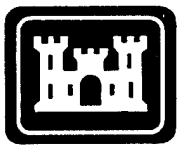
FPMA

FloodPlain Management Assessment

June 1995

Appendix B
(Evaluation)



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The oversight agency for the floodplain management assessment was the North Central Division. The St. Paul District was the lead agency for completion of the report, but actual work on the report was accomplished by five Corps District; St. Paul, Rock Island, St. Louis, Kansas and Omaha.

The assessment evaluated the impacts of a wide array of floodplain policies, programs and flood damage reduction measures to the Midwest Flood of 1993. However, this assessment has taken an important step toward achieving a better understanding of the current uses of floodplain, forces causing those uses and impacts of various alternative changes in the managment of floodplains. Some of the objectives included in the assessment are: describing land and water resources and making projections of future conditions; identify local interests; alternative uses of floodplain resources; identify facilities needing additional flood proction; examine Federal cost-sharing; evaluate cost effectiveness of alternative flood control projects and recommend improvements to current system.

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FLOODPLAIN MANAGEMENT ASSESSMENT

APPENDIX B
EVALUATION APPENDIX

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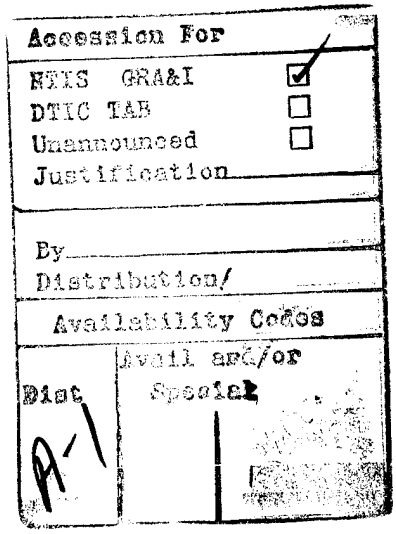

INTRODUCTION

This appendix is a compilation of working papers generated by the five Corps of Engineer Districts involved in the Floodplain Management Assessment. These working papers are often results of separate analyses that were synthesized to generate the main report. The data in these appendices were not as thoroughly reviewed to remove all inconsistencies or editorial errors as was accomplished for the main report. In some cases numbers may have been reconciled in the main report but not in the appendix.

Information and data which support and expand upon the analysis presented in the Main Report, especially Chapters 5, 7, and 9, are contained in this Evaluation Appendix. These cover the 1993 flood base conditions (Chapter 5), the review of policy and program measures comprising the scenarios (Chapter 7), and the review of action alternatives affecting hydrologic and hydraulic conditions (Chapter 9).

The approach that was taken in this floodplain management assessment is to evaluate a wide range of scenario measures and action alternatives from the perspective of how the impacts caused by the 1993 Midwest flooding might have been different if various policy, program, or project options had been in place at the time of the flooding. The focus for the review and analysis of impacts has emphasized the systemic perspective, not site specific evaluations.

While it is understood that this approach may not fully consider the characteristics of the various alternatives under a wide range of flood conditions, there is a significant amount that can be learned in examining the policy, program, and project options from the context of the 1993 flood. Chapters 4 and 6 of the Main Report discuss details of the evaluation framework for this assessment, including the impact and resource categories considered as well as the specific measures and action alternatives examined, and will not be repeated here.

For several subsection headings in this appendix, much of the material to be covered will have already been presented in the Main Report. A cross reference will be made as to where this discussion can be located in the Main Report. The intent is to avoid as much redundancy as possible between the main report and this appendix.

In other cases, there is a substantial amount of information that has been prepared on specific subjects. These products have been kept intact to the extent possible, even if it makes for a less than smooth discussion in some cases. A primary purpose of this appendix is to provide additional supporting information for the main report findings and conclusions.

BASE CONDITIONS

OMAHA DISTRICT BASE CONDITIONS

Study Area. The study reach for the Omaha District (MRO) includes the area from Gavins Point Dam at river mile 811.05 to below Rulo, Nebraska at river mile 498.0. Of the 25 counties adjacent to the Missouri River in this reach, 19 were among the 1993 presidentially-declared flood disaster counties. These 19 counties are the MRO "impact counties".

There are no federal levees from Gavins Point Dam to the Omaha, Nebraska-Council Bluffs, Iowa metropolitan area. The federal levee system starts in the Omaha-Council Bluffs area (Douglas County, Nebraska and Pottawattamie County, Iowa) and protects this metropolitan area. These urban levees were not threatened by the 1993 floods. The return period associated with the flooding level in the area was estimated at the 10-year level. The urban levees protecting the Omaha and Council Bluffs area are approximately 13.3 and 5.8 miles in length, respectively. They were both completed in 1950 and have over a 500-year level of protection according to the Adequacy of the Missouri Levee System from Rulo to Omaha, completed in April of 1986.

Below the Omaha-Council Bluffs area, the Federal levees protect agricultural land and several small towns (population less than 1,500 persons). The right bank of the Missouri River follows relatively close to the bluff line. The Nebraska counties of Cass, Otoe, Nemaha, and Richardson are in this part of the reach. The areas most vulnerable to flood damages are on the left bank, including Mills and Fremont counties in Iowa; and Atchison and Holt counties in Missouri. Most of these areas are protected by the Federal levee system. The length of the levees, in river miles, is approximately 30 miles on the right bank and 90 miles on the left bank. The area in the flood plain, from bluff to bluff, in the FPMA impact counties is approximately 1.0 million acres or 1,560 square miles.

The left bank Federal levee system in the MRO ends near river mile 512. The district boundary extends to river mile 498.4, just above Rulo, Nebraska. This area in Holt County, Missouri is not protected by a Federal levee and is vulnerable to damage. Since some areas of Holt County, Missouri and Richardson County, Nebraska lie within Kansas City District's boundary, the damages have been allocated between Omaha and Kansas City Districts with MRO claiming 81-percent of Richardson County and 24-percent of Holt County.

i. Baseline Economic Impacts

1) Urban Damages. Damages from the 1993 flood event were collected and presented in the Post-Flood Data Collection Report prepared by the Lower Mississippi Valley Division (LMVD). The baseline damages for this report were derived from the LMVD data collection effort. These baseline damages include county-wide data including overbank flooding, interior drainage ponding, and other flooding(including upland and tributary flooding). This data was collected on a county-wide basis and for some damage categories it is impossible to distinguish the exact source of the flooding.

a) Residential Damages. For the most part the areas affected by the 1993 flood event are rural in nature. Most urban damages occurred in rural communities with populations less than 1,500 persons. There were 8 communities vulnerable to flooding by the 1993 event. It is estimated that 530 residences were vulnerable to flooding and approximately 1,600 people. Approximately $24.0 million in urban damages were reported in the FPMA impact counties. Approximately $65.6 million in urban damages were reported in all presidentially declared disaster counties and it is estimated that 12 communities were vulnerable to flooding, affecting approximately 12,600 people and 4,230 residences.

b) Other Urban Damages. Damages to commercial, industrial, public facilities, and other urban uses were reported at $124.6 million for the all disaster counties and $62.6 million for the FPMA counties.

2) Agricultural Damages. For the agricultural damages, the LMVD data collection damages were used for the baseline. These baseline damages include county-wide data including overbank flooding, interior drainage ponding, and other flooding(including upland and tributary flooding). This data was collected on a county-wide basis and for some damage categories it is impossible to distinguish the exact source of the flooding. The damages to agricultural crops is estimated to be $109.2 million for the FPMA impact counties and $623.9 million for all the presidentially declared disaster counties. The damages to other rural activities was estimated to be $16.2 million for the FPMA impact counties and $30.8 million for all the presidentially declared disaster counties.

There were 89,800 acres of farmland in the FPMA impacted counties affected by the 1993 flood event. There were many factors affecting crop production in the spring and summer of 1993. Above normal rainfall in the early spring combined with an early snow melt hampered farming operations in the spring of the year. This slowed the land preparation and early spring planting of crops. The summer continued the pattern with unprecedented precipitation which fell throughout the basin during the summer months of 1993 caused by an unusual weather pattern which developed in mid-June and remained for nearly 2 months. Precipitation for the period averaged well above normal for most of the basin. North Dakota, South Dakota, and Iowa each experienced their wettest summer on record. Nebraska had its third wettest summer on record, with 150 percent of normal rainfall. At least a trace of rain fell somewhere in the Missouri River basin every day from March 14 through July 29. Temperatures throughout the basin averaged from 2 to 6 degrees below normal for the months of June through August. South Dakota, Nebraska, and Iowa experienced their second coldest summer on record while North Dakota had its third coldest (The Great Flood of 1993 Post-Flood Report, Lower Missouri River Basin, Appendix D, September 1994).

The excessive precipitation caused saturated ground conditions which hampered farming efforts. This resulted in large amounts of farmland which were not even planted and of the areas which were planted, the below normal temperatures affected crop growth and maturity. Of the land which was planted and harvested, only about one-eighth of the normal production was harvested.

In the areas which experienced overbank flooding from the 1993 event, there was total crop loss.

3) Change in Value of Floodplain Resources. The net agricultural product is presented as a total value of the agricultural crop land in the FPMA impact counties. It was developed using the total number of acres times an average value per acre of $1,500. The total value was estimated to be $1,608.0 million.

4) Change in Government Expenditures. The LMVD report estimated that $8.3 million were spent on emergency response efforts, $55.2 million was spent for disaster relief programs, and the NFIP paid an estimated $11.7 million in the FPMA impact counties. It was estimated that $26.2, $256.8, and $22.3 million were spent on emergency response, disaster relief, and NFIP, respectively, for all of the presidentially declared disaster counties.

The LMVD report estimated that $59.6 million were spent on disaster relief programs related to agriculture and $34.3 million was spent by the FCIC for the FPMA impact counties. An estimated $323.3 and $179.7 million was spent in all presidentially declared disaster counties for disaster relief and FCIC, respectively.

ii. Environmental Resource Categories

Data on significant and unique environmental resources in the study area (Gavin's Point Dam to Rulo, Nebraska) of the Omaha District was taken from the Environmental Resource Inventory (see Environmental Resources Inventory: Appendix C).

The Missouri River National Recreation Area, Nebraska is located in Thurston County, Nebraska, and includes the only unaltered reach of the Missouri River in the Omaha District below Gavin Point Dam. The area also has numerous access areas to the river for camping, canoeing, and fishing. High concentrations of bald eagles are attracted to the area because of the year-round open water below Gavin Point's Dam which provides ample feeding opportunities. Pallid Sturgeon, interior least terns, and piping plovers, all Federally listed threatened/endangered species, also take advantage of this unchannelized portion of the river.

There are approximately 317 lakes and ponds in the study area a majority of which are oxbow or cutoff lakes which offer significant habitat for migrating waterfowl, passerine, raptors, and shore birds as well as important spawning, nursery, and feeding areas for fish if there is periodic access to the river. These Lakes include: McCook Lake (river mile (RM) 740), Crystal Lake (RM 735), Browns Lake (RM 717), Badger Lake (RM 703), Blue Lake (RM 693), Round Lake (RM 664), DeSoto Lake (RM 643), Lake Manawa (RM 607), Folosom Lake (known bald eagle nesting site) (RM 597), Forneys Lake (RM 577), Greys Lake (RM 545), Big Lake (RM 500).

Public land in the Omaha District is scarce compared to other Mississippi Basin districts; therefore, all public land in the Omaha District

is considered significant. Projects like Missouri River Mitigation and the Missouri River Corridor Study concentrate on land acquisition to restore riparian and stream habitat lost as a result of the Missouri River Bank Stabilization and Navigation Project.

Both the mitigation and corridor study target areas with the greatest potential for habitat restoration. The corridor project emphasizes recreational opportunities while the mitigation project emphasizes fish and wildlife management. A list of recommended restoration sites includes: Omadi Bend, Glovers Point, Blackbird State Wayside Area, Lower Bullard Bend, California Bend, Boyer Chute, Hidden Lake, Missouri River Trails, Louisville Bend, Winnebago Bend, Langdon Bend; Blackbird, Decatur, and Tieville Bend; Soldier Bend, and Tobacco Island. All of these sites involve some sort of reconnection to the main channel either as secondary channels or backwaters.

Boyer Chute National Wildlife Refuge, DeSoto Bend National Wildlife Refuge, and Squaw Creek National Wildlife Refuge constitute the Federally managed areas. Boyer Chute is presently under development and is located in Washington County, Nebraska. The area includes a restored secondary channel and a diversity of wetland and riparian habitats. There will also be numerous recreational opportunities such as river access, fishing, and hiking.

DeSoto Bend National Wildlife Refuge (7,823 acres) is located in both Nebraska and Iowa. The refuge includes many natural features, including an scenic overlook, Bullhead Pond, Cottonwood Trail, Wood Duck Pond, Prairie Land, and a 760-acre oxbow lake. DeSoto is visited each spring and fall by multitudes of migrating waterfowl and bald eagles as well as human spectators.

Squaw Creek National Wildlife Refuge (6,900 acres), located in Holt County, Missouri, was established in 1935 and provides habitat for a variety of riparian vegetation and wildlife. The area contains four large lakes which are surrounded by marshlands and provides fishing, hunting, observation towers, and foot trails. This site is also visited by migrating waterfowl and bald eagles each spring and fall.

iii. Reduction of Risk Categories

(1) Critical Facilities. The baseline data regarding critical facilities was collected using Omaha District GIS data. The area flooded for the 1993 event was derived using GIS and an inventory of the number of critical facilities within this area was determined. Two categories of critical facilities were examined. An inventory of critical facilities was developed using GIS and is presented in Attachment 4 of the Main Report.

a) Critical Facilities with Harmful Releases. This category includes the number of facilities dealing with hazardous or polluted materials that could immediately harm people or the environment if exposed to flooding. This includes municipal and industrial National Pollution Discharge Elimination System (NPDES) sites, superfund sites, landfills, hazardous waste facilities, petrochemical plants and major pipelines, sewage treatment plants, power plants, and water treatment plants, water well fields,

and major water supply intakes. In the FPMA impact counties, it is estimated that 25 facilities fall into this category.

b) Other Critical Facilities. This category includes the number of facilities providing essential public services that are potentially exposed to flooding. This includes major power utility substations, communications equipment and related antennas (television, radio, and telephone services), hospitals and group homes for mobility impaired, public service buildings (i.e., schools, post offices, police stations, and fire departments), prisons, major airports, state or federal bridges, and military bases. In the FPMA impact counties, it is estimated that 7 facilities fall into this category.

c) Supplemental Data. Supplemental data on critical facilities was collected for the impact counties. The area from Gavins Point to Omaha, there were no critical facilities affected by the 1993 Missouri River flooding. There were, however, several critical facilities affected by tributary flooding. In South Dakota, for instance, there were critical facilities affected on the James and Vermillion Rivers. Both of these rivers are tributaries of the Missouri River.

In the area from Omaha to Rulo, there were several critical facilities affected by the Missouri River flooding and this area also had critical facilities affected by tributary flooding. The most extensive tributary flooding problem was in Fremont County, Iowa. The Nishnabotna River and Main Ditch 6 flooded the town of Hamburg, Iowa and caused extensive damages. Interstate Highway 29 was closed in July 1993 by Hamburg in Fremont County, Iowa and was closed for approximately 1 week.

In Sarpy County, damages from the 1993 Missouri River flood were relatively miner. There were a few county roads overtopped with water, for a total distance of a few miles. These were mostly unpaved roads. A Natural Resources District access road to a levee project was washed out and replaced south of Hawthorn park in Bellevue, Nebraska. Although it is not a critical facility, Hawthorn Park took extensive wind damage during the storm on July 7, 1993, and later was flooded entirely. Also, the baseball fields near Offutt Air Force Base Lake flooded.

In Cass County, Nebraska, in the City of Plattsmouth, the water and sewer treatment plants were severely threatened. Quick response by local officials and 10,000 sandbags prevented any damage to these facilities. In addition, there are a number of pipeline crossings in the Plattsmouth area which could be affected by Missouri River levels.

On the left bank of the Missouri, Atchison County, Missouri, there were problems with the water treatment plant in Fairfax. The Fairfax city well had to be pumped out and treated. Also in the county, there was a flood-fight around the City of Rock Port and the city well was threatened, but not damaged. Also, the approach to a bridge on U.S. Highway 136 was washed out and Highway 136 was closed for several weeks.

(2) Protection/Avoidance of Harm. The number of people vulnerable in all the counties is approximately 12,600 persons. The number of people vulnerable to flooding in the FPMA impact counties is approximately 1,650 persons.

(3) Social Well Being. The number of communities and residences vulnerable to flooding in the FPMA impact counties is 8 and 542, respectively. The number of communities and residences vulnerable to flooding in all the counties is 12 and 4,230, respectively.

The baseline 1993 flood damage and resource data for the Omaha District counties is presented in the table on the next page.

	IMPACT CATEGORIES	A All Disast. Counties	B FPMA Impact Counties	L Remove Levees	M Set Back Levees	N 25-YR Fusible Plugs	O Fully Confined	Q 500-Yr [Priority]	R 500-Yr [All]	S No Reservoirs	V Runoff Reduced 5%	W Runoff Reduced 10%
	ECONOMIC ($'s)											
	Fld.Dam.Reduct.											
1	Resid.(Urban)	65,648,752	24,017,611									
2	Other (Urban)	124,621,013	62,572,037									
3	Agricultural	623,663,131	109,170,412									
4	Other Rural	30,828,538	16,249,850									
	Chg. in Govt.Expend.											
5	Emerg.Resp.Costs	26,162,427	8,229,102									
6	Disast.Rel.(Agric.)	323,262,416	59,583,205									
7	Disast.Rel. (Human R.)	256,843,175	55,244,130									
8	Fld.Ins. (NFIP)	22,276,574	11,690,540									
9	Fld.Ins. (FCIC)	179,696,218	34,313,801									
10	Net Ag Product.	NA	0									
11	Net Urban RE Values	NA	0									
	ENVIRONMENTAL											
	Natur. Resour. (# acres)											
12	NonForest Wetlands	not req	6,046									
13	Threat.&Endang. (#/Occ.)	not req	25sp, 253oc									
14	Forest (acres)	not req	22,682									
	Natural Fldpln Functions											
15	Fld Plain Inundated (acres)		120,276									
	Cultural											
16	Impacts (-5 to +5)	-2	-1									
	Open Space											
17	Public Lands (acres)	not req	57,852									
18	Recreation sites (#)	not req	92									
	REDUCT.OF RISK											
	Critical Facilities											
19	# Facil. w/harmf.releas.	no info.	25									
20	# other crit. facil.	no info.	7									
	Prot./Avoid. of Harm											
21	# people vulnerable	12,596	1,647									
	Social Well Being											
22	# commun.vulnerable	12	6									
23	# resid.str.vulnerable	4,230	553									
	IMPLEMENT. COSTS											
24	Structural Costs (Low)	0	0									
	Structural Costs (High)	0	0									
25	Other Costs	0	0									

KANSAS CITY DISTRICT BASE CONDITIONS

Kansas City District base conditions are as discussed on pages 5-11 through 5-14 of the Main Report. The impacts matrix table showing the 1993 flood base conditions damages and resource values for Kansas City District Column A (all declared disaster counties) and B counties (FPMA impact reach counties) is provided on the next page.

BASE CONDITIONS FOR ACTION ALTERNATIVES
KANSAS CITY DISTRICT

		A	B	L	N	O	S
				ACTION ALTERNATIVES AFFECTING HYDRAULIC CONDITIONS			
				AGRICULTURAL LEVEES			UPLAND RETENTION/ WATERSHED MEASURES
	IMPACT CATEGORIES	Base Cond. [All Disast. Counties]	Base Cond. [Floodpln. Impacts]	Remove	Uniform Ht. [25–YR.]	Raise	Without Reservoirs
	ECONOMIC (1,000 $'s)		[1]				
	Flood Damages						
1	Residential (Urban)	$102,326	$72,556				
2	Other (Urban)	$650,251	$541,462				
3	Agricultural	$1,373,434	$303,322				
4	Other Rural	$118,447	$75,509				
	Chg. in Govt.Expend.						
5	Emergen.Resp.Costs	$19,423	$16,332				
6	Disaster Relief (Agric.)	$210,198	$64,762				
7	Disaster Relief (Human R.)	$285,853	$166,510				
8	Flood Insurance (NFIP)	$100,779	$46,687				
9	Flood Insurance (FCIC)	$185,389	$92,975				
	Chg.Value of FP Resources						
10	Net Ag RE Values	–	–				
11	Net Urban RE Values	–	–				
	ENVIRONMENTAL						
	Natur.Resour.(# acres)						
12	Non–Forested Wetl. (acres)	–	42,700				
13	Threat.&Endang. (# / Occ.)	–	30/80				
14	Forest (acres)	–	58,200				
	Natural Fldpln.Functions						
15	Fldpln.inundated (acres)	–	100%				
	Cultural						
16	Archeol Impacts (–5 to +5)	–					
16A	Hist.Sites(–5 to +5)						
	Open Space						
17	Public lands (acres)	–	43,100				
18	Recreation sites (#)	–	20				
	REDUCT.OF RISK						
	Critical Facilities						
19	# Facil. w/harmful releases	–	27				
20	# other critical facilities	–	76				
	Prot./Avoid. of Harm						
21	# people vulnerable	28,375	21022				
	Social Well Being						
22	# communities vulnerable	229	141				
23	# resident.struct.vulnerable	8711	6287				
	IMPLEMENT. COSTS						
24	Structural Costs	–	–				
25	Other Costs	–	–				

[1] Economic impacts collected only at the county level

ST. PAUL DISTRICT BASE CONDITIONS

Impact Categories Covered	Page APP B
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1. FLOOD DAMAGE REDUCTION/URBAN RESIDENTIAL

HDR REPORT (Corps Contractor for St. Paul District via Omaha District on 1993 Flood Damage Data Collection Study being managed by LMVD):

Information and data obtained is indicative or reflective of damages experienced in the impact categories that were covered, but is not definitive. Based on uncertainties regarding extent of coverage, quality of data able to be obtained, and methodologies applied in extending data to a county level of detail in many categories, the results should be reported out generally at an aggregate level by state for the FPMA counties covered within St. Paul District boundaries from data provided by the contractor. The following 13 counties are "FPMA counties" in Minnesota within St. Paul District by virtue of their location adjacent to the Minnesota River from Mankato downstream; the Mississippi River from the confluence of the Minnesota downstream; or the St. Croix River from Stillwater downstream: Blue Earth, Carver, Dakota, Goodhue, Houston, Le Sueur, Nicollet, Ramsey, Scott, Sibley, Wabasha, Washington, and Winona.

For Wisconsin there are 12 "FPMA counties" in St. Paul District given their location along the St. Croix River from Stillwater downstream; the Black River from Black River Falls downstream; the Wisconsin River from Portage downstream; and the Mississippi River: Buffalo, Columbia, Crawford, Jackson, LaCrosse, Pepin, Pierce, Richland, St. Croix, Sauk, Trempealeau, and Vernon. (NOTE: subsequently, the Wisconsin counties were limited to seven for Column B of the impacts matrix summary tables based on location adjacent to the Mississippi River. These are Buffalo, Crawford, La Crosse, Pepin, Pierce, Trempealeau, and Vernon.) There are also two FPMA counties in Iowa in St. Paul District along the Mississippi River: Allamakee and Clayton.

Data for some damage categories at less detail were also obtained for all Federally declared disaster counties within the Upper Mississippi River (UMR) basin. There are a total of 35 such counties in Minnesota within the St. Paul District boundaries (including the 13 "FPMA counties"), and 25 such counties in Wisconsin (including the 12 "FPMA counties").

<u>Estimated Residential Damages</u> (structures and contents)

13 FPMA counties in MN:	$ 3,198,000
35 MN declared UMR disaster counties in St. Paul District:	$ 10,818,000
12 FPMA counties in WI:	$ 9,001,000
25 WI declared UMR disaster counties in St. Paul District:	$ 12,263,000
2 FPMA counties in Iowa	$ 260,000

GALLOWAY REPORT, p. 15

Minnesota, TOTAL damages as estimated by the state ($1.7 billion)
Wisconsin, TOTAL damages as estimated by the state ($930 million)

Galloway report, p. 21 Corps REGIONAL estimate of damage PREVENTED by completed projects is $19.1 billion; $11.5 billion along the Missouri, $7.4 billion due to reservoirs and $4.1 billion due to levees;

Galloway report, p. 21, for prior acquisitions (more than 600 over the previous 20 years) (REGIONAL)

DISTRICT POST FLOOD REPORT, citing from Minnesota DNR report, estimates of $115 million in individual, family, and business losses; WI DNR report estimates $46 million in residential structure damage (5% of state total);

District post flood report: Damage PREVENTED by completed flood control projects $217 million total, including N. Dakota, separate tally for Upper Miss Basin, including Main Stem and tribs of interest, is about $118 million;

DISTRICT PL 84-99 LEVEE REHAB REPORT

Black River Falls, WI

Estimated damage to residential properties at $650,000 (out of assessor's valuation of $2,237,000 for 94 residential structures in "the Grove" area; PUBLIC facility damages were estimated to be $92,500 in this report;

WISCONSIN DNR REPORT The Floods of 1993: The Wisconsin Experience

Description of Black River Falls flooding, forcing evacuation of over 500 people and inundation of 90 homes; I-94 closed for 7 hours; municipal water service and sewage treatment operations lost; water two feet deep downtown at one point; initial damage estimate was $11 million; later updated to $21 million with 100 home uninhabitable; 383 families affected according to the Red Cross; preliminary Jackson County damage estimate was $36 million; Trempealeau County was $2.8 million, most to 180 homes, including low lying homes near L&D 6 at Trempealeau; Eau Claire County was more than $5 million in damages, 10 left homeless, 250 people evacuated, and two dozen homes and businesses destroyed or damaged; Pierce County at least 100 residents on Trenton Island were evacuated and four businesses closed, all trailers removed from Island Campground; LaCrosse County had 20 homes with flooded basements; 25 homes in Prairie du Chien and dozens outside the city limits were evacuated; 20,000 sandbags filled to prevent further damages; Baraboo River and Devil's Lake State Park were locally inundated by a 7.78 inch rainfall in 3 hours, and 10 to 12 inches total in the area on July 17, with damages estimated at $8 to 10 mil. for Sauk County, including $2.3 mil. for roads, $345,000 for private residences, and $100,000 for the state park, commercial damages and losses approaching $4 million.

2. **FLOOD DAMAGE REDUCTION/URBAN OTHER**

GALLOWAY REPORT, p. 18-19 for REGIONAL data

District post flood report: Lake City, MN on Lake Pepin had marina damage caused by a severe local storm, bridge destroyed at mouth of First Creek; Winona had numerous residences with basement flooding or seepage and had two storm sewer mains collapse; Able Island at Guttenberg, IA was inundated by flood water

District post flood report: commercial navigation losses estimated at $700,000 per day (system), over 1,000 barges stranded, 7 million tons of cargo worth $1.6 billion were held up by river closing; truck and rail also impacted by disruptions and reroutings, no disruption cost estimate developed;

MN DNR POST FLOOD REPORT cites $52 million in public facility repairs and clean up costs; **WI DNR POST FLOOD REPORT** of business losses at $31 million, and public damages of $43.6 million; and utility damages at $9.2 million; adding in residential losses at $46 mil. and ag damages at an estimated $800 million, the total Wisconsin damage estimate by the state is $929.8 million;

HDR REPORT

Commercial/industrial damages to structures and contents:	
2 FPMA counties in Iowa:	$ 398,000
13 FPMA counties in MN:	$ 4,743,000
35 MN UMR declared disaster counties in St. Paul Dist.:	$ 6,586,000
12 FPMA counties in WI:	$ 5,712,000
25 WI UMR declared disaster counties in St. Paul Dist.:	$ 7,314,000

HDR REPORT

Commercial REVENUE loss estimates (NOT damages)	
2 FPMA counties in Iowa	$ 74,000
13 FPMA counties in MN:	$ 790,000
35 MN UMR declared disaster counties in St. Paul Dist.:	$ 10,179,000
12 FPMA counties in WI:	$ 828,000
25 WI UMR declared disaster counties in St. Paul Dist.:	$ 943,000

HDR REPORT

Public Facility Damages (including buildings and contents; parks and recreation sites; levees and water control structures)

2 FPMA counties in Iowa:	$ 172,000

13 FPMA counties in MN:	$ 2,405,000
35 MN UMR declared disaster counties in St. Paul Dist.:	$ 4,254,000
12 FPMA counties in WI:	$ 4,576,000
25 WI UMR declared disaster counties in St. Paul Dist.:	$ 6,224,000

Clean up and Restoration Costs to Public Facilities

2 FPMA counties in Iowa:	$ 69,000
13 FPMA counties in MN:	$ 1,080,000
35 MN UMR declared disaster counties in St. Paul Dist.:	$ 1,347,000
12 FPMA counties in WI:	$ 473,000
25 WI UMR declared disaster counties in St. Paul Dist.:	$ 521,000

Land Based Transportation Damages and Disruption Costs

2 FPMA counties in Iowa:	$ 2,580,000
13 FPMA counties in MN:	$ 3,434,000
12 FPMA counties in WI:	$ 1,004,000

Utility Damages

2 FPMA counties in Iowa:	$ 9,000
13 FPMA counties in MN:	$ 3,848,000
12 FPMA counties in WI:	$ 744,000

FEMA INTERAGENCY HAZARD MITIGATION TEAM REPORT, WISCONSIN, July 23, 1993

Initial Damage asssessments compiled by county emergency government directors were reported as follows:

Private Damage (residential and business)	$ 30,280,686
Public Damage	20,033,588

MINNESOTA FLOODING 1993, MnDNR Report

Minnesota Long-Term Grants Coordination Group formed under Governor Carlson's Disaster Task Force, group has screened 238 proposals from local governments totalling $65 mil. in flood recovery projects; 9 acquisition or relocation projects being considered or implemented in Springfield, Austin, Rockford, East Grand Forks, Delano, Waterville, and Norman, Mower, and LeSueur

Counties, potential removal of 84 homes and 12 businesses from floodplain areas

WISCONSIN DNR REPORT The Flood of 1993: The Wisconsin Experience

Public Damages estimated at $43.6 million, categorized as follows:

public buildings	$11 million
dams	10 million
levees	3 million
storm sewers	2 million
parks/forests	1.7 million
railroads	.5 million
airports	.4 million
roads/bridges	15 million

Utility Damages estimated at $9.2 million, categorized as follows:

electric power	$7 million
telecommunications	1.7 million
natural gas	.33 million
water facilities	.14 million

St. Paul Pioneer Press, June 21, 1993

Bridge and highway closings include Bloomington Ferry Bridge; US 169 from Mankato to St. Peter; MN 93 from US 169 to MN 112 in LeSueur Co.; MN 22 from St. Peter to Kasota; MN 66 from West Mankato to Blue Earth County Rd 9; I-94 for 7 hours near Black River Falls for bridge inspection.

3. **FLOOD DAMAGE REDUCTION/AGRICULTURAL**

Galloway Report, p. 15:
Minnesota TOTAL AG damages as estimated by the state ($1.5 billion)
most lost to wet conditions rather than riverine flooding
(p. 16, footnote 16)
Wisconsin TOTAL AG damages as estimated by the state ($800 million)

District post flood report: ten of thousands of acres of farmland were under water due to breakout flows and lack of drainage in Lyon and Redwood counties (upstream of FPMA reaches of interest), in Redwood County 20 to 25 percent of farm acreage was estimated to be under water;

District post flood report: MN DNR report Water, Water Everywhere - Minnesota Flooding 1993, cited as follows: 6.7 million acres inundated with over $1 billion in ag losses; Wisconsin damages summarized in The Floods of 1993: The Wisconsin Experience, $930 million total damages, $800 million ag related;

SAST DATA BASE/USDA DATA

Crop Production Comparisons, 1992 and 1993, by state and crop type, indicative of lost agricultural production due primarily to flooding and other natural factors. (NOTE: Use aggregated state totals, because this data is reported out by Dept. of Ag regional codes, which do not easily correspond to FPMA counties.)

				(000 bushels?)		
	MN 1992	MN 1993	%change	WI 1992	WI 1993	%change
Barley	50,625	37,700	- 25.5%	4,160	3,220	- 22.6%
Corn	741,000	322,000	- 56.5%	10,320	(?) 8,550	- 17.2%
Oats	35,000	23,750	- 32.1%	34,410	24,150	- 29.8%
Soybeans	172,800	110,000	- 36.3%	22,080	20,300	- 8.1%
All Wheat	139,860	71,190	- 49.1%	2,640	4,660	+ 76.5%

HDR REPORT

Damages to Agricultural Crops

	Acres Affected	Total Crop Damage
2 FPMA Counties in Iowa	9,500	$ 7,107,000
13 FPMA Counties in MN	272,000	$ 76,232,000
35 MN UMR Declared Disaster Counties in NCS	886,000	$ 464,121,000

12 FPMA Counties in WI	112,000	$ 31,648,000
25 WI UMR Declared Disaster Counties in NCS	228,000	$ 82,750,000

FEMA INTERAGENCY HAZARD MITIGATION TEAM REPORT, WI, 7/23,93

Initial estimate from county emergency directors of ag losses to crops and buildings was $123,242,050 (NOTE: very early after the event)

Minneapolis Star Tribune, 12/5/93

Minnesota Crop Losses	4 yr ave yield	1993 yield	Est. $ Production Loss
Corn	125 bushels/acre	80/acre	$802 million
Soybeans	35 "	23/acre	$310 million
Wheat	40	33/acre	$ 78 million
		TOTAL	$ 1,190 million

4. FLOOD DAMAGE REDUCTION/RURAL OTHER

GALLOWAY REPORT, p. 16
Damages to field fertility and farm infrastructure of at least $100 million. (regional)
GALLOWAY REPORT, p. 21 damages prevented due to small watershed projects of $400 million (regional)

HDR REPORT

Farm Damages (including damages to buildings; field restoration costs; drainage ditch restoration costs)

2	FPMA Counties in Iowa:	$ 1,503,000
13	FPMA Counties in MN:	$ 1,011,000
35	MN UMR Declared Disaster Counties in St. Paul Dist.:	$ 1,767,000
12	FPMA Counties in WI:	$ 2,276,000
25	WI UMR Declared Disaster Counties in St. Paul Dist.:	$ 3,598,000

5. **EMERGENCY COSTS**

Galloway Report, p. 23-25

MN FEMA administrative costs ($1.3 million projected)
NOAA expenses ($500,000)
USACE flood control costs ($300,000)
HHS subtotal ($4.0 million)
Education subtotal ($800,000)
Labor subtotal ($5 million)
National community service subtotal ($700,000)
Federal Highway Admin. ($4.6 million)
Local Rail Freight Asst. ($2.7 million)
EPA response costs ($2.2 million)
DOI costs ($6.0 million)

WI FEMA administrative costs ($1.9 million projected)
NOAA expenses ($100,000)
HHS subtotal ($3.9 million)
Education subtotal ($300,000)
Labor subtotal ($1.5 million)
National community service subtotal ($300,000)
Federal Highway Admin. ($2.8 million)
EPA response costs ($2.4 million)
DOI costs ($4.8 million)

Galloway report, p. 28 also costs of administering loan programs, covering defaults, and subsidizing interest rates (conceptual)

St. Paul District post flood report: possible increased maintenance dredging required after the flood in main navigation channel, 31 channel locations and 2 small boat harbors were dredged in 1993, not all flood related; repair costs to dikes at L&D 7-10 to fix riprap due to wave action during high water, $145,000 cost;

St. Paul District post flood report: U.S. 169 from Mankato to St. Peter was closed along the Minnesota River; only one bridge between Mankato and the Twin Cities over the Minnesota River remained opened (at Belle Plaine), bridges at St. Peter, Le Sueur, Henderson, Blakely, Jordan, Chaska, Shakopee, and the Bloomington Ferry Bridge were closed; portions or all of two state parks and two national wildlife refuges were closed;

Redwood River at Marshall (not in FPMA study reach area) was subject to damaging flooding on three separate occasions in 1993; Camelot trailer park in Marshall, 100 units, subject to damage; Vesta and Redwood Falls were other communities impacted by overbank ditch or river flooding; other communities experienced localized flooding due to interior drainage problems; Cottonwood River at Springfield flooded on May 9 with roads washed out and hundreds of homes suffering basement flooding, and again on June 17, 13 homes subsequently demolished with homeowners relocated;

Black River Falls, WI: dam overtopping and levee failure led to flooding of "The Grove" neighborhood, with up to 6 feet of water, as many as

90 homes, June 19-20; roads closed throughout area, including I-94 for approx. 8 hours, utilities out, sewage treatment plant out of service indefinitely;

Baraboo River flash flooding after 12" rainfall, roads, bridges, campground, state park, parking lots, lodge all suffered severe damage, one life lost, Madalon Industrial Park in Baraboo was flooded, along with six main streets in the city;

Wisconsin River: rural Portage Co. groundwater contamination problems, bottled water had to be supplied in Hull; sandbagging prevented major problems at Portage; Marion suffered less than $100,000 damage downstream;

Chippewa River: damaging runoff from Eau Claire downstream, including Hay Creek, s. fork Eau Claire River, with subsequent road repairs causing drainage of Rock Dam Lake and loss of recreation; two basement foundations collapse in Augusta; NSP admin bldg flooded in Eau Claire, several university campus bldgs as well; downtown Durand flooded; highway closures elsewhere in basin;

St. Paul District post flood report: floodfighting and preparations for lock closures cost about $182,000 in the district;

Post flood report: District levee repair costs at Guttenberg, IA was $50,000; at Black River Falls, WI $30,000 was spent;

HDR REPORT

Emergency Response Costs

2 FPMA counties in Iowa	$ 112,000
13 FPMA counties in MN	$ 2,132,000
35 MN UMR declared disaster counties in St. Paul Dist.	$ 2,918,000
12 FPMA counties in WI	$ 732,000
25 WI UMR declared disaster counties in St. Paul Dist.	$ 1,074,000

Courier News, Stillwater, MN 7/1/93

City spent $31,000 in various flood control efforts involving sandbagging and pumping out storm sewers; total cost likely to be $50,000 when materials and OT labor are included;

6. & 7. DISASTER RELIEF (Human Resources Related and Agricultural Related)

Galloway Report, p. 23-25

MN FmHA loans and grants ($2.5 million)
infrastructure ($27.5 million projected)
human services ($24.4 million projected)
hazard mitigation ($9.7 million projected)
CDBG 1993 allocations ($13.5 million)
HOME 1993 allocations ($2.7 million)
CDBG 1994 allocation ($13.6 million)
EDA Assistance ($7.4 million)

WI FmHA loans and grants ($800,000)
infrastructure ($18.5 million projected)
human services ($18.0 million projected)
hazard mitigation ($8.0 million projected)
CDBG 1993 allocations ($5.9 million)
HOME 1993 allocations ($1.3 million)
CDBG 1994 allocations ($7.2 million)
EDA assistance ($700,000)

Galloway report, p. 30 (REGIONAL) on state and local costs: 90/10 cost share means state and local governments covered approximately $42 million for Public Assistance and nearly the same for individual assistance. State and local cost shares 75/25 for levee and watershed restoration exceeded $130 million.

Galloway report, p. 83, Des Moines Water Works INSURANCE concept

Galloway report, p. 23-25
MN ASCS disaster payments ($445,557,415)
WI ASCS disaster payments ($100,846,214)

SAST DATA BASE, USDA DATA

ASCS Disaster Payments by County for 1993 (St. Paul District FPMA reach counties identified below):

	Producer Payments	Total Amount
Iowa		
Allamakee Co	1,098	$ 1,543,580
Clayton Co	1,760	2,645,707
Total FPMA NCS Counties in IA	2,858	$ 4,189,287
Minnesota		
Blue Earth Co	1,728	$ 7,967,207
Carver	621	1,484,427
Dakota	495	1,639,754
Goodhue	1,354	4,878,405
Houston	1,536	2,990,309
LeSueur	706	1,554,984
Nicollet	828	3,116,730
Scott	570	1,538,705
Sibley	1,729	5,920,319
Wabasha	1,052	3,629,182
Washington	198	886,926
Winona	721	2,640,650
Total FPMA NCS Counties in MN	11,538	$ 38,247,598
Wisconsin		
Buffalo Co	451	$ 920,941
Columbia	765	2,801,967
Crawford	295	254,327
Jackson	414	1,872,021
LaCrosse	139	176,692
Pepin	310	560,836
Pierce	643	1,796,069
Richland	533	858,807
St. Croix	776	3,256,098
Sauk	1,111	2,467,361
Trempeleau	720	1,871,025
Vernon	989	1,161,444
Total FPMA NCS Counties in WI	7,146	$ 17,997,588

Other ASCS Disaster Related Payments in 1993 in St. Paul District FPMA Counties (SAST)

Livestock Emergency Assistance Program	
Clayton Co., IA	$ 11,707
Columbia Co., WI	65,764
Richland Co., WI	1,736
Sauk Co., WI	534,957
St. Paul District FPMA Counties Total	$ 614,164
Emergency Conservation Program-Flood Related	
Houston Co., MN	$ 21,082
Pepin Co., WI	1,286
	$ 22,368

SAST DATA BASE/USDA DATA

Farmers Home Administration (FmHA) Emergency Disaster FARM Loans, Midwest Flood Assistance Summary as of 7/13/94 (close to final)

County	# of loans	Total Loan Amount
Allamakee, IA	6	$ 87,340
Clayton, IA	11	169,420
FPMA St. Paul District Counties in Iowa	17	$ 256,760
Blue Earth, MN	5	$ 129,840
Dakota, MN	3	205,880
Goodhue, MN	1	88,570
LeSueur, MN	1	1,840
Nicollet, MN	8	264,620
Sibley, MN	28	1,044,430
FPMA St. Paul District Counties in MN	46	$ 1,735,180
Columbia, WI	5	$ 236,930
Jackson, WI	1	28,580
Pepin, WI	4	57,980
Pierce, WI	5	67,230
St. Croix, WI	6	54,410
Vernon, WI	2	48,300
FPMA St. Paul District Counties in WI	23	$ 493,430

FMHA Emergency Disaster HOUSING loan

Jackson, WI	1	$ 5,000	(only one)

*NOTE: David Buland (SAST member) phone call of 10/07/94 indicated that ASCS payments for 1993 increased approx. $600 million over previous estimates based on high payouts over the Feb-April 1994 period. Therefore, the numbers shown above should be treated as indicative but not final numbers.

HDR REPORT

Disaster Relief Costs (includes evacuation and relocation costs; flood related mission assignment costs; unemployment costs; and crisis counseling costs) NOTE: unemployment accounts for approx. 88% of the total disaster relief costs compiled for this report.

2 FPMA Counties in Iowa:	$ 2,224,000
13 FPMA Counties In MN:	$ 47,489,000
35 MN UMR Declared Disaster Counties in St. Paul Dist.:	$ 182,816,000
12 FPMA Counties in WI:	$ 45,922,000
25 WI UMR Declared Disaster Counties in St. Paul Dist.:	$ 69,468,000

FEMA DATA

Acquisition/Relocation Program, Project Approval Summary dated 6/3/94

State/Location	# of Parcels	FEMA Cost	Total Cost
Minnesota			
Springfield	13	$ 400,000	$ 660,000
Chippewa Co.	5		
Montevideo	2		
Rockford	9		
Mower Co.	10		
Waterville	10		
TOTAL	49		
Wisconsin			
Darlington (elevation)	38	$ 1,110,000	$ 1,470,000

Nine State Regional Total

83 Projects involve 4,834 parcels; FEMA cost $64,408,000; total cost of $105,904,000. (Note: This is an average of $21,908 per parcel).

Minneapolis Star Tribune, 12/5/93

The FEMA "buyout" bill, signed 12/3/93, was to provide $110 in federal aid for relocation of flood prone areas, by state to be distributed as follows: MN $7.4 mil.; MO $29.7 mil.; IL $21 mil.; IA $17.2 mil.; KS 15.2 mil.; NE $7.1 mil.; WI $5 mil.; ND $3.7 mil.; SD $3 mil.;

Federal officials reported as approving a $3 mil. buyout in Pierce Co. WI to move more than 80 properties to higher ground, most on Trenton Is. near Red Wing, MN;

Grafton, IL figures it will take $30 mil. to cover transition costs and to move the town

MINNESOTA DIVISION OF EMERGENCY MANAGEMENT

More details on Springfield, MN project (Note: Springfield is located along the Cottonwood River, a tributary of the Minnesota River in Brown County, and not in an FPMA impact reach or county)

Of the $658,900 total project cost, the following funding sources are used:

$ 75,000	FEMA Hazard Mitigation Grant Program (HMGP)
84,800	FEMA Individual and Public Assistance Program
415,000	State of Minnesota
84,800	Applicant (City of Springfield?)

Four state agencies are involved: MnDNR; Dept. of Trade and Economic Development; Division of Emergency Management; and MN Housing Finance Agency. Damages attributable to 1993 flood in this 13 home FLOODWAY area were estimated to be $181,200. Thirteen flood events have occurred in Springfield since 1947; repeat damages much in excess of project cost can be expected over time if no action is taken. Project is consistent with FEMA Interagency Hazard Mitigation Team Report (FEMA 993 DR-MN). A diking alternative may be less expensive but considerable disadvantages include lack of access and public safety concerns during floods.

MINNESOTA DNR, Tom Lutkin presentation at Coast Alliance Workshop, Bloomington, MN, 22 April 94

$1.75 billion in damage statewide, 90% ag related, overbank flooding a very small part of these damages; 250 applications for assistance received from local governments; MN set up a Long Term Recovery Grants Coordination Group to orchestrate relief programs, four work group covered infrastructure; mitigation/flood control; housing; and ag/erosion problems; up to $15 mil. available for acquistion of flood prone lands; more potential sites to use these funds to be identified;

WISCONSIN DNR, Larry Larson presentation at Coast Alliance Workshop, Bloomington, MN, 22 April 94

approx. $1 bil. in damage statewide, 90% ag related; most NOT floodplain related; Black River Falls the major damage site, over 100 homes damaged; Trenton Island in Pierce Co. across from Red Wing, MN another problem site, 80 structures in the community, illegal rebuilding being done; Darlington a third problem site, relocation or elevating some 30 structures with EDA funding; Eau Claire suffered some damage as well; state is building an inventory of potential sites for mitigation/relocation;

Minneapolis Star Tribune, 12/5/93

Federal funding of $25 mil. used to repair facilities at more than a dozen federal refuges in the Midwest, Mark Twain Refuge in IL, IA, and MO was more than 90% flooded, 80 levee breaks.

8. & 9. CROP and FLOOD INSURANCE PAYMENTS

Galloway Report, p. 23-25, 27

MN FCIC insurance claims payments ($353.9 million)
emergency conservation program ($100,000)
emergency watershed program ($1.1 million)
NFIP claims payments ($1,712,960)

WI FCIC insurance claims payments ($46.0 million)
emergency watershed program ($1.0 million)
NFIP claims payments ($1,999,654)

SAST DATA BASE/USDA DATA

Federal Crop Insurance Corporation (FCIC) Data "final data" for 1993

Detailed data is available, by county, of net acres covered, amount of subsidy, total premiums paid, and the total indemnity paid to cover losses, by crop, BY CAUSE OF LOSS, including "excess precipitation", "flooding", "cold wet weather", "disease", "frost", "cold winter kill", "freeze", "hail", "insects", "excess heat", "drought", "poleburn", "wildlife", "no indemnity", and "other"

REMINDER that indemnity paid is NOT a total "loss" to the government, in that premiums have been paid (subsidized in part?) that partially offset the insurance payouts. Further discussion with FCIC is needed to clarify these aspects of the program. Also recall that the insurance is paid only on a percentage of the value of the crops that were lost, so that FCIC payments alone are not a good approximation of total ag losses. ASCS DISASTER PAYMENTS (see category 6 above) are also another part of the picture in estimating total ag crop losses.

(multiply $ values by a factor of 10)

	due to flooding	due to excess precip	due to other causes	paid
IOWA				
Allamakee Co.	$ 0	$ 30,421	$ 6,207	$ 36,628
Clayton Co.	4,761	42,951	3,610	51,322
Total Iowa FPMA Counties in St. Paul District	$ 4,761	$ 73,372	$ 9,817	$ 87,950
MINNESOTA				
Blue Earth Co.	$ 8,136	$ 469,677	$ 175,639	$ 653,452
Carver	2,269	104,967	36,540	143,776
Dakota	409	58,298	36,481	95,188
Goodhue	1,574	182,031	198,110	381,715
Houston	0	14,631	32,086	46,717
LeSueur	5,060	64,951	54,270	124,281

Nicollet	4,131	311,576	78,607	394,314
Scott	474	17,905	35,238	53,617
Sibley	2,304	515,762	135,922	653,988
Wabasha	2,693	75,294	95,328	173,315
Washington	0	14,424	21,380	35,804
Winona	0	45,939	20,824	66,763
Total MN FPMA Counties in St. Paul District	$ 27,050	$1,875,455	$ 920,425	$ 2,822,930
WISCONSIN				
Buffalo Co.	$ 1,012	$ 16,714	$ 35,569	$ 53,295
Columbia	728	51,184	32,283	84,195
Crawford	0	0	718	718
Jackson	873	77,805	113,619	192,297
LaCrosse	0	3,328	433	3,761
Pepin	1,874	3,848	6,515	12,237
Pierce	85	29,573	95,787	125,445
Richland	138	11,256	16,956	28,350
Sauk	819	25,001	27,965	53,785
St. Croix	0	36,746	186,771	223,517
Trempealeau	212	32,674	73,010	105,896
Vernon	182	22,310	11,336	33,828
Total WI FPMA Counties in St. Paul District	$ 5,923	$ 310,439	$ 600,962	$ 917,324

NOTE: David Buland (SAST team) phone call 10/07/94 indicated that ag reimbursements for 1993 losses were approximately $1 billion higher (in the Midwest, presumably) than previous estimates, with $300 to $400 million involving FCIC insurance payments and roughly $600 million in ASCS disaster payments. This sharp increase is due to large jumps in claims paid in the Feb/March/April 1994 period. Therefore, the numbers above should be considered indicative, but not final numbers.

FEMA DATA, NFIP Policy Fund Payments for 1993

MN - $ 1,559,915 0.6% of Midwest Flood total
WI - $ 1,922,362 0.73% of Midwest Flood total

Midwest total $240,901,569, of which MO received $166,680,600, or 63.6%; 8 of the 11 counties receiving more than $5 mil. in the entire Midwest were in the greater St. Louis area;

MINNESOTA FLOODING 1993, Minnesota DNR Division of Waters Report

Only 258 NFIP claims for damages to homes and businesses, average claims payment was $6,060. Statewide, only about 25% of people who should have flood insurance actually have it.

NEWSWEEK, 4/11/94 Peter Annin article "To the River, the Spoils"

SCS has spent $15 mil. to enroll 25,000 acres in wetland reserve; SCS supplemental funding in the February $11 bil. California earthquake aid bill of $340 mil., almost a fifth may go to Emergency Wetland Reserve program to enroll an additional 85,000 acres; $986 million in crop insurance claims submitted last year (NOTE: Galloway report, p. 27, indicated $1,017,000,000 in crop insurance claims)

Minneapolis Star Tribune, 12/5/93

Wall Street Journal reported that disaster aid package could have been trimmed by as much as $1.5 billion if Midwesterners who qualify for flood insurance actually bought it;

Minneapolis Star Tribune, 12/5/93

State program paying for a permanent conservation easement, farmer near Franklin receives $25,700 to stop farming 23 acres along the Minnesota River; grasses to be planted to stem soil erosion; rest of farm on higher ground and will continue to be worked; this after four consecutive years of the MN River innudating these 23 acres; 92 farmers declared eligible to voluntarily enroll land in one of two easement programs, the Reinvest in Minnesota (RIM) Reserve and the Permanent Wetland Reserves; state officials have made $7.6 mil. available through special signups for these two programs, the 92 farmers are putting 4,777 acres into long-term or permanent conservation easements, at about $1,000/acre, or $4.7 mil., the other $3 mil. going to other eligible farmers for the two programs administered by the State Board of Water and Soil Resources and local soil and water conservation districts.

10. **NET AGRICULTURAL REAL ESTATE VALUES**

Galloway Report, p. 16 & 17 (REGIONAL)
"More than 70 percent of the crop disaster assistance payments, however, were made to counties in upland areas -- not in main stem river floodplains."

"Agricultural damages directly attributed to actual flooding totaled more than $2.5 billion, with an estimated $1.4 billion in lost corn and soybean sales."

"Another secondary effect was a reduction in crop support payments after prices adjusted to the reduced production caused by wet weather in the Midwest and drought in the Southeast in 1993. This loss to farmers was a gain for taxpayers since subsidies represent transfer payments. For corn, these deficiency payments were reduced by more than $2.6 billion."

Galloway report, p. 38 (REGIONAL)
concept of increased ag productivity in floodplains
Galloway report, p. 43 (REGIONAL)
ag responsible for 87 percent of wetland losses nationally

Minneapolis Star Tribune, 8/10/93

property damage may mean lower assessments and tax revenue, Clark Co. Missouri an estimated $3.5 mil. was lost in assessed value of flooded land;

SAST DATA BASE, USDA 1993 DATA

Other ASCS Conservation Program Payments, including
Ag Conservation, Regular (Code 30)
Ag Conservation, Rental (Code 31)
Ag Conservation, Long-term (Code 32)
Conservation Reserve Cost Share (Code 33)

County Name	Code 30	31	32	33	TOTAL
Allamakee, IA	$ 51,544	$ 2,897,388	$ 52,003	$ 50,239	$ 3,051,174
Clayton, IA	94,322	4,047,398	99,172	71,501	4,312,393
Blue Earth, MN	69,032	884,626	24,122	3,398	981,178
Carver, MN	7,124	159,061	0	3,041	169,226
Dakota, MN	29,757	680,395	0	4,589	714,741
Goodhue, MN	95,025	1,190,064	0	3,459	1,288,548
Houston, MN	81,013	1,276,925	35,000	35,556	1,428,494
Le Sueur, MN	189,284	2,544,886	0	7,200	2,741,370
Nicollet, MN	12,915	110,611	0	2,030	125,556
Scott, MN	8,793	154,966	0	2,170	165,929
Sibley, MN	17,978	206,214	0	1,335	225,527
Wabasha, MN	116,758	1,319,027	1,783	17,200	1,454,768

Washington, MN	33,212	89,011	48,930	10,260	181,413
Winona, MN	58,352	842,414	0	5,305	906,071
Buffalo, WI	39,376	866,815	27,867	29,443	963,501
Columbia, WI	36,265	600,107	7,574	22,494	666,440
Crawford, WI	60,568	1,133,043	2,259	32,472	1,228,342
Jackson, WI	33,393	527,253	1,354	15,352	577,352
LaCrosse, WI	21,056	729,823	59,557	8,459	818,895
Pepin, WI	36,097	351,570	39,107	3,260	430,034
Pierce, WI	58,719	1,823,351	4,579	34,118	1,920,767
Richland, WI	33,536	925,633	5,578	60,017	1,024,756
St. Croix, WI	75,779	2,838,213	1,446	79,756	2,995,194
Sauk, WI	49,507	1,460,369	0	9,943	1,519,819
Trempeleau, WI	84,843	1,880,518	10,959	42,298	2,018,618
Vernon, WI	56,605	1,039,739	24,934	8,353	1,129,631
TOTALS (rough rounding)	$1,451,000	$30,579,000	$446,000	$560,000	$ 33,036,000

Dan Cassidy and Rickert Althaus, in Choices, first quarter 1994

discussion of land reclamation costs along Missouri River, SCS estimated 60% of cropped MO River floodplain (455,171 acres) were covered with sand, over 9 inches of sand on half this land and 24 inches or more on 91,000 acres; cost of $3,200 to physically remove an acre foot of sand, or $600 acre by turning sand under with deep plowing; more interest in Emergency Wetlands Reserve Program as an alternative, government one time payment in exchange for a permanent easement which precludes crop production; estimated annual crop production value of 478,000 acres of Missouri River floodplain land behind damaged levees is $96 mil. (NOTE: $200/acre annually); is this land is not worked at all the estimate of decreased economic activity in the state is $208 mil. with 3,200 jobs lost; for every $100 reduction in assess value of this cropland there would be a $2.4 mil. reduction in property tax collections in the 25 counties;

U.S. News, 7/26/93

Sec. of Agriculture Espy is reported to have estimated that grain price supports will decline by approx. $750 million based on reduced production from the 1993 flooding leading to higher market prices.

11. NET URBAN FLOODPLAIN REAL ESTATE VALUES

Galloway report, p. 28, Federal income tax reductions (CONCEPTUAL)
Galloway report, p. 29, local property tax reductions (CONCEPTUAL)

RICHARD SHEPARD article in URBAN LAND, March 1994

property values are affected by unanticipated flooding, "In St. Louis, the highest and best suburban use can range from agriculture at $2,500 per acre ($0.06 per square foot) to industrial at $1 to $2 per square foot ($44,000 to $87,000 per acre or higher), or even commercial at more than $5 per square foot (over $200,000 per acre)." A McReynolds Appraisal Company survey of brokers in Chesterfield Valley indicated that the majority felt that property values had taken a major hit (down 30% or more) after the flood, and the minority saw a decrease of 10% to 30% range. If 100 year level of protection is restored, values and rents would still be 10 to 30% lower. Only if 500 year level of protection is provided would preflood values be essentially restored.

19. **NUMBER OF CRITICAL FACILITIES WITH HAZARDOUS MATERIALS OR PUBLIC HEALTH CONCERNS AT RISK**

Galloway report, p. 30 for specific examples (REGIONAL)

Minneapolis Star Tribune, 6/22/93

City of LeSueur planned to close its sewage treatment plant on US 169 temporarily;

6/23/93

City of St. Peter has river flowing into sanitary sewers and the city is pumping a mixture of river water and raw sewage into the Minnesota River; water treatment plant shut down due to flooding interfering with electric power; in St. Peter sewer line backups were causing several businesses to close in downtown; eight homes with up to 5 feet of water in basements;

St. Paul Pioneer Press, story by Stephen Braun, Los Angeles Times, 7/14/93 "Public safety officials say sewage spewed out by flood-jammed river city waste treatment plants from St. Paul to St. Louis poses a major health risk. In St. Paul, where floodwaters are still receding two weeks after cresting, coliform bacteria counts have topped 1,600 particles per million -- above the normal safe range of 1,000 parts per million, said Assistant Fire Chief Warren Schaub, who directed flood operations."

20. **NUMBER OF OTHER CRITICAL FACILITIES AT RISK**

Galloway report, p. 18-19 for REGIONAL data

St. Paul District post flood report, St. Paul downtown airport, Holman Field, was completely closed from the evening of June 23 through July 10 and was opened for dawn to dusk use only from July 11 through July 21.

Minneapolis Star Tribune, 6/22/93: downtown St. Paul Ramsey County jail sandbagged in anticipation of flooding over Shepard Rd.; Post Office, West Building (county offices), and other sites as well; evacuations of downtown St. Paul airport and industrial park area planned;

Minneapolis Star Tribune, 6/23/93: in LeSueur the Chicago and Northwestern RR has suspended train traffic;

St. Paul Pioneer Press, 6/24/93

railroad bridge over the Mississippi River near Randolph Avenue closed; Chicago and Northwestern RR line connecting St. Paul and Kansas City will be closed.

21. **NUMBER OF PEOPLE AT RISK**

Galloway report, p. 131 on number of applicants for Disaster Housing program and Individual and Family Grants (REGIONAL)

District post flood report, citing WI DNR post flood report, 2,500 people were evacuated;

District post flood report, SBA disaster assistance loan information, in MINNESOTA as of Feb 9, 1994, 1,469 homeowner/renter applications received, 883 approved, for $9,972,000; 166 applications for business physical losses, 106 approved, for $4,423,400; and 200 applications for economic injury, 79 approved, for $7,446,400; in WISCONSIN as of Feb 9, 1994, 735 homeowner/renter applications received, 441 approved, for $5,846,200; 126 business physical losses received, 79 approved, for $2,865,100; and 84 economic injury received, 42 approved, for $2,307,300

District post flood report, FEMA individual assistance programs, in MINNESOTA as of Jan 31, 1994, 1,241 individual and family grant program applications had been approved and $1,452,778 disbursed, 5,087 disaster housing program applications had been approved and $8,553,933 disbursed; in WISCONSIN, 683 individual and family grant program applications had been approved and $1,354,975 disbursed, 2,304 disaster housing program applications had been approved and $3,824,175 disbursed;

SAST DATA BASE/ obtained through USDA compilation

Small Business Administration (SBA) emergency flood loans, as of July 7, 1994 (close to final); categories include a) home loans; b) business loans; and c) economic injury disaster loans (EIDL). Damage estimates and loan amounts need interpretation. At this time will report out the NUMBER OF LOANS in each category.

	Home Count	Business Count	EIDL Count	TOTAL Count
IOWA				
Alllamakee Co	3	1	3	7
Clayton Co	6	5	19	30
FPMA Iowa Counties, St. Paul District	9	6	22	37
IA STATEWIDE	2,462	669	612	4,043 (?)
MINNESOTA				
Blue Earth	27	1	0	28
Carver	4	0	2	6
Dakota	5	3	1	9
Goodhue	10	2	3	15

Houston	0	0	1	1
LeSueur	14	5	3	22
Nicollet	21	4	0	25
Ramsey	0	0	1	1
Scott	3	1	2	6
Sibley	16	1	0	17
Wabasha	11	1	1	13
Winona	5	2	1	8
FPMA MN Counties, St. Paul District	116	20	15	151
MN STATEWIDE	899	120	160	1,179 (?)
WISCONSIN				
Buffalo	0	1	3	4
Columbia	29	6	1	36
Crawford	7	6	10	23
Jackson	53	14	1	68
LaCrosse	8	5	5	18
Pepin	0	1	0	1
Pierce	2	5	5	12
Richland	1	0	1	2
Sauk	62	6	1	69
St. Croix	1	0	0	1
Trempeleau	8	2	1	11
Vernon	2	2	2	6
FPMA WI Counties, St. Paul District	173	48	30	251
WI STATEWIDE	449	86	64	599

WISCONSIN DNR The Floods of 1993: The Wisconsin Experience

2,500 people evacuated during the flooding; over 4,000 individuals and private businesses have filed damage claims;

Minneapolis Star Tribune, 6/24/93

Perhaps 1,000 of 12,000 Chaska residents are vulnerable if levee doesn't hold; a few people forced to leave homes in Carver due to flooded basements;

Minneapolis Star Tribune, 7/1/93

Review of Prairie du Chien's permanent evacuation of St. Feriole Island, $4.5 mil. spent on relocation project, 122 families relocated, Fed Govt spent roughly TWICE the purchase price of homes (ave. $18,000) to acquire, raze, or move homes and ensure suitable housing at new locations.

22. **NUMBER OF COMMUNITIES AT RISK**

Galloway report, p. 20 for Prairie du Chien anecdote
Galloway report, p. 30-31 for specific examples (REGIONAL)
Galloway report, p. 118 for 61 communities with approved applications on structures for buyouts (REGIONAL)
Galloway report, p. 123 examples of ongoing acquisition and relocation programs (Beatrice, NE and Austin, MN)
Gallowary report, p. 135, with NFIP payments on structures insured behind Monarch-Chesterfield levee

District post flood report, FEMA public assistance summary as of Feb 2, 1994, notices of applications received in MINNESOTA were 816 from local governments, 38 from state government, 54 from special districts, and 34 from private non-profit organizations, 942 total; in WISCONSIN, 491 from local governments, 7 from the state, 106 from special districts, and 22 from private non-profit organizations, 626 total; in MN, 929 of 950 project applications had been approved, and in WI, 603 out of 650;

HDR REPORT

Number of Public Structures Flooded

2	FPMA counties in Iowa	79
13	FPMA counties in MN	231
35	MN UMR declared disaster counties in St. Paul Dist.	536
12	FPMA counties in WI	277
25	WI UMR declared disaster counties in St. Paul Dist.	383

WISCONSIN DNR REPORT The Floods of 1993: The Wisconsin Experience

650 claims submitted by municipalities and non-profit organizations.

23. **NUMBER OF RESIDENTIAL STRUCTURES AT RISK**

Galloway report, p. 17 see for REGIONAL data

Galloway report, p. 79, data on NFIP claims for structures on land leased from the Federal government in St. Charles Co, MO

Galloway report, p. 118 on number of structures for approved buyouts (REGIONAL)

Galloway report, p. 126 on number of NFIP insured buildings with repetitive losses, including 201 in MN and 66 in WI

District post flood report, citing WI DNR post flood report, identified 4,700 home damaged;

District post flood report, FEMA individual assistance programs, in Minnesota as of Jan 31, 1994, 6,183 homes were scheduled for inspection; in Wisconsin, 2,815 homes;

HDR Report:

306 residential structures damaged in two Iowa counties, including 303 in Clayton County alone (?)

121 residential structures damaged in the 13 MN FPMA counties; 356 total for the 35 MN declared disaster counties in St. Paul District;

944 residential structures damaged in the 12 WI FPMA counties; 1,584 total for the 25 WI declared disaster counties in St. Paul District;

Minneapolis Star Tribune, 6/28/93

Red Cross Service Centers in Mankato, Henderson, and St. Peter State Hospital being set up, as many as 800 residential units with flood damage in 13 county area estimated.

OTHER REGIONAL DATA OF NOTE:

Congressional Hearing, Oct. 28, 1993, House Committee on Public Works and Transportation, Subcommittee on Investigations and Oversight

Testimony of Rodney Slater, Federal Highway Administration administrator:

3 Coast Guard facilities inundated at St. Louis, Keokuk, and Leavenworth, $8.4 mil. damage at St. Louis, $8.85 mil. total; 5,000 buoys and 750 shore aids washed away; 36 airports were closed; Gateway Western railroad bridge at Glasgow, MO collapsed; over 10,000 miles of track affected; numerous highway bridges closed over upper Miss and Mo Rivers; barge industry over $200 mil. in losses; terminal operators over $100 million; railroad repairs to cost "hundreds of millions of dollars"; $103 million provided to 9 states for repair of Fed. aid highways and roads on Fed. lands, $30 to 40 mil. more anticipated;

Testimony of Gen. Arthur Williams, Chief, U.S. Army Corps of Engineers:

Damage to Corps projects estimated to be $100 mil.; 31 million sandbags and over 400 pumps distributed locally; $17 mil. in work supporting 29 FEMA projects in 7 states; Corps to do $180 mil. in levee repairs; damages at Corps rec facilities at $11 mil.; $25 mil. spent in floodfighting costs;

Testimony of James L. Makris, Director, Chemical Emergency Prparedness and Prevention, Office of Solid Waste & Emergency Response, EPA:

309 drinking water facilities and 410 waste water facilities were impacted; 15,000 drums retrieved from the rivers; 52,000 pounds of hazardous wastes stored;

Testimony of Jerry Uhlmann, Director, MO State Emergency Mgmt Agency:

St. Joseph lost water supply for extended period; over 300 roads were closed; levee breach closed airport and over 350 businesses behind Chesterfield levee; 33,000 have applied for assistance; over 30,000 evacuated homes; more than $3 bil. in damages

Testimony of Ellen Gordon, Administrator, Emergency Management Division, Iowa:

15,000 people evacuated; losses in excess of $3.5 bil.; almost 30,000 applicants for assistance;

Testimony of John Plunk, Act. Director, IL State Emergency Mgmt. Agency:

884,000 acres of farmland flooded; $425 mil. in corn and soybeans lost; 82 communities impacted, 59 flooded or seriously damaged; 22,000 households have applied for disaster assistance; 10,000 for crisis counseling; 9,200 applicants for individual and family assistance grant programs; 300 miles of roads closed, 12 bridges, all 4 ferries crossing the Miss.; NFIP mitigation measures applied in 17 jurisdictions since 1981 resulted in removal of 116 structures; a state program has removed 99 structures from floodplains with

another 50-80 pending; the '93 flood may result in 20 times this number of structures;

Submitted statements: EPA allocated $33.9 mil. in Supplemental Dire Emergency Appropriations Act for environmental recovery/restoration efforts at state level; Iowa county level damage estimates were $35.5 mil. for culverts, roads, bridges, buildings, and levees; St. Charles Co., MO 3,800 structures impacted, 15,000 people, 500 businesses, 130,000 acres of farmland; $23 mil in ag losses;

AQUATIC ECOSYSTEMS CONFERENCE, St. Paul, MN, 22 June 94 Presentations

Ray Evans, MO DOC: State to provide $20 mil.to purchase flood prone land on cost shared basis; 100,000 acres, 13% of floodplain, targeted for land purchases, those areas most vulnerable to flooding and erosion; at $1,000/acre total cost would be $100 mil.; easements are not of great interest in MO;

Bruce Mountain, Iowa Natural Heritage Foundation: Louisa Co. levee District 8 buyout involved 3,000 acres, 2,000 cropped acres, 11 landowners; 15 levee breaks between 1926 and 1993; repair costs would have been $2.7 mil., damages over $3,000/acre; easement payment would have been $683/acre; SCS used pre-flood market value minus damage to land to arrive at offers of between $800-$923/acre; acquisition arranged at a cost in excess of $2 million; financing and timing required involvement of non-profit organization;

THE IMPACTS OF THE GREAT FLOOD OF 1993, Changnon and Laver, in the American Meteorological Society symposium preprints, Jan 26, 1994, Nashville, TN, "The Great Flood of 1993"

15,000 sq.mi. flooded, including 2.5 million acres of corn and 1.97 mil. acres of soybeans, about 4% of the Corn Belt's planted acreage; losses on the order of $8-10 bil.; corn production was 31% less in 1993 compared to 1992 nationally, soybeans down 16%; ground transportation losses estimated in excess of $1 billion; 1,860 businesses were closed; 20,000 unemployed; Des Moines, Alton, and St. Joseph were 3 major cities without water treatment plants for several weeks; 74,000 persons evacuated from their residences; 55,000 home seriously damaged; 95,000 requests for govt assistance; FEMA spent $50 mil. on housing and rental assistance; Red Cross cost of $25 million;

NATURE CONSEVANCY magazine, July/Aug 1994, "Rethinking the River", David Tenenbaum:

calculation from Michael Demissie, principal scientist at Illinois Water Survey, that increasing the proportion of wetlands in a watershed by a single percent would reduce stream flow during floods by about 4 percent, thus reducing flood heights and increasing stream flow during dry periods; MO DOC has allocated $5 mil. to buy as much as 10,000 acres of floodprone land along Missouri River from willing sellers, part of proposed Big Muddy National Fish and Wildlife Refuge; six floods since 1951, 29 sites identified, including

5,000 acre levee district near Arrowrock, MO, farmers have already place property in wetland reserve programs and are negotiating to sell remaining rights to TNC; 9 square mile Louisa levee district in Iowa also mentioned;

NEW YORK TIMES, June 9, 1994, article by Keith Schneider:

Soil Conservation Service estimates that of 945,000 acres on MO River floodplain, 455,000 were damaged by sand and erosion, 200,000 acres permanently ruined; long term restoration costs of $500 million;

(NOTE: Scott Faber/Constance Hunt article identified the same 455,000 acres damaged by sand deposits and scouring; of that, 77,500 acres are covered by 6 to 24 inches of sand, and 59,000 acres covered by more than 2 feet of sand)

AMERICAN LAND CONSERVANCY, presentation by Chuck East at Coast Alliance Workshop, Bloomington, MN, 22 April 94

Current opportunity to finance a conversion of marginal/submarginal farmland along the Mississippi in southern Illinois as additions to Shawnee National Forest was discussed; willing buyer/willing seller only, 25,000 acres under consideration, most in 200-400 acre blocks;

MINNEAPOLIS STAR TRIBUNE, 8/1/94 "Making the move to high ground", Jennifer Corbett byline, Washington, D.C.

Austin, MN example (NOTE: not in St. Paul District)
$2.2 mil. in FEMA funding plus $600,000 from state and city to move or destroy 55 houses and a church out of flood area; Todd Johnson is MN flood coordinator, group of 12 state and Fed reps meeting weekly since Aug 93 to coordinate nearly 300 flood repair and control projects; working with local officials such as Kermit Mahan, who runs Austin's housing and redevelopment authority;

URBAN LAND, March 1994, Richard Shepard article on "Floodplain Development: Lessons Learned from the Great Flood of 1993"

floodwater covered 15,600 sq. miles, damaged or destroyed 55,000 homes, and interrupted 30,000 jobs, damage estimates approach $20 bil., 50 deaths; 18 bridges crossing the Missouri and Miss Rivers were closed; 500 miles of flooded track; 7.1 mil. acres flooded or saturated; 25,000 people evacuated in St. Louis area; dozens of propane tanks torn from anchors on south St. Louis waterfront, forcing evacuation of 12,000 residents and businesses within one mile of the site; Monarch levee in Chesterfield failed and 485 businesses, 5,000 employees, county jail with 450 inmates, and Spirit of St. Louis airport, and closure of I-64 all major impacts; Defense Mapping Agency damage estimate at $11 mil., main map library with 100,000 maps destroyed;

estimated 9 to 11 million properties in 100 year floodplains, fewer than 2 million (about 15%) have flood insurance; 4 million homes in 100 year floodplains do not carry flood insurance though their mortgages require coverage; six communities account for almost 30% of all repetitive loss situations;

ENVIRONMENT, Dec. 1993, Mary Fran Myers and Gilbert White, "The Challenge of the Mississippi Flood"

American Red Cross estimates 56,295 family dwellings were impacted by the floods; it spent more than $30 mil. in flood relief; sheltered 14,502 people in 145 shelters and served more than 2.5 million meals; more than 16,200 SBA applications for low interest disaster assistance loans for individuals and businesses; more than 10,500 flood insurance claims; FCIC estimates that of 122.9 million insurable acres in the nine affected states, 69.7 million acres, or 56.7% were insured;

PLANNING, April 1994, John Tibbetts, "Waterproofing the Midwest"

Average home value of flood victims in St. Louis area is $34,000, compared with $69,000 nationally, according to the St. Louis Post Dispatch; St. Charles County has the most repeat flood insurance claims in the region; under pressure from FEMA, St. Charles Co. hired 20 temporary inspectors to examine 4,177 structures in the floodplain, and about half were condemned, making owners eligible for federal buyouts; more than 200 local communities vying for federal funds to relocate buildings; Hazard Mitigation and Relocation Assistance Act, signed in Dec. 1993, makes about $130 mil. available to Midwest through Section 404 disaster mitigation program; 85% to 90% being used for buyouts; Arnold, MO has removed 185 structures from floodplain since major 1979 flood, achieved CRS status, now seeking another 205 buyouts of residences, mobile home pads, and businesses;

Minot Daily News, 7/18/93 AP article by Matthew Fordahl

"Finding alternate routes across flooded rivers", Santa Fe RR detouring 29 trains on a given day; IL - 24 sections of state highway, 125 miles, closed; MO road closures run 4 pages long; IA - 36 roads closed; 7 bridges closed over the Miss River; no AMTRAK passenger trains between Chicago and California;

Minneapolis Star Tribune, 6/3/94

Report by Keith Schneider of New York Times, Chelsea, IA City Council along the Iowa River votes to relocate, town of 330, 15 floods in 25 years, Rhineland, MO and Valmeyer and Grafton, IL are other cases of towns acting to relocate, $137.6 mil. package approved last Dec. to fund relocations, $31 mil. to Iowa, government offers $7 mil to move 136 households, a dozen or so businesses, and to relocate roads and utilities, $10,000 per family to move homes if that is the choice of homeowner, town citizens appear to be split over the idea of relocating the town, however;

Chicago Tribune, 7/26/93 "Floods Sink Towns with huge debts"
Staci D. Kramer byline

Ste. Genevieve, MO spending $50,000/day in emergency response efforts; Quincy, IL has spent more than $400,000; local views that local cost share requirements should be waived; FEMA review procedures described;

New York Times, 7/13/93 ? "Crippled Sewage Plants Empty Into Flood Water"

In Iowa, sewage from Cedar Rapids pouring into Cedar River, and treatment plant in Denison along Boyer River; Des Moines, Burlington, and Davenport are also urban centers affected; in MO, 35 waste water treatment plants have failed, including Kansas City, Savannah, Albany, Canton, LaGrange, Hannibal, Louisiana, Clarksville, Shelbina, Monroe City, and Clarence;

New York Times, 7/20/93 "Risks of Denying Rivers Their Flood Plains"

quote from 1992 Interagency Task Force on Floodplain Management says by 1991, floodplain land in 17,000 communities occupied more than 145,000 acres and included nearly 10 million households and $390 billion in property;

"The Mississippi Falls 1.2 Inches Near St. Louis"

12.5 million acres flooded or totally saturated, South Dakota has 3 million acres flooded and overall property and ag losses at more than $1 billion; flooding in NE covers at least 2 million acres and damages close to $200 million; MN at least 2.5 million acres affected and damage in excess of $1.5 billion; 1.5 million acres in Wisconsin (1/5 of state total) is damaged with losses put at over $1 billion; Iowa has at least 2 million acres flooded and damages at over $3 billion; Missouri with more than 300,000 acres under water and damages estimated at $2.7 billion;

Wall Street Journal, 7/20/93 "Midwest Deluge Thwarts Efforts to Protect Soil"

10% of cropland in Iowa has suffered severe erosion, at least 20 tons an acre, according to Jeffrey Vonk, state conservationist for the SCS; farmers have been increasing use of erosion resistant farming techniques, as encouraged by federal legislation requiring practice of conservation tillage on highly erodable acreage by 1995; 1993 erosion experience, as bad as it is, is less severe than 1984 and 1990 losses in Iowa;

New York Times, 7/26/93, "Railroads Threading Freight Around the Midwest's Floods"

R.L. Banks and Associates, a Washington consulting firm, estimates the flooding to date has cost the railroad industry from $235 million to $275 million;

New York Times, 7/30/93

Missouri losses now estimated at $2.7 billion, 320,000 acres underwater, 19,000 people forced from homes; railroad bridge fails at Glasgow, Route 54 into Jeff City closed, 400 families relocated in Jeff City, 200 homes and 25 businesses lost to floods; liquid propane tank loosened and spills 18,000 gallons, 500 evacuated;

Washington Times, 7/29/93

8,000 people evacuated in Kansas City in anticipation of flooding;

Los Angeles Times, 7/29/93, "Environmental Threat From Floods to Linger", raw sewage being flushed directly into river from at least a dozen communities in Kansas City area, 26 plants in MO River Valley; 415 sites being examined by EPA where hazardous wastes are stored or treated;

Wall Street Journal 8/31/93

Table from FEMA showing households in special flood hazard areas and the number of flood insurance policies, by state:

State	# of households	# of policies	%
Illinois	102,024	8,860	8.7%
Missouri	210,113	14,233	6.8%
Iowa	116,192	6,714	5.8%
Wisconsin	109,924	5,348	4.9%
Minnesota	39,609	1,539	3.9%
Nebraska	169,412	4,019	2.4%
South Dakota	56,426	1,004	1.8%

Christian Science Monitor, 8/3/93, "Des Moines Cleans Up After Flood", Flood Recovery Task Force estimates area losses at $716 million, including multiplier effect of shutdown businesses; more than 300 businesses damaged; and 2,120 damaged homes, with only 150 expected to be uninhabitable;

New York Times, 8/10/93, "What's Left From the Great Flood of '93", by B. Drummond Ayres, Jr., $200 million in damage to rail lines and bridges, 500 miles of highway scarred in MO, $8 bil. in crop damages; 800 of 1,400 levees were overtopped or breached; $300 mil. in lost revenue to barges; highway repair costs at $150 million;

New York Times, 8/13/93 summary of $6.2 ($5.7 billion new funds) billion flood relief bill signed August 12th:

- $ 2.35 bil. to Commodity Credit Corp. for crop loss payments
- $ 2 bil. to FEMA for disaster relief
- $ 389 mil for SBA loans
- $ 235 mil to Corps for levee repairs
- $ 200 mil for long term recovery through Economic Development Admin.

$ 200 mil for disaster recovery planning with state and local agencies
$ 175 mil for highway repairs
$ 75 mil for HHS Public Health and Social Service Emergency Fund
$ 70 mil for flood damaged schools
$ 55 mil for temporary jobs in Job Training Partnership Act
$ 50 mil to HUD to buy and repair public housing
$ 42 mil to Dept. of Ag. to hire temp employees to handle crop disaster requests and help farmers with cleanup
$ 41 mil to Interior Dept., USGS, USFWS, NPS, Historic Preservation Fund, and Bureau of Indian Affairs
$ 34 mil to EPA
$ 4 mil to state youth and conservation corps programs for cleanup
$ 300,000 to Legal Services Corp to help victims with legal problems.

BASE CONDITIONS FOR ACTION ALTERNATIVES (ST. PAUL DISTRICT)

		A	B	B'	B*	P	S	V	W
	IMPACT CATEGORIES	Base Cond. [All NCS]	Base Cond. [Floodpln–NCS]	Base Cond. Pools7–10 MS Riv.	Base Cond. MN Riv.	URBAN LEVEES [500-Yr.]	UPLAND RETENTION Without Reservoirs	Runoff Red. [Decr. 5%]	Runoff Red. [Decr. 10%]
						(1)	(2)	(3)	(3)
	ECONOMIC ($000's)								
	Fld.Dam.Reduct.								
1	Residential (Urban)	$21,460	$5,428						
2	Other (Urban)	$39,466	$25,918						
3	Agricultural	$484,674	$95,155						
4	Other Rural	$6,868	$2,599						
	Chg. in Govt.Expend.								
5	Emergen.Resp.Costs	$10,226	$4,193						
6	Disaster Relief (Agric.)	$283,614	$52,295						
7	Disaster Relief (Human R.)	$254,508	$60,359						
8	Flood Insurance (NFIP)	$2,237	$1,370						
9	Flood Insurance (FCIC)	$215,668	$31,391						
	Chg.Value of FP Resources								
10	Net Ag RE Values	–	–						
11	Net Urban RE Values	–	–						
	ENVIRONMENTAL								
	Natur.Resour.(# acres)								
12	Non–Forested Wetl. (acres)		74,805	21,000	2,230				
13	Threat.&Endang. (# / Occ.)		131/406	54/243	6/7				
14	Forest (acres)		76,095	39,000	4,530				
	Natural Fldpln.Functions								
15	Fldpln.inundated (acres)								
	Cultural								
16	Archeol Impacts (–5 to +5)		–1	–1	–2				
16A	Hist.Sites(–5 to +5)		–1						
	Open Space								
17	Public lands (acres)		77,000		2,214				
18	Recreation sites (#)		127	46	8				
	REDUCT.OF RISK								
	Critical Facilities								
19	# Facil. w/harmful releases		3						
20	# other critical facilities		13						
	Prot./Avoid. of Harm								
21	# people vulnerable	11,677	5,700						
	Social Well Being								
22	# communities vulnerable	64	16						
23	# resident.struct.vulnerable	2,246	1,371						
	IMPLEMENT. COSTS								
24	Structural Costs	–	–						
25	Other Costs	–	–						

(1) Changes in impacts relative to column B*
(2) Changes in impacts relative to column B'
(3) Changes in impacts relative to column A (economics) and column B (environmental)

EXPLANATORY NOTES

Impact Category

1. Urban Residential: USACE Lower Mississippi Valley Division tabulation for the 1993 Flood Damages report. St. Paul District estimate based on HDR, Inc. contract report. Column A includes 62 declared disaster counties within the Upper Mississippi River basin located within St. Paul District boundaries. Column B includes 13 Minnesota counties, 7 Wisconsin counties, and 2 Iowa counties only (those adjacent to the Minnesota River from Mankato downstream and the Mississippi River from St. Paul to Lock & Dam 10).

2. Other Urban: See #1 above.

3. Agriculture: See #1 above.

4. Other Rural: HDR, Inc. Report for the affected Column A and Column B counties in St. Paul District, covering estimates of damages to farm buildings, field restoration costs, and drainage ditch restoration costs.

5. Emergency Response Costs: See #1 above.

6. Disaster Relief Expenditures, Agriculture Related: Based on ASCS disaster payments by county for 1993 for Column A/B counties in St. Paul District.

7. Disaster Relief Expenditures, Human Resources Related: HDR, Inc. Report for the affected Column A/B counties in St. Paul District. They include estimates of evacuation and relocation costs; flood related mission assignment costs; unemployment costs; and crisis counseling costs.

8. NFIP indemnity payments: Based on NFIP payments by county as obtained by HDR, Inc.

9. FCIC indemnity payments: Based on Federal Crop Insurance Corporation data as obtained by the Scientific Assessment and Strategy Team (SAST), by county.

10. Net Agricultural Real Estate Value: This impact category is conceptual in nature, and is considered as an impact of the scenario measures and action alternatives examined as part of the evaluation process.

11. Net Urban Real Estate Value: This impact category is conceptual in nature, and is considered as an impact of the scenario measures and action alternatives examined as part of the evaluation process.

19. Number of Critical Facilities (dealing with toxic/hazardous materials) at Risk: Sources of information include Superfund: Progress at National Priority List Sites, EPA 905-R-94-018, May 1994; The Great Flood of 1993 Post Flood Report, Appendix A, St. Paul District, September 1994; and newspaper press reports at the time of flooding, Minneapolis Star Tribune and St. Paul Pioneer Press.

20. Number of Other Critical Facilities: See #19 above.

21. Number of People Vulnerable: Based on number of FEMA individual and family grant program applications approved STATEWIDE in Minnesota and Wisconsin as of 1/31/94, as reported in the St. Paul District post flood report. Column B is a crude approximation only, using the proportional share of number of residential structures vulnerable between Columns A and B (see #23 below).

22. Number of Communities Vulnerable: Based on number of communities that suffered flooding as identified in Appendix A (St. Paul District) of The Great Flood of 1993 Post Flood Report.

23. Number of Residential Structures Vulnerable: County by county estimates developed by HDR, Inc. contract work.

24. Implementation Costs, Structural Costs: Identified as impacts under the scenario measures and action alternatives, where applicable (not a base condition data item).

25. Implementation Costs, Other: Identified as impacts under the scenario measures and action alternatives, where applicable (not a base condition data item).

ROCK ISLAND DISTRICT BASE CONDITION

ECONOMICS

Base Condition Impacts include physical flood damages as well as emergency response and disaster relief costs. For the Rock Island District, Base Condition Impacts are comprised of two sets of data. One data set is for all counties within the District geographical limits which were designated Federal disaster counties under Federal Emergency Management Agency (FEMA) declarations during the summer of 1993. The second Base Condition data set includes information for those counties within the Rock Island District which are adjacent to the Flood Plain Management Assessment (FPMA) river reaches. Analysis of changes in flood impacts projected from Action Alternatives and Policy Scenarios will be founded on the FPMA river reach Base Condition Impacts.

Three FPMA river reaches are within the District: (1) the Mississippi River from Guttenburg, Iowa, to Saverton, Missouri; (2) the Des Moines River from Saylorville Lake, Iowa, to its confluence with the Mississippi River; and (3) the North Fork Raccoon River in Dallas, Greene, and Polk Counties, Iowa. Table R-1 lists the FPMA river reach counties by state.

Table R-1

FPMA River Reach Counties

Iowa	Iowa	Illinois	Missouri	Wisconsin
Clayton	Polk	Jo Daviess	Clark	Grant
Dubuque	Warren	Carroll	Lewis	
Jackson	Marion	Whiteside	Marion	
Clinton	Mahaska	Rock Island	Ralls	
Scott	Wapello	Mercer	Pike	
Muscatine	Davis	Henderson		
Louisa	Van Buren	Hancock		
Des Moines	Dallas	Adams		
Lee	Greene	Pike		

Flood Damages - County-wide information from several sources was used to gather flood damage estimates for various impact categories. These sources are detailed in the Economic Appendix. Flood impact information was collected for the following categories:

Residential (urban) - number of structures damaged, and damage/costs incurred by residential structures, content and cleanup;

Other (urban) - impacts to commercial, industrial, public, transportation, and utility facilities;

Agricultural - crop acreages and damages; and

Other Rural - damages to farm buildings and equipment, ditches, and land restoration costs.

Government Expenditures - Federal, State and municipal government entities incurred flood disaster-related costs. Data was gathered to include costs for **emergency preparedness** and **response**, **evacuation** and **relocation**, **mitigation** and **buyout**, **National Flood Insurance payments**, **Federal Crop Insurance payments**, **unemployment payments**, and **crisis counseling**.

ENVIRONMENTAL

Many sources have documented the impacts of the Flood of 1993 on flood plain resources. A thorough explanation of the floods' effects is described in a post-flood report completed by the Illinois State Water Survey (Bhowmik, *et al.*, 1994). The report describes the environmental impacts, economic effects, and flood statistics (i.e., flood heights, levees broken, etc.). Other sources documented flood effects on water quality (U.S. Geological Survey 1993) and some effects on the river and natural resources (National Biological Service 1994). Sources documenting flood impacts were the post-flood reports drafted by the Corps of Engineers and the "Galloway" study (Interagency Floodplain Management Review Committee 1994). The following briefly summarizes impacts described in these reports.

Natural Resources - Flood impacts on the environment from flooding are difficult to measure and many will take months and years to be realized. At this point, the possible extent of impacts can only be estimated. The natural environments of the Mississippi River and its flood plain have been sizably altered, with many conditions changed forever. Certainly, the flooding and related excessive erosion have brought both silting and erosion to flood plains and wetlands. Too much silt smothers vegetation and threatens productive farmland, and nonremoval of sandbags and other temporary dirt containment structures represents an environmental problem of considerable proportions. The ecosystem of the Mississippi River and its environs has indeed been put under great stress (Bhowmik, *et al.*, 1994).

Studies of the natural resources during and after the flood indicate a wide variety of impacts -- some are devastating while others are beneficial. Initial studies of fish generally indicated that many species utilized the flood plain for spawning and rearing habitat. Maher, *et al.* (1994) found up to 37 species utilizing flood plain habitats that were previously levied off from the river. The flood plain offered a habitat of slower-moving water, abundant escape cover, and a highly productive food base for first year fish.

In the inundated flood plain, nutrients and organic matter can be released from the newly flooded soils, stimulating microbial activity and the production of microcrustaceans and aquatic insects, just at the time they are needed as food by larval fishes (Bhowmik, *et al.*, 1994).

The 1993 flood impacts to vegetation were mixed. In many choked backwater areas, vegetation was completely removed or set back. While setting back vegetation in some of these areas opened them up and made them more accessible to wildlife use, other areas that were completely voided of vegetation were historic waterfowl migration feeding sites. Ducks and geese had to seek alternative, usually less productive, areas to fuel their migration.

Tree mortality was observed after the flood. One study on the Mississippi River (Yin, *et al.*, 1994) found that mortality rates increased progressively down river, from 1.1% to 37.2% for trees and from 1.8% to 80.1% for saplings. The impacts of the 1993 flood, the effects of which may last for decades to come, demonstrate that extreme flooding in a single growing season is enough to constitute a severe disturbance to the river-flood plain ecosystem.

It is still too early to determine what the long-term effects of the flood will be on many forms of vegetation and wildlife. Hanging in the balance are animals like native mussels, which were in a decline before the flood. Although species utilizing rivers and flood plains have adapted to seasonal floods, impacts to delicate species may be exacerbated by a major flood, even though direct and indirect impacts by man are generally recognized as having a greater influence.

Cultural Resources - Cultural resource base conditions derived from the 1993 flood impacts for the three reaches discussed below are judged to be -2 for both historic structures and archaeological sites. This is based on an arbitrary scale of -5 to +5.

Mississippi River Flood Plain: Muscatine, Iowa, to Saverton, Missouri (River Reach Code MI4) - This discussion is limited to the 156-mile reach of flood plain between Muscatine, Iowa (river mile 457), and Saverton, Missouri (river mile 301). Here the flood plain cuts across portions of 14 counties -- 6 in Illinois and 4 each in Iowa and Missouri.

500-Year Flood Plain Delineation

The 500-year flood plain, as mapped on Plate R-1, covers approximately 458,900 acres between Muscatine and Saverton. Boundaries are from the digital Flood Insurance Rate Map acquired by the Rock Island District from the Federal Emergency Management Agency in March 1994. The delineation is slightly flawed, as revealed by occasional discontinuities at political boundaries and elsewhere. Other flaws in flood plain delineation or in Iowa and Illinois cultural resource data were revealed by non-flood plain landform attributes on 7 of 235 sites in Illinois and on 25 of 209 sites in Iowa (Table R-2). Missouri site information contained no landform attributes.

Known Cultural Sites in the 500-Year Flood Plain

The number of recorded cultural resource sites (n = 551) in this reach of

flood plain is broken down by state and county on Table R-2. This is the total count of cultural sites recorded within the 500-year flood plain as mapped on Plate R-1.

Iowa and Missouri site coverage was limited to certain USGS maps as noted on the table, thus omitting some portions of the extreme western part of the 500-year flood plain.

