identified in flood hazard areas, only 65 (or 24%) of those are even covered by flood insurance policies. In the city of Marshall, where we know that at least 100 trailers were damaged in one trailer park alone, a total of 61 policies are currently in effect. Only 27 claims were submitted, and only a quarter of them actually paid; two policy holders received half of the money.

FEMA disaster assistance, on the other hand, seems appropriate, both in amount and use, to the scale of the disaster. Hundreds of homes were damaged by both surface inundation and storm sewer backup and FEMA paid for personal property losses and temporary housing. The city's sewage lines and treatment facilities were severely overtaxed by the storms of the spring and summer

and FEMA aid dollars helped to make repairs. FEMA mitigation money, along with Economic Development Agency and Community Development Block Grant funds, is being used to upgrade the facilities to prevent future damages.

General Conclusions

The intended goals of our flood control policy are to protect development where it is economically justified, to prevent and reduce damageable development and to compensate those who suffer blamelessly and excessively from flooding. The programs which pursue these goals, however, are flawed. The one program which might prevent future damages is a failure. Mitigation programs which could reduce current damages are still a minor part of our program. We are providing protection to private properties without calculating the cumulative costs of providing that protection. Finally, our overly generous payments in compensation for agricultural flood damages eliminate the risk and make it highly profitable to farm the floodplain.

These are the general conclusions that can be drawn from the three case histories described in this report. Whether these cases are merely aberrations from the norm or whether they truly reflect the state of these programs is beyond our scope to determine. What they lead us to suggest is the following:

The true costs of protection structures are grossly underestimated. The true costs of a levee just begin with its construction. They include not only maintenance and repairs, upgrading and strengthening over the years, but also the periodic damage costs incurred as homeowners and farms move in behind it and are flooded. Agricultural levee districts, such as the two discussed in the case histories, provide property owners with high-yield, low-risk farming opportunities, insured and protected with federal disaster payments and crop insurance. These payments are certainly a part of the true costs of building levees.

The National Flood Insurance Program is a failure. In Lyon County, at least, it covers too few properties, doesn't pay the claims it gets and makes disproportionately large payments to the few policy holders who get paid at all. The \$26,000 in NFIP payments, of which over half went to two recipients, was less than 2/10 of 1% of total federal disaster payments into the county.

Some people suffer. The flood victims in Meyer and Marshall experienced physical danger, helplessness, displacement from their homes and later, the degradation of cleanup with its accompanying filth and stench. Residential areas affected by floods are far from affluent; the Individual and Family Assistance Program payments were

probably well-deserved.

Some people benefit. The sums of money distributed through the agricultural aid programs, in the case where we could document it, benefited a private investor with returns on his money beyond his expectations; and, in Lyon County, disaster payments appeared to provide farmers with incomes well in excess of what they net in a normal year.

FEMA Public Assistance is money well spent. In Lyon County the need was there, the amount of money spent was modest and the use appeared to be intelligent. The state of Minnesota was able to channel mitigation funds into infrastructure improvements that should help to prevent future damages.

Flood control is not an exact science. Floods and flooding, generally, are as unpredictable and full of surprises as the meteorological events which cause them. In our three cases a river flows backwards; a town suffers a 50-year, 25-year and a 20-year flood within a two-month period; and in the third instance, while all attention and sandbagging efforts are concentrated in the one spot considered to be weak, the river pops through the levee at an entirely different place. Engineering solutions are not infallible, protection structures will fail, and the endless possibilities for meteorologic variation confound the oddsmakers.

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