Portions of the 500-year flood plain not covered by this count included the 39,900 acres in Column B on Table R-5 -- roughly 9% of the total flood plain in this reach.

The count of 551 known cultural resource sites represents randomly recorded sites as well as sites recorded within documented Phase I survey boundaries. The documented surveys cover 37,900 acres (Table R-5, Column D) -- well under 10% of the total flood plain acreage. Whether or not this count included all National Register structures and districts listed on Table R-3 was not determined. Also undetermined are how many of the sites occurred inside or outside of the documented survey boundaries. Clearly, any use of these figures to derive site density estimates is inappropriate. See the section entitled Cultural Resource Site Densities, below, for more discussion of this point.

Table R-2

Flood Plain Management Assessment (FPMA) Project:
Cultural Resource Sites along the Mississippi River between Muscatine, Iowa, and Saverton, Missouri –
Count of Sites by State and County
within the 500-Year Flood Plain

	Number of Cultural Sites by State and County			County Totals
County Name	IL	IA*	MO*	
ADAMS	56			56
HANCOCK	15			15
HENRY	25			25
MERCER	47			47
PIKE	84			84
ROCK ISLAND	8			8
DES MOINES		95		95
LEE		26		26
LOUISA		72		72
MUSCATINE		16		16
CLARK			78	78
LEWIS			21	21
MARION			6	6
RALLS			2	2
State Totals	235	209	107	
Sites on Non-Flood Plain Landforms	7	25	?	
			Grand Total	551

Iowa site information current as of October 1991
Illinois site information current as of November 1, 1993
Missouri site information current as of mid-1991

500-year flood plain from digital Flood Insurance Rate Map (acquired from the Federal Emergency Management Agency in March 1994).

* Iowa and Missouri site coverage falls short of the entire 500-year flood plain because information is limited to USGS maps listed below.

Iowa data limited to the following USGS 7.5-minute quadrangles: Muscatine, Blanchard Island, Toolesboro, Joy, Keithsburg, Kingston, Oquawka, Burlington, Fort Madison, Dallas City, Lomax, Nauvoo, Niota, Keokuk, and Hamilton.

Missouri data limited to the following USGS 7.5-minute quadrangles: Croton, Argyle, Kahoka, Wayland, Keokuk, Kahoka SE, Warsaw, Canton, La Grange, Long Island, Quincy West, Quincy SW, Marblehead, Hannibal West, Hannibal East, and Hull.

National Register Structures and Districts

Historic structures and/or districts (n = 32) listed on the National Register of Historic Places within the 500-year flood plain are identified individually on Table R-3. This information was acquired from the National Park Service and is current as of February 4, 1994.

Navigation Zone Cultural Site Count

An arbitrarily defined Navigation Zone was used in preparation of the Mississippi River Historic Properties Management Plan (HPMP). The Navigation Zone was defined as:

> the areas within the Mississippi River main channel, island, and backwater corridor and extending landward one-quarter mile past the railroad grade or principal meander belt levee as shown on the United States Geological Survey 7.5-minute quadrangle maps, regardless of ownership. The navigation zone also includes publicly owned backwater sloughs in levied districts where water levels are controlled. The navigation zone does not include the crest of the bluff even if it lies within the one-quarter mile corridor (Benn, *et al.*, 1994a:37-38).

The Navigation Zone was delineated because the Corps recognized this restricted area as having the most potential for cultural resource site disturbance resulting from commercial and recreational use of the river. This zone also contained the majority of flood plain lands under direct Federal ownership, as well as lands generally most affected by Department of the Army permits issued under the Rivers and Harbors Act and the Clean Water Act.

A total of 196 cultural resource sites was documented within the 156-mile portion of the Navigation Zone between Muscatine and Saverton (Table R-4). Thirty-six of these sites have historic Euro-American components, but the presence of standing structures was not determined. Information on sites within the Navigation Zone was extracted from the draft report by Benn, *et al.* (1994a:Appendix B, HPMP/UMR-IWWS Database File, COE-HPMP.DBF, dated 8/1/94). What proportion of the Navigation Zone has been surveyed for cultural resources was not determined.

Table R-3

Flood Plain Management Assessment (FPMA) Project:
Cultural Resource Sites along the Mississippi River between
Muscatine, Iowa, and Saverton, Missouri --
National Register of Historic Places Listings
within the 500-Year Flood Plain

	Site or District	City	County	State
1	Trinity Episcopal Church	Muscatine	Muscatine	IA
2	First Presbyterian Church	Muscatine	Muscatine	IA
3	McKibben, S. M., House	Muscatine	Muscatine	IA
4	Welch Apartments	Muscatine	Muscatine	IA
5	Bowman Livery Stable	Muscatine	Muscatine	IA
6	Clark, Alexander, House	Muscatine	Muscatine	IA
7	Warde, J. C. B., House	Muscatine	Muscatine	IA
8	Florence-Council On The Iowa Site	Oakville	Louisa	IA
9	Burlington, Cedar Rapids & Northern Freight House	Burlington	Des Moines	IA
10	West Jefferson Street Historic District	Burlington	Des Moines	IA
11	Atchison, Topeka and Santa Fe Passenger and Freight Complex Historic District	Fort Madison	Lee	IA
12	Saint Barnabas Episcopal Church	Montrose	Lee	IA
13	Geo. M. Verity	Keokuk	Lee	IA
1	Commerical House	Keithsburg	Mercer	IL
2	Keithsburg Historic District	Keithsburg	Mercer	IL
3	Nauvoo Historic District	Nauvoo	Hancock	IL
4	Felt, Cyrus, House	Hamilton	Hancock	IL
5	Warsaw Historic District	Warsaw	Hancock	IL
1	Twain, Mark, Boyhood Home	Hannibal	Marion	MO
2	North Main Street Historic District	Hannibal	Marion	MO
3	Mark Twain Historic District	Hannibal	Marion	MO
4	Broadway District	Hannibal	Marion	MO
5	Hafner Grocery Warehouse	Hannibal	Marion	MO
6	Davidson Building	Hannibal	Marion	MO
7	Holmes-Dakin Building	Hannibal	Marion	MO
8	Mark Twain Hotel	Hannibal	Marion	MO
9	Green Double House	Hannibal	Marion	MO
10	Elliott's, Robert, Wholesale Grocery	Hannibal	Marion	MO
11	Buildings at 207--209 South Main St.	Hannibal	Marion	MO
12	Digel Block	Hannibal	Marion	MO
13	Ebert-Dulany House	Hannibal	Marion	MO
14	Hannibal Lime Company Office	Hannibal	Marion	MO

National Register data from National Park Service, current as of February 4, 1994.

500-year flood plain from digital Flood Insurance Rate Map (acquired from the Federal Emergency Management Agency in March 1994).

Table R-4

Flood Plain Management Assessment (FPMA) Project:
Cultural Resource Sites along the Mississippi River between
Muscatine, Iowa, and Saverton, Missouri --
Count of Navigation Zone Sites by State and County

	Number of Cultural Sites in the Navigation Zone by State and County			County Totals
County Name	IL	IA	MO	
ADAMS	13			13
HANCOCK	11			11
HENRY	26			26
MERCER	9			9
PIKE	32			32
ROCK ISLAND	7			7
DES MOINES		14		14
LEE		23		23
LOUISA		46		46
MUSCATINE		1		1
CLARK			0	0
LEWIS			2	2
MARION			11	11
RALLS			1	1
State Totals	98	84	14	
			Grand Total	196

Information from draft file COE-HPMP.DBF dated 8/1/94 prepared by
Bear Creek Archeology, Inc., Cresco, Iowa (DACW25-92-D-0008, W.O. No. 5)

Site information current for Illinois as of November 1, 1993
Site information current for Iowa as of September 30, 1993
Site information current for Missouri as of March 1, 1994

Phase I Cultural Resource Survey

Table R-5 shows Phase I cultural resource surface survey covering 37,900 acres, or 9%, of the 419,000 acres in the 500-year flood plain between Muscatine and Saverton for which cultural resource data were available. Column E shows the percentage of survey completed by state. Iowa with 17% coverage ranks far above Illinois (5%) and Missouri (9%).

Table R-5

Flood Plain Management Assessment (FPMA) Project: Mississippi River 500-Year Flood Plain between Muscatine, Iowa, and Saverton, Missouri -- Phase I Cultural Resource Surface Survey Coverage*

	500-Year Flood Plain (acres)				
	A	B	C**	D	E
State	500-Yr. Flood Plain	Cultural Resource Data Unavailable	Cultural Resource Data Available	Acreage of C with Phase I Cultural Resource Surface Survey Completed	Percent of Phase I Surface Survey Completed, (D/C)x100
Illinois	223,400	0	223,400	11,700	5
Iowa	129,500	25,050	104,450	17,900	17
Missouri	106,000	14,850	91,150	8,300	9
Totals	458,900	39,900	419,000	37,900	9

* Information current as of 1991 or later.

** Iowa data are limited to the following USGS 7.5-minute quadrangles: Muscatine, Blanchard Island, Toolesboro, Joy, Keithsburg, Kingston, Oquawka, Burlington, Fort Madison, Dallas City, Lomax, Nauvoo, Niota, Keokuk, and Hamilton.

Missouri data are limited to the following USGS 7.5-minute quadrangles: Croton, Argyle, Kahoka, Wayland, Keokuk, Kahoka SE, Warsaw, Canton, La Grange, Long Island, Quincy West, Quincy SW, Marblehead, Hannibal West, Hannibal East, and Hull.

Phase I surveys represented in Table R-5 were conducted over several decades during which professional standards for field work and reporting did not remain static. Earlier surveys often took place under ground visibility

conditions or with transect intervals no longer considered acceptable. Some early surveys with extensive acreage showing negative results must be considered suspect until verified by using current survey standards in selected sample areas or until satisfactorily explained by geomorphological or other variables.

Cultural Resource Site Densities

The site counts at Table R-2 and the surveyed acreage at Table R-5 cannot be used to calculate site densities because it is unknown how many sites were recorded within defined Phase I survey boundaries and how many were recorded randomly across the flood plain.

In addition, the limitations of many Phase I surveys, as noted above, restrict the usefulness of any resulting site density figures. This alone should prevent utilizing various raw densities for projecting total site numbers within the flood plain. Even more importantly, site densities within the flood plain vary enormously depending on landform. Without some minimal control for the quality of survey data and for basic geomorphological variables, reliable projection of total numbers of surface-exposed sites in the flood plain is not possible.

Geomorphological mapping is currently under way in Mississippi River Pools 11 through 22 within the Rock Island District of the U.S. Army Corps Engineers. This work, while documenting the potential for many landforms to contain archaeological remains, is also documenting limits to the archaeological record, limits imposed by alluvial processes reworking and removing vast areas of flood plain deposits down through the millennia of human occupation along the river.

The potential for reasonable estimates of site density on selected landforms will continue to increase (at least for surface-exposed sites) as more detailed information on the geomorphology of the valley becomes available and as more carefully controlled surveys are completed.

Knowledge of the extent of buried archaeological sites remains extremely limited. Virtually no sampling has been conducted to determine the extent of buried sites within the rivers' vast alluvial deposits. These deposits are known to contain buried sites of great age and at depths reaching to several meters below the present surface. Even many protohistoric and early historic sites are buried, lying under thick blankets of 19th and 20th century alluvium.

Archaeological sites remain poorly represented in the scientific record, while their destruction continues at a fast pace. These nonrenewable records of past human life along the river must surely have originally numbered well into the thousands just along this reach of river. Today, many classes of sites, burial mounds for instance, remain in only small fractions of their earlier numbers. Other types of sites have suffered similar fates, all resulting in a greatly diminished capacity for gaining an accurate picture of

the past.

Des Moines River Flood Plain: Boone, Iowa, to Red Rock Dam (River Reach Code MIT11) - Much of this reach, except for areas within and immediately adjacent to the city of Des Moines, includes Corps of Engineers fee title and easement lands associated with lakes Saylorville and Red Rock.

Benn (1986:3) identified 521 cultural resource sites on the Corps Saylorville Lake fee title and easement lands, running from near Fraser, Iowa, through the Saylorville Downstream Corridor, and ending at Crocker Woods Park in Des Moines. Presently, 32 of these sites are considered eligible for listing on the National Register of Historic Places while 164 still require evaluation to establish National Register status (U.S. Army Corps of Engineers 1990, as revised). All others have been determined not eligible for the National Register. An Historic Properties Management Plan (HPMP) is in place for Saylorville Lake (U.S. Army Corps of Engineers 1993).

Information current as of October 1994 for Lake Red Rock listed 466 cultural resource sites on the Corps fee title and easement lands, running from just above Case Lake in southeast Des Moines to the Red Rock Dam. No sites were identified as eligible for inclusion in the National Register of Historic Places; 218 sites were listed as not eligible; 194 were listed as still in need of testing to establish National Register status; and 54 were listed with no indication of National Register status. An HPMP is in preparation for Lake Red Rock.

None of the sites at Saylorville Lake or Lake Red Rock include standing structures eligible for the National Register. However, National Register structures and/or districts have been tabulated for areas within the 500-year flood plain (Plate R-2) of the Des Moines River in Polk County. The five structures and/or districts identified on Table R-6 occur within 42,700 acres in the 500-year flood plain of the Des Moines River in Polk County; the flood plain is not defined in the areas above and below Polk County.

Table R-6

Flood Plain Management Assessment (FPMA) Project:
Cultural Resource Sites along the Des River between
Boone, Iowa, and Red Rock Dam --
National Register of Historic Places Listings
within the 500-Year Flood Plain of the Des Moines River
within Polk County, Iowa

	Site or District	City	County	State
1	Municipal Building	Des Moines	Polk	IA
2	Northwestern Hotel	Des Moines	Polk	IA
3	Fish and Game Pavilion and Aquarium	Des Moines	Polk	IA
4	Southeast Water Trough	Des Moines	Polk	IA
5	Civic Center Historic District	Des Moines	Polk	IA

National Register data from National Park Service, current as of February 4, 1994.

500-year flood plain from digital Flood Insurance Rate Map (acquired from the Federal Emergency Management Agency in March 1994).

Raccoon River Flood Plain: Dallas and Polk Counties, Iowa (River Reach Code MIT14) - Only one National Register listing (Table R-7) was found within the 500-year flood plain for this reach (Plate R-2). The listing is limited to the 6,900 acres of flood plain in Polk County because the flood plain is not defined in Dallas County.

Table R-7

Flood Plain Management Assessment (FPMA) Project:
Cultural Resource Sites along the Des River between
Boone, Iowa, and Red Rock Dam --
National Register of Historic Places Listings
within the 500-Year Flood Plain of the Raccoon River
within Polk County, Iowa

	Site or District	City	County	State
1	Valley Junction - West Des Moines City Hall and Engine House	West Des Moines	Polk	IA

National Register data from National Park Service, current as of February 4, 1994.

500-year flood plain from digital Flood Insurance Rate Map (acquired from the Federal Emergency Management Agency in March 1994).

Cultural Resource Site Management in Flood Plains - Regardless of the future course of flood plain management, destruction of the nonrenewable record of the nations' cultural heritage will continue. Only the types of impacts and the rates at which they will affect the resource will vary.

Private, commercial, and governmental actions all have potential to impact upon the fragile and nonrenewable record of the past. Currently, cultural resources are seldom taken into account for private, commercial, and local governmental activities unless Federal or State permitting or granting authorities are involved.

States provide some protection for cultural resources, although limited in many cases primarily to human remains.

Federal law provides the widest protection for cultural resources. This protection extends to all federally owned lands and to activities permitted, funded, or otherwise involving Federal undertakings.

The depletion of the archaeological record that began with the arrival of Euro-Americans in the Upper Mississippi Valley, and which continues into the present, is not likely to slow as increasing demands are placed on land resources from a growing population. With no prospect for the protection of most sites on private lands, Federal lands are becoming inadvertent archaeological reserves. As a result, the archaeological importance of Federal lands will increase through time.

Unique archaeological resources under Federal ownership in the Rock Island District include a significant number of as yet undiscovered sites buried within flood plains. Some indication of this potential is revealed by the presence of buried shell middens in Mississippi River Pool 16 (Barnhardt, *et al.*, 1992; Overstreet 1982, 1986) and by buried sites at Lake Odessa in Pools 17 and 18 (Benn, *et al.*, 1987, 1988). Other types of important sites in the Rock Island District range from an endangered prehistoric mound and village site (Benn, *et al.*, 1994b) through a buried protohistoric site (Boszhardt and Overstreet 1982; Overstreet 1983; Van Dyke and Birmingham 1984) to buried historic period sites such as Burris City (Benn, *et al.*, 1988:336).

All Corps lands in the Rock Island District have Historic Properties Management Plans (HPMPs) completed or in preparation. These plans are important tools that will help determine the allocation of vital, but scarce, financial and human resources in the preservation and/or recovery of the fragile record of the past.

Open Space - The 1993 flood reduced the human use of land- and water-based activity during and after the event. Most recreation sites along the river were either completely inundated, or access points were closed due to high water. Once floodwaters receded, access was still limited due to cleanup of access roads, boat ramps, camping facilities, and day use areas.

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REDUCTION OF RISK

Critical Facilities - The Water Resources Council (WRC) Floodplain Management Guidelines draft established the concept of a critical action. The Council's report expressed concern that the impacts of floods on the safety of human health, physical safety, and welfare for public activities created a need for a greater amount of protection than provided by the 100-year base flood protection. Thus, a greater level of protection and minimum basic standard used to evaluate critical actions were established with the 500-year level or .2% chance flood.

Along with the need for critical action evolves the need to determine the definition of a critical facility and its importance to the public. A suggested list of critical facilities has been determined by agency comments and coordination. Data compiled by the FEMA (Federal Emergency Management Agency), and the SAST (Scientific Assessment Strategy Team) data from nine different states has been compiled and used in a comprehensive manner to identify critical facilities in the 500-year flood plain, using the latest in Global Positioning System (GPS) and Geographic Information System Technology (GIS).

This proposal created a need to determine what constitutes a critical facility. "Critical" is defined as "*being in or approaching a state of crisis especially through economic disorders or by virtue of a disaster; characterized by risk or uncertainty.*" A "facility" is "*something that is built, installed, or established to serve a particular purpose.*" Therefore, a critical facility is a structure which is already built and located in the flood plain which cannot be moved due to the service which it provides and which would cause a crisis or disaster to the lives and health of the community in which it is located if affected by a 500-year level flood.[1]

The critical facilities determined to be hazardous to life and health can be identified by four major categories: Hazardous Materials Production, Storage, and Waste Facilities; Essential Utilities; Essential Services; and Emergency Services. The first category, **Hazardous Materials Production, Storage, and Waste Facilities**, is defined as a plant which produces or stores toxic, volatile, or water-reactive materials for a period greater than 90 days and in sufficient amounts established by the Environmental Protection Agency (EPA) Guidelines. Hazardous Material Production, Storage, and Waste Facilities includes the collection, source separation, storage, transportation, processing, and treatment of hazardous wastes as listed by the Resource Conservation and Recovery Act of 1976, municipal and industrial National Pollution Discharge Elimination Systems (NPDES) sites which have been specifically designated by permit to discharge pollutants into waters of the United States, superfund sites established by the Comprehensive Environmental

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[1] Federal Emergency Management Agency, Interagency Task Force on Floodplain Management, Executive Order 11988 Floodplain Management, 1986.

Response, Compensation and Liability Act (CERCLA) for the treatment of inactive hazardous waste sites, landfills, hazardous waste facilities, petrochemicals, and major pipelines of petroleum and natural gas.[2]

The second category, **Essential Utilities**, provides major service and aid to the essential welfare of a community. Essential Utilities are those which provide the unavoidable necessities of daily life. These facilities for essential utilities include water treatment plants, major water supply intake systems for large communities, water well fields, sewage treatment plants, power plants, major power utility substations/switching facilities, major power lines, municipal wells and substations, communication equipment and related antennas used in essential utilities such as television, radio, and telephone services who are members of the National Emergency Broadcast System. Water supply intake systems for some small communities would be more cost efficient if the well or pipes were capped and drinking water was provided temporarily. These smaller communities would not be designated as "essential utilities" because of their size (and the option of bringing in drinking water for smaller communities). The Safe Drinking Water Act applies the standard rules to the initial building and rebuilding of water intake systems, regardless of the size of the community. Systems that would be inundated and suffer total water loss should be designated as Level I; these communities would have no water available to them at all. Level II is those communities which would have no potable water, but water sufficient for sanitary uses.

Essential Services, a third category, includes services which provide health care, transportation, and safety to society. These services include hospitals, schools, group homes for the mobility impaired, major passenger airports, Federal post offices, bridges, and prisons. Elderly housing is considered a critical facility when fast and unexpected rising of floodwaters would prevent safe evacuation and placement of the elderly, who are relatively mobile.[3]

Airports are considered critical if they accommodate more than 1,000 passengers per day and are located in a flood plain. Essential bridges and highways which are critical include any State or Federal highway bridge across a major river (defined as having a drainage area of 4,000 square miles or more), interstate highway system, and Class I railroad bridges.

Emergency Services provide protection or assistance in the event of an emergency. Emergency Services category includes fire departments, police stations, military bases, and computer centers which serve the previous emergency services.

Historical and cultural sites are not included in the definition of a critical facility but deserve special attention. Protection of those

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[2] Bureau of National Affairs, Environment Reporter, Federal Law Statutes 71:0201-71:4001.

[3] Federal Emergency Management Agency, Interagency Task Force on Floodplain Management, Further Advice on Executive Order 11988 Floodplain Management, 1987.

structures and areas listed on the National Register of Historic Places is important in preserving the history of the country and the education of society (36 CFR 800).

Historic places listed on the National Register of Historic Places are also available on GIS for the identification of historic landmarks in a flood plain (Source: National Park Service)

Table R-8 lists types of critical facilities by priority category. For FPMA Base Condition purposes, Rock Island District GIS data bases were used to identify, categorize, and segregate critical facilities within the FPMA flood plain reaches. Changes in flood impacts to these facilities, under Action Alternative and Scenario assumptions, are indicated in the summary impact matrices.

Table R-8

Critical Facilities List

1. Hazardous Materials Production, Storage, and Waste Facilities

- Petrochemicals and Major Pipelines *(change from draft report)*
- Superfund Sites
- Landfills
- Hazardous Waste Facilities

2. Essential Utilities

- Municipal and Industrial NPDES *(change from draft report)*
- Water Treatment Plants
- Major Water Supply Intakes
- Water Well Fields
- Sewage Treatment Plants
- Power Plants
- Major Power Utility Substations
- Communication Equipment and Related Antennas (television, radio, telephone services) - members of the Emergency Broadcast System

3. Essential Services

- Hospitals
- Group Homes for the Mobility Impaired
- Schools
- Major Airports
- Federal Post Offices
- State or Federal Bridges
- Prisons

4. *Emergency Services*
   - Fire Departments
   - Police Stations
   - Military Bases
   - Major Computer Centers (Federal Government computing stations)

Protection of or Avoidance of Harm to People - For practical purposes, the number of people directly or indirectly impacted by the Flood of 1993 is indeterminable. Obviously, those people were very directly affected who resided in flood plain neighborhoods that were inundated. Those owning businesses or working in flood plain locations also were very directly affected. However, there where numerous situations in which thousands of people were affected by the flood, even though they were not occupants of the flood plain. Transportation routes were cut off, essential public services were lost or hampered to varying degrees, water supplies and other utilities were impaired, and production and employment capacities were severely impacted.

For the FPMA Base Condition Impacts, the number of people vulnerable (to the 1993 flood) is based on an estimate of occupants of flood-damaged residential structures. It is understood that the number of impacted people, direct and indirect, includes many multiples of the number of residential occupants.

Social Well Being - The Base Condition number of Communities and Residential Structures vulnerable during the 1993 flood reflects estimates of those instances of direct floodwater inundation. This delimitation, as with the number of people affected, does not account for a much broader group of community/social impacts. Many communities had levee systems which performed well or where floodfighting reduced potential damages. These communities and residences were still vulnerable, and great effort was extended for emergency preparedness and floodfighting, not to mention anxiety due to the flood threat. Social service resources were often strained to the limit. Government resources at all levels were severely tested. Comprehensive analysis of flood impacts on community and social well being is not addressed in this assessment.

Significant and Unique Resources

Significant and unique resources of the Rock Island District include threatened and endangered species, unique habitats, and public use areas. An inventory of these species, habitats, and sites can be found in the Environmental Resource Inventory, compiled by Burns and McDonnell (1995). This report can be found in Appendix C. What follows is a short overview of what is found in the Burns and McDonnell report and other selected references.

Threatened and Endangered Species. There are many species either, state or federally listed as threatened or endangered, and rare. Throughout the Rock Island District there are 23 plants, 17 fish, 3 mammals, 7 birds, 10 reptiles and amphibians, and 14 other species such as mussels, snails, and insects. The following table identifies for the Rock Island District all floodplain species.

Species	Type	Federal Status	Iowa Status	Illinois Status	Wisconsin Status	Missouri Status
Giant Yellow Hyssop	plant				T	
Prairie Indian Plantain	plant				T	
Wild Quinine	plant				T	
Round-Fruited St. John's Wort	plant				T	
Hairy Gramma	plant				R	
Curved-pod Corydalis	plant		E	T		
Slender Dayflower	plant		T			
Meadow Horsetail	plant			E		E
Dwarf Dandelion	plant		E			
Green Arrow Arum	plant		E			R
Spotted Joe-Pie Weed	plant					E
Patterson Bindweed Pickering Morning Glory	plant		E	E		E
Flaxleaf Aster	plant		T			
Marsh Skullcap	plant					E

E = Endangered T = Threatened R = Rare

Species	Type	Federal Status	Iowa Status	Illinois Status	Wisconsin Status	Missouri Status
Showy Lady's Slipper	plant		T	E		
Willow Herb	plant					E
Crested fern	plant					E
Plains Violet	plant			E		
Dotted Monarda	plant					E
Curved-Pod Corydalis	plant		E			
Brittle Prickly Pear	plant		E			
Prairie Fringed Orchid	plant	T				
Decurrent False Aster	plant	T		E		
Higgins Eye Pearly Mussel	mussel	E	E	E	E	E
Western Sand Darter	fish		T	E		
Lake Sturgeon	fish		E	E		E
Spectacle Case	mussel		E	E	E	
Butterfly	mussel		T	T	E	
Sheepnose/Bullhead	mussel		E	E	E	R
Pallid Shiner	fish			E	E	

ST. LOUIS DISTRICT BASE CONDITIONS

The 1993 Flood was not just an event in the St. Louis District, it was an experience. The Mississippi River went above flood stage (30 feet on the St. Louis gage) at St. Louis in March and continued to bounce around flood stage through June. On June 26 the river went above flood stage and remained there until September 14 reaching a peak of 49.58 feet above flood stage at St. Louis on August 1. The river briefly dipped below flood stage on September 14 but rose again the same day and remained above flood stage until October 7.

Compounding the agony of the flood was the location at the bottom of the funnel. Daily reports of record rainfall and flows in the upper Mississippi and Missouri River basins added to the tension. As news reports of the damage and suffering moved down river along with the flood, the flood fighting efforts of the people were spurred onward. Names like Grafton, Alton, Hardin, Kampsville, and Valmeyer in Illinois and River Des Peres, Kimmswick, Festus, and Ste. Genevieve in Missouri were shown nightly on the national news networks. Some of the cities and towns beat the flood, others lost. Time and the flood took its toll and one by one levees began to give way to the water - most long after they had exceeded their design flood limits. The tables below display the series of events effecting the federal levees in the St. Louis District.

Federal Levees Overtopped/Breached on the Mississippi River

PROJECT NAME	DATE	ACRES PROTECTED	LEVEL OF PROTECTION
Kaskaskia Island	22 Jul 93	9,460	50
Bois Brule	25 Jul 93	26,000	50
Columbia	1 Aug 93	14,000	50
Harrisonville	1 Aug 93	27,800	50
Ft. Chartres (controlled breach)	3 Aug 93	15,900	50

Federal Levees Overtopped/Breached on the Illinois River

PROJECT NAME	DATE	ACRES PROTECTED	LEVEL OF PROTECTION (YEARS)
Nutwood	18 Jul 93	11,300	20
Eldred	30 Jul 93	10,500	20
Spankey	31 Jul 93	800	20
Hillview	1 Aug 93	12,900	20
Hartwell	1 Aug 93	8,900	20

One of the most telling pieces of information of the base condition is the order of magnitude of the urban flood damages. The structural damage

alone for residential, commercial, industrial and other urban related infrastructure amounted to approximately $980 million - 59% of the total economic damages. Considering a proportional amount of the Emergency Response and Human Resources Disaster Relief costs, the total allocated to urban development would approach 70 percent. These damages occurred in cities, towns, and rural enclaves. Estimates within the St. Louis District show approximately 60% of the potential urban damages are either unprotected or behind levees providing less than urban design protection.

In the framework of the Floodplain Management Assessment, these data bear relevance not only as a historical footnote, but also as an evaluation tool. What, if any, policies and/or programs could reduce these damages in the future? Within the Illinois and Missouri portions of the St Louis District, the Federal Emergency Management Agency in cooperation with the states and local jurisdictions are anticipating the removal of 2,999 and 1,194 structures in Missouri and Illinois respectively (as of 1 Feb. 95). These buyouts, that are being made through the 404 Hazard Mitigation Grant Program, are a first step in reducing the number of structures and people at risk from a recurrence of the 1993 Flood.

In reviewing this assessment the base condition is the backdrop upon which the seven policy and program issues and the action alternatives are to be compared. The mixture of policies and programs and structural intervention provide a framework of avoidance and flood risk management, internalization of flood damages, and where necessary, flood protection to mitigate potentially catastrophic damage. It is important to remember that federal flood protection works prevented almost $3 billion in flood damage within the St. Louis District.

In tracking the effects of various policies and programs or alternatives, some will show absolute increases or decreases from the base condition. Others will depict shifts from one category to another reflecting greater or lesser degrees of internalizing the costs of flood damage. Finally, measures and actions must be evaluated in the context of the estimated implementation costs displayed in the matrix tables.

CELMS SUMMARY OF ALTERNATIVES

		A	B	K	L	M	N	O	P	Q	R	S	T	U	V	W
				ACTION ALTERNATIVES AFFECTING HYDRAULIC CONDITIONS												
		Base Con	Base Cond.		AGRICULTURAL LEVEES				URBAN	CRITICAL FACILITIES		UPLAND RETENTION/WATERSHED MEASURES				
	IMPACT	All Disast	(Floodpln.	Limited	Remove	MR&T	Uniform Ht.	Raise	LEVEES	(500-Yr.)	(500-Yr.)	Without	Added	Revised	Runoff Red.	Runoff Red.
	CATEGORIES	Counties)	Impacts)	Fld.Fighting	W\Crop	MRC	(25-YR.)		(500-Yr.)	(Priority)	(All)	Reservoirs	Reservoirs	Operation	(Decr. 5%)	(Decr. 10%)
	ECONOMIC ($'s)		[1]													
	Fld.Dam.Reduct.															
1	Resid.(Urban) (millions)	NA	431.4													
2	Other (Urban) (millions)	NA	549.3													
3	Agricultural (millions)	NA	168.6													
4	Other Rural (millions)	NA	57.2													
	Chg. in Govt.Expend.															
5	Emerg.Resp.Costs(millions)	NA	101.8													
6	Disast.Rel.(Agric.) (millions)	NA	36.4													
7	Disast.Rel.(Human R.)(mill)	NA	134.3													
8	Fld.Ins. (NFIP) (millions)	NA	133.7													
9	Fld.Ins. (FCIC) (millions)	NA	44.9													
	Chg.In Value of FP Res.															
10	Net Ag Product.	NA	NA													
11	Net Urban RE Values	NA	NA													
	ENVIRONMENTAL															
	Natur. Resour. (# acres)															
12	Non-Forested Wetlands	NA	154,990													
13	T & E Species	NA	35/96													
14	Forest	NA	251,110													
	Natural Fldpln.Functions															
15	% of fldpln.inundated	NA	80													
15A	Cultural Archaeological	NA	-4													
16	# sites Impacted Historical	NA	-3													
17	# acres public lands	NA	96,785													
18	# of recreation sites	NA	60													
	REDUCT.OF RISK															
	Critical Facilities															
19	# Facil. w/harmf.releas.	NA	18													
20	# other crit. facil.	NA	231													
	Prot./Avoid. of Harm															
21	# people vulnerable	NA	62,180													
	Social Well Being															
22	# commun.vulnerable	NA	50													
23	# resid.str.vulnerable	NA	23,460													
	IMPLEMENT. COSTS															
24	Structural Costs (millions)	NA	NA													
25	Other Costs (millions)	NA	NA													

FPMA - Project History Tables

The accompanying tables detail the evolution of the flood control infrastructure in the upper Mississippi River basin. The first table focuses on the main stem, providing the project name, type, date authorized and date completed. The second table provides this information for the mainstem and tributaries. The tables show the transition from agricultural levee work to urban levee work. They also show that most urban projects on the main stem and tributaries were not completed until after 1960. Much of the historical overview for the period after 1940 presented in Chapter 2 relied on these tables.

Upper and Middle Mississippi River
Mainstem
Flood Control Projects
Project Type, Authorization Date and Completion Date
1884-1995

PROJECT NAME	NATURE	AUTHORIZED	COMPLETED
Warsaw to Quincy (Hunt, Lima Lake & Indian Grave)	Ag.	1895	1896
Flint Creek to Iowa River	Ag.	1895	1900
Sny Island Levee and Drainage District	Ag.	1884,86,88,90,92,96	By 1900
Drury Drainage District	Ag.	1917	1920
Bay Island Drainage & Levee District No.1	Ag.	1917	1922
Hunt Drainage District	Ag.	1917	1922
Lima Lake Drainage District	Ag.	1917	1922
Henderson County Drainage District No. 3	Ag.	1917	1925
Henderson County Drainage District No. 1	Ag.	1928	1929
Lima Lake DD	Ag.	1928	1930
Henderson County Drainage District No. 2	Ag.	1928	About 1930
Indian Grave Drainage District	Ag.	1928	1932
Bay Island D&LD No. 1	Ag.	1928	1933
Marion County Drainage District	Ag.	1928	1933
South Quincy Drainage & Levee District	Ag.	1936	1939
Fabius River Drainage District	Ag.	1936	1941
Kaskaskia Island Drainage & Levee District	Ag.	1938	1943
Henderson Co. DD No. 3	Ag.	1936	1948
Galena, Galena River	Urban	1944	1951
East Cape Girardeau & Clear Creek Drainage District	Ag.	1936	1953
Chouteau, Nameoki & Venice D&L District	Ag.	1936	1955
Miller Pond Drainage District	Ag.	1938	1955
Aitkin, Minn.	Urban	1948	1957
Sabula, Iowa	Urban	1954	1957
Harrisonville & Ivy Landing Drainage & Levee District No. 2	Ag.	1936	1957
Stringtown - Fort Chartres & Ivy Landing	Ag.	1938	1957
North Alexander Drainage & Levee District	Ag.	1936	1957
Fort Chartres & Ivy Landing	Ag.	1936	1958
Preston Drainage & Levee District	Ag.	1936	1959
Degognia & Fountain Bluff Drainage &Levee District	Ag.	1936	1959
Prairie du Rocher & Vicinity	Ag.	1946	1959
Upper Iowa River	Ag.	1954	1959
Grand Tower D&L District	Ag.	1938	1959
Columbia Drainage & Levee District	Ag.	1936	1959
Muscatine, Mad Creek	Urban	1954	1960
Clear Creek D&L District	Ag.	1936	1962
Prairie du Pont Levee & Sanitary District	Ag.	1936	1962
Hannibal, Bear Creek	Urban	1954	1962
Drury DD	Ag.	1954	1963
Fabius River DD	Ag.	1954	1963
Canton, Missouri	Urban	1950	1964
Cape Girardeau, Missouri	Urban	1950	1964
Des Moines & Mississippi Levee Dist #1	Ag.	1954	1966
South River Drainage District	Ag.	1954	1966
Bay Island D&LD No. 1	Ag.	1954	1966
Green Bay Levee & Drainage District	Ag.	1954	1966
Subdistrict No. 1, Drainage Union No. 1 & Bay Island	Ag.	1954	1967
Marion Co. DD	Ag.	1954	1967
Henderson Co. DD NO. 2	Ag.	1954	1967

Upper and Middle Mississippi River
Mainstem
Flood Control Projects
Project Type, Authorization Date and Completion Date
1884-1995

So. Quincy D&LD	Ag.	1954	1967
Winona, Minn.	Urban	1958	1967
St. Paul & So. St. Paul, Minn.	Urban	1958	1968
Perry County D & LD Nos. 1, 2 & 3	Ag.	1936	1968
Henderson Co. DD No. 1	Ag.	1954	1968
Muscatine Island Levee District &	Ag.		
Muscatine - Louisa Cty Drainage Ditch		1954	1969
Prairie du Pont L&SD	Ag.,	1962	1970
Indian Grave DD	Ag.	1954	1971
Sny Basin	Ag.	1946	1971
Gregory Drainage District	Ag.	1962	1971
Iowa River - Flint Creek Dis. No. 16	Ag.	1954	1971
Hunt & Lima Lake Drainage District	Ag.	1954	1972
Dubuque, Iowa	Urban	1962	1973
Guttenberg, Iowa	Urban	1962	1973
Rock Island, Illinois	Urban	1962	1974
Wood River Drainage & Levee District	Ag.	1965	1977
Meredosia Levee & Drainage District	Ag.	1948	1977
Columbia D&LD	Ag.	1962	1978
St. Louis and Vicinity, Missouri	Urban	1955	FY 1980
Bettendorf, Iowa	Urban	1968	1981
Clinton, Iowa	Urban	1968	1981
Prairie du Chien, Wisconsin	Urban	1974	1984
East Moline, Illiinois	Urban	1968	1984
Fulton, Illinois	Urban	1968	1984
Mississippi River Agricultural Areas (Area 8)	Ag.	1966	1986
Wood River Drainage & Levee District	Ag.	1938	1988
East St. Louis and Vicinity, Illinois	Ag. & Urb	1965	1990
Hannibal, Missouri	Urban	1962	[1992]
State Road & Ebner Coulee, (LaCrosse, Wisconsin)	Urban	1968	1993
Bassett Creek (Minneapolis, Minnesota)	Urban	1976	[1995]
East St. Louis and Vicinity, Illinois	Urban	1988	[1995]
St Paul, Minnesota	Urban	1986	1995
Cape Girardeau - Jackson Metropolitan Area - Missouri	Urban	1986	Underway
Perry Co. D&LD 1, 2, 3	Ag.	1972	Underway
St. Genevieve, Missouri	Urban	1986	Underway
Muscatine Is. LD & Muscatine-Louisa Cty DD	Ag.	1986	Awaiting Funding
East St. Louis and Vicinity, Illinois	Ag. & Urb	1936	?
Kaskaskia Is. D&LD	Ag.	1962	?

Upper and Middle Mississippi River and Tributaries
Flood Control Projects
Project Type, Authorization Date and Completion Date
1884-1995

MINNESOTA FLOOD CONTROL PROJECTS			
MAIN STEM OF MISSISSIPPI RIVER			
PROJECT NAME	NATURE	AUTHORIZED	COMPLETED
Aitkin	Urban	1948	1957
St. Paul & So. St. Paul	Urban	1958	1968
Winona	Urban	1958	1967
St Paul	Urban	1986	1995
Bassett Creek	Urban	1976	[1995]
MINNESOTA RIVER BASIN			
Lac qui Parle Reservoir	Gen. FC	1936	1951
Big Stone Lake - Whetstone River	Ag.	1965	1974
Mankato & North Mankato	Urban	1958	
		1976	1989
Chaska, Minnesota River	Urban	1976	Underway
Marshall	Urban	1960	1963
		1986	[1995]
CANNON-ZUMBRO-ROOT RIVERS BASIN			
Root River and Rush Creek at Rushford	Urban	1958	1969
Zumbro River (Lower Reach)	Ag.	1965	1974
Houston	Urban	1986	Underway
Rochester	Urban	1974	Underway
IOWA FLOOD CONTROL PROJECTS			
MAIN STEM OF MISSISSIPPI RIVER	NATURE	AUTHORIZED	COMPLETED
Dubuque	Urban	1962	1973
Green Bay Levee & Drainage District	Ag.	1954	1966
Guttenberg	Urban	1962	1973
Flint Creek to Iowa River	Ag.	1895	1900
Iowa River - Flint Creek Dis. No. 16	Ag.	1954	1971
Muscatine Island Levee District &	Ag.	1954	1969
Muscatine - Louisa Cty Drainage Ditch			
Muscatine Is. LD & Muscatine-Louisa Cty DD		1986	[1999]
Muscatine, Mad Creek	Urban	1954	1960
Sabula	Urban	1944	
		1954	1957
Upper Iowa River	Ag.	1954	1959
Clinton	Urban	1968	1981
Bettendorf	Urban	1968	1981
TURKEY & UPPER IOWA RIVERS BASIN			
Dry Run, Upper Iowa River	Ag.	1936	1960
Turkey River (Elkport)	Urban	1944	1949
IOWA CEDAR RIVER BASIN			
Coralville Lake, Iowa River	MP	1938	1958
Waterloo, Cedar River	Urban	1965	1985
Marshalltown, Iowa River	Urban	1965	1977
Evansdale, Cedar River	Urban	1965	1982
DES MOINES RIVER BASIN			
Red Rock Dam and Lake	MP	1936	1969
Des Moines	Urban	1944	1971
Ottumwa	Urban	1965	1977
Saylorville Lake	MP	1958	1977

Upper and Middle Mississippi River and Tributaries
Flood Control Projects
Project Type, Authorization Date and Completion Date
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WISCONSIN FLOOD CONTROL PROJECTS			
State Road & Ebner Coulee	Urban	1968	1993
Prairie du Chien	Urban	1974	1984
Chippewa - Black Rivers Basin			
Eau Galle River	Urban	1958	1968
Wisconsin River Basin			
Portage	Urban	1986	underway
ILLINOIS FLOOD CONTROL PROJECTS			
MAIN STEM OF MISSISSIPPI RIVER	**NATURE**	**AUTHORIZED**	**COMPLETED**
Bay Island Drainage & Levee District No.1	Ag.	1917	1922
	Ag.	1928	1933
	Ag.	1954	1966
Chouteau, Nameoki & Venice D&L District	Ag.	1936	1955
Clear Creek D&L District	Ag.	1936	1962
Columbia Drainage & Levee District	Ag.	1936	1959
	Ag.	1962	1978
Degognia & Fountain Bluff Drainage &Levee District	Ag.	1936	1959
Drury Drainage District	Ag.	1917	1920
	Ag.	1954	1963
East Cape Girardeau & Clear Creek Drainage District	Ag.	1936	1953
East Moline	Urban	1968	1984
Fort Chartres & Ivy Landing	Ag.	1936	1958
Fulton	Urban	1968	1984
Galena, Galena River	Urban	1944	1951
Grand Tower D&L District	Ag.	1938	1959
Harrisonville & Ivy Landing Drainage & Levee District No. 2	Ag.	1936	1957
Henderson County Drainage District No. 1	Ag.	1928	1929
		1954	1968
Henderson County Drainage District No. 2	Ag.	1928	About 1930
		1954	1967
Henderson County Drainage District No. 3	Ag.	1917	1925
		1936	1948
Warsaw to Quincy (Hunt, Lima Lake & Indian Grave)	Ag.	1895	1896
Hunt Drainage District	Ag.	1917	1922
Lima Lake Drainage District	Ag.	1917	1922
		1928	1930
Hunt & Lima Lake Drainage District	Ag.	1954	1972
Indian Grave Drainage District	Ag.	1928	1932
		1954	1971
Meredosia Levee & Drainage District	Ag.	1948	1977
Miller Pond Drainage District	Ag.	1938	1955
North Alexander Drainage & Levee District	Ag.	1936	1957
Prairie du Pont Levee & Sanitary District	Ag.	1936	1962
		1962	1970
Prairie du Rocher & Vicinity	Ag.	1946	1959
Preston Drainage & Levee District	Ag.	1936	1959
Rock Island	Urban	1962	1974
Sny Island Levee and Drainage District	Ag.	1884,86,88,90,92,	
		and 1896	By 1900
Sny Basin	Ag.	1946	1971
South Quincy Drainage & Levee District	Ag.	1936	1939
		1954	1967
Stringtown - Fort Chartres & Ivy Landing	Ag.	1938	1957
Subdistrict No. 1, Drainage Union No. 1 & Bay Island	Ag.	1954	1967
Wood River Drainage & Levee District	Ag.	1938	1988
Wood River		1965	1977

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East St. Louis and Vicinity	Ag. & Urb	1936	?
		1965	1990
		1988	[1995]
Kaskaskia Island Drainage & Levee District	Ag.	1938	1943
		1962	1988
Rock River Basin			
Mill Creek & South Slough at Milan	Urban	R&H Act 1927	1932
Penny Slough Drainage & Levee Dist	Ag.	1936	1940
Milan, Rock River	Urban	1968	1988
Rockford IL, Kent Creek	Urban	1962	1988
Illinois River Basin			
Banner Special D & L Dist	Ag.	1936	1941
Big Lake Drainage &Levee District	Ag.	1936	?
		1938	1943
Big Swan Drainage & Levee Dist	Ag.	1928	1934
Coal Creek Drainage & Levee Dist	Ag.	1936	
		1938	1954
Coon Run Drainage & Levee Dist	Ag.	1928	1938
Crane Creek Drainage & Levee Dist	Ag.	1928	
		1938	1941
East Liverpool Drainage & Levee D	Ag.	1936	1941
East Peoria Drainage & Levee Dist	Ag.	1936	1945
Farm Creek	Urban	1944	1954
Hartwell Drainage & Levee District	Ag.	1928	1933
Hennepin Drainage & Levee District	Ag.	1936	1940
Hillview Drainage & Levee District	Ag.	1928	1934
Keach Drainage & Levee District	Ag.	1928	1933
Lacy, Langellier, West Matanzao &	Ag.	1928	
Kerton Valley Drainage & Levee Dist		1936	1949
Liverpool Drainage & Levee District	Ag. & Urban	1936	1941
Lost Creek Drainage & Levee Dist	Ag.	1928	
		1936	1937
Mason & Menard Drainage Dist	Ag.	1936	1939
Mauvaise Terre Drainage & Levee Dis	Ag.	1928	1936
Meredosia Lake & Willow Creek Drainage & Levee Dis	Ag.	1938	1944
New Pankey's Pond, Special Drainage Dis	Ag.	1928	1940
Nutwood Drainage & Levee District	Ag.	1928	1932
Oakford Special Drainage District	Ag.	1936	1939
Pekin & La Marsh Drainage & Levee	Ag.	1936	1954
Remedial Work - Mouth of Sangamon River	Ag. & Urb	1936	1949
	Wildlife	1962	1977
Rocky Ford Drainage & Levee Dist	Ag.	1936	1940
Sangamon River near Springfield	??	1936	1940
Scott County Drainage & Levee Dist	Ag.	1928	1933
Seahorn Drainage & Levee District	Ag.	1936	1939
Sid Simpson, IL River at Beardstown	Urban	1950	1967
South Beardstown & Valley D&L Dist	Ag.	1928, 36 & 38	1941
Spring Lake Drainge & Levee Dist	Ag. & Urban	1936	1941
McGee Creek Drainage & Levee Dist	Ag.	1962	1986
North Branch, Chicago River: 3 Reservoirs	Urban	1986	underway
Bannockburn Reservoir			1988
Deerfield Reservoir			[1992]
Green Oaks Reservoir			[1992]
Chicagoland Underflow Plan (O'Hare)	Urban	1986	underway
Chicagoland Underflow: McCook & Thornton	Urban	1988	
McCook Reservoir			underway
Thornton Reservoir			underway
Farmer's D & L Dist, Sangamon R	Ag.	1936	1941

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Kaskaskia River Basin			
Carlyle Lake, Kaskaskia River	Ag. & Urb	1938/1958	1967
Dively Drainage & Levee Dist No. 23	Ag.	1958	1975
Lake Shelbyville, Kaskaskia River	Ag.	1958	1970
New Athens, Kaskaskia River	Urban	1958	1981
Big Muddy River Basin			
Carbondale Model City Neighborhood	Urban	1970	1979
Devil's Kitchen Dam, Grassy Creek	MP	1955	1960
Rend Lake	MP	1962	?
MISSOURI FLOOD CONTROL PROJECTS			
MAIN STEM OF MISSISSIPPI RIVER & ITS TRIBS	**NATURE**	**AUTHORIZED**	**COMPLETED**
Hannibal, Bear Creek	Urb	1954	1962
Fabius River Drainage District	Ag.	1936	1941
		1954	1963
Canton	Urban	1950	1964
South River Drainage District	Ag.	1954	1966
Marion County Drainage District	Ag.	1928	1933
		1954	1967
Des Moines & Mississippi Levee Dist #1	Ag.	1954	1966
Gregory Drainage District	Ag.	1962	1971
Perry County D & LD Nos. 1, 2 & 3	Ag.	1936	1968
		1972	1985
Cape Girardeau	Urban	1950	1964
Cape Girardeau - Jackson Metropolitan Area	Urban	1986	underway
St. Louis and Vicinity	Urban	1955	FY 1980
St. Genevieve	Urban	1986	underway
Hannibal	Urban	1962	[1992]
Mississippi River Agricultural Areas (Area 8)	Ag.	1966	1986
Clarence Cannon Dam & Mark Twain Lake (Salt River)	MP	1962	1987
Meramec River Basin: Valley Park Levees			underway

POLICY AND PROGRAM OPTIONS

NATIONAL FLOOD INSURANCE PROGRAM REGULATIONS

INTRODUCTION

In terms of areas affected and annual economic losses, flooding remains the greatest and most persistent natural disaster facing our nation, despite concerted efforts at all governmental levels and within the private sector to moderate, account for, or adjust to the flood risk.

Despite the changes in floodplain awareness over the last 30 years, the Midwest Flood of 1993 has sharply refocused our collective attention on the job yet to be done. While local and federal flood damage reduction projects prevented nearly $20 billion in flood damages, flooding caused an estimated $12 - $16 billion that can be counted, and a large amount in unquantifiable impacts on the health and well-being of the population of the Midwest. Although agriculture accounted for over half of the damages, the majority of the remaining damages were due to human habitation of the floodplain.

This analysis of NFIP program/policy measures covers 13 measures in three future scenarios of floodplain development and management. The impacts of measures and each scenario will be compared and contrasted to the base condition flood impacts as described in the impact matrix tables.

SCENARIO DESCRIPTIONS

SCENARIO 1: Existing floodplain policies and programs maintained with known changes included:

1. A 30 day waiting period for policies to take effect, as opposed to a 5 day base condition (PL 103- 325).

2. Enforced compliance of flood insurance requirements for structures with mortgages in the 100 year floodplain (PL 103-325).

3. Pre-flood market values instead of replacement cost to be used in determination of substantially damaged structures (PL 103-325).

4. No change in premium structure.

5. No expansion of riverine areas covered by flood insurance requirements.

SCENARIO 2: Floodplain policy and program proposals of the Interagency Floodplain Management Review Committee, Upper Mississippi River Basin Association and the Association of State Floodplain Managers are implemented:

1. Establish a scale of escalating premiums to place a greater burden on repetitively damaged structures.

2. Flood insurance claims filed for structures outside a mapped floodplain causes the area to be mapped as floodplain and triggers community requirements to manage the area as such.

3. Actuarial based flood insurance requirements are applied to structures behind all levees with less than Standard Project Flood (SPF) protection.

4. Flood insurance maps will not be revised to remove properties placed on fill.

5. All communities with flood hazard areas that are developed or could be developed will be mapped and increased funding to accomplish this will be provided.

SCENARIO 3 : Restoration of natural resources of the floodplain and avoidance of flood risk to lives and property are more aggressively pursued:

1. Provide authority for individuals to sue agents and lenders who fail to provide notice of flood insurance purchase requirements.

2. National Flood Insurance Program (NFIP) Community Rating provisions are mandated to ensure adherence to practices achieving flood damage avoidance.

3. Additional funding for completion and update of flood insurance rate maps (FIRM) is provided (beyond NFIP premiums); maps are based on future conditions hydrology.

ANALYTICAL FRAMEWORK

Each scenario, which is comprised of the various policy and program measures, poses the question - what would the impact of the 1993 Flood have been, if these policies and programs had been in place? There is a discussion of the various measures and their expected consequences and a measurement of those consequences against the 1993 Flood base condition. While the specifics of any one analysis may apply to a particular State or Corps District, the impacts are intended to apply systemically throughout the upper Mississippi and Missouri River basins.

The evaluation of impacts are assessed with respect to the Economic and Reduction of Risk elements in the impact matrix table summary. It is important to note that a certain synergism exists when all of the policy and program measures are taken as one with potential effects greater than the calculus of the matrix tables. For example, the buyout of more than 5,000 structures within the basin will impact not only the number of NFIP policies, but also the value of future payouts.

Each measure will be briefly described, and discussed with regard to its relevance to the 1993 Flood event. Significant findings will be presented and a summary by impact category will be displayed. The expected impact data will also be entered into cells of each scenario measures impact summary. Since much of the scenario formulation is conceptual in nature and deals with behavioral attitudes and responses, the measurement of impacts will be to a large extent qualitative and judgmental. However, order of magnitude and directions of change should be evident.

EVALUATION OF MEASURES - SCENARIO 1

Measure 1: The 30 day waiting period for NFIP policies to take effect, as opposed to the prior 5 day waiting period.

There has always been an inherent unfairness in the prior 5 day waiting period. For those living in areas subject to flash flooding, permanent insurance is a necessity, while those living along main-stem rivers or protected by levees could wait until the risk was readily apparent. In fact, flood insurance was the only form of insurance that allowed for a degree of certitude of impending danger convoluting peoples' perception of the reasons for insuring against potentially large financial loss. According to the Interagency Floodplain Management Review Committee -Sharing The Challenge: Floodplain Management Into The 21st Century (Galloway Report), a 15 day waiting period would have resulted in 1,828 fewer claims and payments would have been $45 million less. A 30 day waiting period would result in 3,390 fewer claims with $82 million less in payments. Likewise, a 60 day waiting period would have decreased the number of claims by 4,588 with a resulting decrease in payments of $105 million. Title V of the Riegle Community Development and Regulatory Improvement Act of 1994 (P.L. 103-325) implements a 30-day waiting period for new flood insurance policies except when real estate changes ownership.

SIGNIFICANT FINDINGS: The impact of this change in the NFIP is primarily one of equity and fairness. The implementation of the 30 day waiting period validates the importance of the program and will increase the permanent base of policyholders. On the behavioral side, it should reinforce the personal responsibility required of those choosing to occupy the floodplain.

SUMMARY BY IMPACT CATEGORY

Flood Damage Reduction (Cells C1-C4, Scenario 1): There would be no impact with regard to base condition flood damages.

Change in Government Expenditures

Disaster Relief (Human Resources) (Cell C-7, Scenario 1): While not quantified, a slight increase could be expected in this category due to a shift from the insured losses under NFIP to governmental disaster programs. However, other elements of P.L. 103-325 should have long term effects of increasing NFIP participation.

Flood Insurance (NFIP) (Cell C8, Scenario 1): There would be a reduction of $82 million in NFIP payments from the base condition.

There would be no other traceable impacts associated with this measure, nor would there be any implementation costs.

Measure 2: Enforced compliance of flood insurance requirements for structures with mortgages in the 100 year floodplain.

The lender compliance requirement of PL 103-325 with the attendant potential for civil penalties (not to exceed $100,000 per lender per year) should be the catalyst to bring significant numbers of floodplain properties, that change ownership, into the NFIP. Equally as important is the requirement to review outstanding mortgages with regard to the need for flood insurance. Lending institutions can require proof of coverage or, in cases of non-compliance, purchase the insurance on behalf of the borrower and may charge appropriate premiums and fees. In addition to the lender compliance, the requirement to offer the option to escrow flood insurance premiums should make NFIP participation more affordable in context of the family budget.

Significant Findings: While the lender compliance components of PL 103-325 will significantly impact floodplain properties which change ownership or have outstanding mortgages, there are other factors which will limit the impact over the total number of floodplain occupants. According to FEMA data (FIA March 1994), of the approximately 61,000 NFIP insured buildings in the nine Midwest states, 28,000 or 46% were built before 1959. Assuming the same proportion among non-insured structures, the compliance requirements could fail to impact a large number of structures. In fact, a 1989 American Housing Survey indicates 42.4% of the owner occupied housing in the nation is owned free and clear of mortgages. Other factors limiting the effectiveness of lender compliance are the differences in housing ownership and sales practices in small rural communities via land transfers and non-traditional financing mechanisms and the socio-economic makeup of floodplain portions of many communities which include higher proportions of low income residents and renters.

SUMMARY BY IMPACT CATEGORY

Flood Damage Reduction (Cells C1-C4, Scenario 1) : There would be no impact with regard to flood damage reduction.

Change in Government Expenditures

Disaster Relief (Human Resources) (Cell C7, Scenario 1): A long term shift in federal disaster payments to insured flood losses borne by the floodplain occupants - not quantified.

Flood Insurance (NFIP) (Cell C8, Scenario 1): There would be a long term increase in the payments of insured flood losses - not quantified.

There would be no other traceable impacts associated with this measure, nor would there be any implementation cost.

Measure 3: Pre-flood market values instead of replacement cost to be used in determination of substantially damaged structures.

There is anecdotal evidence that it took over a month to determine whether a house was valued by its pre-disaster market value or its damaged value (National Flood Policy In Review - Draft March 1994 - Assoc. of State Floodplain Managers). In order to maximize the multitude of disaster funds, there must be a uniformity among agencies in the application of program requirements and eligibility. The issue of substantially damaged structures is two-fold. In the abstract, substantially damaged is a classification used to delineate structures that should not be repaired or rebuilt. This is good floodplain management. Essentially, a substantially damaged structure can not be repaired/rebuilt without being protected from flooding to the base flood elevation (100-year flood frequency). There is no argument that in situ repair of such structures is merely an invitation to further flood damage. In practice, however, application of the rule by local communities is hampered by the political and economic realities of a citizenry already suffering the financial hardships of a flood disaster.

An additional component to the definitional aspect is the recognition of cumulative improvements to the structure rather than viewing each improvement individually. Cumulative additions to determine substantial damage would assist greatly in removing repetitively damaged structures in the absence of large magnitude floods.

Regardless of the preciseness of the definition, implementation will continue to be hampered without financial assistance to the property owners. Mitigation insurance coverage is included in P.L. 103-325 to enable policyholders to use claim payments to bring substantially damaged or repetitive loss structures into compliance with flood hazard regulations and codes.

Significant Findings: Failure to strictly enforce the substantially damaged structure provision continues to allow structures to remain at extreme flood risk. Furthermore, repetitive losses undermine the financial viability of the NFIP. Approximately 41 percent of the almost 3 million policies in force are subsidized pre-FIRM. These pre-FIRM policy payments were about $780 million less than if the rates were actuarially based and participation remained the same.

SUMMARY BY IMPACT CATEGORY

Flood Damage Reduction (Cells C1-C-4, Scenario 1): There would be no immediate impact with regard to the base condition flood damages. However, future flood damages would be reduced due to compliance with the base flood requirements of substantially damaged structures. Assuming increased mitigation and buyout funding, substantial reductions in flood damages could be expected with regard to the pre-FIRM structures. Not quantified.

Disaster Relief (Human Resources) (Cell C-7, Scenario 1): A long term shift in federal disaster payments to insured flood losses - not quantified. Since pre-FIRM structures are 4-1/2 times more likely to suffer flood damages and suffer three times the damage, when flooded, disaster payments would be expected to decrease.

Flood Insurance (NFIP) (Cell C-8, Scenario 1): Initially, NFIP payments under mitigation funding would be expected to increase, but long term decreases in insured flood losses are expected - not quantified.

There would be no other traceable impacts associated with this measure, however, some implementation costs are expected relative to an expanded buyout program.

Measure 4: No change in premium structure.

This measure reflects a continuation of the staus quo. Without increased participation in the NFIP and a reduction in the number of pre-FIRM subsidized structures, the continued viability of the NFIP is doubtful without general revenue contributions.

SUMMARY BY IMPACT CATEGORY

There would be no impacts to the base condition associated with this measure.

Measure 5: No expansion of the riverine areas covered by flood insurance requirements.

There would be no impacts to the base condition associated with this measure.

EVALUATION OF MEASURES - SCENARIO 2

Measure 1: Establish a scale of escalating premiums to place a greater burden on repetitively damaged structures.

While this measure is certainly appealing, there are circumstances that minimize the impact. The majority of repetitively damaged structures are pre-FIRM and the premiums are subsidized. A General Accounting Office study from March 1994 estimated a threefold increase necessary to bring subsidized policies up to actuarial standards. This would result in annual premiums of about $1,100 per structure. Earlier GAO studies estimated that a doubling of premiums would result in a 40 percent cancellation of policies. A more appropriate action would be to gradually raise premiums (although not to actuarial levels) along with strict enforcement of the "substantially damaged" criterion and aggressive relocations of the structures at most risk.

SUMMARY BY IMPACT CATEGORY

Flood Damage Reduction (Cells C1-C4, Scenario 2): Long term reduction due to removal of structures at risk - not quantified.

Change in Government Expenditures

Emergency Response Costs (Cell C8, Scenario 2): Long term reduction due to removal of repetitively and substantially damaged structures - not quantified.

Disaster Relief (Human Resources) (Cell C7, Scenario 2): Long term reduction due to removal of at risk structures - not quantified.

Flood Insurance (NFIP) (Cell C8, Scenario 2): Removal of subsidized structures will add to the financial viability of the NFIP - not quantified.

Reduction in Risk (Cells C21-C23, Scenario 2): Would cause long term reduction in people and structures at risk of flooding - not quantified.

There would be no other traceable impacts associated with this measure. Implementation costs would be minimal - not quantified.

Measure 2: Flood insurance claims filed for structures outside a mapped floodplain causes the area to be mapped as floodplain and triggers community requirements to manage the area as floodplain.

This measure would increase the areas and communities under control of the minimum NFIP floodplain regulations. Restrictions on future development would apply and existing structures would be regulated under the substantially damaged criterion. Additional properties would be added to the NFIP program.

SUMMARY BY IMPACT CATEGORY

Flood Damage Reduction (Cells C1-C4, Scenario 2): There would be a long term reduction due to structures being elevated above the base flood level - not quantified.

Change in Government Expenditures

Emergency Response Costs (Cell C5, Scenario 2): Long term decrease due to floodplain regulation - not quantified.

Disaster Relief (Human Resources) (Cell C7, Scenario 2): There should be a long term decrease due to increased floodplain regulation and increased NFIP participation - not quantified.

Flood Insurance (NFIP) (Cell C8, Scenario 2): There would be a long term shift from disaster payments to insured losses covered by owner premiums - not quantified.

Reduction in Risk (Cells C21-C23, Scenario 2): This measure would reduce the number of communities, people, and structures at risk of flooding - not quantified.

There would be no other traceable impacts associated with this measure and implementation cost would be minimal.

Measure 3: Actuarial based flood insurance requirements are applied to structures behind all levees and floodwalls with less than Standard Project Flood (SPF) protection.

This measure would signify a fundemental change in the direction of the NFIP. This movement from the 100-year flood designation would broaden the program coverage to include most floodplain areas. Assuming vastly increased mandatory participation, the financial base and viability of the NFIP would be enhanced. There would also be an increased recognition of the potential for catastrophic flood damages from floods greater than the 1993 event.

SUMMARY BY IMPACT CATEGORY

Flood Damage Reduction (Cells C1-C4, Scenario 2): There would be no change from the base condition associated with this measure.

Change in Government Expenditures

There would be a long term decrease in all forms of government disaster payments with the shift to owner insured coverage under the NFIP.

There would be no implementation costs associated with this measure.

Measure 4: Flood insurance maps will not be revised to remove properties based on fill.

While removing structures from the base flood level is desirable, the practice of raising floodplain land above the base flood elevation does nothing to prevent damage to infrastructure and health and safety. No empirical studies have been undertaken, but there may be little or no difference in the emergency response and disaster relief expenditures associated with elevated structures versus floodplain structures.

SIGNIFICANT FINDINGS: Flood risk awareness will not be diminished by changes in the FIRM map and some savings could be expected by not remapping filled areas. While no data has been developed tabulating the number of structures on fill above the base flood elevation, keeping these structures in the NFIP would enhance the financial viability of the program.

SUMMARY BY IMPACT CATEGORY

Flood Damage Reduction (Cells C1-C4, Scenario 2): There would be little or no change with regard to the base condition flood damages.

Change in Government Expenditures

Emergency Response Costs (Cell C5, Scenario 2): There may be a slight long term decrease due to avoidance of the floodplain - not quantified.

Disaster Relief (Human Resources) (Cell C7, Scenario 2): There should be a long term decrease in disaster relief payments to floodplain occupants not now covered by flood insurance. The overall impact is expected to be low, not quantified.

Flood Insurance (NFIP) (Cell C8, Scenario 2): Long term, there would be a shift in expenditures from uninsured disaster relief to insured losses covered by owner premiums. While not quantified, the impact is expected to be low.

Measure 5: All communities with flood hazard areas that are developed or could be developed will be mapped, and increased funding to accomplish this will be provided.

The critical factor in this measure is the provision of additional funding in excess of the $25 per policy surcharge for mapping. The NFIP cannot generate internally the necessary funds to accomplish this task. The advantage to actively pursue flood hazard mapping is the increased awareness of the flood risk and the provision of floodplain management information to local governments.

Significant Findings: Future development could be prohibited below the base flood elevation and NFIP participation in the unsubsidized actuarial based portion of the program would increase. Likewise, pre-FIRM structures would fall under the "substantially damaged" criterion and could not be rebuilt or replaced below the base flood delineation.

SUMMARY BY IMPACT CATEGORY

Flood Damage Reduction (Cells C1-C4, Scenario 2): Long term reductions in flood damages due to building restrictions below the base flood elevation and potential removal of pre-FIRM substantially damaged structures.

Change in Government Expenditures

Emergency Response Costs (Cell C5, Scenario 2): Long term decrease due to risk avoidance - not quantified.

Disaster Relief (Human Resources) (Cell C7, Scenario 2): Long term decrease in disaster relief payments to floodplain occupants not now covered by flood insurance - not quantified.

Flood Insurance (NFIP) (Cell C8, Scenario 2): Long term shift from uninsured disaster payments to insured losses covered by owner premiums - not quantified.

Reduction in Risk (Cells C21-C23, Scenario 2): There would be long term reductions in communities, people, and structures at risk.

There would be no other traceable impacts associated with this measure and implementation cost would be minimal.

EVALUATION OF MEASURES - SCENARIO 3

Measure 1: Provide authority for individuals to sue sellers, agents, and lenders who fail to provide notice of flood insurance purchase requirements.

Significant Findings: Taken in concert with the lender compliance provisions of PL 103-325, this could close the loop on many of the exceptions to ownership changes not covered by existing regulations. However, there may be some difficulty in implementation due to differences in tort law across jurisdictional boundaries. It is difficult to assess the impact of this measure in any quantitative manner due to the dependence on behavioral responses. Judgmentally, the expectation would be that more people would either buy flood insurance or not buy in the floodplain. In either case, awareness of the flood risk is heightened and the base of floodplain structures within the NFIP is increased.

SUMMARY BY IMPACT CATEGORY

Flood Damage Reduction (Cells C1-C4, Scenario 3): There would little or no change expected with regard to base condition flood damages.

Change in Government Expenditures

Emergency Response Costs (Cell C5, Scenario 3): No change to the base condition, but a slight decrease in emergency response costs may be evidenced due to avoidance of the floodplain - not quantified.

Disaster Relief (Human Resources) (Cell C7, Scenario 3): There should be a long term decrease in disaster relief payments to floodplain occupants not now covered by flood insurance. The overall impact is expected to be low, not quantified.

Flood Insurance (NFIP) (CELL C8, Scenario 3): Long term, there would be a shift in expenditures from uninsured disaster relief to insured losses covered by owner premiums. While not quantified, the impact is expected to be low.

There would be no other traceable impacts associated with this measure, nor would there be any implementation costs.

Measure 2: NFIP Community Rating provisions are mandated to ensure adherence to practices achieving flood damage avoidance.

The Community Rating System (CRS) is a program designed to provide communities participating in the NFIP positive reinforcement to institute floodplain management requirements exceeding the minimum for the NFIP. The goal of the CRS is to: reduce flood losses; facilitate accurate insurance rating; and promote awareness of flood insurance. Reductions in flood insurance premiums are provided to policy holders within communities that take certain actions to reduce flood losses. Among the creditable activities are: more restrictive standards for new and existing development; floodplain property disclosure statements; public information programs; repetitive loss reduction; high risk flood hazard mitigation. As originally envisioned, full implementation of the CRS could reduce insurance premiums up to 45%. Since the CRS is designed to be "revenue neutral", the reduction in premiums reflect the reduced exposure to flood risks and expected reductions in future flood losses.

Significant Findings: The CRS is the first proactive program initiated to reduce future flood losses. Critical to the success of the program is the positive feedback from policy holders with reduced insurance premiums and the willingness of the uninsured to join the program. In addition to stricter floodplain regulation and increased NFIP participation, two aspects should provide long term reductions in flood damages. Programs targeted at repetitive loss structures and high risk hazard mitigation will reduce the current exposure of the NFIP to the substantial number of pre-FIRM losses.

SUMMARY BY IMPACT CATEGORY

Flood Damage Reduction (Cells C1-C4, Scenario 3): Long term reductions in flood damages are expected. If insurance premiums can be reduced up to 45%, future flood damages may be expected to decrease proportionally - not quantified.

Change in Government Expenditures

Emergency Response Costs (Cell C5, Scenario 3): Long term decrease expected due to the avoidance of high hazard flood areas - not quantified.

Disaster Relief (Human Resources) (Cell C7, Scenario 3): No change to the base condition, but long term shift from disaster relief to insured flood losses. Also, high impact disaster areas should be reduced by limiting repetitive losses. Not quantified.

Flood Insurance (NFIP) (Cell C8, Scenario 3): No change to the base condition. The interaction of community efforts will reduce high risk structures thereby reducing future exposure to flooding and the subsequent insurance payments. Not quantified.

Reduction in Risk (Cells C21-C23, Scenario 3): Removal of repetitive loss structures and high hazard mitigation should provide long term reductions in people and structures at risk.

There would be no other traceable impacts associated with this measure.

Measure 3: Additional funding for completion and update of flood insurance rate maps (FIRM), is provided beyond NFIP premiums; maps are based on future hydrology.

The Flood Insurance Rate Map (FIRM) is a critical planning item for the management of floodplains. They are the key planning tool for communities and states, identify flood insurance rates to be charged, and provide for the identification of areas subjected to floodplain regulation. Since mapping of floodplains began in 1968, total funding for flood studies and surveys has been $873 million (as of September 1990). Over 18,600 communities have been mapped. There have been 12,146 initial rate studies and 1,726 restudies. These studies are a part of the NFIP and are funded through the premium structure of the insurance program by a $25 dollar per policy surcharge. The current level of funding derived from the surcharge is not sufficient to cover the new and updating mapping needs. Any significant increase in the policy surcharge may hamper the marketing of new policies with many more flood hazard areas remaining to be mapped. In the nine Midwest states, 209 counties have not been mapped, including 108 that were declared disaster areas due to the 1993 floods.

The FIRM map is merely the graphical representation of detailed hydrologic and engineering studies. A significant portion of these studies is based upon historical records and hydrologic modeling. Inherent in these scientific methods are statistical error and uncertainty which impacts the accuracy of the mapping.

Significant Findings: Considering the extensive areas yet to be mapped, some form of funding outside of the NFIP needs to be provided. While the policyholders are the principal beneficiaries, considerable savings from reduced disaster expenditures would accrue to the general public. Additionally, as more mapping is completed, less pre-FIRM structures will be located in highly damageable areas.

If the FIRM map is the primary tool in floodplain management, it cannot be a static picture in time already dated before printing and dissemination to the public. A consistent and generally accepted definition of what constitutes "future hydrology" should be incorporated into the preparation of the FIRM map. This will not only save time and money in later revisions, but, also provide states and communities with the necessary information to plan for the future.

A related issue is the modification of existing maps to reflect reductions in floodplain areas due to structural or hydrologic changes. In general, good floodplain management should not promote reclamation of the floodplain for development with the potential for catastrophic damage.

SUMMARY BY IMPACT CATEGORY

Flood Damage Reduction (Cells C1-C4, Scenario 3): There would be no impact with regard to the base condition flood damages. However, long term reductions would be achieved due to NFIP development restrictions - not quantified.

Change in Government Expenditures

Emergency Response Costs (Cell C5, Scenario 3): Long term decrease due to better and more accurate information with regard to flood hazards - not quantified.

Disaster Relief (Human Resources) (Cell C-7, Scenario 3): No change to the base condition, but long term shift from federal disaster relief to insured losses - not quantified.

Flood Insurance (NFIP) (Cell C8, Scenario 3): No change to the base condition, but long term shift to insured flood losses - not quantified.

Reduction of Risk (Cells C21-C23, Scenario 3): Expedited flood hazard mapping would have a long term beneficial impact on the number of people, communities, and structures at risk of flooding - not quantified.

There would be no other traceable impacts associated with this measure. Implementation costs would be required in excess of funds generated by the NFIP premiums - not quantified.

SCENARIO CATEGORY C

National Flood Insurance Program Regulations

	IMPACT CATEGORIES	A Base Cond. [All Disast. Counties]	B Base Cond. [FPMA Imp. Counties]	Scenario 1	Scenario 2	Scenario 3
	ECONOMIC (1,000 $'s)		[1]			
	Flood Damages					
1	Residential (Urban)	$760,892	$662,008	LOW	LOW	LOW
2	Other (Urban)	$1,612,543	$1,447,322	LOW	LOW	LOW
3	Agricultural	$3,852,701	$817,054	0	0	0
4	Other Rural	$233,648	$161,010	LOW	LOW	LOW
	Chg. in Govt.Expend.					
5	Emergen.Resp.Costs	$227,405	$200,663	LOW	LOW	LOW
6	Disaster Relief (Agric.)	$1,160,632	$285,180	0	0	LOW
7	Disaster Relief (Human R.)	$1,297,474	$551,862	+82,000	LOW	LOW
8	Flood Insurance (NFIP)	$371,969	$276,496	−82,000	MODERATE	MODERATE
9	Flood Insurance (FCIC)	$748,095	$269,061	0	0	0
	Chg.Value of FP Resources					
10	Net Ag RE Values	–	–	0	0	0
11	Net Urban RE Values	–	–	0	0	0
	ENVIRONMENTAL					
	Natur.Resour.(# acres)					
12	Non−Forested Wetl. (acres)	–	365,285	0	0	0
13	Threat.&Endang. (# / Occ.)	–	(281/1,043)	0	0	0
14	Forest (acres)	–	534,705	0	0	0
	Natural Fldpln.Functions					
15	Fldpln.inundated (acres)	–	776,276	0	0	0
	Cultural					
16	Archeol Impacts (−5 to +5)	–	−1	−1(+1)	−1(+1)	−1(+2)
16A	Hist.Sites(−5 to +5)		−1	−1(+1)	−1(−2)	−1(−3)
	Open Space					
17	Public lands (acres)	–	392,512	0	0	0
18	Recreation sites (#)	–	485	0	0	0
	REDUCT.OF RISK					
	Critical Facilities					
19	# Facil. w/harmful releases	–	207	0	0	0
20	# other critical facilities	–	1,208	0	0	0
	Prot./Avoid. of Harm					
21	# people vulnerable	185,630	134,849	LOW	LOW	LOW
	Social Well Being					
22	# communities vulnerable	433	293	0	0	0
23	# resident.struct.vulnerable	56,339	42,743	LOW	LOW	LOW
	IMPLEMENT. COSTS					
24	Structural Costs	–	–	0	0	0
25	Other Costs	–	–	+ MODERATE	LOW	MODERATE

[1] Economic Impacts collected only at the county level

STATE FLOODPLAIN MANAGEMENT MEASURES

This section will address the State floodplain management measures associated with scenarios 1, 2 and 3 that states could enact to reduce flood damages. Each measure will be reviewed to determine current state-level programs and the impacts that it would have had on the flood damages experienced during the "Flood of 93".

2.1 MEASURE S1 Variety of state policies and programs assumed to continue without major change (Scenario 1).

This measure focuses on non-structural changes, such as changes in floodplain zoning ordinances which have taken place since the "Flood of 93".

Objective: The objective of this measure is to identify state floodplain management policies and programs, and any changes that have been implemented since the "Flood of 93", as well as the impact of these changes.

2.1.1 Current State Programs and Policies The following summary of state floodplain management activities extracted from the *Galloway Report, Appendix F* provides an overview of the programs in place as of 1991 for the seven states included in this study.

Summary of State Floodplain Management Activities, 1991

	Budget: State Contribution/Total (in $1000)	Floodplain Mapping Programs	Riverine Regulatory Standards exceed NFIP Minimums	Regs for Areas Behind Levees	Acquisition & Relocation Funding Programs	Cooperative Projects to Protect Floodplain Resources
Illinois	> 150				H/L	
Iowa	300/300					
Kansas	588/769					W
Minnesota	615/2400				H,P/L	M,F,W,B,Q,O
Missouri	34.4/137.4					W,Q
Nebraska	97/157					
Wisconsin	1000/1108				A	M,Q,O

Source: Galloway Report, Appendix F, 1994 — Applicable Programs

A = Other acquisition program
B = Fish and wildlife
F = Forestry
H = Help localities obtain 1362 funds
L = Local purchase loans/grants
M = Multi-objective mgmt of watersheds
O = Other
P = Floodplain acquisition is a priority
Q = Water quality
W = Wetlands

All of the states in this assessment, with the exception of Missouri, had floodplain zoning regulations in place prior to the "Flood of 93" that exceeded National Flood Insurance Program (NFIP) minimum standards. An overview of these zoning regulations compared to the NFIP requirements is provided in the table on the following page. It is important to note that model zoning ordinances produced by states and the Federal Emergency Management Agency (FEMA), which are the basis for floodplain management programs, only regulate the 100-year floodplain and floodways. The ordinance does not stipulate protection requirements for structures built between the 100-year and 500-year flood elevations. This is significant in that these states exceeded the national requirements for floodplain regulatory standards, yet still experienced significant damage during the "Flood of 93".

State Floodplain Zoning Programs that Exceed NFIP Requirements

States	Floodways	Floodfringe	Critical Facilities
Illinois	▒	▒	
Iowa	▒	▒	▒
Kansas		▒	
Minnesota	▒	▒	▒
Missouri			
Nebraska	▒	▒	▒
Wisconsin	▒	▒	▒

Source: FPMA State Floodplain Management Regulations ▒ Applicable Cell

In a nutshell, the FEMA model ordinance restricts development in floodways to uses that will not create obstructions (raise 100-year flood elevation), and stipulates that new structures or substantially improved structures within the 100-year floodplain must be elevated or floodproofed to at least the 100-year flood elevation, or in some states one foot above the 100-year flood elevation.

Floodways are defined as the channel of a river and that portion of the overbank floodplain that carries most of the flood. Regulations require that the floodway be kept open so that flood waters can proceed downstream and not be obstructed or diverted onto other properties.

FEMA also defines two occasions when work on a structure is considered a substantial improvement:

- an improvement made to a building that exceeds 50 percent of the value of the building; or
- reconstruction of a building, the value of which exceeds 50 percent of

the value of the building before it was damaged.

If an addition to an existing building is a substantial improvement, then the addition must be protected from the base flood (100-year flood elevation). If a reconstruction project is a substantial improvement, then the entire building must be protected from the base flood.

Illinois: The state of Illinois uses the FEMA model zoning ordinance as the basis for its floodplain management program, and has not passed any new floodplain management legislation since the "Flood of 93". The State did, however, amend an administrative rule in the Spring of 1994 requiring project sponsors to analyze the impacts of all new levees to the top of their freeboard versus the 100-year flood elevation. Under the model ordinance, the following minor projects are exempt from the permitting process:

- buildings and additions valued at less than $1,000 (tool sheds, porches, etc.);
- installing utilities, constructing roads or similar projects built at grade (septic tanks, driveways, etc.);
- maintenance of existing buildings or facilities (painting or reroofing); and
- gardening, plowing and similar agricultural practices that do not involve filling, grading or construction of levees. Sodding or adding top soil can be exempt providing it involves no more than two inches of new dirt on no more than one lot.

The Illinois Department of Transportation, Division of Water Resources has permitting authority for projects that may obstruct flood flows or cross or modify the shape of a channel. Development in the floodway is not prohibited, however, development that causes an obstruction is prohibited. An obstruction is considered to be any addition to the floodway that would cause the base flood height (100-year flood elevation) to rise more than 1/10th of a foot. A permit from the Division of Water Resources is required prior to any construction in the floodway.

Iowa: The state of Iowa has had an active floodplain management program since 1957, and has not made any policy or program changes since the "Flood of 93". The floodplain management regulations of the State set forth administrative thresholds requiring approval from the Department of Natural Resources for any development including construction, operation, maintenance and use of a structure, dam, obstruction, deposit, excavation or "flood control work" in a floodplain or floodway.

Bridges, culverts, temporary stream crossings, road embankments, pipeline crossings, stream bank protective devices, and excavations in rural areas in or on the floodway of any river or stream draining more than 100 square miles require department approval. In urban areas department approval is required if the river or stream drains more than two square miles.

Levees or dikes, waste or water treatment facilities, sanitary landfills, and buildings and associated fill in rural areas in the floodplain or floodway of any river or stream draining more than 10 square miles require department approval. In urban areas department approval is required if the river or stream drains more than two square miles.

The regulations also set forth the following minimum standards for floodway uses:

- no building or other structure, deposit of fill, or other potential obstruction shall be allowed in the floodway if the development individually or collectively would increase the level of the 100-year flood;

- notwithstanding the above statement, a structure, associated fill, or another potential obstruction whose location in the floodway provides a substantial public benefit may be allowed if the resulting increase in flood levels is mitigated by purchase of flooding easements or execution of other appropriate agreements with the owners of property on which flooding would be increased; and

- fill, structure or other potential obstruction allowed in the floodway shall be the minimum size to achieve the intended purpose.

The state of Iowa also regulates additions, reconstruction, replacement and changes in the use of preexisting nonconforming structures. The State encourages improvements or replacement construction that provides an adequate degree of flood protection commensurate with the damage potential of the structure. The state of Iowa also prohibits improvements or replacement that would contribute to perpetuation of an individual or collective obstruction which causes a significant increase in the 100-year flood elevation; perpetuation of a significant hazard to health and safety during flooding; or perpetuation of the potential for significant flood damages to property and associated public costs.

Kansas: The state of Kansas has not passed any new legislation as a result of the "Flood of 93". The State regulation stipulates that any zoning regulation which regulates development of floodplains shall include the following minimum standards and criteria:

- development standards shall meet or exceed the minimum requirements of the National Flood Insurance Act of 1968, as amended, 42 U.S.C. Section 4001 *et seq.* and the regulations adopted pursuant to that act;

- development standards adopted by the governing body for which minimal requirements have been set by the chief engineer in Kansas Agriculture Regulation 5-45-1 *et seq.* shall meet or exceed the requirements of the chief engineer;

- the governing body shall designate a local floodplain administrator and an enforcement officer by position or job title;

- an application for floodplain development permit shall be made to the local floodplain administrator if any part of a proposed development is located within the floodplain;

- new or substantially improved residential structures located in an area designated as zone AO (area of 100 year shallow flooding where depths are between one and three feet) on a Flood Insurance Rate Map (FIRM) shall have the lowest floor (including the basement) elevated above the highest adjacent natural grade at least as high as the depth number specified in feet on the FIRM. If no depth number is specified on the FIRM, structure shall be elevated at least two feet above the highest adjacent natural grade;

- new or substantially improved non-residential structures located in an area designated as zone AO on a FIRM shall be dry floodproofed or elevated to at least as high as the depth number specified in feet on the FIRM above the highest adjacent natural grade. If no depth number is specified on the FIRM, structure shall be dry floodproofed or elevated at least two feet above the highest adjacent natural grade;

- when zone AO is not specified on the FIRM, or proposed development will be located in the floodplain outside zone AO, then the lowest floor of new or substantially improved residential structures shall be elevated at least one foot above the base flood (100-year flood elevation) elevation; and

- when zone AO is not specified on the FIRM, or proposed development will be located in the floodplain outside zone AO, then new or substantially improved non-residential structures shall be dry floodproofed or elevated to at least one foot above the base flood (100-year flood elevation) elevation.

Minnesota: The state of Minnesota has had an active floodplain management program since 1969. The State divides the 100-year floodplain into two districts, the floodway and flood fringe, for regulatory purposes. Floodway districts are considered high hazard areas adjacent to stream channels, while flood fringe districts are lower hazard areas representing the remainder of the floodplain.

The State has two land use categories within the floodplain, permitted uses and conditional uses. For permitted uses the community must require a building/use permit prior to the construction, addition or alteration of any building, structure, or portion thereof; the use or change of a structure, building or land; the extension or change of a nonconforming structure or use of land; and the placement of fill or excavation of land. Conditional uses represent certain uses and construction methods which may not be appropriate, but cannot positively be ruled as inappropriate. A special review process has been established for permits of this type.

The following open-type uses are permitted within the floodway provided they do not include structures, fill, or storage of materials or equipment:

- agricultural - general farming, pasture, horticulture, and sod farming;
- industrial/commercial - loading areas, parking areas, and airport landing strips;
- recreation - tennis courts, parks, picnic grounds, ball fields, nature preserves, target ranges and recreational trails (golf courses are not considered appropriate); and
- residential - lawns, gardens, parking and play areas.

Some examples of potential conditional uses within the floodway are structures accessory to open space uses; placement of fill; sand and gravel operations; marinas, docks piers and other water control structures; railroads, streets, and pipelines; and storage yards for materials and equipment.

New construction or additions to residential, commercial and industrial buildings are permitted within the floodfringe provided the structures are elevated on fill, or otherwise protected against flood damage from the Regulatory Flood Protection Elevation (RFPE), at a minimum, this is an elevation no lower than the 100-year flood elevation. A conditional use permit would be required for these structures if another type of flood damage prevention method were to be proposed. These could include the elevation of the structure on pilings or concrete support columns or dry flood proofing in the case of non-residential structures. Dry flood proofing involves physically sealing the lower portions of a structure to prevent flood waters from entering.

The state of Minnesota also regulates nonconforming uses within the floodway and floodfringe districts. Nonconforming uses are existing structures or uses of land or structures that do not meet all of the standards of an ordinance. The following actions are prohibited in the floodway:

- additions to structures in the floodway district, unless the addition is to an accessory structure of an open space use;
- reconstruction of a residential, commercial or industrial structure damaged to greater than 50 percent of its value unless the structure is relocated outside of the floodway; and
- intensification of use that increases the flood damage potential, potential for loss of life or increases the stage of the 100-year flood.

The following requirements must be met for nonconforming structures in the floodfringe:

- additions must be elevated on fill or floodproofed to the RFPE;
- entire structure must be brought into compliance with the requirements for a conforming structure if the improvements exceed 50 percent of the structures current market value;

- intensification in use must not increase flood damage potential of the original use; and

- reconstruction of any structure damaged to greater than 50 percent of its market value at the time of loss is contingent on the reconstructed structure meeting the requirements for a conforming structure.

Missouri: The state of Missouri has not enacted any new legislation related to floodplain management since the "Flood of 93". The State does have statutes enabling counties, inorporated townships and cities to participate in the NFIP.

The Governor's Task Force on Floodplain Management recommended that the Governor and Legislature:

> "Create a multijurisdictional entity to advise the Governor on structural (levees, dams) and non-structural projects (National Flood Insurance, outdoor recreational areas) and institutional and legal strategies for floodplain management.
>
> Empower and resource a designated State Agency to develop and implement an effective overall strategy for floodplain management, under the guidance of the multijurisdictional entity."

The Missouri state legislature and various governmental agencies are currently reviewing the findings of the Task Force report to determine what, if any actions the State will take to decrease the impacts of flooding in Missouri. As a first step in this direction, legislation has been introduced in the Missouri House of Representatives to adopt the FEMA model zoning ordinance as the State standard for floodplain management.

Nebraska: The state of Nebraska has had an active floodplain management program since 1967, and has not made any program changes since the "Flood of 93". The following minimum standards apply to the location of obstructions and substantial improvements within the floodplain:

- no new construction, substantial improvements, or other construction (including fill) shall be permitted unless the cumulative effect of the construction when combined with all other known construction will not increase the water surface elevation of the base flood (one percent chance of being equalled or exceeded in magnitude in any given year) more than one foot at any location;

- designed and adequately anchored to prevent flotation, collapse, or lateral movement of the obstruction and be constructed by methods and practices that minimize flood damage;

- public utilities and facilities, such as sewer, gas, electrical, and water systems shall be located and constructed to minimize or eliminate flood damage;

- new and replacement water and sanitary sewage systems shall be designed to minimize or eliminate infiltration of flood waters; and

- residential and non-residential structures shall have their lowest floor elevated to or above one foot above the base flood (100-year flood elevation) level.

The state of Nebraska also prohibits the storage or processing of materials that are, in time of flooding, buoyant, flammable, explosive, or injurious to human, animal or plant life in the floodplain.

Wisconsin: The state of Wisconsin has had an active floodplain management program since 1965, and has made no changes to its zoning policies as a result of the 1993 flooding. The program stipulates that municipalities shall prohibit the following uses in floodway areas:

- development which will cause an obstruction to flood flows, an increase in regional flood discharge or adverse affects on existing drainage facilities;

- structures designed for human habitation, associated with high flood damage potential, or not associated with permanent open space uses;

- storage of materials that are buoyant, flammable, explosive or injurious to human, animal, plant, fish or other aquatic life;

- sewage systems that cannot be removed during flooding;

- wells which are used to obtain water for ultimate human consumption; and

- solid or hazardous waste disposal facilities (also prohibited in floodfringe areas).

Municipalities may issue permits in floodway areas for open space uses having a relatively low flood damage potential, such as agriculture, recreation, surface parking lots, storage yards or certain sand and gravel operations.

The state of Wisconsin also requires that new development or substantial improvements within floodfringe areas be elevated or floodproofed against the regional flood height (100-year flood elevation).

Officials with the Wisconsin Department of Natural Resources pointed out that property owners along the Upper Mississippi River in Pierce County have been pressuring their legislators to relax the State's 50 percent nonconforming use provision. Under the proposal, no limitations would be placed on the repair, reconstruction, or improvement of nonconforming uses in a flood hazard area that are damaged or destroyed by fire or a natural disaster other than flooding. The proposed legislation, which was challenged, would have changed existing state policy, placing property owners at continued risk as well as creating substantial negative economic impacts to taxpayers and insurance ratepayers.

2.1.2 Impacts There will be no impacts associated with this measure since none of the FPMA states have made floodplain zoning changes since the "Flood of 93". However, the state of Missouri could realize a decrease in flood damages if it passes legislation to establish a state level floodplain management program and implements the recommendations in the Governor's Task Force on Floodplain Management report.

Our review also highlighted the fact that state floodplain zoning regulations are written at varying levels of complexity. Some state regulations can be easily understood by laymen while others require a regulatory expert to provide interpretations. It would be helpful if all of the states adopted more readable products for local governments to use in developing their floodplain management programs.

It is important to note once again that NFIP and state floodplain zoning regulations only regulate development within the 100-year floodplain and floodways. The regulations do not place limitations or protection requirements on structures built between the 100-year and 500-year floodplains. This is significant because a large portion of the structural damages experienced during the 1993 flooding were to structures outside of the 100-year floodplain.

It should also be noted that a large percentage of the communities damaged during the 1993 flooding were founded long before national and state floodplain zoning ordinances were put into effect. Many of the structures in these communities are, therefore, nonconforming or historically significant. It is unknown how many of these damaged structures have been acquired, relocated, demolished or restored to meet the zoning requirements applicable for their communities.

2.2 MEASURE S2 National Flood Insurance Program (NFIP) funding provided (up to $1.5 million annually) for state and local floodplain management and advanced mitigation planning (Scenario 1).

This change in policy would provide grants for planning assistance of up to $150,000 to any State, or $50,000 to any community. With a maximum sum of grants in any fiscal year to any one State and all communities located in such State of $300,000. The grants may cover a period of from one to three years. States and communities can only receive these grants once in every five years.

It is important to note that this funding is for mitigation planning only, and cannot be used to fund actual mitigation projects. The mitigation plans will describe the mitigation activities to be carried out to provide protection against flood losses to structures for which contracts for flood insurance are available. The legislation also carries a stipulation that States and communities must have acceptable mitigation plans in place before they can receive mitigation assistance funding.

The following types of mitigation activities may be included in mitigation plans:

- demolition or relocation of any structure located on land that is along the shore of a body of water and is subject to imminent collapse or subsidence as a result of erosion or flooding;
- elevation, relocation, demolition or floodproofing of structures located in areas having special flood hazards or other areas of flood risk;
- acquisition by States and communities of properties located in areas having special flood hazards or other areas of flood risk and properties substantially damaged by flooding; and
- minor physical mitigation efforts that do not duplicate the flood prevention activities of other Federal Agencies and that lessen the severity or frequency of flooding and decrease predicted flood damages (does not include major flood control projects such as dikes, levees, seawalls, groins and jetties).

Objective: The objective of this measure is to provide another funding stream for mitigation planning to help state and local floodplain managers avoid impacts associated with major flood events.

2.2.1 Current State Programs and Policies State floodplain managers from Kansas, Nebraska, Iowa and Missouri were not aware of the proposed change in policy, but felt that new funding would always be welcome. They said they would need to review the application requirements and funding limitations associated with the new legislation before they could determine its applicability to their programs. We did not receive comments from the state of Illinois.

Kansas: The state of Kansas is already developing a floodplain mitigation

plan. State officials plan to take their mitigation plan to river basin district meetings throughout the year for the district committees to review it and identify additional mitigation requirements. Once this has been accomplished and the plan is finalized, Hazard Mitigation Program personnel will initiate legislative efforts to obtain funding for these projects.

State officials felt that additional mitigation funding couldn't hurt, but that proper Federal Government enforcement of the NFIP rules and regulations already in place would be more beneficial to the State. They provided the following example to illustrate their point:

> "Mitigation project personnel responded to an area that had just suffered its fourth flood event, and determined that the individuals affected were not eligible for disaster assistance because they were not carrying flood insurance. Then personnel from NFIP came in behind them and provided assistance anyway."

Their point is that the Federal Government is indiscriminately providing assistance to flood victims, instead of requiring them to follow the regulations and take responsibility for insuring their own property. This does not discourage people from living in the floodplain, it encourages them by giving the impression they will be taken care of regardless of the cost.

Minnesota: The state of Minnesota established a flood hazard mitigation program to provide state technical and financial assistance to local governments for conducting flood damage reduction studies and implementing structural and non-structural flood damage reduction measures in 1987.

Under the flood hazard mitigation program, the Minnesota Department of Natural Resources may award grants up to $75,000, which must be equally matched by local governments. According to the Minnesota Department of Natural Resources publication, *Floodplain Management, A Handbook for Local Officials*:

> "financial assistance may be available for conducting flood damage reduction studies and for planning and implementing structural and non-structural measures including: dams, dikes, levees, flood bypass channels, flood storage and retardation structures, water level control structures, acquisition of floodplain lands, relocations, floodproofing, development of flood warning systems and evacuation procedures, development of flood mitigation plans, flood prone structure inventories, emergency levee evaluations, signs and other notifications of 100-year flood areas, provision of flood insurance information and public education activities."

Missouri: The state of Missouri has fully embraced the mitigation concept and has initiated a very aggressive program to relocate and acquire structures within the floodplain. The State's program has resulted in the relocation of 3,500 Missouri families out of the floodplain since the "Flood of 93". The Missouri Department of Economic Development has estimated that the $80 million invested to-date in the State buyout program will save taxpayers well over $250 million in future flood claims.

Nebraska: Officials with the Nebraska Department of Natural Resources stated that they do not receive any funding from NFIP for mitigation planning at this time. They did participate in the program for a one-year period, but felt their time could be better spent focusing on community programs. They stated that the NFIP required them to sign a contract with a preset number of communities to contact in order to qualify for funding. This required them to work with communities that were less in need of their assistance, requiring time and resources that they could have used for communities needing more assistance.

Officials with the state of Nebraska stated that they will look into the new funding provided by the policy change, but will only participate if they have more control over how the funding is used to help communities.

Wisconsin: The state of Wisconsin strongly supports the new mandatory requirement to have local mitigation plans prior to the receipt of mitigation assistance. They feel that promoting mitigation as an option for communities immediately after a flood represents an opportunity to educate local officials on the linkage between long-range planning and recovery.

2.2.2 Impacts The states of Kansas, Minnesota, Missouri and Wisconsin have already implemented mitigation planning programs. Officials with these states felt that mitigation is one of the keys to reducing damages within the floodplain. Floodplain managers from the state of Wisconsin also strongly supported the new legislation as a means to convince local communities to incorporate mitigation planning into their long-range planning process.

Overall, this measure will have a low impact (reduction) on floodplain damages because of the limited amount of funding provided by the program when compared to the number of communities requiring mitigation plans. According to the NFIP Community Status Book, 5 December 1994, there are approximately 3,972 communities located in flood hazard areas in the seven state region under study. If the entire $1.5 million in mitigation planning funds were used for communities, then a total of 30 communities could be funded each year. At this rate it would take approximately 132 years to fund mitigation plans for all of the communities in the seven state region.

While this measure may have a low impact on the total need, it will have a high impact on the communities which receive grants through the program. The grants will allow these communities to develop strategies for reducing their flood damage risk, giving them a powerful tool for making funding and future development decisions. These plans will also help the communities take advantage of Federal and State funding for mitigation activities.

An assessment of the potential changes in damages experienced during the "Flood of 93" as a result of this measure is provided by impact category below (see Section 4, Impact Matrices).

- **Flood Damage Change (Low)** There will be a low reduction in flood damages as a result of the mitigation planning associated with this measure. The low impact rating is based on the relatively low amount of

funding for the program when compared to the number of communities requiring mitigation plans.

- **Government Expenditure Change (Low)** There will be a low reduction in government expenditures as a result of the mitigation planning associated with this measure. The low impact rating is based on the relatively low amount of funding for the program when compared to the number of communities requiring mitigation plans.

- **Change in Floodplain Resources (None)** There will be no appreciable change in the urban income potential associated with undeveloped floodplain lands as a result of this measure.

- **Critical Facilities (Low)** There will be a low reduction in the number of critical facilities at risk as a result of the mitigation planning associated with this measure. The low impact rating is based on the relatively low amount of funding for the program when compared to the number of communities requiring mitigation plans.

- **Protection/Avoidance of Harm (Low)** There will be a low reduction in the number of people vulnerable as a result of the mitigation planning associated with this measure. The low impact rating is based on the relatively low amount of funding for the program when compared to the number of communities requiring mitigation plans.

- **Social Well Being (Low)** There will be a low reduction in the number of households vulnerable as a result of the mitigation planning associated with this measure. The low impact rating is based on the relatively low amount of funding for the program when compared to the number of communities requiring mitigation plans.

- **Implementation Costs (Low)** The implementation costs for this program are low compared to the amount of damage experienced during the "Flood of 93". The legislation has already been passed, therefore the only costs associated with the program are the $1.5 million in grants and administrative costs associated with running the program.

2.3 MEASURE S3 Locational requirements and contingency planning requirements for critical facilities are tightened to avoid the standard project flood (SPF) or provide protection against the SPF (Scenario 2).

The SPF discharge in a river represents the flow that can be expected from the most severe combination of meteorologic and hydrologic conditions reasonably characteristic of the geographic region involved, approximately equal to the 500-year flood elevation.

Critical facilities were broken down by the Corps into the four categories listed below for this study:

Hazardous Materials Production, Storage and Waste Facilities: These include pipelines and petrochemical facilities, superfund sites, landfills, and hazardous waste facilities;

Essential Utilities: These include municipal and industrial NDPES sites, water treatment plants, major water supply intakes, water well fields, sewage treatment plants, power plants, major power utility substations, and communication equipment and related antennas;

Essential Services: These include hospitals, group homes for the mobility impaired, schools, major airports, federal post offices, state or federal bridges, and prisons; and

Emergency Services: These include fire departments, police stations, and military bases.

This measure will only examine the impacts associated with providing SPF protection to hazardous materials production, storage, and waste facilities and essential utilities. It is not economically feasible to protect all existing essential services and emergency services facilities to the SPF.

Objective: The objective of this measure is to reduce the risk to critical facilities by increasing the structural protection around these facilities and tightening the siting requirements for future facilities within the floodplain.

2.3.1 Current State Programs and Policies

Illinois: The state of Illinois does not have separate regulations addressing critical facilities. The State does, however, require communities to follow the guidelines in the Federal Emergency Management (FEMA) model ordinance, which stipulates that no development in the 100-year floodplain shall include locating or storing chemicals, explosives, buoyant materials, flammable liquids, pollutants, or other hazards or toxic materials below the Flood Protection Elevation (FPE) unless such materials are stored in a storage tank or floodproofed building. The FPE is the 100-year flood elevation plus one foot.

New and replacement sanitary, sewer lines and on-site waste disposal systems

may be permitted providing all manholes or other above ground openings located below the FPE are watertight.

Iowa: The state of Iowa currently requires that hospitals and like institutions; buildings or building complexes containing documents, data, or instruments of great public value; buildings or building complexes containing materials dangerous to the public or fuel storage facilities; power installations needed in emergencies or buildings or building complexes similar in nature to these uses be protected to the 500-year flood elevation plus one foot. Wastewater treatment facilities, sanitary landfills, water supply treatment facilities, and other habitable residential buildings or industrial facilities where flooding would result in high public damages will be protected to the 100-year flood elevation plus one foot.

Kansas: The state of Kansas does not have separate regulations addressing critical facilities. The State does, however, require communities to follow the guidelines in the FEMA model ordinance, which stipulates that no development in the 100-year floodplain shall include locating or storing chemicals, explosives, buoyant materials, flammable liquids, pollutants, or other hazards or toxic materials below the Flood Protection Elevation (FPE) unless such materials are stored in a storage tank or floodproofed building. The FPE is the 100-year flood elevation plus one foot.

New and replacement sanitary, sewer lines and on-site waste disposal systems may be permitted providing all manholes or other above ground openings located below the FPE are watertight.

Minnesota: The state of Minnesota currently requires that all public utilities and facilities such as gas, electrical, sewer, and water supply systems located in the floodplain be floodproofed in accordance with the State Building Code or elevated above the Regulatory Flood Protection Elevation (RFPE). The RFPE is an elevation no lower than the 100-year flood elevation plus any increase in flood levels resulting from the designation of flood fringe areas. The Minnesota Department of Natural Resources strongly encourages all communities to also include at least one foot of freeboard in their local ordinance.

Missouri: There are no state-level policies governing the siting or protection of critical facilities within the state of Missouri at this time. The Governor's Task Force on Floodplain Management did, however, recommend that state-wide standards for new construction in the floodplain be established to:

> "prohibit construction of critical structures and facilities (hospitals, nursing homes, retirement homes, homes for the elderly or handicapped, emergency and rescue facilities, prisons, drinking water, electric power supply substations, sewage treatment) in the floodplain. (It is recognized there may be no alternative upland site for sewage treatment. If not, then sewage treatment structures must be elevated two feet above base flood elevation.)"

The Task Force also recommended that the State:

> "enact building standards for critical structures that require either elevation or flood-proofing two feet above the base flood (100-year flood elevation) elevation, or vacating basements and floors to a level two feet above base flood elevation."

The Missouri state legislature and various governmental agencies are currently reviewing the findings of the Task Force report to determine what, if any actions the State will take to decrease the impacts of flooding in Missouri.

Nebraska: The state of Nebraska's floodplain zoning regulations require that:

- public utilities and facilities (i.e. sewer, gas, electrical and water systems) shall be located and constructed to minimize or eliminate flood damage;
- new and replacement water systems shall be designed to minimize or eliminate infiltration of flood waters into the system;
- new and replacement sanitary sewer systems shall be designed to minimize or eliminate infiltration of flood waters into the system and discharges from the system into flood waters; and
- on-site waste disposal systems shall be designed to avoid impairment to them or contamination from them during flooding.

Wisconsin: The state of Wisconsin prohibits the placement of solid or hazardous waste disposal facilities in floodfringe areas (that portion of the floodplain outside of the floodway, which is covered by flood water during a 100-year flood event). Public utilities, streets and bridges in the floodfringe must be adequately floodproofed.

The state of Wisconsin also stipulates that the storage of materials that are buoyant, flammable or explosive, or which in times of flooding could be injurious to property, water quality or human, animal, plant, fish or aquatic life shall be floodproofed to or placed at or above the FPE.

2.3.2 Impacts This measure proposes the structural protection of all existing hazardous materials production, storage and waste facilities, and essential utilities to meet the SPF, or the relocation of these facilities and siting of new facilities outside of the SPF.

An assessment of the potential changes in damages experienced during the "Flood of 93" as a result of this measure is provided by impact category below (see Section 4, Impact Matrices).

- **Flood Damage Change (Low)** There will be a low reduction in the amount of flood damages as a result of increasing the flood protection for hazardous materials production, storage and waste facilities, and essential utilities. With no values available for critical facility

damages versus overall damages, it was assumed that the damages associated with these facilities were small when compared to the overall damages experienced during the "Flood of 93".

- **Government Expenditure Change (Low)** There will be a low reduction in government expenditures as a result of increasing the flood protection for hazardous materials production, storage and waste facilities, and essential utilities. With no values available for critical facility damages versus overall damages, it was assumed that the damages and government expenditures associated with these facilities were small when compared to the overall damages experienced during the "Flood of 93".

- **Change in Floodplain Resources (None)** There will be no appreciable change in the urban income potential of the land near critical facilities as a result of their increased levels of protection. The increased protection provided to the critical facilities will not increase protection levels for undeveloped land.

- **Critical Facilities (High)** There will be a high reduction (100 percent) in the number of critical facilities with harmful releases at risk from flooding if all of the facilities are protected to the SPF. There will be a moderate reduction in the number of other critical facilities at risk because the decision was made to only require SPF protection for hazardous materials production, storage and waste facilities, and essential utilities. This will leave essential and emergency services facilities still at risk from flooding.

- **Protection/Avoidance of Harm (Low)** There will be a low reduction in the number of people at risk because this measure only addresses the protection of critical facilities, not households.

- **Social Well Being (None)** There will be no change in the number of communities and residential structures at risk as a result of protecting critical facilities to the SPF.

- **Implementation Costs (High)** The implementation costs associated with planning, designing and constructing structural protection for all of the hazardous materials production, storage and waste facilities, and essential utilities in the seven state FPMA study area to meet the SPF will be very high. The costs associated with building levees, floodwalls, dikes and other structural types of protection are high because of the large amounts of labor and materials required for such projects.

2.4 MEASURE S4 Community Development Block Grants (CDBG) through the Department of Housing and Urban Development (HUD) are provided which finance relocations in NON-DISASTER situations, once cost sharing requirements are met by state/local governments (Scenario 2).

The CDBG program provides formula grants to metropolitan cities and urban counties and to States for use in non-entitlement areas which do not receive entitlement grants. All funded activities must meet one of three broad national objectives: to benefit low and moderate income persons; to eliminate slums and blight; or to meet urgent community development needs. These grants are currently available for the acquisition and relocation of facilities through supplemental appropriations that occur after a natural disaster.

According to the *Galloway Report*,

> "The 1993 Supplemental Appropriation included $200 million for the CDBG program to assist in acquisition and relocation and in meeting other housing needs. The 1994 Earthquake Supplemental included an additional $250 million for a total of $450 million."

The CDBG program is not currently a cost sharing program, funds are distributed to the requesting States and communities with no requirement for matching funds. The measure proposes to change this to a cost sharing program, most likely at the standard federal match of 75 percent federal and 25 percent local.

Objective: The objective of this measure is to provide states and communities with another funding stream to be more proactive in acquiring and relocating floodprone facilities prior to a disaster.

2.4.1 Current State Programs and Policies One of the most significant changes in state and community policies and programs after the "Flood of 93" was the move towards mitigation. Floodplain managers and government officials realized after the flooding that the only way to prevent similar disasters was to relocate, acquire or demolish the structures at the greatest risk. The following discussion examines the ongoing programs for the states included in this study, with the exception of the states of Illinois and Minnesota, who did not provide comments on this measure.

Iowa: The following table from FEMA Region VII outlines some of the FEMA 404 Hazard Mitigation Grant projects that are currently being pursued in the state of Iowa (FEMA column represents total project cost):

Summary of Iowa FEMA Acquisition and Relocation Projects

Community	*Type*	*Number*	*FEMA*
Ames	Acquisition	26	$1,690,685
Audubon	Acquisition	29	$407,702

Buffalo	Acquisition	1	$96,500
Cedar Falls	Acquisition	40	$1,068,787
Chelsea	Acquisition/Relocation	136	$5,000,000
Cherokee	Acquisition	171	$5,267,523
Davenport	Acquisition	2	$135,560
Des Moines	Acquisition	126	$2,000,000
Des Moines County	Acquisition	52	$2,790,815
Estherville	Acquisition	10	$74,770
Evansdale	Acquisition	8	$193,880
Fairbank	Acquisition	5	$99,150
Farmington	Acquisition	12	$106,500
Independence	Acquisition	1	$245,429
Louisia County	Acquisition	198	$12,578,971
Marion	Acquisition	3	$324,900
Maxwell	Acquisition	6	$646,243
Muscatine	Acquisition	10	$158,588
Muscatine County	Acquisition	2	$129,576
Nevada	Acquisition	13	$1,011,895
Rock Rapids	Acquisition	6	$112,223
Scott County	Acquisition	3	$105,652
Van Buren County	Acquisition	8	$203,967
Wappello County	Acquisition	23	$769,462
	Total	891	$35,218,778
Source: FEMA Region VII, 9 Dec 1994			

Kansas: The state of Kansas has identified 15 communities with facilities in need of relocation funding. Officials with the Kansas Hazard Mitigation Program estimated that the State would require approximately $50 million to relocate all of these facilities, but that they currently have only $15 million in funding.

The following table from FEMA Region VII outlines some of the FEMA 404 Hazard

Mitigation Grant projects that are currently being pursued in the state of Kansas (FEMA column represents total project cost):

Summary of Kansas FEMA Acquisition and Relocation Projects			
Community	*Type*	*Number*	*FEMA*
Douglas County	Acquisition	5	$210,000
Easton	Acquisition	12	$299,130
Ellsworth	Acquisition	19	$187,330
Harvey County	Acquisition	18	$594,600
Jefferson County	Acquisition	1	$52,175
Kansas City	Acquisition	56	$3,065,114
Leavenworth County	Acquisition	9	$365,813
Riley County	Acquisition	346	$4,901,170
Shawnee County	Acquisition	14	$278,000
Tonganoxie	Acquisition	1	$50,000
Willard	Acquisition	10	$318,000
	Total	491	$10,321,332
Source: FEMA Region VII, 9 Dec 1994			

Missouri: The Missouri Department of Economic Development prepared a report in December 1994 outlining the State's experiences with the Community Development Block Grant Program during the "Flood of 93", entitled *A Summary Report for Flood Recovery*. According to the report, Missouri received $97 million in CDBG funds in 1993 and 1994 from HUD. In addition to the State allocation, HUD also provided approximately $40 million in CDBG funds directly to disaster communities (i.e. St Louis, St Louis County, Kansas City, St Charles, St Joseph and Independence). These funds are being used by the State and communities to proceed with projects related to acquisition and relocation, public facilities, and economic development.

The report cited the following "areas of excellence" with respect to the State's use of CDBG funds:

- $80 million invested in State buyout program, will save Missouri taxpayers well over $250 million in future flood damage claims;
- provided Missourians with low to moderate income housing outside of the floodplain, breaking the flooding/rebuilding cycle;

- gave the State and communities the means to match and use FEMA 404 Hazard Mitigation Grant funds;

- Governor's Office decided early on that the State's priority would be relocation, allowed emergency assistance personnel to eliminate elevation and rehabilitation projects from the evaluation process; and

- resulted in the relocation of 3,500 Missouri families out of the floodplain.

The report also provided the following lessons learned and recommendations for improving the program:

- there should be one buyout program form for communities to fill out, versus separate forms for FEMA 404 and CDBG funds;

- FEMA and HUD policy decision changes during the initial buyout program made it difficult for communities to prepare applications; and

- state agencies need to address emergency management on a day-to-day basis, rather than pulling out regulations and trying to prepare plans and policies during an emergency.

The following table from FEMA Region VII and the Missouri Department of Economic Development outlines some of the FEMA 404 Hazard Mitigation Grant and CDBG projects that are currently being pursued in the state of Missouri (FEMA column represents total project cost):

Summary of Missouri FEMA and CDBG Acquisition and Relocation Projects

Community	Type	Number	Description	FEMA	CDBG
Alexandria	Acquisition	106	Residential	$1,039,016	$657,758
Boone County	Acquisition	6	Residential	$343,000	-
Buchanan County	Acquisition	39	Residential	$946,950	$678,825
Camden County	Acquisition	-	Residential/Business	-	$1,255,978
Carroll County	Acquisition	55	Residential	$353,000	$202,500
Clark County	Acquisition	25	Residential	$805,000	$425,800
Cooper County	Acquisition	-	Residential	-	$92,492
Edgerton	Acquisition	5	Residential	$78,300	-
Excelsior Springs	Acquisition	99	Residential	$1,366,110	$683,055
Franklin County	Acquisition	14	Residential	$612,717	$321,640
Hartsburg	Acquisition	3	Residential	$100,500	-
Hermann	Acquisition	16	Residential/Business	$1,574,250	$153,000
Howard County	Acquisition	73	Residential/Business	$1,660,128	$2,217,054

Jefferson County	Acquisition	444	Residential/Business	$7,979,375	$5,747,624
Jefferson City	Acquisition	181	Residential/Business	$2,668,202	$2,457,216
Levasy	Acquisition	9	Residential	$214,862	$111,681
Lewis County	Acquisition	32	Residential	$565,135	$379,717
Lincoln County	Acquisition	285	Residential	$4,067,360	$4,110,210
Marion County	Acquisition	151	Residential/Business	$3,471,024	$2,912,559
Marthasville	Acquisition	20	Apartments	$333,400	-
Maryville	Acquisition	2	Residential	$90,000	$70,000
Montgomery County	Acquisition	28	Residential/Business	$1,359,500	$2,806,525
Morrison	Acquisition	-	Residential	-	$73,200
Neosho	Acquisition	21	Residential	$714,000	$286,800
Park Hills	Acquisition	-	Residential/Business	-	$1,511,180
Pattonsburg	Acquisition	197	Residential/Business	$4,200,000	$5,075,000
Perry County	Acquisition	41	Residential	$578,303	$421,481
Phelps County	Acquisition	15	Residential	$444,773	$141,950
Platte County	Acquisition	25	Residential/Business	$347,970	$3,340,160
Ralls County	Acquisition	-	Residential	-	$59,760
Rock Port	Acquisition	-	Residential	-	$203,000
Springfield	Acquisition	-	Residential	-	$482,600
St Charles County	Acquisition	1,508	Residential/Business	$13,505,419	$6,563,575
St Genevieve	Acquisition	162	Residential/Business	$1,985,921	$1,582,768
St Louis County	Acquisition	557	Residential	$7,146,773	$4,096,100
Warren County	Acquisition	21	Residential	$263,000	$145,500
Waynesville	Acquisition	-	Residential	-	$194,010
Willow Springs	Acquisition	-	Public	-	$395,500
	Total	4,143		$58,813,988	49,856,218

This table clearly illustrates the importance that the state of Missouri has placed on moving its citizens out of the floodplain and away from risk. The table also demonstrates how the State took full advantage of funds available to communities in both the FEMA 404 Hazard Mitigation and CDBG programs.

Nebraska: The state of Nebraska is currently pursuing FEMA 404 Hazard Mitigation Grant acquisition of 26 residential and 25 commercial properties in the City of Beatrice. FEMA Region VII estimated that the total project cost would be $902,850.

Wisconsin: There are approximately nine communities in the State actively pursuing the following acquisition and relocation projects.

Summary of Wisconsin Acquisition and Relocation Projects

Community	Type	Number	Description	Estimated Cost
Darlington	Relocation	8	Business	$861,275
Pierce County	Relocation	94	Residential/Business	$6,000,000
Eau Claire	Acquisition	99	Residential	$4,450,000
Eau Claire	Relocation	10	Residential	$815,000
Eau Claire County	Acquisition	10	Residential	$769,000
Spring Green	Acquisition	1	Residential	*
Spring Green	Relocation	4	Residential	*
Fitchburg	Acquisition	2	Residential	$68,000
Vernon County	Relocation	49	Residential	$3,000,000
Jefferson County	Relocation	24	Residential	$1,300,000
Kenosha County	Relocation	75	Residential	$3,200,000
	Total	376		$20,463,275

Source: Wisconsin Interagency Disaster Recovery Group

* Estimated cost not available at this time

The State is currently providing 50 percent of the local communities' matching requirements for FEMA Hazard Mitigation Grant Program acquisition and relocation grants. This means that the communities are paying 12.5 percent, the State 12.5 percent and FEMA 75 percent of the grant.

According to the Wisconsin Department of Natural Resources, the department is also proposing the inclusion of $500,000 in the Fiscal Year 1995 State budget for Mitigation Grant Assistance for local communities. The money would be provided to the communities on a 50/50 matching basis for acquisition, relocation and floodproofing projects.

2.4.2 Impacts The "Flood of 93", perhaps more than any other flood event has shown floodplain managers that the only sure way to avoid flood damages is to acquire, relocate or demolish structures at risk. The seven states considered by this study have initiated FEMA 404 Hazard Mitigation Grant and CDBG projects to acquire or relocate approximately 5,901 properties or structures at an estimated cost of over $174 million. The state of Missouri accounts for the largest percentage of this activity, with projects to acquire or relocate 4,143 properties or structures.

The states did not provide a great deal of feedback on the merits of this

measure, but rather concentrated on reviewing their current mitigation efforts. They did, however, feel that it would be a good idea to continue pursuing funding avenues for mitigation projects not related to disaster relief. The floodplain managers also liked the flexibility they currently have to use CDBG funds to provide state and local matching funds for FEMA 404 Hazard Mitigation Grants.

It is important to note that the benefits of mitigation activities such as acquisitions, relocations and demolition are high regardless of the funding source, because theses activities eliminate the risk to structures associated with flooding. Therefore, the impact assessments shown below reflect the benefits of funding mitigation activities in general. It does not necessarily indicate that changes to the CDBG program are the best way to fund mitigation activities. Further analysis of the ramifications associated with changing the CDBG program would be required to determine if would provide the best source for non-disaster mitigation funding.

An assessment of the potential changes in damages experienced during the "Flood of 93" as a result of this measure is provided by impact category below (see Section 4, Impact Matrices).

- **Flood Damage Change (High)** There will be a high reduction in non-agricultural flood damages as a result of the acquisitions and relocations that could be funded with non-disaster CDBG funds. The high impact rating is based on the fact that mitigation activities (acquisition, relocation and demolition) completely eliminate the risk of flood damages to the affected structures and their occupants. The extent of the benefits would depend on the amount of the expenditures.

- **Government Expenditure Change (High)** There will be a high reduction in non-agricultural government expenditures as a result of the acquisitions and relocations that could be funded with non-disaster CDBG funds. The high impact rating is based on the fact that mitigation activities (acquisition, relocation and demolition) completely eliminate the risk of flood damages to the affected structures and their occupants. The extent of the benefits would depend on the amount of the expenditures.

- **Change in Floodplain Resources (None)** There will be no change in the urban income potential associated with undeveloped floodplain properties. This is based on the assumption that the zoning for undeveloped land is not changed by this measure.

- **Critical Facilities (Low)** There will be a low reduction in the number of critical facilities at risk as a result of providing CDBG funding for acquisitions and relocations in non-disaster situations. A large percentage of these facilities are location dependant, and cannot easily be relocated.

- **Protection/Avoidance of Harm (High)** There will be a high reduction in the number of people vulnerable as a result of the acquisitions and relocations that could be funded with non-disaster CDBG funds. The high

impact rating is based on the fact that mitigation activities (acquisition, relocation and demolition) completely eliminate the risk of flood damages to the affected structures and their occupants. The extent of the benefits would depend on the amount of the expenditures.

- **Social Well Being (High)** There will be a high reduction in number of households vulnerable as a result of the acquisitions and relocations that could be funded with non-disaster CDBG funds. The high impact rating is based on the fact that mitigation activities (acquisition, relocation and demolition) completely eliminate the risk of flood damages to the affected structures and their occupants. The extent of the benefits would depend on the amount of the expenditures.

- **Implementation Costs (Moderate)** The implementation costs for this program will be moderate when compared to the amount of damage experienced during the "Flood of 93".

2.5 MEASURE S5 State governments as well as federal agencies are also required to meet the standards contained in Executive Order (E.O.) 11988 (Scenario 3).

E.O. 11988 directs federal agencies to evaluate the potential effects of their actions on floodplains and to include the evaluation and consideration of flood hazards in agency permitting and licensing procedures. Since federal actions covered by the E.O. include federal financing programs, the requirements apply to a broad range of construction and development activities at state and local levels. The E.O. also establishes the one percent chance flood (100-year flood elevation) as the standard to be used by all federal agencies for non-critical actions and the 0.2 percent chance flood (500-year flood elevation) for critical actions.

In laymans terms, this means that the federal government should not fund or construct infrastructure type projects (sewage and water treatment plants, highways, prisons, hospitals, airports, etc.) in or near floodplains unless there is no viable alternative, because these types of facilities will encourage people and businesses to move into the area. If a facility must be built within the floodplain, then the E.O. requires that structural protection be provided for the facility to the appropriate flood elevation, and that restrictions are put into place to limit new development in relation to the facility.

For example, the *Floodplain Management in the United States: An Assessment Report* provides the following example of a facility that was sited within a floodplain:

> In 1983, in accordance with E.O. 11988, the U.S. Environmental Protection Agency (EPA) agreed to provide federal funds for a sewer system only if the state and Worcester County, Maryland promised to deny sewer hookups for new development inside the "100-year" floodplain. The only exception to the ban was for property that had been platted for development before 1977, and existing homes and buildings.
>
> A local property owner brought the issue to court, arguing that he needed sewer hookups to develop and that the State has the authority to restrict sewer hookups only if it was necessary to ensure that the treatment plant did not become overloaded. The Worcester County Circuit Court ruled that the State and local government officials did not have the authority to enter into the agreement with EPA. However, in June 1989 the Maryland Court of Appeals overturned the Circuit Court decision and upheld the agreement. The appeals court supported the State and local governments as having "made a rational determination ... that the federal grant proposal presented the most viable alternative available to abate the deteriorating conditions in West Ocean City." The court also noted that the property owner could develop the land by installing his own sewerage system and stated that "The burdens on ... [the owner's] rights are necessary and not unreasonable to promote the general public health and welfare."

Objective: The objective of this measure is to encourage states to be more responsible for floodplain management by directing all of their agencies to:

- avoid directly or indirectly supporting floodplain development;
- avoid actions located in or affecting the floodplain, unless the floodplain location is the only practicable alternative; and
- in the absence of a practicable alternative, require that actions be designed or modified in order to minimize potential harm to or within the floodplain.

2.5.1 Current State Programs and Policies According to the *National Flood Policy in Review - 1994*, Association of State Floodplain Managers:

> "E.O. 11988 directs federal agencies to comply with wise floodplain management practices. Although on its face it is a powerful mandate, E.O. 11988 unfortunately seems to be receiving only marginal compliance."

Illinois: The state of Illinois requires that all construction within the floodplain, regardless of the funding used for the project adhere to applicable federal, state and local regulations.

Iowa: The state of Iowa requires that all construction within the floodplain, regardless of the funding used for the project adhere to applicable federal, state and local regulations.

Kansas: The state of Kansas requires that all construction within the floodplain, regardless of the funding used for the project adhere to applicable federal, state and local regulations.

Minnesota: The state of Minnesota requires that all state agencies and local units of government comply with Minnesota regulations in the construction of structures, roads, bridges or other facilities located within floodplain areas delineated by local ordinance.

Missouri: Missouri currently has no state-level program to monitor or discourage development in the floodplain. Construction must, however, meet local floodplain zoning requirements.

Nebraska: The state of Nebraska has directed its state agencies to assure that when state lands are used and state-owned and state-financed facilities are located and constructed, flood hazards are prevented, flood losses are minimized, and the State's eligibility for flood insurance is maintained.

Wisconsin: The governor signed Executive Order 132 in 1992, establishing floodplain management guidelines for state agencies and creating the Flood Hazard Interagency Coordinating Committee. The E.O. requires all state agencies proposing to construct new facilities in the 500-year floodplain to go through an eight step decision making process to document impacts and lessen the risk of losses to floods.

The E.O. also stipulates that public facilities, including additions to existing facilities which will be owned or leased by the State may not be constructed in the 100-year floodplain unless there is no practicable alternative. Critical use facilities which will be owned or leased by the State may not be constructed in the 500-year floodplain unless there is no practicable alternative.

2.5.2 Impacts This measure will have the positive impact of encouraging state governments to more closely follow and assess the impacts of their actions on the floodplain. It will, however, only regulate floodplain development funded with state monies, not development which is funded by private citizens and corporations.

An assessment of the potential changes in damages experienced during the "Flood of 93" as a result of this measure is provided by impact category below (see Section 4, Impact Matrices).

- **Flood Damage Change (Low)** There will be a low reduction in the flood damages as a result of implementing E.O. 11988 at the state-level. The low impact rating is based on the fact that the E.O. will only regulate state funded development in the floodplain and does not address the flood damage risk to existing facilities.

- **Government Expenditure Change (Low)** There will be a low reduction in government expenditures as a result of implementing E.O. 11988 at the state-level. The low impact rating is based on the fact that the E.O. will only regulate state funded development in the floodplain and does not address the flood damage risk to existing facilities.

- **Change in Floodplain Resources (Moderate)** There will be a moderate reduction in urban income potential of undeveloped floodplain land as state funded infrastructure projects are not completed within the floodplain. This measure may affect the viability or development costs of private projects in the floodplain to the extent that public services or utilities would be limited.

- **Critical Facilities (Low)** There will be a low reduction in the number of critical facilities at risk. The impact is low because the measure only affects state funded construction of critical facilities and it does not address critical facilities that are already at risk. Federally-funded projects are already covered by this policy.

- **Protection/Avoidance of Harm (Low)** There will be a low reduction in the number of people vulnerable as a result of implementing E.O. 11988 at the state-level. The low impact rating is based on the fact that the E.O. will only regulate state funded development in the floodplain and does not address the flood damage risk to existing facilities.

- **Social Well Being (Low)** There will be a low reduction in the number of households vulnerable as a result of implementing E.O. 11988 at the state-level. The low impact rating is based on the fact that the E.O.

will only regulate state funded development in the floodplain and does not address the flood damage risk to existing facilities.

- **Implementation Costs (Low)** The costs for implementing E.O. 11988 at the state-level would be low, since it is mainly an administrative matter. The administrative costs would consist of tracking and review of state construction funding. The indirect cost of implementation would be higher. The effect may increase the cost of some projects, and result in the loss of state funding.

SCENARIO CATEGORY D

State Floodplain Management & Zoning

	IMPACT CATEGORIES	A Base Cond. [All Disast. Counties]	B Base Cond. [FPMA Imp. Counties]	Scenario 1	Scenario 2	Scenario 3
	ECONOMIC (1,000 $'s)		[1]			
	Flood Damages					
1	Residential (Urban)	$760,892	$662,008	–LOW	– HIGH	– LOW
2	Other (Urban)	$1,612,543	$1,447,322	– LOW	– HIGH	– LOW
3	Agricultural	$3,852,701	$817,054	0	0	0
4	Other Rural	$233,648	$161,010	– LOW	– LOW	– LOW
	Chg. in Govt.Expend.					
5	Emergen.Resp.Costs	$227,405	$200,663	– LOW	– HIGH	– LOW
6	Disaster Relief (Agric.)	$1,160,632	$285,180	0	0	0
7	Disaster Relief (Human R.)	$1,297,474	$551,862	– LOW	– HIGH	– LOW
8	Flood Insurance (NFIP)	$371,969	$276,496	– LOW	– HIGH	– LOW
9	Flood Insurance (FCIC)	$748,095	$269,061	0	0	0
	Chg.Value of FP Resources					
10	Net Ag RE Values	–	–	0	0	0
11	Net Urban RE Values	–	–	0	0	– MODERATE
	ENVIRONMENTAL					
	Natur.Resour.(# acres)					
12	Non–Forested Wetl. (acres)	–	365,285	0	0	+
13	Threat.&Endang. (# / Occ.)	–	(281/1,043)	0	0	+
14	Forest (acres)	–	534,705	0	0	+
	Natural Fldpln.Functions					
15	Fldpln.inundated (acres)	–	776,276	0	0	0
	Cultural					
16	Archeol Impacts (–5 to +5)	–	–1	0(0)	–1(+1)	–1(0)
16A	Hist.Sites(–5 to +5)		–1	0(0)	–1(–2)	+1(0)
	Open Space					
17	Public lands (acres)	–	392,512	0	+	+
18	Recreation sites (#)	–	485	0	+	+
	REDUCT.OF RISK					
	Critical Facilities					
19	# Facil. w/harmful releases	–	207	– LOW	– HIGH	– LOW
20	# other critical facilities	–	1,208	– LOW	– MODERATE	– LOW
	Prot./Avoid. of Harm					
21	# people vulnerable	185,630	134,849	– LOW	– HIGH	– LOW
	Social Well Being					
22	# communities vulnerable	433	293	– LOW	– MODERATE	– LOW
23	# resident.struct.vulnerable	56,339	42,743	– LOW	– HIGH	– LOW
	IMPLEMENT. COSTS					
24	Structural Costs	–	–	0	–	–
25	Other Costs	–	–	+ LOW	+ HIGH	+ LOW

[1] Economic impacts collected only at the county level

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LOCAL FLOODPLAIN MANAGEMENT MEASURES

This section will address the local floodplain management measures associated with scenarios 1, 2 and 3 that local communities could enact to reduce flood damages. Each measure will be reviewed to determine current local-level programs and the impact that the measure would have had on the flood damages experienced during the "Flood of 93".

3.1 MEASURE L1 No major changes in local floodplain management and zoning trends; standards for participation in National Flood Insurance Program (NFIP) generally adhered to (Scenario 1).

This measure focuses on non-structural changes, such as changes in floodplain zoning ordinances which have been implemented since the "Flood of 93".

Objective: The objective of this measure is to identify local floodplain management policies and programs, and any changes that have been implemented since the "Flood of 93", as well as the impact of these changes.

3.1.1 Current Local Programs and Policies The following summary of eligible communities participating in the National Flood Insurance Program (NFIP) highlights changes in local floodplain zoning policies since the "Flood of 93". A total of 89 communities have implemented floodplain zoning ordinances meeting NFIP minimum requirements since 1992. The state of Iowa showed the greatest increase in participation, with 41 communities implementing new programs to participate in the NFIP.

Summary of Eligible Communities Participating in the NFIP Program

	1992			1994		
State	Participating	Mapped but not Participating	Total	Participating	Mapped but not Participating	Total
Illinois	736 (85%)	127	863	751 (86%)	119	870
Iowa	370 (63%)	215	585	411 (70%)	178	589
Kansas	302 (73%)	114	416	305 (73%)	112	417
Minnesota	469 (80%)	119	588	472 (80%)	118	590
Missouri	505 (82%)	113	618	520 (83%)	104	624
Nebraska	274 (81%)	64	338	285 (84%)	54	339
Wisconsin	484 (89%)	59	543	485 (89%)	58	543
Total	3,140 (79%)	811	3,951	3,229 (81%)	743	3,972

Source: National Flood Insurance Program, Community Status Book, 5 Dec 94 ≥ 1% Δ

To get a feel for changes in local floodplain policies and programs, fifteen communities were contacted about their programs. The following information contains an overview of each state's current level of community involvement

and a synopsis of the information received from individual communities.

Illinois: At 86 percent, the state of Illinois currently has the second highest NFIP participation rate of the seven states included in this study. The *Floodplain Management, Local Floodplain Administrator's Manual* prepared by the Illinois Department of Transportation, Division of Water Resources contains an overview of what is required for a local floodplain management program.

The City of Grafton has adopted Federal Emergency Management Agency (FEMA) model regulations for floodplain management, and has no plans to change its policies or procedures as a result of flooding in 1993. The City has also instituted a buy-out program with enough funding to meet its goals.

The City of Valmeyer currently adheres to the rules and regulations set forth by the NFIP. The City has no plans to change its policies or programs because it is relocating all buildings within the floodplain to a new site.

Iowa: The state of Iowa currently has the lowest NFIP participation rate of the seven states in this study. At 70 percent, it is 11 percent below the average participation rate for the seven states. The State did, however, have a seven percent (41 community) increase in participation since the "Flood of 93".

The City of Davenport has a Flood Damage Prevention ordinance that simply states that NFIP standards and State guidelines must be adhered to with one exception, construction in the floodplain will not decrease the volume of area allowed for flooding (No Net Loss of Volume) associated with creek ways. The No Net Loss of Volume ordinance was passed in 1990 as a result of creek flooding damage incurred during that year. The City has no plans to change its policies or procedures as a result of the "Flood of 93".

The City of Des Moines requires anyone planning to build within the floodplain to obtain a Certificate of Compliance prior to construction. Those wishing to build within the floodway must also obtain a permit stating that the structure meets their requirements for construction and that there will be no fill. These policies were established in 1981, and the City has no plans to alter them at this time.

Kansas: The state of Kansas currently has 73 percent of its eligible communities participating in the NFIP program, this is essentially the same level of participation that the State had before the 1993 flooding. This is the second lowest participation rate of the seven states under study.

The City of Kansas City has adopted the FEMA model zoning ordinance, and has made no changes to their regulations since the 1993 flooding. The City has, however, initiated an inventory of the floor elevations of commercial buildings in the 100-year floodplain.

Minnesota: The state of Minnesota currently has an 80 percent rate of participation in the NFIP program, and has not experienced any change in participation levels since the "Flood of 93".

The City of St Paul follows the guidelines set forth by the Minnesota Department of Natural Resources and FEMA, and has made no changes in its program since the "Flood of 93".

Missouri: The state of Missouri currently has an 83 percent rate of participation in the NFIP program, and experienced a one percent increase in participation after the 1993 flooding. It is encouraging to note the high levels of participation, because the state of Missouri relies almost entirely on local and county floodplain management programs.

The City of St Louis has adopted FEMA model floodplain management regulations. The City does not have any floodplain ordinances of their own, and does not plan to develop any as a result of the "Flood of 93".

Jefferson City adopted the FEMA model ordinance in 1987, and has made only minor changes to its requirements for storage tanks. The Jefferson City official contacted did not have specific information on the extent of the change.

The City of St Charles also adopted FEMA model regulations, and has no plans to change its policies and procedures as a result of the "Flood of 93". Officials with the city's Flood Relief Office stated that there is a buy-out program to purchase property in the floodplain for parks and recreational uses. They indicated that they are currently 50 percent complete with the project, and should have enough funding to fully accomplish their goals.

The City of St Joseph adheres to the FEMA model ordinance, and has also made no changes to its program since the 1993 flooding.

Nebraska: The state of Nebraska currently has an 84 percent level of participation in the NFIP program, and experienced a three percent increase in the number of communities participating since the "Flood of 93".

Sarpy County does not have any floodplain management policies or procedures of its own, they simply adhere to the guidelines outlined in the State policy. The County has no intention to implement a more stringent program at this time.

Wisconsin: The state of Wisconsin currently has an 89 percent level of participation in the NFIP program, the highest of the seven states under study. The state has not experienced a change in participation levels as a result of the 1993 flooding.

The Wisconsin Department of Natural Resources is currently developing a model mitigation/pre-disaster guidebook for use by communities within the state to develop their own local mitigation plans. The department has targeted seven communities in need of specific mitigation planning assistance to implement projects over the next two to five years to receive the first batch of guidebooks. Officials stated that Illinois and Ohio are also developing model mitigation plans for use by communities in their planning efforts.

The City of Darlington has developed and implemented a comprehensive flood hazard mitigation plan in response to the "Flood of 93". The plan identifies

structures and areas of the central city that are subject to repeated flooding or the risks of future flood events, and proposes strategies for minimizing or eliminating damages to these structures from flooding. Approximately 65 residences and businesses will be floodproofed or elevated under the plan, with approximately eight additional businesses voluntarily acquired and relocated.

The City of LaCrosse adheres to Wisconsin Department of Natural Resources and FEMA guidelines for floodplain management, and has made no changes since the "Flood of 93".

3.1.2 Impacts Eighty nine communities have implemented floodplain zoning ordinances to qualify for the NFIP program since the "Flood of 93". This represents a two percent increase in the total participation of the 3,972 communities identified as being in special hazard areas. The state of Iowa realized the largest increase in participation, with 41 communities becoming eligible for the NFIP program.

The local communities that were contacted in conjunction with this study have not made any non-structural (zoning) policy changes since the "Flood of 93". They have, however, been aggressively pursuing buyout programs and mitigation planning to help them avoid future damage during flooding conditions.

An assessment of the potential changes in damages experienced during the "Flood of 93" as a result of this measure is provided by impact category below (see Section 4, Impact Matrices).

- **Flood Damage Change (Low)** There will be a low reduction in flood damages as a result of changes in local floodplain zoning ordinances. The low impact rating is based on the two percent increase in NFIP participation levels.

- **Government Expenditure Change (Low)** There will be a low reduction in government expenditures as a result of changes in local floodplain zoning ordinances. The low impact rating is based on the two percent increase in NFIP participation levels.

- **Change in Floodplain Resources (None)** There will be no appreciable change in the urban income potential associated with undeveloped floodplain land affected by this measure. It is assumed that increased flood insurance eligibility associated with the increase in NFIP participation won't affect property values.

- **Critical Facilities (None)** There will be no impact on the number of critical facilities at risk as a result of the two percent increase in NFIP participation. This impact rating is based on the fact that the new zoning ordinances do not change the protection levels for existing critical facilities.

- **Protection/Avoidance of Harm (Low)** There will be a low reduction in the number of people vulnerable as a result of changes in local floodplain zoning ordinances. The low impact rating is based on the two percent increase in NFIP participation levels.

- **Social Well Being (Low)** There will be a low reduction in the number of households vulnerable as a result of changes in local floodplain zoning ordinances. The low impact rating is based on the two percent increase in NFIP participation levels.

- **Implementation Costs (Low)** The implementation costs associated with establishing the ordinances required for the 89 communities to become eligible for the NFIP program are low, since it only requires adoption of existing regulations. Administrative costs would not be significant either, because zoning review programs already exist in most communities.

3.2 MEASURE L2 Community Rating System (CRS) features are promoted; reduced premiums for structures in participating communities are increased from the current 5 percent discount to as much as 20-25 percent (Scenario 2).

The goal of the CRS is to encourage state and community activities to go beyond the basic National Flood Insurance Program (NFIP) requirements to:

- reduce flood losses;
- facilitate accurate insurance rating; and
- promote the awareness of flood insurance.

Communities that qualify will earn an initial five percent NFIP premium reduction, while ultimately premiums could be reduced up to 45 percent for policy holders in communities that exceed the minimum NFIP standards for floodplain land use management. The CRS is designed to be revenue neutral, meaning that reductions in premiums will reflect the reduced exposure to flood hazards and expected losses.

There are ten classes of communities under the CRS, with Class 1 having the greatest premium credit and Class 10 having no premium credit. The CRS class is based upon the number of credit points calculated for activities that are undertaken to reduce flood losses, facilitate accurate insurance rating, and promote the awareness of flood insurance. Communities are automatically given a Class 10 rating unless they apply for CRS classification and show that their floodplain management activities warrant a better class.

Communities in full compliance with the rules and regulations of the NFIP can apply for a CRS classification. The community must submit documentation with its application that it is implementing one or more of the 18 creditable activities recognized by the CRS. These activities fall into four categories: Public Information, Mapping and Regulations, Flood Damage Reduction, and Flood Preparedness. The communities are then given credit points based upon how well the activities affect the three goals of the CRS.

Communities that already exceed minimum NFIP standards anticipate that the CRS will increase public support for their programs, while floodplain managers that wish to improve their programs view the CRS as a political incentive for their elected officials to increase funding for floodplain management activities.

Small and economically disadvantaged communities, however, are concerned that a lack of funding and manpower will keep them from participating in the benefits offered by the program.

Objective: The objectives of this measure are to increase individual participation in the NFIP and induce more communities to exceed minimum NFIP floodplain land use management requirements by providing NFIP policy holders with higher reductions in premiums than currently available under the CRS.

3.2.1 Current Local Programs and Policies Some of the Public Information, Mapping and Regulations, Flood Damage Reduction, and Flood Preparedness

creditable activities required for CRS classification may be implemented by state or regional districts rather than at the local-level. Strong state and regional programs will, therefore, help smaller disadvantaged communities gain credit points under the CRS that they could not obtain for themselves.

To get a feel for CRS participation at the local level, fifteen communities were contacted about the program. The following information contains an overview of each state's current level of participation (where available) and a synopsis of the information received from individual communities.

Illinois: The *Floodplain Management, Local Floodplain Administrator's Manual* prepared by the Illinois Department of Transportation, Division of Water Resources contains an excellent overview of the CRS program and its application to communities within the state. It points out that all communities in the state can receive Flood Preparedness activity credit points if they apply for CRS classification, because the State has dam safety regulations that meet CRS criteria. State participation in the CRS program was not available.

Officials with the City of Grafton were not familiar with the CRS program, but stated that the City is an active participant in the NFIP. They said they would contact someone in the NFIP for more information about the CRS to decide whether or not it would be beneficial for the City to participate.

Officials with the City of Alton were familiar with the CRS program but are not currently participating. They did not indicate an intention to join the program.

The City of Valmeyer is not participating in the CRS program, and has no plans to participate in the future because they are relocating all buildings out of the floodplain.

Iowa: Iowa currently has two cities participating in the CRS program, Corralville and Des Moines. Corralville currently has a Class 8 rating, while Des Moines carries a Class 9 rating. Des Moines recently applied for a Class 8 rating, and is awaiting confirmation of its application. Officials with the City of Des Moines felt that an increase in premium reductions would induce residents to comply with regulations to a higher degree than is currently being experienced.

The City of Davenport has recently applied for participation in the CRS and hopes to receive a reply on its application in the near future. An increase in premium reductions would be an extra bonus to them, because they have already committed to the program.

Kansas: Kansas City officials indicated that they are not participating in the CRS program, and that they do not have a clear understanding of the program and its benefits. City officials stated that they were not sure that it would be cost effective for them to pursue the program. Information for the rest of Kansas was not available.

Minnesota: The Minnesota Department of Natural Resources publication, *Floodplain Management, A Handbook for Local Officials* has a good synopsis of

the CRS program. Information on state-level participation in this program was not available.

The City of St Paul is not participating in the CRS program, and did not indicate a desire to participate in the future.

Missouri: Information on state-level participation in the CRS program was not available.

Officials from St Louis felt that the CRS program would take too much time to make it worthwhile for them to participate, even at the higher premium reduction levels. The City of St Charles also has no plans to participate in the CRS.

Jefferson City is not participating in the CRS program, officials stated that they had a notebook on the program but that there were no immediate plans to pursue participation.

The City of St Joseph also does not participate in the CRS program, and showed no interest in participating.

Nebraska: Nebraska has two cities participating in the CRS, Fremont and Lincoln. Fremont currently qualifies for a five percent discount (Class 9), while Lincoln is qualified for a ten percent discount (Class 8) under the program.

Officials from Sarpy County attended a CRS seminar this summer and are reviewing the application requirements at this time. An increase in premium reductions would have a positive influence on their deliberations concerning participation in the program.

Wisconsin: Wisconsin has twelve communities participating in the CRS program. The state has developed a guide outlining the credit given to all Wisconsin communities based on state standards that provide greater flood protection than the NFIP minimum standards.

The City of Black River Falls does not participate in the CRS program, and the officials contacted were not familiar with it.

The City of LaCrosse is a CRS program participant. They currently qualify for a five percent discount (Class 9). Officials with the city felt that increased premium reductions would be an inducement for the community to improve their classification under the program.

3.2.2 Impacts In general terms, the majority of communities contacted about the CRS program were either not familiar with the CRS or felt that it was not cost effective for them to participate. Their main concern was that they would have to carry the financial burden of providing the programs and protection required to be eligible for the program, but would not receive the benefits the program offered to individuals. From this point of view, they did not see how they could fund these programs without passing on the costs to the ratepayers, which would eliminate the benefits they receive from the program.

The communities that are currently participating in the program did, however, feel that the increased NFIP premium reductions would provide an incentive for individual property owners to purchase flood insurance and pressure local governments to qualify for even higher premium reductions. This would in turn lead to better floodplain management programs within these communities.

An assessment of the potential changes in damages experienced during the "Flood of 93" as a result of this measure is provided by impact category below (see Section 4, Impact Matrices).

- **Flood Damage Change (Low)** There will be a low reduction in flood damages as a result of increased NFIP premium reductions. The low impact rating is based on the perception that communities have to develop and fund programs to qualify for CRS discounts, but that they do not receive any return on their investment if only policy holders receive the discounts. While this perception exists, the number of communities participating in the program will remain low.

- **Government Expenditure Change (Low)** There will be a low reduction in government expenditures as a result of increased NFIP premium reductions. The low impact rating is based on the perception that communities have to develop and fund programs to qualify for CRS discounts, but that they do not receive any return on their investment if only policy holders receive the discounts. While this perception exists, the number of communities participating in the program will remain low.

- **Change in Floodplain Resources (None)** There will be no impact on the urban income potential of undeveloped floodplain property as a result of increased NFIP premium reductions.

- **Critical Facilities (Low)** There will be a low reduction in the number of critical facilities at risk as a result of increased NFIP premiums. This is based on the assumption that there will be some increase in the level of participation that might drive increased protection for some critical facilities.

- **Protection/Avoidance of Harm (Low)** There will be a low reduction in the number of people vulnerable as a result of increased NFIP premium reductions. The low impact rating is based on the perception that communities have to develop and fund programs to qualify for CRS discounts, but that they do not receive any return on their investment if only policy holders receive the discounts. While this perception exists, the number of communities participating in the program will remain low.

- **Social Well Being (Low)** There will be a low reduction in the number of households vulnerable as a result of increased NFIP premium reductions. The low impact rating is based on the perception that communities have to develop and fund programs to qualify for CRS discounts, but that they do not receive any return

on their investment if only policy holders receive the discounts. While this perception exists, the number of communities participating in the program will remain low.

- **Implementation Costs (Moderate)** The implementation costs associated with establishing programs and funding activities to qualify for CRS discounts range from comparatively low for large communities to high for small communities. Small communities might have to commit a significant portion of their budget to meet the programs requirements, while large communities might already meet many of requirements without additional effort.

3.3 MEASURE L3 Communities are required to obtain private insurance to cover flood losses to public facilities in order to receive supplemental post-flood disaster assistance (Scenario 3).

For example, the *Galloway Report* cited the following example of the benefits of private insurance for public facilities:

> "In July 1993 the Des Moines Water Works was inundated and put out of commission for two weeks. The damage totalled $12 million, $9.9 million of which will be covered by private insurance previously obtained by the water works. This resulted in minimizing federal public assistance costs to $2.1 million. Although the insurance carrier would not renew their insurance, the water works was able to acquire new insurance for the water treatment plant. The new private insurance premium of $1,720 per year purchased $10 million of flood insurance. Subsequent to the flood of 1993, the levees surrounding the plant have been raised six feet and concrete flood gates have been constructed to close the gap made by the roadway into the plant."

Objective: The objective of this measure is to shift the fiscal responsibility for floodplain management and damages to public facilities away from the federal government.

3.3.1 Current Local Programs and Policies To get a feel for public facility damages and the impact of private insurance, fifteen communities were contacted about their experiences. The following information contains a synopsis of the information received from individual communities that experienced damage to public facilities during the "Flood of 93".

Illinois: The City of Grafton only received minor damage to its water and sewage treatment plants during the "Flood of 93". These facilities were insured through the Illinois Municipal League insurance program.

The City of Valmeyer suffered damage to the village hall, police office, water and sewage treatment plants, U.S. Post Office, fire department, and K-12 school during the 1993 flooding. The K-12 school was insured for $200,000; the village hall, police office and water treatment plant were all located in the same building which was insured for $90,000; the sewage treatment plant was insured for $90,000; the Post Office was privately owned; and the fire department was not insured. Of these buildings only the sewage treatment plant has been repaired, the other buildings are being relocated. The NFIP made up the difference between what the insurance company paid out and their actual costs.

The City of Alton sustained damage to their convention and visitors center, which was covered with private insurance. City officials stated that FEMA covered the damages that the insurance did not pick up. Dollar figures were not available.

Iowa: The City of Davenport sustained damage to five public facilities during the flooding of 1993, the old railroad station, a training building at the sewage treatment plant, the public works facility, baseball stadium, and some golf course support buildings. The City plans to relocate the public works

facility out of the floodplain and repair the remaining buildings, all of which were insured by the City.

Davenport officials estimated the repair and replacement costs for these facilities to be approximately $354,000, of which they received a settlement of $211,000 from the insurance company. The differential included the $100,000 deductible on the policies and depreciation on the facilities. FEMA initially indicated that they would reimburse the city for the $100,000 deductible because they had insured their facilities, however, Officials with the City stated that they are no longer sure that FEMA will come through with the money.

Kansas: Kansas City sustained some damage to public facilities during the 1993 flooding, but the officials contacted were unable to give us damage estimates or information on how the facilities were insured.

Minnesota: The metropolitan airport was the only public facility damaged in St Paul during the 1993 flooding, and a combination of grants/federal funding and private insurance covered the damages.

Missouri: Jefferson City sustained damage to four public facilities during the 1993 flooding. Of these, only one facility was insured. FEMA provided assistance to cover the damages to the other three structures. Damage figures were not available.

Thirty five public facilities were damaged or destroyed in the City of St Joseph during the "Flood of 93". Of these only three were privately insured. The city did receive federal and state aid to repair the damaged facilities that were not insured. Damage figures were not available.

There were no public facilities damaged in the City of St Louis during the 1993 flooding, however, if damage had occurred all of the public facilities in the city are self-insured.

Nebraska: Sarpy County did not sustain any damage to public facilities during the "Flood of 93", however they did experience bridge and road damage.

Wisconsin: The City of Black River Falls' water and sewage treatment plants were damaged during the "Flood of 93". The city had private insurance for both of the facilities. City officials indicated that the insurance and FEMA payments would cover 95 percent of the damages, and that the state of Wisconsin was going to cover the remaining five percent.

The City of LaCrosse did not experience any damage to public facilities. City officials stated that alot of overtime and hard work was required to keep their waste treatment plant from being inundated during the flooding.

3.3.2 Impacts Private flood insurance for public facilities seems to be an idea that has caught on with a number of the communities contacted. In the case of the City of Des Moines, Iowa Water Works, private insurance saved taxpayers approximately $9.9 million.

An assessment of the potential changes in damages experienced during the

"Flood of 93" as a result of this measure is provided by impact category below (see Section 4, Impact Matrices).

- **Flood Damage Change (None)** There will be no change in the amount of flood damages as a result of requiring private insurance for public facilities. This measure does not increase protection levels, which means that there would still be damages to facilities at risk.

- **Government Expenditure Change (Low)** There will be a low reduction in government expenditures as a result of requiring private insurance for public facilities. With no values available for expenditures related to public facilities versus overall expenditures, it was assumed that the expenditures associated with these facilities were small when compared to the overall damages experienced during the "Flood of 93".

- **Change in Floodplain Resources (None)** There will be no impact on the urban income potential of undeveloped floodplain property as a result of requiring private insurance for public facilities.

- **Critical Facilities (None)** There will be no change in the number of critical facilities at risk as a result of requiring private insurance for public facilities. It is possible that private insurers might provide premium reductions for increased levels of protection, that would in turn reduce the number of critical facilities at risk. However, it is unlikely that the reductions in premiums would offset the high costs of increasing structural protection.

- **Protection/Avoidance of Harm (None)** There will be no change in the number of people vulnerable as a result of requiring private insurance for public facilities.

- **Social Well Being (None)** There will be no change in the number of households vulnerable as a result of requiring private insurance for public facilities.

- **Implementation Costs (Low)** The implementation costs for obtaining private insurance for public facilities will be relatively low when compared to the amount of coverage provided. For example, the City of Des Moines, Iowa is currently paying only $1,720 annually for a $10 million policy to cover their Water Works plant.

SCENARIO CATEGORY E

Local Floodplain Management & Zoning

	IMPACT CATEGORIES	A Base Cond. [All Disast. Counties]	B Base Cond. [FPMA Imp. Counties]	Scenario 1	Scenario 2	Scenario 3
	ECONOMIC (1,000 $'s)		[1]			
	Flood Damages					
1	Residential (Urban)	$760,892	$662,008	– LOW	– LOW	0
2	Other (Urban)	$1,612,543	$1,447,322	– LOW	– LOW	0
3	Agricultural	$3,852,701	$817,054	0	0	0
4	Other Rural	$233,648	$161,010	– LOW	– LOW	0
	Chg. in Govt.Expend.					
5	Emergen.Resp.Costs	$227,405	$200,663	– LOW	– LOW	– LOW
6	Disaster Relief (Agric.)	$1,160,632	$285,180	0	0	0
7	Disaster Relief (Human R.)	$1,297,474	$551,862	– LOW	– LOW	0
8	Flood Insurance (NFIP)	$371,969	$276,496	– LOW	– LOW	– LOW
9	Flood Insurance (FCIC)	$748,095	$269,061	0	0	0
	Chg.Value of FP Resources					
10	Net Ag RE Values	–	–	0	0	0
11	Net Urban RE Values	–	–	0	0	0
	ENVIRONMENTAL					
	Natur.Resour.(# acres)					
12	Non–Forested Wetl. (acres)	–	365,285	0	0	0
13	Threat.&Endang. (# / Occ.)	–	(281/1,043)	0	0	0
14	Forest (acres)	–	534,705	0	0	0
	Natural Fldpln.Functions					
15	Fldpln.inundated (acres)	–	776,276	0	0	0
	Cultural					
16	Archeol Impacts (–5 to +5)	–	–1	0(0)	0(0)	0(0)
16A	Hist.Sites(–5 to +5)		–1	0(0)	0(0)	0(0)
	Open Space					
17	Public lands (acres)	–	392,512	0	0	0
18	Recreation sites (#)	–	485	0	0	0
	REDUCT.OF RISK					
	Critical Facilities					
19	# Facil. w/harmful releases	–	207	0	– LOW	0
20	# other critical facilities	–	1,208	0	– LOW	0
	Prot./Avoid. of Harm					
21	# people vulnerable	185,630	134,849	– LOW	– LOW	0
	Social Well Being					
22	# communities vulnerable	433	293	– LOW	– LOW	0
23	# resident.struct.vulnerable	56,339	42,743	– LOW	– LOW	0
	IMPLEMENT. COSTS					
24	Structural Costs	–	–	0	–	–
25	Other Costs	–	–	+ LOW	+ MODERATE	+ LOW

[1] Economic impacts collected only at the county level

COMMUNITY RELOCATION, FLOOD HAZARD MITIGATION, AND LAND USE CONVERSION PROGRAMS, and

FLOOD DISASTER RELIEF PROGRAMS

INTRODUCTION

Eleven measures in the two program categories identified in the title above have been examined as part of the Floodplain Management Assessment effort to consider "non-structural" policy and program options that could reduce future exposure to damages caused by extreme flood events. The eleven measures discussed in this review are listed below:

Community Relocation, Flood Hazard Mitigation, and Land Use Conversion Programs

4.1. FEMA buyouts of 5,000 or more substantially damaged structures are completed (Scenario 1)

4.2. Up to $20 million to be provided annually from NFIP premiums for "National Flood Mitigation Fund", with cost sharing requirements (see NFIP reform legislation, Section 554) (Scenario 1)

4.3. 1993 Hazard Mitigation and Relocation Assistance Act (PL 103-181) and FEMA interim rule (May 11, 1994) in place increasing federal share for eligible hazard mitigation and relocation from 50% to 75% (Scenario 1)

4.4. Federal leases of floodplain areas for cottages and other private uses are discontinued (Scenario 2)

4.5. Flood hazard mitigation funds for floodproofing, elevating, or relocating structures are made available as quickly as construction funds for repairs in place (Scenario 2)

4.6. Cost shared funding for acquisition of all structures repeatedly flooded is provided by Federal/State/Local governments (Scenario 3)

Flood Disaster Relief Programs

5.1. Existing Federal agency disaster relief programs assumed to continue independently (Scenario 1)

5.2. All disaster assistance strictly cost shared at 75%/25% and made consistent across all Federal relief programs (Scenario 2)

5.3. Public assistance grants to communities not in NFIP are greatly reduced (Scenario 2)

5.4. Post flood disaster relief is eliminated for those communities and individuals within designated STANDARD PROJECT FLOOD areas not participating in the NFIP (Scenario 3)

5.5. Repeat flood DISASTER payments to individuals and communities is eliminated (Scenario 3)

ANALYTICAL APPROACH

A survey form was prepared, containing questions to raise or clarify issues under each of these measures, and sent to a floodplain management or disaster relief specialist in each of the seven states (IL, IA, KS, MN, MO, NE, WI) and the FEMA regional offices in Chicago and Kansas City. Responses to the questions were obtained either by telephone interview or in writing. This information, and data where available, provides a basis for the summaries of potential impacts that are developed in this paper. These agency representatives are not, however, responsible for the interpretations of the responses and data that were provided. The list of questions that were prepared, along with the names and affiliations of staff people who work on these issues in the various agencies and the identification of those from whom responses were requested and obtained, are included as an attachment to this paper.

The context for review of the measures was to ask what difference it would have made if these policy options had been in place at the time of the 1993 flood. Responses to these questions are considered with respect to the economic and reduction of risk impact categories that have been identified in the evaluation framework matrix table summary. This approach was developed to ensure that all policy options and structural alternatives would be examined using a consistent methodology.

The measures reviews are to cover all portions of the basin being addressed by this floodplain management assessment. In other words, they are systemic in nature, not by individual Corps of Engineers district, or for a single district only.

Each measure will be discussed in turn. The measure will be briefly described, and then discussed based on the information and data that were obtained. Significant findings will be presented, and then a summary by impact category will be provided. The impacts data and information will be based on a COMPARISON OF THE ESTIMATED CHANGE in damage, government expenditure, or number of facilities or people affected that might have been expected if the measure had been in place at the time of the 1993 flood. The impacts data and information will also be entered into cells of a scenario measures summary impacts table that will be the focus of presentation in the Main Report of the FPMA. These cells will be identified by column letter and row number for cross referencing purposes (e.g., F2 or G18). In many cases, these comparisons will be qualitative and judgmental in nature, because many of the measures themselves are quite conceptual and data bases do not exist that can provide quantitative indications of the change in impacts that might be expected.

4. COMMUNITY RELOCATION, FLOOD HAZARD MITIGATION, AND LAND USE CONVERSION PROGRAMS

MEASURE 4.1: FEMA buyouts of 5,000 or more substantially damaged structures are completed (SCENARIO 1)

DESCRIPTION OF THE MEASURE: A significant change in the response to the 1993 flood was the increased public interest and program emphasis on the acquisition of substantially damaged structures and their removal from the floodplain to ensure avoidance of repetitive damages. At several locations entire towns are being considered or have actually begun relocating out of the floodplain. Estimates in mid-1994 were that some 5,000 structures would eventually be acquired. This would represent a substantial difference in potential future damages and government insurance and disaster aid expenditures that would be needed should an event comparable to the 1993 flood occur in this region in the future.

DISCUSSION OF THE MEASURE: The two FEMA regional offices and several of the states have supplied data to indicate the status of mitigation projects near the end of 1994. A summary of this data, representing a likely maximum estimate of the number of potential mitigation projects, number of structures or properties affected, and costs, is provided on the next page. Mitigation projects for the purposes of this measure include acquisitions, relocations, elevations, or floodproofing of residential or commercial structures, or acquisition of undeveloped lots or mobile home pads. All of the possible projects will not be completed due to property owners' unwillingness to proceed, or the lack of funds in some states to pursue all identifiable projects at this time.

The bulk of Federal dollars to support mitigation projects involving residential and commercial properties after the 1993 flood were sourced from the FEMA Section 404 hazard mitigation grants program and Community Development Block Grants (CDBG) from the Department of Housing and Urban Development. Evidence suggests that, for most if not all of the affected states, Federal dollars accounted for at least 75% of the cost of these mitigation projects, and in several states (IL and MO in particular), the share was probably close to 100%, because CDBG funds were used to cover the local cost shares of many of these projects. Large amounts of other Federal disaster assistance dollars were provided through other FEMA and other Federal agency funding authorities, and CDBG's especially were used for other public disaster recovery purposes beyond assistance to homeowners and businesses.

The numbers in the table below are approximations based on the combinations of FEMA and state data that were obtained. A single data source was not used because in several cases states took their own initiatives to implement mitigation projects involving residential structures. The data should therefore be considered only as indicative of the magnitude of potential mitigation projects for housing and businesses that are at various stages of completion at this time.

The mitigation process requires a lot of preparation and coordination, with a number of clearances and approvals to be obtained from agencies at all government levels, and as of early December 1994 many of these proposed projects are far from complete. They do suggest, however, the possibility of a significant reduction in exposure to future flood damages as many of these mitigative actions are completed. It does NOT appear that interest is being lost at most locations despite the amount of time it is taking to complete the process.

State	# of Sites	# of Parcels	Est. Total Cost
IL	46	1,977	$ 54,307,000
IA	28	954	36,300,000
KS	12	471	10,300,000
MN	13	155	8,400,000
MO	68	4,178	80,000,000
NE	1	51	903,000
WI	10	494	24,567,000
TOTALS	178	8,280	$ 214,777,000

By far the largest number of projects involve acquisition of substantially damaged properties. In Missouri, Minnesota, Kansas, and Nebraska, all of the mitigation projects involving residential and commercial structures are for buyouts. In Illinois, Iowa, and Wisconsin, there are a few projects that involve elevations of structures rather than acquisitions and/or relocations.

(**SIDE NOTE**: Mitigation actions may also be broadly considered to include disaster assistance to restore or repair public facilities, transportation assets, and utilities that were damaged by the flood. While in concept these expenditures are assumed to be directed largely to restoring damaged infrastructure in kind and in place, the completion of these repairs in ways that could avoid obvious problems with repetitive flood damage can become features of the work. There is the obvious concern that disaster assistance from the Federal Government not be used to provide upgrades of municipal systems and services which are primary responsibilities of states and local communities. FEMA rules guard against misallocation of FEMA disaster funds in these ways. However, the damages experienced to public and transportation facilities and utilities from the 1993 flood are estimated at $859 million (see Corps of Engineers report on 1993 flood damages), so there would appear to be considerable potential to examine how repairs can be accomplished in a manner that would reduce the need for future expenditures at times of severe flooding.)

The State of Missouri has made extensive use of Federal disaster assistance funds to address infrastructure repairs and needs in the aftermath of the flood. This has included expenditures of up to $20 million of FEMA Section 406 public assistance demolition funds to cover the cost of removing

vacated structures; and the use of Community Development Block Grants (CDBG) for public facility and levee projects. With 1993 funding, 12 public facility projects involving water, sewer, and infrastructure hazard mitigation, replacement, and/or moving of public facilities were undertaken for $3.1 million, in many cases to prepare for the placement of FEMA temporary housing trailers. Another $2.1 million was spent on five levee projects to bring them to Federal standards. With 1994 funding, another 42 projects totaling $11.5 million were undertaken for levee repairs, sewer, water and drainage projects, and road, bridge, and other public facility repairs. FEMA assistance for several small mitigation projects for these kinds of purposes are also being pursued in Nebraska and Iowa.

These types of mitigation activities are not the primary focus of this measure, but they are a significant part of the flood damage and recovery picture and should be fully considered by communities in the planning of actions that can be taken to prepare for, avoid, or recover from future flood events. **End of SIDE NOTE).**

SIGNIFICANT FINDINGS: While the potential cost of implementing mitigation projects for residential and commercial structures is substantial (approaching $215 million, or an average cost per property of roughly $26,000), the removal (in most cases) of structures vulnerable to flooding and substantially damaged during the 1993 flood represents a major step toward reducing future exposure to flood damages. In a number of flood risk locations, the cycle of repair and replacement in kind and in place will be broken. Other positive impacts of this measure should be related to reductions in emergency response costs; reductions in Federal disaster relief expenditures needed for human services; and reductions of risk to communities, individuals, and housing from flooding in the future, with corresponding positive impact on human health and safety issues. Negative impacts could be associated with the affordability of alternative housing for those whose properties are being acquired. This should be considered a very important measure with substantial positive impacts.

SUMMARY BY IMPACT CATEGORY:

Change in Flood Damages

Residential Urban (CELL F1 of Scenario 1 Impacts Summary Table): Given that damages to residential structures and contents alone from the 1993 flood are estimated at $761 million basin wide, and that commercial and industrial structural and contents damage are estimated at $753 million (see Corps of Engineers report on 1993 flood damages), the projected mitigation expenditures of $215 million that have been identified can be put into perspective. The real question is what FUTURE damages will have been avoided with the completion of these mitigation projects. Each of these projects goes through a FEMA benefit/cost analysis before it is implemented, with the underlying assumption that each project to be approved will pay for itself by way of at least an equivalent present worth dollar benefit received from future flood damage, mitigation, and relocation costs avoided. So a minimum estimate of the present value of future flood damages avoided is the same $215 million

projection of mitigation expenditures. However, other information suggests the benefit could be much higher. The State of Missouri Department of Economic Development, in its summary report (Dec. 1994) for flood recovery addressing the Missouri Community Development Block Grant program, finds that the $80 million invested in the state buyout program will save taxpayers over $250 million in future flood disaster claims. Also, some of the benefit/cost analyses for individual projects show results far greater than a 1.0 B/C ratio. (It must also be noted that due to exceptional circumstances a number of projects are being approved with ratios less than 1.0). Enough data is not available to make a reasonable estimate of an "upper range" of benefits to be realized from these mitigation projects. It is reasonable to assume, however, that it is in excess of the minimum estimate of $215 million.

Other Urban (CELL F2, Scenario 1): Data base records obtained allow only a partial reporting of mitigation actions and costs for commercial structures as separate from residential structures. A minimum of 241 out of the 8,280 parcels identified for potential mitigative actions could be clearly identified as commercial properties. For the 164 commercial properties where a separate cost estimate was provided, projected mitigation costs amounted to $12.3 million, or an average of approximately $75,000 per property. This would be a subtotal of the $215 million mitigation cost estimate previously identified, not an additional amount. Again, the assumption is that these mitigation expenditures are assumed to achieve at least an equivalent present worth dollar benefit through the future avoidance of flood damage, mitigation, and relocation costs to these commercial properties.

Other urban categories also include damages to public facilities, transportation facilities, and utilities. While there appear to be a few mitigation projects that involve relocations of these kinds of facilities, enough data and information has not been obtained to make a reasonable estimate of just how large an impact on "potential future damage avoided" should be expected for these facilities. Analyst judgment based on available information is that this amount would be quite small in comparison with the benefits obtained from the acquisition of residential and commercial structures.

Agricultural (CELL F3, Scenario 1): The mitigation projects are not targeted at agricultural lands or expected to impact on crop production. There are no impacts expected from this measure in this impact category.

Other Rural (CELL F4, Scenario 1): It is possible that there are isolated rural residences that are included in the proposed mitigation actions, but it is not possible to provide a separate estimate of projected change in impacts for this impact category. Any change would likely be relatively small and would already be included in the residential urban impact category discussed above. There would be no change expected for ditch restoration or farmland restoration costs.

Change in Government Expenditures

Emergency Response Costs (CELL F5, Scenario 1): There is clearly a

potential to reduce future emergency response costs if most of the 178 proposed mitigation sites are completed. This would especially be the case not only for an extraordinary event such as the 1993 flood, but also for smaller, more frequent events, especially in areas that were previously subject to repetitive damages. An estimated $227 million was spent in emergency response during the 1993 flood, (see Corps of Engineers summary of 1993 flood damages report), which include advance preparedness, response, and evacuation activities. While it would be very difficult to reasonably develop a quantitative estimate of future emergency response costs avoided as a result of implementing these mitigation projects, there is a potentially sizable benefit to be gained in this category, especially considering those sites where more frequent flooding has been experienced.

Disaster Relief (Agric) (CELL F6, Scenario 1): Almost all of the agricultural disaster relief provided after the 1993 flood was targeted at lost crop production and incomes to farmers, and the mitigation projects identified with this measure would not have any impact in these areas. To the extent that some portion of the $15.8 million in Farmers Home Administration loans and grants (see Interagency Review Committee report, June 1994, Table 1.4, p. 23) may have been directed to restoring damaged farmsteads, there is some possibility of reducing these expenditures in the future, but only to the extent that buyouts and/or relocations of farmsteads are a part of the mitigation actions covered by this measure. Specific data on this point has not been obtained. Analyst judgment based on available information is that this amount would be quite small.

Disaster Relief (Human Resources) (CELL F7, Scenario 1): Over $650 million were expended by the Federal Government in providing disaster aid to citizens through programs operated by FEMA and the Departments of Agriculture, HUD, Health and Human Services, and Education (see Interagency Review Committee Report, June 1994, Table 1.4, p. 23-24). These are funds in addition to the FEMA infrastructure and hazard mitigation programs and the community development block grants that have already been discussed for other impact categories. Disaster assistance data has not been obtained that would allow an estimate to be made of the share of this relief aid that was provided to those owning or occupying the 8,280 properties that are candidates for mitigative actions. Analyst judgment is that a large amount of disaster relief dollars would not have been needed had the acquisition and other mitigative actions been in place at the time of the 1993 flood, because the exposure to flooding would have obviously been significantly reduced. A very crude, constructed estimate might be developed if one takes the maximum amount of FEMA individual or family disaster assistance grants that were provided (approximately $11,900) times the number of affected properties (8,280), which results in roughly $100 million, but this should be considered only as an indicator of what an "order of magnitude" change in impact could be. It is also important to remember that the acquisitions and relocations would presumably avoid the need for disaster aid from other, more frequent flood events (if declared Federal disasters) in areas of repetitive flood risk.

Flood Insurance (NFIP) (CELL F8, Scenario 1): Information has not been obtained that would allow an estimate to be made of the number of candidate

mitigation properties that were previously covered by flood insurance. To the extent that those structures are acquired and removed from exposure to flooding, there would be a reduction in the number of flood insurance policies required. This is not judged to be a large number in comparison to the number of properties that remain at risk in the floodplain but without flood insurance.

Flood Insurance (FCIC) (CELL F9, Scenario 1): No change in impact for this category (federal crop insurance).

Change in Value of Floodplain Resources

Net Agric Real Estate Value (CELL F10, Scenario 1): No significant change in impact for this category expected. At an isolated site, such as the relocation of entire towns (e.g., Valmeyer, IL; Chelsea, IA), there could be some small amount of farm acreage lost because of the local change in land use associated with the community relocation.

Net Urban Real Estate Value (CELL F11, Scenario 1): FEMA acquisition projects are completed only when the local community agrees to maintain the land in public ownership and to ensure that no development will take place that is subject to any significant flood damage. Lands are to be kept as open space; parks may be subsequently developed by the community and contribute to other community goals and needs related to recreation opportunities, public access to the river, etc. These are among the potential positive amenities that can follow from post flood acquisition projects. There are also potential detrimental effects. Land that previously contributed to the tax base is now removed (although other properties may "join" or increase the tax base as a result of residents or businesses relocating elsewhere in the town or city). It is unlikely that property values would be affected unless the number of parcels being acquired is a noticeable share of the local real estate market, or unless the local housing market is already extremely tight. A town or city may view its development potential to be constrained if the properties being acquired represent a sizable area, or were previously considered as having promising development potential. In many cases, these are probably not major concerns, given the number of properties to be acquired within the context of an entire town or city, but there are undoubtedly exceptional situations. In any case, information and/or data has not been obtained, and may not exist without significant original research, that would allow a reliable quantification of this type of impact associated with this measure. It is not part of the FEMA benefit/cost formula to determine the viability of buyout projects, nor does this issue appear to be a significant factor in the mitigation decision making process.

Reduction of Risk

 # Critical Facilities w/harmful releases (CELL F19, Scenario 1): This measure (i.e., FEMA buyout of 5,000 or more substantially damaged structures) focuses on residential and commercial structures, and therefore does not address critical facilities. Other FEMA disaster assistance has been provided to communities for infrastructure repairs. Some of this funding may have been

used to address critical facilities needs at specific locations. Critical facilities with potentially harmful releases (including Superfund sites, NPDES sites, landfills, and petrochemical plants) and their location, protection, and repair are the subject of other analyses within this floodplain management assessment.

 # Other Critical Facilities (CELL F20, Scenario 1): There is some information from the state of Missouri and other states of FEMA and CDBG funding used to restore, replace, or relocate water and sewer lines and to undertake bridge repairs, among other mitigation projects. Sufficient data has not been obtained to make a quantitative estimate of the number of sites involved throughout the basin, or an estimate of future flood damage costs avoided.

 # People Vulnerable (CELL F21, Scenario 1): Data has not been obtained to enable an accurate count of the number of people who will be removed from flood hazard risk as the result of completing many of these mitigation projects. A very crude estimate can be derived by taking the number of proposed mitigation properties (8,280) times an average number of people per household (say between 2 and 2.5), and come up with an estimate in the range of 16,000 to 20,000 people. The State of Missouri indicates that over 3,500 families will be removed from the floodplains in that state alone. While there is not an ability to project the numbers of deaths, injuries, or degree of emotional trauma that will be avoided through the elimination of flood risk to these people, it is judged to be a significant if somewhat intangible positive impact that is attributable to this measure.

 # Communities Vulnerable CELL F22, Scenario 1): A total of 178 projected mitigation sites involving residential and commercial structures have been identified. Assuming completion of most of these projects, a substantial number of these communities will have taken major steps to avoid future flood problems. This is a significant change from pre-flood conditions.

 # Residential Structures Vulnerable (CELL F23, Scenario 1): Of the 8,280 properties identified for potential mitigative actions, more than 7,000 are expected to involve acquisitions. This would be a substantial reduction in the potential exposure to future flood risk. There is a concern whether many of these homeowners will find affordable housing at alternative locations outside the floodplain. People residing in floodplain locations at risk appear to be disproportionately represented by those with lower incomes. Data has not been obtained, nor is it certain that such data is collected, that would track where people relocate to and with what financial impact. Answers to these questions would probably require substantial original research which goes beyond what can be accomplished in this floodplain management assessment.

Implementation Costs

Structural Costs (CELL F24, Scenario 1): The projected costs of completing the proposed mitigation projects are estimated to be $215 million.

Other Costs (CELL F25, Scenario 1): There is also the administrative costs

of operating these programs to be considered. An estimate of additional FEMA administrative costs associated with the 1993 Midwest flood is $90 million (see Interagency Review Committee report, Table 1.4, p. 23). A network of FEMA field representatives had to be established which is still in place and very busy in pursuing the technical requirements associated with successful completion of these mitigation projects. To the extent that future, widespread Federal flood disaster declarations in this region can be avoided through the completion of these actions, one could assume that administrative needs and costs will also be reduced. A quantitative estimate of such a change in impact has not been developed, as it is more of a conceptual item, but it is a factor to be considered in looking at overall Federal mitigation and disaster response costs.

MEASURE 4.2: Up to $20 million to be provided annually from NFIP premiums for "National Flood Mitigation Fund", with cost sharing requirements (see NFIP reform legislation, Section 554) (Scenario 1)

DESCRIPTION OF THE MEASURE: Title V of the Riegle Community Development and Regulatory Improvement Act (Public Law 103-325), signed into law on September 23, 1994, contains a number of changes to the National Flood Insurance Program (NFIP). One provision establishes a ceiling of $1.5 million to be used in any fiscal year for plannng assistance grants. Another establishes a fund to be used for mitigation, on a 75%/25% cost shared basis, to plan for and implement projects that would elevate, relocate, floodproof, or acquire flood prone structures. The amount of funding to be made available at the Federal level, $20 million annually after a 3 year phase in period, greatly exceeds what has previously been provided for this purpose. There will now be greater opportunity to pursue these kinds of projects in known problem areas on a more continual basis instead of only in the immediate aftermath of a major flood.

DISCUSSION OF THE MEASURE: From the perspective of state government officials, this measure is considered very favorably. It will allow for more continuous attention to potential mitigation projects. It will encourage and enhance a greater state and local government capability for dealing with floodplain management planning responsibilities and mitigation opportunities. Especially important is the need to do more upfront planning to anticipate needs and take mitigative actions in advance of the next big flood.

Most states do not have a backlog of candidate "projects" but do have a knowledge of where repetitive flood problems occur. In most cases, the preference is to pursue mitigation projects in the form of acquisitions or buyouts instead of elevations or floodproofing, but there are locations where these other approaches may be preferred.

There is no reasonable way to estimate just how many additional projects may be pursued over time, or the future flood damages that would be avoided, as a result of this measure being used in the Midwest states, keeping in mind that this is a national program. But there is strong support for the idea that this designated annual funding for planning and mitigation purposes should be effective in achieving much greater reductions in expenditures for flood losses and disaster payments over time.

A common theme in the discussion of this measure is the importance of developing comprehensive floodplain management programs at the local government level. Local expertise and participation are essential components in developing effective floodplain management policies. In a number of small Midwest communities, however, the institutional capability to implement such programs and policies does not exist, so it is important that state governments improve their capabilities in these areas. In other states, there is a need for a stronger state role in working with urban communities as well. This funding source should help with these needs.

Minnesota, Wisconsin, and Illinois have, prior to 1993, provided state funding to contribute to mitigation projects; the other four states have

apparently not. This measure, given a 75 percent Federal cost share, and in combination with in-depth reviews of floodplain management issues in the other affected states, may lead to increased support for mitigation projects.

SIGNIFICANT FINDINGS: No quantitative data is available that would allow an estimate to be made of future flood damages avoided as the result of this measure. It remains to be determined, as the program is implemented, just how effectively a reduction of exposure to future flood damages will be achieved. The prevailing view is that funds spent on advance mitigation planning and mitigation projects should result in much greater reductions in future flood damages and disaster payments. The importance of the measure is that it encourages and funds mitigation activities independently of specific flood disasters.

SUMMARY BY IMPACT CATEGORY:

Change in Flood Damages

Residential Urban (CELL F1, Scenario 1): If the assumption is made that each mitigation project under this measure will pass the FEMA benefit/cost analysis requirements, then the present value benefits of future flood damage, mitigation, and relocation costs avoided will at least equal the current cost of the project. It is not yet possible to know how many projects could be pursued in the seven Midwest states, or nationwide, under this measure.

Other Urban (CELL F2, Scenario 1): Same as answer above.

Agricultural (CELL F3, Scenario 1): No change in impact expected.

Other Rural (CELL F4, Scenario 1): No change in impact expected.

Change in Government Expenditures

Emergency Response Costs (CELL F5, Scenario 1): To the extent that mitigation projects are implemented that remove residential and commercial structures from future flood risk, there would be a reduction in emergency response costs.

Disaster Relief (Agric) (CELL F6, Scenario 1): No change in impact expected.

Disaster Relief (Human Resources) (CELL F7, Scenario 1): A reduction in future disaster relief expenditures would be expected with the implementation of additional mitigation projects funded under this measure.

Flood Insurance (NFIP) (CELL F8, Scenario 1): There should be a reduction, probably quite small, in the number of flood insurance policies required, depending on how many property owners at future mitigation sites were participants in the NFIP.

Flood Insurance (FCIC) (CELL F9, Scenario 1): No change in impact expected.

Change in Value of Floodplain Resources

Net Agric Real Estate Value (CELL F10, Scenario 1): No change in impact.

Net Urban Real Estate Value (CELL F11, Scenario 1): Most mitigation projects will probably involve buyouts that would remove private property from the tax rolls. This would not likely be a significant factor in most communities, but could be influenced by the size of the proposed project relative to the size of the community.

Reduction of Risk

 # Critical Facilities w/harmful releases (CELL F19, Scenario 1): No significant change in impact is expected.

 # Other Critical Facilities (CELL F20, Scenario 1): Some, probably small proportion of mitigation project proposals could involve critical facilities such as water and sewage treatment plants, schools, hospitals, nursing homes, etc. Based on the 1993 flood experience, it is assumed at this time that most projects will be devoted to residential and commercial structures.

 # People Vulnerable (CELL F21, Scenario 1): This is directly related to the number of mitigation projects for residential structures that will ultimately be pursued through the funds available under this measure.

 # Communities Vulnerable (CELL F22, Scenario 1): In most of the seven Midwest states there are a few communities with repetitive flooding problems that may now be of interest. A listing of these potential mitigation project sites has typically not been developed or maintained. An estimate based on available information is that there may be twenty or so communities of very intense interest in the region that would otherwise probably not be addressed.

 # Residential Structures Vulnerable (CELL F23, Scenario 1): Again, a good estimate was not able to be obtained. There is certainly housing in the floodplains of the region in areas that were not affected by the 1993 flood but are known to be at high risk, or sites where the mitigation funding that was provided after the 1993 flood is not adequate to cover all the structures severely impacted at that time.

Implementation Costs

Structural Costs (CELL F24, Scenario 1): Unable to estimate with available information.

Other Costs (CELL F25, Scenario 1): While not a subject of discussion, there would seem to be an imperative that this new source of mitigation funding be used to complete projects, and not be used in large part only to cover the administrative costs of mitigative actions. States and/or local communities are to contribute substantially in the decisions as to how and where the funds can best be used. It is also essential to remember, however, that mitigation projects are complex real estate transactions, and that there

is a very "labor intensive" effort that is associated with successful completion of these projects.

MEASURE 4.3: 1993 Hazard Mitigation and Relocation Assistance Act (PL 103-181) and FEMA interim rule (May 11, 1994) in place increasing federal share for eligible hazard mitigation and relocation from 50% to 75% (Scenario 1)

DESCRIPTION OF THE MEASURE: This measure, signed into law on December 3, 1993, had the effect of making more equitable the alternative of acquiring and relocating flood prone property. Other Federal disaster assistance has ordinarily been provided on a 75/25 cost shared basis, and an even greater cost share (90/10) has been provided for several recent disasters, including the 1993 flood. Often the disaster assistance is used to restore damaged homes and businesses in kind and in place as quickly as possible, leaving these structures subject to the same kind of flooding in the future. This measure should make more viable the option of removing substantially damaged structures to avoid repetitive flood problems.

DISCUSSION OF THE MEASURE: State respondents generally agreed that this measure was an important change. There is concern that for some communities the 1993 flood was so devastating that the remaining 25% cost share for mitigation projects was still too burdensome. Evidence suggests that in many communities CDBG funds were used to largely cover the local cost share for these projects. There is also the perception that more mitigation projects can be considered by local interests with the increase in the Federal cost share to 75% as compared to 50%.

There is no data or information to suggest that mitigation project opportunities were lost in any number during the time when the Federal cost share was only 50%. The obvious explanation is that other, mostly Federal funding sources were used to cover the remaining costs. There were also no estimates to be made on the question of whether disaster relief or flood insurance payments would have been structured more to mitigation alternatives if this increase in Federal cost share had been in place at the time of the 1993 flood.

The concept of a state revolving fund to service loans that could be used for local mitigation projects was identified as an alternative to consider. Such funds are available in some state governments for other purposes. In Wisconsin, the state covers 12.5 percent of the local cost share for mitigation projects, leaving the remaining 12.5 percent for the local community to cover. There is also interest at the state government level in ensuring that local communities use disaster funds effectively to avoid repetitive flood problems. There is an idea that CDBG distributions should perhaps be based in part on how well communities have used past Federal and state assistance dollars, rewarding those who do well and reducing or even withholding funds from those who fail to respond to chronic flood problems.

There is a strong sense that states and communities will be more aggressive in pursuing mitigation projects with the increased Federal funding support supplied by this measure following the 1993 flood and into the future. There is also an expectation that hazard mitigation plans of the states and local communities will be more rigorously and comprehensively prepared after

the experience of the 1993 flood.

SIGNIFICANT FINDINGS: No quantitative data is available that would indicate just how much more future damages avoided will be achieved with this measure in place. Clearly it should allow an increased emphasis on pursuing more mitigative actions involving acquisitions and relocations as opposed to making repairs in kind and in place to substantially damaged structures. While Federal funds expended for mitigation purposes will increase with this measure, as compared to the base condition, there is the prospect of even greater reductions in future damages with the completion of more mitigation projects. This measure, while favorably considered and reinforcing of the two previous measures already discussed, probably has substantially less overall impact.

SUMMARY BY IMPACT CATEGORY:

Change in Flood Damages

Residential Urban (CELL F1, Scenario 1): Increases in the reduction of future damages to residential structures are expected. It is judged that this impact will be relatively small, in the context of overall damages experienced from the 1993 flood, because many mitigation projects were initiated even prior to the increase in Federal cost share from 50% to 75%. The real question is what is the incremental increase in the number of mitigation projects and affected structures that will be pursued with this increase in Federal cost share, and there is insufficient information to make an estimate.

Other Urban (CELL F2, Scenario 1): Same as answer above.

Agricultural (CELL F3, Scenario 1): No change in impact expected.

Other Rural (CELL F4, Scenario 1): No change in impact expected.

Change in Government Expenditure

Emergency Response Costs (CELL F5, Scenario 1): To the extent that more mitigation projects could be completed with this measure in place, a reduction in emergency response costs would be expected. There is insufficient information to make a quantitative estimate.

Disaster Relief (Agric) (CELL F6, Scenario 1): No change in impact expected.

Disaster Relief (Human Resource) (CELL F7, Scenario 1): To the extent that more mitigation projects could be completed with this measure, future exposure to flood risk would be reduced along with the need for future flood disaster relief. There is insufficient information to make a quantitative estimate.

Flood Insurance (NFIP) (CELL F8, Scenario 1): There may be a fewer number of NIFP policies required, depending on the incremental increase in the number of acquired structures with this measure in place. There is insufficient

information to make a quantitative estimate.

Flood Insurance (FCIC) (CELL F9, Scenario 1): No change in impact expected.

Change in Value of Floodplain Resources

Net Agric Real Estate Value (CELL F10, Scenario 1): No change in impact expected.

Net Urban Real Estate Value (CELL F11, Scenario 1): To the extent that an incremental increase in the number of mitigation projects and acquired structures is realized with this measure, there would likely be a reduction in the number of properties on the local tax rolls. This is not expected to be a major impact in most communities.

Reduction of Risk

 # Critical Facilities w/harmful releases (CELL F19, Scenario 1): No change in impact expected.

 # Other Critical Facilities (CELL F20, Scenario 1): No significant change in impact expected.

 # People Vulnerable (CELL F21, Scenario 1): Data is not available to make a quantifiable estimate of the reduction in the number of people who will be exposed to major flood risk as the result of this measure, though the change in impact would be expected to be favorable.

 # Communities Vulnerable (CELL F22, Scenario 1): Same as answer above.

 # Residential Structures Vulnerable (CELL F23, Scenario 1): Same as answer above.

Implementation Costs

Structural Costs (CELL F24, Scenario 1): Beyond the mitigation project costs identified for the first two measures already discussed, it is not expected that this measure would lead to much of an increase in overall implementation costs, only a shifting of these costs so that 25% more would be borne by the Federal Government.

Other Costs (CELL F25, Scenario 1): It is not expected that there would be any significant change in administrative costs associated with this measure.

MEASURE 4.4: Federal leases of floodplain areas for cottages and other private uses are discontinued (Scenario 2)

DESCRIPTION OF THE MEASURE: There is an inconsistency in allowing private residential use of Federal leased lands in floodplains while at the same time allowing for the possibility of disaster assistance and insurance coverage for these structures when they are flooded. This measure would address this inconsistency by ending these lease arrangements, or at a minimum by clarifying in law that structures on these lands are ineligible for any flood disaster aid or flood insurance coverage and cannot be used for permanent housing.

DISCUSSION OF THE MEASURE: After the 1993 flood it became evident that cottage lease holders were in some cases submitting claims for disaster assistance or flood insurance payments despite specific language in the standard Corps of Engineers lease that prohibits participation in these programs. It has also become clear that over the years some of these "cottge sites" have been transformed into year-round permanent residences. The structures and contents are in private ownership but located on Federal land along the Mississippi River, for which small annual lease payments are made to the Federal Government. At the same time, there have been efforts from FEMA and the Federal Insurance Administration to expand participation in the national flood insurance program, and that has included some of these lease sites. Some of these lease sites are among the most frequent repetitive insurance claims. After the 1993 flood, a determination was made at Corps headquarters not to enforce language in the standard lease that would have prohibited receipt of disaster assistance or flood insurance payments.

Structures on these sites have been interpreted as NOT being eligible for buyouts because the land on which the structures sit is already in public ownership. The Government has been prohibited from unilaterally terminating these lease arrangements because of language contained in Section 1134 of the 1986 Water Resources Development Act.

Damage was so extensive that, at approximately 100 of the lease sites, occupants have voluntarily given up the leases. There are still over 1,100 leases in effect. Based on limited data, it appears that an average annual lease payment is in the range of $500 to $600, so that lease revenues to the Federal Government are on the order of $600,000 annually.

The locations, by county, of these leases are listed below:

State and County	# of Leases
IL, Adams	67
IL, Calhoun	102
IL, Carroll	30
IL, Henderson	52
IL, Jersey	198
IL, Jo Daviess	62
IL, Madison	6

IL, Mercer		2
IL, Pike		65
IL, Rock Island		50
IL, Whiteside		17
	Illinois subtotal	653
IA, Clayton		1
IA, Clinton		39
IA, Des Moines		23
IA, Dubuque		22
IA, Jackson		65
IA, Louisa		2
IA, Muscatine		78
IA, Scott		27
	Iowa subtotal	257
MN, Winona		3
	Minnesota subtotal	3
MO, Lewis		2
MO, Lincoln		8
MO, St. Charles		145
MO, Ralls		1
	Missouri subtotal	156
WI, Crawford		2
WI, Grant		17
WI, La Crosse		4
WI, Vernon		21
	Wisconsin subtotal	44
GRAND TOTAL		1,113

The position of state officials is very much against using any disaster relief dollars to buy out structures at these lease locations. One suggestion was made that any flood insurance, if it is to be offered at these locations, should be issued only on an actuarially sound basis. The view is that contradictions in policy among the Federal agencies on this issue need to be resolved. It was reported that, even at the local level, citizens and local governments are unhappy at seeing Federal dollars spent on restoring vulnerable uses on these leased lands that are clearly subject to repetitive flood damage, especially given the perception that there is already an advantage being given to lessees through their private access to and use of Federal land.

SIGNIFICANT FINDINGS: This measure is not highly significant in terms of achieving a dramatic reduction in the overall amount of Federal disaster aid and insurance payouts that would be required for a comparable future flood event. Nevertheless, implementation of a measure to end private residential use of Federal land in the floodplain would meet several important objectives, including reductions in property damage, emergency costs, disaster aid,

insurance payouts, and exposure of risk to life and health from major flooding. It would also demonstrate the Federal Government's willingness to take an action consistent with what other citizens have been encouraged to do in areas that suffered extensive flood damage.

SUMMARY BY IMPACT CATEGORY:

Change in Flood Damages

Residential Urban (CELL F1, Scenario 2): Data has not been obtained at this time that would allow an estimate to be made of the damages to residential structures and contents that could be avoided with the implementation of this measure. There would appear to be the possibility of cross referencing the addresses of the lease sites with the NFIP or disaster payments data bases to determine just how many dollars were expended for these purposes at these locations after the 1993 flood. This has not yet been accomplished.

Other Urban (CELL F2, Scenario 2): Aside from a very few commercial fishing access sites, etc., that could be excepted from this measure, there would be no change in impacts in this category.

Agricultural (CELL F3, Scenario 2): No change in impacts.

Other Rural (CELL F4, Scenario 2): No change in impacts.

Change in Government Expenditure

Emergency Response Costs (CELL F5, Scenario 2): There would probably be a small reduction in overall emergency response costs to government with this measure in place. It is unlikely that data could be developed at this level of detail to provide a quantitative estimate.

Disaster Relief (Agric) (CELL F6, Scenario 2): No change in impacts.

Disaster Relief (Human Resource) (CELL F7, Scenario 2): There would likely be a small reduction in overall disaster relief payments with this measure in place. A quantitative estimate would depend on a detailed review of records to determine just how many leased properties received disaster aid and how much was received.

Flood Insurance (NFIP) (CELL F8, Scenario 2): There would be a small reduction in the number of flood insurance policies in effect and the amount of insurance payments made if this measure were implemented. A quantitative estimate would depend on a detailed review of flood insurance payment records by address to cross reference with leased properties.

Flood Insurance (FCIC) (CELL F9, Scenario 2): No change in impacts.

Change in Value of Floodplain Resources

Net Agric Real Estate Value (CELL F10, Scenario 2): No change in impacts.

Net Urban Real Estate Value (CELL F11, Scenario 2): No significant change in impacts expected, as the land itself will not change from public ownership. There could be some problems locating adequate, affordable housing in some counties if a substantial number of leases have been used for permanent housing at a specific location and these arrangements are terminated for all at the same time.

Reduction of Risk

 # Critical Facilities w/harmful releases (CELL F19, Scenario 2): No change in impacts.

 # Other Critical Facilities (CELL F20, Scenario 2): No change in impacts.

 # People Vulnerable (CELL F21, Scenario 2): There would be a small reduction in the total number of people at risk from major flooding. A quantitative estimate would depend on determining how many of the properties on leased land that were substantially damaged were being used as permanent housing.

 # Communities Vulnerable (CELL F22, Scenario 2): There would be little if any change here, although "neighborhoods" of permanent residents, to the extent they have developed on leased properties, would be affected.

 # Residential Structures Vulnerable (CELL F23, Scenario 2): While it is assumed that most leased sites have some kind of structure on them, the significant point is the number which have been substantially upgraded and used for permanent housing. Data has not been obtained to make an estimate of how many such structures are in place that would be forced to be relocated or demolished.

Implementation Costs

Structural Costs (CELL F24, Scenario 2): Aside from the costs of relocating or demolishing structures, there should be no other structural costs.

Other Costs (CELL F25, Scenario 2): There would be some small reduction in administrative costs associated with record keeping on the leased lands. On the other hand, some $600,000 in annual revenues would be foregone if all leases were terminated.

MEASURE 4.5: Flood hazard mitigation funds for floodproofing, elevating, or relocating structures are made available as quickly as construction funds for repairs in place (Scenario 2)

DESCRIPTION OF THE MEASURE: This measure in intended to ensure that, as disaster relief funds are provided, they are able to be used for mitigation and relocation projects as well as for repairs to damaged structures in place, so that flood victims have an opportunity to equally consider all the alternatives that may be available to avoid repetitive flood problems. Currently the pattern is for the earliest available funds to be used to make repairs in kind and in place in flood prone areas.

DISCUSSION OF THE MEASURE: While there is not definitive information on this point, it does not appear that a large number of mitigation opportunities were missed for structures that were substantially damaged in the flood. Even though the buyout process is taking well over a year in many locations, the flood victims whose homes were substantially damaged do not in most cases have a real alternative other than to wait out the process. In cases where damages to homes were less severe, there is more of a tendency to make repairs quickly and to be less concerned about the prospect of repetitive flood problems.

The concept underlying this measure is considered to be very important by the state officials. Otherwise there can be a temptation to "shop around" among the Federal disaster aid programs to obtain the fastest assistance, even if the result is to complete repairs that leave people vulnerable to repetitive flooding.

It would also help to resolve problems with different definitions and interpretations of what constituted substantal damage to a structure, whether it was based on the amount damage incurred reaching 50 percent or more of the pre-flood market value of the property, or whether it was based on the replacement cost of making repairs exceeding 50 percent of the value. When the latter definition was used, there was more restoration work that occurred in kind and in place. The state of Iowa did not accept FEMA's use of the latter definition because it was in conflict with state floodplain regulations.

The question of timing and quick response in providing funding for mitigation actions emphasizes the importance of ADVANCE planning and coordination to expedite pursuit of such projects. Six months or less was suggested as the timetable to be met that would encourage flood victims to consider a mitigation project as a favored course of action. It was also noted that a more liberal interpretation that does not require individual grant funds that were used for repairs to be subtracted from buyout offers provides more encouragement to homeowners to complete mitigation projects in areas of substantial flood risk.

A continuing concern is that mitigation funding be used to address repetitive flood problems in a consistent and coherent manner. A site by site review process and the offering of buyouts may not be logical if it results in piecemeal acquisition proposals. It was suggested that more flexibility would

help in supporting mitigation projects in marginal cases by allowing states and local communities to pick up a larger share of overall project costs.

SIGNIFICANT FINDINGS: This measure was considered to be important in concept and in principle, but no quantitative data or other information was obtained to estimate what the relative magnitude of change in impacts from implementation of this measure would be.

SUMMARY BY IMPACT CATEGORY:

Change in Flood Damages

Residential Urban (CELL F1, Scenario 2): Some positive impact in future flood damage reduction, especially in areas with repetitive flood problems, would be expected with this measure, but a quantitative estimate is not able to be made.

Other Urban (CELL F2, Scenario 2): Little to no change in impact expected.

Agricultural (CELL F3, Scenario 2): No change in impact expected.

Other Rural (CELL F4, Scenario 2): No change in impact expected.

Change in Government Expenditure

Emergency Response Costs (CELL F5, Scenario 2): Some positive impact in reducing future emergency response costs would be expected if more relocations are completed instead of repairs to structures that have suffered significant flood damage and remain at substantial risk of future flooding. A quantitative estimate is not able to be developed.

Disaster Relief (Agric) (CELL F6, Scenario 2): No change in impact expected.

Disaster Relief (Human Resource) (CELL F7, Scenario 2): Some reduction in future disaster relief expenditures would be expected if this measure were in place, and more mitigation projects were completed in areas that have experienced repetitive flooding. A quantitative estimate is not able to be developed.

Flood Insurance (NFIP) (CELL F8, Scenario 2): There would be a small reduction in the number of policies needed as this measure would appear to result in more relocations or evacuations of structures in danger of repetitive flooding. A quantitative estimate is not able to be developed.

Flood Insurance (FCIC) (CELL F9, Scenario 2): No change in impact expected.

Change in Value of Floodplain Resources

Net Agric Real Estate Value (CELL F10, Scenario 2): No change in impact expected.

Net Urban Real Estate Value (CELL F11, Scenario 2): The question of availability and affordability of alternative housing may be a concern, especially in communities where a large number of acquisitions are taking place. Data has not been obtained that would allow an analysis of this problem. There could be a reduction of property tax revenues with the evacuation of structures from the floodplain, but this may be offset by the movement to residences and commercial sites elsewhere in the taxing jurisdiction. There could be a tendency for property values to increase somewhat if a tight housing market exists in a given community. These factors likely vary community by community. Separate studies would be needed to determine the significance of each of these possibilities, and this goes beyond what can be accomplished in this assessment.

Reduction of Risk

 # Critical Facilities w/harmful releases (CELL F19, Scenario 2): No change in impact expected.

 # Other Critical Facilities (CELL F20, Scenario 2): No change in impact expected.

 # People Vulnerable (CELL F21, Scenario 2): It is expected that fewer people would be at risk over time if this measure were implemented, assuming that more mitigation projects involving acquisitions or relocations would be pursued. A quantitative estimate has not been attempted.

 # Communities Vulnerable (CELL F22, Scenario 2): There are probably only a very few additional communities where mitigation projects would be pursued with this measure in place that are not already involved with mitigation projects. This measure is assumed to have more of a potential influence with individual property owners' decisions, not on the decision as to whether an entire community, or substantial portion thereof, needs to be relocated.

 # Residential Structures Vulnerable (CELL F23, Scenario 2): It is expected that more relocations would be pursued with this measure in place. A quantitative estimate has not been attempted.

Implementation Costs

Structural Costs (CELL F24, Scenario 2): The measure would likely entail some increase in costs, because mitigation projects, especially involving acquisitions or relocations, are usually more expensive than funds provided to make repairs in kind and in place. The underlying assumption, however, is that the large majority of any additional projects pursued as the result of this measure will be justified based on the damages, mitigation, and relocation costs avoided from future flooding.

Other Costs (CELL F25, Scenario 2): There could be some up front incremental increase in administrative costs to make mitigation programs and funds available more quickly, but this is not expected to be a major factor.

MEASURE 4.6: Cost shared funding for acquisition of all structures repeatedly flooded is provided by Federal/State/Local governments (Scenario 3)

DESCRIPTION OF THE MEASURE: This measure would work toward the objective of removing all repetitively damaged structures from the floodplain. The definition of "repetitive loss structure" in Title V of the 1994 Act is any insured structure incurring flood damage on at least 2 occasions in a 10-year period for which the cost of repair, on average, equals or exceeds 25% of the value of the structure.

DISCUSSION OF THE MEASURE: It is somewhat difficult to use the 1993 flood as the standard to gain a perspective on the question of repetitively damaged structures, because it was such a large scale event that caused problems in some areas where none were previously experienced. Nonetheless, the Interagency Review Committee report (June 1994, Table 8.1, p. 126) identifies more than 5,700 structures in the National Flood Insurance Program in the nine Midwest states affected by the 1993 flood that were repetitively damaged over the period 1978-1993. More than 57 percent of these structures are in Missouri alone. There are undoubtedly other structures with repetitive flooding problems that are not a part of the flood insurance program. The priority for this measure would be on those structures that are a part of the NFIP.

In some states the sense is that sites with repetitive damages are quite well known and that activity since the 1993 event is addressing many of these locations. Other states hope to prepare more detailed plans to identify the potential for future mitigation work.

Data has not been obtained that would permit an estimate to be developed of how many of these repetitively damaged structures are candidates for buyout projects currently being pursued.

This measure would not require strict economic justification for all candidate buyout sites, only that they have been subject to two substantial flood events in any 10 year period. Based on very limited information at this time, the impression is that a large number of these situations are currently being addressed.

SIGNIFICANT FINDINGS: There is not much information or data to suggest that this measure would have a significant incremental increase in the number of acquisitions that will need to be pursued. More specific information relevant to this measure may be developed over time as a number of the Midwest states and communities complete more detailed hazard mitigation plans.

SUMMARY BY IMPACT CATEGORY:

Change in Flood Damages

Residential Urban (CELL F1, Scenario 3): Not enough information is available to make an estimate of the potential increase in future flood damages avoided with this measure in place.

Other Urban (CELL F2, Scenario 3): Not enough information available to make an estimate of potential change in impact.

Agricultural (CELL F3, Scenario 3): No change in impact.

Other Rural (CELL F4, Scenario 3): No change in impact.

Change in Government Expenditure

Emergency Response Costs (CELL F5, Scenario 3): These costs should go down over time if action is taken to acquire properties subject to repeated flood damage. No estimate has been developed of how much a reduction in these costs could be expected.

Disaster Relief (Agric) (CELL F6, Scenario 3): No change in impact.

Disaster Relief (Human Resource) (CELL F7, Scenario 3): Disaster relief expenditures should go down with this measure in place. No quantitative estimage has been developed.

Flood Insurance (NFIP) (CELL F8, Scenario 3): A reduction in the number of flood insurance policies required has not been determined.

Flood Insurance (FCIC) (CELL F9, Scenario 3): No change in impact.

Change in Value of Floodplain Resources

Net Agric Real Estate Value (CELL F10, Scenario 3): No change in impact.

Net Urban Real Estate Value (CELL F11, Scenario 3): No significant change in impact expected.

Reduction of Risk

 # Critical Facilities w/harmful releases (CELL F19, Scenario 3): No change in impact.

 # Other Critical Facilities (CELL F20, Scenario 3): No significant change in impact expected.

 # People Vulnerable (CELL F21, Scenario 3): This number should decrease over time, but no estimate has been developed.

 # Communities Vulnerable (CELL F22, Scenario 3): More "problem sites" would be addressed with this measure in place, but a quantitative estimate has not been developed.

 # Residential Structures Vulnerable (CELL F23, Scenario 3): This number should decrease over time, but no estimate has been developed.

Implementation Costs

Structural Costs (CELL F24, Scenario 3): This is a very important question mark. Mitigation projects are currently being pursued for thousands of residential structures at a cost roughly estimated at $25,000 per parcel. Depending on the number of insured structures that have been repetitively damaged that are NOT a part of the current round of mitigation projects, there is some potential for this to be a sizable cost.

Other Costs (CELL F25, Scenario 3): Administrative costs are high in completing mitigation projects, which are usually real estate transactions requiring lots of reviews and clearances. There may be large increases in costs to implement this measure over time, again depending on how many "candidate" projects remain or may develop over time.

SCENARIO CATEGORY F
Relocation, Mitigation Programs

	IMPACT CATEGORIES	A Base Cond. [All Disast. Counties]	B Base Cond. [FPMA Imp. Counties]	Scenario 1	Scenario 2	Scenario 3
	ECONOMIC (1,000 $'s)		[1]			
	Flood Damages					
1	Residential (Urban)	$760,892	$662,008	−200,000	< 5%	−< 10%
2	Other (Urban)	$1,612,543	$1,447,322	−15,000	0	−< 10%
3	Agricultural	$3,852,701	$817,054	0	0	0
4	Other Rural	$233,648	$161,010	0	0	0
	Chg. in Govt.Expend.					
5	Emergen.Resp.Costs	$227,405	$200,663	−20%	−< 5%	−< 5%
6	Disaster Relief (Agric.)	$1,160,632	$285,180	0	0	0
7	Disaster Relief (Human R.)	$1,297,474	$551,862	−100,000	− < 5%	−< 5%
8	Flood Insurance (NFIP)	$371,969	$276,496	−10%	−< 5%	−< 5%
9	Flood Insurance (FCIC)	$748,095	$269,061	0	0	0
	Chg.Value of FP Resources					
10	Net Ag RE Values	−	−	0	0	0
11	Net Urban RE Values	−	−	< 5%	< 5%	< 5%
	ENVIRONMENTAL					
	Natur.Resour.(# acres)					
12	Non−Forested Wetl. (acres)	−	365,285	0	0	0
13	Threat.&Endang. (# / Occ.)	−	(281/1,043)	0	0	0
14	Forest (acres)	−	534,705	0	0	0
	Natural Fldpln.Functions					
15	Fldpln.inundated (acres)	−	776,276	0	0	0
	Cultural					
16	Archeol Impacts (−5 to +5)	−	−1	−1(0)	−1(+1)	−1(+2)
16A	Hist.Sites(−5 to +5)		−1	−1(0)	−1(−2)	−1(−2)
	Open Space					
17	Public lands (acres)	−	392,512	0	0	+
18	Recreation sites (#)	−	485	0	0	+
	REDUCT.OF RISK					
	Critical Facilities					
19	# Facil. w/harmful releases	−	207	−< 5%	0	0
20	# other critical facilities	−	1,208	−< 10%	0	0
	Prot./Avoid. of Harm					
21	# people vulnerable	185,630	134,849	−20,000	−< 5%	< 10%
	Social Well Being					
22	# communities vulnerable	433	293	−100	0	−20
23	# resident.struct.vulnerable	56,339	42,743	−6,000	−< 5%	−< 10%
	IMPLEMENT. COSTS					
24	Structural Costs	−	−	+$215,000	+<$10,000	+$100,000
25	Other Costs	−	−	+$90,000	+$600	+$25,000

[1] Economic impacts collected only at the county level

CELL DESCRIPTION NOTES AND EXPLANATIONS

SCENARIO 1 MEASURES (NOTE: Estimates of change in impacts for the measures considered are based on comparisons with Column A Base Condition/All Federally declared disaster county estimates. They should be interpreted as providing indications of expected direction of change and RELATIVE magnitude of change, and NOT as measurements.)

Cell F1: NCS estimate based on projected mitigation/buyout projects for residential structures; some FEMA data to substantiate the estimate

Cell F2: NCS estimate based on projected mitigation/buyout projects for commercial structures; some FEMA data to substantiate the estimate, which is probably underestimated because mitigation projects involving public, transportation and utility facilities are not being included due to lack of specific data for each of these categories

Cell F3: Scenario 1 mitigation measures do not change this impact category (ag crop damages)

Cell F4: Scenario 1 mitigation measures would not measurably reduce the damages to farmsteads and farmland; other programs are targeted to address these problems

Cell F5: Scenario 1 mitigation measures (buyouts) could have a significant impact in reducing future emergency response costs; 20% reduction in these costs is analyst judgment, no supporting data available

Cell F6: Scenario 1 mitigation measures would not measurably reduce ag disaster payments; other programs are targeted to address these problems

Cell F7: NCS estimate based on assumed completion of a large proportion of projected buyout projects; estimate is not highly reliable, no supporting data available

Cell F8: Scenario 1 mitigation measures (buyouts) could have a small impact in reducing the number of NFIP policies; other measures would likely have a greater impact in encouraging more policies to be carried; estimate is analyst judgment, no supporting data avail.

Cell F9: Scenario 1 mitigation measures would not affect FCIC payments

Cell F10: Scenario 1 mitigation measures would not measurably effect a change in net agricultural productivity or rural land values

Cell F11: Estimate is analyst judgment considering such factors as slightly depressed land values and tax receipts that MAY be tied to buyouts; estimate is HIGHLY uncertain, even the direction of change in impact can easily be questioned; no supporting data available

Cell F19: A very few critical facilities with harmful releases may be handled through these Scenario 1 mitigation measures; no count of how many is available; estimate is analyst judgment

Cell F20: A few of the other critical facilities may be handled through these Scenario 1 mitigation measures; no count of how many is available; estimate is analyst judgment

SCENARIO 1 MEASURES (cont.)

Cell F21: Estimate is based on assumed completion of a substantial number of residential buyouts; based on analyst judgment without supporting data

Cell F22: Estimate is based on assumed completion of a large number of mitigation projects that will largely address flood problems for a number of communities; based on analyst judgment without supporting data, not reliable

Cell F23: Estimate is based on assumed completion of a substantial number of residential buyouts; some FEMA data to substantiate estimate

Cell F24: Estimate is based on projected mitigation project costs in the post flood period, some FEMA data to substantiate estimate; does not include future expenditures

Cell F25: Estimate is based on additional FEMA administrative costs tied to 1993 flood response and recovery, some data available

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SCENARIO 2 MEASURES (NOTE: Estimates of changes in impacts for these measures are based on comparisons with Column A Base Conditions. They should be interpreted as providing indications of expected direction of change and RELATIVE magnitude of change, and NOT as measurements.)

Cell F1: Estimate based on analyst judgment; no supporting data available

Cell F2: No measurable change in impacts expected

Cell F3: No change in impacts expected

Cell F4: No change in impacts expected

Cell F5: Estimate based on analyst judgment; no supporting data available

Cell F6: No change in impacts expected

Cell F7: Estimate based on analyst judgment; no supporting data available

Cell F8: Estimate based on analyst judgment; no supporting data available

Cell F9: No change in impacts expected

Cell F10: No change in impacts expected

Cell F11: There are several possible impacts that could result, with changes perhaps involving increases and decreases at the same time with respect to land values, taxable property, and alternative housing costs; net impact in each case expected to be relatively small, and overall affect is little total change; based on analyst judgment, no supporting data available

Cell F19: No change in impacts expected

Cell F20: No measurable change in impacts expected

Cell F21: Estimate based on analyst judgment; no supporting data available

Cell F22: No measurable change in impacts expected

Cell F23: Estimate based on analyst judgment; no supporting data available

Cell F24: Estimate of increased costs based on analyst judgment, no supporting data available

Cell F25: Estimate of "increased cost" largely reflects a decrease in revenues associated with termination of cottage leases, very little supporting data

SCENARIO 3 MEASURES (NOTE: Estimates of changes in impacts for these measures are based on comparisons with Column A Base Conditions. They should be interpreted as providing indications of expected direction of change and RELATIVE magnitude of expected change, and NOT as measurements.)

Cell F1: The acquisition of all structures with substantial repetitive damage could result in a measurable, incremental decrease in damages in this category; estimate based on analyst judgment, no supporting data available

Cell F2: See explanation for F1

Cell F3: No change in impacts expected

Cell F4: No measurable change in impacts expected

Cell F5: Estimate based on analyst judgment; no supporting data available

Cell F6: No change in impacts expected

Cell F7: Estimate based on analyst judgment; no supporting data available

Cell F8: Estimate based on analyst judgment; no supporting data available

Cell F9: No change in impacts expected

Cell F10: No change in impacts expected

Cell F11: Estimate based on analyst judgment; highly uncertain, no supporting data available

Cell F19: No change in impacts expected

Cell F20: No change in impacts expected

Cell F21: An additional, incremental reduction in the number of people exposed to flood risk could be realized; no supporting data available

Cell F22: An additional, incremental reduction in the number of communities with repetitive flood problems could be realized; no supporting data available

Cell F23: See cell F21 explanation above.

Cell F24: Estimate based on analyst judgment; highly uncertain, no supporting data available

Cell F25: Estimate based on analyst judgment; highly uncertain, no supporting data available

5. DISASTER RELIEF POLICIES AND PROGRAMS

MEASURE 5.1: Existing Federal agency disaster relief programs assumed to continue independently (Scenario 1)

DESCRIPTION OF THE MEASURE: Efforts have been made to improve coordination among the Federal agencies and programs in providing disaster relief in the aftermath of Federally declared disasters, and commentary suggests that the disaster response was provided more effectively in the 1993 flood. This measure assumes that "lessons learned" from that experience will continue to be applied in responding to future flood disasters, but that fundamental changes in the the respective roles and authorities of the various Federal agencies concerning flood disaster response will not occur. The measure is intended to elicit views of what other positive changes could be made that would increase the effectiveness of the Federal response and reduce the cost of providing the response.

DISCUSSION OF THE MEASURE: The formation of interagency recovery groups or task forces at the state level in most of the states, with participation from Federal agency representatives, marked an innovation at the time of the flood that proved to be very valuable for all concerned. FEMA Interagency Hazard Mitigation Teams were also formed and completed reports, as required, in response to the Federal disaster declarations. Many of the task forces or recovery groups continued to meet well into 1994 to coordinate disaster response activities and prepare recommendations for needed follow up actions. Post flood interagency recovery groups continue to meet periodically, especially to coordinate actions on mitigation projects.

In general, there is a desire from the perspective of state officials to have more flexibility and discretion at their level in how disaster relief funds can be applied. It was suggested that the FEMA Hazard Mitigation Grant Program be administered in the same manner as HUD's CDBG program. This would mean that the FEMA role would be to establish program regulations and oversight, but the selection of individual projects and funding allocations would be delegated to the states. In some states it would appear that a strengthening of state floodplain management and mitigation planning capabilities would be required before these responsibilities could be assumed.

Other suggestions from state officials for improved coordination of disaster relief programs and mitigation projects include: a single environmental review standard and process is needed, irrespective of the Federal agency providing funding for a project; continuation of the concept of joint Federal-state agency recovery/hazard mitigation grants coordination committees; FEMA should coordinate ALL Federal disaster recovery/hazard mitigation efforts following a major disaster; a buyout program community application should only have to be filled out once rather than a set for the FEMA Section 404 HMGP and another for the HUD CDBG funds; and a broader consideration of issues and quantification of impacts, if necessary, related to social welfare, health, and community well-being needs to be included in

determining disaster aid needs and mitigation project justification, because important factors going beyond what is currently included in benefit/cost analyses are not well considered.

SIGNIFICANT FINDINGS: There is an appreciation for the responsiveness that was for the most part demonstrated by Federal agencies in addressing needs caused by the 1993 flood. Some specific suggestions for improvement have been noted above. There are no quantifiable indicators to suggest major changes in the impact categories presented below.

SUMMARY BY IMPACT CATEGORY:

Change in Flood Damages

Residential Urban (CELL G1, Scenario 1): To the extent that more flexibility is granted to the states and more social type factors are considered in the review of disaster aid needs and mitigation projects, there may be more actions taken to remove people from areas of repeated flooding.

Other Urban (CELL G2, Scenario 1): No significant change in impacts expected.

Agricultural (CELL G3, Scenario 1): No change in impacts.

Other Rural (CELL G4, Scenario 1): No change in impacts.

Change in Government Expenditure

Emergency Response Costs (CELL G5, Scenario 1): These could go down depending on whether additional residential structures are removed from flood risk.

Disaster Relief (Agric) (CELL G6, Scenario 1): No change in impacts.

Disaster Relief (Human Resource) (CELL G7, Scenario 1): These needs would be expected to decrease over time as more mitigation actions are taken.

Flood Insurance (NFIP) (CELL G8, Scenario 1): Some small decrease in the number of policies could be expected; not a significant change in the context of the overall program.

Flood Insurance (FCIC) (CELL G9, Scenario 1): No change in impacts.

Change in Value of Floodplain Resources

Net Agric Real Estate Value (CELL G10, Scenario 1): No change in impacts.

Net Urban Real Estate Value (CELL G11, Scenario 1): No significant change in impacts expected.

Reduction of Risk

 # Critical Facilities w/harmful releases (CELL G19, Scenario 1): No change in impacts expected.

 # Other Critical Facilities (CELL G20, Scenario 1): No significant change in impacts expected.

 # People Vulnerable (CELL G21, Scenario 1): A small reduction in the number of people exposed to repeated flood risk, over time, would be expected if some of the suggestions for increased flexibility and more consideration of other than economic factors were implemented.

 # Communities Vulnerable (CELL G22, Scenario 1): No significant change in impacts expected.

 # Residential Structures Vulnerable (CELL G23, Scenario 1): Some additional structures would presumably be pursued for mitigation projects with the ideas for further reforms that have been offered.

Implementation Costs

Structural Costs (CELL G24, Scenario 1): Some increase in costs associated with pursuit of more mitigation projects and provision of disaster assistance would be expected.

Other Costs (CELL G25, Scenario 1): No significant increase in costs would be expected.

MEASURE 5.2: All disaster assistance strictly cost shared at 75%/25% and made consistent across all Federal relief programs (Scenario 2)

DESCRIPTION OF THE MEASURE: This measure is intended to remove what may be serving as a "disincentive" to states, communities, businesses, and individuals of the need to take advance planning and mitigative actions to avoid flood damages because of the perception that the Federal Government will relax its standard 75/25 cost share at times of extraordinary flooding. If it appears that the amount of disaster aid will be proportionately greater than the amount of funding that is provided to undertake other types of mitigative actions, then the incentive may be to "wait" until the big flood strikes with the expectation that more Federal dollars will be forthcoming.

DISCUSSION OF THE MEASURE: State officials were generally very supportive of this concept and this measure, especially those working in floodplain management program areas. It is widely recognized that advance planning and implementation of mitigation actions will be made more difficult if the perception exists that disaster relief will be available to cover even more of the damages that could be experienced. The focus needs to shift from "how do we obtain even more Federal disaster funds?", to "how do we improve our floodplain management and mitigation programs to avoid future flood damages?".

Some concern was expressed that, in catastrophic events affecting large numbers of people or covering a large area, there may be a genuine need for urgent assistance that would go beyond the resources of a state and local community to cover a 25 percent cost share. The 1993 flood was overwhelming to many small towns on the river. It is also possible for a community to suffer more than one devastating event even if proper actions were taken to meet accepted standards of damage avoidance.

Most state officials indicate that more could be done at their level to encourage communities to prepare or update emergency hazard response plans and to emphasize avoidance of potential flood risks as an important factor in community development and land use policies. There is also recognition of the importance of using disaster aid to take actions that will avoid repetitive flood damages, not just to recover as quickly as possible by restoring damaged structures in kind and in place.

SIGNIFICANT FINDINGS: There is substantial support for this measure from state officials, which might be considered somewhat surprising given that they are on the receiving end when Federal disaster declarations are made. While this would mean a shifting of more of the disaster assistance costs to state and local governments, it could be a powerful encouragement to get governments at all levels, as well as businesses and citizens, to make plans and take actions that in the long run should lead to overall reductions in the amount of disaster aid that would be required. There was no information or data obtained that would lead to readily quantifiable estimates of what changes in impacts could be expected with implementation of this measure. However, the Interagency Review Committee report (June 1994, Table 1.4, p. 23-25) identifies more than $4.2 billion in Federal disaster response and recovery costs, with non-agriculture related expenses approaching $2.5 billion. If it

is assumed that the $2.5 billion estimate is based on a 90 percent cost share, then the effect of reducing these expenditures by 15 percent, to a 75 percent cost share, would have led to approximately $375 million less in Federal spending on emergency response and recovery costs.

SUMMARY BY IMPACT CATEGORY:

Change in Flood Damages

Residential Urban (CELL G1, Scenario 2): The presumed change in impact is that more aggressive actions would have been taken by communities and individuals to remove some very small additional number of residential structures from flood risk if it were known that Federal share of disaster aid would not be greater than aid available for mitigation projects. If a more limited Federal cost share had been imposed, the impact in this category for the 1993 flood is estimated to be approximately $30 million less in Federal expenditures.

Other Urban (CELL G2, Scenario 2): If a more limited Federal cost share had been imposed, the change in impact for this category is estimated to be approximately $170 million less in Federal expenditures related to damages to commercial, public, transportation, and utility related facilities.

Agricultural (CELL G3, Scenario 2): No change in impact expected. Federal disaster assistance for agriculture is provided from other program and funding authorities not being considered as a part of this measure.

Other Rural (CELL G4, Scenario 2): The amount of disaster assistance for a few farmsteads and other rural structures may have been reduced as a result of this measure, but this change in impacts is assumed to already have been identified in cell G1 and G2 above.

Change in Government Expenditure

Emergency Response Costs (CELL G5, Scenario 2): A reduction in the amount of emergency response costs, if this measure had been implemented, is estimated to be approximately $20 million.

Disaster Relief (Agric) (CELL G6, Scenario 2): No change in impact expected.

Disaster Relief (Human Resource) (CELL G7, Scenario 2): A reduction in the amount of government expenditures for these purposes, if this measure had been implemented, is estimate to be approximately $150 million.

Flood Insurance (NFIP) (CELL G8, Scenario 2): If any change in impact could be anticipated here, it is that a few more structures vulnerable to flooding would have been covered by insurance if this measure had been in place. This is a almost certainly an insignificant number compared to the vulnerable structures subject to flood risk not currently insured.

Flood Insurance (FCIC) (CELL G9, Scenario 2): No change in impacts.

Change in Value of Floodplain Resources

Net Agric Real Estate Value (CELL G10, Scenario 2): No change in impacts.

Net Urban Real Estate Value (CELL G11, Scenario 2): No significant change in impacts would be expected.

Reduction of Risk

 # Critical Facilities w/harmful releases (CELL G19, Scenario 2): Data has not been obtained to make an estimate of how many of these facilities have been aided by Federal disaster assistance, and whether the reduction in Federal cost share would have influenced the decision to proceed with any needed restorative or protective work. Best judgment is that implementation of this measure would have caused few if any changes.

 # Other Critical Facilities (CELL G20, Scenario 2): There is the possibility that some of the repair and restorative work on these facilities might have been postponed or delayed if a smaller Federal cost share had been available, but best judgment again is that in most cases this work would have proceeded, if at greater state and/or local expense.

 # People Vulnerable (CELL G21, Scenario 2): A significant change in impact would depend on people being knowledgable of the provisions of disaster aid and having this information become a major factor in the decision to insure, relocate, or otherwise mitigate the flood risk to their homes. It is judged that this is hardly ever the case.

 # Communities Vulnerable (CELL G22, Scenario 2): This measure may be a little more of a factor to communities as they consider flood damage mitigation or avoidance strategies than it would be to an individual homeowner, but even here it is not thought to be a key consideration. If the measure were implemented and adhered to, it might become a more significant factor.

 # Residential Structures Vulnerable (CELL G23, Scenario 2): It is expected that there would be only a very marginal, if any, increase in the number of structures removed from flood risk as the result of this measure.

Implementation Costs

Structural Costs (CELL G24, Scenario 2): The real change in impact may not be in the need for recovery works or the total dollars expended for these actions, but the fact that state and local governments and the businesses and individuals with losses would have to assume more of these costs.

Other Costs (CELL G25, Scenario 2): No significant change in administrative expenses or other costs would be expected from this measure.

MEASURE 5.3: Public assistance grants to communities not in NFIP are greatly reduced (Scenario 2)

DESCRIPTION OF THE MEASURE: This measure is intended to gain greater participation on the parts of communities to enroll in the NFIP and to meet program requirements that should serve to reduce floodplain development and avoid increasing exposure to flood problems. There is also the inconsistency where a community's citizens are participants in the NFIP but the community itself has not taken steps to insure its public facilities from damages caused by floods, which this measure is intended to address.

DISCUSSION OF THE MEASURE: There is substantial support from state officials for adoption of this measure. Otherwise, it "rewards" communities who fail to take actions to protect themselves if they receive disaster aid to the same extent as communities who have taken steps to obtain insurance and meet other NFIP standards. Two such situations were reported for Minnesota, and there are certainly other examples elsewhere in the basin. A specific suggestion is for the disaster aid to be reduced by the amount of damage that could have been insured. Sometimes the problem is not recognized or confronted until a request for declaring a Federal disaster is NOT approved, and the local community and state are faced with the costs of recovery on their own.

While the concept is endorsed, states on their own are doing little at this time to formally review or require compliance with NFIP standards on the parts of communities. For instance, there appears to be little follow up by way of funding, monitoring, or enforcement to ensure that recommendations of the FEMA Interagency Flood Hazard Mitigation Team reports subsequent to Federally declared disasters are implemented. There is a suggestion that states themselves might wish to try a "carrot and stick" approach whereby communities who do take positive steps to insure themselves, establish floodplain zoning requirements, and plan other mitigative actions are supported with additional funding, while communities who fail to respond to repetitive flooding problems may risk reductions in funding support.

By establishing consistent standards for NFIP participation on the parts of both communities and individuals, it should heighten awareness of the program and encourage greater participation. There is a recognized need to encourage insuring of public structures.

SIGNIFICANT FINDINGS: Implementation of this measure would create a strong incentive for communities to seek greater self-protection through insurance and other mitigative actions and less reliance on Federal disaster assistance. No quantitative data or other information has been obtained that would allow estimates of reduced dollars expended for disaster assistance to be reliably developed.

SUMMARY BY IMPACT CATEGORY:

Change in Flood Damages

Residential Urban (CELL G1, Scenario 2): No change in impacts expected.

Other Urban (CELL G2, Scenario 2): There should be a reduction in exposure of public infrastructure and buildings to flood damages with implementation of this measure. A quantitative estimate is not able to be developed with available information.

Agricultural (CELL G3, Scenario 2): No change in impacts expected.

Other Rural (CELL G4, Scenario 2): No significant change in impacts expected.

Change in Government Expenditure

Emergency Response Costs (CELL G5, Scenario 2): There should be a reduction in these expenditures if actions are taken by communities to comply with NFIP standards that result in reductions in flood losses. A quantitative estimate is not able to be made.

Disaster Relief (Agric) (CELL G6, Scenario 2): No significant change in impacts expected.

Disaster Relief (Human Resource) (CELL G7, Scenario 2): Some reduction in expenditures would be expected with implementation of this measure. A quantitative estimate is not able to be developed with available information.

Flood Insurance (NFIP) (CELL G8, Scenario 2): There would be more participation on the part of communities to obtain insurance with this measure. Dollars expended for insurance premiums would increase, perhaps significantly, but reductions in government expenditures for post flood disaster assistance could be equally substantial. The result would be a shift of costs to communities to cover more of their own risks by paying for their insurance, and less expense to the Federal government for disaster aid. There is no quantitative estimate available on how significant these changes might be.

Flood Insurance (FCIC) (CELL G9, Scenario 2): No change in impacts.

Change in Value of Floodplain Resources

Net Agric Real Estate Value (CELL G10, Scenario 2): No change in impacts.

Net Urban Real Estate Value (CELL G11, Scenario 2): No significant change in impacts expected. Local property taxes may have to increase a small amount to cover the increased costs of communities paying for insurance and taking other steps to avoid flood damages to public infrastructure and buildings. This is in exchange for larger Federal disaster assistance which is also paid for by citizens and businesses through income taxes or by adding to chronic Federal budget deficits.

Reduction of Risk

 # Critical Facilities w/harmful releases (CELL G19, Scenario 2): There is the potential for reduced exposure to flood damages to these types of facilities through implementation of this measure, although it must be recognized that many of these facilities are the responsibility of entities in the private sector. A quantitative estimate of the reduction in the number of these facilities exposed to flood risk as the result of this measure has not been developed.

 # Other Critical Facilities (CELL G20, Scenario 2): This measure should be effective in helping to reduce the number of these facilities exposed to flood risk, or that remain uninsured. A quantitative estimate of this potential reduction has not been developed.

 # People Vulnerable (CELL G21, Scenario 2): This measure should be of some assistance in reducing the number of people exposed to flood risk, primarily through protection of important public services. No quantitative estimate is available.

 # Communities Vulnerable (CELL G22, Scenario 2): There could be a substantial number of communities who would be encouraged to obtain insurance or take other mitigative actions to reduce the exposure of public infrastructure and public buildings to flood risk if this measure were implemented. Data has not been obtained that would allow a quantitative estimate of the potential increase in the number of participating communities to be developed.

 # Residential Structures Vulnerable (CELL G23, Scenario 2): Little to no change in impacts would be expected.

Implementation Costs

Structural Costs (CELL G24, Scenario 2): Some increase in expenditures on the parts of local communities to better protect, operate, or relocate public buildings and infrastructure could be expected with implementation of this measure. Federal infrastructure disaster assistance was estimated at more than $400 million after the 1993 flood. The expectation is that this magnitude of disaster assistance could be significantly reduced through the costs incurred to better protect public buildings and facilities from flood damages or to avoid those damages through better siting practices. A quantitative estimate of these increased expenditures at the local level to avoid major flooding problems has not been developed.

Other Costs (CELL G25, Scenario 2): Some increase in administrative costs, especially related to increased insurance premium payments to cover flood risks to public facilities, would be expected. A quantitative estimate has not been developed.

MEASURE 5.4: Post flood disaster relief is eliminated for those communities and individuals within designated STANDARD PROJECT FLOOD areas not participating in the NFIP (Scenario 3)

DESCRIPTION OF THE MEASURE: This measure assumes a greatly enlarged NFIP program and mapping effort. It would entail an expanded definition of flooding and a floodplain designation that would no longer be tied to the "100-year" level, but would include all areas up to the standard project flood extent (typically a 500-year or "urban" level of protection). Participation in the much enlarged program would be a requirement before post flood disaster aid would be provided.

DISCUSSION OF THE MEASURE: While there is support for the concept of expanding the definition of flood risk to go beyond the "100 year" level, there are several problems that are anticipated with this proposal from the perspective of state officials. The general theme is that there are enough challenges to improve the mapping, increase participation, and ensure compliance with the existing NFIP requirements. Until this is accomplished, it is too much to expect successful adoption of this provision. The mapping requirements, in particular, would be extremely costly and time consuming to complete.

The key instead is to focus efforts on repetitive loss sites within the 100 year flood risk zone. There are truly exceptional cases that go beyond the ability to plan for and insure against. The 1993 flood may have been such an event in a very few locations. These are the rare occasions when disaster aid is legitimate as a preferred approach over insurance, which cannot be expected to cover every flood problem for every structure. The challenge of defining what constitutes these truly exceptional cases is probably beyond the ability of regulation writers to prepare and politicians to abide by.

On the other hand, there is a recognized need to heighten awareness, sensitivity, and understanding of the flood risk that goes beyond attainment of a "100 year" level of protection. There is still a fair degree of uncertainty surrounding flood prediction and flood delineation that needs to be much more recognized and appreciated. An expanded delineation of flood risk zones would be useful. There needs to be much more attention devoted to the residual flood risk that remains even in areas that are "protected" by a "100 year" levee or in areas that are just beyond the mapped 100 year flood zone. Communities need to recognize that these locations are not immune from flood problems and therefore to plan for and manage acceptable uses of land in these areas accordingly.

One way to encourage this sensitivity to a broader definition of flood risk is to combine floodplain management policies with other important community needs related to land use, recreation, and transportation planning and management. In this way the need to plan for and avoid the risk of flood damages is not perceived as a unique burden but merely a component of the factors that need to be addressed in the planning for wise community development.

SIGNIFICANT FINDINGS: This measure would be very difficult to implement and enforce at this time. A substantial up front cost and time commitment would be required to complete the mapping necessary to successfully implement this measure. There is reluctance to define such a strict limitation on the provision of disaster aid, because there are extraordinary cases where disaster aid will continue to be needed. There have been no quantitative estimates of costs or other changes in impacts that could take place if this measure were adopted.

SUMMARY BY IMPACT CATEGORY:

Change in Flood Damages

Residential Urban (CELL G1, Scenario 3): This measure would probably have relatively little impact on the exposure of residential structures to flood damage, although there would be a potentially very large increase in the number of structures that would fall under flood insurance requirements with this measure in place.

Other Urban (CELL G2, Scenario 3): Exposure to flood damages would be relatively unchanged, although many more commercial structures and public facilities would be subject to flood insurance requirements.

Agricultural (CELL G3, Scenario 3): No change in impacts.

Other Rural (CELL G4, Scenario 3): A few farmsteads and other rural structures could be included in an expanded delineation of areas requiring flood insurance, but this measure would not result in a major change in expected flood damages.

Change in Government Expenditure

Emergency Response Costs (CELL G5, Scenario 3): There would not likely be any substantial change in emergency response costs for existing structures. Over time, there could be some reduction in costs if future development more and more is directed to locations beyond the risk of flooding.

Disaster Relief (Agric) (CELL G6, Scenario 3): No change in impacts expected.

Disaster Relief (Human Resource) (CELL G7, Scenario 3): A substantial reduction in disaster costs would be expected for two reasons. The first is that more of the post flood recovery costs would be covered through insurance payments as opposed to disaster aid. The second is that "non-complying" areas previously receiving disaster aid but not participating in the NFIP would no longer receive this aid. The problem of "non-compliance" might be even bigger with a much expanded definition of flood risk that is proposed with this measure. No quantitative data has been developed to estimate what this change in impact could be, but the premise is that a much larger share of post flood recovery costs would move from this impact category to the NFIP category below.

Flood Insurance (NFIP) (CELL G8, Scenario 3): The costs in this category would significantly increase, both from the requirements for much greater participation that would be expected with the much expanded definition of flood risk and from the threat of loss of disaster aid if communities and individuals fail to participate. A quantitative estimate of the increased cost for flood insurance premiums with this measure in place has not been developed.

Flood Insurance (FCIC) (CELL G9, Scenario 3): No change in impacts.

Change in Value of Floodplain Resources

Net Agric Real Estate Value (CELL G10, Scenario 3): No change in impacts.

Net Urban Real Estate Value (CELL G11, Scenario 3): There could be small changes in this impact category with this measure in place. To the extent that many more structures will be identified as being located in areas of potential flood risk, there could be a slight downward pressure in the price of such property. Development might proceed somewhat more cautiously, or at somewhat greater cost, to comply with NFIP requirements. These kinds of changes are largely conceptual at this point, but may be deserving of more detailed analysis prior to implementation of the measure. The objective of the measure is to reduce the need for even larger disaster relief expenditures in the future. A quantitative estimate of these factors has not been developed.

Reduction of Risk

 # Critical Facilities w/harmful releases (CELL G19, Scenario 3): This measure would reinforce the need to locate such facilities beyond standard project flood risk levels. No estimate has been developed of how many additional structures would be relocated, better protected, or future facilities better located as the result of this measure, but the incremental impact is largely conceptual and unable to be quantified with available information at this time.

 # Other Critical Facilities (CELL G20, Scenario 3): This measure would encourage greater protection or better location of such facilities, but a quantitative estimate of the change in impacts associated with this measure has not been developed.

 # People Vulnerable (CELL G21, Scenario 3): Implementation of this measure could tend to slightly reduce the number of people who would locate in areas of expanded flood risk, but this would probably not be a significant change in impact.

 # Communities Vulnerable (CELL G22, Scenario 3): There are potentially more vulnerable communities, or at least additional areas of concern in many communities, with the expanded definition of flood risk contained in this measure. A quantitative estimate is unavailable, and may not be reliably developed until the expanded floodplain mapping that would be required with

this measure were completed.

 # Residential Structures Vulnerable (CELL G23, Scenario 3): There would be a significant increase in the number of residential structures that would be identified as exposed to flood risk with this measure in place. A quantitative estimate would depend on the delineation of expanded flood risk zones that would be a part of the mapping effort required to implement this measure.

Implementation Costs

Structural Costs (CELL G24, Scenario 3): Some increase in structural costs associated with increased protection or relocation of structures subject to flood risk could be anticipated. A quantitative estimate has not been developed.

Other Costs (CELL G25, Scenario 3): A large increase in NFIP administrative costs would be expected with a much enlarged program associated with mapping expanded flood risk zones and servicing many more policies. No estimate has been developed of what the increased costs could be. For some perspective, close to $900 million was spent over the period 1968 to 1990 to prepare over 18,000 flood studies, surveys, and maps (see Floodplain Management in the United States: An Assessment Report, Vol 2, June 1992, Table 6-3).

MEASURE 5.5: Repeat flood DISASTER payments to individuals and communities is eliminated (Scenario 3)

DESCRIPTION OF THE MEASURE: This measure would withhold disaster aid from individuals and communities who failed to use previous disaster assistance to comply with requirements to take actions to avoid repetitive flood damage. The effect would be to discourage flood victims from using disaster assistance only to restore substantially damaged structures in kind and in place.

DISCUSSION OF THE MEASURE: This measure was considered too arbitrary by several of the state officials and did not received much support. The concern is that there are too many exceptions to the rule that would require special consideration, and that these cannot all be anticipated in advance. Communities and individuals might apply their disaster aid to meet required standards by way of elevation or relocation, and yet be impacted by an even larger subsequent event. The approach of simply eliminating repeat disaster payments is too simplistic.

There is support for tying disaster aid to the development and implementation of mitigation plans and to encourage wise floodplain management and land use policies that deal with chronic flood problems at the local level. The emphasis should clearly be on avoidance of exposure to repetitive flood risks. Money spent on better planning and implementation of floodplain management policies and mitigation projects at the state and local level should pay big dividends in the reduction of expenditures necessary for future disaster relief.

SIGNIFICANT FINDINGS: While the objective of reducing post flood disaster relief expenditures is well accepted, it was not agreed that this measure is a fair or substantial step toward achieving this objective. There was no data or information obtained that would allow an estimate to be developed of how large a reduction in Federal disaster assistance after the 1993 flood would have resulted.

SUMMARY BY IMPACT CATEGORY:

Change in Flood Damages

Residential Urban (CELL G1, Scenario 3): It is assumed that more mitigative actions removing structures from flood damage would take place with this measure in place. No quantitative estimate has been developed of how large a change in impact this might be.

Other Urban (CELL G2, Scenario 3): More actions to reduce flood damages to commercial and public structures would be expected with this measure in place. No estimate has been developed of how significant a change in impact would be realized.

Agricultural (CELL G3, Scenario 3): No change in impact.

Other Rural (CELL G4, Scenario 3): No significant change in impact anticipated.

Change in Government Expenditure

Emergency Response Costs (CELL G5, Scenario 3): These expenditures could theoretically decrease if additional actions are motivated through this measure to relocate structures out of harm's way in advance of the next major flood event. The reality, however, is that it would be very hard to restrain an all out response in the midst of a flood disaster on the basis that such assistance had previously been provided, so there would most likely be little or no change in this impact category.

Disaster Relief (Agric) (CELL G6, Scenario 3): Agriculture disaster relief is handled through programs other than the measure proposed here, so there would be no change in impacts.

Disaster Relief (Human Resource) (CELL G7, Scenario 3): There is the potential for a significant reduction in disaster expenditures with this measure in place. No estimate of a change in impact has been developed.

Flood Insurance (NFIP) (CELL G8, Scenario 3): Presumably this measure would encourage greater participation in the NFIP as a substitute for reliance on Federal disaster assistance, especially in areas of repetitive flooding. No estimate of an increase in NFIP premium receipts has been developed.

Flood Insurance (FCIC) (CELL G9, Scenario 3): No change in impact.

Change in Value of Floodplain Resources

Net Agric Real Estate Value (CELL G10, Scenario 3): No change in impact.

Net Urban Real Estate Value (CELL G11, Scenario 3): This measure could marginally decrease the value of real estate in areas of repetitive flood risk, knowing that repeat disaster payments would no longer be forthcoming, but this is not judged to be a significant factor at these locations.

Reduction of Risk

 # Critical Facilities w/harmful releases (CELL G19, Scenario 3): This measure is expected to have little impact on these facilities. To the extent there is a change, it would likely be in the direction of more expenditures by local communities and private operators to better protect potentially vulnerable facilities, thereby reducing the number of facilities at risk.

 # Other Critical Facilities (CELL G20, Scenario 3): This measure would presumably create an incentive to take preventative actions to reduce exposure to flood damages to these facilities, or to insure against these risks, as opposed to relying on repetitive disaster relief. A quantitative estimate of this change in impact has not been developed.

 # People Vulnerable (CELL G21, Scenario 3): There could be some small incremental reduction in the number of people exposed to flood risk if actions are taken to accelerate the relocation of residential structures from vulnerable floodplain locations as the result of this measure. A quantitative estimate of this change in impact has not been developed.

 # Communities Vulnerable (CELL G22, Scenario 3): There could be a few communities who would take actions to remove exposure to flood risk as the result of this measure but who would otherwise not act. It is not thought that this would be a sizable number.

 # Residential Structures Vulnerable (CELL G23, Scenario 3): There could be some small incremental reduction in the number of vulnerable structures with this measure in place, with the elimination of repetitive disaster payments. No quantitative estimate has been developed.

Implementation Costs

Structural Costs (CELL G24, Scenario 3): Expenditures for mitigative actions that would remove structures from the threat of flood damages could increase with this measure in place. A quantitative estimate of this potential change in impact has not been developed.

Other Costs (CELL G25, Scenario 3): There could be some reduction in administrative costs if there were a reduced number of disaster claims to process and monitor. No quantitative estimate of this possible change in impact has been developed.

SCENARIO CATEGORY G
Disaster Relief Programs

	IMPACT CATEGORIES	A Base Cond. [All Disast. Counties]	B Base Cond. [FPMA Imp. Counties]	Scenario 1	Scenario 2	Scenario 3
	ECONOMIC (1,000 $'s)		[1]			
	Flood Damages					
1	Residential (Urban)	$760,892	$662,008	-< 5%	-< 5%	-< 5%
2	Other (Urban)	$1,612,543	$1,447,322	-< 5%	-< 10%	-< 5%
3	Agricultural	$3,852,701	$817,054	0	0	0
4	Other Rural	$233,648	$161,010	0	0	0
	Chg. in Govt.Expend.					
5	Emergen.Resp.Costs	$227,405	$200,663	-< 5%	-< 15%	-< 10%
6	Disaster Relief (Agric.)	$1,160,632	$285,180	0	0	0
7	Disaster Relief (Human R.)	$1,297,474	$551,862	-< 5%	-375,000	-25%
8	Flood Insurance (NFIP)	$371,969	$276,496	-< 5%	+20%	+ 100%
9	Flood Insurance (FCIC)	$748,095	$269,061	0	0	0
	Chg.Value of FP Resources					
10	Net Ag RE Values	-	-	0	0	0
11	Net Urban RE Values	-	-	0	-< 5%	-< 5%
	ENVIRONMENTAL					
	Natur.Resour.(# acres)					
12	Non-Forested Wetl. (acres)	-	365,285	0	0	0
13	Threat.&Endang. (# / Occ.)	-	(281/1,043)	0	0	0
14	Forest (acres)	-	534,705	0	0	0
	Natural Fldpln.Functions					
15	Fldpln.inundated (acres)	-	776,276	0	0	0
	Cultural					
16	Archeol Impacts (-5 to +5)	-	-1	-1(0)	-1(+1)	-1(+2)
16A	Hist.Sites(-5 to +5)		-1	-1(0)	-1(-2)	-1(-2)
	Open Space					
17	Public lands (acres)	-	392,512	0	0	0
18	Recreation sites (#)	-	485	0	0	0
	REDUCT.OF RISK					
	Critical Facilities					
19	# Facil. w/harmful releases	-	207	0	-< 5%	-< 5%
20	# other critical facilities	-	1,208	0	-< 5%	-< 5%
	Prot./Avoid. of Harm					
21	# people vulnerable	185,630	134,849	-< 5%	-< 5%	+ 25%
	Social Well Being					
22	# communities vulnerable	433	293	0	-< 10%	+> 5%
23	# resident.struct.vulnerable	56,339	42,743	-< 5%	0	+ 25%
	IMPLEMENT. COSTS					
24	Structural Costs	-	-	+< 5%	+$50,000	+$100,000
25	Other Costs	-	-	0	+$100	+$500,000

[1] Economic impacts collected only at the county level

CELL NOTE DESCRIPTIONS and EXPLANATIONS

SCENARIO 1 MEASURES (NOTE: Estimates of change in impacts for the measures considered are based on comparisons with Column A Base Condition/All Federally declared disaster county estimates. They should be interpreted as providing indications of expected direction of change and RELATIVE magnitude of change, and NOT as measurements.)

Cell G1: No significant change in impact from this measure expected; some proposed reforms could lead to small reductions in future exposure to damages, cell entry is analyst judgment with no data to support
Cell G2: See description for cell G1
Cell G3: No change in impacts with this measure expected
Cell G4: No change in impacts with this measure expected
Cell G5: A small reduction in these costs could be realized with reforms; cell entry is analyst judgment with no data to support
Cell G6: No change in impacts with this measure expected
Cell G7: See description for cell G5
Cell G8: See description for cell G5
Cell G9: No change in impacts with this measure expected
Cell G10: No change in impacts with this measure expected
Cell G11: No measurable change in impacts with this measure expected

Cell G19: No measurable change in impacts with this measure expected
Cell G20: No measurable change in impacts with this measure expected
Cell G21: A small reduction in exposure to flood risk could be realized over time with proposed reforms identified with this measure; cell entry is analyst judgment without supporting data
Cell G22: No measurable change in impacts with this measure expected
Cell G23: See description for cell G21
Cell G24: A small increase in costs, tied largely to more mitigative actions that could result from proposed reforms identified with this measure, might be realized; cell entry is analyst judgment without supporting data; less than 5% increase relates to cell F24 value, though these G24 expenditures could be on an annual basis rather than a single, large lump sum

SCENARIO 2 MEASURES (NOTE: Estimates of changes in impacts for these measures are based on comparisons with Column A Base Conditions. They should be interpreted as providing indications of expected direction of change and RELATIVE magnitude of change, and NOT as measurements.)

Cell G1: Relatively little reduction in DAMAGES assumed with these Scenario 2 measures, though government expenditures for disaster relief would be expected to decrease measurably (see cell G7 below); estimate based on analyst judgment; no supporting data available
Cell G2: See cell G1 explanation
Cell G3: No change in impacts expected

Cell G4: No measurable change in impacts expected
Cell G5: A sizable reduction in government expenditures would be expected; estimate is based largely on analyst judgment, little supporting data
Cell G6: No change in impacts expected
Cell G7: A sizable reduction in government expenditures would be expected; estimate is based largely on analyst judgment, little supporting data
Cell G8: A sizable increase in NFIP premiums based on increased participation in the program would be expected; estimate based on analyst judgment, no supporting data available
Cell G9: No change in impacts expected
Cell G10: No change in impacts expected
Cell G11: Estimate based on analyst judgment, highly uncertain, no supporting data available

Cell G19: Estimate based on analyst judgment, no supporting data available
Cell G20: Estimate based on analyst judgment, no supporting data available
Cell G21: Estimate based on analyst judgment, no supporting data available
Cell G22: Estimate based on analyst judgment, no supporting data available
Cell G23: No measurable change in impacts expected
Cell G24: Estimate based on analyst judgment, no supporting data, highly uncertain
Cell G25: Estimate based on analyst judgment, no supporting data, highly uncertain

SCENARIO 3 MEASURES (NOTE: Estimates of changes in impacts for these measures are based on comparisons with Column A Base Conditions. They should be interpreted as providing indications of expected direction of change and RELATIVE magnitude of expected change, and NOT as measurements.)

Cell G1: Estimate based on analyst judgment; no supporting data available
Cell G2: Estimate based on analyst judgment; no supporting data available
Cell G3: No change in impacts expected
Cell G4: No change in impacts expected
Cell G5: Estimate based on analyst judgment; no supporting data available
Cell G6: No change in impacts expected
Cell G7: A substantial reduction in disaster relief expenditures would be expected with these two measures; estimate based on analyst judgment, no supporting data available
Cell G8: A very large expansion of the NFIP would be expected with these two measures; estimate based on analyst judgment, no supporting data available
Cell G9: No change in impacts expected
Cell G10: No change in impacts expected
Cell G11: Estimate based on analyst judgment; no supporting data available

SCENARIO 3 MEASURES (cont.)

Cell G19: Estimate based on analyst judgment; no supporting data available
Cell G20: Estimate based on analyst judgment; no supporting data available
Cell G21: Estimate reflects a definitional change in expanding the areas recognized as subject to flood risk and therefore INCREASING the number of people vulnerable; based on analyst judgment, highly uncertain, no supporting data available
Cell G22: See cell G21 explanation
Cell G23: See cell G21 explanation
Cell G24: Estimate anticipates a large response in relocations motivated by these measures; based on analyst judgment, highly uncertain, no supporting data available
Cell G25: Estimate reflects huge expansion of NFIP mapping program; based on analyst judgment, no supporting data available

U.S. ARMY CORPS OF ENGINEERS FLOODPLAIN MANAGEMENT ASSESSMENT

Questions to Develop Data and Information Related to Potential Policy and Program Changes (Scenario Reviews)

Policy/Program Categories:

4. Community Relocation, Flood Hazard Mitigation, and Land Use Conversion Programs (6 policy options to be reviewed), and

5. Flood Disaster Relief Programs (5 policy options to be reviewed)

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SOURCES OF INFORMATION include:

- FEMA Regional Offices
- the 7 states - floodplain management or emergency response offices;

(persons consulted or supplying information on this package of policy options are identified with an asterisk *)

FEMA: POC's identified in response letter
Michael Robinson, Chief, Program Coordination Branch, HQ, FEMA, Washington, D.C. 20472, area code (202) 646-2716; John McShane, (202) 646-2971 for info on FEMA programs; *David Schein, Region V, 175 West Jackson, Chicago, IL 60604, (312) 408-5539, fax (312) 408-5551; *Ron McCabe, Region VII, Federal Office Building, 911 Walnut Street, Kansas City, MO 64106, (816) 283-7007, fax (816) 283-7018.

MINNESOTA: *Joe Gibson, MN DNR, Division of Waters, Box 32, 500 Lafayette Road, St. Paul, MN 55155-4032, (612) 296-2773; Ogbazghi Sium, MN DNR, Division of Waters, Supervisor, Land Use Management Unit, 296-0444, fax 296-0445 (*Tom Lutkin 296-0522 on staff); Todd Johnson, MN Flood Coordinator.

WISCONSIN: *Diane Kleiboer, WI State Hazard Mitigation Officer (FEMA Interagency Team), (608) 242-3200, fax (608) 242-3248; Larry Larson, State Floodplain Manager, (608) 266-1926, fax (608) 264-9200; Tim McClain, Bureau of Water Regulation and Zoning, (608) 266-0161; Susan Boldt and *Mike Strigel, FEMA WI Disaster Recovery Office (608) 242-3214, fax (608) 242-3248.

NEBRASKA: *Brian Dunnigan, Head, Floodplain Management Section, Nebraska Natural Resources Commission, 301 Centennial Mall South, P.O. Box 94876, Lincoln, NE 68509-4876, (402) 471-2081, fax (402) 471-3132; Randy Strauss, same location.

MISSOURI: Ron Kucera, MO Dept. of Natural Resources, Director of Intergovernmental Coorperation, P.O. Box 176, Jefferson City, MO (314) 751-3195, fax (314) 751-7627; *Steve MacIntosh, MO DNR, P.O. Box 176, Jefferson City, MO 65102-0176, (314) 751-2867, fax (314) 751-8475; *Terry Martin, MO

Dept. of Economic Development, P.O. Box 118, Jefferson City, MO 65102, (314) 751-4146.

ILLINOIS: David R. Boyce, Floodplain Management Section, Department of Transportation, 3215 Executive Park Drive, Springfield, IL 62794-9484, (217) 782-3862; *Molly O'Toole, IL Dept. of Transportation, Division of Water Resources, 310 S. Michigan Ave., Room 1606, Chicago, IL 60604, (312) 793-3123, fax (312) 793-5968; *Jan Horton, FEMA IL Disaster Recovery Office, 500 W. Monroe, Springfield, IL 62704, (217) 544-2007, fax (217) 544-2059; *Patrick Glithero, same location.

IOWA: *Jack Riessen, Iowa DNR, Wallace State Office Building, Des Moines, IA 50319, (515) 281-5029, fax (515) 281-8895; Chris Finch, Emergency Management Division, Dept. of Public Defense, (505) 281-4556.

KANSAS: Donald F. Kostecki, Water Structures Section, Division of Water Resources, Kansas State Board of Agriculture, 901 South Kansas Avenue, Topeka, KS 66612-1283, (913) 296-2933, fax (913) 296-1176; *Kerry Wedel, Kansas State Water Office, (913) 296-3185; Marvin Henry, Kansas Division of Emergency Management, (913) 266-1411.

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POLICY OPTIONS:

4.1. FEMA buyouts of 5,000 or more substantially damages structures is completed

QUESTIONS:

How many buyouts have been completed (as of 9/30/94, or 10/31/94)?

Where (what states and communities) have the buyouts occurred?

Is there a data base listing the sites and the number of acquisitions completed for each?

What have the acquisition costs been (total cost; average cost)?

Are acquisition costs broken down by Federal, state, and local shares?

How many people are affected by the buyouts?

Has affordable alternative housing been available nearby? Are there records kept of where people move to (stay in the same town; move out of the area; etc.?)

How long is the buyout process taking on average?

What alternative housing arrangements are being used in the interim?

Can an estimate be made of the future disaster relief and/or insurance costs avoided as a result of the buyouts? What were previous insurance payments or disaster relief dollars paid at these locations?

How many sellers had flood insurance?

Is the Section 1362 authority being used as the vehicle for most buyouts? Are requirements for conversion of land acquired to open space use being met?

Do "willing sellers" become fewer the longer the buyout process takes? What seems to be the period of time beyond which people lose interest in relocating? What is happening in the post 1993 flood period?

Do states have buyout assistance programs (MN cited on p. 11-48 of the Floodplain Management Task Force Assessment Report (1992)? Where have they been applied, how many structures, and how effectively?

How about local governments? Soldiers Grove, WI, Ibid., 11-49, cited as example in early 1980's of locally packaging funding sources from other Federal and state agencies. Any other good cases elsewhere in the seven Midwest states?

Other questions or issues that should be considered in this context?

4.2. Up to $20 million to be provided annually from NFIP premiums for "National Flood Mitigation Fund", with cost sharing requirements (see NFIP reform legislation, Section 554)

QUESTIONS:

How many vulnerable structures could be anticipated to be relocated or purchased annually under this funding source (in the 7 Midwest states)?

Do communities in the seven Midwest states have an inventory or backlog of qualified candidate structures already identified based on past experience? If so, how many and where are they located?

Is there any "estimate" of what proportion of this funding would go to buyouts as opposed to relocation of structures, or elevation of structures, or floodproofing, etc.? (The real question is what is the degree of effectiveness that is considered to be achieved with each of these approaches, and how would each be supported in evaluating how mitigation funding is proposed to be used?)

Can an estimate be developed of the amount of flood damages that can be avoided annually through implementation of this program for mitigation funding?

Other questions or issues that should be considered in this context?

4.3. 1993 Hazard Mitigation and Relocation Assistance Act (PL 103-181) and FEMA interim rule (May 11, 1994) in place increasing federal share for eligible hazard mitigation and relocation from 50% to 75%

QUESTIONS:

Can an estimate be made (or speculated) concerning how much more relocation and purchases of vulnerable structures would have taken place with this change in the post 1993 flood period in the Midwest, instead of repairing damaged structures in place?

What about the future?

What is an estimate of the dollar value of increased expenditures for mitigation, as opposed to disaster relief and flood insurance payments to affected structures, for the post 1993 flood experience in the Midwest, if this provision had been in place last year?

Will states and communities more aggressively pursue mitigation and relocation programs with this change in cost sharing? Are opportunities to do so already identified (see IV. A. above)?

Are Section 409 hazard mitigation plans being more comprehensively developed in the aftermath of the 1993 flood?

Other questions or issues that should be considered in this context?

4.4. Federal Leases of Floodplain Areas for cottages or other private uses are discontinued

QUESTIONS:

How many leases in the Midwest involve land or property in the 100 year floodplain?

How many of these have been covered by Federal flood insurance?

What was the insurance payout for how many of these properties from the 1993 flood?

What other disaster relief, if any, was provided in these locations?

How many of these are repetitive damage situations?

Other questions or issues that should be considered in this context?

NOTE: These may be Corps (Real Estate offices) as well as FEMA sources of information to develop data responding to these questions.

4.5. Flood hazard mitigation funds for floodproofing, elevating, or relocating structures are made available as quickly as construction funds for repairs in place

QUESTIONS:

Can an estimate be developed of how many more structures might have been modified or relocated, as opposed to repaired in place, if this change had been in effect during the post 1993 flood recovery?

(repeat question) Are there "lists" maintained at state or local level of prospective structures where buyouts or other actions could be implemented based on repeated flooding, etc.?

How are Federal records regarding repeated disaster or flood insurance payments maintained and used (% cumulative damage, e.g.)?

How are state and/or community programs structured to provide mitigation assistance in combination with Federal aid (anticipates issue IV. F.)?

What is the experience of MN and IL in providing funding for floodproofing? (see p. 11-78 of 1992 Floodplain Task Force Assessment report)

Other questions or issues that should be considered in this context?

4.6. Cost shared funding for acquisition of all structures repeatedly flooded is provided by Federal/State/Local governments

QUESTIONS:

What is the estimated cost of implementing this measure in areas affected by the 1993 flooding in the Midwest?

How many structures (residential and commercial) would have qualified?

What is an estimate of insurance payouts and disaster relief payments that could be avoided with this action, using the 1993 event as an example?

Does the data show that repeat flood victims more likely to be willing sellers for buyouts?

Other questions or issues that should be considered in this context?

5.1. Existing Federal agency disaster relief programs assumed to continue independently

QUESTIONS:

What have the flood disaster relief cost trends been in the Midwest over the past decade? What is the number of declared disaster floods, when and where, in the 7 Midwest states over the period 1984-1993?

What are the incentives (or disincentives) that are caused by the way these programs are structured and operated, especially reviewing the post 1993 flood recovery?

What suggestions are there for improved coordination and efficiencies in the administration of flood disaster relief programs?

Should state and local government development of integrated emergency management plans that incorporate responses to major flooding be enforced? Is an inventory of communities who have approved plans maintained by state?

Other questions or issues that should be considered in this context?

5.2. All disaster assistance strictly cost shared at 75/25 and made consistent across all Federal relief programs

QUESTIONS:

How would the 1993 Federal flood disaster relief expenditures have changed with adherence to these cost sharing provisions?

Any other Federally declared flood disasters in the Midwest that would have been affected over the past decade? If so, how would disaster aid have been affected?

How might participation rates in Federal insurance programs be affected, with what changes in premiums paid, if at all, if these cost sharing requirements were strictly applied?

Are there (more stringent) requirements that should be tied with the granting of disaster aid? Which categories (individual and family assistance, SBA grants or loans, public assistance, etc.)?

Other questions or issues that should be considered in this context?

5.3. Public assistance grants to communities not in NFIP are greatly reduced

QUESTIONS:

How would the 1993 FEMA Infrastructure relief payments to Midwest communities have been different had this provision been applied?

How many communities would have been affected (not in NFIP but received disaster relief anyway)?

Are there requirements (more stringent, again) that should be tied to the granting of disaster relief to communities? (e.g., enaction or enforcement of land use or zoning requirements . . .)

Should future disaster assistance be made dependent on implementation of actions recommended by the Interagency Flood Hazard Mitigation Teams? How should this requirement be monitored and enforced?

Other questions or issues that should be considered in this context?

5.4. Post flood disaster relief is eliminated for those communities and individuals within designated STANDARD PROJECT FLOOD areas not participating in the NFIP

QUESTIONS:

What is an estimate of the additional number of communities and structures in the 1993 Midwest flood area that would have to participate in the NFIP under this condition?

What is an estimate of how much disaster aid was paid to such communities and individuals in the post 1993 flood period in the 7 Midwest states?

Other questions or issues that should be considered in this context?

5.5. Repeat flood DISASTER payments to individuals and communities is eliminated

QUESTIONS:

How many such repeat flood disaster payments to individuals and communities can be identified in the 7 Midwest states?

What has the cost of repeated flood disaster relief been at these locations?

Has the use of past disaster relief funds focused on restoration in kind and place or mitigative actions? Should conditions be tied to the use of CDBG/disaster relief funds?

Other questions or issues that should be considered in this context?

FLOODPLAIN WETLAND RESTORATION POLICIES (Column H in Matrix Table)

Introduction

Six measures in the Floodplain Wetland Restoration Program issue area are examined as part of the Floodplain Management Assessment effort to consider "nonstructural" policy and program options that may reduce future damages and flood stages caused by extreme flood events like which occurred in 1993. This set of existing, modified, or new policies and programs was also reviewed in terms of floodplain land use changes that might offer a more optimal mix of floodplain outputs. The goal was to consider a range of floodplain and wetland restoration programs and was not intended to be exhaustive in scope.

Many of the existing protection or restoration programs have been established with different primary goals, such as water quality enhancement, waterfowl habitat enhancement, soil loss reduction, etc. Often the secondary benefits of these programs are similar: wetlands protected for waterfowl benefits, may also provide water quality benefits, run-off reduction benefits, etc. It must be noted that not all individual wetlands provide all of the functions and related benefits attributed to wetlands in general. However, because of the spatial scale considered in this assessment, our impact categories simply show changes in wetland acres as the indicator of environmental health or integrity, realizing that a wetlands location and hydrology are the ultimate determinants of its function.

1. Existing wetland protection and restoration policies assumed to continue without major change.

2. Increased funding for Refuge Revenue Sharing Act is provided to cushion local governments' tax base from land conversion effects.

3. Stream and riparian restoration program established with Federal funding and technical assistance from DOI, USDA, and/or EPA.

4. Flood plain wetlands targeted for priority enrollment in the Wetlands and Emergency Wetlands Reserve Programs.

5. $2 million annual funding for land acquisition for habitat improvement under the Upper Mississippi River Environmental Management Program is provided.

6. New funding is provided to initiate a Lower Missouri River Environmental Management Program, with land acquisition for habitat improvement allowed.

ANALYTICAL APPROACH

The Galloway Report was studied to determine the major programs which exist to promote flood plain restoration and related technical support. The Federal agencies involved in restoration activities were contacted to develop a section which provides a general description of the programs available, the extent of acquisitions/relocation, and the funding levels. Data acquisition

from these agencies by FPMA reach was near impossible. Effort was made to obtain data by county. With the exception of the Federal Emergency Management Agency (FEMA) data, most data were available by state. Specific data on various programs including acreages enrolled and acreage in the floodplain was provided by NCRS staff. The eight states involved in this study are: Illinois, Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, and Wisconsin.

Each measure is discussed separately. Questions within each measure are posed to determine what effect each measure may have on future program and policy issues. In order to quantify impacts of these measures, available information on program rules, acreages, and costs were compiled. In many cases assumptions had to be made regarding the future direction of the programs, funding, etc. These assumptions have been documented under each measure. In some cases the assumptions may not seem realistic with the current rapid rate of federal policy changes being made. However, the assumptions allow comparison, in broad terms, of the various programs and the degree of potential impact these could have in affecting floodplain outputs.

Mostly descriptive information is provided to address Measure H1. Funding levels are presented, along with targeted acreage conversion, where available. Specific case studies were utilized in the discussion of Measure H2 to demonstrate impact of buyout/relocation on the local tax base. The analysis of Stream and Riparian Restoration Programs in Measure H3 summarizes the existing programs and provides a general discussion of the cost to implement an increase in program activity and the potential damage reduction of proposed policy changes. Measure H4 is considered NRCS/CFSA specific, and, as such, the discussion confines itself to these Department of Agriculture programs only. The analysis and discussion for Measures H5 and H6 follow a similar format, as these measures address the Environmental Management Program (EMP) for the Upper Mississippi River and the Lower Missouri River, respectively.

A table will be included in the final report which identifies the total potential wetland restoration sites within the FPMA flood plain. The data presented in this table will be developed by the staff from the Corps of Engineers North Central Region (NCR) Geographic Information System (GIS) based on established criteria. The potential sites will be further identified by those acres "protected" by levees and those "unprotected" by levees.

SCENARIO I MEASURES

H1 Measure - Existing wetland protection and restoration policies assumed to continue without major change.

A brief description of the existing programs follows. Additional description of some of these programs can be found in Section 3G.

UNITED STATES DEPARTMENT OF AGRICULTURE (USDA)

Agricultural Stabilization and Conservation Service (ASCS) -- now part of the Consolidated Farm Service Agency (CFSA)

Swampbuster Provision of the Food Security Act of 1985, as amended, discourages the conversion of natural wetlands to cropland use. Severe penalties if conversion is substantiated. Report due out shortly which identifies acreage converted and penalties to operators.

Wetland Reserve Program (WRP) - provides financial incentives for restoration and protection of wetlands with long-term or perpetual easements. The administration of this program will be transferred to the newly formed Natural Resource Conservation Service (NRCS) sometime during FY95. The ASCS is still responsible for the FY92 fund allocation carryover and the FY94 fund allocation (program was not funded in FY93), as well as overall program activity until transfer. The 1994 allocation and program activity for the WRP is still with the ASCS. For FY95, the SCS (now part of the National Resource Conservation Agency, NRCS), will administer the WRP program. Under the WRP, there is no National mandate to target flood-prone areas.

Water Bank Program - protects existing wetlands for waterfowl production.

Farmers Home Administration (FmHA) -- farm programs now part of the Consolidated Farm Service Agency (CFSA).

Debt Cancellation Conservation Easements - forgiveness of debt in exchange for conservation easements. No allocation for this program.

Transfers of Inventory Farm Properties to Federal and State Agencies for Conservation Purposes - FmHA can transfer certain farm properties for conservation purposes. Properties containing wetland may qualify. No allocation for this program.

Section 335 of the Consolidated Rural Development Farm Act (CONACT) allows for conservation programs. Programs as they relate to wetlands: debt cancellation in exchange for conservation easement, sale/transfer inventory farm properties for conservation purposes with restrictive covenants (deed restriction/easement). Main intent of the programs is to protect and to conserve. No budget appropriated for these programs -- take each request as it comes. Debt Cancellation basically a "write-off" of borrower debt. Borrower may retain fee title ownership of real property. Disposition of inventory property shown as asset at fair market value with reduction for imposition of restrictive covenants. FmHA tried to push these programs in 1993, but there was no marked increase of interest in the

programs. Many operators went through the EWRP. To date, there have been 379 transfers involving 115,000 acres. Direct costs to agency paid through contracting, including costs for title work (approximately $100-$300), appraisals (approximately $500-$1,000), and surveys (ranging anywhere from $1,000-$15,000, depending on the tract of land).

Data on properties approved for transfer to Federal and State agencies for conservation purposes and debt cancellation easements, including dollar amounts may be available in the final report.

Federal Crop Insurance Corporation (FCIC) - provides incentive to *not* convert wetlands. Under Swampbuster, farmers who plant on newly converted wetlands are ineligible for crop insurance coverage on *all* planted acreage.

Soil Conservation Service (SCS) -- now part of the Natural Resources Conservation Service (NRCS)

Emergency Wetland Reserve Program - purchase of easements from persons owning cropland who voluntarily agree to restore farmed, converted, or potential wetlands. The EWRP was established in direct response to the Flood of 1993 and targets agricultural lands protected by levees. Up to $100 million was allocated. The initial emergency supplemental appropriation was $15 million to enroll approximately 25,000 acres. No expenditures in 1993. Funds are allocated by state. Total FY 95 allocation is $28 million. The cutoff date for applications under the EWRP was December 31, 1994.

Wetland Reserve Program - Responsibility for administration of this program by NRCS to be transferred from ASCS sometime in FY95.

DEPARTMENT OF THE ARMY, U.S. ARMY CORPS OF ENGINEERS

Planning Assistance - Section 22, Water Resources Development Act of 1974, Public Law 93-251, authorizes cooperation with states and federally recognized Indian Tribes in the preparation of comprehensive plans for the development of water and related resources of drainage basins. Activities include methodologies to evaluate wetlands. Expenditures in any one state cannot exceed $300,000 in any one year. Non-Federal cost share is 50%.

Project Modifications to Improve Environment - Section 1135, Water Resources Development Act of 1986, Public Law 99-662, provides for modifications of the operation of completed USACE projects for the purpose of improving environmental quality. Program can be used to project, restore, or create wetlands. Non-Federal cost share is 25%.

U.S. DEPARTMENT OF COMMERCE

Economic Development Administration (EDA) - Grant assistance to communities and businesses adversely affected by disasters. Not a wetland restoration-specific program. The 1993 Supplemental Appropriation provided $200 million for 1993 flood relief efforts.

ENVIRONMENTAL PROTECTION AGENCY (EPA)

Wetland Protection - State Development Grants to develop new or refine existing state and tribal wetland protection programs. Grant program targets new wetland programs in the states as well as existing programs. States must apply for these grants, and it is highly competitive. Not a marked increase from previous years in grant applications or dollars allocated for the program post-flood 1993. Totals available by state for 1994, but data are not available on applications on hand for 1995. For 1994, Illinois and Iowa made no application for grant dollars, South Dakota applied but received no grant award, and Missouri received four grants totaling $627,000. These grant awards are to be used to set up or assist existing wetland conservation programs; no physical movement of earth or equipment with grant funds. Fiscal year 1994 grant activity:

Illinois, Iowa, South Dakota, and Nebraska -- no grants awarded.

Kansas -- $97,500 EPA grant with State match of $26,000 for a Wetland and Riparian Areas Project.
Minnesota -- $241,000 EPA grant with State match of $81,000 for a Biological Wetland Assessment.
Missouri -- $137,000 EPA grant with State match of $46,000 for Wetland Identification project; $215,000 EPA grant with State match of $72,000 for Wetland Characterization and Mitigation Guidelines; $238,000 EPA grant with State match of $79,000 for the Meramec River Watershed Demonstration Project; and $37,000 EPA grant with State match of $12,000 for Wetland Success Stories.
Wisconsin -- $150,000 EPA grant with State match of $50,000 for Watershed Protection Plan for Assessing and Correcting Water Quality Impacts from Cranberry Operations; $77,000 EPA grant with State match of $19,000 for State Permit Tracking System.

The 1995 fiscal year funding level is $15 million.

FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA)

Section 404 Mitigation Programs -- Buyout, Acquisition, and Relocation - Provides grants to state and local governments, certain private non-profit organizations, and Indian Tribes for hazard mitigation activities.

Available data from FEMA indicates participatory funding in the

acquisitions/relocation following the 1993 flood in the study area as shown in Table R-45.

Table R-45

FEMA Section 404 Program
Flood of 1993
Flood Plain Management Assessment

State	Number	Total Project Dollars
Illinois	1,327	$53,921,755
Iowa	340	$11,314,933
Kansas	243	N/A
Minnesota	2	$330,000
Missouri	3,903	$53,196,590
Nebraska	N/A	N/A
South Dakota	0	0
Wisconsin	143	$10,837,367

Additional data may be available for inclusion in the final report.

U.S. DEPARTMENT OF THE INTERIOR (DOI)

Bureau of Reclamation - constructs, operates, and maintains multipurpose water projects in the 17 western States. The Wetland Development Program seeks to restore and enhance wetlands for purposes such as wastewater treatment and waterfowl habitat.

U.S. Fish and Wildlife Service (FWS)

North American Wetlands Conservation Fund - provides for 50/50 cost share funding to states, local government, businesses and individuals to protect, restore, and manage wetland habitat for migratory birds and other wildlife.

Partners for Wildlife (PFW) - provides for grants and technical assistance to private landowners interested in restoring wetlands and riparian habitats on their land.

The objective of PFW is to protect and restore through cooperative efforts with other governmental agencies and private partnerships, Federal trust species habitats on private land and easement/transfer properties of the Rural Economic and Community Development Agency (RECD); to contribute to the conservation of biological diversity through careful selection, design, and implementation of restoration projects; and to provide technical assistance to the U.S. Department of Agriculture and private landowners involved in the implementation of key conservation programs. PFW wetland restoration sites (1994) are shown in Table R-46.

Table R-46
FWS Partners for Wildlife
Flood Plain Management Assessment

State	Acres
Illinois	227
Iowa	299
Kansas	332
Minnesota	2,086
Missouri	1,133
Nebraska	697
South Dakota	860
Wisconsin	691
TOTAL	6,325

Small Wetlands Acquisition Program (SWAP) - purchase of or perpetual easement agreement on wetlands.

National Park Service (NPS)

Federal Land Transfer - technical assistance and transfer of available surplus of Federal land to states and local governments for the purpose of establishing parks for recreation and open space.

Rivers and Trails Conservancy Program - NPS Staff assistance to communities for river and trail corridor planning and open space preservation efforts.

SMALL BUSINESS ADMINISTRATION

Disaster Loan Program - loans made to property owners to restore any property, including wetlands damaged by flooding.

The major Federal programs of flood plain wetland restoration which results in direct conversion, as described above, are administered by FEMA, USDA, and USFWS. Other non-Federal entities also contribute to wetland restoration efforts.

OTHER NON-FEDERAL ENTITIES

Numerous organizations/agencies exist which have wetland restoration programs, including, but not limited to: State Departments of Historic Preservation, Economic Development, Natural Resources, Emergency Management, Natural Heritage Agriculture, Archeology, and Game, Fish and Wildlife; The Conservation Fund Wetland Initiative; Ducks Unlimited; FFA Chapters; Izaak Walton League; The Nature Conservancy; The National Fish and Wildlife Foundation; Pheasants Forever; Waterfowl, USA, and others.

ANALYSIS

Question: What is an estimate of the number of communities in the 1993 Midwest flood area where land use conversions after the flooding due to mitigation, buyouts, or other existing programs are resulting in increases in riverfront park, recreation, or wetland/habitat acreage?

The above FEMA acquisitions/relocation total approximately 6,000. If acreage ranged from 0.2 to 0.75 per property, total acreage converted would range from 1,200 to 4,500. The end use of this land is for open space or recreational purposes, as regulated by the Volkmer Act of 1993. It is considered that this conversion rate would have had a minimal effect on the flood event of 1993 in terms of flood stages levels and damage reduction.

Question: What is an estimate of the number of acres of wetland that would be restored or protected under measure H1?

Assumptions:

Wetland Reserve Program

1) Of the program goal of 1 million acres, 22% (based on existing sign-up) are in the FPMA states. Assume that this ratio remains the same.

2) A breakdown of specific locations of WRP lands was not available. Assume for purposes of comparison that 50% of enrolled WRP acres are in the floodplain.

3) Assume 50,000 acres converted to date. This leads to approximately 105,000 additional floodplain acres restored if the program meets it goals. Of this amount assume 75% reverts to forested wetland and 25% reverts to non-forested wetland.

COSTS: Average to date is $907/acre for a total of ~$95 million.

Emergency Wetland Reserve Program

4) There is a potential to enroll 50,000 total acres in the program.

5) Assume that to date, half of the targeted acres are enrolled, leaving 25,000 acres to be enrolled.

6) Since only 75% of enrolled acres are required to be wetland, we have assumed this will be the actual percentage enrolled, resulting in an additional 18,750 acres. The remainder converted land will be non-wetland.

COSTS: Approximately $2000/acre for easement and restoration costs = ~$50 million dollars.

Conservation Reserve Program

7) A precise count of CRP acres in the floodplain is not currently available. In consultation with NCRS staff and using estimates of floodprone cropland (see Agricultural Support Policy 2, below), it is assumed that at the time of the flood, 212,000 acres were enrolled.

8) Because under this scenario measure no major changes would occur in this program, no increase or decrease in estimated CRP acreage is assumed.

COSTS: No additional cost or savings.

Other Programs

9) Because of the difficulty in estimating acres enrolled in the floodplain and specifically the FPMA study area, we have assumed that all other existing wetland programs combined contribute 10% of the three major programs (WRP, EWRP, and CRP) discussed above. Under this measure this would amount to approximately 12,000 acres.

COSTS: Assume a cost/acre for agricultural conversion of $1,500 (King and Bohlen, NCRS pers. comm.) results in ~$18 million.

H2 Measure - Increased funding for Refuge Revenue Sharing Act is provided to cushion local governments' tax base from land conversion effects.

Funding for this program comes from refuge receipts and from special appropriations from Congress. In some years, Congress has not funded the program, so the Service has had to reduce payments by a certain percentage. Only those lands within the Wildlife Refuge System, either through purchase or gift, are eligible for payments.

Detailed information on the acres converted and payments made to mitigate the loss of revenue from these acres by the Service will be provided for the 8 states in the study area in the final report.

Question: What is an estimate of the NET loss of property tax revenues that could be realized due to land use conversion actions in the 8 Midwest states after the 1993 flood? What would be due to residential and commercial relocation or removals?

A residential/commercial test case to illustrate impact to tax revenues as a result of these land conversions is the city of Des Moines, Iowa. A total of 121 buyouts of residential and commercial properties were completed following the 1993 flood. Assigning a range of acres per property of .2 to .75 yields total acres converted ranging from 24 to 91. The end use of these acres is for greenspace or present zoning use, depending upon use of FEMA money for the buyouts. The total assessed valuation of the properties converted is estimated at $2.7 million.

Participation in Refuge Revenue Sharing Act program is dependent upon being in the Wildlife Refuge System. The area involved in the Des Moines buyouts is not in the system, therefore, the city received no funds from this program to cushion its loss of tax revenues.

Since most of the lands within the Wildlife Refuge System are outside centralized urban areas, it is expected that program impact to residential/commercial area conversion is insignificant.

What would be due to permanent farmland conversions?

A case study for farmland conversion is the Louisa County Levee District #8 buyout. The Fish and Wildlife Service added Iowa lands of approximately 3,000 acres, formerly known as Louisa County Levee District Number 8, to the Wapello District of the Mark Twain National Wildlife Refuge. To offset income received from county property taxes annually by previous landowners ($16,040), a revenue-sharing payment under the authority of the Refuge Revenue Sharing Act was proposed. According to the Environmental Assessment dated April 1994, a formula was used to calculate a full entitlement payment of $12,962. However, due to anticipated congressional appropriations for this program, payments would be reduced to 90% of full entitlement, or $11,666. The assessment states that "Although it appears that the county would lose tax money, it is emphasized that current tax revenues are based on pre-flood property values and not on current appraised values. It is reasonable to expect that the county would adjust downward its assessed value of properties severely damaged by flooding, especially if the flood damage resulted in an economically detrimental change of land use by the landowner."

While increased funding for this program will cushion local governments' tax base from land conversion effects, the payments to be made to these local interests is limited by the number of acres eligible for enrollment in the Wildlife Refuge System and will be mainly limited to rural areas.

H3 Measure - Stream and riparian restoration program established with Federal funding and technical assistance from DOI, USDA, and/or EPA.

Riparian ecosystems are being degraded and destroyed throughout the United States. The lower 48 states originally contained 75-100 million acres of indigenous, woody riparian habitat, but today only 35 million remain in nearly natural condition (FIFMTF 1992). The rest have been inundated by reservoirs, channelized, dammed, riprapped, converted to agricultural use, overgrazed, paved, or altered by a combination of factors that have impeded their ability to stabilize and maintain the biological diversity of their own watersheds. Riparian habitats have been lost in every region of the country. They are unique in their linear form, they have very large energy, nutrient, and biotic interchanges with aquatic systems on the inner margin and upland terrestrial ecosystems on their outer margin, and they are connected to both upstream and downstream ecosystems.

Objective: The change in policy described by this measure consists of

an expansion and integration of existing programs or creation of a new program which would allow the Federal Government to acquire land for restoration using a comprehensive approach or ecosystem approach and which would have a set amount of discretionary funds so that the Secretaries of the Interior and/or Agriculture can take advantage of unforeseen opportunities or urgent acquisition developments. The change also involves a modification of the process for determining land acquisition priorities and current procedures to acquire land. The Interagency Floodplain Management Review Committee Report (1994) discusses the importance of such a program (pgs. 95 and 109).

Summary of Current Programs: The Department of Interior, U.S. Department of Agriculture (USDA), Environmental Protection Agency (EPA), and U.S. Army Corps of Engineers (COE) are involved in stream and riparian restoration programs. Some of these programs include: the Fish and Wildlife Service Partners for Wildlife Program (PFW) and Small Wetland Acquisition Program (SWAP), Rural Economic and Community Development conservation program relating to the disposition of inventory property, the Consolidated Farm Service Agency Swampbuster provision of the 1985 and 1990 Farm Bills, Natural Resource Conservation Service Wetlands Reserve Program (WRP) and Emergency Wetlands Reserve Program (EWRP), and U.S. Environmental Protection Agency Section 104(b)(3) Grant Program. These specific programs are described above under Measure H1. General information obtained from most Federal agencies contacted indicates that these programs will continue to be funded at levels similar to pre-flood funding levels, i.e., programs are expected to maintain activity.

Question: What is an estimate of cost needed to implement such a program for suitable target areas in the 8 Midwest states in the aftermath of the 1993 flood and how many acres would be protected?

Increased funding for the administration, technical assistance, and acquisition will enhance the existing programs and lead to a more efficient and economical restoration effort. The major players in the restoration effort administer active programs with current appropriations; additional funding would supplement and augment these programs and lead to increased support and a more coordinated federal, state, and local restoration effort through goals established in interagency ecosystem management plans. Because the amount of existing riparian habitat, potential habitat, and quality of that habitat is not known for the smaller rivers and streams that would be targeted by this program, we chose to assume that the budget for such a program would be similar to other national restoration programs, such as the Wetland Reserve Program. Ideally the amount and priority of riparian habitat required to meet some defined ecosystem management goals would be the basis for determining the costs required for his program.

Assumptions:

1) Assumptions for the WRP are based on the current sign-up in the eight state FPMA study area of 22% of the national program sign-up. This would allocate $220 million to the FPMA states, based on the estimated cost of $1 billion for the WPR program if the goal of 1 million acres protected is met. As stated above this budget will be used to gauge the impact of the proposed stream and riparian habitat restoration program.

2) Assume the cost of restoration, easements, etc. are $1,000/acre. This would result in 220,000 acres of riparian habitat protected or restored. If a 100 foot buffer strip is used as the average width protected, approximately 9,200 river miles (24 acres/mile) could be impacted by this program, given the $220 million budget.

3) Since the habitat for most of the streams that would be targeted by this program were not quantified in the FPMA base conditions, the acres protected are not indicated in the matrix table. However, it is estimated that 209,000 acres of floodplain forest and 11,000 acres of non-forested wetland would be protected or restored.

Question: What is an estimate of damages and other losses that could have been avoided if such a program had been in place at suitable target areas at the time of the 1993 flood?

Some benefits would have accrued from prevented damages had suitable target areas been converted. Indications are, based upon hydraulic modeling and identification of suitable target areas, that damage reduction potential would be minimal and wetland restoration would not likely have a significant impact on stage conditions. However, the most of the benefits from such a program would not be seen simply during a flood event but would be generated on a daily basis as part of the natural functions of the ecosystem.

Impacts: The expanded stream and riparian restoration programs could lead to a more comprehensive approach to ecosystem management. The expanded program could be managed in a cooperative and collaborative manner that recognizes, restores, and maintains the composition, structure, and function of ecosystems, in order to ensure their sustainability and biological diversity at landscape and other relevant ecological scales. Critical ecosystem components could be restored or acquired when unforeseen opportunities become available.

H4 Measure - Floodplain wetlands targeted for priority enrollment in the Wetlands and Emergency Wetlands Reserve Programs.

Question: What is an estimate of the number of acres and outstanding candidate locations that should be targeted for these programs in the areas affected by overbank flooding (i.e., FLOOD PLAIN related) in the 8 Midwest states in 1993?

Data being developed by NCR GIS and will be provided in the final report.

Question: What is an estimate of cost to implement these enrollments or permanent conversions?

The FY95 allocation of $93 million is scheduled for allocation to the states sometime in May or June of this year. Of the '92 funding, $12 million has been carried over. Agency has asked the Secretary of Agriculture to immediately release the $12 million carryover along with approximately $43

million of the FY95 funding to distribute to states experiencing an overflow of requests. 1992 was the first year this program was funded. The states of SD, IL, KS, and NE received no allocation in 1992, so easement acres converted for these states pre-flood would be zero.

The 1994 allocation and program activity for the WRP is still with the ASCS (now part of the Consolidated Farm Service Agency, CFSA). For FY95, the SCS (now part of the National Resource Conservation Agency, NRCS), will administer the WRP program. Information about the program is shown in Table R-47.

Table R-47
Wetland Reserve Program Allocations
Flood Plain Management Assessment

FY	Allocation	Targeted Acres**	Acres Converted
92	$46 million	50,000	39,000 recorded
94	$66 million	75,000	none recorded yet*
95	$93 million	no cap (approx. 115-120,000)	
96	$230 million (requested for 96)		

* Takes about 18 months to process from time the landowner applies for participation in the program. All appraisals have been completed and commitments have been made, so should start recordation soon.

** Note that these are nationwide target acres.

The FY95 allocation of $93 million is scheduled for allocation sometime in May or June of this year. Of the '92 funding, $12 million has been carried over. Agency has asked the Secretary of Agriculture to immediately release the $12 million carryover along with approximately $43 million of the FY95 funding to distribute to states experiencing an overflow of requests. 1992 was the first year this program was funded. The states of SD, IL, KS, and NE received no allocation in 1992, so easement acres converted for these states pre-flood would be zero.

The Emergency Wetland Reserve Program (EWRP) was authorized by the "Emergency Supplemental Appropriations for Relief from Major Widespread Flooding in the Midwest Act of 1993." Participation is limited to those states affected by the 1993 flood. The initial emergency supplemental appropriation was $15 million to enroll approximately 25,000 acres. No expenditures in 1993. Funds are allocated by state. Total FY95 allocation is $28 million. Good chance that some of these funds will be pulled back. The cutoff date for applications under the EWRP was December 31, 1994. (Remaining data in this section from Kansas City District). The following criteria prescribe priorities for inclusion of lands submitted in the EWRP:

1. Protection and enhancement of habitat for migratory birds and wildlife, including the contribution the restoration of the land may make to threatened and endangered species.

2. Potential for floodway expansion.
3. Proximity to other protected wetlands.
4. Restoration potential of wetland hydrology.
5. Intrinsic wetland functions and values.
6. Potential for successful restoration of wetlands values.
7. Costs of easement acquisition and restoration of wetland functions.
8. Other relevant and/or non-descript considerations.
9. Final enrollment in the EWRP will be approximately 57,000 acres.

Applications approved as of February 1995 are shown in Table R-48.

Table R-48
Wetland Reserve Program Applications
Flood Plain Management Assessment

State	Applications Approved	Acres	Cost ($1,000)
Illinois	12	1,300	1,450
Iowa	380	34,000	27,000
Kansas	4	137	120
Minnesota	39	1,892	2,639
Missouri	143	15,540	11,266
Nebraska	10	200	170
South Dakota	25	4,185	1,745
Wisconsin	No applications received		
TOTAL	613	57,254	$44,390

FY95 is the final year for the EWRP.

Assumptions for Matrix Table Analysis:

Wetland Reserve Program

1) Of the program goal of 1 million acres, 22% (based on existing sign-up) are in the FPMA states. Assume that this ratio remains the same.

2) A breakdown of specific locations of WRP lands was not available. Assume for this measure, because floodplain wetlands are specifically targeted, that 75% of enrolled WRP acres are in the floodplain.

3) Assume 50,000 acres have been converted to date. This leads to approximately 157,000 additional floodplain acres restored if the program meets it goals. Of this amount assume 75% reverts to forested wetland and 25% reverts to non-forested wetland.

COSTS: Average to date is $907/acre for a total of ~$142 million.

Emergency Wetland Reserve Program

4) This program already targets floodplain wetlands so there is no change from the Scenario 1 measures.

5) There is a potential to enroll 50,000 total acres in the program. Assume that to date, half of the targeted acres are enrolled, leaving 25,000 acres to be enrolled.

6) Since only 75% of enrolled acres are required to be wetland, we have assumed this will be the actual percentage enrolled, resulting in an additional 18,750 acres. The remainder coverted land will be non-wetland.

COSTS: Approximately $2000/acre for easement and restoration costs = ~$50 million dollars.

H5 Measure - $2 million annual funding for land acquisition for habitat improvement under the Upper Mississippi River Environmental Management Program is provided.

This measure would expand the list of implementable solutions considered in habitat restoration planning under EMP to alleviate habitat quality problems on the Upper Mississippi River.

Habitat Rehabilitation and Enhancement Projects were authorized as part of the Upper Mississippi River System Environmental Management Program, under the Water Resource Development Acts of 1986 and 1990. These projects involve the expenditure of $150 million over a 15-year period (1988-2002) for habitat rehabilitation and enhancement on public lands that lie in and along the Mississippi River from St. Louis to Minneapolis-St. Paul, and the lower 80 miles of the Illinois River. The habitat projects are proposed by the states of Illinois, Missouri, Iowa, Wisconsin, and Minnesota and the U.S. Fish and Wildlife Service, developed and designed by interagency planning teams, and engineered and constructed by the Corps of Engineers (St. Paul, Rock Island, and St. Louis Districts).

Because the most pervasive environmental problem on the Upper Mississippi River System is sedimentation, most of the projects are designed to counteract side channel and backwater sedimentation. The project designs generally involve dredging and alteration of flow patterns with riverine structures, construction of enclosed levee systems with pumping facilities for water level control, or island construction.

Although "acquisition of wildlife lands" was a part of the original 1985 implementation framework for the EMP, and past project proposals in Missouri and Minnesota included land acquisition components, land acquisition was only recently approved as an authorized habitat project component (31 Oct 94 letter from John Zirschky). To date little discussion has occurred among project partners regarding specific acquisition proposals for existing EMP projects. However, all state EMP partners share a desire to include consideration of projects that involve land acquisition.

Land acquisition can be either an incidental feature of a habitat project (dredge material placement) or a primary tool for restoration (e.g. land conversion to floodplain habitat). It is not envisioned that one substantially large land acquisition project would be undertaken, but several

projects that include smaller parcels of land. Acquisition would most likely be done in conjunction with projects already in, or previously considered in the EMP slate. Given this new initiative, a reprioritization process of the remaining projects to be initiated could result in improvement of the overall value of the full roster of EMP projects.

Land acquisition would be for fish and wildlife preservation, enhancement, or restoration. Any flood damage reduction offered should be recognized as ancillary benefits. Any land acquired must include active construction and/or operation and management measures to improve the value of the fish and wildlife habitat over its value in its current condition.

Questions to consider:

How is land acquisition prioritized under this plan?
- Benefits to:
  - Water Quality?
  - Runoff Reduction?
  - Point Source Reduction?
  - Fish and Wildlife?
- Related to Ecosystem Management Goals?
- Related to Other State Programs (Priority Watershed, etc.)

Is acquisition targeted to uplands or flood plain areas?

Question: Where are prime candidate locations for such land acquisition?

The NCR GIS staff is working to identify potential wetland acquisition locations. Once developed, these data will be presented in tabular form, reporting protected and unprotected acreage. (Note: The GIS wetland identification criteria is much broader than the above-mentioned criteria, so the GIS data *will* include targeted acres for the Upper Mississippi River Environmental Management Program).

The following assumptions were made to quantify impacts from this policy measure:

1. This policy was in place from start of EMP (1986). However, because significant project construction and funding did not begin until 1988, it is assumed that acquisition began in 1988.

2. Most acquisition occurred within the flood plain. This is based on discussions with Habitat Restoration and Enhancement Project (HREP) managers and EMP project managers and examples of HREPs with land acquisition components to date.

3. Land was acquired at a 1:1 ratio of non-wetland to wetland. Waterfowl habitat acquisition or land treatment programs often protect roughly 3 acres of upland to 1 acre of wetland. Different ratios of upland to wetland acres purchased would result in different total acreage purchased because of differences in land prices as shown in the Table R-49.

Table R-49
Land Acquisition for EMP
Flood Plain Management Assessment

Cover	Ratio	Cost/Acre ($)	Acres	Total Cost ($)
Upland	1	750	2539	1,904,250
Wetland	1	300	2539	761,700
Total			**5078**	2,665,950
Upland	2	750	2962	2,221,500
Wetland	1	300	1481	444,300
Total			**4443**	2,665,800
Upland	3	750	3135	2,351,250
Wetland	1	300	1045	313,500
Total			**4180**	2,664,750

Because most of the acquisition occurs in the flood plain in close proximity to the HREP problem area, a smaller ratio of acquired upland to wetland acres is assumed.

4. Average cost per acre of non-wetland = $750. This is based on averaging the costs shown for existing acquisition programs.

5. Average cost per acre of wetland = $300. This is based on averaging the costs shown for existing acquisition programs.

6. Land acquisition is cost-shared 75% Federal/25% non-Federal. This is the same as current policy.

7. Acres that can be purchased under this plan and these assumptions = 5,000/yr or 30,000 acres of land up to 1993.

8. Land acquisition is divided equitably between participating states/districts.

The following impacts relevant to FPMA environmental impact categories are expected:

Non-forested wetlands: + 15,000 acres
Threatened and endangered species: (increase)
Forest: + 15,000 acres
Percent of flood plain inundated: (no change)
Cultural: archaeological -1 (-1)
Cultural: historic 0 (-1)
Public lands: + 30,000 acres
 # Recreation sites: (increase)

Note: Acres are not additive (i.e., *public land* includes same areas as *non-forested* wetland, etc.)

There appears to be little potential for flood stage impacts from land acquisition for habitat improvement under the Upper Mississippi River Environmental Management Program but this program was not established for such a purpose. In general, however, applying resources to preserve existing habitats that are essentially healthy or enhance marginal habitats not currently in state or national wildlife refuge systems can be an economically efficient means to achieve environmental restoration.

H6 Measure - New funding is provided to initiate a Lower Missouri River Environmental Management Program, with land acquisition for habitat improvement allowed.

This measure would expand the list of Federal programs available under habitat restoration planning to alleviate habitat quality problems on the Lower Missouri River. There currently is no environmental management program for the Lower Missouri River. There is an Environmental Management Program for the Upper Mississippi River, and it has been described above in H5. Many of the findings of the existing EMP would likely be expanded, applied and tested under the Missouri River EMP. Some of these findings have been discussed by Delaney (1994).

> *Current models assume an integral relationship between the main channel of the river and its floodplain and accept the flood pulse and morphological diversity arising from it as the major driving factor in such ecosystems. A series of ancillary considerations such as connectivity are accepted as expressions of river integrity.*
>
> *It is generally appreciated that rivers and their fauna are very resilient and that measures to improve or rehabilitate them can produce rapid positive responses within the system. In general, rehabilitation should be guided by the principle that if you provide the right conditions of structure and hydrology nature will take care of the rest. Current theories on floodplain function predict that the area needed for an improvement to the biota is probably relatively small and could lead toward restoration in the form of a string of beads with a series of floodplain patches connected by more restricted river corridors. A primary research role of the Environmental Management Technical Center, in fact, is to help define these floodplain connections.*

Existing acquisition programs on the flood plain of the Lower Missouri River include: (1) creation of the new Big Muddy National Fish and Wildlife Refuge, encompassing about 6,000 acres in Missouri, by the U.S. Fish and Wildlife Service; (2) the Partnership for Missouri Wetlands, involving about 32,000 acres in fee or under easement across 25 counties in Missouri by a variety of Federal and State agencies, non-governmental organizations, and private landowners; and (3) the Missouri River Fish and Wildlife Mitigation Project, administered by the Kansas City and Omaha Districts of the Corps, which has targeted the acquisition of 14,600 acres in Missouri, 950 acres in Kansas, 7,200 acres in Iowa, and 7,150 acres in Nebraska (SAST, 1994:131; USACE, 1994). An additional program is the Wetland Reserve Program administered by the National Resource Conservation Service (see environmental

group writeup for PPM F4).

Criteria for Selecting Sites:

To select and prioritize areas for acquisition, a number of criteria are available. Because the lower Missouri River flood plain ecosystem has been highly modified by different activities, chiefly navigation, flood control, and agriculture [see SAST (1994:115-123) and FMRC (1994:53-56) for a description of adverse impacts], these criteria can be considered to be indicators or remnants of the pre-settlement environment. They can be grouped into two categories, physical and biotic resources.

Examples of physical resource criteria include chutes, oxbows (oxbow-lakes), side channels, sloughs, sandbars, backwaters, and nonagricultural vegetated areas on the flood plain. Other examples include physical habitats created by the 1993 flood, such as deep scour holes (preferably connected to the river), and shallow scour areas that are seasonally flooded.

Examples of biological criteria are remnants of prairies, wet meadows, marshes, bottomland forests (including riparian), grasslands, wooded islands, and early successional sandbars. Other examples include critical habitats for threatened and endangered species, or areas inhabited by one or more such species. Other factors can be overlaid upon these criteria, such as relative scarcity of the above physical and biological resources, levee reaches with repetitive damage, and willing sellers.

The SAST report (1994:131-134) identified and mapped significant biological habitat on a portion of the lower Missouri flood plain near Kansas City. However, there is no system-wide up-to-date inventory of species, communities, significant or critical habitats, and opportunities for restoration, and this effort is needed (FMRC, 1994:109; SAST, 1994:138).

Question: Where are prime candidate locations for such land acquisitions?

The NCR GIS staff is working to identify potential wetland acquisition locations. Once developed, these data will be presented in tabular form, reporting protected and unprotected acreage.

Assumptions:

1. Within the context of the FPMA study, the lower Missouri River extends from Gavins Point Dam, Nebraska (river mile 810) to its confluence with the Mississippi River, and that is followed here. Note that the Galloway report (FMRC, 1994:4) used Sioux City, Iowa (river mile 732) as the dividing point between the upper and lower Missouri River watersheds. The SAST (1994:8) report also defines the upper limit of the lower Missouri River as Gavins Point Dam, the first main stem dam.

2. The EMP program proposed for the Lower Missouri River under this policy/program measure will be very similar to the one for the Upper Mississippi River. Because of the limited amount of public land on the Missouri River compared to the Mississippi River, it is assumed that a

Missouri River EMP would require a larger land acquisition budget. Habitat projects would be defined by the participating states and the FWS and would most likely be prioritized according to goals identified in anticipated ecosystem management planning.

3. Because land acquisition for the Missouri River EMP would likely be a primary tool for aquatic habitat restoration on the Missouri, assume a budget of $10 million for land acquisition, and a ten year program.

4. Cost sharing and land cost assumptions as in Measure H5.

5. Acres that can be purchased under this plan and these assumptions = ~25,000/yr or ~250,000 acres of land.

6. Land acquisition is divided equitably between participating states.

Impacts relevant to FPMA environmental impact categories

Non-forested wetlands: + 125,000 acres
Threatened and endangered species: (increase)
Forest: + 125,000 acres
Percent of flood plain inundated: (increase)
Cultural: archaeological -1 (-1)
historic 0 (-1)
Public lands: 250,000 acres
 # Recreation sites: (increase)

Note: Acres are not additive (i.e., *public land* includes same areas as *non-forested* wetland, etc.)

SUMMARY OF FLOODPLAIN WETLAND RESTORATION POLICIES

The measures identified and discussed above would require national program and policy changes in order to be fully implemented. These actions take a considerable amount of time and effort to implement and must be considered the best use of the nation's resources. The policy measures discussed above often spark a considerable amount of interest from land owners, but failure to fully fund the programs may make them unable to compete with other "production oriented" programs. It appears that these measures, even if fully implemented, have a low potential to significantly impact flood stage levels or the extent of flood damage from 1993 type flood events. Flood reduction benefits for smaller events needs to be considered in more detail than was considered in the FPMA. However, these programs would not have flood stage reduction as their primary goal, but rather improvement of biotic integrity, environmental health, and habitat quality. Floodplain restoration program development in an ecosystem context and with multi-agency and private interest partnerships that would minimize duplication of effort and recognize the common or overlapping goals of these programs, could be economically efficient and maximize public values and outputs of the floodplain at the same time.

SCENARIO CATEGORY H
Floodplain Wetland Restoration Programs

	IMPACT CATEGORIES	A Base Cond. [All Disast. Counties]	B Base Cond. [FPMA Imp. Counties]	Scenario 1	Scenario 2	Scenario 3
	ECONOMIC (1,000 $'s)		[1]			
	Flood Damages					
1	Residential (Urban)	$760,892	$662,008	0	0	0
2	Other (Urban)	$1,612,543	$1,447,322	0	0	0
3	Agricultural	$3,852,701	$817,054	0	<-5%	<-10%
4	Other Rural	$233,648	$161,010	0	0	0
	Chg. in Govt.Expend.					
5	Emergen.Resp.Costs	$227,405	$200,663	0	<-5%	<-10%
6	Disaster Relief (Agric.)	$1,160,632	$285,180	0	<-5%	<-10%
7	Disaster Relief (Human R.)	$1,297,474	$551,862	0	0	0
8	Flood Insurance (NFIP)	$371,969	$276,496	0	0	0
9	Flood Insurance (FCIC)	$748,095	$269,061	0	<-5%	<-10%
	Chg.Value of FP Resources					
10	Net Ag RE Values	-	-	0	<-5%	<-10%
11	Net Urban RE Values	-	-	0	0	0
	ENVIRONMENTAL					
	Natur.Resour.(# acres)					
12	Non-Forested Wetl. (acres)	-	365,285	37,000	52,000	31,000
13	Threat.&Endang. (# / Occ.)	-	(281/1,043)	+	+	+
14	Forest (acres)	-	534,705	110,000	157,000	94,000
	Natural Fldpln.Functions					
15	Fldpln.inundated (acres)	-	776,276	0		
	Cultural					
16	Archeol Impacts (-5 to +5)	-	-1	-1(NA)	-1(?)	-1(?)
16A	Hist.Sites(-5 to +5)		-1	-1(NA)	-1(?)	-1(?)
	Open Space					
17	Public lands (acres)	-	392,512	26,000	80,000	200,000
18	Recreation sites (#)	-	485	25	75	100
	REDUCT.OF RISK					
	Critical Facilities					
19	# Facil. w/harmful releases	-	207	0	0	0
20	# other critical facilities	-	1,208	0	0	0
	Prot./Avoid. of Harm					
21	# people vulnerable	185,630	134,849	0	0	0
	Social Well Being					
22	# communities vulnerable	433	293	0	0	0
23	# resident.struct.vulnerable	56,339	42,743	0	0	0
	IMPLEMENT. COSTS					
24	Structural Costs	-	-	-	$8 million	$50 million
25	Other Costs	-	-	$190 mil	$196 mil.	$50 million

[1] Economic impacts collected only at the county level

AGRICULTURAL SUPPORT POLICIES RELATED TO FLOODPLAIN USE

(1) Scenario 1 Measures.

(a) Federal Crop Insurance Reform. Measure I-2. Federal crop insurance reform requiring participation of all farmers receiving other farm program benefits is assumed to be in place.

The Federal Crop Insurance Reform Act of 1994 (Title I, Public Law 103-354) modified the crop insurance program. The goal of the act is to provide an actuarially sound crop insurance program, and to mandate coverage for all producers.

In order to be eligible for any benefits such as price supports, production adjustment, conservation reserve, or other benefits, farm producers must purchase crop insurance. Crop insurance is the only method for producers to receive assistance for natural disasters. The Act presents parliamentary barriers to providing other disaster payments.

The method for implementing several important features of the reform act are still being developed. In general, however, coverage is provided at various levels of risk protection. All producers must obtain at least the catastrophic level of protection in order to receive other benefits. This coverage will provide assistance for producers for losses due to natural disasters, such as the 1993 flood. Producers can also obtain additional levels of coverage at various yield and market price levels.

Under the act, each producer pays a fee to obtain coverage. The fee varies according to the coverage level. The producer pays a $50 fee per crop per county up to $200 per county with an overall maximum of $600. For higher levels of additional protection, the fee is $10.

The premiums are fixed at rates that are sufficient to cover anticipated losses and a reasonable reserve for the catastrophic and additional coverage levels, plus an amount sufficient to cover administrative and operating expenses for the additional coverage levels.

The Federal Government subsidizes all of the premium for the catastrophic level of coverage and a portion of the premium for the additional levels of coverage. The Act establishes an insurance fund for the deposit of premiums to be used in managing the program.

Implementation procedures for several key elements of the program are still being developed, and so there are several uncertainties that do not allow the quantification of impacts for this report. The most important element is the manner in which "unrated" lands will be addressed. Unrated lands, for purposes of this report, include high risk properties such as those between the rivers and the levees.

At the present time, it has not been determined whether these properties will be insured under the standard procedures of the act, whether they will be insured individually with a different rate structure, or whether they will be

treated as they would have been under the previous disaster payment systems. For this reason, the crop insurance reform impacts cannot be projected, and must be left as an unresolved issue. The effects that an actuarially sound program would have had on the 1993 event will be examined under Scenario 3.

For purposes of this report, it is assumed that the Federal Government will add the appropriate premium values to the crop insurance fund so that the fund will be sufficient to cover anticipated losses plus a reserve, as stated in the act. In effect, the disaster assistance that the Federal Government would have paid to producers would be transferred, over time, into the crop insurance fund.

The difference in payments that an individual producer would have received under the disaster payment program and the revised crop insurance program cannot be determined given the funding and schedule parameters of this study. Both programs appear to be keyed to a loss threshold of about 35 percent; however, and for the purposes of this report, it is assumed that there would be no appreciable difference in the payment structure between the two programs.

Under the Crop Insurance Reform Act, the large disaster payments that previously accompanied flood events will be prepaid under the revised insurance program. For the Scenario 1 matrix, the crop disaster payment component of the agricultural loss category would be the same as for the Base Condition. This is misleading, however, as the matrix does not accommodate the fact that the insurance payments would come from the insurance fund which is prepaid.

(b) Other Incentive Programs. Measure I-2. Other incentive programs such as Wetlands Reserve Program, Emergency Wetland Reserve Program, and the Conservation Reserve Program, are assumed to continue (or phase out) based on existing authorization language (see Galloway report, Appendix E)

1) Wetlands Reserve Program (WRP). The WRP was authorized in the 1990 Farm Bill. Under the program, the USDA can acquire conservation easements to protect and restore formerly degraded agricultural wetlands. The goal of the program is to protect or restore 1 million acres of wetlands in private ownership. Land owners agree to a long term (30-year) or permanent easement. The landowner receives a lump sum payment for the easement and must pay up to 25 percent of the cost of restoration, with the Federal Government paying the remainder of the costs.

Eligible lands include those wetlands farmed under natural conditions, substantially altered lands as determined by USDA's Natural Resource Conservation Service (NRCS), or prior converted croplands (when conversion was commenced prior to 23 December 1985) with those adjacent lands deemed necessary to protect the restored areas. FWS provides technical assistance to USDA agencies and private landowners on site selection and restoration planning for easements offered voluntarily by interested landowners.

Since its inception, the program has received substantially more

applications than it has been able to support. In Fiscal Year 1991, with a total budget of $46.7 million, 249,000 acres were offered for enrollment while only 50,000 were accepted. The program was not funded in Fiscal Year 1992. In Fiscal Year 1993, with a budget of $66.7 million, approximately 600,000 acres were offered for enrollment while only 75,000 acres were accepted.

An estimate of the enrollment in the WRP for the study area States is shown below on table MRO-3. The values shown in the table include all acres submitted for Fiscal Year 1993, it is not known how many of these were accepted, however, and it is likely that the table overstates enrollment in the study area.

Table MRO-3
Estimated Enrollment in WRP

State	Acres
Illinois	2,804
Iowa	10,040
Kansas	2,580
Minnesota	3,168
Missouri	5,249
Nebraska	1,500
South Dakota	2,200
Wisconsin	N/A
TOTAL	27,541

2) Emergency Wetland Reserve Program (EWRP). The EWRP was specially authorized following the 1993 flood event. The EWRP provides landowners an alternative to restoring severely flood damaged land. Landowners receive payments for permanent easements to USDA and for restoring and protecting wetlands on their property.

To be eligible for the program, the land must have been flooded in 1993. The cost of reclamation and repair must exceed the easement cost. The land must have been cropped in one of the previous 5 years. At least 75 percent of the land must be farmed wetlands, prior converted wetlands, wetlands farmed under natural conditions, or potential wetlands. The wetlands restoration costs must be "reasonable".

The States established wetlands ranking systems to determine which lands to accept into the program. The following criteria describe the priority system for inclusion of lands in the EWRP.

1- Protection and enhancement of habitat for migratory birds and wildlife (including T&E species contributions).
2- Potential for floodway expansion.
3- Proximity to other protected wetlands.
4- Restoration potential of wetland hydrology.
5- Intrinsic wetland functions and values.

6- Potential for successful restoration of wetlands values.
7- Costs of easement acquisition and restoration of wetland functions.
8- Other relevant considerations.

A total of $100 million was authorized for acquisition of easements. As of March 1994, a total of 44,000 acres were submitted for inclusion in the program. The Federal Government pays the easement value, estimated at $600 per acre, and the total cost of the restoration of lands to wetlands.

An estimate of the enrollment in the EWRP for the study area States is shown below on table MRO-4. The values shown in the table include all acres submitted through March 1994, it is not known how many of these were accepted, however, and it is likely that the table overstates enrollment in the study area.

Table MRO-4
Estimated Enrollment in EWRP

State	Acres
Illinois	722
Iowa	14,676
Kansas	154
Minnesota	N/A
Missouri	13,718
Nebraska	N/A
South Dakota	4,000
Wisconsin	N/A
TOTAL	33,270

3) Conservation Reserve Program (CRP). The Conservation Reserve Program was originally authorized in the 1985 Farm bill and was expanded in the 1990 re-authorization. Under the program, land is taken out of production for the purposes of reducing soil erosion on highly erodible lands, and reducing the volume of surplus crops.

In return for removing highly erodible lands from production, landowners receive conservation payments for a period of 10 to 15 years. The goal of the program is to enroll between 39 and 44 million acres by 1995. Through Fiscal Year 1993, there were 36.5 million acres enrolled in the program. Unless it is re-authorized, the program will expire in 1995. There are currently 1.8 million acres in the study area enrolled in the program, as shown in table MRO-5.

Table MRO-5 Enrollment in CRP in Study Area	
State	Acres Enrolled (1,000)
Illinois	247
Iowa	585
Kansas	36
Minnesota	222
Missouri	478
Nebraska	87
South Dakota	26
Wisconsin	124
TOTAL	1,767

Total annual expenditure of the CRP in the study area have not been identified. Data for the State of Minnesota show that annual payments for the CRP average about $54 per acre. At this rate, the annual expenditure for the study area would be about $95 million. Also at this rate, the expenditure for all lands enrolled nationwide would be nearly $2 billion.

There is very little available information regarding the future of these three programs. One estimate for the CRP is that it will be re-authorized, but at a considerably smaller size -- about 20 million acres by the year 2000 -- and would be strictly limited to highly erodible lands. This would represent a reduction of nearly 50 percent from the current enrollment. There are no estimates of the future of the WRP. The EWRP is applicable only to the areas flooded by the 1993 flood and the authorized funding levels are clearly limited.

4) Overall Impacts. Table MRO-6 presents data collected from various sources that can be used to generally describe the impacts of these programs on flood events. As shown on the table, there may be approximately 5.3 million acres of flood prone cropland in the study area. This probably overstates the flood prone area. Data from the 1993 flood event indicates this value could be in the range of 8 to 10 percent which would yield a significantly lower flood prone area.

It is not known how many of the CRP lands shown on the table are located in flood prone areas, however, because of the generally flat nature of flood plains, it can be assumed that the percentage is relatively small.

For purposes of this analysis, it is assumed that the percentage of CRP land in the flood plain is the same as the average of the estimated flood prone cropland shown in column 3. This would be approximately 12 percent, or about 212,000 acres.

The three programs (CRP, WRP, and EWRP) provide significant benefits for the purpose for which they were authorized. The study area lands in these programs, however, represent a very small proportion of total flood prone lands in the area. While they take cropland out of production, thereby

Table MRO-6
Agricultural Programs Summary
(1,000 acres)

State	Study Area Acres in Farms[1]	Study Area in Acres Cropland[1]	Estimated Flood Prone Cropland in Study State[2]	Estimated Flood Prone Cropland in Study Area	Study Area Acres in CRP[3]	Total Acres in State in CRP[3]	WRP	EWRP
Illinois	6,009	4,845	12%	581	247	822	3	1
Iowa	7,155	5,815	13%	756	585	2,255	10	15
Kansas	1,177	888	11%	98	36	2,890	3	<1
Minnesota	3,084	2,506	7%	175	222	1,836	3	N/A
Missouri	9,037	11,467	27%	3,096	478	1,733	5	14
Nebraska	2,205	1,904	14%	267	87	1,377	2	N/A
South Dakota	756	672	12%	81	26	1,776	2	4
Wisconsin	2,612	1,580	13%	205	124	713	N/A	N/A
Total	32,035	29,677		5,259	1,803	13,402	28	34

1/ Source: County City Data Book
2/ Source: Revisiting Flood Control, Nancy S. Phillipi; Wetlands Research, Inc., 1994
3/ Source: USDA

reducing flood damages, the programs are not sufficiently large to appreciably reduce flood damages. It would require a considerable increase in expenditures for these programs to have significant impacts on flood damages in the study area.

(2) Scenario 2 Measures.

(a) Levee Repair Criteria. Measure I-3. Levee repair criteria are consistently and rigorously applied, with increased consideration of repetitive losses, maintenance costs, and environmental and social impacts of levee restoration versus other alternatives.

This measure is broken into two major sections. The first is the economic analysis which discusses the current levee system, Federal assistance programs, and expenditures. The second is the environmental analysis which attempts to quantify land use conversion resulting from this measure.

I. Economic Analysis

Throughout the years, the interests of the nation, the definition, and the management of the floodplain and floodway have changed. Today, the national objective is to maintain an unobstructed floodway. The agricultural levees that have been encroaching riverward over the years, jeopardize the intent of the floodway. Repair of these agricultural levees is costly and the criteria for repair is inconsistent between different Federal agencies. If repair criteria were made consistent, this would be a step towards sound floodplain management.

1) Floodplain and Floodway History. In an effort to protect adjacent farmlands and provide ample space for flood passage, the Pick-Sloan plan was adopted by Congress as a part of the Flood Control Act of 1944. This plan called for a floodway from Sioux City, Iowa to the mouth of the Missouri River that was 3,000 feet wide from Sioux City to Kansas City, Missouri and 5,000 feet wide below Kansas City, in addition more than 100 reservoirs were to be built throughout the Missouri River basin[1].

In 1962, based on new construction methods for levees, additional reservoirs, and flood control structures, it was recommended that the floodway be decreased to 3,000 feet in width for the entire length downstream from Sioux City, Iowa. This recommendation was based on proposed reservoirs on the Grand River which were never constructed. Federal levees that were constructed in an effort to protect highly productive agricultural lands and communities along the river were built in accordance with the 3,000 feet floodway requirements[1].

2) Today's Floodplain and Floodway. The private levee systems that were built along the Missouri River were placed as close to the river as possible. Many of these private levees have tie-offs into existing federal levees, and do not allow for the recommended 3,000 feet wide

floodway as defined in 1962. Any secondary levee riverward of the federal levee system is not only within the 3,000 feet wide floodway defined in 1962, but is also within the floodway defined at present by the National Flood Insurance Program (NFIP).

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the NFIP, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 100-year floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights (Figure 1). Minimum Federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced.

The present system of agricultural flood-control levees below Sioux City, Iowa along the lower Missouri River floodplain is an aggregate of levees constructed by different agencies and individuals at various times and under various programs[1]. Their physical composition, degree of flood protection, and locations vary from area to area. Some are on or near the channel bank and extend across old river-channel deposits. Others are setback to the landward margin of the floodway to permit flood flow conveyance. In some areas, multiple levees have been built successively riverward during the past four decades as the river width decreased due to channelization and previous open water and wetland areas were converted to cropland due to floodplain aggradation. If damaged during a flood, such a levee may not meet the specific criteria for repair under one federal program, but may qualify for assistance under another program due to the inconsistent Federal levee repair policy from agency to agency. Levees are repaired without mitigating the adverse effects these levees may have on the NFIP floodway, the environment, and the capacity of adjacent "mainline" levees. Regulation of the floodway is the responsibility of the local municipality. In the area of regulation, there is a lack of coordinated planning and management which undermines the federal and state objectives of sound floodplain management.

Many districts with levees designed for high-magnitude floods have been flooded between 5 and 10 times during the past 50 years (table MRO-7), a history which reflects on the location and the design capacity of many of these levees. In addition, failures have often been catastrophic, resulting in not only rapid, deep flooding of previously "protected" acres of land, but also substantial deep scour accompanied by concomitant deposition of thick sand deposits over significant areas of the floodplain. Within the reach from Glasgow to St. Louis, Missouri (about 225 river miles), approximately 5 to 7 percent of the floodplain (13,000 to 18,000 acres) was substantially damaged as a result of the levee breaches during the 1993 flood. Based on preliminary analysis, 90 to 95 percent of this deep scour and thick sand deposition on the lower Missouri River was directly related to levee breaches[1].

TABLE MRO-7[1]

Levee Damage History - Lower Missouri River
Selected Levee Districts

A sample of levee districts that were severely impacted by the 1993 Flood

District (Area) Name	Damage Years									
Mittler et. al.	'45	'46	'52	'53	'58	'66	'73	'82	'86	'93
Darst Bottoms	'44	'50	'58	'60	'61	'73	'86	'93		
Labadie Bottoms	'42	'47	'51	'58	'67	'73	'86	'93		
Pinckney-Peers	'42	'44	'48	'51	'73	'86	'93			
Berger Bottoms	'42	'44	'48	'51	'57	'61	'73	'86	'93	
Overton Bottoms	'42	'47	'48	'51	'57	'65	'73	'82	'86	'93
Lisbon Bottoms	'43	'44	'48	'52	'59	'60	'67	'69	'73	'79
	'82	'86	'93							
Cambridge	'82	'83	'84	'85	'93					
Rhoades Island	'61	'73	'74	'82	'83	'84	'86	'93		
Miami-Dewitt	'43	'47	'51	'67	'93					

3) The Development of a Levee Database. The Scientific Assessment and Strategy Team which wrote Science for Floodplain Management into the 21st Century-1994, realized it was a necessity to have a levee data base. Such a data base would be used for system-wide analysis and management on the floodplain. The data set would consist of locations of levees, elevations at specific points along the levees, levee sponsorship, dates of breaches or overtopping if known, area protected, levee length, eligibility for PL-84-99 (refer to the next page for discussion), and cost of 1993 repairs. The five FPMA Districts have developed the levee data base. The data sets developed by the Districts contain information including a levee name, levee location, levee length, PL 84-99 eligibility, sponsor's name, address, city, state, zipcode, telephone number, and cost of 1993 repairs.

This data set is valuable for river modeling efforts, emergency operations, and floodplain management. The levee data set has required a major effort to collect, enter, and ensure the quality of the data. Since the data are of most value to the USACE for modeling and operations efforts, the data set should be maintained by the USACE[1].

(b) Federal Assistance Programs and Their Expenditures for the 1993 Flooding

1) The USACE's PL 84-99 Program. The USACE has an Emergency Rehabilitation Program for non-federal flood control projects under the public law 84-99 (PL 84-99). The USACE has authority under PL 84-99 to supplement local efforts in the repair of flood control projects (i.e. levees) which are damaged by flooding. To be eligible for rehabilitation assistance, levees must meet certain criteria and standards set forth by the USACE. The USACE contributes 80% of the construction cost for rehabilitation repairs and the local sponsors are responsible for the remaining 20% of the costs.

a) Criteria Set Forth by the USACE for Levees to Qualify for Assistance Under the PL 84-99 Program[2]

1- The levee must have a public sponsor as defined by the applicant's state laws. This sponsor will be the public representative for the levee. The public sponsor must be one of the following:

- A legal subdivision of a state government or a state itself.
- A local unit of government.
- A state chartered organization such as a levee board.
- A qualified Indian tribe or tribal organization.

2- The function of the levee must be for the purpose of providing flood protection. The levee is not eligible for the rehabilitation program if it was built for a non-flood related purpose such as channel alignment, recreation, fish and wildlife, land reclamation, drainage, or to protect against land erosion.

3- The levee must provide complete flood protection. A levee system which provides complete flood protection is one that is technically sound (i.e. Levee is tied off to high ground, is geotechnically stable, etc.), well maintained, and provides reliable flood protection.

4- The levee must protect against a minimum of a 5-year flood event. This means that if the levee has a probability of being overtopped more than once in five years, it is not eligible for the rehabilitation program, (A 5-year flood event has a twenty percent chance of occurring each year).

5- The levee must be a primary levee. Secondary levees (a levee which is constructed near, or tied into the main levee and provides a lesser degree of flood protection than the main system) are not eligible for the rehabilitation program. Exceptions to this policy may be granted if the secondary levee was designed to protect human life or the levee is a major component of the primary levee system and is necessary to assure the flood control protection of the total system.

6- The levee must be constructed in accordance with all applicable federal, state and local permits, codes, ordinances, and their applicable laws in order to be eligible for the rehabilitation program. The levee rehabilitation must be in accordance with the regulations set forth by the National Flood Insurance Program (NFIP). This includes floodplain management ordinances in counties where no flood insurance programs exist.

b) 1993 Expenditures by USACE for Levees Under the PL 84-99 Program[2]. The USACE received many requests for assistance to repair levees under the PL 84-99 Program. The total expenditures on agricultural levee repairs by the five USACE Districts is $165 million as of

February 1995. Expenditures by individual District are shown in Tables MRO-8 to MRO-12.

TABLE MRO-8
USACE EXPENDITURES OMAHA DISTRICT

STATE	# OF PROJECTS	$ AMOUNT
IOWA	9	1,640,000
KANSAS	0	0
MISSOURI	3	5,600,000
NEBRASKA	8	4,960,000
TOTAL	20	12,200,000

TABLE MRO-9
ROCK ISLAND DISTRICT

STATE	# OF PROJECTS	$ AMOUNT
IOWA	4	3,700,000
ILLINOIS	14	19,800,000
MINNESOTA	6	11,800,000
WISCONSIN	0	0
TOTAL	24	35,300,000

TABLE MRO-10
ST. LOUIS DISTRICT

STATE	# OF PROJECTS	$ AMOUNT
MISSOURI	14	27,400,000
ILLINOIS	34	55,000,000
TOTAL	48	82,400,000

TABLE MRO-11
ST. PAUL DISTRICT

STATE	# OF PROJECTS	$ AMOUNT
IOWA	0	
MINNESOTA	1	490,000
WISCONSIN	0	0
TOTAL	1	490,000

TABLE MRO-12
KANSAS CITY DISTRICT

	# OF PROJECTS	$ AMOUNT
TOTAL	100	34,300,000

2) The NRCS'S Watershed Protection Program. The Natural Resource and Conservation Service (NRCS) has an Emergency Watershed Protection Program (EWP). The objective of this program is to assist in relieving imminent hazards to life and property from floods and the products of erosion created by a natural disaster that causes a sudden impairment of a watershed. A watershed impairment exists when the ability of a watershed to carry out its natural functions is reduced to the extent that it creates an imminent threat to life or property. The NRCS can provide engineering assistance to plan and install measures and can pay 75% of repair or rehabilitation costs (The federal share can be 100% in extreme hardship cases). Eligible levee repair projects must have sustained damage due to a natural occurrence (i.e. floods). To be eligible for the EWP, projects must meet certain criteria[3].

a) Criteria Set Forth by the NRCS[3].

1- The repair must address an imminent threat to life or property from a flood event.
2- The repair must be sponsored by an eligible project sponsor, which may be a legal subdivision of a state government or a state itself, a local unit of government, or a qualified Indian tribe or tribal organization.
3- The repair must benefit more than one individual, except in exigencies where single beneficiaries are permitted.
4- Repairs must be economically and environmentally defensible and technically sound.
5- Repair must conform to the regulations for protection of wetlands and floodplain management.
6- Restoration costs must exceed sponsors' and landowners' available funds or services.
7- Assistance for repairs to levees is generally limited to those levees on streams with drainage areas of 400 square miles or less.
8- Special funds were provided through the Supplemental Disaster Relief Bill of 1994, that may be used on streams with drainage areas over 400 square miles. However, sponsors of repairs to levees on those streams must agree to take whatever additional steps are necessary to bring the entire levee system into compliance with the USACE's eligibility standards for participation in the PL 84-99 Rehabilitation Program within a two year time period.

b) Results after 1993. As a direct result of the 1993 flood events, the NRCS in the State of Nebraska expended $10,000 on 1 levee repair project. In the State of Iowa, $2.46 million was expended on 49 levee repair projects. The State of Illinois expended $630,000 on 35 levee repair projects. Kansas expended $35,000 on 1 levee repair project and

Missouri expended $3.72 million on 187 levee repair projects. In the States of Wisconsin and Minnesota, there were no expenditures by the NRCS on agricultural levee repair projects. The total expenditure on agricultural levee repairs by the NRCS was $4.4 million.

3) The Federal Emergency Management Agency (FEMA). Under authority of the Emergency Assistance Act (The Stafford Act) and 44 CFR Part 205 Subpart H Section 205.121, FEMA may provide direct Federal assistance for eligible work when the state or local government lack the capability to perform or contract for the work or it is determined by the Regional Director that assistance is necessary to meet an immediate threat to life, health, or safety. FEMA will not repair any levees that are not eligible for other Federal assistance, in accordance with current FEMA, USACE, and NRCS policy, even if critical infrastructure is at risk. To be eligible for FEMA assistance, projects must meet certain criteria.

a) Criteria Set Forth by FEMA.

1- Levee project is in a Presidentially declared disaster area
2- A public entity must apply for the assistance
3- There is great financial loss

b) FEMA Expenditures. FEMA, Region V, which includes Illinois, Minnesota, and Wisconsin, expended $18 million in financial assistance for agricultural levee repair for the State of Illinois. FEMA, Region VII, includes Nebraska, Iowa, Missouri, and Kansas. FEMA Region VII expended a total of $3.1 million. FEMA requires non-federal shares of 25% for the repairs (although this was modified to 10% for the 1993 flood).

In the State of Missouri, a State Agency, the Department of Economic Development, provided $9.86 million in financial assistance for agricultural/urban levee repairs. The assistance is funded through the Community Development Block Grant Program and does not have any specific criteria for eligibility. The main concern is the threat to communities, land, and infrastructure.

4) Agency Collaboration to Resolve Discrepancies. There are several agencies which are engaged in the repair of agricultural levees. These agencies have not used the same engineering standards or methods of economic analysis in carrying out their programs. Some of the differences rest with the purposes of the programs and the varying nature of the levees. Nevertheless, these differences cause confusion among those dealing with multiple programs. The nation cannot afford to have this duplication of effort in the federal system. The costs to the nation of this multi-agency approach, measured in dollars or social and environmental impacts, remain large[4].

Cost-sharing differences among the federal agencies vary and if the USACE is authorized to be the principal agency for levee repair and construction, these cost-sharing inconsistencies would be resolved. If there are to remain several agencies repairing levees, these federal agencies should coordinate with each other to identify all differences in cost-sharing and in-kind services and develop a consistent cost-sharing program[4].

5) Conclusions. There is a need to consistently and rigorously apply levee repair criteria. In addition, there is also a need to consider repetitive loss data on levees and also the adverse effects levees may have on raising flood water surface elevations. Information on repetitive losses is available in most Districts of the USACE, but it is not readily accessible or available on a levee database. A major effort would be needed to collect and enter repetitive loss data into a levee database, but this type of information would be very useful for determining levees that have a repetitive damage history. Levees that do have a history of repetitive damage could be evaluated for factors contributing to the levee damage and solutions found to lessen or eliminate the damage caused. If repetitive losses and adverse effects on flood water surface elevations are properly analyzed, many levees may not be justified for repair.

Another area to consider is average levee maintenance costs. The average annual maintenance costs per mile of levee ranged from $300 - $3500 per mile of levee. The drainage districts contacted were in the State of Missouri and the levee lengths ranged from 10-30 miles. In Nebraska, the Papio-Missouri River Natural Resources District (NRD) was contacted and this agency reported an average annual maintenance cost of $3500 per mile of levee. A levee with a $300 per mile maintenance cost is probably not being repaired adequately. The Papio-Missouri River NRD's cost of $3500 per mile of levee is probably an amount providing adequate maintenance. With an average levee length taken as 20 miles, the average maintenance costs per year would be $70,000.

Many steps are needed to better manage the floodplain. In order to achieve sound floodplain management, levee repair criteria need to be consistently and rigorously applied, repetitive levee damage data needs to be gathered and put into a levee database, and the expense of maintaining these agricultural levees that may be adversely affecting the floodplain need to be addressed.

6) References.

a) Scientific Assessment and Strategy Team (SAST). 1994. Science for Floodplain Management into the 21st Century. Preliminary report to the Administration Floodplain Management Task Force, Washington, D.C.

b) U.S. Army Corps of Engineers. March 1987. Public Law 84-99 Rehabilitation Assistance for Non-Federal Flood Control Projects.

c) USDA, NRCS. July 1993, revised January 1994. Missouri Emergency Watershed Protection Field Manual. Columbia, Missouri.

d) Interagency Floodplain Management Review Committee (FRMC). 1994. Sharing the Challenge: Floodplain Management into the 21st Century. Final report to the Administration Floodplain Management Task Force, Washington, D.C.

II. Environmental Analysis

Objective

The objective of this measure is 1) to eliminate confusion among the public and inefficiency within the federal system caused by multiple federal agencies involved in the repair of federal and non-federal levees, among which engineering standards and methods of economic analysis are not consistent, and 2) to broaden the scope of impact analysis for proposed repairs of these levees to describe all costs and benefits.

Status of Current Policy/Program

There are five federal agencies involved in the repair of federal and non-federal levees: Corps of Engineers, Natural Resource Conservation Service (NRCS, formerly the Soil Conservation Service), Federal Emergency Management Agency, Economic Development Administration, and Department of Housing and Urban Development. The Corps has traditionally handled the repair of such levees along major rivers and tributaries under its emergency flood-control repair program under Public Law 84-99. Cost-sharing requirements are not consistent across agencies. Criteria for the economic evaluation of repairs differ between the Corps and NRCS.

Under the PL 84-99 program, impact analyses prepared by the Corps for proposals to repair damaged federal and non-federal levees often do not include the identification of geomorphological factors contributing to repetitive losses, or analyses of the frequency of past damages. Corps District offices maintain rather complete records of historic damages for levees built by the federal government ("federal" levees), but records for privately-built levees eligible for the PL 84-99 program ("non-federal" levees) are not very complete. Records for private levees ineligible for the PL 84-99 program are even less complete. There has been no systematic effort within the Corps to study in detail the floodplain of the Upper Mississippi and Lower Missouri Rivers to identify repetitively damaged levees and geomorphological features associated with them.

Change from Current Policy

The change in this Scenario II measure from the current policy would include consistency within federal policy for the repair of federal and non-federal levees. The Galloway report recommends the Corps to be the lead federal agency for levee repairs. Repair criteria would be consistent across the five federal agencies. Impact analyses would be broadened to include environmental and social factors, repetitive loss data, and maintenance costs, so as to identify all benefits and costs associated with the repair and no-repair alternatives.

Questions to consider:

Are there locations where continued levee protection appears to be economically inefficient? If so, where, and what factors contribute to this finding?

Overview of Environmental Aspects of Repetitively Damaged Levees

After a review of the Galloway and SAST reports, it is clear that continued levee protection in some areas along the Missouri and Mississippi Rivers is costly over the long term because certain areas are at high risk of repetitive damage. The SAST report presents an in-depth preliminary assessment of environmental factors associated with levees damaged by the 1993 flood. The detailed analysis does not cover the entire FPMA study area, but focuses on that portion exhibiting the greatest damages. Because of the nature of this assessment, the SAST report has served as the principle source of information used to address PPM I3 from the viewpoint of the environmental work group.

General Location of Inefficient Levee Protection From a regional point of view, most of the levee breaches, scour holes, and associated damages to agricultural lands from sand deposits and erosion occurred on the lower Missouri River (FMRC, 1994:51). Between Kansas City and St. Louis, over 600 levee breaches occurred, and in over 500 of these breaches a scour hole had formed (SAST, 1994:169,171). About seven percent of the floodplain between the Grand River (a tributary in mid-Missouri) and St. Charles (near the confluence with the Mississippi) experienced heavy scour and sand deposition (SAST, 1994:165). Similar damage on the Mississippi River floodplain was not common.

Environmental Factors Contributing to Repetitive Damages For the Missouri River floodplain, the SAST team analyzed spatial patterns of levee breaches, scour holes, and land damaged by erosion and deposition, and compared them with floodplain morphology. They concluded that greater than 90 percent of all sand deposits and scour areas are adjacent to levee breaches. They also identified four types of floodplain settings with which most levee breaches were associated. For the 225-mile reach within Missouri from Glasgow (a short distance downriver from the Grand River confluence) to St. Louis, the four settings occurred in the following decreasing order of abundance (SAST, 1994:169):

"(1) areas occupied by one or more active channels within the past 120 years (72 percent)
(2) areas along downstream channel banks between initiation and inflection points of meanders (17 percent)
(3) areas along tributary channels subjected to significant cross flow conditions during flooding (17 percent)
(4) areas along chutes (minor subsidiary channels) (8 percent)."

To begin the process of establishing cause-effect relationships, the SAST team listed five factors that led to levee breaks along the Missouri and Mississippi Rivers (SAST, 1994:169):

"(1) highly permeable substrata composed of channel-sand deposits with or without a thin silt-clay cap;
(2) channel banks subject to high-energy flow conditions at
(a) downstream banks of meanders between points of initiation and inflection, and

(b) channel banks opposite deflecting cross flows on tributary, chute or flood channel:
(3) levee irregularities and (or) discontinuities at
(a) high-angle junctions between levee segments and,
(b) repaired levees that ring old levee scour holes;
(4) inadequate levee design, construction, repair; and
(5) inadequate levee maintenance."

Specific Areas with Repetitive Damage The SAST team identified nine specific reaches on the lower Missouri River within Missouri that are very prone to disastrous levee failure and/or widespread erosional or depositional damage. They also compiled repetitive damage data from the last 50 years for 10 specific levee districts severely damaged by the 1993 flood (SAST, 1994:171).

Recommendations from Galloway and SAST Reports The SAST report recommends three actions to avoid and minimize flood damage to levees (SAST, 1994:169-170). First, the Corps, USGS, and SCS together should analyze historically where and why levee breaching has occurred. Second, based on the information in the joint study, these three agencies should develop alternative alinements for high risk levees so that they could be moved out of harm's way. Third, to minimize the potential for large floods to damage levees when they are overtopped, the Corps and USGS should come up with new ways to build levees so that the protected areas behind the levees are flooded in a predictable and controlled fashion. The Galloway report also recommends that these three actions be taken (FMRC, 1994:116-117,161).

1993 Post-flood PL 84-99 Repairs The post-flood reports for the five Corps Districts (USACE 1994a, 1994b, 1994c, 1994d, 1994e) provide information on levee damages by levee district, including breaches. The table below displays data from these reports enumerating breaches in federal levees and non-federal levees that qualify for PL 84-99 repairs. Note that the method of quantifying breaches in these reports is not standardized. Rock Island District and Kansas City District (in part) reported breached levee districts, whereas the other three Corps districts reported actual number of breaches. Most of these breaches are on the floodplain of the mainstem rivers, but some occurred along their tributaries. Fifty-two of the 100 breaches in non-federal levees reported for the St. Louis District are actually located on the Missouri River, and are included in the Kansas City District's count.

None of the reports presented data for breaches occurring in private levees that do not qualify for PL 84-99 repairs. The 209 occurrences of breaches included in this table for the Kansas City District is considerably less than the 623 breaks reported by SAST (1994; 171) for that District's Grand River - St. Louis portion of the lower Missouri River. The discrepancy between these two figures represents not only a difference in the way of counting (levee districts versus actual breaks) but probably reflects the inclusion of private non-PL 84-99 levees in the SAST figure.

District	Federal Levees	Non-federal levees	Comments
St. Paul	0	1	actual breaches
Rock Island	9	9	# of levee districts breached
St. Louis	23	100 - 52 = 48	actual breaches; one man-made; 52 on Missouri River
Omaha	1	10	actual breaches; one man-made
Kansas City	4	153 + 52 = 205	combination of actual breaches and # of levee districts breached; 52 on Missouri River

All breaches in federal and non-federal levees have been repaired. Of the 110 levee repair sites fixed by the Kansas City District (in which there were at least 157 breaches), 104 were realigned or set back, and six were repaired on the original alinement. Realinements were more common because they represented the least-cost alternative; building the levee on the original alinement was more costly because it required the filling of one or more scour holes. The Kansas City District generally maintained a distance of 750 feet from the edge of the scour hole to the riverside toe of the setback levee. The setback repairs involved a landuse change from agriculture to natural habitat for the area in between the original and new levee alinements. For all 104 setback sites, this conversion affected 2,500 - 3,000 acres, and it stayed in private ownership (Marge DeBrot, pers. comm.). Of the 123 breaches repaired by the St. Louis District, ten were set back, of which five are on the Missouri River; the average area left unprotected by a setback was about 20 acres (Cpt. Scott Fehnel, pers. comm.). In the Rock Island District, only one levee breach involved a setback (Kent Stenmark, pers. comm.).

It is worthwhile noting that the Administration and Congress provided supplemental funding for the repair of private non-PL 84-99 levees that were damaged by the 1993 flood. To receive this funding, levee districts or sponsors would be required to enroll in the PL 84-99 program and attain compliance with all eligibility criteria (see FMRC, 1994:116). In the Kansas City District, relatively few private non-PL 84-99 levee districts took advantage of this funding because the cost of attaining compliance far outweighed the cost of repairs (Marge DeBrot, pers. comm.).

Assumptions for Environmental Impact Analysis

1. The Galloway and SAST reports focus on major levee damage, such as breaches and scour holes, and not minor damage, such as erosion of levee

crowns or sideslopes. In addressing measure I3, minor damages will not be dealt with.

2. "Levee repair" is not limited to repair of damage to levees only, but can include repair of land damaged by sand deposits or erosion. At the request of local landowners, some lands damaged by scour holes were restored under the PL 84-99 program (by the St. Louis District) as part of the overall levee repair, but only if filling of the hole was determined to be necessary for repair of the levee itself, and also only if the land restoration was cost effective (i.e. the use of sand deposits to fill a scour hole was no more expensive than available earthen material). On the other hand, in some instances within the St. Louis District where sand was thinly deposited over soils with a high clay content, farmers chose to keep the sand in place because it would improve overall drainage conditions once it was worked into the ground.

3. Although a detailed inventory of levees susceptible to repetitive damages and an assessment of opportunities for levee setbacks or realinements is lacking, it is assumed that quantitative changes in floodplain land use associated with implementation of measure I3 are proportional to the incidence of levee breaches by District, as shown in the table below. For the Kansas City District, 623 rather than 209 breaks are included in the table. It is assumed that the higher number includes a significant number of private non-PL 84-99 levees. The greater number of levees for the Kansas City District are being addressed rather than the lower number as an attempt to establish an upper bound on the magnitude of effects measure I3 has on various resources. There is no estimate included in the first table (above) of the number of breaches in private non-PL 84-99 levee districts for the other four Corps Districts.

4. The average realinement will affect 2,000 feet of levee. This is the estimated average length of realinement for levees in the Kansas City District (Marge BeBrot, pers. comm.). The average area left unprotected by one realinement is 25 acres, which agrees closely with the averages reported by the Kansas City and St. Louis Districts.

5. Assume that the levee setbacks built under the PL 84-99 repair program in 1993-94 fall under scenario 1. Under measure I3, it is assumed half of the levee breaches that were not set back during the PL 84-99 repair program represent locations of historical damages, and they will be realigned or setback also. The other half will not be realigned, but will be repaired on the original alinement. For all realinements, affected land owners will cost-share for repairs, and will not "abandon" their levee districts, such as occurred at the Louisa No. 8 Levee District in Iowa.

6. A setback will cause a shift in landuse from agriculture to forested and nonforested wetlands. The ratio of these two wetland types will be based on the existing mix of these two wetland types by Corps District, as obtained from the Burns & McDonnell Environmental Inventory Report. Scour holes will not be a consideration under this measure in terms of landuse changes because they will not be present (by definition measure I3 was in place prior to the 1993 flood).

	St. Paul	Rock Island	St. Louis (Mississippi River)	Omaha	Kansas City (Missouri River)
# breaches or breached districts	1	18	123-52 = 71	11	623
incidence	<.01	.02	.10	.02	.86
# of realinements already constructed	0	1	10-5 = 5	0	104+5 = 109
# of realinements to be constructed under I3	0	(18-1)/2 = 8	(71-5)/2 = 33	11/2 = 5	(623-109)/2 = 257
# acres affected	0	200	825	125	6,425
existing F/NF wetland ratio	.62/.38	.72/.28	.53/.47	.26/.74	.22/.78
acres F/NF wetlands	0/0	145/55	440/385	30/95	1,410/5,015

F= forested, NF = nonforested

7. Assume that the average cost of constructing a 2,000 foot levee setback for an agricultural levee having 10- to 25-year protection is $187,500. This includes $150,000 as the estimated 80% federal share (Marge DeBrot, pers. comm.) and $37,500 as the 20% non-federal share. The $187,500 total cost represents the implementation cost. "Other" costs are assumed to be costs incurred by the local sponsor for obtaining borrow. These are assumed to be 25% of the 20% non-federal cost, or $9,400. The 25% figure was obtained after examining several PL 84-99 levee repair reports from the St. Louis District.

Impacts Relevant to FPMA Environmental Impact Categories

Non-forested wetlands: + 5,550 acres

The conversion of agriculture to nonforested wetland is the sum of "new" nonforested wetland for each of the five Districts: 55 + 385 + 95 + 5,015 = 5,550.

Threatened & Endangered: unquantified increase

Implementation of measure I3 would convert 7,575 acres of agriculture to

nonforested and forested wetland. Endangered and threatened species would benefit from this conversion, but to some unquantifiable degree. General groups of species benefiting (as used in the Burns & McDonnell report) would include plants, wildlife, and fish, but probably not mussels. Fish would benefit from the increased floodplain area subject to flooding, as many species take advantage of flooded forests and other natural habitats for spawning and feeding.

Forest: + 2,025 acres

The conversion of agriculture to forested wetland is the sum of "new" forested wetland for each of the five Districts: 145 + 440 + 30 + 1,410 = 2,025

Percent of floodplain inundated: no change

The area of floodplain inundated by the flood of 1993 would not change under measure I3 even though setbacks would be implemented. This is because the realigned levees would still be overtopped.

Cultural: archaeological -1 (-2)
historic 0 (0)

An explanation for the cultural ratings is found in the St. Louis District's section on cultural resources.

Public lands: no change

There would be no change in ownership of lands affected by levee setbacks.

Number of Recreation sites: no change

Because there would be no increase in acres of public lands, there would not be any additional recreation sites.

Implementation costs: $57.0 million

The cost of constructing 303 levee setbacks throughout the FPMA study area would be significant ($187,500 x 303 = $56,812,500). This cost includes the 80% federal and 20% non-federal share.

"Other" costs: $2.85 million

The cost to non-federal sponsors is assumed to represent costs for obtaining borrow ($9,400 x 303 = $2,848,200).

Significant Findings

Implementing measure I3 would involve the realinement of over 250 levee segments on the lower Missouri River, almost all of which represent private non-PL 84-99 levee systems. Most of these would lie between Kansas City and St. Louis. Only about 10 such levee realinements would occur along the Mississippi River, and they would involve federal and non-federal levee systems. Overall, minor changes in landuse are expected. These changes would be confined to conversion of agricultural lands to forested and nonforested wetlands.

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(b) 1995 Farm Bill. Measure I-4. The 1995 Farm Bill will continue conservation and voluntary acquisition program emphasizing restoration of marginal agricultural areas frequently flooded to wetlands and natural habitat.

The status of the 1995 Farm Bill is so uncertain that it is virtually impossible to predict the future of this program (see Measure I-2, above). The direction that Congress sets in the Farm Bill is integral to the future course of this study because the Farm Bill and associated incentives for production or set-aside can have a major affect on land-use. For purposes of this analysis we have made the following assumptions:

1. Although it was estimated that 212,000 acres in the FPMA study area floodplain are currently enrolled in the CRP, this Measure I-4 emphasizes restoration of frequently flooded marginal agricultural lands. Therefore it is assumed that of the 5.3 million acres of flood prone cropland in the FPMA counties, 25% or 1.3 million acres are in the FPMA floodplain.

2. Of the 1.3 million flood prone acres in the study area, 10% or 131,000 acres will be targeted as convertible to wetland.

3. It is assumed that 100,000 acres will revert to floodplain forest and 31,000 will revert to non-forested wetland.

4. The cost for this program for the FPMA study floodplain will be similar to the existing CRP, assuming a 10 year program at $54/acre/yr. Total cost would be approximately $71 million.

(c) Post Flood Land Restoration Activities. Measure I-5. Post-flood land restoration activities, including explicit consideration of environmental attributes, are formalized to expand opportunities for pursuing buyout options. Resolution of this item requires input from several sources. The economic analysis focuses on the decision-making process that farm producers face regarding farming in flood-prone areas and in the process of selling their property or otherwise removing it from production. These are presented in the following sections.

1) Consideration of "Willingness to Sell": Land Value. Estimated fair market values assume that a willing buyer and a willing seller exist and are based on recent real estate transactions involving comparable properties. In this scenario, in order for a farmer to be a willing seller, he must consider it in his best interests to sell his flood plain farmland to a government entity. Many factors other than net return on crop sales influence the value that an individual farmer places on his flood plain farmland, and thereby his willingness to sell that land at a specified price. Some of these factors are financial costs that the farmer incurs when he sells his flood plain farmland, and some of these factors are emotional and social impacts. The costs of mitigation for these emotional and social impacts represent economic costs that need to be included in estimates of land values (land purchase prices). The farmer will not consider the price offered

"fair" if he is not compensated for these costs.

The availability of alternative farming land in the area is of paramount importance. Farmers like the independence and rural way of life that farming offers them. If the farmer desires to continue farming, he would incur economic costs even if he could acquire upland farmland in the same general area that could produce the same major crops. If the land had been in his family for several generations, and he intended to bequeath it to his children, the loss of the land would represent a heritage cost. If his house had been on the flood plain land, several economic costs would be incurred in moving to another house. These economic costs would include the emotional cost of household disruption; possibly the heritage cost if his family had owned it for generations; and possibly a social cost if his children would have to change school districts. The economic costs would also include the financial cost of the move itself and possibly the financial cost of acquiring additional equipment more suited to upland farming. In the Missouri River basin, the labor required to farm an upland acre of rolling to moderately steep hills can be approximately 33 percent greater than to farm flood plain land. Some reasons for this additional labor are the contour plowing required on the upland hills, more frequent turning of equipment, and slower speeds to ensure that the large equipment remains upright. The additional hired labor increases the farmer's financial cost, and the additional labor required of the farmer himself is an economic cost because it reduces his leisure time, time in which he could beneficially engage in recreation or other pursuits.

It should also be noted that a flood plain purchase program by government entities would result in many farmers who sold their flood plain land seeking to acquire nearby upland farmland. This excess of demand over supply would tend to result in increased prices for upland farmland. The farmer would desire the same net income from his new upland farmland as he obtained from the flood plain farmland he sold. Because of the increased labor costs incurred in upland farming and the increased price of upland farmland, the net return per upland acre would be less than the net return per flood plain acre (unless flooding caused frequent crop losses on the flatlands). Therefore, the number of upland acres the farmer would need to acquire would usually exceed the number of flood plain acres he sold and would require him to obtain a proportionately higher price per flood plain acre than he would expect to pay for each upland acre.

The farmer would also desire to obtain a price for his flood plain land that would be sufficient to cover his real estate transaction costs. Closing costs are a consideration, regardless of whether the farmer is paying cash or is obtaining a loan for the purchase. If a mortgage is involved, the farmer would also consider the cost of financing the new purchase. The farmer may have been paying a relatively low interest rate on his mortgage for the flood plain land. After he applies the proceeds of the land sale towards the purchase price of the new upland farmland, the remaining balance would need to be covered by a new mortgage, possibly at higher interest rates than the mortgage on the flood plain land.

The farmer's economic costs would be greater if he could not acquire other farmland in the area and instead acquired farmland in another area on

which he could produce the same major crops. In that case, he would incur all the economic and financial costs that he would have if he acquired upland farmland near his old farmland and would incur several additional costs. The additional economic costs would include the emotional costs of household disruption; social costs of adjusting to new friends, schools, churches, stores, and places of entertainment and recreation; and social costs of losing previous daily contact with friends and relatives. The additional financial costs would include the costs of moving his household and farm equipment.

The farmer's economic costs would be even greater if he could not acquire other farmland in the area and instead acquired farmland in another area for which the major crops he formerly produced were not suited. In that case, he would incur all the economic and financial costs that he would have if he acquired upland farmland far from his old farm but on which he could produce the same major crops and would incur several additional costs. The additional economic costs would include the emotional costs of having to learn new farming techniques, regimes, and markets. The additional financial costs would include the great costs of acquiring equipment more suited to the new crops.

If the farmer was not able to acquire replacement farmland, he would probably have to work a standard 40-hour workweek for 48 to 50 weeks per year. In addition to the possible heritage costs, it is expected that there would be great emotional costs to the farmer of changing his type of work, changing his work schedule, and working under the direction or supervision of others. The extent of the emotional costs would partly depend on whether the farmer was able to find work in a town near his old farm and if not, how far away from his old farm he would have to relocate. The farmer's expectations in regard to the potential for acquisition of replacement farmland and his future livelihood would influence what price for his farmland he would consider acceptable.

2) Impacts of Taking Agricultural Land Out of Production. If flood plain land is taken out of production, there would be many positive and negative effects. Some of these effects can be quantified, and others can only be described qualitatively. Table MRO-13 displays all the effects that could be identified and the quantitative or qualitative assessment used to determine the extent of the impact. The effects are classified under four categories: National Economic Development (NED) benefits and costs; effects on regional economic development; other social effects; and effects on environmental quality. In regard to environmental quality, the table presents comparisons of the impacts of four structural alternatives for flood plain management discussed elsewhere in this report.

Table MRO-13 Type of Benefits and Costs.

FLOOD PLAIN MANAGEMENT ASSESSMENT				
TYPE OF BENEFITS AND COSTS		AMOUNT	UNITS	EXPLANATION
1. NATIONAL ECONOMIC DEVELOPMENT (NED)				
a. Benefits				
(1) Avoidance of agricultural flood damage on land removed from agricultural production	+	26.91	per ac/yr	$269.13 x 0.1 year total flood loss potential
	+	21.57	per ac/yr	$107.86 x 0.2 year loss from flood-forced replanting
	+	17.50	per ac/yr	$58.34 x 0.3 year late-planting loss
(2) Avoidance of land restoration costs for land removed from agricultural production	+	57.75	per ac/yr	$875 x 0.33 of lands x 0.2 years heavy damage
	+	23.10	per ac/yr	$350 x 0.33 of lands x 0.2 years medium damage
	+	12.38	per ac/yr	$150 x 0.33 of lands x 0.25 years light damage
(3) Avoidance of low-yield loss the year after land restoration	+	10.89	per ac/yr	$165 x 0.33 of lands x 0.2 years heavy damage
	+	2.72	per ac/yr	$41.25 x 0.33 of lands x 0.2 years moderate damage
(4) Cost avoidance of levee O&M and repair	+	?		Cost unknown at present; additional studies needed.
(5) Cost avoidance of additional flood damage (urban and rural) from higher river stages resulting from levees	+	?		Cost unknown at present; additional studies needed.
(6) Recreation benefits of publicly owned and accessible environmental restoration land	+	38.76	per ac/yr	9.5 visitors/ac/yr (1980 Missouri R. Fish & Wildlife Mitigation Plan) x $4.08 UDV (FY93, 31 points, 50% general recreation, 50% general fishing & hunting)
b. Costs				
(1) Net loss of farmer's recreation benefits on riverside flood plain land	-	0.47	per ac/yr	0.5 hrs. addt'l labor/ac. on upland acres x $3.74 UDV (FY93, 10 points, gen fish & hunt) /4 hrs. per rec day
(2) Wetlands Reserve Program costs for perpetual easement	-	162.09	per ac/yr	$1,100/ac. ($900 lump sum to farmer; $200 admin., surveys, some restoration) amort. over 10 years at 7.75%
(3) Emergency Wetlands Reserve Program costs for perpetual easement	-	132.62	per ac/yr	$900/ac. ($700 lump sum to farmer; $200 adminis., surveys, some restoration) amort. over 10 years at 7.75%
(4) Conservation Reserve Program payments	-	?		
(5) Additional cost to farmers of new higher interest rates for replacing land	-	8.00	per ac/yr	$900 principal owed on 1 acre farmland at 7% vs. 8% amortized over the 30-year life of the loan
(6) Additional cost to farmers of new higher interest rates for replacing home	-	267.00	per house per year	$30,000 unpaid mortgage balance at 7% vs. 8% amortized over 30 years

Table MRO-13 (cont.) Type of Benefits and Costs.

(7) Moving displaced farm households	-	3060.00 per family	$2100 intrastate move x 1.5 families per 1000 acres + $4500 50-mile interstate move x 1 family per 1000 acres
(8) Fee acquisition of flood plain land	-	79.40 per ac/yr	$1000/acre (including appraisal) amortized over the 50-year project life at 7.75% FY95 discount rate
(9) Extensive environmental restoration	-	149.51 per ac/yr	Cost of project management, planning, engineering, design, and construction (some areas with dredged flow-through channels, some areas with pumps, and some areas with trees, shrubs, and native grasses) for the Missouri R. Fish and Wildlife Mitigation Project amortized over the 50-year project life at 7.75%
(10) Operation, maintenance, repair, rehabilitation, & replacement costs at publicly owned sites w/extensive environmental restoration and low-density rec. areas	-	44.60 per ac/yr	Estimated annual OMRR&R of Corps of Engineers' Missouri River Fish and Wildlife Mitigation Project and the portion of annual OMRR&R for Nebraska Game and Parks Commission low-density recreation lands that are used for low-density recreation facilities
2. REGIONAL ECONOMIC DEVELOPMENT			
a. Tax loss	-	20.00 per ac/yr	Real estate taxes per acre removed from tax rolls
b. Employment			
(1) Beneficial	+	?	An unknown number of short-term jobs would be created during environmental restoration construction. More studies are needed to determine local econ. benefits.
	+	?	Wildlife management & recreation jobs would be created. More studies needed to determine local econ. benefits.
	+	66.50 per ac/yr	9.5 visitors/ac./yr. x $10/visitor spent in local area x .5 of visitors from another county x 1.4 county multiplier
	+	10.71 per acre	$3060 avg. moving costs (using local moving co.) x 2.5 households per 1000 acres x 1.4 county multiplier
	+	?	Additional cost at 1% higher interest rate for new equipment for uplands or different crops, minus salvage value of old equipment, x 1.4 county multiplier x .75 of displaced farmers remain in the same county
(2) Adverse	-	294.00 per ac/yr	7 full-time agricultural jobs lost per 1000 acres repurchased by gov't (2 jobs per 283-acre farm)

Table MRO-13 (cont.) Type of Benefits and Costs.

			x 1.4 county multiplier x $30,000
3. OTHER SOCIAL EFFECTS a. Community Impacts (1) Community cohesion	(-)		Displacement of 2.5 farm families per 1000 acres results in a change in the existing social network
	(-)		The change from agriculturally generated income to income from recreation services brings new residents or tourists whose backgrounds and values may be different from those formerly prevailing in the town
(2) Community viability	(- -)		Farm families departing the area or reducing farm size might cause some key businesses to have yearly sales below the threshhold needed for profitability. If most retail establishments cease operating and are not replaced by recreation-oriented businesses, the town may cease to be economically viable; remaining businesses may move to a nearby larger town.
b. Displacement (1) Residences	- 2.5 farm-houses	/1000 ac.	2 to 3 farmhouses per 1000 acres would be replaced, entailing emotional cost of household disruption
	- 2 families	/1000 ac.	Emotional loss of heritage for families who had lived for several generations in about 2 farmhouses per 1000 ac.
	- 1 family	/1000 ac.	Emotional cost of having to adjust to a new school, new town, new friends, and less frequent contact with relatives and old friends
(2) Farms	- 3.5 farms	/1000 ac.	Approximately 3.5 farms (7 half-farms) per 1000 acres
	- 4 families	/1000 ac.	Emotional loss of heritage for about 4 families who had held for several generations about 700 ac. per 1000 ac.
	- 1 farmer	/1000 ac.	Emotional cost of having to learn new techniques for farming uplands or producing different crops
4. ENVIRONMENTAL QUALITY a. Waterfowl production	(+ +)		"Remove Levee" Alt. – Flooded fields are rich in seeds and invertebrates. Spring or fall flooding is especially beneficial for migrating waterfowl.
	(+)		"Levee Setback" Alt. – Benefit lower than the above alt.

Table MRO-13 (cont.) Type of Benefits and Costs.

	(+)	"Max. 25-Year Levee" Alt. -- Cropland now protected by 50-year levees would flood more frequently.
	(-)	"Raise Levee to 100-Year" Alt. -- River would be more restricted, with fewer fields being flooded.
b. Fisheries	(+ +)	"Remove Levee" Alt. -- Periodic flooding recharges the nutrient base of a river. It also may open a spawning area, especially if flooded during spring and fall.
	(+)	"Levee Setback" Alt. -- Benefit lower than the above alt.
	(+)	"Max. 25-Year Levee" Alt. -- Cropland now protected by 50-year levees would flood more frequently.
	(-)	"Raise Levee to 100-Year" Alt. -- Less area flooded
c. Other wildlife	(+ +)	"Remove Levee" Alt. -- Biodiversity of land in flood plain buyback or put into WRP/EWRP would increase.
	(+)	"Levee Setback" Alt. -- Benefit lower than the above alt.
	(+)	"Max. 25-Year Levee" Alt. -- Cropland now protected by 50-year levees would flood more frequently, resulting in temporary increases in biodiversity behind the levee.
	(-)	"Raise Levee to 100-Year" Alt. -- The foot of the levee may impact riparian wetlands, grassland, and forest habitat; this would decrease wildlife habitat diversity.
d. Water quality	(+)	"Remove Levee" Alt. -- Due to periodic flooding, some ag. land would not be farmed & would convert naturally to wetlands. Water quality would improve because ag. chemicals & sediment have a reduced concentration in runoff & are filtered out as flow goes through wetlands.
	(+)	"Levee Setback" Alt. -- Benefit lower than the above alt.
	(**)	"Max. 25-Year Levee" Alt. -- would have little or no effect
	(**)	"Raise Levee to 100-Year" Alt. -- would have no effect
e. Air quality	(+)	"Remove Levee" Alt. -- Due to periodic flooding, it would no longer be feasible to farm a significant percent of the flood plain land. Therefore, there would be a decrease in total suspended particulates (TSP's) or windblown dust, carbon monoxide, and possibly lead that result from agricultural production.
	(+)	"Levee Setback" Alt. -- Benefit lower than the above alt.
	(**)	"Max. 25-Year Levee" Alt. -- would have little or no effect
	(**)	"Raise Levee to 100-Year" Alt. -- would have no effect

3) **Impacts of Flooding on Farm Returns.** Based on Iowa data, returns to management for flood plain farmland with a minor degree of flooding appear to be greater than returns to management for upland farmland. Per-acre returns to management were calculated using January 1994 Iowa crop budgets and FY93 normalized corn and soybean prices. It was assumed that whenever possible, corn and soybeans would alternate in a field; for replanting or late planting, it was assumed that soybeans would be planted. Over a 10-year period, the calculated per-acre returns to management for uplands that never flood were less than for flood plain land where soggy field conditions force late-planting of soybeans (giving a yield 78 percent of normal) 2 years out of 10 and were only slightly greater than for flood plain land on which the first crop was flooded out, forcing a late replanting of soybeans with 78 percent of normal yield, 1 year out of 10.

A farmer who owns his land, paying only the tax levy, can financially withstand much more in flood damages which are not reimbursed by insurance than can a farmer who is making rent or mortgage payments on the land. The cash rent equivalent in the Iowa crop budgets ranged from 32 to 39 percent of the calculated gross receipts per acre. The calculated net returns per acre for a flood plain farmer who does not own his own land would become negative over a 10-year period if floods caused a complete crop loss 1 year out of 10 and flooded his first crop, forcing a late planting of soybeans at reduced yield, 1 year out of 10. The calculated net returns per acre for a flood plain farmer who owns his own land would become negative over a 10-year period if floods caused a complete crop loss 3 years out of 10 and his first crop flooded, forcing a replanting at reduced yield, several more years out of 10.

Environmental Analysis of Measure I-5

Within the Rock Island District there are over 300 levee systems. Ninety-six of these levees are eligible for Corps assistance under emergency repair law (Public Law 84-99). Even though most of these levee systems performed successfully, 33 were damaged to an extent that warranted Corps emergency repair work. Repairs to these systems again protect more than 360,000 acres of farmland and urban property.

Other levee systems not eligible for the Public Law 84-99 program were repaired under the authorities of the NRCS, Economic Development Administration, and through private funding from levee system owners.

Post-flood land restoration activities, including explicit consideration of environmental attributes, were formalized to expand opportunities for pursuing buyout options. Yet, at just one Public Law 84-99 eligible site, Louisa County Levee District Number 8, Corps assistance for repairs was considered, but refused in lieu of a buyout of the levee district by resources agencies for the purpose of creating refuge lands. The 3,000-acre site will be managed as part of the Mark Twain National Wildlife Refuge. The area is now called the Horseshoe Bend Division of that refuge.

Funding for the buyout came from the Emergency Wetland Reserve Program (EWRP) administered by the Natural Resources Conservation Service (NRCS),

whereby the NRCS purchases EWRP easements. Also, the U.S. Fish and Wildlife Service will purchase remaining lands as fee title for the purpose of establishing fish and wildlife refuge lands.

Despite the conversion of the Louisa County Levee District No. 8 to fish and wildlife lands, little interest was shown on the part of the other eligible levee districts to participate in environmental/wetland buyout programs. Landowners and Federal agencies should have incentives to consider and pursue environmental/wetland buyouts. Not only would flood damage costs be reduced, but wetland benefits derived from the land use conversion would increase.

3) Scenario 3 Measures.

(a) Crop Insurance Rates. Measure I-6. Crop insurance rates reflect actuarial risk for farming behind levees in floodplain areas.The intent of the Crop Insurance Reform Act of 1994 is to develop an actuarially sound, or self-supporting, flood insurance program. Under the act, farm producers must purchase crop insurance in order to be eligible for any benefits such as price supports, production adjustment, conservation reserve, or other benefits. Crop insurance is the only method for producers to receive assistance for natural disasters. The Act presents parliamentary barriers to providing other disaster payments.

The Federal Government subsidizes all of the premium for the basic, catastrophic level of coverage and a portion of the premium for additional, higher levels of coverage. Farm producers must purchase at least the catastrophic level to be eligible for other programs. Under the catastrophic level, producers pay a $50 fee per crop per county up to $200 per county with an overall maximum of $600. The premiums are paid into an insurance fund for use in managing the program.

If crop insurance were to totally replace disaster payments, as mandated by the act, the considerable outlay of Federal agricultural disaster relief funds that occurred in 1993 would not have been necessary. These expenditures would have been, in effect, prepaid by the premiums placed into the crop insurance fund. Because the Federal Government subsidizes most of the insurance premiums, it would still have paid for most of the costs of crop disaster relief, but a relatively more modest outlay of funds would be made during each year, rather than being borne in a lump sum following the disaster.

The intent of the Crop Insurance Reform Act of 1994 is to spread the cost of disaster relief over time, and not to reduce or eliminate farming practices. Because of the significant investment of Federal subsidies, the act does not cause the producer to weigh the risks of farming in flood prone areas. It is doubtful, therefore, that the act will result in any significant reduction of farm production activities in the flood plain.

(b) Upland Farm Management Practices. Measure I-7. Expanded implementation of existing upland farm land use management practices to retain sediment and reduce peak flood runoff, such as terracing, no-till farming, construction of windbreaks, leaving vegetative strips along watercourses, etc.

1) The Scientific Assessment and Strategy Team (SAST). The Scientific Assessment and Strategy Team (SAST), in preparing its efforts for the Galloway report, conducted a brief assessment of the effects that upland management practices would have on flood-flows. The results of this assessment are presented in Section IV: The Engineered System, Chapter 7: Upland Management of the report "Science for Flood Plain Management into the 21st Century.

This SAST report presented far more analysis and information than is possible for this study. The SAST examined four watersheds in the study area. In three of the basins, the SAST modeled the potential effects of various land management practices. In the fourth watershed, the SAST examined a significant increase in wetlands development and the potential effect that this would have on runoff. The alternative practices examined are shown below.

a- Maximizing wetland storage in upland and/or floodplain areas;
b- converting cropland to the CRP;
c- maximizing infiltration by using all applicable land treatment methods;
d- installing traditional SCS-type small flood prevention structures;
e- a combination of the first three alternative (above); and
f- a combination of all possible alternatives.

For each alternative, total coverage of the basin was assumed. The analysis, therefore, examined the maximum effect that these alternatives would have on flood-flows. The analysis examined the effects of these alternatives at various flood levels. The results varied from basin to basin but some significant reductions in flows were discovered, ranging from slightly less than one percent to nearly 40 percent. Some general conclusions can be drawn. These are explained below.

For the wetlands development alternative, both upland and flood plain wetlands were evaluated. Both alternatives identified the potential for significant reductions in peak flood-flow. The reductions resulting from upland wetlands, however, were nearly double that of flood plain wetlands in one of the basins examined, and were about three times larger for a second basin. In this basin, the reductions ranged from 23 percent for the most frequent flood, to 10 percent at the 100-year flood level.

Conversion of cropland to the CRP showed reductions generally in the 3 to 4 percent range. This alternative generally showed the smallest reductions. This is probably due to the limited application (i.e., only highly erosive soils are included in the CRP) of the program.

Maximizing the infiltration rate of soils, which includes conservation

tillage, terraces, and permanent cover, had the highest variation in reductions among the basins. These ranged from about 2 percent to just over 20 percent.

The traditional small detention structure alternative showed the highest reduction in peak flood-flows of all alternatives. Reductions ranged from about 8 percent to nearly 30 percent. This would be expected since this alternative is specifically targeted at reducing flows at the most effective locations.

The combination of all alternatives showed very significant reductions in peak flows for three of the four basins. The variation among the basins points to the need for basin specific analyses. These alternatives show considerable promise in the area of reducing peak flood-flows. This should be examined in detail during future studies.

2) Federal Programs. This change in policy would expand and concentrate Conservation Reserve Program (CRP), Wetland Reserve Program, and other Food Security Act of 1985 (FSA), as amended by the 1990 Food, Agriculture, Conservation, and Trade Act (FACTA) programs to include areas of high natural resource value, riparian areas, wetlands, floodplains, areas with high biodiversity, habitat for threatened or endangered species, and areas with significant fisheries. The expansion of FSA-FACTA would bring the number of acres of highly erodible land (HEL) under cultivation to a tolerable soil loss rate (T). There is also a significant reduction in runoff, especially during smaller events, as a result of fully implemented FSA-FACTA.

a) Summary of Current Programs. FSA-FACTA were enacted primarily to reduce soil erosion and to reduce the production of certain crops. Land use management practices installed for erosion control through FSA-FACTA at the same time reduce runoff rates. The Iowa Natural Resource Conservation Service (NRCS) conducted a study as part of the Scientific Assessment and Strategy Team (SAST) Report which calculated the runoff curve numbers (CN) expected under various condition of soil type, land use, and land treatment. The percent change in runoff, per curve number reduction, was determined for a 1-year, 5-year, 25-year, and 100-year events. The greatest reductions in flood runoff with the implementation of FSA-FACTA was for the 1-year event and least for the 100-year event. Smaller CN's are indicative of less runoff than larger CN's.

TABLE 1

PRACTICE	CURVE NUMBER REDUCTION[1]
Conservation Tillage	3
Terrace	6
Conservation Cropping System	4
Field Border	4
Water and Sediment Control Basin	6
Conversion to Permanent Vegetation	7
Strip Cropping	4
Conservation Reserve Program (CRP)	6
Pasture and Hayland Management	8
Forest Land Management	5
Contour Farming	2

Source: Chenoweth, J.W. and Shirley, C.E. FSA and FACTA - Effects on Flooding

[1] Based on 24-hour rainfall in south central Iowa.

b) Summary of Current Land Treatment Programs by State.

The information in the following tables was provided by NRCS staff from their Natural Resources Inventory database.

TABLE 2

NATIONAL RESOURCE INVENTORY INFORMATION -- NEBRASKA	
TOTAL CROPLAND ACRES	20,600,800
ACRES EXCEEDING T	4,004,700
ACRES OF HEL	10,008,970
ACRES OF HEL PLANNED UNDER FSA	10,008,970
ACRES OF HEL TREATED WITH BASIC CONSERVATION SYSTEMS (TO T)	NOT AVAILABLE[2]
ACRES OF HEL TREATED WITH ALTERNATIVE CONSERVATION SYSTEMS (RANGE FROM 2T UP TO AS MUCH AS 5T)	NOT AVAILABLE
DATA ON SPECIFIC TYPES OF UPLAND TREATMENT -- NEBRASKA	
ACRES OF CONSERVATION TILLAGE	4,275,000
ACRES OF CONTOUR FARMING	2,652,205
ACRES OF GRASSED WATERWAYS	215,500
ACRES OF PASTURE PLANTING	646,600
RANGE SEEDING	563,100
FEET OF TERRACES	399,898,000

[2] Basic Conservation Systems and Alternative Conservation Systems are not quantified separately in Nebraska.

TABLE 3

NATIONAL RESOURCE INVENTORY INFORMATION -- MINNESOTA	
TOTAL CROPLAND ACRES	21,355,600
ACRES EXCEEDING T[3]	12,227,800
ACRES OF HEL	2.8 MILLION
ACRES OF HEL PLANNED UNDER FSA	2.5 MILLION
ACRES OF HEL TREATED WITH BASIC CONSERVATION SYSTEMS (TO T)	1.1 MILLION
ACRES OF HEL TREATED WITH ALTERNATIVE CONSERVATION SYSTEMS (RANGE FROM 2T UP TO AS MUCH AS 5T)	1.7 MILLION
DATA ON SPECIFIC TYPES OF UPLAND TREATMENT -- MINNESOTA	
DATA NOT AVAILABLE[4]	

TABLE 4

NATIONAL RESOURCE INVENTORY INFORMATION -- WISCONSIN	
TOTAL CROPLAND ACRES	8,250,481
ACRES EXCEEDING T[5]	1,879,300
ACRES OF HEL	4,067,534
ACRES OF HEL PLANNED UNDER FSA	4,098,073
ACRES OF HEL TREATED WITH BASIC CONSERVATION SYSTEMS (TO T)	NOT AVAILABLE
ACRES OF HEL TREATED WITH ALTERNATIVE CONSERVATION SYSTEMS (RANGE FROM 2T UP TO AS MUCH AS 5T)	NOT AVAILABLE
DATA ON SPECIFIC TYPES OF UPLAND TREATMENT -- WISCONSIN	
DATA NOT AVAILABLE[6]	

[3] Figure represents a combination of sheet and rill and wind erosion.

[4] The number of acres implemented in specific conservation practices is not tracked in Minnesota.

[5] Figure represents all acres in Wisconsin exceeding T -- cultivated and uncultivated.

[6] The number of acres implemented in specific conservation treatments is not tracked in Wisconsin.

TABLE 5

NATIONAL RESOURCE INVENTORY INFORMATION -- ILLINOIS	
TOTAL CROPLAND ACRES	24,000,000
ACRES EXCEEDING T	6,000,000
ACRES OF HEL	5,300,000
ACRES OF HEL PLANNED UNDER FSA	4,600,000
ACRES OF HEL TREATED WITH BASIC CONSERVATION SYSTEMS (TO T)	1,000,000
ACRES OF HEL TREATED WITH ALTERNATIVE CONSERVATION SYSTEMS (RANGE FROM 2T UP TO AS MUCH AS 5T)	2,500,000

DATA ON SPECIFIC TYPES OF UPLAND TREATMENT -- ILLINOIS
DATA NOT AVAILABLE [7]

TABLE 6

NATIONAL RESOURCE INVENTORY INFORMATION -- SOUTH DAKOTA	
TOTAL CROPLAND ACRES	16,436,300
ACRES EXCEEDING T[8]	4,177,400
ACRES OF HEL	4,145,214
ACRES OF HEL PLANNED UNDER FSA	4,450,681
ACRES OF HEL TREATED WITH BASIC CONSERVATION SYSTEMS (TO T)	4,120,431
ACRES OF HEL TREATED WITH ALTERNATIVE CONSERVATION SYSTEMS (RANGE FROM 2T UP TO AS MUCH AS 5T)	NOT AVAILABLE[9]
DATA ON SPECIFIC TYPES OF UPLAND TREATMENT -- SOUTH DAKOTA	
ACRES OF CONSERVATION TILLAGE	2,520,100
ACRES OF CONTOUR FARMING	1,66,5005
ACRES OF NO-TILL FARMING	1,630,895
ACRES OF TERRACES	291,800

[7] The number of acres implemented in specific conservation treatments is not tracked in Illinois.

[8] Figure represents a combination of sheet and rill and wind erosion.

[9] The number of acres of HEL treated with Alternative Conservation Systems not tracked in South Dakota.

TABLE 7

NATIONAL RESOURCE INVENTORY INFORMATION -- MISSOURI[10]	
TOTAL CROPLAND ACRES	13.3 MILLION
ACRES EXCEEDING T	NOT AVAILABLE[11]
ACRES OF HEL	12.4 MILLION[12]
ACRES OF HEL PLANNED UNDER FSA	6.7 MILLION
ACRES OF HEL TREATED WITH BASIC CONSERVATION SYSTEMS (TO T)	6.0 MILLION
ACRES OF HEL TREATED WITH ALTERNATIVE CONSERVATION SYSTEMS (RANGE FROM 2T UP TO AS MUCH AS 5T)	NOT AVAILABLE
DATA ON SPECIFIC TYPES OF UPLAND TREATMENT -- MISSOURI	
ACRES OF CONSERVATION TILLAGE	3,469,400
ACRES OF CONTOUR FARMING	23,500,000
ACRES OF STRIP CROPPING	41,000
MILES OF TERRACES	22,000 MILES
ACRES OF GRASSED WATERWAYS	14,800
ACRES OF GRASSLAND PLANTING	6,299,000

[10] 1992 National Resource Inventory data.

[11] Acres of land exceeding tolerable soil loss (T) is not tracked in Missouri.

[12] Figure represents a combination cultivated and uncultivated cropland and pasture land.

TABLE 8

NATIONAL RESOURCE INVENTORY INFORMATION -- IOWA	
TOTAL CROPLAND ACRES	24,987,800
ACRES EXCEEDING T	7,346,200
ACRES OF HEL	12,572,100
ACRES OF HEL PLANNED UNDER FSA	9,833,100
ACRES OF HEL TREATED WITH BASIC CONSERVATION SYSTEMS (TO T)	7,443,100
ACRES OF HEL TREATED WITH ALTERNATIVE CONSERVATION SYSTEMS (RANGE FROM 2T UP TO AS MUCH AS 5T)	2,390,000
DATA ON SPECIFIC TYPES OF UPLAND TREATMENT -- IOWA	
ACRES OF CONSERVATION TILLAGE	15,271,000
ACRES OF CONTOUR FARMING	4,388,000
FILTER STRIP	4,500
MILES OF TERRACES	2,321,200
GRASSED WATERWAYS	2,540,400
CONSERVATION COVER	1,875,700
TREE PLANTING	25,000
FIELD WINDBREAK	3,400

TABLE 9

NATIONAL RESOURCE INVENTORY INFORMATION -- KANSAS	
TOTAL CROPLAND ACRES	26,565,300
ACRES EXCEEDING T	NOT AVAILABLE[13]
ACRES OF HEL	12,993,204
ACRES OF HEL PLANNED UNDER FSA	12,798.172
ACRES OF HEL TREATED WITH BASIC CONSERVATION SYSTEMS (TO T)	11,913,539
ACRES OF HEL TREATED WITH ALTERNATIVE CONSERVATION SYSTEMS (RANGE FROM 2T UP TO AS MUCH AS 5T)	800,000
DATA ON SPECIFIC TYPES OF UPLAND TREATMENT -- KANSAS	
ACRES OF CONSERVATION TILLAGE	1,653,522
ACRES OF CONTOUR FARMING	4,107,025
ACRES OF STRIP CROPPING	379,997
FEET OF TERRACES	700,449,640
ACRES OF GRASSED WATERWAYS	159,326
ACRES OF GRASSLAND PLANTING	355,691
ACRES OF TREE PLANTING	7,000

c) Assumptions. 1) Expansion of FSA/FACTA would entail bringing at least an additional 10% of HEL to T.

d) Impacts. Expansion of the upland farm use management practices would have a positive impact on fish and wildlife by creating habitat and improving water quality while at the same time reducing peak flood runoff and erosion. The ultimate goal of FSA-FACTA is to bring all HEL to T.

(4) Findings From Summary Impacts Matrix Table - Agricultural Support Policies Related to Floodplain Use. The scenario matrix is presented in table MRO-14.

[13] Acres of land exceeding tolerable soil loss (T) is not tracked in Kansas.

SCENARIO CATEGORY I

Agricultural Support Policies

	IMPACT CATEGORIES	A Base Cond. [All Disast. Counties]	B Base Cond. [FPMA Imp. Counties]	Scenario 1	Scenario 2	Scenario 3
	ECONOMIC (1,000 $'s)		[1]			
	Flood Damages					
1	Residential (Urban)	$760,892	$662,008	0	0	0
2	Other (Urban)	$1,612,543	$1,447,322	0	0	0
3	Agricultural	$3,852,701	$817,054	(–) SMALL	(–)	(–)
4	Other Rural	$233,648	$161,010	NEGLIG.	(+)	(–)
	Chg. in Govt.Expend.					
5	Emergen.Resp.Costs	$227,405	$200,663	(–) NEGL.	(–) NEGL.	(–) NEGL.
6	Disaster Relief (Agric.)	$1,160,632	$285,180	0	NA	0
7	Disaster Relief (Human R.)	$1,297,474	$551,862	(–) NEGL.	(–) NEGL.	(–) NEGL.
8	Flood Insurance (NFIP)	$371,969	$276,496	(–) NEGL.	(–) NEGL.	(–) NEGL.
9	Flood Insurance (FCIC)	$748,095	$269,061	$64,484	NA	$64,484
	Chg.Value of FP Resources					
10	Net Ag RE Values	–	–			
11	Net Urban RE Values	–	–			
	ENVIRONMENTAL					
	Natur.Resour.(# acres)					
12	Non–Forested Wetl. (acres)	–	365,285	32,000	77,600	0
13	Threat.&Endang. (# / Occ.)	–	(281/1,043)	0	+	+
14	Forest (acres)	–	534,705	95,000	218,000	0
	Natural Fldpln.Functions					
15	Fldpln.inundated (acres)	–	776,276	0	0	0
	Cultural					
16	Archeol Impacts (–5 to +5)	–	–1	–1(NA)	–1(NA)	–1(NA)
16A	Hist.Sites(–5 to +5)		–1	–1(NA)	–1(NA)	–1(NA)
	Open Space					
17	Public lands (acres)	–	392,512	13,000	8,000	0
18	Recreation sites (#)	–	485	10	5	0
	REDUCT.OF RISK					
	Critical Facilities					
19	# Facil. w/harmful releases	–	207	0	0	0
20	# other critical facilities	–	1,208	0	0	0
	Prot./Avoid. of Harm					
21	# people vulnerable	185,630	134,849	0	0	0
	Social Well Being					
22	# communities vulnerable	433	293	0	0	0
23	# resident.struct.vulnerable	56,339	42,743	0	0	0
	IMPLEMENT. COSTS					
24	Structural Costs	–	–	–	$60 million	+$100,000
25	Other Costs	–	–	$108 mil	$153 mil.	+$500,000

[1] Economic impacts collected only at the county level

(a) Cell I3

1) Scenario 1. This scenario would result in a very slight reduction in agricultural damages. The Crop Insurance Reform Act of 1994 attempts to make the program self-supporting (i.e. actuarially sound) and requires all farmers to participate in the program in order to qualify for other programs. The program is highly subsidized by the Federal government, however, and there is very little incentive for farmers to reduce their risk exposure.

The programs that could remove flood plain lands from production (Wetlands Reserve, Emergency Wetlands Reserve, and the Conservation Reserve programs) have never been sufficiently funded to make a significant reduction in croplands subject to flood damages.

2) Scenario 2. Further study is needed to assess the number of levees that would not be repaired under this change in policy. If a large number of levees receive continuous and significant damages, however, flood damage reductions could be significant <u>if</u> they are not repaired, <u>and if</u> significant amounts of flood prone farmland are removed from production and developed as wetlands or other natural habitat.

3) Scenario 3. As stated under Scenario 1, the Crop Insurance Reform Act of 1994 does not provide incentives for farmers to avoid flood risks. Expanded land use management practices in the upland areas, however, have the potential to significantly reduce flood losses. Previous studies have shown this potential, but further drainage basin-specific analysis will be necessary to determine the actual impacts.

(b) Cell I4

1) Scenario 1. Other rural damages may show a slight reduction under the assumption in this scenario, however, the assumptions are not directed at other rural development, so the damage reductions will be negligible.

2) Scenario 2. Further study is needed to assess the number of levees that would not be repaired under this change in policy. If a large number of levees receive continuous and significant damages, however, flood damage reductions could be significant <u>if</u> they are not repaired, <u>and if</u> significant amounts of flood prone farmland are removed from production and developed as wetlands or other natural habitat.

3) Scenario 3. As stated under Scenario 1, the Crop Insurance Reform Act of 1994 does not provide incentives for farmers to avoid flood risks. Expanded land use management practices in the upland areas, however, have the potential to significantly reduce flood losses. Previous studies have shown this potential, but further drainage basin-specific analysis will be necessary to determine the actual impacts.

(c) **Cell I6.** Under the Crop Insurance Reform Act of 1994, disaster relief payments are replaced by crop insurance payments. Disaster relief payments would, therefore, be reduced from $55.5 million to zero.

1) **Scenario 2.** Disaster relief payments are not affected by any of the assumptions under this scenario.

2) **Scenario 3.** Under the Crop Insurance Reform Act of 1994, disaster relief payments are replaced by crop insurance payments. Disaster relief payments would, therefore, be reduced from $55.5 million to zero.

(d) **Cell 9.**

1) **Scenario 1.** Under the Crop Insurance Reform Act of 1994, crop insurance payments would replace disaster relief payments. Crop insurance payments would, therefore, be increased by $55.5 million.

2) **Scenario 2.** Crop insurance payments are not affected by any of the assumptions under this scenario.

3) **Scenario 3.** Under the Crop Insurance Reform Act of 1994, disaster relief payments are replaced by crop insurance payments. Disaster relief payments would, therefore, be reduced from $55.5 million to zero.

(e) **Cell I10**

1) **Scenario 1.** The value of the lands removed from agricultural production and placed into one of the reserve programs would cause the economic value of the lands to be reduced. Because of the limited funding provided for these programs, this effect will be negligible.

2) **Scenario 2.** Further study is needed to assess the number of levees that would not be repaired under this change in policy. If a large number of levees receive continuous and significant damages, however, land values might be reduced if the levees are not repaired for those lands that would be subject to high frequency flooding.

The value of the lands removed from agricultural production and placed into one of the reserve programs would cause the economic value of the lands to be reduced. Because of the limited funding provided for these programs, this effect will be negligible.

3) **Scenario 3.** Expanded upland farm management practices would, to the extent that they limit flood exposure on flood plain lands, have a positive impact on land values.

(f) Cells I19 through I23. The assumptions under scenarios 1 and 2 would not affect any of these impact categories. To the extent that expanded upland farm management practices would reduce downstream flooding, the risks shown for these cells would be reduced.

(g) Summary of Agricultural Support Policies (PPM).

1) The crop insurance reforms will, because they are designed to make the program self-supporting, spread disaster losses over time, thereby eliminating the very large outlay of funds following a disaster. Because the program is heavily subsidized by the Federal Government, however, individual farm producers do not need to weigh the risks of farming in areas subject to flooding. Flood losses will not be significantly affected under the crop insurance reform.

2) Expenditures on the reserve programs, which remove lands from production to meet various goals, or on buyout programs to purchase flood-prone lands will have to be substantially increased from their present levels to significantly affect flood losses.

3) Additional studies are needed to address levee repair criteria. These efforts should focus on identifying those areas where considerable expenditures are made for levees that are damaged on a regular basis.

4) Additional studies are needed to address upland farm land use management practices. These studies should focus on the hydrologic impact of the various methods and should identify the return on investment, not only for improved farming practices, but also in terms of economic and environmental goals downstream from these areas.

Cultural Resources Assessment of Scenario Impacts

For the cultural resources section of this study, we have broken the scenario assessment into two distinct areas. One deals with the effect of implementing the various policies and programs examined here. The other deals with the effects that a 1993 Flood would have had if those policies or programs had been in place. We have done this because implementing a policy or program could have a greater adverse effect on cultural resources than a flood. And to assess the feasibility (economic and political) of implementing any given policies or programs those who make the decision must know the consequences. Relocating an entire historic district could costs hundreds of thousands of dollars. We have also created two categories to avoid a potential misconception. If all the historic structures in a certain floodplain were removed, the adverse effect of another 1993 flood would be eliminated for those structures, but the effect removing them would have destroyed their historic significance. As the analysis below demonstrates, for the St. Paul District, the effect of implementing the policies and programs could have a much greater effect on cultural resources than another 1993 flood could.

To better assess the effect of various policies and programs on cultural resources we first defined a base condition. This base condition is effect that the Flood of 1993 had on cultural resources. A flood can either have no effect on cultural resources or it can have a negative effect. For this reason we decided to use a scale of 0 to a -5 to measure the effect of the 1993 Flood on cultural resources. If the flood had had no effect, it would have measured 0. If it had affected most of the cultural resources in the floodplain, it would have been a -5.

In the St. Paul District, we are measuring the effect of the flood on cultural resources on the Minnesota and Mississippi Rivers. Because the flood affected the Minnesota River and the St. Paul District's reach of the Mississippi River differently, selecting an overall value for the flood is difficult and the value selected will not truly represent the flood's effect on either river. *The flood's effect on cultural resources on the Minnesota River is judged to be a -2 and on the Mississippi River a -1. Because we have little detailed information on the flood's effect on cultural resources on the Minnesota River, we have selected a value of -1 for the overall effect of the flood on cultural resources.* The Minnesota River received the -2 rating because the *potential* for damage was greater than on the Mississippi River. A more detailed discussion of the flood's effects on cultural resources on the Minnesota and Mississippi Rivers appears below. Changes in the base condition that would make the effect of a flood on cultural resources worse would increase the negative rating; those changes that would reduce the effect would bring the measure up to zero.

To measure the effect of implementing policy and programs on cultural resources we decided to use a scale of a -5 to a +5. If a policy benefited a historic site by protecting it from ever being flooded again, without causing any adverse effects, it would receive a +5. If a policy resulted in impacts to a series of significant archeological sites, it could receive a -5.

As we began assessing the effect of implementing the various policies and programs on cultural resources, we realized that we could not measure the effects on historic and archeological sites together. Many of them would affect historic and archeological sites differently. Some programs and policies that encourage people to leave or forces them out of the floodplain (e.g., relocation) could cause significant adverse affects to historic structures. Yet, any decrease in floodplain use would probably benefit archeological sites by stopping or limiting development.

So, on the tables that accompany this section there are two lines for cultural resources: archeological (16) and historical (16a). In each cell we put a measure for the effect on historic or archeological resources of another 1993 Flood if the policy and programs had been implemented. This number appears without parenthesis and represents the change from the base condition. If there is no change, the number stays at a -1. If implementing the policy and programs made the damages from flood worse, the number might become a -2. If they eliminated all flood damage, the number would go to zero or no effect.

There is a second number in each cell. This number appears in parenthesis. It reflects the effect of implementing the policy and programs on historic or archeological resources, as described above. A (+3) would mean that there was a positive effect and a (-3) would mean a negative effect from implementation.

SCENARIO 1 Under this scenario, existing floodplain policies and programs would be maintained with known changes included. The philosophy underlying this scenario is that changes in floodplain management will, in most cases, come somewhat slowly and incrementally.

National Flood Insurance Program Regulations (C16). Tightening national floodplain insurance requirements would have mixed effects on cultural resources. As low-income residents usually live in the floodplain, making them get flood insurance could lead them to leave their homes and to the eventual loss of the structures. If the structures were historic, this would represent an adverse affect of the policy. Having flood insurance could help with a building's repair, however. If the pre-flood market value was used to determine aid to substantially damaged structures rather than replacement costs, some historic structures might be destroyed rather than repaired. On the other hand, discouraging floodplain development could benefit historic and archeological sites in the floodplain by preventing their destruction by new urban expansion.

Implementing the changes in the national flood insurance program regulations as stated in this scenario would have little overall effect on mitigating or preventing the damages that would be caused by another 1993 flood on cultural resources. And the effect of implementing the policies and programs of this category would be minimal.

State Floodplain Management and Zoning Practices (D16). Mitigation planning could aid historic and archeological sites, if they are included in the planning. Overall, the policies here would not change the flood effect

and would have no effect in their implementation.

Local Floodplain Management and Zoning Practices (E16). The policies here would not change the flood effect and would have no effect in their implementation.

Community Relocation, Flood Hazard Mitigation, and Land Use Conversion Programs (F16). Any effort to remove structures from the floodplain must consider whether they are historic or not. Removing historic structures would adversely effect their character and significance. Overall, implementing the policies in this category would have little effect on cultural resources. The policies would not change the effect of another 1993 flood on cultural resources.

Flood Disaster Relief Programs (G16). The policies here would not change the flood effect and would have no effect in their implementation.

Floodplain Wetland Restoration Policies (H16). The policies here would not change the flood effect and would have no effect in their implementation.

Agricultural Support Policies Relation to Floodplain Use (I16). How requiring farmers to have crop insurance will affect cultural resources is unknown. If some decide to abandon floodplain farming as a result, archeological sites could benefit. If in leaving, farmers abandon their dwellings and other buildings and those structures are historic, then those historic structures could suffer. Any programs that keeps land out of farming probably limits the destruction of archeological sites.

Summary. The -1 affect on historic and archeological resources caused by the flood of 1993 would not change much under this scenario. For the St. Paul District, there would be no change from the base condition for Scenario 1.

SCENARIO 2 Floodplain policy and program proposals of the Interagency Floodplain Management Review Committee report (Galloway report), Upper Mississippi River Basin Association (UMRBA), and Association of State Floodplain Managers (ASFPM) are implemented. This scenario assumes that many of the floodplain policy and program proposals presented in the Galloway report, along with position papers prepared by the UMRBA and the ASFPM are implemented. The measures in this and the other scenarios focus on policies and programs that have the potential for changing floodplain management and use "on the ground." Other issues related to institutional and administrative reforms are to be considered outside this evaluation framework.

The philosophy underlying this scenario assumes a more active response to the 1993 flood and a persistent pursuit of floodplain policy and program reforms. The major objectives to be achieved include reduction of risk to lives and property, economically efficient use of floodplain resources, and environmental enhancement of floodplain resources. This is a more aggressive scenario for getting structures out of the floodplain and for discouraging development in the floodplain. It also includes more floodplain protection

efforts such as elevating and floodproofing buildings.

National Flood Insurance Program Regulation (C16). A sliding scale of escalating premiums for repeatedly damaged structures, if those structures are historically significant, could lead to the loss of those structures. Historic structures should be given special consideration in measures such as this. Tightening national floodplain insurance requirements and bringing more structures under these restrictions through mapping would have mixed effects on cultural resources. As low-income residents usually live in the floodplain, making them get flood insurance could lead them to leave their homes and to the eventual loss of the structures. If the structures were historic, this would represent an adverse effect of the policy. Having flood insurance could help with a building's repair, however. And, discouraging floodplain development could benefit historic and archeological sites in the floodplain by preventing their destruction by new urban expansion.

Unless given special consideration during implementation, the policies and programs under this category could adversely effect historic structures. For this reason, we have given this category a -2 for implementation effects on historic structures. As discouraging floodplain development is stronger under this scenario, the benefits to archeological sites would increase. Implementation of this category on archeological sites might have a +1 benefit. Overall this category would not change effect of another flood of 1993 on cultural resources in the St. Paul District. The historic sites affected by that flood would still be there under the policies proposed here.

State Floodplain Management and Zoning Practices (D16). Some critical facilities could also be historic structures. Protecting them from flooding, as long as the protection is consistent with historic preservation standards, could benefit them. Any increase in the effort to remove structures from the floodplain must consider whether those structures are historically significant. If they are, they should receive special attention. If, as under the Prairie du Chien, Wisconsin, project, nonhistoric structures were removed from the floodplain and the historic structures were left, then flood protection and mitigation plans should be developed for them.

For the effects of these policies and programs, see the second paragraph of C16 above.

Local Floodplain Management and Zoning Practices (E16). This program could be quite broad and effect cultural resources in a variety of ways. Requiring flood insurance could affect historic resources in the ways already discussed above. Floodproofing, elevating and relocating structures could adversely affect them. Overall, a more active community effort to alter or remove historic structures in the floodplain could lead to considerable adverse effect to those structures. Again, such an active program could protect other historic and archeological sites by preventing further development in the floodplain.

For the effects of these policies and programs, see the second paragraph of C16 above.

Community Relocation, Flood Hazard Mitigation, and Land Use Conversion Programs (F16). Any effort to remove structures from the floodplain must consider whether they are historic or not. Removing historic structures would adversely affect their character and significance. Floodproofing and elevating historic structure could damage their historic character, as well.

For the effects of these policies and programs, see the second paragraph of C16 above.

Flood Disaster Relief Programs (G16). Any effort to remove structures from the floodplain must consider whether they are historic or not. Removing historic structures would adversely affect their character and significance. Unless given special consideration during implementation, the policies and programs under this category could adversely affect historic structures.

For the effects of these policies and programs, see the second paragraph of C16 above.

Floodplain Wetland Restoration Policies (H16). The principal concern here would be that efforts to restore wetland habitat would not disturb or destroy historic and archeological sites. At this time, it would be too speculative to determine how such efforts would affect cultural resources sites. Implementing this category, however, would probably not change the overall effect of another 1993 flood on cultural resources.

Agricultural Support Policies Related to Floodplain Use (I16). Any policy that discourages levee restoration could have significant adverse effects on historic properties protected by levees. Taking floodplain lands out of farming could benefit archeological sites by limiting the extent to which they are disturbed. Buyout options, to return land to the floodplain, must consider the effect on historic structures.

Summary. Implementing this scenario could have a greater overall negative effect on historic resources. It could potentially have a greater beneficial effect on archeological resources as less of the floodplain is subject to agriculture and urban development. Implementing this scenario would rate a -2 for historic structures. Implementing the scenario could benefit archeological sites and for this would rate a +1. Overall, implementing this scenario would not change the effect on cultural resources of another 1993 flood.

SCENARIO 3 This scenario seeks to achieve the greatest reduction of risk to lives and property with some environmental enhancement. This scenario is based on a very active pursuit of floodplain management reforms, emphasizing restoration of environmental resources in the floodplain and maximum avoidance of risk from flood damages as the two primary policy objectives. Long term planning in the use of floodplains at all government levels discourages development of floodplain areas even where it may be economically viable to use them. The philosophy underlying this scenario is that reliance on natural features such as extensive wetland restoration in upland portions of watersheds as well as in the floodplains is encouraged. New structural works

to manage floods will only be used to protect existing development and will not be constructed to protect areas of potential future development. Avoiding exposure to flooding is the foundation in developing floodplain management policies and programs under this scenario.

National Flood Insurance Program Regulations (C16). This program could be quite broad and effect cultural resources in a variety of ways. Requiring flood insurance could affect historic resources in the ways already discussed above. Floodproofing, elevating and relocating structures could adversely affect them. Overall, a more active community effort to alter or remove historic structures in the floodplain could lead to considerable adverse effect to those structures. Making this program mandatory would lead to more immediate changes. Again, such an active program could protect other historic and archeological sites by preventing floodplain development. Tightening national floodplain insurance requirements and bringing more structures under these restrictions through mapping would have mixed effects on cultural resources.

Unless given special consideration during implementation, the policies and programs under this category could adversely affect historic structures. For this reason, we have given this category a -3 for implementation effects on historic structures. As discouraging floodplain development is stronger under this category, the benefits to archeological sites would increase. The Section 106 requirements of the National Historic Preservation Act should be made to apply, if the Federal government is going to require this. Implementation of this category on archeological sites might have a +2 benefit. Overall this category would not change effect of another flood of 1993 cultural resources in the St. Paul District. The historic and archeological sites affected by the flood would still be there under the policies proposed here.

State Floodplain Management and Zoning Practices (D16). See p. E1 of the Galloway report. Nothing in this policy overtly threatens historic or archeological sites. Special consideration during implementation of the policies under program should be given to historic structures. The Section 106 requirements of the National Historic Preservation Act should be made to apply, if the Federal government is going to require this. As this program would help prevent further development in the floodplain it could benefit historic and archeological sites.

The overall effect of implementing this program is difficult to measure. For the St. Paul District, the program would not change the effect of another 1993 flood on cultural resources. It could, however, change the effect of a greater flood in the district, making fewer historic sites subject to flooding. This would not be a positive effect, however, as removing a historic property would probably destroy its integrity and significance.

Local Floodplain Management and Zoning Practices (E16). If communities decided to abandon historically significant public facilities rather than acquire private insurance, the effect of implementing this policy could be quite negative for those structures. Taking a historic structure out of the floodplain removes it from being harmed in future floods but would destroy its

integrity of location and maybe its overall significance. This policy should include a special provision for historically significant public facilities.

Unless given special consideration during implementation, the policies and programs under this category could adversely affect historic structures. For this reason, we have given this category a -2 for implementation effects on historic structures. As discouraging floodplain development is stronger under this category, the benefits to archeological sites would increase. Implementation of this category on archeological sites might have a +2 benefit.

As the historic public facilities affected by the Flood of 1993 would not be removed from the floodplain under this category, the change would not change the impact of a similar flood on historic resources.

Community Relocation, Flood Hazard Mitigation, and Land Use Conversion Programs (F16). Any effort to remove structures from the floodplain must consider whether they are historic or not. Removing historic structures would adversely affect their character and significance. Taking historic structures out of the floodplain removes them from being harmed in future floods but would destroy their integrity of location and maybe their overall significance. This policy should include a special provision for historically significant public facilities.

See category E16 for the effects of implementing this program on cultural resources. With another flood like 1993, having implemented this policy would not change the effect on historic or archeological resources.

Flood Disaster Relief Programs (G16). These policies could lead to the abandonment of significant historic structures in the floodplain, unless a special provision was made for them. Discouraging floodplain development could benefit historic and archeological sites in the floodplain by preventing their destruction by new urban expansion.

See category E16 for the effects of implementing this program on cultural resources. Another 1993 flood would have the same -1 effect on cultural resources in the Mississippi and Minnesota Rivers valleys even with this policy implemented, because the resources affected would still be there.

Floodplain Wetland Restoration Policies (H16). The principal concern here is that efforts to restore wetland habitat no disturb or destroy historic and archeological sites. At this time, it would be too speculative to determine how such efforts would effect cultural resources sites. Implementing this category, however, would probably not change the overall effect of another 1993 flood on cultural resources.

Agricultural Support Policies Related to Floodplain Use (I16). Any policy that discourages levee restoration could have significant adverse effects on historic properties protected by levees. Taking floodplain lands out of farming could benefit archeological sites by limiting the extent to which they are disturbed. Buyout options, to return land to the floodplain, must consider the effect on historic structures.

SEPARATE EVALUATION CASE STUDY: Inconsistencies Between States in the administration of floodplain regulations?

INTRODUCTION: This section provides an overview of the floodplain management programs in each of the states within the Floodplain Management Assessment. A summary discussion of this subject is found in the Main Report on pages 10-13 through 10-16.

All of the states in this assessment, with the exception of Missouri, had floodplain zoning regulations in place prior to the "Flood of 93" that exceeded National Flood Insurance Program (NFIP) minimum standards. It is important to note that the model zoning ordinance provided to states and communities by the Federal Emergency Management Agency (FEMA), which is the basis for the NFIP program, only regulates the 100-year floodplain and floodways. The ordinance does not stipulate protection requirements for structures built between the 100-year and 500-year flood elevations. This is significant in that these states exceeded the national requirements for floodplain regulatory standards, yet still experienced significant damage during the "Flood of 93".

In brief, the FEMA model ordinance restricts development in floodways to uses that will not create obstructions (raise 100-year flood elevation by more than 1/10th of a foot), and stipulates that new structures or substantially improved structures within the 100-year floodplain must be elevated or floodproofed to at least one foot above the 100-year flood elevation.

Floodways are defined as the channel of a river and that portion of the overbank floodplain that carries most of the flood. Regulations require that the floodway be kept open so that flood waters can proceed downstream and not be obstructed or diverted onto other properties.

FEMA also defines two occasions when work on a structure is considered a substantial improvement:

- an improvement made to a building that exceeds 50 percent of the value of the building; or

- reconstruction of a building, the value of which exceeds 50 percent of the value of the building before it was damaged.

If an addition to an existing building is a substantial improvement, then the addition must be protected from the base flood (100-year flood elevation). If a reconstruction project is a substantial improvement, then the entire building must be protected from the base flood.

Current State Programs and Policies The following excerpts from state regulations governing development within the floodplain provide an overview of current state interpretations of the FEMA model ordinance:

Illinois: The state of Illinois uses the FEMA model zoning ordinance as the basis for its floodplain management program. Under this ordinance, the following minor projects are exempt from the permitting process:

- buildings and additions valued at less than $1,000 (tool sheds, porches, etc.);
- installing utilities, constructing roads or similar projects built at grade (septic tanks, driveways, etc.);
- maintenance of existing buildings or facilities (painting or reroofing); and
- gardening, plowing and similar agricultural practices that do not involve filling, grading or construction of levees. Sodding or adding top soil can be exempt providing it involves no more than two inches of new dirt on no more than one lot.

The Illinois Department of Transportation, Division of Water Resources has permitting authority for projects that may obstruct flood flows or cross or modify the shape of a channel. Development in the floodway is not prohibited, however, development that causes an obstruction is prohibited. An obstruction is considered to be any addition to the floodway that would cause the base flood height to rise more than 1/10th of a foot. A permit from the Division of Water Resources is required prior to any construction in the floodway.

Iowa: The state of Iowa has had an active floodplain management program since 1957, and has not made any policy or program changes since the "Flood of 93". The floodplain management regulations of the State set forth administrative thresholds requiring approval from the Department of Natural Resources for any development including construction, operation, maintenance and use of a structure, dam, obstruction, deposit, excavation or "flood control work" in a floodplain or floodway.

Bridges, culverts, temporary stream crossings, road embankments, pipeline crossings, stream bank protective devices, and excavations in rural areas in or on the floodway of any river or stream draining more than 100 square miles require department approval. In urban areas department approval is required if the river or stream drains more than two square miles.

Levees or dikes, waste or water treatment facilities, sanitary landfills, and buildings and associated fill in rural areas in the floodplain or floodway of any river or stream draining more than 10 square miles require department approval. In urban areas department approval is required if the river or stream drains more than two square miles.

The regulations also set forth the following minimum standards for floodway uses:

- no building or other structure, deposit of fill, or other potential obstruction shall be allowed in the floodway if the development individually or collectively would increase the level of the 100-year flood;

- notwithstanding the above statement, a structure, associated fill, or another potential obstruction whose location in the floodway provides a substantial public benefit may be allowed if the resulting increase in flood levels is mitigated by purchase of flooding easements or execution of other appropriate agreements with the owners of property on which flooding would be increased; and

- fill, structure or other potential obstruction allowed in the floodway shall be the minimum size to achieve the intended purpose.

The state of Iowa also regulates additions, reconstruction, replacement and changes in the use of preexisting nonconforming structures. The State encourages improvements or replacement construction that provides an adequate degree of flood protection commensurate with the damage potential of the structure. The state of Iowa also prohibits improvements or replacement that would contribute to perpetuation of an individual or collective obstruction which causes a significant increase in the 100-year flood elevation; perpetuation of a significant hazard to health and safety during flooding; or perpetuation of the potential for significant flood damages to property and associated public costs.

Kansas: The state of Kansas has not passed any new legislation as a result of the "Flood of 93". The State stipulates that any zoning regulation which regulates development of floodplains shall include the following minimum standards and criteria:

- development standards shall meet or exceed the minimum requirements of the National Flood Insurance Act of 1968, as amended, 42 U.S.C. Section 4001 *et seq.* and the regulations adopted pursuant to that act;

- development standards adopted by the governing body for which minimal requirements have been set by the chief engineer in Kansas Agriculture Regulation 5-45-1 *et seq.* shall meet or exceed the requirements of the chief engineer;

- the governing body shall designate a local floodplain administrator and an enforcement officer by position or job title;

- an application for floodplain development permit shall be made to the local floodplain administrator if any part of a proposed development is located within the floodplain;

- new or substantially improved residential structures located in an area designated as zone AO (area of 100-year shallow flooding where depths are between one and three feet) on a Flood Insurance Rate Map (FIRM) shall have the lowest floor (including the basement) elevated above the highest adjacent natural grade at least as high as the depth number specified in feet on the FIRM. If no depth number is specified on the FIRM, structure shall be elevated at least two feet above the highest adjacent natural grade;

- new or substantially improved non-residential structures located in an area designated as zone AO on a FIRM shall be dry floodproofed or elevated to at least as high as the depth number specified in feet on

the FIRM above the highest adjacent natural grade. If no depth number is specified on the FIRM, structure shall be dry floodproofed or elevated at least two feet above the highest adjacent natural grade;

- when zone AO is not specified on the FIRM, or proposed development will be located in the floodplain outside zone AO, then the lowest floor of new or substantially improved residential structures shall be elevated at least one foot above the base flood elevation; and

- when zone AO is not specified on the FIRM, or proposed development will be located in the floodplain outside zone AO, then new or substantially improved non-residential structures shall be dry floodproofed or elevated to at least one foot above the base flood elevation.

Minnesota: The state of Minnesota has had an active floodplain management program since 1969. The State divides the 100-year floodplain into two districts, the floodway and flood fringe, for regulatory purposes. Floodway districts are considered high hazard areas adjacent to stream channels, while flood fringe districts are lower hazard areas representing the remainder of the floodplain.

The state of Minnesota has two land use categories within the floodplain, permitted uses and conditional uses. For permitted uses the community must require a building/use permit prior to the construction, addition or alteration of any building, structure, or portion thereof; the use or change of a structure, building or land; the extension or change of a nonconforming structure or use of land; and the placement of fill or excavation of land. Conditional uses represent certain uses and construction methods which may not be appropriate, but cannot positively be ruled as inappropriate. A special review process has been established for permits of this type.

The following open-type uses are permitted within the floodway provided they do not include structures, fill, or storage of materials or equipment:

- agricultural - general farming, pasture, horticulture, and sod farming;

- industrial/commercial - loading areas, parking areas, and airport landing strips;

- recreation - tennis courts, parks, picnic grounds, ball fields, nature preserves, target ranges and recreational trails (golf courses are not considered appropriate); and

- residential - lawns, gardens, parking and play areas.

Some examples of potential conditional uses within the floodway are structures accessory to open space uses; placement of fill; sand and gravel operations; marinas, docks, piers and other water control structures; railroads, streets and pipelines; and storage yards for materials and equipment.

New construction or additions to residential, commercial and industrial buildings are permitted within the flood fringe provided the structures are elevated on fill, or otherwise protected against flood damage from the

Regulatory Flood Protection Elevation (RFPE), at a minimum, this is an elevation no lower than the 100-year flood elevation. A conditional use permit would be required for these structures if another type of flood damage prevention method were to be proposed. These could include the elevation of the structure on pilings or concrete support columns or dry flood proofing in the case of non-residential structures. Dry flood proofing involves physically sealing the lower portions of a structure to prevent flood waters from entering.

The state of Minnesota also regulates nonconforming uses within the floodway and flood fringe districts. Nonconforming uses are existing structures or uses of land or structures that do not meet all of the standards of an ordinance. The following actions are prohibited in the floodway:

- additions to structures in the floodway district, unless the addition is to an accessory structure of an open space use;
- reconstruction of a residential, commercial or industrial structure damaged to greater than 50 percent of its value unless the structure is relocated outside of the floodway; and
- intensification of use that increases the flood damage potential, potential for loss of life or increases the stage of the 100-year flood.

The following requirements must be met for nonconforming structures in the flood fringe:

- additions must be elevated on fill or floodproofed to the RFPE;
- entire structure must be brought into compliance with the requirements for a conforming structure if the improvements exceed 50 percent of the structures current market value;
- intensification in use must not increase flood damage potential of the original use; and
- reconstruction of any structure damaged to greater than 50 percent of its market value at the time of loss is contingent on the reconstructed structure meeting the requirements for a conforming structure.

Missouri: The state of Missouri has not enacted any new legislation related to floodplain management since the "Flood of 93". In fact, the State does not have a separate piece of legislation governing development within the floodplain at this time, leaving responsibility for floodplain management, for the most part, at the local level.

The Governor's Task Force on Floodplain Management recommended that the Governor and Legislature:

> "Create a multijurisdictional entity to advise the Governor on structural (levees, dams) and non-structural projects (National Flood Insurance, outdoor recreational areas) and institutional and legal strategies for floodplain management.

Empower and resource a designated State Agency to develop and implement an effective overall strategy for floodplain management, under the guidance of the multijurisdictional entity."

The Missouri state legislature and various governmental agencies are currently reviewing the findings of the Task Force report to determine what, if any actions the State will take to decrease the impacts of flooding in Missouri. As a first step in this direction, legislation has been introduced in the Missouri House of Representatives to adopt the FEMA model zoning ordinance as the State standard for floodplain management.

Nebraska: The state of Nebraska has not made any changes in its floodplain management program since the "Flood of 93". The following minimum standards apply to the location of obstructions and substantial improvements within the floodplain:

- no new construction, substantial improvements, or other construction (including fill) shall be permitted unless the cumulative effect of the construction when combined with all other known construction will not increase the water surface elevation of the base flood (one percent chance of being equalled or exceeded in magnitude in any given year) more than one foot at any location;

- designed and adequately anchored to prevent flotation, collapse, or lateral movement of the obstruction and be constructed by methods and practices that minimize flood damage;

- public utilities and facilities, such as sewer, gas, electrical and water systems shall be located and constructed to minimize or eliminate flood damage;

- new and replacement water and sanitary sewage systems shall be designed to minimize or eliminate infiltration of flood waters; and

- residential and non-residential structures shall have their lowest floor elevated to or above one foot above the base flood level.

The state of Nebraska also prohibits the storage or processing of materials that are, in time of flooding, buoyant, flammable, explosive, or injurious to human, animal or plant life in the floodplain.

Wisconsin: The state of Wisconsin has had an active floodplain management program since 1965, but has made no changes to its zoning policies as a result of the 1993 flooding. The program stipulates that municipalities shall prohibit the following uses in floodway areas:

- development which will cause an obstruction to flood flows, an increase in regional flood discharge or adverse affects on existing drainage facilities;

- structures designed for human habitation, associated with high flood damage potential, or not associated with permanent open space uses;

- storage of materials that are buoyant, flammable, explosive or injurious to human, animal, plant, fish or other aquatic life;
- sewage systems that cannot be removed during flooding;
- wells which are used to obtain water for ultimate human consumption; and
- solid or hazardous waste disposal facilities (also prohibited in flood fringe areas).

Municipalities may issue permits in floodway areas for open space uses having a relatively low flood damage potential, such as agriculture, recreation, surface parking lots, storage yards or certain sand and gravel operations.

The state of Wisconsin also requires that new development or substantial improvements within flood fringe areas be elevated or floodproofed against the regional flood height (100-year flood elevation).

Officials with the Department of Natural Resources pointed out that property owners along the Upper Mississippi River in Pierce County have been pressuring their legislators to relax the State's 50 percent nonconforming use provision. Under the proposal, no limitations would be placed on the repair, reconstruction, or improvement of nonconforming uses in a flood hazard area that are damaged or destroyed by fire or a natural disaster other than flooding. The proposed legislation, which was challenged, would have changed existing state policy, placing property owners at continued risk as well as creating substantial negative economic impacts to taxpayers and insurance ratepayers.

Comparison As stated earlier in this case study, all of the states in this assessment currently have floodplain zoning regulations that exceed minimum NFIP standards, with the exception of Missouri. The state of Missouri does not currently have any separate state-level legislation governing development within floodways or the 100-year floodplain.

The state of Missouri has delegated floodplain zoning and construction permitting responsibilities to county and community governments. Eighty-three percent of the communities in the state of Missouri that require floodplain management programs currently have programs meeting NFIP requirements. There is no department or agency at the state-level to review permits for development within floodways or the 100-year floodplain. County and community governments must, therefore, work directly with FEMA whenever they have questions regarding floodplain management or have problems enforcing their regulations.

The states of Wisconsin, Minnesota, Iowa, Nebraska, Illinois and Kansas have gone beyond the minimum standards of the FEMA model ordinance and have passed their own legislation to govern development within floodways and the 100-year floodplain. These states all adhere to the following basic policies:

- restrict development within floodways (do not allow obstructions), requiring developers to obtain state permits prior to construction;

- prohibit the development of hazardous waste facilities within floodways;
- require elevation on fill or floodproofing for structures built within the 100-year floodplain; and
- require substantially improved structures to meet zoning requirements.

The states of Illinois, Iowa, Minnesota and Wisconsin take the restrictions on development within floodways one step further, stipulating that only open space uses (agricultural, recreational, etc.) be permitted in floodways. These states do, however, have strict provisions for the construction of certain types of structures within floodways if they support an open space use and meet construction requirements.

The states of Iowa, Minnesota and Wisconsin also exceed the NFIP minimum requirements for the zoning of critical facilities.

- The state of Iowa currently requires that hospitals and like institutions; buildings or building complexes containing documents, data or instruments of great public value; buildings or building complexes containing materials dangerous to the public or fuel storage facilities; power installations needed in emergencies or buildings or building complexes similar in nature to these uses be protected to the 500-year flood elevation plus one foot. Wastewater treatment facilities, and other habitable residential buildings or industrial facilities where flooding would result in high public damages will be protected to the 100-year flood elevation plus one foot.
- The state of Minnesota currently requires that all public utilities and facilities such as gas, electrical, sewer and water supply systems located in the floodplain be floodproofed in accordance with the State Building Code or elevated above the Regulatory Flood Protection Elevation (RFPE). The RFPE is an elevation no lower than the 100-year flood elevation plus any increase in flood levels resulting from the designation of floodfringe areas. The Minnesota Department of Natural Resources strongly encourages all communities to also include at least one foot of freeboard in their local ordinance.
- The state of Wisconsin prohibits the placement of solid or hazardous waste disposal facilities in floodfringe areas (that portion of the floodplain outside of the floodway, which is covered by flood water during a 100-year event). Public utilities, streets and bridges in the floodfringe must be adequately floodproofed.

State floodplain zoning ordinances are summarized in the following table:

State Floodplain Zoning Ordinances Compared to NFIP Requirements						
	Exceed NFIP Requirements			Do Not Meet NFIP Requirements		
States	Floodways	Floodfringe	Critical Facilities	Floodways	Floodfringe	Critical Facilities
Illinois	■	■				
Iowa	■	■	■			
Kansas		■				
Minnesota	■	■	■			
Missouri				■	■	■
Nebraska		■				
Wisconsin	■	■	■			
Source: FPMA State Floodplain Management Regulations				■ Applicable Cell		

The states of Minnesota and Illinois have published floodplain management handbooks to assist local communities trying to implement floodplain management ordinances and programs. These handbooks provide step-by-step procedures for communities to follow when establishing programs to meet NFIP requirements.

It is also important to note that state floodplain zoning regulations are written at varying levels of complexity. Some state regulations can be easily understood by laymen while others require a regulatory expert to provide interpretations. It would be helpful if all of the states followed the example set by the states of Minnesota and Illinois and adopted more readable products for local governments to use in developing their floodplain management programs.

Conclusions With the exception of the state of Missouri, the states studied under this assessment have viable floodplain management programs. Their floodplain zoning regulations are consistent with those set forth in the FEMA model ordinance, and in some instances more stringent than the model. The states of Iowa, Minnesota and Wisconsin currently exceed the NFIP minimum zoning standards for floodway, 100-year flood elevation, and critical facility siting and protection.

The state of Missouri has focussed its efforts since the "Flood of 93" on acquiring and relocating at risk structures in the floodplain, giving it one of the most aggressive programs reviewed. The Missouri program will acquire or relocate 4,143 structures. The State is also in the process of reviewing legislation to implement the FEMA model floodplain zoning ordinance in an effort to establish a state-level program.

The states of Illinois, Iowa, Kansas, Minnesota and Wisconsin have also developed aggressive acquisition and relocation programs to reduce the level of flood damages experienced during the 1993 flooding. In particular, the states of Illinois, Minnesota and Wisconsin have created state-level programs to fund mitigation activities.

According to the *Galloway Report*, state budget contributions for floodplain management activities in 1991 ranged from a low of $34,400 for the state of Missouri to a high of $1 million for the state of Wisconsin. From a budget standpoint, therefore, the states of Wisconsin, Minnesota and Kansas appeared to be spending the most on floodplain management activities in 1991.

Overall, the state floodplain management programs reviewed provide a good framework for regulating development within floodways and the 100-year floodplain, but do not provide guidance for the protection of residential and non-critical facilities located between the 100-year and 500-year flood elevations.

ACTION ALTERNATIVES

IMPACT AND RESOURCE EVALUATIONS FOR OMAHA DISTRICT (Columns K - W)

(1) Method for analyzing changes in flood impacts.

The alternatives for modifying the flooding impacts of the 1993 Flood are the levee removal, levee setback, 25-year notch, fully confined levee system, no reservoirs, 5-percent reduction in runoff, and 10-percent reduction in runoff. It was assumed that overbank flooding is the only source of damage that would be affected by these alternatives. Internal drainage problems and other flooding including upland and tributary flooding were not considered. In the Omaha District, these alternatives, except for the 5% and 10% flow reduction, would be implemented in the Missouri River flood plain. The impacts for all the alternatives would be most significant in that flood plain.

The Omaha District's effort was directed toward measuring impacts in the Missouri River flood plain with the existing flood control measures in place and for each of the new alternatives. Existing Omaha District hydrologic, hydraulic, geographical, and economic computer programs and models were used to the extent possible. The MRO Hydraulics section used the micro-station and inroads to create surfaces and intersect water and ground surface to generate the flooded area boundary for the 1993 flood event. This information was transferred to ArcInfo Geographical Information System (GIS) coverage. These plots were then overlaid with other GIS data, including data from the Post-Flood Data Collection from LMVD and land use from the Missouri River Basin Association Atlas (Atlas) published in July 1982. The Atlas was digitized and attributed for this study and includes land use information to Anderson Classification Level Two, and some Level Three. This was used to calculate the number of acres flooded, of various landuse types, for the different hydrologic and engineering alternatives. The data from this process were used to estimated damages to urban and agriculture damage and the government expenditures that would be expected from the 1993 Flood assuming each alternative was in place.

(a) Economic Impact Categories.

1) Urban. In order to examine the change in overbank flooding, water surface profiles for the existing conditions and all alternatives were estimated. Land use in the Missouri River floodplain was established using the land use data collected for the Emergency System Operating Plan, Missouri River Main Stem Reservoir System, Gavins Point to Rulo, Nebraska Report (ESOP). Damages for the 1993 event and the various alternatives were calculated using this land use data and the Omaha District Damage Calculation Model. Urban damages were estimated for residential and for other urban activities. Residential damages included damage to structure and contents. Other urban damage included damage to commercial, industrial, and public buildings (and contents), and to the transportation infrastructure.

2) Agricultural. Agricultural damages for the 1993 event need to be put into perspective in order to examine the effects of the various alternatives. Rainfall events in the spring of 1993 disrupted most farmers'

regular planting schedule and in some circumstances, prevented the farmer from planting at all. These rainfall events affected the overall damageable acres in the study area. The 1993 flood event caused extensive damages to agricultural land and to the crops which had been planted. Damages in the study area were caused by three sources: overbank flooding, interior drainage ponding, and upland flooding. The analysis assumed that none of the alternatives could have an effect on the damages caused by interior drainage or upland flooding.

In order to look at the effects of the various alternatives, the overbank flooded area was quantified and compared to the baseline. Damages for the agricultural baseline were based on the acres of cropland flooded by the 1993 event.

The analysis assumed that the total acres from GIS were inundated for greater than 48 hours, all acres were planted, and there was no opportunity for the farmer to replant. The crop distribution in the flooded area was assumed to be 50-percent corn and 50-percent soybeans. As required by regulations, current normalized prices were used in the damage estimates. These prices eliminate any short-term abnormalities in crop prices.

3) Change in Value of Floodplain Resources.

The net agricultural product is presented as a total value of the agricultural crop land in the FPMA impact counties. As stated in the methodologies, it was developed using the total number of acres times an average value per acre of $1,500 and the total value was estimated to be $1,608.0 million. Changes in the value were determined using information from the USDA. For the baseline, the fully confined levee system, and the 10- and 5-percent runoff reduction the value of the agricultural land was assumed not to change. For the no levee the area which would no longer receive protection because of this alternative would be devalued by 30- to 40-percent. For the 25-year notch, the area which would receive less protection because of this alternative would be devalued by 5- to 10-percent. For the land which would receive no protection because of the levee setback, the area would be devalued by 60- to 70-percent. For the no reservoir alternative it was assumed that the land subject to increased flooding would be devalued by 30-to 40-percent (Bob Bartels, USDA, personal communication, 1995).

4) Government Expenditures.

Government expenditures include emergency costs, disaster relief (non-agricultural), agricultural disaster relief, non-agricultural flood insurance payments, and agricultural flood insurance payments. Estimates of emergency costs, non-agricultural disaster relief, and non-agricultural flood insurance payments for each of the alternatives were based on the ratio of the respective costs under existing conditions to the residential damage under existing condition. Estimates of the costs of agricultural flood disaster relief and agricultural flood insurance payments were made by applying the ratio of the respective costs to the crop damage under the baseline to the crop damage estimate for each alternative (i.e. {cost/crop damage for the baseline}*{crop damage for each alternative}).

It should be noted that all categories except emergency costs are partially or totally reimbursed and do not represent a net government outlay. No attempt was made to measure the difference in net government outlays for any of the alternatives.

(b) Environmental Impact Categories

Land use categories for the environmental analysis of this report were established using the Missouri River Basin Atlas (see GIS write-up for details). Base conditions include all natural resource acres in the Missouri River flood plain, bluff to bluff, from Omaha to Rulo, Nebraska. Damage to natural resources from the 1993 flood were not evaluated because no dollar value is attributed to natural resources and short-term damage to natural resources from flooding is outweighed by the long-term benefits.

1) Non-Forested Wetland. Non-forested wetlands were classified as emergent and do not include mixed and shrub-forest wetland. The total number of acres of non-forested wetlands, bluff to bluff, is 7,638.

2) Threatened/Endangered Species. There are approximately 25 State and/or Federally listed threatened/endangered (T&E) species which occur in the flood plain of the study reach. The number of occurrences refers to an actual sighting of a T&E species within the flood plain of the study reach.

The primary source for T&E information were the state agencies responsible for fish and wildlife resources and the U.S. Fish and Wildlife Service. Data on occurrences of T&E species was provided by the Natural Heritage programs in each state.

3) Forest. The data for forest were derived in the same manner as non-forested wetland. The category, forest, included forested-wetland and upland forest with tree crown (spread) of at least 10 percent. Approximately 29,202 acres of forest are present in the study area.

4) Flood Plain Inundated. Approximately 120,276 acres of floodplain were inundated in the 1993 flood event. This data was collected using GIS.

5) Cultural Resources. Cultural resource impact evaluation was entirely conceptual. Nearly all culurally significant sites on the mainstem floodplain are below the surface and those located in the bluffs are not affected by the alternatives evaluated.

6) Public Lands. There are approximately 57,852 acres of public lands located within the flood plain of the study reach. Public lands include state and Federal wildlife refuges, wildlife management areas, and state conservation lands. While some of these areas also provide recreational opportunities, their primary purpose is for wildlife.

7) Recreation Sites. There are approximately 92 recreation sites located within the flood plain of the study reach. Recreation areas include land designated primarily for recreational use. It includes Federal, state and local parks, and public use areas. State and national forests have been

included in this section because they also provide significant recreational opportunities.

(c) **Reduction of Risk Categories.**

1) **Critical Facilities.** Information from GIS was used to derive the number of critical facilities which were affected by the 1993 flood event, and the number of facilities which would be affected by the various alternatives studied.

2) **Protection/Avoidance of Harm.** The number of people in the flooded area was used as the measure of the protection/avoidance of harm. It was derived from the number of residential structures that were vulnerable to flooding in the Missouri River floodplain from the 1993 flood. The number of people subject to flooding from upland and tributaries were not included. It was assumed that an average of 3 people resided in each residential structure.

3) **Social Well Being.** The social well being parameter was represented by the number of communities and the number of residential structures vulnerable to flooding from a flood similar to the 1993 flood. The number of communities vulnerable to flooding was derived from GIS mapping available for each alternative. The number of residential structures vulnerable to flooding for each alternative was determined from the output provided by the Omaha District Damage Calculation Model.

(2) Summary and Findings of Impact and Resource Evaluations for the Action Alternatives for the Omaha District.

The Omaha District evaluated the levee removal, levee setback, 25-year notch, fully confined levee system, no reservoirs, 5-percent reduction in runoff, and 10-percent reduction in runoff as the alternatives to the existing flood control system. The impacts, or changes, with respect to the baseline conditions in the impacted counties was estimated for all categories. The impacts presented would arise from changes in flood damages, flooded area, and expenditures attributable to the alternatives in the Missouri River floodplain in the Omaha District. The matrix which shows the incremental change from the baseline impacts of the alternatives is shown on page 9-2a of the Main Report

(a) **Economic Impact Categories.**

1) **Urban.** Table MRO-17 shows the 1993 urban flood damages for the baseline and the alternatives. With no reservoirs on the mainstem, damages to urban activities increased significantly in the Missouri River floodplain. The impacts on 1993 urban flood damages of the various alternatives is shown in table MRO-18. The greatest reductions in damages in the Omaha District would be to the fully confined levee system. Substantive damage reduction for the 1993 flood would also be realized for the levee setback and the reduced runoff alternatives. The 25-year notch would reduce the level of protection in the Omaha District but would not alter total urban damages for the base condition. Under this alternative increases in residential damages would be offset by decreases in other urban damages. This is due to increased water

surface elevations in areas where residential activities are located and decreased water surface elevation in areas where other urban activities are located. Without levees or reservoirs in the basin, damages from the 1993 flood would have been significantly higher than under the base condition.

Table MRO-17
Urban Damages
(Millions of $)

	Base	No Reservoirs	No Levees	25-YR Plugs	Runoff Red 5%	Runoff Red 10%	Set Back	Fully Confined
Residential	24.0	99.5	30.7	24.3	22.4	21.3	21.6	20.3
Other Residential	62.6	625.5	82.7	62.4	60.5	59.8	60.9	60.6
Total	86.6	725.0	113.3	86.6	82.9	81.1	82.5	80.8

Table MRO-18
Urban Impacts
(Millions of $)

	Base	No Reservoirs	No Levees	25-YR Plugs	Runoff Red 5%	Runoff Red 10%	Set Back	Fully Confined
Residential	0.0	75.4	6.6	0.2	-1.6	-2.7	-2.4	-3.8
Other Residential	0.0	562.9	20.1	-0.2	-2.0	-2.8	-1.7	-2.0
Total	0.0	638.3	26.7	0.0	-3.7	-5.5	-4.1	-5.8

2) **Agricultural.** Table MRO-19 shows the total agricultural and other rural damages that would be experienced with each alternative. These damages include internal drainage, upland flooding, and Missouri River overbank flood damages for the FPMA impact counties.

Table MRO-19
Agricultural and Other Rural Damages
(Millions of $)

	Base	No Reservoirs	No Levees	25-Yr Notch	Runoff Red 5%	Runoff Red 10%	Set Back	Fully Confined
Agricultural	109.2	386.3	146.5	126.2	107.9	107.6	102.3	97.0
Other Rural	16.2	57.5	21.8	18.8	16.1	16.0	15.2	14.4
Total	125.4	443.8	168.3	145.0	124.0	123.6	117.5	111.4

Table MRO-20 presents the monetary impacts to agricultural crop and other rural areas for each of the alternatives. Damages in the Omaha District increase significantly with no reservoirs, no levees, and by lowering the level of protection with the 25-year notch. Agricultural damages from the 1993 flood in the Omaha District would decrease significantly with the levee setback and the fully confined levee system.

Table MRO-20 Agricultural and Other Rural Impacts (millions of $)								
	Base	No Reservoirs	No Levees	25-YR notch	Run-off- 5%	Run-off- 10%	Set Back	Fully Confined
Agricultural	0.0	277.2	37.3	17.1	-1.3	-1.6	-6.9	-12.2
Other Rural	0.0	41.3	5.6	2.5	-0.2	-0.2	-1.0	-1.8
Total	0.0	318.5	42.9	19.6	-1.5	-1.8	-7.9	-14.0

The impacts were derived from the changes in overbank flooded areas. The acres inundated for the baseline and the various alternatives is presented in table MRO-21.

Table MRO-21 Number of Acres Affected		
Alternative	Acres Inundated	Alternative - Baseline
Baseline	89,800	
10-percent reduction in runoff	83,300	- 6,500
5-percent reduction in runoff	84,400	- 5,400
Infinitely high levees	39,600	- 50,200
No levees	243,300	+ 153,500
No reservoirs	1,072,000	+ 982,200
25-year notch	160,100	+ 70,300
3000 foot levee setback	61,500	- 28,300

As stated earlier, the agricultural data includes interior ponding and upland flooding, as well as, overbank flooding. An estimate of the percent of damages by caused by flooding, as opposed to excess precipitation has been made and is presented in table MRO-22.

As shown in the table, 40.3-percent of the damages in the impact counties were caused by flooding. Approximately 14-percent of the damages in all the FPMA counties is caused by flooding.

Table MRO-22 Agricultural Damage by Category		
Impact Counties	State	Flood Damage Percent of Total
Yankton	SD	5.9%
Clay	SD	0.0%
Union	SD	11.8%
Woodbury	IA	1.3%
Monona	IA	0.1%
Harrison	IA	4.1%
Pottawattamie	IA	0.0%
Mills	IA	33.0%
Fremont	IA	54.6%
Atchison	MO	66.7%
Holt	MO	89.6%
Burt	NE	7.1%
Washington	NE	37.0%
Douglas	NE	15.6%
Sarpy	NE	23.5%
Cass	NE	0.0%
Otoe	NE	26.6%
Nemaha	NE	72.2%
Richardson	NE	24.6%
	TOTAL	40.3%

3) Change in Value of Floodplain Resources.

For the baseline, the fully confined levee system, and the 10- and 5-percent runoff reduction, the value of the agricultural land was assumed not to change. For the no levee, 25-year notch, no reservoir, and the levee setback alternatives, the value of the agricultural land was assumed be decreased.

4) Change in Government Expenditures.

Government expenditures for the 1993 flood for the base and the alternatives are shown in table MRO-23. The no reservoirs alternative is shown to have the largest expected government expenditures for floods similar to the 1993 flood. It is over three times as large as was actually expended for the flood. Table MRO-24 shows the impacts of the alternatives when compared to the base condition. Government expenditures increase significantly in the Omaha District for the no reservoir, no levees, and the 25-year notch alternatives. Decreases in these expenditures would be expected for the other alternatives. The fully confined alternative would have the greatest reduction.

Table MRO-23 Total Costs (millions of $)								
	Base	No Reser-voirs	No Levees	25-Yr Notch	Runoff -5%	Runoff - 10%	Set Back	Fully Con-fined
Emergency Response Costs	8.2	34.1	10.5	8.3	7.7	7.3	7.4	6.9
Disaster Relief (Agriculture)	59.6	210.9	79.9	68.9	58.9	58.7	55.8	52.9
Disaster Relief (urban)	55.2	228.7	70.5	55.8	51.5	49.0	49.7	46.6
Fld.Ins. (NFIP)	11.7	48.4	14.9	11.8	10.9	10.4	10.5	9.9
Fld.Ins. (FCIC)	34.3	121.4	46.0	39.7	33.9	33.8	32.2	30.5
Total	169.0	643.5	221.8	184.5	162.9	159.2	155.6	146.8

Table MRO-24 Total Impact (millions of $)								
	Base	No Reser-voirs	No Levees	25-Yr Notch	Runoff -5%	Runoff - 10%	Set Back	Fully Con-fined
Emergency Response Costs	0.0	25.8	2.3	0.1	-0.6	-0.9	-0.8	-1.3
Disaster Relief (Agriculture)	0.0	151.3	20.4	9.3	-0.7	-0.9	-3.8	-6.7
Disaster Relief (urban)	0.0	173.5	15.3	0.6	-3.8	-6.2	-5.5	-8.6
Fld.Ins. (NFIP)	0.0	36.7	3.2	0.1	-0.8	-1.3	-1.2	-1.8
Fld.Ins. (FCIC)	0.0	87.1	11.7	5.4	-0.4	-0.5	-2.2	-3.8
Total	0.0	474.4	52.9	15.5	-6.3	-9.8	-13.5	-22.2

(b) Environmental Impact Categories

Environmental impacts were based on the gain or loss of natural resources from each action alternative. The environmental work group assumed that implementation of some of the alternatives would involve land use changes from agriculture to natural conditions and vice versa.

	Urban	Forest	Forested Wetland	Wetland	Water	Barren	Agricultural	Total
Total Acres	13,816	19,896	2,966	6,046	15,230	503	277,925	336,355
Unprotected	504	12,193	2,571	5,349	9,858	71	89,800	117,271
Protected	13,312	7,676	395	697	5,372	432	188,125	219,084

*Data taken from *Missouri River Basin Atlas*

1) Wetlands.

Alternative L-Remove Levees (+4,732)

If all agricultural levees were removed, there would be an increase in

non-forested and forested-wetland acres. The environmental group assumed that approximately tem percent of agricultural land currently protected by levees would revert to wetland because of permanent inundation/saturation, plus an additional five percent because of an increace flood frequency. Whether the agricultural land reverts to forested-wetland or non-forested wetland is proportional to the ratio of wetland to forest in the Omaha District's study area. From Omaha to Rulo, Nebraska, where most of all of the Federal levees are located, the ratio of forest to wetland is 3:1.

acres protected agriculture, permanently inundated: 0.10 x 188,125 = 18,812
acres protected agriculture, flooded periodically: 0.05 x 188,125 = 46,630
acres inundated and flooded, as non-forested wetland: 28,218
28,218 x 6,046/(6,046 + 2,966) = 18,930 x .25 = 4,732

Alternative M - Set Back Levees (+384)

Levees in the study reach would be set back approximately 3000 feet over a stretch of 28 river miles. The same assumptions as Alternative L for landuse change were used were applied for Alternative M.

28 mi x .57 mi = 16 sq mi x 640 ac = 10,240 ac
acres of agriculture, permanently inundated: 0.10 x 10240 = 1024
acres protected agriculture, flooded periodically: 0.05 x 10240 = 512
1,024 + 512 = 1,536 x .25 = 384

Alternative N - 25-Year Levee (0)

There would be negligible change from current conditions if all levees in the study area were lowered or raised to the 25-year event level. A majority of the existing levees in the study area are 30-year levees.

Alternative O - Fully Confined River (-)

This alternative involves raising levees to contain a 500-year event which would result in an unquantified loss in wetland acres. Levees would be placed where no levees currently exist decreasing the frequency of flooding substantially. If fill for the levee is taken from wetlands, there would also be a loss of wetland acres. The footprint of the levee is not assumed to affect wetlands adversely because wetlands do not provide stable footing for levees.

Alternative S - No Reservoirs (+)

There would be an unquantified gain in wetland acres if there were no reservoirs in the study area because of an increased frequency in flooding. The reservoirs would no longer hold back sediment and river bed degradation would return to a normal rate allowing for the maintenance of hydraulic connections to riparian wetlands.

Alternative V/W - Runoff Reduction (0)

There would be a negligible gain in wetland acres assuming that non-structural measures (WRP, CRP, WRP) are implemented to reduce runoff by 5 to 10 percent.

2) Threatened & Endangered Species

There would be an unquantified increase in the number of T&E species if all agricultural levees are removed or set back in the Omaha District study area because of the assumed landuse change from agricultural to wetland and forest. The Federal government would be expected to purchase land no longer protected by levees; therefore, the land would become public property making it easier to manage these lands as wildlife refuges or recreation areas. The successional stages of riparian habitat would increase diversity. The uniform height and 500-year (or 1993 flood event) levee alternatives would have little or no effect on T&E species. There would be an unquantified increase in T&E species with the removal of the reservoirs. Species such as the interior least tern and piping plover, which are very dependent on the river's natural hydrography, and the pallid sturgeon, whose migration is interrupted by the dams would benefit from reservoir removal and their numbers would be expected to increase. Bald eagles benefit from the perpetual open water below the dams and although their numbers would not decrease, the number of occurrences may decrease. Baseline biological conditions were not documented before the construction of the main stem Missouri River dams.

T&E would benefit and consequently increase in numbers with the addition of habitat, both upland and riparian, resulting from a runoff reduction of 5 and 10 percent alternatives; assuming that non-structural methods such as CRP, WRP, EWRP, and others are implemented.

3) Forest:

Alternative L-Remove Levees (+24,557)

If all agricultural levees were removed, there would be an increase in wetland and forest acres. The environmental group assumed that approximately ten percent of agricultural land currently protected by levees would revert to forest because of permanent inundation/saturation, plus an additional five percent because of an increase flood frequency. Whether the agricultural land reverts to forest or wetland is proportional to the ratio of wetland to forest in the Omaha District's study area. From Omaha to Rulo, Nebraska, where most of all of the Federal levees are located, the ratio of forest to wetland is 3:1.

acres protected agriculture, permanently inundated: 0.10 x 188,125 = 18,812
acres protected agriculture, flooded periodically: 0.05 x 188,125 = 46,630
acres inundated and flooded, as non-forested wetland: 28,218
28,218 x 19,896/(19896 + 2,996) = 24,557

Alternative M - Set Back Levees (+1,152)

Levees in the study reach would be set back approximately 3000 feet over a stretch of 28 river miles. The same assumptions as Alternative L for landuse change were used were applied for Alternative M.

28 mi x .57 mi = 16 sq mi x 640 ac = 10,240 ac
acres of agriculture, permanently inundated: 0.10 x 10240 = 1024
acres protected agriculture, flooded periodically: 0.05 x 10240 = 512
1,024 + 512 = 1,536 x .75 = 1,152

Alternative N - 25-Year Levee (0)

There would be negligible change from current conditions if all levees in the study area were lowered or raised to the 25-year event level. A majority of the existing levees in the study area are 30-year levees.

Alternative O - Fully Confined River (-)

This alternative involves raising levees to contain a 500-year event which would result in an unquantified loss in wetland acres. Levees would be placed where no levees currently exist decreasing the frequency of flooding substantially. If fill for the levee is taken from forest, there would also be a loss of wetland acres. Trees in the path of the levee right-of-way would be removed.

Alternative S - No Reservoirs (+)

There would be an increase in the number of acres of woodlands because thousands of acres of bottomland forest were inundated by the filling of the main stem reservoirs. Also marginal farmland would be expected revert to natural conditions.

Alternative V/W - Runoff Reduction (0)

There would be a negligible gain in wetland acres assuming that non-structural measures (WRP, CRP, WRP) are implemented to reduce runoff by 5 to 10 percent.

4) Flood Plain Acres Inundated

	Base	Bluff to Bluff (total acres)	Remove Levees	Setback Levees	Uniform Ht 25-year	Raise	No Reservoirs	Runoff Decrease 5%	Runoff Decrease 10%
Acres Inundated	120,276	1,012,834	295,556	97,995	194,937	65,706	170,285	114,621	113,093

5) Cultural Impacts

Remove. If the agricultural levees were removed, the fill from the levees would have to be placed in a spoil area. The spoil could not be placed on top of a site listed on or eligible for the National Register of Historic Places without appropriate mitigation. An inventory level survey would need to be conducted of the spoil area, the staging area, any new haul or access roads, and other areas of new impacts. Should any significant historic or prehistoric sites be impacted, the impacts would need to be mitigated prior to levee removal. In a few (albeit rare) cases, the levee alignment has been designed to avoid impacts to significant cultural resources. In these cases, extreme caution would have to be used to avoid damage to the site when removing the levee (e.g., the levee north of La Platte, Nebraska, which neatly

avoids the steamboat wreck of the General Grant. The General Grant sank on March 18, 1866. She was bound for Fort Benton, Montana to deliver 172 tons of cargo to supply the people who were working in the the gold fields). Removal of the levees would allow additional lands and additional historic and prehistoric sites to be flooded. In some cases, this would cause damage, particularly to historic structures. Prehistoric sites could be damaged, either by the additional fill or by erosion which could occur during a flood.

Set Back (Varied). Should this alternative be chosen, the cultural impacts and ramifications would be similar to levee removal. Besides surveying the staging areas, any new haul or access roads, and other areas of new impacts, the new location for the levee alignment would need to be surveyed. Surveys of the new borrow areas would also be required. This type of action is more likely to affect a larger number of sites than levee removal would. Significant sites located between the orginal levees and the new set back location could be adversely affected by future floods.

Uniform Height (25 Yr.). The reconfiguration of all existing levees to the 25 year height would cause some levees to remain the same, other levees to be lowered, and yet other levees to be raised. A combination of effects would be expected under this alternative. The levees which would remain the same would have no new impacts to significant cultural resources. The levees which would need to be lowered would have the possibility to impact sites along the haul roads and in the spoil areas. Levees which would need additional fill would also have the possibility of impacting sites along the haul and access roads. Borrow areas would also be needed (if sufficient suitable fill could not be located along levee alignments which were too high) and could possibly impact significant sites.

Raise. A levee raise would necessitate additional fill. The borrow area for this fill would have to be surveyed for cultural resources. Excavation of fill for the levee raise would have the possibility of causing impacts to significant cultural sites. Haul roads, access routes, and borrow areas would all need to be surveyed for cultural resources. As with the other alternatives, significant sites would need to be mitigated prior to construction.

Upland Retention/Watershed Measures

Without Reservoirs. The absense of reservoirs would cause additional flooding. Significant cultural resources would have a greater chance of sustaining adverse impacts under this scenario.

Run Off Reduced (Decreased by 5%). Significant cultural resources would still have a chance of sustaining adverse impacts under this scenario, but the impacts would be smaller in scope than the without reservoir condition.

Run Off Reduced (Decreased by 10%). As with the alternative where run off is reduced by 5%, there would still be a chance of a significant site sustaining adverse impacts under this scenario. The impacts would be smaller in scope that the without reservoir alternative, but greater than the run off reduced by 5% alternative.

5) Public Lands

Alternative L-Remove Levees (+)

There would be an increase in the number of acres of publicly owned land assuming that agricultural land left unprotected would be purchased by the Federal government.

Alternative M - Set Back Levees (+)

There would be an increase in the number of acres of publicly owned land assuming that agricultural land left unprotected would be purchased by the Federal government.

Alternative N - 25-Year Levee (0)

There would be negligible change from current conditions if all levees in the study area were lowered or raised to the 25-year event level. A majority of the existing levees in the study area are 30-year levees.

Alternative O - Fully Confined River (0)

There would be a negligible increase in the number of acres of Federally owned lands because of the increase levee footprint and right-of-way.

Alternative S - No Reservoirs (0)

In order to fill the reservoirs behind the main stem dams, a substantial amount of land was purchased by the Federal government; therefore, if the reservoirs were not in place that land would no longer be in the possession of the Federal government. Federally owned land in the Omaha District would decrease dramatically; however, this would have little impact on the amount of public land in the study area.

Alternative V/W - Runoff Reduction (0)

With increased implementation of FSA/FACTA, there would be a negligible increase of public land because most of the land in these programs are leased from the private land owner, not purchased.

6) Recreation Sites

Alternative L-Remove Levees and Alternative M - Set Back Levees (+)

There would be an increase in the number of acres of publicly owned land assuming that agricultural land left unprotected would be purchased by the Federal government. Many of these lands would be expected to be developed as recreation sites or wildlife management areas with some recreation.

Alternative N - 25-Year Levee (0)

There would be negligible change from current conditions if all levees in the study area were lowered or raised to the 25-year event level. A majority of the existing levees in the study area are 30-year levees.

Alternative O - Fully Confined River (-)

There would be a negligible increase in the number of acres of Federally owned lands because of the increase levee footprint and right-of-way; however, this does not necessarily constitute an increase in recreation sites.

Alternative S - No Reservoirs (0)

The main stem reservoirs offer a large number and variety of recreational opportunities. If the reservoirs did not exist, recreation would decrease in the Omaha District; however, there would be little change in recreation sites in the study area.

Alternative V/W - Runoff Reduction (0)

There would be no increase in the number of recreation sites in the study area with this alternative. Although the number of public lands would increase slightly, no there would be no additional recreation sites. Hunting activities, if the private land owner permitted, would increase.

(c) Reduction of Risk Categories.

Table MRO-25 summarizes the impacts of the alternatives with respect to the measurement of risk in the Missouri River floodplain in the Omaha District. It presents the change in the number of critical facilities, people vulnerable, and social well being in the Missouri River floodplain.

1) **Critical Facilities.** The largest adverse effect to critical facilities would be present with the no reservoir alternative. It would significantly increase the number of both categories of critical facilities subject to floods of the magnitude of the 1993 flood. Removing the levee system, the 25-year notch, and the 500-year priority alternatives also would have adverse effects on critical facilities. The remaining alternatives would either have no effect or would have beneficial impacts on risk to critical facilities.

2) **Protection/Avoidance of Harm.** The alternatives that adversely impact the number of people vulnerable to flooding are the no reservoir, levee removal, and the 25-year notch. The no reservoir alternative would have the greatest increase in the number of people vulnerable to flooding. The 500-year (priority) and 500-year (all) alternatives would not change the number of people vulnerable to flooding compared to the baseline condition. The remaining alternatives would reduce the number of people vulnerable to flooding. The fully confined levee alternative would reduce the number of people vulnerable by 450 persons over the baseline.

Table MRO-25
Reduction of Risk Categories
Impacts of Various Alternatives

Impact Category	All Disaster Counties	FPMA Counties	Remove	Set-back	25-year Notch	Fully Confined	500-yr [Priority]	500-yr [All]	No Reservoir	Runoff Red -5%	Runoff Red -10%
REDUCTION OF RISK											
Critical Facilities											
#Facilities w/harmful releases	no info.	25	38	-3	9	-3	0	0	62	-2	-2
#other critical facilities	no info.	7	12	-3	1	-7	20	0	67	0	0
Prot./Avoid. of Harm											
# people vulnerable	12,598	1,647	661	-277	36	-450	0	0	2,529	-292	-292
Social Well Being											
#communities vulnerable	12	8	4	-5	4	-8	less	less	0	-2	-2
#residential structures vulnerable	4,230	553	222	-93	12	-151	0	0	849	-98	-9

3) **Social Well Being.** The no reservoir, levee removal, and the 25-year notch alternative would adversely effect the social well being in the Omaha District by subjecting more communities and residential structures to flooding than the baseline from floods similar to the 1993 flood event. The greatest adverse impact would be if no reservoirs were present on the Missouri River mainstem. The remaining alternatives would have a beneficial impact on the social well being by reducing the number of communities and/or residential structures subject to the effects of a flood similar to the 1993 flood event.

(3) **Summary of Results.**

a) Economic & Risk Impacts. Table MRO-26 summarizes the impacts of the alternatives for all categories, including project costs. Government expenditures in this table represent only emergency costs since no attempt was made to determine net expenditures for the other government expenditures categories. The change in agricultural land value was not estimated for the 5-percent and 10-percent runoff reduction or for the fully confined levee alternatives. It was assumed that a small increase in the level of protection offered by these alternatives would not result in a measurable increase in land value.

Project costs were included for all alternatives except the no reservoir, 5-percent reduced runoff, and the 10-percent reduced runoff alternatives. Costs for the no reservoir alternative did not include changes in hydropower, water supply, navigation, or recreation benefits provided by the current system operations. Project costs for the 5- and 10-percent runoff reduction alternatives would include any land treatment or additional storage construction cost needed to achieve the reduced runoff.

The no reservoirs alternative would have the largest increase in flood related costs of any of the alternatives. It would increase the damages in the Omaha District for a flood similar to the 1993 event by approximately $2.5 billion. Removing the agricultural levees would result in the next greatest loss in the Omaha District. The levee setback and the 25-year notch would also result in loss in economic value in the District. The fully confined levee system and the reduced runoff alternatives would decrease the damages to the 1993 flood in the Omaha District. The levee setback would decrease damages in all categories except in agricultural land values. This reduction would result from lowering the level of protection behind the Federal agricultural levees in the District.

Table MRO-26
Summary of Impacts
(millions of $)

	Base	No Reservoirs	No Levees	25-Yr Notch	Run off -5%	Run off -10%	Set Back	Fully Confined
Urban	0.0	638.3	26.7	0.0	-3.7	-5.5	-4.1	-5.8
Agriculture	0.0	318.5	42.9	19.6	-1.5	-1.8	-7.9	-14.0
Government Expenditures	0.0	25.8	2.3	0.1	-0.6	-0.9	-0.8	-1.3
Project Costs	0.0	NA	9.2	32.4	NA	NA	51.8	84.6
Total	0.0	NA	81.1	52.1	NA	NA	39.0	63.5

The results of the economic analysis would conclude that the existing flood control system (baseline) would be the best alternative for a flood such as the 1993 event. Since no costs were developed for the 5- and 10-percent runoff reduction measures the analysis of these two alternatives is not complete, therefore, no conclusion could be drawn about their effectiveness. Based on the information provided several of the alternatives would reduce the flood impacts of a flood similar to the 1993 event, however, conclusions about the desirability of implementing any of these alternatives should be delayed until further studies are completed. Future studies would need to include a study of all potential flood events which would be affected by these alternatives.

b) Cultural. In all cases, it will be necessary to conduct pedestrian surveys to determine the exact (or, in this case, even approximate) impacts to significant sites. There have been very few surveys conducted along the existing levee alignments and even fewer in the floodplain. Significant sites exist in the floodplain zone (steamboat wrecks, early Euroamerican settlements) and in the uplands (prehistoric villages, burial mounds, lithic quarries). Once an alternative is selected, an inventory of the sites would be conducted. Following the inventory, sites with potential significance would have to be evaluated for National Register significance. Any significant site would then be considered in terms of impacts. Adverse impacts would be mitigated, then the project would proceed.

c) Environmental. Natural areas do not generally benefit from manipulation such as flood control. A river ecosystem is an open, dynamic system consisting not only of the open water of the main channel, but of shallows, secondary channels, cut-offs, backwaters, wetlands, and riparian woodlands. Flood control measures, such as levees, dams, and channelization, isolate rivers from their floodplains and alter the natural flood regime allowing non-riparian invaders to become established, decreasing the organic nutrient base of rivers, decreasing habitat diversity, secluding fish from ancestral spawning and feeding areas, and disconecting hydraulic connections between wetlands and the main channel.

Periodic flooding recharges the nutrient base of the flood plain as well. In areas where annual flooding is allowed to occur unhindered, the bottomland farm fields are rich and require little supplemental fertilizer. A problem which arises from artificial fertilization is nutrient loading, which accelerates the growth of algea which deplete the dissolved oxygen levels essential for a healthy fishery. This fact illustrates the importance of riparian wetlands as filtering systems.

In conclusion, the most environmentally beneficial alternatives include those which restore the natural funtions of the flood plain to its original (unaltered) state.

(4) Cell Notes.

These are included in the Main Report discussion of the action alternatives in Chapter 9, pages 9-2 to 9-12.

COST ESTIMATING APPENDIX

Overview

The cost estimating effort was divided into two major phases. Phase I was to estimate the cost of each of the selected structural design alternatives for a representative case study. Phase II involved application of the costs obtained in Phase I to the entire basin within the Omaha District's study area boundaries.

The representative case study chosen for Phase I was Missouri River levee L550. This levee has been studied numerous times in the past due to its failure to provide design level of protection up to the 100-year event. MCACES cost estimates were prepared for each of the alternatives. Assumptions used during the design of the alternatives included, but were not limited to: (1) uniform levee cross-sections; (2) a 50 foot wide by 3 foot high underseepage control berm along the entire length; (3) evenly spaced relief wells and piezometers; (4) any required raising would follow the front face slope and push the toe back; (5) any real estate required would only be that within the footprint of the re-designed levee; (6) suitable borrow material and spoil areas are readily available and would not need to be mitigated; (7) zero impact to utilities, bridges, and roads. Quantities were obtained for the designs of each of the alternatives and were given to cost estimating for input into the MCACES model. The case study cost summary is presented in the detailed description of Phase I as Table 2.

The application of the results of the case study to the system-wide levees, Phase II, began with a conceptualization of how the costs could be transferred to the other levees in a representative manner. Careful consideration of the results of the case study lead to the conclusion that factoring the costs by, first, the length of the levee, and, second, the cross-sectional area of the main levee section would produce reasonable unit costs for each alternative. These unit costs could then be applied to the remaining levees to achieve estimates for system-wide application of the alternatives. The case study levee, L550, was determined to be of sufficient length that factoring by the length and applying the result system-wide would not result in artificially high costs (an economy of scale problem encountered when small scale cost estimates are applied to larger structures). The main levee cross-section was chosen as the factoring element because of the recognition that the costs are exponentially related to the height of the levee. Also, the berm was assumed to be of uniform size along the entire length, and all of the levees under consideration were assumed to have berms of the same size.

The cost of the case study was broken into three major categories to isolate and minimize any possible errors arising from the analysis. These categories were embankment costs, structural costs, and real estate costs. Costs for each of these categories were factored and applied to the selected levees individually. The total costs for each alternative were then determined by summing these costs. It should be noted that not all categories of costs applied to all of the alternatives. For example, the 25-year plug

alternative did not require any alteration of the interior drainage or underseepage control structures, nor did it require the purchase of any additional real estate. The final results of the system-wide implementation are presented in Table 1 followed by detailed descriptions of the procedures for each of the phases.

TABLE 1
SUMMARY OF SYSTEM-WIDE COSTS FOR SELECTED ALTERNATIVES

	10% LEVEE REMOVAL	100% LEVEE REMOVAL	SET-BACK w/ 10% REMOVAL	SET-BACK w/ 100% REMOVAL	25-YR w/ ERODIBLE PLUGS	500-YR ULTIMATE RAISE
CONSTRUCTION COST ESTIMATE	5,500,000	58,800,000	16,270,000	32,870,000	20,595,000	52,650,000
REAL ESTATE COST ESTIMATE	n/a	n/a	230,000	230,000	105,000	1,350,000
TOTAL BASE COST ESTIMATE	5,500,000	58,800,000	16,500,000	33,100,000	20,700,000	54,000,000
1993 DE-ESCALATION	167,000	1,788,000	502,000	1,006,000	629,000	1,642,000
SUB-TOTAL	5,300,000	57,000,000	16,000,000	32,100,000	20,100,000	52,400,000
CONTINGENCY (30%)	1,590,000	17,100,000	4,800,000	9,630,000	6,030,000	15,720,000
SUB-TOTAL	6,900,000	74,100,000	20,800,000	41,700,000	26,100,000	68,100,000
E & D (15%)	1,035,000	11,115,000	3,120,000	6,255,000	3,915,000	10,215,000
SUB-TOTAL	7,900,000	85,200,000	23,900,000	48,000,000	30,000,000	78,300,000
S & A (8%)	632,000	6,816,000	1,912,000	3,840,000	2,400,000	6,264,000
GRAND TOTAL COST ESTIMATE	8,500,000	92,000,000	25,800,000	51,800,000	32,400,000	84,600,000

PHASE I: CASE STUDY DESIGN AND COST ESTIMATING

The case study chosen for evaluation by the Omaha District was Missouri River Levee L550. This levee is located on the left bank of the Missouri River just south of the Iowa - Missouri state line. The levee is approximately 31.5 miles long, two-thirds of which is located parallel to the river and one-third of which are the two tie-backs. The levee averages approximately 15 feet in height over the river reach (10 - 12 feet on the tie-backs). The main bulk of the levee is a symmetrical trapezoid in shape with a 10 foot crest width and 1V on 3H side slopes. Underseepage on this levee is controlled by a low berm which extends from the landward toe of the levee. This berm is about three to four feet high and extends for about 50 to 70 feet. Underseepage pressure relief wells and piezometers are dispersed along the length of the levee. There are several interior drainage structures located along the levee ranging from 24-inch CMP (corrugated metal pipe) culverts to 6-foot x 6-foot reinforced concrete box culverts.

This levee was chosen because it was considered to be representative of the rest of the Federal Missouri River levees and it was one of the longest levees, which was desirable for the factoring approach used to approximate system-wide implementation. Levee L550 has been studied extensively because of its history of failure during both the 1952 and 1993 floods. A 1990 reconnaissance level re-evaluation investigation identified L550 as providing less than 50-year protection with two feet of freeboard. That report found raising the levee to provide its design level of protection (100-year) was economically feasible, but financial constraints of the local maintenance district prevented further studies.

Detailed quantities information for Missouri River levee L550 was obtained from Detailed Plans and Specifications 1949 - 54, As-built drawings 1948 - 54, Operation and Maintenance Manual Agricultural Levees Units L561-L550-L536 October 1954. Additional information was compiled from various post-flood reports and levee re-evaluation surveys completed between 1950 and 1994. One of the base assumptions of this analysis is that the dimensions and quantities obtained from the Plans and Specifications are accurate and already include appropriate compaction ratios.

THE ALTERNATIVES

Originally, four structural alternatives were evaluated for levee L550 to determine their design requirements and costs. The results of this evaluation allowed the estimating of an additional two alternatives which were added mainly for comparison purposes, since the additional costs would not be justified by improved performance. The original four alternatives were:

(1) Partial removal of the levee along the river reach;
(2) Set-back the levee 3,000 feet from its original location (w/ partial removal of the original levee);
(3) Notching the levee to lower its effective level of protection to a 25-year event;
(4) Raising the levee to provide protection for the 1993 event (approx. 500-year).

The two additional alternatives added for comparison purposes are:

(5) Total removal of the levee along the river reach;
(6) Set-back the levee 3,000 feet from its original location (w/ total removal of the original levee).

Partial removal of the levee along the river reach

The partial removal alternative involved excavation of 200 foot holes at 2,000 foot intervals along the river reach of the levee (a 10% volume reduction). This would effectively eliminate the effectiveness of the levee at providing protection, allowing flow to spread out through the entire floodplain. Assumptions for this alternative were:

- Holes reduce the levee volume by 10%
- Holes extend through both the levee and the berm
- Crest surfacing, topsoil, and compacted fill were to be removed and spoiled
- All existing drainage structures and underseepage structures (relief wells and piezometers) were considered abandoned in place [i.e. no removal costs].

Set-back of the levee 3,000 feet from its original location (w/ partial removal)

The levee set-back alternative consisted of two parts, (1) construction of a new levee 3,000 feet behind and identical to the existing one utilizing the existing tie-backs since their size and location would not change, and (2) partial removal and abandonment of the original levee (same as previous alternative). The set-back of levee L550 would provide enough additional flow area on the riverward side to convey the 1993 flood discharge without overtopping or failure of the levee. Assumptions for this alternative were:

- The same as for the partial removal alternative, plus
- The new levee would be of identical size as the existing levee
- The interior drainage and underseepage control structures for the new levee would need to be constructed and would be the identical in size and number as those for the original levee.
- All materials required for construction of the new levee (compacted fill, topsoil, ...etc.) are readily available and would not need to be brought in.
- Impacts to existing infrastructure and private and environmental lands are assumed to be negligible and were assumed not to affect the designs and alignments.
- Real estate requirements use a flat land value rate, and include only the new lands in the footprint of the new levee with no provision for right-of-way.

Notching the levee to provide 25-year protection only

The 25-year notch alternative consists of removal of 500 foot holes at the upstream and downstream ends of the levee and back-filling the holes with an easily erodible material up to the elevation of the 25-year flood. This would allow the levee to provide protection up to a 25-year flood event with larger events causing rapidly-controlled erosion of the plugs leaving 500 foot holes in their place. The effect of the holes would be to allow flooding of those lands behind the levee resulting in attenuation of the flood flow and lowering of the hydrograph peak. Assumptions for the 25-year erodible plug alternative are:

- The holes are to have 500 foot lengths and are overexcavated to 5 feet below the existing ground surface.
- The easily erodible material was assumed to be an unconsolidated sand. The riverward sides of the plugs are to be covered with a clay liner to prevent erosion at events smaller than the design level, 25-year.
- The levee was divided into two reaches because of its excessive length. Each reach was designed with a pair of plugs. Hydraulic operation and safety concerns required that the crest elevation of the downstream plugs were set with no freeboard to assure that their failure would occur prior to the upstream plugs, which were designed to have 3 feet of freeboard. This would assure that a downstream outflow hole would exist for drainage after the passage of the flood peak.

Raise levee to provide protection against the 1993 event (approx. 500-year)

The ultimate levee raise alternative involves raising of the existing levee to protect against the 1993 flood event (approximately a 500-year flood). The raise was accomplished by extending the existing riverward face upward to achieve the desired crest elevation. This method of raising the levee results in pushing the toe of the base farther away from the river. Assumptions for this alternative are:

- Topsoil and crest surfacing were removed prior to the addition of new compacted fill to raise the levees.
- The existing toe of the levee was moved back to accommodate the design raise.
- Designing for a higher stage on the riverward side would require a detailed re-evaluation of underseepage control. For this design we assumed that the berm would need to be extended an additional 20 feet.
- Extending the berm and toe of the levee would impact the existing piezometers and underseepage relief wells. For this analysis we removed the original piezometers and relief wells and constructed new ones at the toe of the extended berm. Assumption was made that the numbers and size of these structures would be the same as for the original levee.
- Extending the berm and toe of the levee would impact the existing interior drainage facilities. For this analysis we assumed that the existing gate structures and culverts could be used as they were with the addition of retrofitting an extension onto the landward side. The extension would be long enough to extend through the additional length of levee and berm.

Total removal of the levee along the river reach

The total removal alternative was added to the original four alternatives for comparison purposes. It involves complete removal of the existing levee along the river reach. Assumptions for this alternative are:

- The entire river reach of the levee is to be removed and disposed of assuming no spoil or disposal costs.
- Removal costs for this were taken from the cost estimate for the partial removal alternative. That alternative assumed abandonment of the additional existing structures (no demolition or disposal costs). This forces the total removal alternative to also assume abandonment of existing interior drainage, relief wells, and piezometer structures.
- After removal of the levee the excavation scar would be graded and re-seeded.

Set-back with total removal of the original levee

The set-back with total removal alternative was also added to the original four alternatives for comparison purposes. It involves a combination of the set-back alternative with the total removal alternative described above. Assumptions for this alternative are the same as for those two alternatives.

Critical Facilities Protection

A final alternative considered the protection of highly critical facilities from the ultimate design flood (1993 event). These facilities included powerplants, water plants, . . . etc. The assumptions for this alternative were:

- New levees constructed to protect against the 1993 event.
- The levees would each be one mile in length surrounding the perimeter of the facility (assume the facilities occupy approximately 40 acres of land).
- No real estate requirements because the property was assumed to already belong to the facility owner.
- No new interior drainage facilities would be required.

Case Study Results

Table 2 summarizes the results of the case study costs.

TABLE 2
MISSOURI RIVER LEVEE L550
SUMMARY COSTS FOR SELECTED ALTERNATIVES ($)

	10% LEVEE REMOVAL	TOTAL REMOVAL	LEVEE SET [w/ 10%	LEVEE SET [w/ total	500-YEAR ULTIMATE	25-YEAR ERODIBLE
EMBANKMENT	1,070,000	11,590,000	8,610,000	19,130,000	4,790,000	2,860,000
STRUCTURES	0	0	3,460,000	3,460,000	3,340,000	0
REAL ESTATE	0	0	532,025	532,025	185,399	0
TOTAL COST	1,070,000	11,590,000	12,602,025	23,122,025	8,315,399	2,860,000

PHASE II: SYSTEM-WIDE COST ESTIMATE IMPLEMENTATION

The system-wide implementation of the costs determined in Phase I involved determination of unit costs for selected alternatives, and application of these unit costs to all of the levees in the study area.

The application of the results of the case study to the system-wide levees began with a conceptualization of how the costs could be transferred to the other levees in a representative manner. Careful consideration of the results of the case study lead to the conclusion that factoring the costs by, first, the total length of the reach of the levee to which the chosen alternative would apply, and, second, the cross-sectional area of the main levee section (i.e not including the berm) would produce reasonable unit costs for each alternative. These unit costs could then be applied to the remaining levees to achieve estimates for system-wide application of the alternatives. The case study levee, L550, was determined to be of sufficient length that factoring by the length and applying the result system-wide would not result in artificially high costs (an economy of scale problem encountered when small scale cost estimates are applied to larger structures). The main levee cross-section was chosen as the factoring element because of the recognition that the costs are exponentially related to the height of the levee for any given unit length. Also, the berm was assumed to be of uniform size along the entire length, and all of the levees under consideration were assumed to have berms of the same size.

The cost of the case study was broken into three major categories to isolate and minimize any possible errors arising from the analysis. These categories were embankment costs, structural costs, and real estate costs. Cost for each of these categories were factored and applied the selected levees individually. The total costs for each alternative were then determined by summing these costs. It should be noted that not all categories of costs applied to all of the alternatives. For example, the 25-year plug alternative did not require any alteration of the interior drainage or underseepage control structures, nor did it require the purchase of any additional real estate.

Embankment

The first category was the embankment costs. Included in the embankment costs were the costs for (1) clearing and grubbing, (2) topsoil stripping, (3) embankment fill removal and spoil, (4) new compacted fill, (5) topsoil placement, (6) seeding, (7) crest surfacing, and (8) erodible fill for the 25-year alternative. It was felt that the design quantities for these items determined for the case study were reasonably accurate and would probably correlate well with detailed design quantities for all of the levees within the system. Total costs for these were determined using the MCACES cost estimates for each alternative. The costs were factored by the applicable levee length and the cross-section, as described above, to determine the embankment unit cost factors.

A unit cost curve was then developed using the unit cost and assumed levee heights varying in increments of two feet and a length of one mile. The unit curve was plotted showing a comparison of existing levee height to embankment costs. The unit cost curve approach allowed a linear unit cost to be found for any levee in the system if the average height of the levee was known. The unit cost curve for the embankment category is shown in Figure 1.

Structures

The second category of costs was that of structures. This category included the costs of (1) underseepage relief wells, (2) piezometers, and (3) interior drainage facilities, including culverts, gates, and control structures. The exact numbers and size of these structures were determined during the case study investigation. It was assumed that all structures of each type (i.e. relief well, piezomenters, ...etc) were identical and could be approximated by an average size for cost estimating purposes. This assumption was determined to be adequate for estimating costs since detailed design analysis of underseepage and interior drainage control structures was beyond the scope of this analysis. The total costs for the case study for this category (determined by MCACES) were factored by the levee length and cross-section as described above, and the resulting unit cost curve is included as Figure 2.

The use of the linear average for the relief wells and piezometers was felt to be reasonably accurate since they are usually spaced relatively evenly along the entire levee length. Interior drainage structures, on the other hand, would need to be designed on a site-by-site basis which was beyond the scope of this analysis. Use of the linear average approach was implemented to provide a reasonable number of structures for each levee based upon the levee length. This could possibly result in an increased margin of error, but was felt to be reasonable and accurate enough for this analysis. Separation of the structures costs away from the embankment costs instead of using just a total cost was used to keep the larger sources of possible error (due to various assumptions) from being lumped together with those costs which were felt to be more accurate. Detailed design and cost estimating of the underseepage and interior drainage structures was beyond the scope of this analysis and would need to be performed prior to the implementation of any of the alternatives considered.

Real Estate

The final category of construction costs was real estate costs. Included in this category were costs for any additional real estate which would be required to construct any of the selected alternatives. A key element of the real estate analysis was the assumption that the only real estate required was that which was required for the footprint. No additional real estate for right-of-way was considered. The real estate design assumed that any additional land purchase would be of agricultural land, and that alignments and design would be altered to avoid commercial, residential, industrial, and environmentally significant (wetlands and other environmental areas) lands. The agricultural lands were assumed to have a uniform value of $1,500 dollars per acre. The final costs for the case study were factored as in the other categories. The unit cost curve for real estate costs is included as Figure 3.

System-wide Application of Unit Costs

The system-wide application of the unit costs from the case study required an inventory of the levees under consideration. The levee reach analyzed included all levees along the Missouri River between the Omaha - Council Bluffs metropolitan area and the southern edge of the Omaha District, approximately Rulo, Nebraska. Some of the levees were broken into multiple reaches, mainly corresponding to different Operation and Maintenance reaches. Table 3 is a summary of the levees used for this analysis.

TABLE 3
SYSTEM-WIDE LEVEE INVENTORY
SUMMARY OF PERTINENT DATA

MISSOURI RIVER LEVEE [Index / name]	LEVEE LENGTH [miles]	MAIN LEVEE ALONG THE MISSOURI RIVER		APPROXIMATE LEVEE HEIGHT [ft.]
		PERCENT [%]	LENGTH [miles]	
L611-614 REACH 1 (Missouri River)	17.7	100%	17.7	14.0
L611-614 REACH 2 (Upper Pony Cr.)	7.8	0%	0.0	15.0
L611-614 REACH 3 (Lateral 1-B)	1.7	0%	0.0	12.0
L-601	11.7	80%	9.4	12.0
L-594	11.4	60%	6.8	14.0
L-575 REACH 1	2.4	0%	0.0	15.0
L-575 REACH 2	4.6	50%	2.3	14.0
L-575 REACH 3	3.2	100%	3.2	12.0
L-575 REACH 4	28.4	100%	28.4	13.0
L-575 REACH 5	7.3	80%	5.8	12.0
R-573	5.9	75%	4.4	13.0
R-562	7.6	95%	7.2	12.0
L-561	8.9	50%	4.5	13.0
L-550 REACH 1	CASE STUDY			
L-550 REACH 2	CASE STUDY			
R-548 REACH 1 (District No. 2)	6.2	100%	6.2	14.0
R-548 REACH 2 (District No. 3)	13.4	0%	0.0	13.0
L-536	4.1	60%	2.5	13.0
R-520	5.6	35%	2.0	11.0
CORNING No.2	5.0	90%	4.5	6.0
IDEKER	5.0	80%	4.0	2.0
NO LEVEE	16.0	75%	12.0	0.00

Application of the unit costs was performed in two steps. First, a determination of the average height of the existing levee under consideration was made and cross-referenced with the unit cost curve for each cost category (embankment, structures, and real estate costs). The costs determined represented the linear unit cost of each category for the levee. Second, these unit costs were multiplied by the length of the levee reach to which the selected alternative was applied (river length or total length). The cost were then summed for each levee and then for the whole alternative to determine a total cost for the alternative. This procedure was repeated for each of the structural alternatives analyzed.

A few of the alternatives, namely the fully confined and 25-year plug alternatives, also required the modification of the local levees located at the southern edge of the study area. These local levees (Corning No.2 and Ideker in Table 3) partially protect the agricultural lands below the end of the Federal levees. These alternatives required that levees be constructed in this reach for the analysis. Consultation with the geotechnical embankments engineers and various re-evaluation reports concluded that the Corning No.2 levee met reasonably well with Corps' standards and would provide approximately 30-year protection. The Ideker levee was felt to be very inadequate, and for purposes of analysis was assumed not to exist. A new levee construction cost curve for embankment quantities was developed for this area (Figure 4) since the other cost curves were developed based on the existing height of the levee. For the 25-year plug alternative, the Corning No.2 levee was felt to be adequate and was designed the same as for the Federal levees. For the other levees and the fully confined alternative on the Corning levee the costs were determined in two steps. First, new levees of identical height to L536 (the last Federal levee) were designed and the corresponding cost estimates were determined. Second, the unit cost curves for the different cost categories were used to implement the alternative under consideration. Costs for these lower levees, referred to as the Rulo levees were computed independent of the rest of the analysis (see Tables 11 and 12) with the resulting cost being added into the analysis as a lump sum.

The final cost computation tables for each alternative (Tables 5 thru 10) show how the unit costs were applied to each of the levees to determine the costs for each category. It should be noted that not all of the alternatives were applied to all of the levees in the system. For example, both of the removal alternatives did not consider the non-Federal levees at the southern edge of the study area. Final construction costs were de-escalated to reach an October 1993 cost level using the construction cost index method. A 30 percent contingency was used to reflect the assumed level of accuracy in the analysis. This contingency was felt to be representative and correlated well with the numbers used by the other Districts. Engineering and design and supervision and administration factors of 15 and 8 percent respectively were added to arrive at the final costs presented in Table 1.

TABLE 5
CALCULATION OF ESTIMATED COSTS FOR THE 10% REMOVAL ALTERNATIVE

MISSOURI RIVER LEVEE [Index / name]	TOTAL LEVEE LENGTH [miles]	RIVER LENGTH [miles]	EXISTING LEVEE HEIGHT [ft.]	EMBANKMENT QUANTITIES COST ESTIMATE UNIT COST [$ / mile]	EMBANKMENT QUANTITIES COST ESTIMATE SUB-TOTAL COST [$]	DRAINAGE AND UNDERSEEPAGE STRUCTURES COST ESTIMATE UNIT COST [$ / mile]	DRAINAGE AND UNDERSEEPAGE STRUCTURES COST ESTIMATE SUB-TOTAL COST [$]	REAL ESTATE COST ESTIMATE UNIT COST [$ / mile]	REAL ESTATE COST ESTIMATE SUB-TOTAL COST [$]	TOTAL LEVEE COST [$]
L611-614 REACH 1 (Missouri River)	17.7	17.7	14	50,000	885,000	n/a	n/a	n/a	n/a	885,000
L611-614 REACH 2 (Upper Pony Cr.)	7.8	0.0	15	55,000	0	n/a	n/a	n/a	n/a	0
L611-614 REACH 3 (Lateral 1-B)	1.7	0.0	12	35,000	0	n/a	n/a	n/a	n/a	0
L-601	11.7	9.4	12	35,000	327,600	n/a	n/a	n/a	n/a	327,600
L-594	11.4	6.8	14	50,000	342,000	n/a	n/a	n/a	n/a	342,000
L-575 REACH 1	2.4	0.0	15	55,000	0	n/a	n/a	n/a	n/a	0
L-575 REACH 2	4.6	2.3	14	50,000	115,000	n/a	n/a	n/a	n/a	115,000
L-575 REACH 3	3.2	3.2	12	35,000	112,000	n/a	n/a	n/a	n/a	112,000
L-575 REACH 4	28.4	28.4	13	45,000	1,278,000	n/a	n/a	n/a	n/a	1,278,000
L-575 REACH 5	7.3	5.8	12	35,000	204,400	n/a	n/a	n/a	n/a	204,400
R-573	5.9	4.4	13	45,000	199,125	n/a	n/a	n/a	n/a	199,125
R-562	7.6	7.2	12	35,000	252,700	n/a	n/a	n/a	n/a	252,700
L-561	8.9	4.5	13	45,000	200,250	n/a	n/a	n/a	n/a	200,250
L-550 REACH 1					CASE STUDY					1,100,000
L-550 REACH 2					CASE STUDY					
R-548 REACH 1 (District No. 2)	6.2	6.2	14	50,000	310,000	n/a	n/a	n/a	n/a	310,000
R-548 REACH 2 (District No. 3)	13.4	0.0	13	45,000	0	n/a	n/a	n/a	n/a	0
L-536	4.1	2.5	13	45,000	110,700	n/a	n/a	n/a	n/a	110,700
R-520	5.6	2.0	11	30,000	58,800	n/a	n/a	n/a	n/a	58,800
CORNING No.2	5.0	4.5	6			NOT CONSIDERED FOR THIS ALTERNATIVE				0
IDEKER	5.0	4.0	2			NOT CONSIDERED FOR THIS ALTERNATIVE				0
NO LEVEE	16.0	12.0	0			NOT CONSIDERED FOR THIS ALTERNATIVE				0
TOTALS					4,395,575		0		0	5,495,575

TOTAL	5,495,575
DE-ESCALATION (3.04%)	167,065
SUB-TOTAL	5,328,510
CONTINGENCY (30%)	1,598,553
SUB-TOTAL	6,927,062
ENGINEERING & DESIGN (15	1,039,059
SUB-TOTAL	7,966,122
SUPERVISION & ADMIN. (8%)	637,290
GRAND TOTAL	8,603,411

TABLE 6

CALCULATION OF ESTIMATED COSTS FOR THE 100% REMOVAL ALTERNATIVE

[NOTE: THIS ESTIMATE IS FOR COMPARISON PURPOSES ONLY. DRAINAGE AND UNDERSEEPAGE CONTROL STRUCTURES REMOVAL COSTS ARE NOT INCLUDED.]

MISSOURI RIVER LEVEE [index / name]	TOTAL LEVEE LENGTH [miles]	RIVER LENGTH [miles]	EXISTING LEVEE HEIGHT [ft.]	EMBANKMENT QUANTITIES COST ESTIMATE UNIT COST [$ / mile]	EMBANKMENT QUANTITIES COST ESTIMATE SUB-TOTAL COST [$]	DRAINAGE AND UNDERSEEPAGE STRUCTURES COST ESTIMATE UNIT COST [$ / mile]	DRAINAGE AND UNDERSEEPAGE STRUCTURES COST ESTIMATE SUB-TOTAL COST [$]	REAL ESTATE COST ESTIMATE UNIT COST [$ / mile]	REAL ESTATE COST ESTIMATE SUB-TOTAL COST [$]	
L611-614 REACH 1 (Missouri River)	17.7	17.7	14	525,000	9,292,500	n/a	n/a	n/a	n/a	9,292,500
L611-614 REACH 2 (Upper Pony Cr.)	7.8	0.0	15	600,000	0	n/a	n/a	n/a	n/a	0
L611-614 REACH 3 (Lateral 1-B)	1.7	0.0	12	400,000	0	n/a	n/a	n/a	n/a	0
L-601	11.7	9.4	12	400,000	3,744,000	n/a	n/a	n/a	n/a	3,744,000
L-594	11.4	6.8	14	525,000	3,591,000	n/a	n/a	n/a	n/a	3,591,000
L-575 REACH 1	2.4	0.0	15	600,000	0	n/a	n/a	n/a	n/a	0
L-575 REACH 2	4.6	2.3	14	525,000	1,207,500	n/a	n/a	n/a	n/a	1,207,500
L-575 REACH 3	3.2	3.2	12	400,000	1,280,000	n/a	n/a	n/a	n/a	1,280,000
L-575 REACH 4	28.4	28.4	13	475,000	13,490,000	n/a	n/a	n/a	n/a	13,490,000
L-575 REACH 5	7.3	5.8	12	400,000	2,336,000	n/a	n/a	n/a	n/a	2,336,000
R-573	5.9	4.4	13	475,000	2,101,875	n/a	n/a	n/a	n/a	2,101,875
R-562	7.6	7.2	12	400,000	2,888,000	n/a	n/a	n/a	n/a	2,888,000
L-561	8.9	4.5	13	475,000	2,113,750	n/a	n/a	n/a	n/a	2,113,750
L-550 REACH 1						CASE STUDY				11,600,000
L-550 REACH 2						CASE STUDY				
R-548 REACH 1 (District No. 2)	6.2	6.2	14	525,000	3,255,000	n/a	n/a	n/a	n/a	3,255,000
R-548 REACH 2 (District No. 3)	13.4	0.0	13	475,000	0	n/a	n/a	n/a	n/a	0
L-536	4.1	2.5	13	475,000	1,168,500	n/a	n/a	n/a	n/a	1,168,500
R-520	5.6	2.0	11	350,000	686,000	n/a	n/a	n/a	n/a	686,000
CORNING No.2	5.0	4.5	6			NOT CONSIDERED FOR THIS ALTERNATIVE				0
IDEKER	5.0	4.0	2			NOT CONSIDERED FOR THIS ALTERNATIVE				0
NO LEVEE	16.0	12.0	0			NOT CONSIDERED FOR THIS ALTERNATIVE				0
TOTAL	147.9				47,154,125		0		0	58,754,125

TOTAL	58,754,125
DE-ESCALATION (3.04%)	1,786,125
SUB-TOTAL	56,968,000
CONTINGENCY (30%)	17,090,400
SUB-TOTAL	74,058,399
ENGINEERING & DESIGN (15%)	11,108,760
SUB-TOTAL	85,167,159
SUPERVISION & ADMIN. (8%)	6,813,373
GRAND TOTAL	91,980,532

TABLE 7
CALCULATION OF ESTIMATED COSTS FOR THE 3,000 FOOT SET-BACK ALTERNATIVE WITH 10% REMOVAL OF THE ORIGINAL LEVEE

MISSOURI RIVER LEVEE [index / name]	TOTAL LEVEE LENGTH [miles]	RIVER LENGTH [miles]	EXISTING LEVEE HEIGHT [ft.]	EMBANKMENT QUANTITIES COST ESTIMATE UNIT COST [$ / mile]	EMBANKMENT QUANTITIES COST ESTIMATE SUB-TOTAL COST [$]	DRAINAGE AND UNDERSEEPAGE STRUCTURES COST ESTIMATE UNIT COST [$ / mile]	DRAINAGE AND UNDERSEEPAGE STRUCTURES COST ESTIMATE SUB-TOTAL COST [$]	REAL ESTATE COST ESTIMATE UNIT COST [$ / mile]	REAL ESTATE COST ESTIMATE SUB-TOTAL COST [$]	
L611-614 REACH 1 (Missouri River)	17.7	17.7	14	NOT CONSIDERED FOR THIS ALTERNATIVE						0
L611-614 REACH 2 (Upper Pony Cr.)	7.8	0.0	15	NOT CONSIDERED FOR THIS ALTERNATIVE						0
L611-614 REACH 3 (Lateral 1-B)	1.7	0.0	12	NOT CONSIDERED FOR THIS ALTERNATIVE						0
L-601	11.7	9.4	12	NOT CONSIDERED FOR THIS ALTERNATIVE						0
L-594	11.4	6.8	14	NOT CONSIDERED FOR THIS ALTERNATIVE						0
L-575 REACH 1	2.4	0.0	15	NOT CONSIDERED FOR THIS ALTERNATIVE						0
L-575 REACH 2	4.6	2.3	14	NOT CONSIDERED FOR THIS ALTERNATIVE						0
L-575 REACH 3	3.2	3.2	12	NOT CONSIDERED FOR THIS ALTERNATIVE						0
L-575 REACH 4	28.4	28.4	13	NOT CONSIDERED FOR THIS ALTERNATIVE						0
L-575 REACH 5	7.3	5.8	12	NOT CONSIDERED FOR THIS ALTERNATIVE						0
R-573	5.9	4.4	13	NOT CONSIDERED FOR THIS ALTERNATIVE						0
R-562	7.6	7.2	12	NOT CONSIDERED FOR THIS ALTERNATIVE						0
L-561	8.9	4.5	13	NOT CONSIDERED FOR THIS ALTERNATIVE						0
L-550 REACH 1					CASE STUDY					11,500,000
L-550 REACH 2					CASE STUDY					
R-548 REACH 1 (District No. 2)	6.2	6.2	14	340,000	2,108,000	160,000	992,000	24,000	148,800	3,248,800
R-548 REACH 2 (District No. 3)	13.4	0.0	13	300,000	0	140,000	0	20,000	0	0
L-536	4.1	2.5	13	300,000	738,000	140,000	344,400	20,000	49,200	1,131,600
R-520	5.6	2.0	11	220,000	431,200	100,000	196,000	16,000	31,360	658,560
CORNING No.2	5.0	4.5	6			NOT CONSIDERED FOR THIS ALTERNATIVE				0
IDEKER	5.0	4.0	2			NOT CONSIDERED FOR THIS ALTERNATIVE				0
NO LEVEE	16.0	12.0	0			NOT CONSIDERED FOR THIS ALTERNATIVE				0
TOTAL	147.9				3,277,200		1,532,400		229,360	16,538,960

TOTAL	16,538,960
DE-ESCALATION (3.04%)	502,784
SUB-TOTAL	16,036,176
CONTINGENCY (30%)	4,810,853
SUB-TOTAL	20,847,028
ENGINEERING & DESIGN (15%)	3,127,054
SUB-TOTAL	23,974,083
SUPERVISION & ADMIN. (8%)	1,917,927
GRAND TOTAL	25,892,009

TABLE 8

CALCULATION OF ESTIMATED COSTS FOR THE 3,000 FOOT SET-BACK ALTERNATIVE WITH 100% REMOVAL OF THE ORIGINAL LEVEE

[NOTE: THIS ESTIMATE IS FOR COMPARISON PURPOSES ONLY. DRAINAGE AND UNDERSEEPAGE CONTROL STRUCTURES REMOVAL COSTS ARE NOT INCLUDED.]

MISSOURI RIVER LEVEE [Index / name]	TOTAL LEVEE LENGTH [miles]	RIVER LENGTH [miles]	EXISTING LEVEE HEIGHT [ft.]	EMBANKMENT QUANTITIES COST ESTIMATE UNIT COST [$ / mile]	EMBANKMENT QUANTITIES COST ESTIMATE SUB-TOTAL COST [$]	DRAINAGE AND UNDERSEEPAGE STRUCTURES COST ESTIMATE UNIT COST [$ / mile]	DRAINAGE AND UNDERSEEPAGE STRUCTURES COST ESTIMATE SUB-TOTAL COST [$]	REAL ESTATE COST ESTIMATE UNIT COST [$ / mile]	REAL ESTATE COST ESTIMATE SUB-TOTAL COST [$]	
L611-614 REACH 1 (Missouri River)	17.7	17.7	14	NOT CONSIDERED FOR THIS ALTERNATIVE						0
L611-614 REACH 2 (Upper Pony Cr.)	7.8	0.0	15	NOT CONSIDERED FOR THIS ALTERNATIVE						0
L611-614 REACH 3 (Lateral 1-B)	1.7	0.0	12	NOT CONSIDERED FOR THIS ALTERNATIVE						0
L-601	11.7	9.4	12	NOT CONSIDERED FOR THIS ALTERNATIVE						0
L-594	11.4	6.8	14	NOT CONSIDERED FOR THIS ALTERNATIVE						0
L-575 REACH 1	2.4	0.0	15	NOT CONSIDERED FOR THIS ALTERNATIVE						0
L-575 REACH 2	4.6	2.3	14	NOT CONSIDERED FOR THIS ALTERNATIVE						0
L-575 REACH 3	3.2	3.2	12	NOT CONSIDERED FOR THIS ALTERNATIVE						0
L-575 REACH 4	28.4	28.4	13	NOT CONSIDERED FOR THIS ALTERNATIVE						0
L-575 REACH 5	7.3	5.8	12	NOT CONSIDERED FOR THIS ALTERNATIVE						0
R-573	5.9	4.4	13	NOT CONSIDERED FOR THIS ALTERNATIVE						0
R-562	7.6	7.2	12	NOT CONSIDERED FOR THIS ALTERNATIVE						0
L-561	8.9	4.5	13	NOT CONSIDERED FOR THIS ALTERNATIVE						0
L-550 REACH 1					CASE STUDY					23,100,000
L-550 REACH 2					CASE STUDY					
R-548 REACH 1 (District No. 2)	6.2	6.2	14	860,000	5,332,000	160,000	992,000	24,000	148,800	6,472,800
R-548 REACH 2 (District No. 3)	13.4	0.0	13	750,000	0	140,000	0	20,000	0	0
L-536	4.1	2.5	13	750,000	1,845,000	140,000	344,400	20,000	49,200	2,238,600
R-520	5.6	2.0	11	550,000	1,078,000	100,000	196,000	16,000	31,360	1,305,360
CORNING No.2	5.0	4.5	6			NOT CONSIDERED FOR THIS ALTERNATIVE				0
IDEKER	5.0	4.0	2			NOT CONSIDERED FOR THIS ALTERNATIVE				0
NO LEVEE	16.0	12.0	0			NOT CONSIDERED FOR THIS ALTERNATIVE				0
TOTAL	147.9				8,255,000		1,532,400		229,360	33,116,760

TOTAL	33,116,760
DE-ESCALATION (3.04%)	1,006,750
SUB-TOTAL	32,110,010
CONTINGENCY (30%)	9,633,003
SUB-TOTAL	41,743,014
ENGINEERING & DESIGN (15%)	6,261,452
SUB-TOTAL	48,004,466
SUPERVISION & ADMIN. (8%)	3,840,357
GRAND TOTAL	51,844,823

TABLE 9
CALCULATION OF ESTIMATED COSTS FOR THE 25-YEAR ERODIBLE NOTCH ALTERNATIVE

MISSOURI RIVER LEVEE [Index / name]	TOTAL LEVEE LENGTH [miles]	NUMBER O ERODIBLE NEEDED [miles]	EXISTING LEVEE HEIGHT [ft.]	EMBANKMENT QUANTITIES COST ESTIMATE UNIT COST [$ / mile]	EMBANKMENT QUANTITIES COST ESTIMATE SUB-TOTAL COST [$]	DRAINAGE AND UNDERSEEPAGE STRUCTURES COST ESTIMATE UNIT COST [$ / mile]	DRAINAGE AND UNDERSEEPAGE STRUCTURES COST ESTIMATE SUB-TOTAL COST [$]	REAL ESTATE COST ESTIMATE UNIT COST [$ / mile]	REAL ESTATE COST ESTIMATE SUB-TOTAL COST [$]	TOTAL LEVEE COST [$]
L611-614 REACH 1 (Missouri River)	17.7	6.0	14	650,000	3,900,000	n/a	n/a	n/a	n/a	3,900,000
L611-614 REACH 2 (Upper Pony Cr.)	7.8	0.0	15	700,000	0	n/a	n/a	n/a	n/a	0
L611-614 REACH 3 (Lateral 1-B)	1.7	0.0	12	475,000	0	n/a	n/a	n/a	n/a	0
L-601	11.7	2.0	12	475,000	950,000	n/a	n/a	n/a	n/a	950,000
L-594	11.4	2.0	14	650,000	1,300,000	n/a	n/a	n/a	n/a	1,300,000
L-575 REACH 1	2.4	0.0	15	700,000	0	n/a	n/a	n/a	n/a	0
L-575 REACH 2	4.6	1.0	14	650,000	650,000	n/a	n/a	n/a	n/a	650,000
L-575 REACH 3	3.2	0.0	12	475,000	0	n/a	n/a	n/a	n/a	0
L-575 REACH 4	28.4	2.0	13	550,000	1,100,000	n/a	n/a	n/a	n/a	1,100,000
L-575 REACH 5	7.3	1.0	12	475,000	475,000	n/a	n/a	n/a	n/a	475,000
R-573	5.9	2.0	13	550,000	1,100,000	n/a	n/a	n/a	n/a	1,100,000
R-562	7.6	2.0	12	475,000	950,000	n/a	n/a	n/a	n/a	950,000
L-561	8.9	2.0	13	550,000	1,100,000	n/a	n/a	n/a	n/a	1,100,000
L-550 REACH 1					CASE STUDY					2,900,000
L-550 REACH 2					CASE STUDY					
R-548 REACH 1 (District No. 2)	6.2	2.0	14	650,000	1,300,000	n/a	n/a	n/a	n/a	1,300,000
R-548 REACH 2 (District No. 3)	13.4	0.0	13	550,000	0	n/a	n/a	n/a	n/a	0
L-536	4.1	2.0	13	550,000	1,100,000	n/a	n/a	n/a	n/a	1,100,000
R-520	5.6	2.0	11	400,000	800,000	n/a	n/a	n/a	n/a	0
CORNING No.2	5.0	2.0	6			SEE ADDITIONAL COMPUTATIONS				300,000
IDEKER	5.0	2.0	2			SEE ADDITIONAL COMPUTATIONS				925,000
NO LEVEE	16.0	2.0	0			SEE ADDITIONAL COMPUTATIONS				2,620,000
TOTALS					14,725,000		0		0	20,670,000

TOTAL	20,670,000
DE-ESCALATION (3.04%)	628,368
SUB-TOTAL	20,041,632
CONTINGENCY (30%)	6,012,490
SUB-TOTAL	26,054,122
ENGINEERING & DESIGN (15%)	3,908,118
SUB-TOTAL	29,962,240
SUPERVISION & ADMIN. (8%)	2,396,979
GRAND TOTAL	32,359,219

TABLE 10
CALCULATION OF ESTIMATED COSTS FOR THE ULTIMATE LEVEE RAISE ALTERNATIVE (1993 FLOOD)

MISSOURI RIVER LEVEE [index / name]	TOTAL LEVEE LENGTH [miles]	RIVER LENGTH [miles]	EXISTING LEVEE HEIGHT [ft.]	EMBANKMENT QUANTITIES COST ESTIMATE UNIT COST [$ / mile]	EMBANKMENT QUANTITIES COST ESTIMATE SUB-TOTAL COST [$]	DRAINAGE AND UNDERSEEPAGE STRUCTURES COST ESTIMATE UNIT COST [$ / mile]	DRAINAGE AND UNDERSEEPAGE STRUCTURES COST ESTIMATE SUB-TOTAL COST [$]	REAL ESTATE COST ESTIMATE UNIT COST [$ / mile]	REAL ESTATE COST ESTIMATE SUB-TOTAL COST [$]	TOTAL LEVEE COST [$]
L611-614 REACH 1 (Missouri River)	17.7	17.7	14	140,000	2,478,000	90,000	1,593,000	5,500	97,350	4,168,350
L611-614 REACH 2 (Upper Pony Cr.)	7.8	0.0	15	150,000	1,170,000	110,000	0	6,500	0	1,170,000
L611-614 REACH 3 (Lateral 1-B)	1.7	0.0	12	100,000	170,000	70,000	0	3,500	0	170,000
L-601	11.7	9.4	12	100,000	1,170,000	70,000	655,200	3,500	32,760	1,857,960
L-594	11.4	6.8	14	140,000	1,596,000	90,000	615,600	5,500	37,620	2,249,220
L-575 REACH 1	2.4	0.0	15	150,000	360,000	110,000	0	6,500	0	360,000
L-575 REACH 2	4.6	2.3	14	140,000	644,000	90,000	207,000	5,500	12,650	863,650
L-575 REACH 3	3.2	3.2	12	100,000	320,000	70,000	224,000	3,500	11,200	555,200
L-575 REACH 4	28.4	28.4	13	120,000	3,408,000	85,000	2,414,000	4,500	127,800	5,949,800
L-575 REACH 5	7.3	5.8	12	100,000	730,000	70,000	408,800	3,500	20,440	1,159,240
R-573	5.9	4.4	13	120,000	708,000	85,000	376,125	4,500	19,913	1,104,038
R-562	7.6	7.2	12	100,000	760,000	70,000	505,400	3,500	25,270	1,290,670
L-561	8.9	4.5	13	120,000	1,068,000	85,000	378,250	4,500	20,025	1,466,275
L-550 REACH 1						CASE STUDY				8,300,000
L-550 REACH 2						CASE STUDY				
R-548 REACH 1 (District No. 2)	6.2	6.2	14	140,000	868,000	90,000	558,000	5,500	34,100	1,460,100
R-548 REACH 2 (District No. 3)	13.4	0.0	13	120,000	1,608,000	85,000	0	4,500	0	1,608,000
L-536	4.1	2.5	13	120,000	492,000	85,000	209,100	4,500	11,070	712,170
R-520	5.6	2.0	11	90,000	504,000	65,000	127,400	3,000	5,880	637,280
CORNING No.2	5.0	4.5	6			SEE ADDITIONAL COMPUTATIONS				3,747,000
IDEKER	5.0	4.0	2			SEE ADDITIONAL COMPUTATIONS				3,622,000
NO LEVEE	16.0	12.0	0			SEE ADDITIONAL COMPUTATIONS				11,588,000
TOTALS					18,054,000		8,271,875		456,078	54,038,953

TOTAL	54,038,953
DE-ESCALATION (3.04%)	1,642,784
SUB-TOTAL	52,396,168
CONTINGENCY (30%)	15,718,851
SUB-TOTAL	68,115,019
ENGINEERING & DESIGN (15%)	10,217,253
SUB-TOTAL	78,332,272
SUPERVISION & ADMIN. (8%)	6,266,582
GRAND TOTAL	84,598,853

TABLE 11
CALCULATION OF ESTIMATED COSTS FOR THE 25-YEAR ERODIBLE NOTCH ALTERNATIVE FOR THE NEW RULO LEVEES

CONSTRUCTION COST ESTIMATE FOR A NEW LEVEE IN THE RULO, NE REACH THE SAME HEIGHT AS CORNING No. 2 (6 feet) (Corning No. 2 is assumed to be adequate to provide at least 25-year protection.)

MISSOURI RIVER LEVEE [Index / name]	TOTAL LEVEE LENGTH [miles]	NUMBER OF ERODIBLE PLUGS NEEDED [miles]	EXISTING LEVEE HEIGHT [ft.]	NEW LEVEE CONSTRUCTION COST ESTIMATE UNIT COST [$ / mile]	NEW LEVEE CONSTRUCTION COST ESTIMATE SUB-TOTAL COST [$]	DRAINAGE AND UNDERSEEPAGE STRUCTURES COST ESTIMATE UNIT COST [$ / mile]	DRAINAGE AND UNDERSEEPAGE STRUCTURES COST ESTIMATE SUB-TOTAL COST [$]	REAL ESTATE COST ESTIMATE UNIT COST [$ / mile]	REAL ESTATE COST ESTIMATE SUB-TOTAL COST [$]	TOTAL NEW LEVEE COST [$]
CORNING No.2	5.0	2.0	6	Assume it's adequate.		n/a	n/a	n/a	n/a	0
IDEKER	5.0	2.0	2	80,000	400,000	40,000	200,000	5,000	25,000	625,000
NO LEVEE	16.0	2.0	0	100,000	1,600,000	40,000	640,000	5,000	80,000	2,320,000
TOTALS					2,000,000		840,000		105,000	2,945,000
									SUB-TOTAL	2,945,000

COST ESTIMATE FOR THE 25-YEAR ERODIBLE PLUG ALTERNATIVE FOR THE NEW LEVEE IN THE RULO, NE REACH

MISSOURI RIVER LEVEE [Index / name]	TOTAL LEVEE LENGTH [miles]	NUMBER OF ERODIBLE PLUGS NEEDED [miles]	EXISTING LEVEE HEIGHT [ft.]	ERODIBLE PLUG QUANTITIES COST ESTIMATE UNIT COST [$ / mile]	ERODIBLE PLUG QUANTITIES COST ESTIMATE SUB-TOTAL COST [$]	DRAINAGE AND UNDERSEEPAGE STRUCTURES COST ESTIMATE UNIT COST [$ / mile]	DRAINAGE AND UNDERSEEPAGE STRUCTURES COST ESTIMATE SUB-TOTAL COST [$]	REAL ESTATE COST ESTIMATE UNIT COST [$ / mile]	REAL ESTATE COST ESTIMATE SUB-TOTAL COST [$]	SUB-TOTAL LEVEE COST [$]	TOTAL LEVEE COST [$]
CORNING No.2	5.0	2.0	6	150,000	300,000	n/a	n/a	n/a	n/a	300,000	300000
IDEKER	5.0	2.0	2	150,000	300,000	n/a	n/a	n/a	n/a	300,000	925000
NO LEVEE	16.0	2.0	0	150,000	300,000	n/a	n/a	n/a	n/a	300,000	2620000
TOTALS					900,000		0		0	900,000	3845000
									SUB-TOTAL	900,000	
									GRAND TOTAL		3845000

TABLE 12
CALCULATION OF ESTIMATED COSTS FOR THE ULTIMATE LEVEE RAISE ALTERNATIVE (1993 FLOOD) FOR THE NEW LEVEES NEAR RULO, NE

CONSTRUCTION COST ESTIMATE FOR A NEW LEVEE IN THE RULO, NE REACH THE SAME HEIGHT AS L536 (14 feet)

MISSOURI RIVER LEVEE [index / name]	TOTAL LEVEE LENGTH [miles]	RIVER LENGTH [miles]	EXISTING LEVEE HEIGHT [ft.]	NEW LEVEE CONSTRUCTION COST ESTIMATE UNIT COST [$ / mile]	NEW LEVEE CONSTRUCTION COST ESTIMATE SUB-TOTAL COST [$]	DRAINAGE AND UNDERSEEPAGE STRUCTURES COST ESTIMATE UNIT COST [$ / mile]	DRAINAGE AND UNDERSEEPAGE STRUCTURES COST ESTIMATE SUB-TOTAL COST [$]	REAL ESTATE COST ESTIMATE UNIT COST [$ / mile]	REAL ESTATE COST ESTIMATE SUB-TOTAL COST [$]	TOTAL NEW LEVEE COST [$]
CORNING No.2	5.0	4.5	14	350,000	1,750,000	160,000	720,000	25,000	86,000	2,556,000
IDEKER	5.0	4.0	14	350,000	1,750,000	160,000	640,000	25,000	86,000	2,476,000
NO LEVEE	16.0	12.8	14	350,000	5,600,000	160,000	2,048,000	25,000	274,000	7,922,000
TOTALS					9,100,000		3,408,000		446,000	12,954,000
									SUB-TOTAL	12,954,000

COST ESTIMATE FOR THE ULTIMATE LEVEE RAISE ALTERNATIVE (1993 FLOOD) FOR THE NEW LEVEE IN THE RULO, NE REACH

MISSOURI RIVER LEVEE [index / name]	TOTAL LEVEE LENGTH [miles]	RIVER LENGTH [miles]	EXISTING LEVEE HEIGHT [ft.]	EMBANKMENT QUANTITIES COST ESTIMATE UNIT COST [$ / mile]	EMBANKMENT QUANTITIES COST ESTIMATE SUB-TOTAL COST [$]	DRAINAGE AND UNDERSEEPAGE STRUCTURES COST ESTIMATE UNIT COST [$ / mile]	DRAINAGE AND UNDERSEEPAGE STRUCTURES COST ESTIMATE SUB-TOTAL COST [$]	REAL ESTATE COST ESTIMATE UNIT COST [$ / mile]	REAL ESTATE COST ESTIMATE SUB-TOTAL COST [$]	SUB-TOTAL LEVEE COST [$]	TOTAL LEVEE COST [$]
CORNING No.2	5.0	4.5	14	140,000	700,000	90,000	405,000	5,500	86,000	1,191,000	3747000
IDEKER	5.0	4.0	14	140,000	700,000	90,000	360,000	5,500	86,000	1,146,000	3622000
NO LEVEE	16.0	12.8	14	140,000	2,240,000	90,000	1,152,000	5,500	274,000	3,666,000	11588000
TOTALS					3,640,000		1,917,000		446,000	6,003,000	
									SUB-TOTAL	6,003,000	
									GRAND TOTAL		18957000

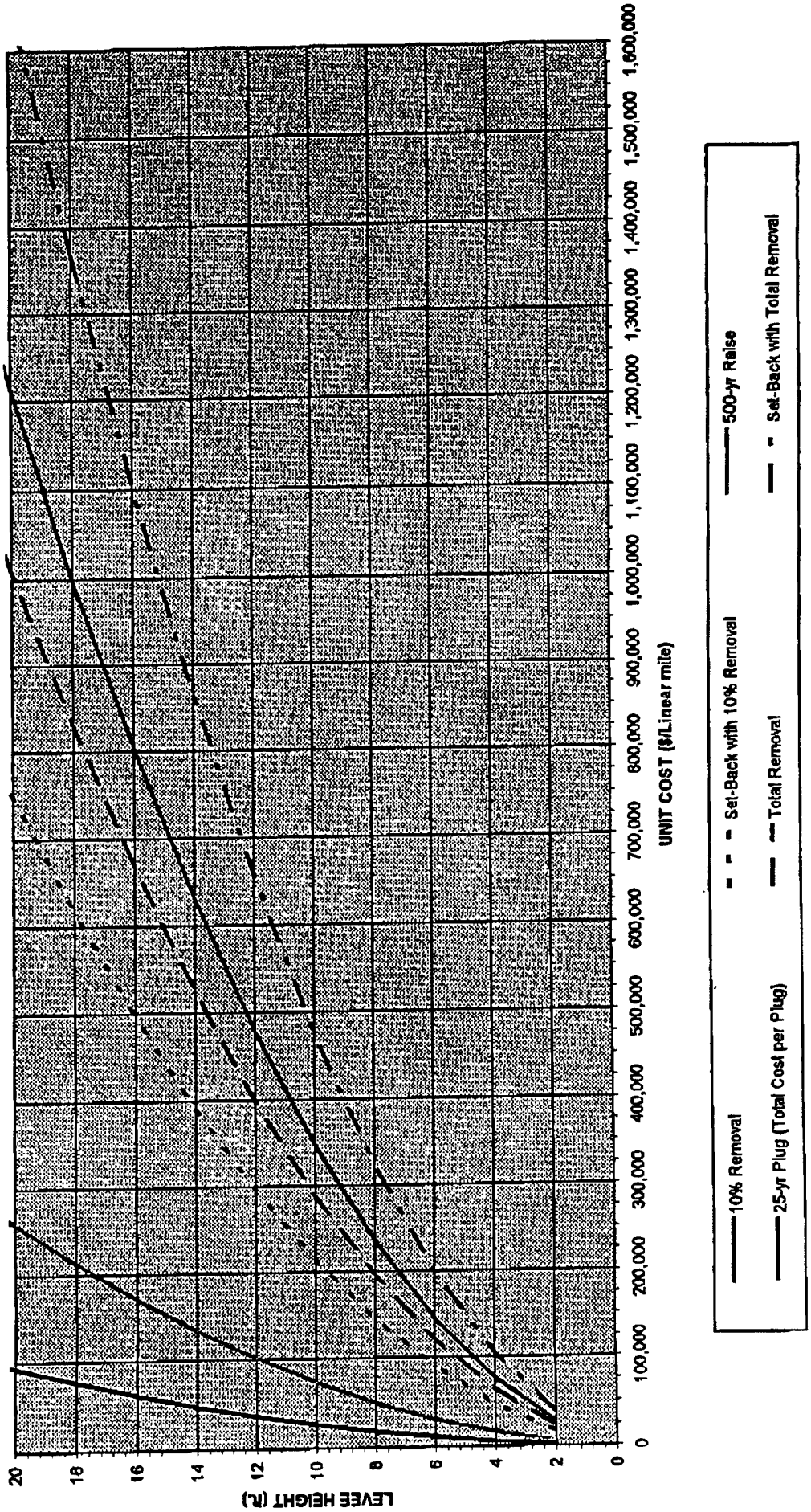

EXISTING LEVEE HEIGHT -vs- EMBANKMENT COST PER LINEAR MILE
LEVEE HEIGHT (ft)
20
18
16
14
12
10
8
6
4
2
0
0
100,000
200,000
300,000
400,000
500,000
600,000
700,000
800,000
900,000
1,000,000
1,100,000
1,200,000
1,300,000
1,400,000
1,500,000
1,600,000
UNIT COST ($/Linear mile)
10% Removal
Set-Back with 10% Removal
500-yr Raise
25-yr Plug (Total Cost per Plug)
Total Removal
Set-Back with Total Removal

FIGURE 1

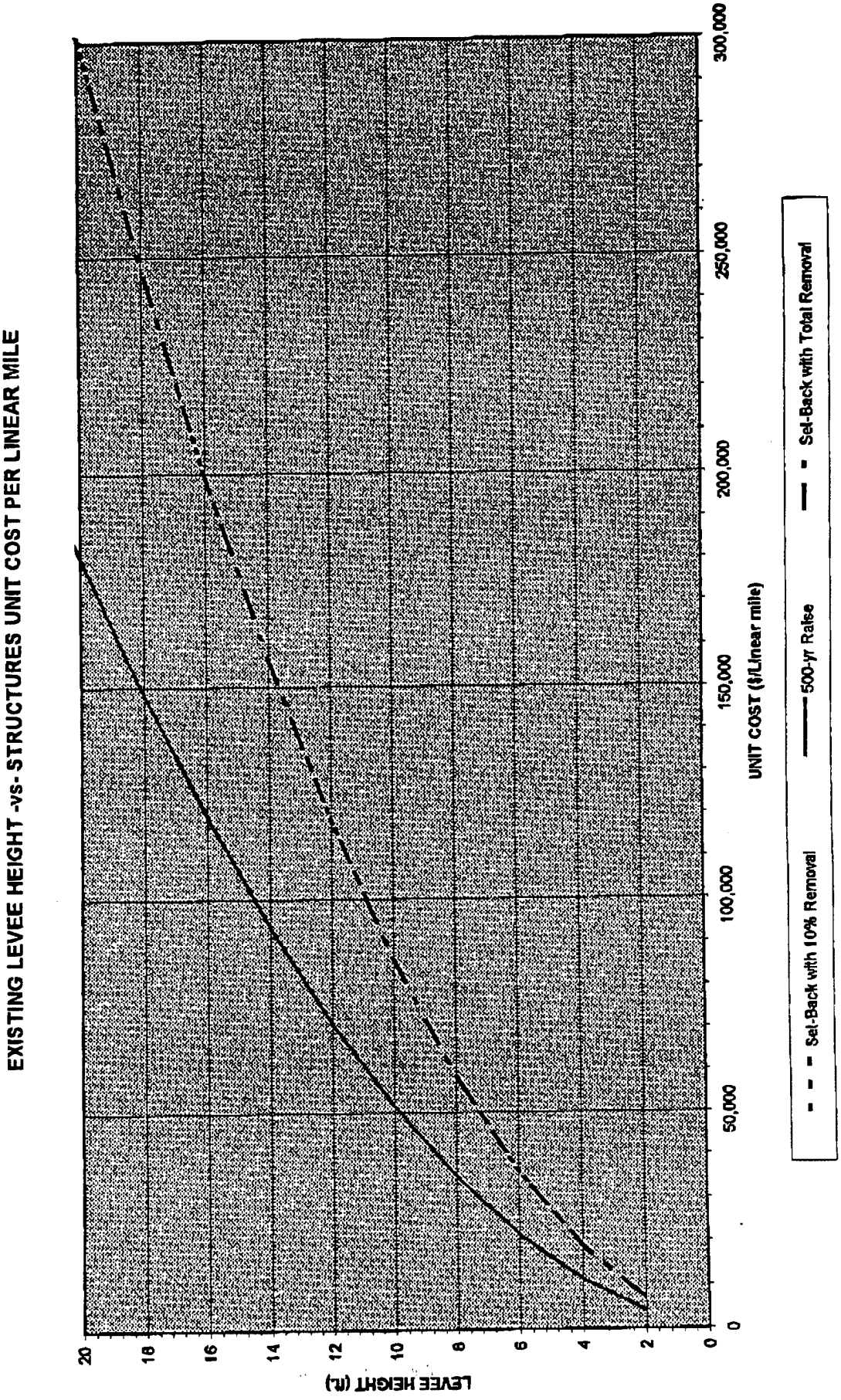

EXISTING LEVEE HEIGHT -vs- STRUCTURES UNIT COST PER LINEAR MILE
LEVEE HEIGHT (ft.)
0
2
4
6
8
10
12
14
16
18
20
UNIT COST ($/Linear mile)
0
50,000
100,000
150,000
200,000
250,000
300,000
Set-Back with 10% Removal
500-yr Raise
Set-Back with Total Removal

FIGURE 2

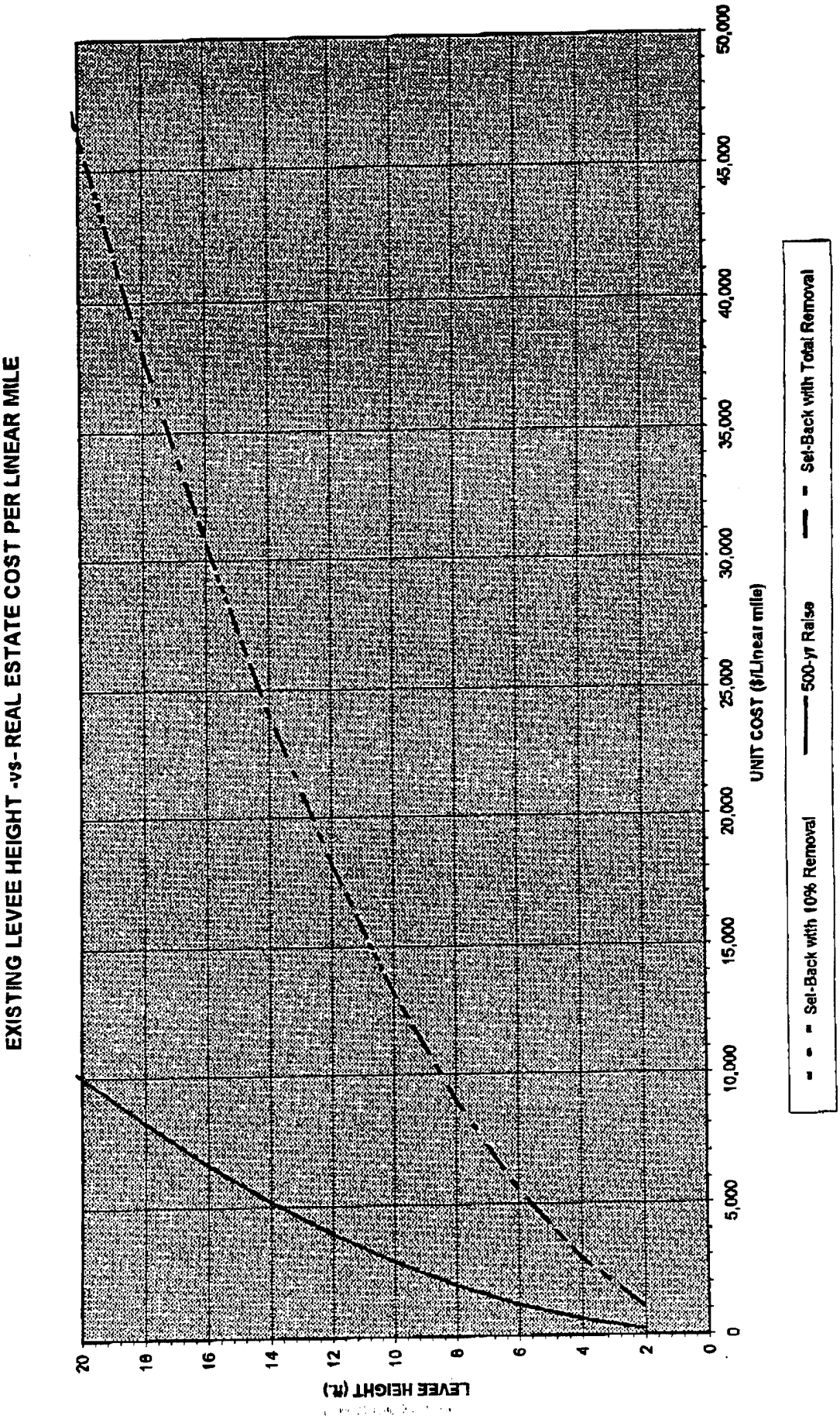

EXISTING LEVEE HEIGHT -vs- REAL ESTATE COST PER LINEAR MILE
LEVEE HEIGHT (ft.)
0
2
4
6
8
10
12
14
16
18
20
UNIT COST ($/Linear mile)
0
5,000
10,000
15,000
20,000
25,000
30,000
35,000
40,000
45,000
50,000
Set-Back with 10% Removal
500-yr Raise
Set-Back with Total Removal

FIGURE 3

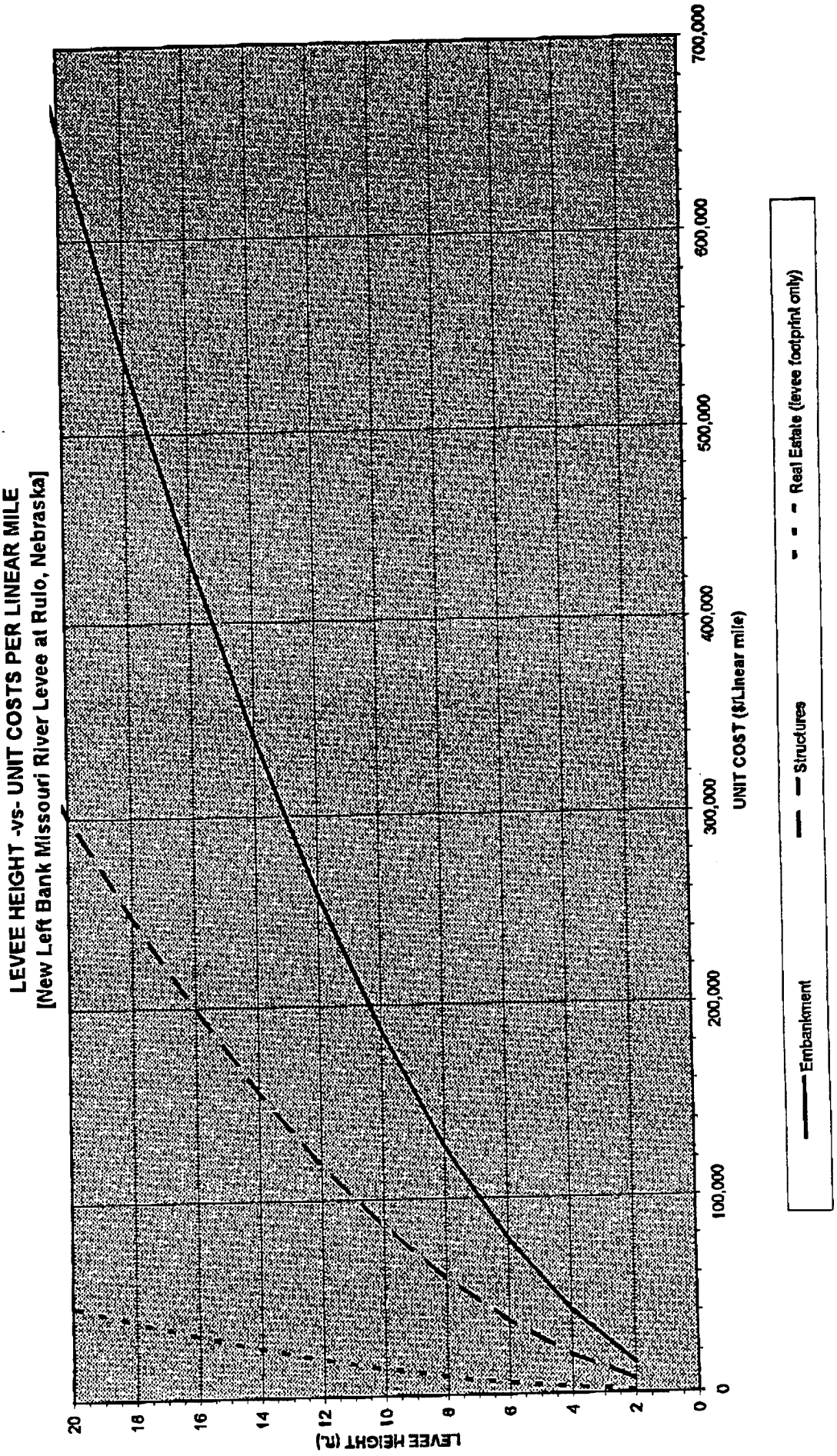

LEVEE HEIGHT -vs- UNIT COSTS PER LINEAR MILE
[New Left Bank Missouri River Levee at Rulo, Nebraska]
LEVEE HEIGHT (ft.)
0
2
4
6
8
10
12
14
16
18
20
UNIT COST ($/Linear mile)
0
100,000
200,000
300,000
400,000
500,000
600,000
700,000
Embankment
Structures
Real Estate (levee footprint only)

FIGURE 4

Critical Facilities

The final alternative evaluated was the possibility of protecting only those facilities considered to be of critical nature (i.e. hazardous or of critical importance). An inventory analysis identified 25 critical facilities of hazardous nature and 7 of non-hazardous nature. The final height of most of the levees in the system for the ultimate raise / fully confined alternative was determined to be about 16 feet, so this was chosen as the target height for levees to protect these facilities. The critical facilities alternative assumed that the existing structures were not already protected so new levees would need to be constructed. These facilities were assumed to have an average area of 40 acres so a levee around their perimeter would be about one mile long. The new levee cost curve developed for the Rulo levees (Figure 4) was used to determine the costs of these levees. No interior drainage was felt necessary and the real estate costs were assumed to be zero since the facilities would already own the land. Table 4 shows the costs for protecting the critical facilities.

TABLE 4
CRITICAL FACILITIES
SUMMARY COSTS

	TOTAL NUMBER	EMBANKMENT UNIT COST	LENGTH	SUB-TOTAL COST	TOTAL COST
HAZARDOUS	25	$430,000	1 mile	$430,000	$10,750,000
HAZARDOUS & NON-HAZARDOUS	32	$430,000	1 mile	$430,000	$13,760,000

	IMPACT	A	B	L	M	N	O	Q	R	S	V	W
	CATEGORIES	[All Disast. Counties]	[FPMA Imp. Counties]	Remove	Set Back [Varied]	[25-YR.]	Fully Confine	[500-Yr.] [Priority]	[500-Yr.] [All]	No Reservoirs	Runoff Red 5% [Decr. 5%]	Runoff Red 10% [Decr. 10%]
	ECONOMIC ($'s)											
	Fld.Dam.Reduct.											
1	Resid.(Urban)	65,648,752	24,017,611	6,635,000	-2,398,000	243,000	-3,750,000	0	0	75,432,000	-1,639,000	-2,706,000
2	Other (Urban)	124,621,013	62,572,037	20,078,000	-1,681,000	-220,000	-2,011,000	(-)	(-)	562,893,000	-2,040,000	-2,766,000
3	Agricultural	623,863,131	109,170,412	37,300,196	-6,869,916	17,079,351	-12,199,214	0	0	277,167,943	-1,306,596	-1,588,503
4	Other Rural	30,828,538	16,249,850	5,552,077	-1,022,577	2,542,235	-1,815,834	0	0	41,256,027	-194,485	-236,446
	Chg. in Govt.Expend.											
5	Emerg.Resp.Costs	26,162,427	8,229,102	2,273,336	-821,622	83,259	-1,284,854	(-)	(-)	25,845,103	-561,567	-927,151
6	Disast.Rel.(Agric.)	323,262,416	59,583,205	20,357,762	-3,749,474	9,321,596	-6,658,107	0	0	151,273,171	-713,116	-866,976
7	Disast.Rel. (Human R.)	256,843,175	55,244,130	15,261,501	-5,515,762	558,937	-8,625,566	(-)	(-)	173,504,985	-3,769,947	-6,224,208
8	Fld.Ins. (NFIP)	22,276,574	11,690,540	3,229,577	-1,167,223	118,280	-1,825,307	0	0	36,716,425	-797,781	-1,317,142
9	Fld.Ins. (FCIC)	179,695,218	34,313,801	11,723,978	-2,159,312	5,368,281	-3,834,385	0	0	87,117,795	-410,682	-499,289
10	Net Ag Product.	NA	0	(-)	(-)	(-)	(+)	0	0	(-)	(+)	(+)
11	Net Urban RE Values	NA	0	(-)	0	(-)	0	0	0	(-)	(+)	(+)
	ENVIRONMENTAL											
	Natur. Resour. (# acres)											
12	NonForest Wetlands	not req	10,604	265	255	0	0	0	0	0	0	0
13	Threat.&Endang. (#/Occ.)	not req	25sp, 253oc	(+)	(++)	0	0	0	0	(+)	(+)	(+)
14	Forest (acres)	not req	26,236	1,967	768	0	0	0	0	0	0	0
	Natural Fldpln Functions											
15	Fld Plain Inundated (acres)		120,276	175,280	-22,281	74,661	-54,570	0	0	50,009	-5,655	-7,183
	Cultural											
16	Impacts (-5 to +5)	-2	-1	-2	-1	-1	-1	-1	-1	-1	-1	-1
	Open Space											
17	Public Lands (acres)	not req	57,852	(+)	(+)	0	(-)	0	0	0	(+)	(+)
18	Recreation sites (#)	not req	92	(+)	(+)	0	(-)	0	0	(-)	(+)	(+)
	REDUCT.OF RISK											
	Critical Facilities											
19	# Facil. w/harmf.releas.	no info.	25	38	-3	9	-3	0	0	62	-2	-2
20	# other crit. facil.	no info.	7	12	-3	1	-7	20	0	67	0	0
	Prot./Avoid. of Harm											
21	# people vulnerable	12,598	1,647	661	-277	36	-450	0	0	2,529	-292	-292
	Social Well Being											
22	# commun.vulnerable	12	8	4	-5	4	-8	less	less	0	-2	-2
23	# resid.str.vulnerable	4,230	553	222	-93	12	-151	0	0	849	-98	-98
	IMPLEMENT. COSTS											
24	Structural Costs (Low)	0	0	8,500,000	25,800,000	32,400,000	84,600,000	10,800,000	13,800,000	NA	NA	NA
	Structural Costs (High)	0	0	92,000,000	51,800,000	32,400,000	84,600,000	10,800,000	13,800,000	NA	NA	NA
25	Other Costs	0	0	(*)	(*)	(*)	(*)	(*)	(*)	(*)	(*)	(*)

(*) There are a variety of additional costs which were not quantified, variously including:

1) Possible environmental and cultural resource mitigation costs
2) Loss of tax base to the state and local governments.
3) Costs of easements or land purchases by government entities. Covered in change in land use value from an NED perspective.
4) Pumping costs.
5) Social and occupational dislocation and psychological hardship.

IMPACT EVALUATIONS FOR KANSAS CITY DISTRICT

This section provides a description of the methodologies used and assumptions made in determining potential effects on 1993 flood impacts in the Kansas City District of different alternatives that affect hydraulic conditions. Some alternatives were examined systemically and some were examined on an impact study reach basis.

Systemic Analyses.

On a systemic basis, Kansas City District examined potential changes in impacts for three agricultural levee alternatives and one alternative that assumed "natural conditions" (without existing reservoirs).

General Description of Study Methodologies. Analyses of the action alternatives required evaluation and integration of hydraulic modeling results and economic data, including economic base condition impacts, changes in flood stages, and assumptions about levees. The methodologies and assumptions used in estimating the potential changes in 1993 flood impacts are described below.

Study Reaches.

The level of detailed data available for the 1993 flood base condition impacts used for the analyses is at the county level. Although Kansas City District used available field survey damage data in estimating the Residential and Other Urban impacts, data for other impact categories are only available at the county level. Thus, the major challenge in accomplishing the socio-economic impact analyses for the study was the integration of detailed data from hydraulic modeling efforts with mainly county level socio-economic impacts. For purposes of the analyses, the county level base condition impacts in the Kansas City District were generally aggregated on a Missouri River reach basis. Missouri River reaches used correspond to existing Missouri River gauges and are traditional Missouri River reaches for which Kansas City District has historical data available about stage-damage and stage-area relationships. Each Missouri River study reach used in the analyses covers one or more of the FPMA impact study reaches listed in FPMA milestone packages as shown below. Since county boundaries do not exactly correspond to traditional study reach boundaries however, the aggregation of impacts does not conform exactly to the traditional river mile reach boundaries.

Correlation of FMPA Study Reaches
With Missouri River Reaches Used in the Systemic Analyses

Missouri River Reach	FPMA Impact Study Reaches
St Joseph	MO3, MO4, MO5
Kansas City	MO6
Waverly	MO7
Boonville	MO8, MO9, MO10
Hermann	MO11

Flood Stages.

The UNET hydraulic model provided 1993 flood stages at Missouri River gauges at St. Joseph, Kansas City, Waverly, Boonville and Hermann for each of the alternatives examined and for the 1993 flood. The stage reduction or stage increase from the 1993 flood was then determined at each gauge. The changes in stage at the gauge were assumed to be representative for the river reach affected for purposes of the study, and are shown in the table below.

Change in 1993 Flood Stages at Selected Missouri River Gauges For Various Action Alternatives

Alternative	St Joseph	Kansas City	Waverly	Boonville	Hermann
Remove Ag Levees-agric in overbank	-3.0	-1.2	-2.7	-0.1	+1.0
Remove Ag Levees-trees in overbank	-2.9	-2.9	-0.7	+1.8	+4.6
Levees Raised to Contain 93 flood	+1.6	+2.8	+6.9	+4.1	+6.8
Ag Levee System-25 yr notch	-5.0	-4.5	-0.7	-0.3	-0.8
Without Existing Reservoirs	+0.4	+5.1	+1.2	+1.4	+3.6

Levee Assumptions.

Based on information provided in the Kansas City District 1993 Post Flood Report and the PL 84-99 database, existing Federal and non-Federal levees were generally grouped by study reach. Crop acres and other (non-crop) acres protected by levees were also determined. For purposes of the analyses, urban levees along the Missouri River were defined as: R471-460, L455 (urban portion) in the upstream portion of the Kansas City District, levees in the metropolitan Kansas City area including CID Mo and KS, Lower Fairfax, Fairfax-Jersey Creek, NKC-Airport, Birmingham, and Northeast. (New Haven is an urban levee; however because of its size it was not included in the UNET model runs.) Levees that overtopped during the 1993 flood were identified based on information in the Kansas City District Post Flood Report. Kansas City District hydrologic engineering staff provided assumptions about whether levees overtopped or held for each of the action alternatives. Levee assumptions used for the analyses are shown in the table on the next two pages.

LEVEE ASSUMPTIONS FOR 1993 FLOOD AND
SYSTEMIC ACTION ALTERNATIVES

LEVEE	1993 Flood	Remove Ag Levees	Raise to Prevent Overtop	Ag Levees 25 yr Notch	W/O Existing Rsvrs
FEDERAL					
R519-513-504	held	removed	held	held	held
R500	overtop	removed	raised	overtop	held
L497	held	removed	held	overtop	held
L488	overtop	removed	raised	overtop	held
R482	overtop	removed	raised	overtop	held
L476	held	removed	held	overtop	held
*R471-460	overtop	held	raised	overtop	overtop
*L455 (part)	held	held	held	held	held
L455 (part)	held	removed	held	held	overtop
L448-443	overtop	removed	raised	held	overtop
R440	held	removed	held	overtop	overtop
L408	overtop	removed	held	held	overtop
L400	overtop	removed	held	held	overtop
*CID-MO	held	held	raised	held	overtop
*CID-KS	held	held	raised	held	overtop
*Lower Fairfax	held	held	held	held	overtop
*Fairfax-Jrsy Cr	held	held	held	held	overtop
*NKC-Airport	held	held	raised	held	overtop
*Birmingham	held	held	held	held	held
*Northeast	held	held	held	held	overtop
R351	held	removed	held	overtop	overtop
L246	overtop	removed	held	held	overtop
Chariton	overtop	removed	held	held	overtop
NON-FEDERAL	overtop	removed	raised	**	overtop

SUMMARY:	# of Levees Ovrtop in 1993	Net Chg	Net Chg	Net Chg	Net Chg
URBAN	2	-1	raised	NC	+6
FED AG	8	removed	raised	-1	NC
NON-FED AG	all	removed	raised	-11	NC

* Urban Levees
** Overtopped except Rushville, Hundley, Sherman Field, Ramsey, Ray County # 6, Ray Fail, MiDe, Miami DeWitt, DeWitt LD, Brunswick LD, Stonner

Changes in Flood Damage Impacts.

For Residential and Other Urban damages, changes in impacts were determined based on assumptions about: a) certain communities that may no longer be flooded because of reduction in stage or because levees that overtopped in 1993 are not overtopped under an action alternative; b) additional communities that were not flooded in 1993 but might be flooded under an action alternative because of levees being removed or overtopped, and c) changes in damages to communities still flooded because of changes in stage. Changes in damages for commmunities still flooded due to changes in stage are rough estimates derived by applying historical stage damage relationships to 1993 flood damages.

For Agricultural and Other Rural damages, which are determined by number of acres flooded, stage-area relationships for the Missouri River reaches were used to determine the estimated number of crop acres that could flood with each alternative based on the changes in stage provided by the UNET model. Based on the levee assumptions shown in the preceding section, these acres were then decreased by the number of acres protected with each action alternative, to estimate the number of acres that would be flooded with each alternative.

Change in Government Expenditures.

Changes in these categories are estimates based on analytical judgment. Sufficient data are not available to make detailed estimates. Impacts in these categories (Emergency Response, Disaster Relief and Flood Insurance) would generally be expected to have changes somewhat similar to the changes in flood damages incurred. In the Flood Insurance categories, however, there could be some offset to these corresponding changes if it is assumed that floodplain residents would increase their participation in the flood insurance program under any of the action alternatives. In this event the change in flood insurance payments for the different alternatives may not be of the same magnitude as the change in flood damages.

Change in Value of Floodplain Resources.

The change in net agricultural product which could be expected under the

various alternatives analyzed is assumed to be reflected in the change in market value of crop land. These changes are based on estimates of differences in the market value of agricultural and urban or other (non-crop) land with varying flood hazard levels provided with each of the action alternatives. Acres protected by levees would have decreases or increases in market value depending on whether the existing level of protection is greater or lesser than the new level of protection provided with each action alternative. The estimated change applies only to the acres affected with each alternative. Since some acres may have market value increases and other acres may have market value decreases with any one alternative, a weighted net percentage overall change is displayed in the matrix table. No change in the type of land use for these acres was assumed in the analyses.

Based on discussions with USDA representatives and local real estate appraisers and brokers, a range of percent changes in market values for crop land was developed depending on the flood hazard. The value for an unprotected crop acre is estimated to be about 50 percent of the value of a crop acre with no flood hazard or 500 year protection. Values are assumed to change by about 10 percent per increment as the protection provided changes to 100, 50, 25 and 5-10 year levels.

The change in net urban real estate values used for the analyses of alternatives are based on conversations with local real estate appraisers. Values for these areas are difficult to determine because of the variety of factors which may affect the value. Location, tract size, access, availability of other suitable sites, zoning, and topography are among the factors which can greatly influence value. However, for purposes of this study some gross assumptions were made. In major urban areas, an acre of developed commercial/industrial land protected to the 100 year event was reported to range from 50% to 80% of the value of an acre of flood free commercial/industrial land. The higher percentage estimate was based on the ready availability of low cost flood insurance. For purposes of the analysis, additional assumptions were required for other urban (non-crop) use acres not located in a major urban area. These acres have widely varying uses and, for instance, may be sites for small communities, railroads, highways, etc. For these acres, a range of percentage values was also developed to relate the value of an acre with varying levels of flood hazard to the value of a flood free acre. With 100 year protection the value was assumed to be about 60% to 70% of the value of a flood free acre; for 25 year protection, about 30%; and for very low or no protection, about 20%.

Change in Risk.

Changes in these categories are also estimates based on analytical judgment. Sufficient data are not available to make detailed estimates.

Alternatives Analyses. Using the data, study methodologies and assumptions generally described above, each action alternative was examined to determine how the 1993 flood impacts might have changed had that alternative been in place at the time of the flood. This analysis is included in Chapter 9 of the Main Report.

ACTION ALTERNATIVES
KANSAS CITY DISTRICT

		A	B	L	N	O	S
				ACTION ALTERNATIVES AFFECTING HYDRAULIC CONDITIONS			
				AGRICULTURAL LEVEES			UPLAND RETENTION/ WATERSHED MEASURES
	IMPACT CATEGORIES	Base Cond. [All Disast. Counties]	Base Cond. [Floodpln. Impacts]	Remove	Uniform Ht. [25-YR.]	Raise	Without Reservoirs
	ECONOMIC (1,000 $'s)		[1]				
	Flood Damages						
1	Residential (Urban)	$102,326	$72,556	-7%	-4%	-50%	7%
2	Other (Urban)	$650,251	$541,462	-10%	-5%	-(75-90)%	500%
3	Agricultural	$1,373,434	$303,322	+(0-2)%	-20%	-80%	Insignificant
4	Other Rural	$118,447	$75,509	+(0-2)%	-20%	-80%	Insignificant
	Chg. in Govt.Expend.						
5	Emergen.Resp.Costs	$19,423	$16,332	-	-	-	+
6	Disaster Relief (Agric.)	$210,198	$64,762	NC	-low	-high	Insignificant
7	Disaster Relief (Human R.)	$285,853	$166,510	-low	-low	-high	+high
8	Flood Insurance (NFIP)	$100,779	$46,687	Insignificant	-NC to low	-	+
9	Flood Insurance (FCIC)	$185,389	$92,975	-+	-NC to low	-high	+low
	Chg.Value of FP Resources						
10	Net Ag RE Values	-	-	-20%	4%	30%	-10%
11	Net Urban RE Values	-	-	-20%	Insignificant	-	-30%
	ENVIRONMENTAL						
	Natur.Resour.(# acres)						
12	Non-Forested Wetl. (acres)	-	42,700	+5,600	NC	NC	NC
13	Threat.&Endang. (# / Occ.)	-	30/80	+	-	-	NC
14	Forest (acres)	-	58,200	+7,100	NC	NC	NC
	Natural Fldpln.Functions						
15	Fldpln.inundated (acres)	-	100%	NC	NC	-90%	NC
	Cultural						
16	Archeol Impacts (-5 to +5)	-		-1 (-1)	-3 (-1)	-3 (-1)	0 (-1)
16A	Hist.Sites(-5 to +5)			-1 (-1)	-1 (-1)	-1 (-1)	0 (-1)
	Open Space						
17	Public lands (acres)	-	43,100	NC	NC	NC	NC
18	Recreation sites (#)	-	20	NC	NC	NC	NC
	REDUCT.OF RISK						
	Critical Facilities						
19	# Facil. w/harmful releases	-	27	NC	Insignificant	-NC/low	+
20	# other critical facilities	-	76	NC	Insignificant	-low/mod	+
	Prot./Avoid. of Harm						
21	# people vulnerable	28,375	21022	-low	-low	-mod/high	+mod/high
	Social Well Being						
22	# communities vulnerable	229	141	-2%	-3%	-(20-70)%	+
23	# resident.struct.vulnerable	8711	6287	-7%	-5%	-53%	+
	IMPLEMENT. COSTS						
24	Structural Costs	-	-	+$16.4 MIL +LERRD	+$340 MIL +LERRD	+$2.5 BIL +LERRD	?????
25	Other Costs	-	-	High	Low	Moderate	High

[1] Economic impacts collected only at the county level

ST. PAUL DISTRICT EVALUATION

The St. Paul District analysis of a limited number of action alternatives is located in Chapter 9 of the Main Report. The impacts matrix table, showing estimates of possible changes in impacts associated with implementation of these actions, is shown on the following page.

ACTION ALTERNATIVES (NCS)

		A	B	B'	B"	P	S	V	W
	IMPACT CATEGORIES	Base Cond. [All NCS]	Base Cond. [Floodpln-NCS]	Base Cond. Pools7-10 MS Riv.	Base Cond. MN Riv.	URBAN LEVEES [500-Yr.]	UPLAND RETENTION Without Reservoirs	Runoff Red. [Decr. 5%]	Runoff Red. [Decr. 10%]
						(1)	(2)	(3)	(3)
	ECONOMIC ($000's)								
	Fld.Dam.Reduct.								
1	Residential (Urban)	$21,460	$5,428			0	0	0	0
2	Other (Urban)	$39,466	$25,918			0	0	0	0
3	Agricultural	$484,674	$95,155			0	0	-200,000	-400,000
4	Other Rural	$6,868	$2,599			0	0	-2,875	-5,750
	Chg. in Govt.Expend.								
5	Emergen.Resp.Costs	$10,226	$4,193			0	0	0	0
6	Disaster Relief (Agric.)	$283,614	$52,295			0	0	-118,750	-237,500
7	Disaster Relief (Human R.)	$254,508	$60,359			0	0	0	0
8	Flood Insurance (NFIP)	$2,237	$1,370			0	0	0	0
9	Flood Insurance (FCIC)	$215,668	$31,391			0	0	-87,500	-175,000
	Chg.Value of FP Resources								
10	Net Ag RE Values	-	-			0	0	HIGH	HIGH
11	Net Urban RE Values	-	-			+< 5%	0	0	0
	ENVIRONMENTAL								
	Natur.Resour.(# acres)								
12	Non-Forested Wetl. (acres)		74,805	21,000	2,230	-	0	0	0
13	Threat.&Endang. (# / Occ.)		75/406	54/243	6/7	-	-	+	+
14	Forest (acres)		76,095	39,000	4,530	0	0	0	0
	Natural Fldpln.Functions								
15	Fldpln.Inundated (acres)					0	-	-	-
	Cultural								
16	Archeol Impacts (-5 to +5)		-1	-1	-2	-2(0)	-2(0)	-1(-1)	-1(-1)
16A	Hist.Sites(-5 to +5)		-1						
	Open Space								
17	Public lands (acres)		77,000	47,000	2,214	0	0	0	0
18	Recreation sites (#)		127	46	8	0	0	0	0
	REDUCT.OF RISK								
	Critical Facilities								
19	# Facil. w/harmful releases		3			0	0	0	0
20	# other critical facilities		13			0	0	0	0
	Prot./Avoid. of Harm								
21	# people vulnerable	11,677	5,700			0	0	0	0
	Social Well Being								
22	# communities vulnerable	64	16			0	0	0	0
23	# resident.struct.vulnerable	2,246	1,371			0	0	0	0
	IMPLEMENT. COSTS								
24	Structural Costs	-	-			+2,770	-	0	0
25	Other Costs	-	-			-	-	+1,250,000	+2,500,000

(1) Changes in impacts relative to column B"
(2) Changes in impacts relative to column B'
(3) Changes in impacts relative to column A (economics) and column B (environmental)

File:ACTNCS1

IMPACT AND RESOURCE EVALUATIONS FOR ROCK ISLAND DISTRICT

AGRICULTURAL LEVEES

STUDY AREA

The study area contains 19 agricultural levees which extend along the Mississippi River from Muscatine, Iowa, to Hannibal, Missouri, as shown in plates after Chapter 8 of the Main Report. Levees are located in the States of Illinois, Iowa, and Missouri. Agricultural levees located solely on tributary streams are not included in the study area. The levees are typically large agricultural districts with an average length of 22 miles and average protected area of 18,600 acres. A listing of agricultural levees is found in Table R-9.

Table R-9

Flood Plain Management Assessment
Mississippi River Agricultural Levees
Muscatine, Iowa, to Hannibal, Missouri

Levee District	Length (Miles)	Protected Area (Acres)
Muscatine Island Levee District	14.2	26,478
Drury Drainage District	9.6	4,165
Bay Island Drainage & Levee District No. 1 and Subdistrict No. 1 of Drainage Union No. 1	25.1	22,720
Iowa River-Flint Creek Levee District No. 16	47.2	48,800
Henderson County Drainage District No. 3	6.6	2,700
Henderson County Drainage District No. 1	11.3	6,163
Henderson County Drainage District No. 2	7.3	6,970
Green Bay Levee District No. 2	19.6	13,337
Des Moines-Mississippi Levee District No. 1	16.6	10,989
Mississippi Fox Drainage & Levee Dist. No. 2	28.5	8,675
Gregory Drainage District	11.1	8,000
Hunt & Lima Lake Drainage District	30.3	28,496
Indian Grave Drainage District	29.0	17,777
Union Township Drainage District	7.8	5,037
Fabius River Drainage District	17.3	14,264
Marion County Drainage District	8.7	4,000
South River Drainage District	12.8	10,300
South Quincy Drainage & Levee District	8.8	5,515
Sny Island Levee & Drainage District	107.0	110,000
Totals	419	354,000

A number of agricultural levees on the Mississippi River between Muscatine, Iowa, and Hannibal, Missouri, were overtopped by the Flood of

1993. Flood heights ranged from over the 100-year flood at Muscatine to over the 500-year flood at Hannibal. Table R-10 shows a listing of agricultural levees and their overtopping status.

Table R-10

Flood Plain Management Assessment
Status of Agricultural Levees in 1993 Flood
Mississippi River Agricultural Levees
Muscatine, Iowa, to Hannibal, Missouri

Levee District	Overtop During Flood of 1993
Muscatine Island Levee District	No
Drury Drainage District	No
Bay Island Drainage & Levee District No. 1 and Subdistrict No. 1 of Drainage Union No. 1	No
Iowa River-Flint Creek Levee District No. 16	No
Henderson County Drainage District No. 3	Yes
Henderson County Drainage District No. 1	No
Henderson County Drainage District No. 2	No
Green Bay Levee District No. 2	Yes
Des Moines-Mississippi Levee District No. 1	Yes
Mississippi Fox Drainage & Levee District No. 2	Yes
Gregory Drainage District	Yes
Hunt & Lima Lake Drainage District	Yes
Indian Grave Drainage District	Yes
Union Township Drainage District	Yes
Fabius River Drainage District	Yes
Marion County Drainage District	Yes
South River Drainage District	Yes
South Quincy Drainage & Levee District	No
Sny Island Levee & Drainage District (Upper Unit)	Yes
Sny Island Levee & Drainage District (Middle & Lower Units)	No

Most of the agricultural levees on the Mississippi River in the study area are eligible for Corps of Engineers emergency repairs under the authority of Public Law 84-99. Levees are determined eligible by an ongoing periodic inspection program. Table R-11 shows a listing of agricultural levees and their eligibility for emergency repairs status.

Table R-11

Flood Plain Management Assessment
Eligibility of Agricultural Levees for Emergency Repairs
Mississippi River Agricultural Levees
Muscatine, Iowa, to Hannibal, Missouri

Levee District	Eligible for Emergency Repairs
Muscatine Island Levee District	Yes
Drury Drainage District	Yes
Bay Island Drainage & Levee District No. 1 and Subdistrict No. 1 of Drainage Union No. 1	Yes
Iowa River-Flint Creek Levee District No. 16	Yes
Henderson County Drainage District No. 3	No
Henderson County Drainage District No. 1	Yes
Henderson County Drainage District No. 2	Yes
Green Bay Levee District No. 2	Yes
Des Moines-Mississippi Levee District No. 1	Yes
Mississippi Fox Drainage & Levee District No. 2	Yes
Gregory Drainage District	Yes
Hunt & Lima Lake Drainage District	Yes
Indian Grave Drainage District	Yes
Union Township Drainage District	No
Fabius River Drainage District	Yes
Marion County Drainage District	Yes
South River Drainage District	Yes
South Quincy Drainage & Levee District	Yes
Sny Island Levee & Drainage District	Yes

Notes:
(1) Levees active in the Corps of Engineers inspection program are eligible for emergency repairs under the authority of the Flood and Coastal Storm Emergencies Act (33 U.S.C. 701n) (69 STAT. 186, Public Law 84-99).
(2) Rock Island District, Corps of Engineers inspection list, dated August 11, 1993.

PLAN FORMULATION

Six alternatives are examined for agricultural levees. At one extreme, levees would be completely removed and possibly restored to natural areas. At the other extreme, levees would be raised to a very high level to protect against virtually every flood. Moderate alternatives are to set back levees to increase the area available for flood conveyance, and to notch levees at the 25-year level to allow agricultural production in dry years and make provisions for occasional flooding in the least damaging method possible. Restoring levees in-kind maintains the base condition that exists in 1994, including the completion of levee repairs currently under way. The subject of limiting the flood fight is examined as a sixth alternative.

Levee Storage and Conveyance - In order to analyze the effects of levee storage and conveyance on water surface profiles, the unsteady flow model UNET was used. Each of the action alternatives was modeled to produce water surface profiles which could be compared with the calibrated profile of the 1993 flood, the base condition for hydraulic analyses. Each alternative was modeled individually. By not combining alternatives, the impact that each action alternative has on river stages is more clearly defined. The hydraulics appendix contains details of the model and the methodology used in the analysis.

The effect on water surface profiles of storage and conveyance behind levees varies with the alternative under consideration. Alternatives in which the levees remained intact consider only storage effects. This assumption was based on observation during the 1993 flood. Once the levied areas filled with water following overtopping, water clarity improved, leading to the conclusion that there was minimal flow occurring behind the levees. Removal of levees considers conveyance as well as storage since levee cells would no longer be continuously obstructing the flow path. The major factors which govern the effects of storage and conveyance on water surface profiles are size of the protected area behind the levee, timing of failure or overtopping of the levee during the course of the flood event, land use in the protected area, and the location and concentration of levees along the river.

RESTORING LEVEES IN-KIND

The base condition for the assessment is the restored levee system as exists in 1994, including any levee repairs under way. The profiles show levee elevations as they existed prior to the flood and the increase in elevation due to emergency floodfighting measures. Levees were typically raised by pushing up the landside embankment face with a bulldozer and using sandbags. This option applies to Scenario 1 only.

Cultural Resources - Cultural resource impacts of restoration in-kind following the Flood of 1993 can be summarized for the levee repairs conducted under Public Law 84-99 in the study area. Three sites impacted by repairs were determined eligible for inclusion in the National Register of Historic Places. One was the historic town site of West Quincy, Missouri. The remaining two were Missouri pump stations in the Fabius River and the Marion County Drainage Districts.

Mitigation for repair impacts at West Quincy included archaeological and archival research. The two pump stations received Historic American Buildings Survey architectural documentation supplemented with a summary of the historical development of the respective drainage districts.

Three archaeological sites were avoided by removal from project borrow areas in the Mississippi Fox Drainage & Levee District No. 2. These sites were removed without determinations of National Register eligibility being made.

An unknown number of cultural resource sites was protected or avoided by the use of repair plans intentionally designed to minimize damage to these resources. For example, use of existing or previously disturbed borrow locations was encouraged whenever possible. Restrictions also were placed on sand recovery in some instances in order to avoid disturbance to pre-flood soil surfaces or to maintain recovery within the existing levee right-of-way.

In general, impacts from the actual restoration-in-kind activities under Public Law 84-99 following the Flood of 1993 are judged by Rock Island District cultural resource specialists to have been negative ($^{-5}...._{-2}.^{0}.....^{+5}$) compared to the existence and operation of the levee system under non-overtopping conditions.

Not considered here as impacts of restoring the levees in-kind are the considerable damages to both historic structures and archaeological sites that were sustained throughout the levee districts, but which occurred beyond the areas impacted by repairing the levees to a pre-flood condition. Damage to structures was widespread and catastrophic. Scour holes and extensive soil erosion affected cultural resource sites in areas well beyond those locations involved in levee repairs. This more complete set of damages, however, is taken into consideration as part of the existence and operation of the current levee system when comparisons of the remaining five alternatives are made to the current or "zero" condition as described below.

For the remaining five alternatives, the impacts to cultural resources throughout the levee districts resulting from the existence and operation of the current (pre-1993 or rebuilt-in-kind) levee system are arbitrarily assumed to be "zero." Negative or positive variations are given for each alternative based on judgments representing the professional opinion of Rock Island District cultural resource specialists.

Positive impacts of the current levee system are prevention of flood damages to structures and protection of archaeological sites from flood-induced and/or bank line erosion. Negative impacts are primarily those associated with agricultural production, residential and commercial development, and the extensive damages from periodic levee failures, including those involved in post-flood repairs.

LIMITED FLOOD FIGHT

This section is presented in Chapter 9 of the Main Report.

PERMANENT LEVEE REMOVAL

General - Several options are possible for permanent levee removal. The areas could remain in agricultural production with a much greater probability of sustaining flood damages. Alternatively, the areas could be restored as wildlife habitat. Natural systems, such as the flood pulse, would be allowed to function without interference.

Remove Sample Agricultural Levee - A plan was formulated using the Drury Drainage District, Illinois, as a sample area. The agricultural levee is 9.6 miles in length and covers 165 acres. The levee protects 4,165 acres from flooding on the Mississippi River. Permanent removal would involve degrading fifty 100-foot sections of levee. Sections would be removed every 1,000 feet, allowing floodwaters to enter the area unimpeded (see plate R-11).

The environmental option would involve purchasing 4,165 acres in fee title. Wetland plants would be established on 3,125 acres, and forest plants would be established on 1,040 acres.

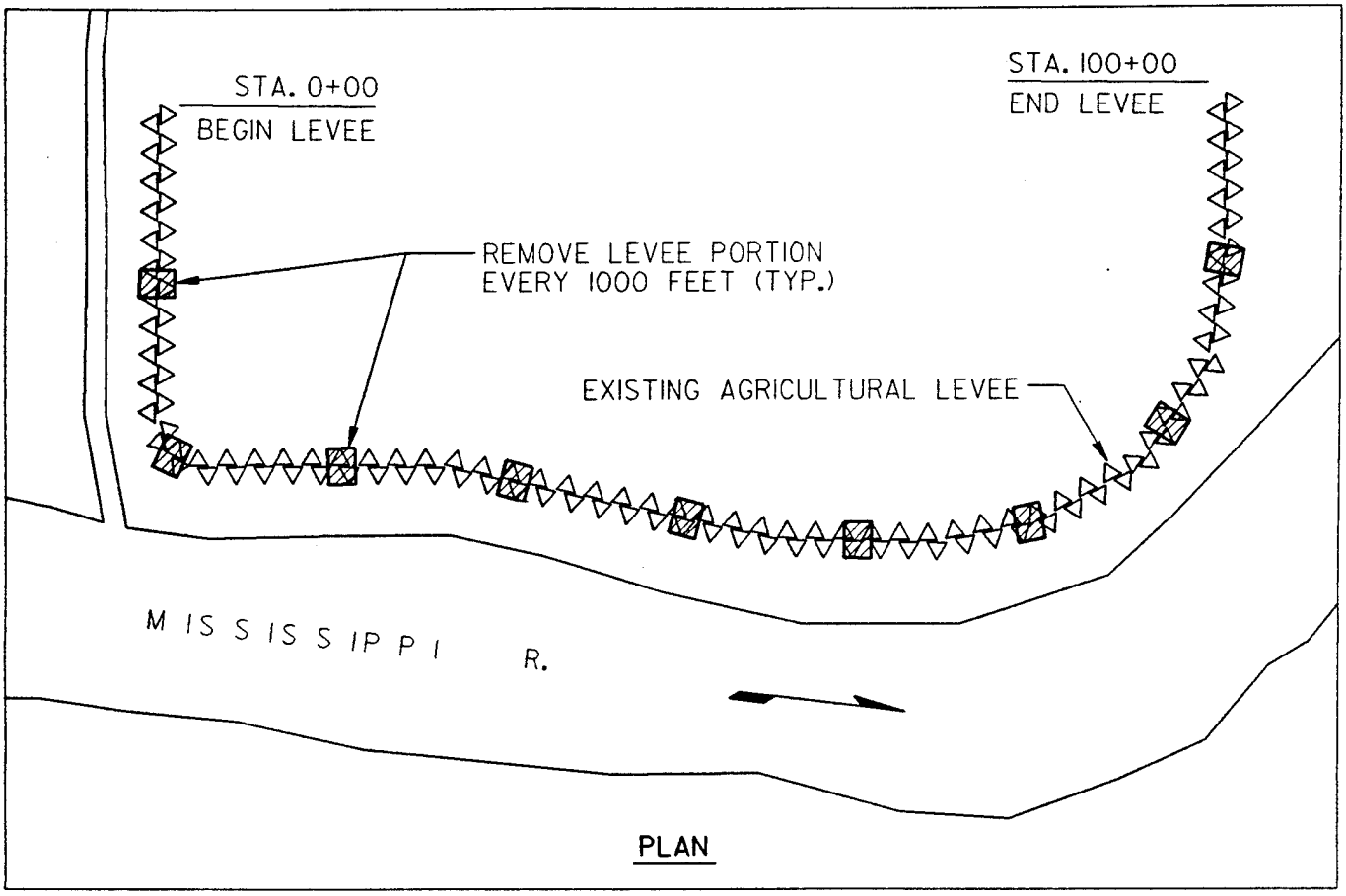
The agricultural production option would involve purchasing 4,165 acres of flood easement. The land would remain in agricultural production. Costs for both options are found in Tables R-14 and R-15.

Table R-14

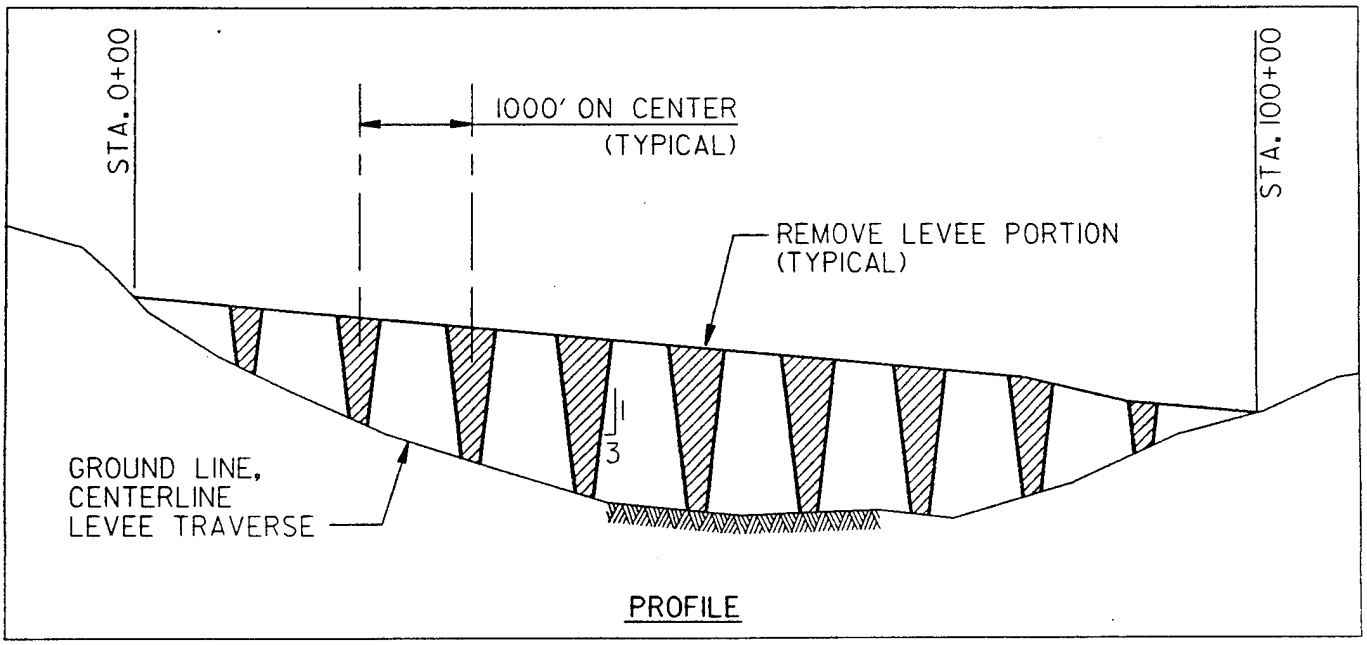
Cost to Remove Sample Agricultural Levee
(Environmental Option)
Flood Plain Management Assessment

Category	Cost ($000)	Total ($000)
LANDS AND DAMAGES		
Purchase 4,165 acres in fee title and existing 9.6-mile levee (165 acres)	16,200.0	
		16,200.0
FISH AND WILDLIFE FACILITIES		
Establish 3,125 acres wetland plants	6,250.0	
Establish 1,040 acres forest plants	4,160.0	
		10,410.0
LEVEES AND FLOODWALLS		
Remove fifty 100-foot levee segments	650.0	650.0
		27,260.0

Notes:
(1) Costs were developed for the Drury Drainage District, Illinois.
(2) Does not include Planning, Engineering and Design; or Construction Management Costs.
(3) Land and property values for other drainage districts in the study area may differ from those identified in the sample. Agricultural lands may vary in market value depending on productive capacity and local market conditions. Other drainage districts may include more intensive land uses such as residential, commercial, and industrial uses that would have significantly different land and property values. Relocation assistance (Public Law 91-646) may vary substantially based on the number and type of improvements located in a drainage district. Project enhancement or condemnation blight have not been considered in the sample estimate.



PLAN



PROFILE

FLOOD PLAIN MANAGEMENT
ASSESSMENT

PERMANENT
LEVEE REMOVAL

Plate
R-11

Table R-15

Cost to Remove Sample Agricultural Levee
(Crop Production Option)
Flood Plain Management Assessment

Category	Cost ($000)	Total ($000)
LANDS AND DAMAGES		
Purchase 4,165 acres flood easement and existing 9.6-mile levee (165 acres)	15,000.0	15,000.0
LEVEES AND FLOODWALLS		
Remove fifty 100-foot levee segments	650.0	650.0
		15,650.0

Notes:
(1) Costs were developed for the Drury Drainage District, Illinois.
(2) Does not include Planning, Engineering and Design; or Construction Management Costs.
(3) Land and property values for other drainage districts in the study area may differ from those identified in the sample. Agricultural lands may vary in market value depending on productive capacity and local market conditions. Other drainage districts may include more intensive land uses such as residential, commercial, and industrial uses that would have significantly different land and property values. Relocation assistance (Public Law 91-646) may vary substantially based on the number and type of improvements located in a drainage district. Project enhancement or condemnation blight have not been considered in the sample estimate.

Remove All Agricultural Levees - One alternative to reduce flood damages would be to permanently remove 419 miles of agricultural levees in 19 levee districts. The levees protect 354,000 acres from flooding on the Mississippi River and tributary streams. Permanent removal would involve degrading two thousand two hundred (2,200) 100-foot sections of levee. Sections would be removed every 1,000 feet, allowing floodwaters to enter the area unimpeded.

Removing all of the agricultural levees could impact the lock and dam system. It may be necessary to modify Federal structures in some cases, if warranted.

The environmental option would involve purchasing 354,000 acres in fee title. Wetland plants would be established on 240,000 acres, and forest plants would be established on 80,000 acres. The remaining area would be inundated by normal river levels.

The agricultural production option would involve purchasing 354,000 acres of flood easement. The land would remain in agricultural production. Costs for both options are found in Tables R-16 and R-17.

Table R-16

Cost to Remove All Agricultural Levees
(Environmental Option)
Flood Plain Management Assessment

Category	Cost ($000)	Total ($000)
FISH AND WILDLIFE FACILITIES		
Establish 240,000 acres wetland plants	480,000.0	
Establish 80,000 acres forest plants	320,000.0	
		800,000.0
LEVEES AND FLOODWALLS		
Remove 100-foot levee segments (Quantity = 2,200)	28,600.0	
		28,600.0
		829,000.0

Notes:
(1) Costs for lands and damages were not developed.
(2) Does not include Planning, Engineering and Design; or Construction Management Costs.
(3) Land and property values for other drainage districts in the study area may differ from those identified in the sample. Agricultural lands may vary in market value depending on productive capacity and local market conditions. Other drainage districts may include more intensive land uses such as residential, commercial, and industrial uses that would have significantly different land and property values. Relocation assistance (Public Law 91-646) may vary substantially based on the number and type of improvements located in a drainage district. The cost of lands and damages found in the example cannot be used to project the cost for other drainage districts. The level of study required to determine costs of lands and damages for removal of levees is not within the scope of the assessment.

Table R-17

Cost to Remove All Agricultural Levees
(Crop Production Option)
Flood Plain Management Assessment

Category	Cost ($000)	Total ($000)
LEVEES AND FLOODWALLS		
Remove 100-foot levee segments (Quantity = 2,200)	28,600.0	

Notes:
(1) Costs for lands and damages were not developed.

(2) Does not include Planning, Engineering and Design; or Construction Management Costs.
(3) Land and property values for other drainage districts in the study area may differ from those identified in the sample. Agricultural lands may vary in market value depending on productive capacity and local market conditions. Other drainage districts may include more intensive land uses such as residential, commercial, and industrial uses that would have significantly different land and property values. Relocation assistance (Public Law 91-646) may vary substantially based on the number and type of improvements located in a drainage district. The cost of lands and damages found in the example cannot be used to project the cost for other drainage districts. The level of study required to determine costs of lands and damages for removal of levees is not within the scope of the assessment.

Scenario 1 does not apply in this case. Scenario 2 is the option to remove the levee and continue agricultural production. Scenario 3 is the option to remove the levee and restore the land to wildlife habitat.

Hydrology and Hydraulics - The impact that removal of levees would have on water surface profiles is highly dependent upon the land use after removal. Assuming the land were allowed to revert to a natural condition populated with trees and dense vegetation, simulation with the UNET model shows stages would be reduced on the average by 1 to 3 feet throughout the study reach. If the land were to continue to be utilized primarily for agriculture, reductions in stage would average 5 to 7 feet. Table R-18 shows the impact levee removal has on water surface elevations at key gages within the impact reach.

Simulation of these conditions was intended to provide a range of what might be expected if the levees were removed. However, in modeling this alternative, the broad assumption was made that the entire flood plain would be available for conveyance of flood flows. Realistically, conveyance in the overbanks would be limited by features such as railroad and roadway embankments, buildings, and existing vegetation. Time constraints and limited data prevented inclusion of these features in the model. It is possible that a more refined model may produce results for these conditions which are significantly different from those presented in this report.

Table R-18

Flood Plain Management Assessment
Impact of Removal of Agricultural Levees
Mississippi River-Muscatine, Iowa, to Hannibal, Missouri

Location	Computed WSEL	Levee Removal Agricultural Condition Difference in Feet	Levee Removal Natural Condition Difference in Feet
Muscatine	556.0	-6.6	-2.8
Burlington	536.4	-1.7	-0.9
Quincy	490.0	-6.6	-1.9
Hannibal	476.0	-5.5	-1.6

Cultural Resources - This is judged to have an extremely negative impact on historic structures in the flood plain ($^{-5}_{-5}....^{0}.....^{+5}$). Increased flood frequency would result in increased deterioration of structures accompanied by accelerated rates of abandonment and demolition.

Although the impacts to archaeological sites are more varied, the consequences of permanent levee removal on these resources are judged to be strongly positive ($^{-5}.....^{0}..._{+4}.^{+5}$).

One positive consequence for archaeological resources would be decreased site disturbance from agricultural practices as fields are abandoned. Increased sediment deposition would also benefit sites by counteracting natural trends in soil erosion. Where agricultural fields remained in production, the added sediment would slow, or perhaps reverse, the gradual degradation of deposits now occurring on near-surface sites. Less surface exposure from agriculture would reduce the rate of loss of site contents to collecting and vandalism. Damages from scouring and other consequences of catastrophic levee breaks would be eliminated as would damages sustained during levee repairs.

Negative impacts on archaeological sites from permanent levee removal would result from erosion in the vicinity of the degraded levee sections. This would be a concern regardless of whether the actual sections were hardened. This erosion could impact both surface-exposed and deeply buried deposits.

Careful selection of sections to degrade would be required in order to avoid placements that could impact important cultural resource sites. Opening large sections along more recently abandoned channels while leaving large stretches of un-degraded levee along archaeologically sensitive areas is preferable to systematic notching. This procedure should be followed whenever hydraulically feasible.

Other negative impacts would arise from erosion associated with the natural re-establishment of watercourses within the levee districts. The consequences of changes in the water table are difficult to predict, but could have a negative impact on the accessibility of sites to archaeological investigation. On the other hand, increasing water tables could provide protection for some types of artifacts and ecofacts in more deeply buried deposits.

Another alternative is for permanent levee removal with a government buyout. This proposal is the same as the preceding one, except that the formerly levied acreage would be purchased by the government. The issues associated with cultural resources are the same as above, except for the mitigative actions that would result from the fact of governmental (Federal) involvement.

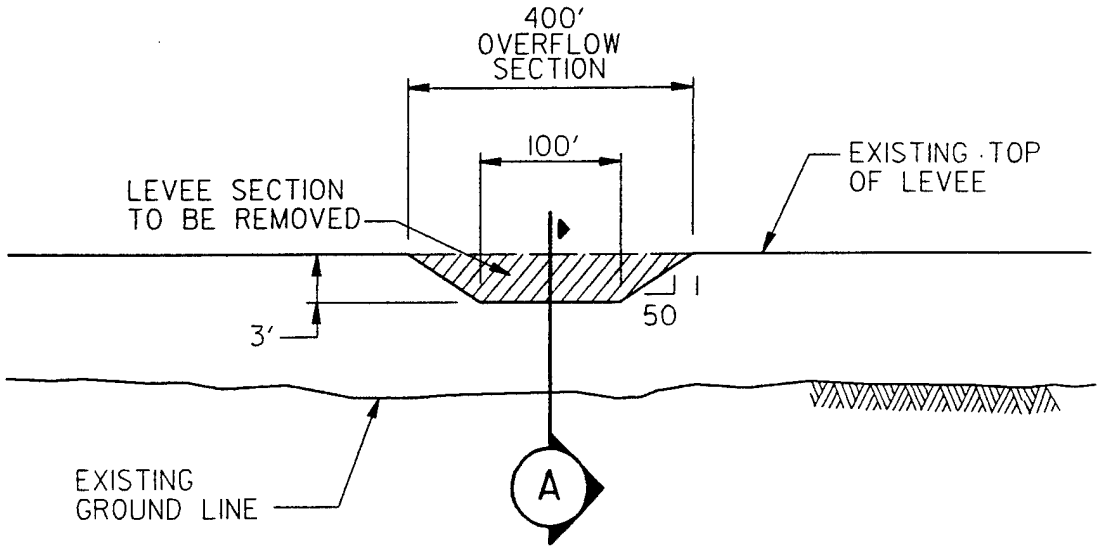
This is judged to have a negative impact on historic structures in the flood plain ($^{-5}..._{-3}..^{0}.....^{+5}$). Increased flood frequency would result in increased deterioration of structures accompanied by accelerated rates of abandonment and demolition that would be offset only by the mitigative measures associated with governmental acquisition and ownership. Note that this alternative is judged only somewhat less negatively for historic structures than simple levee removal. This is because structures would generally require considerable expenditures to protect in place; therefore, they are more likely to be demolished following Historic American Buildings Survey or Historic American Engineering Record recordation.

For archaeological sites, the consequences of permanent levee removal with government buyout are judged to be very strongly positive ($^{-5}$ .....^{0}....$_{+5}$ $^{+5}$) for the same reasons as above. In addition, the governmental acquisition and ownership would assure adequate consideration of the impacts to archaeological sites. Just as with historic structures, this alternative is seen as having more positive impacts for archaeological sites than simple levee removal.

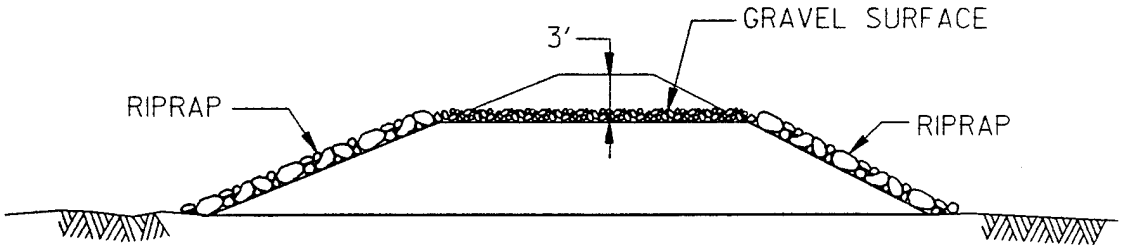
MAXIMUM LEVEE HEIGHT AT 25-YEAR LEVEL

The 25-year maximum height alternative involves constructing overflow sections in each agricultural levee at a pre-determined elevation. The minimum number of sections required for each levee district is shown in Table R-19. Ideally, an overflow section would be set in the downstream end of a levee, as shown on Plate R-22. In the event of overtopping, floodwater would back into the protected area at a low, damage minimizing velocity. This is the case for Scenarios 2 and 3. Scenario 1 does not apply for this alternative.

Levees also may require the addition of superiority features to ensure overtopping at the overflow weir. An illustration of the superiority concept is shown on Plate R-23. The cost to install overflow weirs is shown in Table R-20.



LEVEE PROFILE AT
OVERFLOW WEIR
NO SCALE



A LEVEE SECTION AT
OVERFLOW WEIR
NO SCALE

FLOOD PLAIN MANAGEMENT
ASSESSMENT

OVERFLOW
WEIR DETAILS
Plate
R-22

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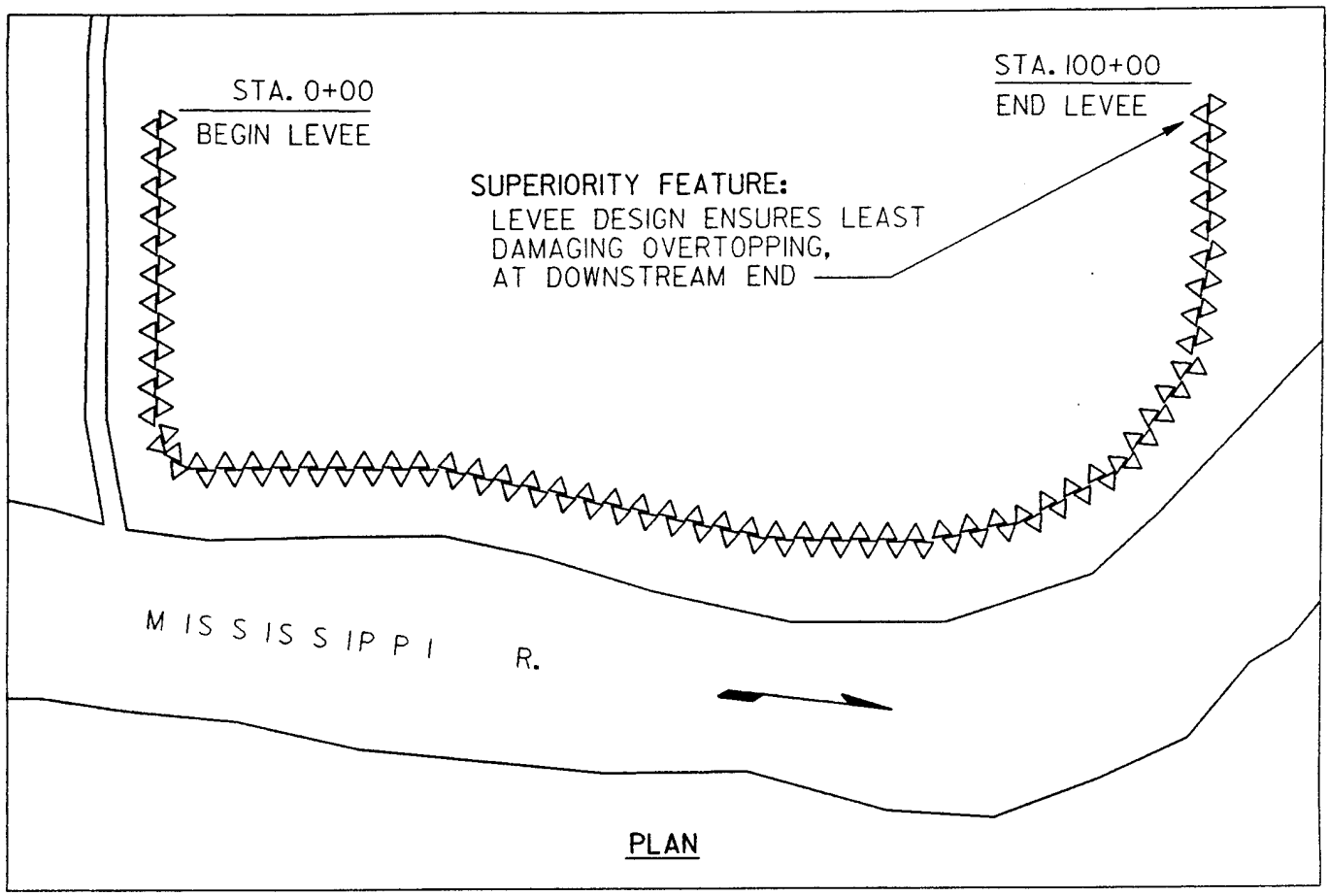
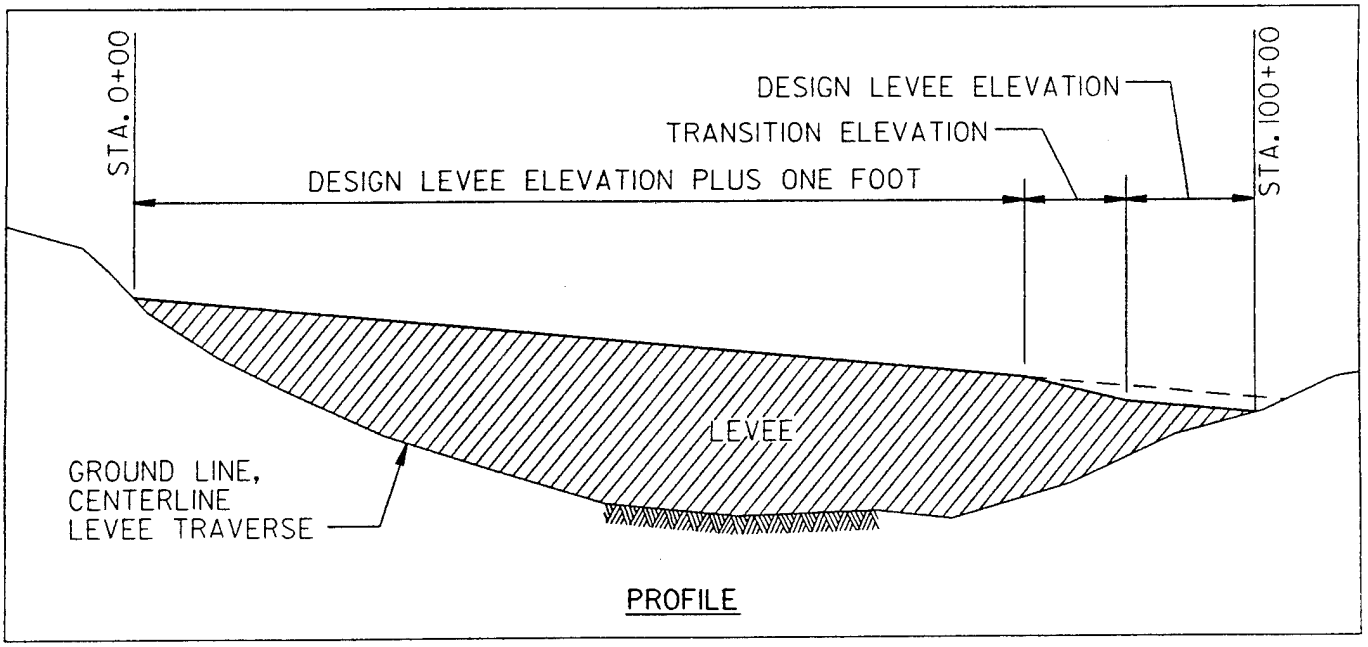




FLOOD PLAIN MANAGEMENT
ASSESSMENT

LEVEE
SUPERIORITY Plate R-23

Table R-19

Location of Agricultural Levee Overflow Weirs
Flood Plain Management Assessment

Levee District	Minimum Number of Weirs Needed
Muscatine Island Levee District	2
Drury Drainage District	1
Bay Island Drainage & Levee District No. 1 and Subdistrict No. 1 of Drainage Union No. 1	1
Iowa River-Flint Creek Levee District No. 16	3
Henderson County Drainage District No. 3	2
Henderson County Drainage District No. 1	1
Henderson County Drainage District No. 2	2
Green Bay Levee District No. 2	1
Des Moines-Mississippi Levee District No. 1	2
Mississippi Fox Drainage & Levee District No. 2	4
Gregory Drainage District	1
Hunt & Lima Lake Drainage District	2
Indian Grave Drainage District	2
Union Township Drainage District	1
Fabius River Drainage District	1
Marion County Drainage District	1
South River Drainage District	1
South Quincy Drainage & Levee District	1
Sny Island Levee & Drainage District (Upper Unit)	4
	Total - 33

Table R-20

Cost to Construct Agricultural Levee Overflow Weirs
Flood Plain Management Assessment

Category	Cost ($000)	Total ($000)
FLOODWAY CONTROL & DIVERSION STRUCTURES (Construct 33 overflow weirs)		
Riprap (2,900 CY each)	2,870.0	
Granular Surfacing (200 CY each)	198.0	
Earthwork (400-foot section each)	99.0	
		3,167.0

Notes:
(1) Costs for lands and damages were not developed.

(2) Does not include Planning, Engineering and Design; or Construction Management Costs.
(3) Land and property values for other drainage districts in the study area may differ from those identified in the sample used for removal of agricultural levees. Agricultural lands may vary in market value depending on productive capacity and local market conditions. Some drainage districts may include more intensive land uses such as residential, commercial, and industrial uses that would have significantly different land values. Relocation benefits (Public Law 91-646) may vary substantially based on the number and type of improvements located in a drainage district. The cost of lands and damages found in the example cannot be used to project the cost for other drainage districts. The level of study required to determine costs of lands and damages for construction of overflow weirs is not within the scope of the assessment.

Levee overtopping damages could be reduced by construction of overflow weirs in agricultural levees. By controlling overtopping in the least damaging method possible, there would be a reduction or elimination of repair costs and land restoration costs associated with levee breaches. Levee repair costs from the Flood of 1993 are shown in Table R-21.

Table R-21

Flood Plain Management Assessment
Agricultural Levees Repaired by Corps
Mississippi River Agricultural Levees
Muscatine, Iowa, to Hannibal, Missouri

Emergency Repairs Resulting from Flood of 1993	Cost ($000)
Iowa River-Flint Creek Levee District No. 16	1,300.0
Green Bay Levee District No. 2	2,500.0
Mississippi Fox Drainage & Levee District No. 2	700.0
Des Moines-Mississippi Levee District No. 1	2,500.0
Gregory Drainage District	4,000.0
Hunt & Lima Lake Drainage District	9,250.0
Indian Grave Drainage District	9,500.0
Fabius River Drainage District	4,000.0
Marion County Drainage District	2,500.0
South River Drainage District	3,300.0
South Quincy Drainage & Levee District	60.0
Sny Island Levee & Drainage District (Upper Unit)	4,200.0
	43,800.0

Note: Emergency repairs were conducted by the Corps of Engineers under the authority of the Flood and Coastal Storm Emergencies Act (33 U.S.C. 701n) (69 STAT. 186, Public Law 84-99).
Repairs made as the result of the Flood of 1993.

The installation of an overflow weir would eliminate the need for flood fight levee raises. Overtopping at the pre-determined 25-year level would be planned and accepted by involved parties. State or Federal government would maintain an interest in the overtopping elevation to prevent unauthorized floodfighting activities. Levee elevation flood fight and levee grade restoration costs are included in Table R-12.

Hydrology and Hydraulics - UNET simulation of this alternative shows that overflow sections constructed at a 25-year level would have an impact on water surface profiles similar to limiting flood fight levee raises. Again, failure of the middle cell of the Sny Levee and Drainage District during the simulation, along with changes in timing of levee failures, were responsible for most of the decrease in water surface elevations at the downstream end of the district. Upstream, between Lock and Dam 16 and Burlington, Iowa, reductions in stage were greater than those for the no flood fight levee raise alternative. This was because all of the levees fail under the 25-year overflow option, even those that did not fail during the 1993 flood. Table R-22 shows the impact that construction overflow sections at the 25-year level have on water surface elevations.

The major benefit of providing an overflow section in the levee is the reduction in flood fight costs and damage to the levee. Reduction of the water surface profile is no greater than what could be achieved by limiting flood fight levee raises. Also, flooding would occur earlier and with events smaller than the 1993 flood since the level of protection would be reduced. Most of the levees within the Rock Island District are designed to provide protection against a 50-year flood event.

Table R-22

Flood Plain Management Assessment
Impact of 25-Year Controlled Overtopping of Agricultural Levees
Mississippi River-Muscatine, Iowa, to Hannibal, Missouri

Location	1993 Computed WSEL	25-Year Controlled Overtopping Difference in Feet
Muscatine, Iowa	556.0	-0.6
Burlington, Iowa	536.4	-1.1
Quincy, Illinois	490.0	-2.3
Hannibal, Missouri	476.0	-3.3

Cultural Resources - This is judged to have a very negative impact on historic structures in the flood plain ($^{-5}$.$_{-4}$...^{0}.....$^{+5}$). Increased flood frequency would result in increased deterioration of structures accompanied by accelerated rates of abandonment and demolition second only to that of complete levee removal.

None of the positive effects for archaeological sites that were seen with complete levee removal are predicted here. Little agricultural abandonment

would occur in the levee districts, and only minor amounts of sediment would offset agricultural erosion. The negative impacts would be limited mainly to the establishment and maintenance of the overflow weirs. Overall, the impacts to archaeological sites are judged as slightly negative compared to the existing operation of the levee system ($^{-5}\ldots\ldots_{-1}{}^{0}\ldots\ldots{}^{+5}$).

RAISE LEVEES TO 500-YEAR LEVEL

Agricultural levees raised to the relatively high 500-year level would offer protection from most floods. The likelihood of a levee being overtopped would be reduced to a very slight risk. Agricultural levees currently have a relatively low level of protection, typically designed to protect against the 50-year flood with 3 feet of freeboard. A typical section for the levee raise is found on Plate R-29. This is the case for Scenario 1.

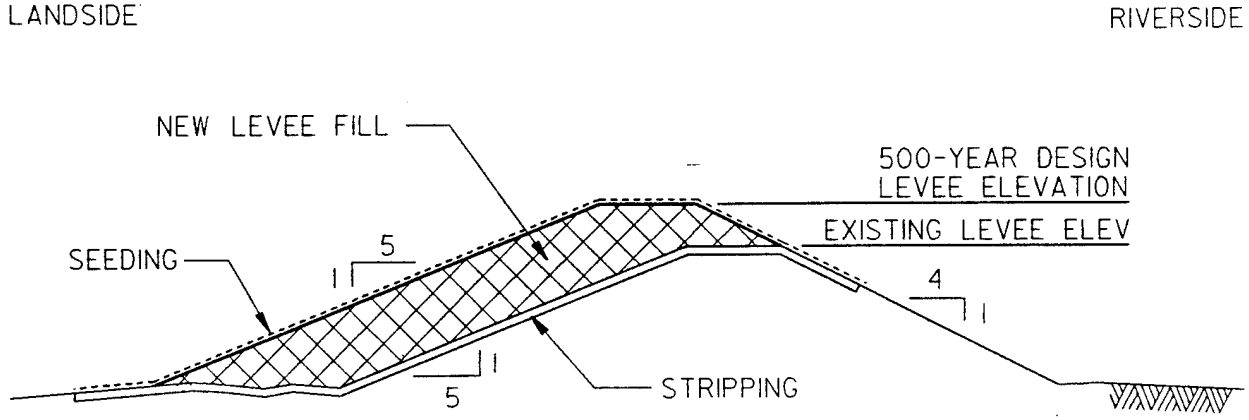
Raise Sample Agricultural Levee - An alternative was formulated to raise a sample agricultural levee. The cost estimate was done with a general level of detail and includes lands and damages, and closure structures. Cost estimates for other levee districts would vary considerably from the sample area. The cost estimate is found in Table R-23.

Table R-23

Cost to Raise Sample Agricultural Levee
Flood Plain Management Assessment

Category	Cost ($000)	Total ($000)
LANDS AND DAMAGES		
(40 acres)	150.0	
		150.0
LEVEES AND FLOODWALLS		
(Raise 9.6 miles of levee)		
Stripping Foundation (116,000 CY)	349.0	
Embankment from Borrow-Clay or Sand (1,190,000 CY)	6,154.0	
Seeding (151 Acres)	227.0	
		6,775.0
		6,925.0

Notes:
(1) Raise agricultural levee at Drury Drainage District, Illinois, to the 500-year level of protection.
(2) Does not include Planning, Engineering, and Design; Construction Management; and other costs, as appropriate.
(3) Land and property values for other drainage districts in the study area may differ from those identified in the sample. Agricultural lands may vary



TYPICAL SECTION -
LEVEE RAISE

NO SCALE

FLOOD PLAIN MANAGEMENT
ASSESSMENT

TYPICAL LEVEE RAISE
TO 500-YEAR

Plate
R-29

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in market value depending on productive capacity and local market conditions. Other drainage districts may include more intensive land uses such as residential, commercial, and industrial uses that would have significantly different land and property values. Relocation assistance (Public Law 91-646) may vary substantially based on the number and type of improvements located in a drainage district. Project enhancement or condemnation blight have not been considered in the sample estimate.

Raise All Agricultural Levees - A plan to raise agricultural levees was formulated for the entire study reach. Cost items were limited to foundation preparation (stripping), embankment, and seeding. The cost estimate to raise all agricultural levees is found in Table R-24.

Table R-24

Cost to Raise All Agricultural Levees
Flood Plain Management Assessment

Category	Cost ($000)	Total ($000)
LEVEES AND FLOODWALLS		
(Raise 419 miles of levee)		
Stripping Foundation (4.2 million CY)	12,500.0	
Embankment from Borrow-Clay or Sand (40 million CY)	269,000.0	
Seeding (5,500 Acres)	8,200.0	
		289,700.0

Notes:
(1) Raise agricultural levees to the 500-year level of protection.
(2) Costs for lands and damages were not developed.
(3) Does not include Planning, Engineering and Design; or Construction Management Costs.
(4) Land and property values for other drainage districts in the study area may differ from those identified in the sample. Agricultural lands may vary in market value depending on productive capacity and local market conditions. Other drainage districts may include more intensive land uses such as residential, commercial, and industrial uses that would have significantly different land and property values. Relocation benefits (Public Law 91-646) may vary substantially based on the number and type of improvements located in a drainage district. The cost of lands and damages found in the example cannot be used to project the cost for other drainage districts. The level of study required to determine costs of lands and damages for raising all levees is not within the scope of the assessment.

The alternative to raise agricultural levees does not apply to Scenarios 2 or 3.

Hydrology and Hydraulics - Had all levees been raised to a level at which no levees had failed during the 1993 flood, the increase in the 1993 water surface profile would have been less than 0.5 feet upstream of Fort Madison, Iowa. Downstream, between Fort Madison and Lock and Dam 22, increases in stage of 2.5 to 4.5 feet could be expected. The large increase in stage below Fort Madison can be attributed to the concentration of levees in that reach. In 1993, practically every levee below Fort Madison failed. When levees are raised to contain the 1993 flood, storage that was available in 1993 no longer exists. As a result, higher discharges are conveyed downstream, causing water levels to increase. Increasing the height of the agricultural levees would require an examination of the adequacy of urban flood protection, especially in the lower portion of the Rock Island District. Table R-25 shows the impact that containing the 1993 flood would have on water levels at key gages.

Table R-25

Flood Plain Management Assessment
Impact of 500-Year No Fail Agricultural Levees
Mississippi River-Muscatine, Iowa, to Hannibal, Missouri

Location	1993 Computed WSEL	No Failure 500-Year Levees Difference in Feet
Muscatine, Iowa	556.0	+0.3
Burlington, Iowa	536.4	+0.3
Quincy, Illinois	490.0	+3.8
Hannibal, Missouri	476.0	+3.5

Cultural Resources - Reduced flood damages would have a very positive effect on historic structures in the flood plain. Increases in agricultural, residential, and commercial development would negatively affect historic structures. Overall, the effect of this alternative on structures is judged to be quite positive ($^{-5}.....^{0}...._{+4}.^{+5}$).

Archaeological sites would see varying effects. Positive impacts would result from the reduction of direct flood damages such as scour holes, flood-induced soil erosion, etc. The reduced frequency of major levee repairs also would be of positive benefit to archaeological sites by cutting the need for borrow sites, equipment staging areas, and other repair-related soil disturbances.

On the negative side, some increase in agricultural utilization of the flood plain would mean a continuation and slight increase in the present trend of degradation of near-surface archaeological deposits. Increased residential and commercial development would destroy archaeological sites at an increased rate. The construction-related effects to sites from the actual levee raise also would be negative.

Overall, impacts to archaeological sites from this alternative are judged to be moderately negative ($^{-5}\ldots_{-2}.^{0}\ldots..^{+5}$).

LEVEE SETBACKS

The levee setback alternative explores the benefits of stage reduction by increasing the area available for flood conveyance. The plan would require the removal and setback of 207 miles of levee. The face lengths of levees fronting on the Mississippi River average 11 miles in the study area and are shown on Table R-26. The distance between left and right bank levees was increased by 50%. The distance between left and right bank levees typically ranges from 4,000 to 14,000 feet. A 50% increase would widen the distance between levees ranging from 6,000 feet to 21,000 feet. The average setback distance is 1,600 feet. Typical setback distances are shown in Table R-27. The cost to set back agricultural levees is found in Table R-28. This is the case for Scenarios 2 and 3. Scenario 1 does not apply for setbacks.

Table R-26

Flood Plain Management Assessment
Face Lengths Fronting on Mississippi River
Mississippi River Agricultural Levees
Muscatine, Iowa, to Hannibal, Missouri

Levee District	Length of Face (Miles)
Muscatine Island Levee District	10.5
Drury Drainage District	7.1
Bay Island Drainage & Levee District No. 1 and Subdistrict No. 1 of Drainage Union No. 1	17.3
Iowa River-Flint Creek Levee District No. 16	25.3
Henderson County Drainage District No. 3	6.0
Henderson County Drainage District No. 1	6.0
Henderson County Drainage District No. 2	0.9
Green Bay Levee District No. 2	9.2
Des Moines-Mississippi Levee District No. 1	3.5
Mississippi Fox Drainage & Levee District No. 2	4.3
Gregory Drainage District	8.6
Hunt & Lima Lake Drainage District	16.3
Indian Grave Drainage District	9.1
Union Township Drainage District	3.8
Fabius River Drainage District	7.6
Marion County Drainage District	2.4
South River Drainage District	7.9
South Quincy Drainage & Levee District	6.9
Sny Island Levee & Drainage District	54.0
	206.7

Table R-27
Flood Plain Management Assessment
Typical Levee Setback Distances
Mississippi River Agricultural Levees
Muscatine, Iowa, to Hannibal, Missouri

Levee District	Average Levee Setback (Feet)
Muscatine Island Levee District	1,300
Drury Drainage District	1,000
Bay Island Drainage & Levee District No. 1 and Subdistrict No. 1 of Drainage Union No. 1	1,200
Iowa River-Flint Creek Levee District No. 16	1,800
Henderson County Drainage District No. 3	1,700
Henderson County Drainage District No. 1	1,700
Henderson County Drainage District No. 2	1,700
Green Bay Levee District No. 2	1,700
Des Moines-Mississippi Levee District No. 1	1,000
Mississippi Fox Drainage & Levee District No. 2	3,400
Gregory Drainage District	1,200
Hunt & Lima Lake Drainage District	1,200
Indian Grave Drainage District	3,100
Union Township Drainage District	1,700
Fabius River Drainage District	1,500
Marion County Drainage District	1,700
South River Drainage District	1,200
South Quincy Drainage & Levee District	1,500
Sny Island Levee & Drainage District	2,200

Table R-28
Cost to Set Back Agricultural Levees
Flood Plain Management Assessment

Category	Cost ($000)	Total ($000)
Cost to Remove All Agricultural Levees (from Table R-16)		28,600.0
LEVEES AND FLOODWALLS (Construct 207 miles of levee)		
Stripping Foundation (3.2 million CY)	9,540.0	
Embankment from Borrow-Clay or Sand (51 million CY)	203,700.0	
Seeding (4,000 Acres)	6,050.0	
		219,290.0
		247,890.0

Notes:
(1) Setback levees constructed to same elevation as existing levees.
(2) Does not include Planning, Engineering and Design; or Construction Management Costs.
(3) Land and property values for other drainage districts in the study area may differ from those identified in the sample. Agricultural lands may vary in market value depending on productive capacity and local market conditions. Other drainage districts may include more intensive land uses such as residential, commercial, and industrial uses that would have significantly different land and property values. Relocation benefits (Public Law 91-646) may vary substantially based on the number and type of improvements located in a drainage district. The cost of lands and damages found in the example cannot be used to project the cost for other drainage districts. The level of study required to determine costs of lands and damages for construction of setback levees is not within the scope of the assessment.

Cultural Resources - Impacts to historic structures from setting back the levees would be overwhelmingly negative for those structures left riverward of the levee. For those still protected, the results of reduced levee overtopping would be positive. Overall, this alternative is judged to have a solidly negative impact on historic structures ($^{-5}..._{-3}..^{0}.....^{+5}$).

Some positive benefit for archaeological sites would result from levee setbacks. The abandonment of farm fields riverward of the new levees would halt the degradation of near-surface archaeological deposits, while sedimentation would cover and protect many archaeological sites.

Negative effects would result from increased susceptibility to erosion at archaeological sites left riverward of the new levees. The natural tendency of the river to meander would have a long-term negative impact as these archaeological sites were destroyed by movement of the river channel. Landforms such as old natural levees near the present river channel would be particularly vulnerable, as would other archaeologically rich landforms left within the river's reach.

The most overwhelming and immediate impact of levee setbacks would be the damage sustained from construction of the new levees. Even if the need for borrow could be reduced by utilizing the existing levees, soil disturbance within the new construction right-of-way would be extensive and generally have greater archaeological impacts than those within the original levee right-of-way. This is because landforms farther back from the present channel generally have a greater potential for containing archaeological sites than those near the channel. Overall, the effects of levee setbacks are judged to be solidly negative for archaeological resources ($^{-5}..._{-3}..^{0}.....^{+5}$).

URBAN LEVEES

STUDY AREA

The study area is located in central Iowa in the vicinity of the city of Des Moines and the confluence of the Des Moines and Raccoon Rivers. The city of Des Moines is the state capital.

PLAN FORMULATION

Much of the urban study area in the vicinity of the city of Des Moines has existing flood protection or flood damage reduction projects under construction. Alternatives were examined for no change, increasing levee heights to a very high elevation and protection to specific critical facilities. Existing urban levees are listed in Table R-29 and urban levees under construction are listed in Table R-30.

Table R-29

Flood Plain Management Assessment
Existing Urban Levees
Vicinity of the City of Des Moines, Iowa

Levee	Location
Des Moines Project	Des Moines
Water Works	Des Moines
Birdland Levee	Des Moines
SE Des Moines Remedial Works	Des Moines, Pleasant Hill
Central Place Levee	Des Moines
Raccoon River-Valley Drive	Des Moines

Table R-30

Flood Plain Management Assessment
Urban Levees Under Construction
Vicinity of the City of Des Moines, Iowa

Levee	Location	Initiate Construction
Raccoon River & Walnut Creek	Des Moines, West Des Moines	October 1993
Raccoon River-Valley Drive	Des Moines	1994?

Note: Existing levee at Raccoon River-Valley Drive to be significantly improved with new construction.

EXPERIENCE DURING THE FLOOD OF 1993

Existing urban levees offered a sufficient level of protection against the flood of 1993 in most cases. There were two incidents of levee overtopping and one incident of widespread urban flooding on the Raccoon River. The Water Works levee and the Raccoon River-Valley Drive levee were both overtopped by the Raccoon River. Record high water stages on the Raccoon River during the Flood of 1993 overwhelmed the Water Works levee.

The Raccoon River-Valley Drive levee did not provide a level of protection similar to the typical urban levee. The Corps of Engineers was preparing to proceed to construction with a project to improve the Raccoon River-Valley Drive levee at the time of the Flood of 1993. As a result of the flood experience, the levee elevation design has been raised 1.5 to 2 feet.

High water damages occurred in the city of West Des Moines during the Flood of 1993. The city does not have a flood control project. The Corps of Engineers was preparing to proceed to construction with a project to improve the Raccoon River-Valley Drive levee at the time of the Flood of 1993. As a result of the flood experience, the levee elevation design has been raised up to 1 foot.

The cities of Des Moines and West Des Moines have taken a number of actions as a result of the Flood of 1993. Repairs and improvements have been made to several flood control projects. The design of two levees under construction has been modified based upon experience gained from the Flood of 1993. Activities on urban levees following the Flood of 1993 are listed in Table R-31.

Table R-31
Flood Plain Management Assessment
Activities on Urban Levees Following Flood of 1993
Vicinity of the City of Des Moines, Iowa

Levee	Improvements
Des Moines Project gate (vicinity Fleur Drive Bridge)	Replace sandbag closure with
Des Moines Project (SE 6th-SE 9th St)	Set back levee from bank as result of flood damages
Water Works	Raise levee
Raccoon River & Walnut Creek	Raise levee design up to 1 foot
Raccoon River-Valley Drive	Raise levee design 1.5 to 2 feet
Birdland Levee	Reconstruct levee
SE Des Moines Remedial Works	Repair damages to flood wall

NO CHANGE TO URBAN LEVEES

The no change alternative would maintain the present scheme of flood protection. No change can be considered under two options: (1) No Change to Urban Levees (existing at time of 1993 flood) and (2) No Change to Urban Levees (completion of projects under construction in 1994). Levees considered under option 1 are shown in Table R-29. Levees considered under option 2 are shown in Tables R-30 and R-31. This is the case for Scenario 1.

Urban levees under construction or modification will be completed in the near future and become part of the base condition. Urban levees will be assessed according to structures in place at the time of the 1993 flood and according to structures expected to be in place in the near future.

An inventory of urban levees is as follows:

Des Moines Project - The Des Moines project was authorized by the Flood Control Act of 1944 as shown in House Document 651, 78th Congress, 2nd session. Construction was initiated by the Corps of Engineers on three reaches (Nos. 3, 4 and 5) in the 1960ś totaling about 10 miles in length. The January 1963 construction estimate was $2,060,000 Federal and $950,000 non-Federal.

Reach No. 3 is on the left descending bank of the Des Moines River from Maple Street to the area of the Sewage Treatment Works. Reach No. 4 is on the right descending bank of the Des Moines River extending from Grand Avenue to Riverside Park and then along the right descending bank of the Raccoon River up to the vicinity of the Fleur Drive bridge. Reach No. 5 is on the left descending bank of the Raccoon River to First Street and then along the left descending bank of the Des Moines River to Hartford Avenue in the vicinity of Pioneer Park.

In response to experience gained during the 1993 flood, two modifications were made to the Des Moines project. The sandbag closure in Reach No. 4 near the Fleur Drive bridge has been replaced by a gate structure. The levee in Reach No. 3 between SE 6th and SE 9th Streets has been realigned in a configuration set back from the bank.

Water Works - A ring levee surrounds the Des Moines Water Works which is located in the Raccoon River flood plain just upstream of Fleur Drive. The levee was constructed by the Water Works as part of the design of the plant. Following overtopping by the Flood of 1993, the city raised the levee around the Water Works.

Birdland Levee - The Birdland levee was constructed by the city of Des Moines in the 1950ś. The levee runs along the right descending bank of the Des Moines River from Riverview Park to Birdland Park. Improvements to the levee were studied by the Corps of Engineers for the Des Moines project, but were not incorporated into the final design. The Corps of Engineers investigated the feasibility of improving the Birdland levee in 1988, but found a variety of alternatives to lack economic justification. In response to the Flood of

1993, the city has reconstructed the Birdland levee.

Central Place Levee - The Central Place levee was constructed by the city of Des Moines in the 1950ś. The levee runs along the left descending bank of the Des Moines River from the vicinity of Second Avenue to University Avenue. Improvements to the levee were studied by the Corps of Engineers for the Des Moines project, but were not incorporated into the final design.

SE Des Moines Remedial Works - The SE Des Moines Remedial Works is a 6.6-mile Federal structure constructed as part of the Lake Red Rock project. It is located on the left descending bank of the Des Moines River and extends downstream from the vicinity of Highway 46. A partial failure of the wall in the area of the power plant during the Flood of 1993 has been repaired by the Corps of Engineers.

Raccoon River-Valley Drive - The city of Des Moines constructed the levee in the vicinity of Valley Drive in a series of stages, including a realignment in the 1970ś and Water Works Administrative Building levee in 1984. The Corps of Engineers investigated the feasibility of improving the levee in the 1980ś and formulated a justified project to raise the levee to the 100-year level of protection and extend the levee to a length of about 1.3 miles. The construction cost, as shown in the Corps of Engineers May 1988 feasibility report, is $1,356,100 Federal and $462,000 non-Federal. In response to the Flood of 1993, water surface profiles were revised for the Raccoon River and the levee design elevation was increased by 1.5 to 2.0 feet. The updated design was approved for construction in 1994.

Raccoon River and Walnut Creek - A levee project for the Raccoon River and Walnut Creek in West Des Moines and Des Moines was authorized in the Water Resources Development Act of 1986, Public Law 99-662, 99th Congress. The Corps of Engineers formulated an economically justified 100-year level of protection project for a 4-mile levee, primarily protecting the city of West Des Moines. As a result of the Flood of 1993, the levee design was raised up to 1 foot. The first stage of construction was initiated in October 1993.

Cultural Resources - Cultural resource impacts of continuing the urban levee systems as presently designed and operated are both positive and negative.

Positive impacts of the current urban levee system are prevention of flood damages to structures and protection of some small number of archaeological sites from flood-induced and/or bank line erosion. Negative impacts are primarily those associated with continued residential and commercial development and the damages from periodic levee failures, including those involved in post-flood repairs.

Overall, the effect of this alternative on structures is judged to be generally positive ($^{-5}.....^{0}..{}_{+3}..^{+5}$) while the effect on archaeological sites is judged to be generally negative ($^{-5}\ {}_{-3}..^{0}.....^{+5}$).

RAISE URBAN LEVEES TO 500-YEAR LEVEL

The alternative to raise urban levees to the 500-year level falls under Scenario 2. Scenario 3 does not apply.

Raccoon River-Valley Drive - The Corps of Engineers 1988 feasibility study for the Raccoon River-Valley Drive levee included an analysis of 500-year protection. A levee at the 500-year level was found to have economic justification. The selected levee plan which maximized net benefits was for a 100-year level of protection as shown in Table R-32.

Table R-32

Flood Plain Management Assessment
1988 Economics Raccoon River-Valley Drive Levee
Vicinity of the City of Des Moines, Iowa

Category	50-Yr Levee	100-Yr Levee	200-Yr Levee	500-Yr Levee	SPF-Level Levee
Annual Benefits ($000)	177.0	246.7	283.9	317.4	332.9
Annual Costs ($000)	150.0	174.1	224.1	265.2	386.6
Net Benefits ($000)	27.0	72.6	59.8	52.2	-53.7
Benefit-to-Cost Ratio	1.2	1.4	1.3	1.2	0.9

Source: *Definite Project Report, Section 205 Flood Control Project, Raccoon River, Des Moines, Iowa, with Environmental Assessment*, U.S. Army Corps of Engineers, Rock Island District, May 1988, Page 11, Table 3.

Notes:
(1) November 1987 prices, 50-year analysis period, 8-5/8% discount rate.
(2) SPF = Standard Project Flood

Raccoon River and Walnut Creek - A Standard Project Flood levee plan was justified for the Raccoon River and Walnut Creek project by the Corps of Engineers in the June 1975 *Feasibility Study for Flood Damage Reduction and Related Purposes, Des Moines River Basin, Iowa and Minnesota*. The Standard Project Flood levee was recommended for implementation, even though the greatest net benefits were derived for the 200-year level of protection project as shown in Table R-33.

In 1989, a General Reevaluation Report was completed by the Corps of Engineers due to changed conditions since the 1975 study. The 500-year levee was shown to be economically justified. It was determined that a 100-year levee maximized net benefits as shown in Table R-34. The 100-year project is currently under construction.

Table R-33

Flood Plain Management Assessment
1975 Economics Raccoon River & Walnut Creek Levee
Vicinity of the City of West Des Moines, Iowa

Level	Annual Cost ($)	Annual Benefits ($)	B/C	Excess Benefits ($)
50-Year	332,300	542,700	1.63	207,700
	338,900	569,500	1.68	230,600
	345,200	597,000	1.73	251,800
	351,600	623,800	1.77	272,200
100-Year	357,800	647,400	1.81	289,600
	364,600	673,500	1.85	308,900
	371,400	690,000	1.86	318,600
	377,900	703,200	1.86	325,300
200-Year	385,000	717,100	1.86	332,100
	407,000	732,000	1.79	325,000
	442,800	757,800	1.71	315,000
SPF	476,200	779,600	1.64	303,400

Source: *Feasibility Study for Flood Damage Reduction and Related Purposes, Des Moines River Basin, Iowa and Minnesota,* U.S. Army Engineer District, Rock Island, June 1975, Page F-32, Table F-16.

Notes:
(1) B/C = Benefit-to-Cost Ratio
(2) SPF = Standard Project Flood

Table R-34

Flood Plain Management Assessment
1989 Economics Raccoon River & Walnut Creek Levee
Vicinity of the City of West Des Moines, Iowa

Category	50-Yr Levee	100-Yr Levee	200-Yr Levee	500-Yr Levee	SPF Levee
Total Project Costs ($000)	6,560	17,757	18,933	20,147	25,339
Annual Charges ($000)	1,694	1,815	1,936	2,063	2,587
Annual Benefits ($000)	2,999	3,253	3,360	3,463	3,520
BCR	1.8	1.8	1.7	1.7	1.4
Net Benefits ($000)	1,306	1,438	1,424	1,400	933

Source: *General Reevaluation Report for Flood Control Project, Raccoon River and Walnut Creek, West Des Moines-Des Moines, Iowa, with Final Supplement No. 1 to the Final Environmental Impact Statement*, U.S. Army Corps of Engineers, Rock Island District, July 1989, page 23, table 4.

Notes:
(1) SPF = Standard Project Flood
(2) BCR = Benefit-to-Cost Ratio

Cultural Resources - Reduced flood damages would have a very positive effect on historic structures in the flood plain. Increases in residential and commercial development would negatively affect historic structures. Overall, the effect of this alternative on structures is judged to be quite positive ($^{-}5\ldots\ldots^{0}\ldots_{+4}\ldots^{+5}$).

Archaeological sites would see varying effects, many similar to those discussed for raising agricultural levees to this level. Positive impacts would result from the reduction of direct flood damages such as scour holes, flood-induced soil erosion, etc. The reduced frequency of major levee repairs would also be of positive benefit to archaeological sites by cutting the need for borrow sites, equipment staging areas, and other repair-related soil disturbances.

On the negative side, increases in residential and commercial development of the flood plain would mean an increase in the present trends of archaeological site destruction. The construction-related effects to sites from the actual levee raise also would be negative.

Overall, impacts to archaeological sites from this alternative are judged to be quite negative ($^{-5}\ldots_{-4}\ldots^{0}\ldots\ldots^{+5}$).

CRITICAL FACILITIES

PROTECT PRIORITY SITES TO 500-YEAR LEVEL

The city of Des Moines was used as a test case to study protecting critical facility priority sites. Examples of critical facilities plates are shown between pages 9-47 and 9-48 of the Main Report. The level of protection would be for the 500-year flood. Only one critical facility needing additional protection was identified in the study area. The Des Moines Waterworks on the Raccoon River was overtopped by the Flood of 1993. The levee protecting the Waterworks was raised after the flood in 1993. This alternative applies to Scenario 1. Scenarios 2 and 3 do not apply.

Cultural Resources - Cultural resource impacts for providing priority sites with 500-year level protection would generally have little effect on historic structures listed on or eligible for listing on the National Register of Historic Places. However, in cases where the facilities are eligible for the National Register, the effect could be positive.

The primary impacts to archaeological sites would be from the acquisition of borrow. Construction access, staging, and other associated impacts also would negatively affect sites. Few, if any, benefits to archaeological sites can be predicted for this alternative.

Overall, the effect of this alternative on structures is judged to be neutral ($^{-5}.....^{0}.....^{+5}$) while the effect on archaeological sites is judged to be solidly negative ($^{-5}._{-4}...^{0}.....^{+5}$).

PROTECT ALL SITES TO 500-YEAR LEVEL

The Mississippi River-Muscatine, Iowa, to Hannibal, Missouri, was used as a test case to study protecting critical facilities. Six major highway bridges over the Mississippi River were adversely affected during the Flood of 1993 as listed in Table R-35.

Bridge access was lost due to flooding of approach roads. Approach roads would be raised to 2 feet above the 500-year flood elevation. A standard design was used for each road consisting of two 12-foot concrete travel lanes, two 12-foot concrete shoulders, and two 6-foot gravel shoulder extensions. The embankment would be constructed of compacted fill with the sideslopes protected by riprap. Affected approach roads would be raised between 7 and 17 feet, on average. The costs to protect critical facilities are shown in Table R-36. The alternative only applies to Scenario 3. Scenarios 1 and 2 do not apply.

Cultural Resources - Cultural resource impacts for providing all sites with 500-year level protection would generally have some positive effects, assuming historic structures listed on or eligible for listing on the National Register of Historic Places were among the facilities in this category. For example, some historic bridges would benefit from this protection.

The primary impacts to archaeological sites would be from the acquisition of borrow. Construction access, staging, and other associated impacts also would negatively affect sites. Few, if any, benefits to archaeological sites can be predicted for this alternative.

Overall, the effect of this alternative on structures is judged to be mildly positive ($^{-5}.....^{0}_{+1}....^{+5}$) while the effect on archaeological sites is judged to be solidly negative ($^{-5}._{-4}...^{0}.....^{+5}$).

Table R-35

List of Critical Facilities
Bridges Over the Mississippi River
Flood Plain Management Assessment

Bridge Location	Length of Approach Road Subject to Flooding (miles)
Muscatine, IA	1.7
Burlington, IA	4.5
Fort Madison, IA	0.9
Keokuk, IA	1.3
Quincy, IL	5.1
Hannibal, MO	5.9

Table R-36

Cost to Protect Critical Facilities
Bridges Over the Mississippi River
Flood Plain Management Assessment

Category	Cost ($000)	Total ($000)
Muscatine, IA		
Fill (250,000 CY)	3,000.0	
Granular surfacing (8,000 CY)	240.0	
Riprap (32,000 CY)	1,280.0	
Concrete pavement (8,000 CY)	4,000.0	
		8,520.0
Burlington, IA		
Fill (705,000 CY)	8,460.0	
Granular surfacing (22,000 CY)	660.0	
Riprap (84,000 CY)	3,360.0	
Concrete pavement (21,000 CY)	10,500.0	
		22,980.0
Fort Madison, IA		
Fill (78,000 CY)	936.0	
Granular surfacing (5,000 CY)	150.0	
Riprap (18,000 CY)	720.0	
Concrete pavement (4,000 CY)	2,000.0	
		3,806.0
Keokuk, IA		
Fill (93,000 CY)	1,116.0	
Granular surfacing (6,000 CY)	180.0	
Riprap (25,000 CY)	1,000.0	
Concrete pavement (6,000 CY)	3,000.0	
		5,296.0
Quincy, IL		
Fill (840,000 CY)	10,080.0	
Granular surfacing (25,000 CY)	750.0	

Riprap (96,000 CY)	3,840.0	
Concrete pavement (24,000 CY)	12,000.0	
		26,670.0
Hannibal, MO		
Fill (1,171,000 CY)	14,052.0	
Granular surfacing (29,000 CY)	870.0	
Riprap (111,000 CY)	4,440.0	
Concrete pavement (28,000 CY)	14,000.0	
		33,362.0
		100,634.0

Notes:
(1) Costs for lands and damages were not developed.
(2) Does not include costs for Planning, Engineering and Design; and Construction Management.

UPLAND RETENTION AND WATERSHED MEASURES

WITHOUT RESERVOIRS

ADDED RESERVOIRS

REVISED OPERATION

These alternatives are discussed under their respective section headings of Chapter 9 in the Main Report.

																5/9/95
	ROCK ISLAND DISTRICT	ACTION ALTERNATIVES AFFECTING HYDRAULIC CONDITIONS														
		A	B	K	L	L1	L2	M	N	O	P	Q	R	S	T	U
		BASE CONDITIONS		AGRICULTURAL LEVEES							URBAN	CRITICAL FACILITIES		UPLAND RETENTION		
	IMPACT CATEGORIES	NCR Disaster Counties	NCR FPMA Counties	Limited Flood Fighting	Remove	Remove (n=0.08)	Remove (n = 0.32)	Set Back	25-Year Maximum Height	Raise to Contain '93 Flood	500-year Urban Levees	500-Year Priority Crit. Fac.	500-Year All Critical Facilities	Without reservoirs	Added reservoirs	Revised reservoir operation
				POTENTIAL FOR REDUCING FLOOD IMPACTS (1993 EVENT)												
	ECONOMIC															
	Flood Damage							Not								
1	Residential (Urban)	$203,000,000	$129,000,000	<-5%	-5-20%			Yet	<-5%	>-90%	>-90%	None	None	*	Minimal	None
2	Other (Urban)	$350,000,000	$262,000,000	<-5%	-5-20%			Modeled	<-5%	>-90%	>-90%	Moderate	Moderate	*	Minimal	None
3	Agricultural	$1,170,000,000	$140,000,000	<-5%	-10-50%				<-5%	>-50%	None	None	None	#	Minimal	None
4	Other Rural	$20,000,000	$9,000,000	<-5%	-10-20%				<-5%	>-50%	None	None	None	#	Minimal	None
	Change in Gov't Expend.															
5	Emerg. Response Costs	$128,000,000	$97,000,000	<-5%	-50%				<-5%	>-50%	>50%	Moderate	None	*	Minimal	None
	Disaster Relief															
6	Disaster Relief (Agric.)	$307,000,000	$72,000,000	<-5%	-10-50%				<-5%	>-50%	None	None	None	#	Minimal	None
7	Disaster Relief (Human Res.)	$366,000,000	$135,000,000	<-5%	-5-20%				<-5%	>-90%	>90%	Moderate	Moderate	*	Minimal	None
	Flood Insurance Payments															
8	NFIP	$113,000,000	$83,000,000	<-5%	-5-20%				<-5%	>-90%	>90%	None	None	*	Minimal	None
9	FCIC	$12,000.00	$7,000,000	<-5%	-10-50%				<-5%	>-50%	None	None	None	#	Minimal	None
	Change in Value of Floodplain Res.															
10	Net Ag Land Values			0	-30-40%			-60-70%	-5-10%	+5-10%	None	None	None	-low	Minimal	None
11	Net Urban RE Values			<+5%	+5-25%				<+5%	25%	+low	None	None	*	Minimal	None
	ENVIRONMENTAL															
	Natural Resources															
12	Non-Forested wetland (acres)		61,000	no chng		3,900	121,000	3,900	no chng	no chng	no chng	no chng	no chng	no chng	no chng	no chng
13	Threatened & Endangered (#)		68	61		61	61	61	61	61	7	7	7	7	7	7
13a	Threatened & Endangered (# occur.)		250	237		237	237	237	237	237	13	13	13	13	13	13
14	Forest (acres)		138,000	no chng		no chng	252,000	no chng	no chng	no chng	no chng	no chng	no chng	no chng	no chng	no chng
	Natural Floodplain Functions															
15	Floodplain Inundated (acres)			416,000		491,000	497,000		494,000	159,000	no chng	no chng	no chng	unavail	unavail	unavail
	Cultural Impacts (-5 to +5)															
16a	Historic Structures		-2	+4	-5			-3	-4	+4	+4	0	+1	-1	-1	-2
16b	Archeological Sites		-2	+4	+4			-3	-1	-2	-4	-4	-4	-1	-4	-2
	Open Space															
17	Public Lands (acres)		131,000	no chng		no chng	373,000	no chng	no chng	no chng	no chng	no chng	no chng	no chng	no chng	no chng
18	Recreation Sites (#)		202	no chng		no chng	300	no chng	no chng	no chng	no chng	no chng	no chng	no chng	no chng	no chng
	REDUCTION OF RISK															
	Critical Facilities															
19	# Facilities w/harmful releases	151	134	@	@			@	@	@	@	@	@	@	@	@
20	# Other critical facilities	1,282	881	low	low-mod.				low	high	high	High	high	*	Minimal	None
	Protection/Avoidance of Harm															
21	# People vulnerable	70,000	44,000	low	low-mod.				low	high	high	None	None	*	Minimal	None
	Social Well Being															
22	# Communities vulnerable		78	low	low-mod.				low	>-90%	high	None	None	*	Minimal	None
23	# Residential Structures vulnerable	18,000	11,000	low	low-mod.				low	>-90%	high	None	None	*	Minimal	None
24	Implementation Costs ($000's)			5,800	829,000			248,000	3,200	290,000	25,000	Moderate	101,000		High	

NOTES:

1. @ No known releases in 1993 flood.
2. * Potential for huge increases to urban flood damages and impacts.
3. # Potential for moderate increases to agricultural/rural impacts.
4. Agricultural levee costs do not include LERRD
5. Urban levee is construction costs for West Des Moines

IMPACT AND RESOURCE EVALUATIONS FOR ST. LOUIS DISTRICT

Introduction

The floodplain management assessment has selected several action alternatives that would impact the 1993 flood elevations if enacted. It is not intended to insinuate that these action alternatives are recommended or not recommended. Instead, they have been chosen to set the maximum boundaries of what would happen if these relatively extreme actions were taken. Time and funds available for this assessment did not allow preparation of accurate design and quantity estimates. The approach used was to select a typical sample area, rough out a best guess estimate and then apply those typical area values to the entire applicable St. Louis District area. The implementation costs, both structural and other costs (which are basically real estate costs), have been estimated for six alternative plans as shown on the bottom two lines of the table that follows. The six different alternative plans evaluated encompass the entire Mississippi River mainstem in St. Louis District. These alternatives are:

1) Removal of agricultural flood protection (ie, 10% agricultural levees removal);

2) Provide uniform protection height for 25 year flood of agricultural levees;

3) Provide uniform height of protection for the 1993 flood for agricultural levees;

4) Provide the MR&T level of protection to urban and agricultural areas, Cairo to St. Louis;

5) Upgrade urban areas within the St. Louis District to the 500 year level of protection (basically Cape Girardeau);

6) Provide 500 year flood protection to critical facilities within the St. Louis District (one typical site evaluated and multiplied by the number of sites).

CELMS SUMMARY OF ALTERNATIVES (FLOODPLAIN SCENARIO 1)

		A	B	K	L	M	N	O	P	Q	R	S	T	U	V	W
								ACTION ALTERNATIVES AFFECTING HYDRAULIC CONDITIONS								
		Base Con	Base Cond.		AGRICULTURAL LEVEES				URBAN	CRITICAL FACILITIES		UPLAND RETENTION/WATERSHED MEASURES				
	IMPACT															
	CATEGORIES	[All Disast	[Floodpln.	Limited	Remove	MR&T	Uniform Ht.	Raise	LEVEES	[500-Yr.]	[500-Yr.]	Without	Added	Revised	Runoff Red.	Runoff Red.
		Counties]	Impacts]	Fld.Fighting	W\Crop	MRC	[25-YR.]		[500-Yr.]	[Priority]	[All]	Reservoirs	Reservoirs	Operation	[Decr. 5%]	[Decr. 10%]
	ECONOMIC ($'s)		[1]													
	Fld.Dam.Reduct.															
1	Resid.(Urban) (millions)	NA	431.4	NA	-60.4	NA	26.1	-43.7	14.3	NA	NA	1,860.1	NA	NA	-0.7	-18.5
2	Other (Urban) (millions)	NA	549.3	NA	-78.5	NA	33.0	-55.2	0.0	NA	NA	2,388.5	NA	NA	-0.3	-27.9
3	Agricultural (millions)	NA	168.6	NA	8.8	NA	72.5	-126.4	0.0	NA	NA	101.2	NA	NA	-2.9	-13.3
4	Other Rural (millions)	NA	57.2	NA	3	NA	24.6	-42.9	0.0	NA	NA	5.5	NA	NA	-1.0	-15.0
	Chg. in Govt.Expend.															
5	Emerg.Resp.Costs(millions)	NA	101.8	NA	-14.3	NA	2.5	-13.8	0.0	NA	NA	439.6	NA	NA	-0.3	-7.6
6	Disast.Rel.(Agric.) (millions)	NA	36.4	NA	1.8	NA	0.9	-27.3	0.0	NA	NA	20.3	NA	NA	-0.4	-16.0
7	Disast.Rel.(Human R.)(mill)	NA	134.3	NA	2.9	NA	2.9	-13.3	0.0	NA	NA	575.9	NA	NA	-0.3	-6.3
8	Fld.Ins. (NFIP) (millions)	NA	133.7	NA	26.7	NA	8.1	-13.7	0.0	NA	NA	68.5	NA	NA	-0.7	-6.7
9	Fld.Ins. (FCIC) (millions)	NA	44.9	NA	19.3	NA	19.3	-33.7	0.0	NA	NA	26.9	NA	NA	-0.9	-3.8
	Chg.In Value of FP Res.															
10	Net Ag Product.	NA	NA	NA	-255.5	-73	73	NA	NA	NA	NA	NA	NA	NA	NA	NA
11	Net Urban RE Values	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	ENVIRONMENTAL															
	Natur. Resour. (# acres)															
12	Non-Forested Wetlands	NA	154,990	NA	65,750	NA	0.0	0.0	0.0	0.0	0.0	0.0	NA	NA	0.0	0.0
13	T & E Species	NA	35/96	NA	+	NA	0/0	0/0	0/0	0/0	0/0	0/0	NA	NA	0/0	0/0
14	Forest	NA	251,110	NA	74,150	NA	0.0	0.0	0.0	0.0	0.0	0.0	NA	NA	0.0	0.0
	Natural Fldpln.Functions															
15	% of fldpln.inundated	NA	80	NA	15	-25	10	-62	0	0	0	19	NA	NA	0	0
15A	Cultural Archaeological	NA	-4	-4 (0)	-5 (-3)	-1 (-2)	-4 (-1)	-1 (-2)	-4 (-1)	-4 (-1)	-4 (-2)	-5 (+2)	-3 (-5)	-4 (-4)	-4 (-4)	-3 (-5)
16	# sites impacted Historical	NA	-3	-3 (0)	-2 (-1)	0 (-1)	-3 (0)	0 (-1)	0 (-1)	-2 (-1)	-1 (-2)	-4 (+1)	-3 (-4)	-3 (-3)	-3 (-3)	-3 (-4)
17	# acres public lands	NA	96,785	NA	139,900	NA	0	0	0	0	0	0	NA	NA	0	0
18	# of recreation sites	NA	60	NA	+	NA	0	0	0	0	0	0	NA	NA	0	0
	REDUCT.OF RISK															
	Critical Facilities															
19	# Facil. w/harmf.releas.	NA	18	NA	0	NA	0	-3	0	-18	-18	24	NA	NA	0	0
20	# other crit. facil.	NA	231	NA	0	NA	0	-147	0	0	-231	249	NA	NA	0	-17
	Prot./Avoid. of Harm															
21	# people vulnerable	NA	62,180	NA	6,199	NA	6,199	-44,670	0	0	0	188,620	NA	NA	0	-2,520
	Social Well Being															
22	# commun.vulnerable	NA	50	NA	8	NA	8	-27	0	0	0	21	NA	NA	0	-4
23	# resid.str.vulnerable	NA	23,460	NA	3,000	NA	2,340	16,850	0	0	0	73,240	NA	NA	0	-950
	IMPLEMENT. COSTS															
24	Structural Costs (millions)	NA	NA	NA	44.0	5,704.0	141.0	6,071.0	51.0	85.0	1,175	NA	NA	NA	NA	NA
25	Other Costs (millions)	NA	NA	NA	1,536.0	0.0	447.0	0.0	0.0	0.0	0	NA	NA	NA	NA	NA
															File: LMSALT3.wk4	

Design & Quantities Estimates

The engineering effort for the subject study was limited in scope and detail. Given the complexity of evaluating a number of alternatives for the St. Louis District flood protection system in a short period of time and under limited resources an abbreviated effort was performed in developing relative costs and efforts needed to raise or lower flood protection systems for the 6 different alternatives previously listed. To generate quantities for levee embankment or excavation, right-of-way, and establishment of "turf" (which relates to the construction site that requires seeding), and other pertinent information, a spread sheet was developed using the primary St. Louis District levee and drainage districts. It is recognized that this listing of drainage and levee districts is only a portion of the entities within the District, however they were selected for analysis because they coincide with the St. Louis Corps District hydraulic models for this study. The general assumptions in developing these alternative plans is located with the cost estimate sheets attached to the corresponding tables that follow.

MISSISSIPPI RIVER LEVEE SYSTEM	UPPER RIVER MILE	LOWER RIVER MILE	APPROX. AREA PROTECT ACRES	LENGTH OF LEVEE DISTRICT MILES	LEVEE CROWN WIDTH FEET	LEVEE SIDE SLOPES 1 ON H	AVERAGE INTERIOR ELEV NGVD	LEVEE HEIGHT AT LOWER R.M. NGVD	WEIR LENGTH AT LOWER R.M. FEET	LEVEE SYSTEM 10 % REMOVED CY	25 YEAR AT LOWER R.M. NGVD	25 YEAR LEVEE CY	1993 FLOOD AT LOWER R.M. NGVD	1993 FLOOD LEVEE CY	MR&T FLOOD AT LOWER R.M. NGVD	MR&T FLOOD LEVEE CY	25 YEAR ESTABL. TURF. ACRES	1993 ESTABL. TURF ACRES	MR&T ESTABL. TURF ACRES	25 YEAR FLOOD LEVEE ROW ACRES	1993 FLOOD LEVEE ROW ACRES	MR&T FLOOD LEVEE ROW ACRES
Riverland	292.5	288.5	5878	14.6	12	3	455.1	464	1,295	38116	461	(3,022)	475	3061828	-	-	2	343	-	-	294	-
Elsberry Main	259.5	249.5	23481	23.8	10	3	436.9	446	5,348	55059	443	(11,291)	457.1	5150793	-	-	8	489	-	-	481	-
King's Lake	250.5	246.5	3300	7.8	10	3	436.4	447	752	21019	442.5	(2,944)	456.7	1565285	-	-	1	241	-	-	150	-
Kissinger PL	252.5	250.5	2290	6.8	10	2.5	434.8	447.5	770	21110	443.8	(2,030)	457.4	1639188	-	-	1	220	-	-	123	-
Sandy Creek	245.5	245.5	944	2.5	12	2.5	435.4	447.9	233	8881	442	(1,360)	456.5	457405	-	-	0	154	-	-	43	-
Foley	245	244.5	1214	3.8	12	3	435	446	295	12261	441.5	(1,252)	456.4	947974	-	-	1	182	-	-	75	-
Cap Au Gris	243	241.5	3491	7	12	2.5	433.1	444	965	21635	440.5	(2,595)	455.8	1920282	-	-	1	224	-	-	135	-
Winfield	240.5	239.5	2826	9.4	12	3	432.8	441	760	22610	440	(422)	454.8	2880868	-	-	1	277	-	-	207	-
Brevator	239	238.5	1841	5.7	10	2.5	433.9	439	385	7106	439.5	20,482	454.4	1326010	-	-	16	196	-	2	122	-
Old Monroe PL	237.7	238.5	900	3.7	10	3	433.9	439	188	4797	439.5	15,231	454.4	1003371	-	-	10	178	-	1	86	-
Consol. N. County (Mo. Rvr.)	227	198	30000	31	8	3	422	432	16,355	66684	436.6	2,281,098	446.2	12067002	-	-	184	695	-	104	698	-
Kuhs Levee (Mo. Rvr.)	1.1	198	1914	7	10	2	420	425	715	8213	430	273,778	446.1	2920422	-	-	36	219	-	17	158	-
Columbia Bottom (Mo. Rvr.)	2	194	4427	8	8	3	416.2	425	2,116	15144	429	455,567	444.6	4981453	-	-	44	294	-	23	211	-
Chouteau Island	194.5	189.5	2400	4.4	10	3	415	424	1,031	10067	426.5	153,805	444.1	2932771	446.4	3509658	19	218	226	8	118	125
Gabaret/Cabrolet Island	191	189	800	3.5	10	3	415	424	344	8008	426.5	122,345	444.1	2332886	446.4	2791773	15	198	204	6	94	99
Columbia	165	156.5	13560	20.1	20	3	395.1	417.5	7,038	202508	409	(100,815)	426.3	10656219	429	14002442	25	601	642	-	372	412
Harrison./ FT. Chart./String.	156.3	130.8	48700	31.4	20	3	390.1	407	17,264	238679	400	(183,507)	411.6	4739943	414.7	9656792	48	638	712	-	486	556
Prairie du Rocher	129.6	118	13000	16.5	20	3	380	395	4,126	111320	388.5	(39,237)	403.8	5099177	406.6	7549385	10	421	456	-	306	339
Ste. Genevieve #2	119.5	116.5	7000	12	9	3	369.5	389.5	4,836	56320	388	(3,627)	403.3	8758654	406.1	10860588	14	431	457	-	266	290
Kaskaskia Island	113.2	112.1	9460	14.8	10	3	367.6	392	6,608	91805	386.3	(37,792)	401.1	8745404	403.9	11333771	24	500	532	-	277	307
Bois Brule Levee	110.1	97.1	26050	33.1	20	3	361	385.2	18,536	360281	378	(183,443)	393.1	17491792	395.7	22883980	63	935	1001	-	591	654
Degognia	98.3	84.7	36200	19.4	20	3	359.6	377.5	14,734	156190	370.5	(156,616)	385.5	6833368	388.1	9626809	43	505	544	-	348	385
Grand Tower	81.3	76.2	14800	17.2	20	3	350	372	7,848	170196	364.2	(98,390)	378.8	6903108	382.1	10263005	27	500	543	-	294	335
Preston	75	66	16200	14.6	20	3	346.4	368	7,320	141842	358.5	(124,906)	370.3	2141195	374.1	5122623	25	388	430	-	201	242
Clear Creek	65	57.8	18000	21	20	3	340.5	361.5	10,082	198352	355.5	(85,137)	365	4097436	369.2	8919988	34	514	582	-	308	372
East Cape	56.8	46.3	12000	10.9	20	3	334	352	5,556	88246	346.4	(42,409)	354.8	984610	360.2	3988832	16	294	339	-	154	197
Len Small	34.4	33	2300	17	20	3	320	334.2	1,554	108576	338.1	1,515,651	345.8	7327092	354.1	15596700	92	456	564	48	349	452
ILLINOIS RIVER LEVEE SYSTEMS																						
McGee Creek	74.8	67.7	12400	14.6	10	4	430	448	6,714	71949	444.5	(20,888)	452.5	2923640	-	-	24	448	-	-	241	-
Willow Creek	70.5	69.5	4600	7	10	3	440	453	773	23134	444.5	(8,638)	452.6	-	-	-	2	-	-	-	-	-
Mauvaise Terre	66.1	65.3	7000	6.4	10	3	440	447.5	1,048	12203	444	(2,778)	452.4	427445	-	-	1	181	-	-	100	-
Valley City	66.1	63.6	4700	8.2	10	3	435.9	446	1,334	21055	443.5	(2,161)	452.2	886832	-	-	2	222	-	-	136	-
Scott County	62.6	57.2	12700	17	10	3	433.6	444.5	4,078	47107	442.2	(5,871)	451.9	2401052	-	-	7	358	-	-	298	-
Big Swan	58.1	50.8	14200	11.3	10	3	435	444	3,022	25854	440.7	(7,351)	451.5	1433597	-	-	4	263	-	-	199	-
Hillview	49.5	43.7	13700	12.8	10	3	427.9	443	6,088	49138	439.8	(14,141)	451.2	3395828	-	-	14	349	-	-	231	-
Hartwell	42.6	38.7	9300	12.2	10	3	426.9	442.5	4,202	48384	439	(11,166)	451.1	3657024	-	-	10	348	-	-	224	-
Keach	37.5	33.3	9700	12.4	10	3	429.9	443	3,079	41296	438.4	(12,484)	450.9	2393783	-	-	6	320	-	-	222	-
Eldred and Spanky	31.9	24.3	9800	19.6	10	3	427.4	440	3,659	62783	437.4	(8,272)	450.8	6187830	-	-	7	472	-	-	392	-
Nutwood	23.2	15.5	10600	12.3	10	3	428.3	439	2,850	33458	435.5	(7,573)	450.6	3594538	-	-	5	330	-	-	253	-
***** TOTALS *****			409676	500.8						2,681,364		(1,180,118)		1.6E+08		1.4E+08	842	13,800	7,232	209	9,239	4,765
												4,837,957										
URBAN PROTECTION SYSTEMS MISSISSIPPI RIVER																						
Wood River	202.6	196	13700	20.8	20	3	426	444							-	-			-			-
Chout., Namoeoki, Venice & L27	195	190.5	4800	18	20	3	425	442.5							445	1038447			365			223
MESD (LEVEE)	190.5	175	61645	12.8	20	3	420	429.5							437	1117016			287			225
MESD (F.WALL)	190.5	175	61645	5.9	-	-	420	429.5							-	-			-			-
St. Louis Reach 3 & 4 (LEVEE)	187.3	178.3	3790	4	20	3	422	430.2							437.6	184886			168			70
St. Louis Reach 3 & 4 (F.WALL)	187.3	178.3	3790	7	-	-	422	430.2							-	-			-			-
Prairie Du Pont / Fish Lake	175	166.2	9560	15.2	20	3	407	424							433	5769528			423			284
Cape Girardeau (LEVEE)	52.8	52	140	0.4	20	3	340	359.2							364	87459			127			6
Cape Girardeau (F.WALL)	52.8	52	140	1.1	-	-	340	359.2							-	-			-			-
***** TOTALS *****				81.7												8107877			1370			808

NOTES:

1) Information for the above levee and drainage districts provided by CELMS-CO-R, CELMS-ED-HE, DR 500-1-1, and other office files.

2) Levee and drainage districts provided above represent only a portion of the flood protection entities within the St. Louis District. Listing was selected to coincide with CELMS-ED-HE hydraulic models for this study.

3) ROW = Right of Way

4) ESTABL.TRUF. = levee surface acreage that requires seeding

Date: 15 MAR 95

FILE: Table1.WK4

Real Estate Estimates

Time and funds available for this assessment did not allow preparation of a detailed real estate estimate. The pages that follow describe the real estate cost estimates. Immediately following each cost estimate sheet is information regarding the logic used to develop the Real Estate estimate shown.

Design Cost Estimates

Structural costs for each of the case studies were developed using very preliminary quantities furnished by the design engineers. These values are summarized on the previous "Design & Quantities Estimates" table. The detailed cost estimates used to support the general design criteria for each case were developed using historical unit prices established during the repairs of the levees that were damaged from the flood of 1993. A contingency of 50% was used on the construction cost for each case study. A higher than normal contingency was used to cover unknowns such as relocations, soil conditions, detailed design quantities, availability of borrow areas, haul distances and the number of local contractors available due to the large volume of work. Following each cost estimate sheet is information regarding the logic used to develop the real estate estimate shown.

COST ESTIMATE. (Oct 94 P.L.)
09 March 1995
File: FPMA2.wk4

FLOODPLAIN MANAGEMENT ASSESSMENT STUDY
REMOVE LEVEE SYSTEMS (10% LEVEE SECTION)

Item	Quantity	Unit	Unit Price	Estimated Amount
REMOVE LEVEE				
Mob. and Demob.	Sum	Job		$1,500,000
Levee Excavation-Assume 1/4 mile haul				
Disposal area needed-831 Acres	3,360,000	CY	$5.00	16,800,000
Establishment of Turf	1,138	ACRE	1,200.00	1,365,600
Other Structures & Relocations, and				
Utilities, Pipelines, and Railroads	SUM	JOB		5,000,000
All Gravity Drains, Pump Stations,				
Closure Structures Remain	SUM	JOB		0
Subtotal				24,665,600
Contingencies - 50%				12,332,800
Subtotal				36,998,400
Engineering and Design - 15%				5,549,800
Construction Management - 10%				3,699,800
TOTAL				$46,000,000
REAL ESTATE COST:				0
TOTAL PROJECT COST:				$46,000,000

Design Comments: Degrading All Agricultural Levees

This plan consists of removal of 10 percent of a levee district by notching or removal of 10 percent of the length of the levee district. This would allow flood waters to freely occupy once protected lands. This plan assumes that all material removed from the levee system is disposed of within 1/4 mile of the levee system. Depth of disposal was assumed to be 3 feet. Areas once occupying the levee would be vegetated. Disposal areas would not be vegetated. An additional lump sum cost was identified to cover some structures, utilities and pipelines that would be directly effected by the levee embankment removal. It was assumed that the existing gravity drains, closure structures, and pump stations be left undisturbed even though their purpose would be eliminated. This estimated total cost is $46,000,000 as shown in the first table herein column "L" row 24.

REAL ESTATE COSTS
DEGRADING ALL AGRICULTURAL LEVEES
TO ELIMINATE FLOOD PROTECTION
(ie 10% LEVEE REMOVAL REQUIRED)

Degrading All Agricultural Levees (10% removal)

Non-Structural Cost

Real Property	$1,002,434,800
Contingencies	$ 250,608,700
Total Real Property	$1,253,043,500
Call	**$1,253,044,000**

Relocation of Towns and Villages	$ 45,000,000
Acquisition Cost	$ 54,640,000
PL 91-646 Cost	$ 179,828,000
Title III Payments	$ 3,390,000
Total Non- Structural Cost	**$1,535,902,000**
Call	**$1,536,000,000**
Structural Cost	**$ 0**
TOTAL PROJECT COST	**$1,536,000,000**

Real Estate Comments: Degrading All Agricultural Levees sufficiently to eliminate flood protection (ie 10% removal)

The appraisal problem for this estimate is what the government would be responsible for when implementing this alternative. The land owners and occupants have enjoyed federally supported flood protection for a number of years, consequently development has occurred on the land side of these levees. Therefore, first it must be recognized that the government does not have the legal authority to remove the flood protection However, if such authority was granted and the levees degraded, this would constitute a taking, and the government would be responsible for compensating the private land occupants. This compensation would be in the form of acquiring some type of permanent easement of the previously protected property, probably similar to flowage easement requirements. After analyzing the protection previously enjoyed by the occupants it is estimated the fair market value of these easements would be tantamount to the fee simple interest. In addition to acquiring the above noted easement (or fee simple) the owners and tenants are eligible to receive certain relocation assistance benefits under the Uniform Relocation Assistance and Real Properties Acquisition Act of 1970, Public Law 91-646, as amended by the Surface Transportation Act of 1987, Public Law 100-17. All cost associated with this alternative are $1,536,000,000 as found in the first table herein column "L" row 25.

COST ESTIMATE. (Oct 94 P.L.)
09 March 1995
File: FPMA5.wk4

FLOODPLAIN MANAGEMENT ASSESSMENT STUDY
MISSISSIPPI RIVER MILE 196 TO 33
CAIRO TO ST. LOUIS, RAISE TO MRT ELEVATION

Item	Quantity	Unit	Unit Price	Estimated Amount
MRT DESIGN FLOOD				
Mob. and Demob.	Sum	Job		$179,900,000
Levee Embankment-Assume 1 mile haul				
(Borrow needed-65,260 Acres)	252,700,000	CY	$6.00	1,516,200,000
Establishment of Turf	9,900	ACRE	1,200.00	11,880,000
Crushed Stone Surfacing	650,000	TON	15.00	9,750,000
Relief Wells	12,170	EACH	25,000	304,250,000
Gravity Drains, Avg Size 48" RCP	540	EACH	350,000	189,000,000
Levee Closure Structures	100	EACH	500,000	50,000,000
FLOOD WALL (URBAN ONLY) 50,556 LIN FT				
Remove existing Floodwall	113,300	CY	150.00	16,995,000
Concrete Floodwall	150,100	CY	450.00	67,545,000
Reinforcing Steel	9,430	TON	2,000.00	18,860,000
Waterstop	236,000	LIN FT	18.00	4,248,000
Foundation H-Pile	1,642,300	LIN FT	35.00	57,480,500
Pump Station-Upgrades & New	SUM	JOB		72,000,000
Other Structures & Relocations, and				
Utilities, Pipelines, and Railroads	SUM	JOB		500,000,000
Subtotal				2,998,108,500
Contingencies - 50%				1,499,054,250
Subtotal				4,497,162,750
Engineering and Design - 15%				674,574,400
Construction Management - 10%				449,716,300
TOTAL				$5,621,000,000
REAL ESTATE COSTS:				83,200,000
TOTAL PROJECT COSTS:				$5,704,000,000

Design Comments: MR&T

MR&T Flood Uniform Height (River Mile 33.0 to 194.5) Plan - This plan consists of raising the level of protection of given levee district to the MR&T flood level. Borrow for the levee raises was assumed to be hauled an average 1 mile. The portions of the levee raised would be seeded with grasses. A one lane road surface of crushed stone would be provided. The existing floodwalls within urban areas were assumed to be completely removed and replaced at the higher flood protection level. An assumption was made of the number of closure structures that would be required and/or replaced. An assumption was made of the number of gravity drains which would be required and/or replaced. An assumption was also made to handle under-seepage concerns for embankments higher than 20 foot. One relief well per 150 lineal feet was included for embankments higher than 20 feet. An assumption was made on the number of pump stations new or modified to handle the additional level of protection. In addition, a lump sum cost was assumed for impacts to other structures, roads, railroads, and utilities relocations. This estimated total cost is $5,704,000,000 including $83,200,000 real estate costs as shown in the first table herein column "M" line 24.

REAL ESTATE COSTS
MR & T

NON-STRUCTURAL COST.....	**$**	**0**
Structural Cost		
Right of Way		
Land Value (ROW).....	$	7,559,900
Damage to the Remainder.....	$	1,133,985
Contingencies.....	$	2,173,471
Total Real Property.....	$	10,867,356
Call		**$ 10,900.000**
Acquisition Cost.....	$	4,800,000
PL 91-646 Cost.....	$	3,000,000
Title III Payments.....	$	300,000
Total (ROW).....	$	19,000,000
Call		**$ 19,000,000**
Borrow Areas		
Land Value	$	40,789,375
Contingencies.....	$	10,197,344
Total Real Property.....	$	50,986,719
Call		**$ 51,000,000**
Acquisition Cost.....	$	13,200,000
Total Borrow Cost.....	$	**64,200,000**
Total Structural Cost.....	**$**	**83,200,000**
TOTAL PROJECT COST.....	**$**	**83,200,000**

Real Estate Comments: MR & T

This alternative consists of raising all levee along the Mississippi River to the MR&T elevation. This alternative requires the acquisition of right of way for levee construction and borrow area. The cost estimate for this alternative is. $83,200,000 which has been included within the $5,704,000,000 shown in the first table herein column "M" line 24.

COST ESTIMATE. (Oct 94 P.L.) FLOODPLAIN MANAGEMENT ASSESSMENT STUDY
09 March 1995 25 YEAR LEVEL OF PROTECTION
File: FPMA4.wk4

Item	Quantity	Unit	Unit Price	Estimated Amount
25 YEAR LEVEE				
Mob. and Demob.	Sum	Job		$4,000,000
Levee Embankment-Assume 1 mile haul				
(Borrow needed-1,560 Acres)	6,047,000	CY	$6.00	36,282,000
Levee Excavation-Assume 1/4 mile haul				
(Disposal area needed-366 Acres)	1,475,000	CY	5.00	7,375,000
Establishment of Turf	1,053	ACRE	1,200.00	1,263,600
Crushed Stone Surfacing	212,000	TON	15.00	3,180,000
Levee Closure Structures	5	EACH	500,000	2,500,000
Gravity Drains, Avg Size 48" RCP	10	EACH	350,000	3,500,000
Relief Wells	100	EACH	25,000	2,500,000
Pump Station Upgrades	10	EACH	250,000	2,500,000
Other Structures & Relocations, Roads				
Utilities, Pipelines, Railroads	SUM	JOB		10,000,000
Subtotal				$73,100,600
Contingencies - 50%				36,550,300
Subtotal				$109,650,900
Engineering and Design - 15%				16,447,600
Construction Management - 10%				10,965,100
TOTAL				$137,000,000
REAL ESTATE COST:				4,000,000
TOTAL PROJECT COST:				$141,000,000

Design Comments: Agricultural Levees @ 25 year protection

This plan consists of raising or lowering the level of protection of a given levee district to the 25 year flood level. In the case of levees higher than the 25 year flood level a section along the downstream portion of the levee system would be degraded to the 25 year flood level. The length of the overflow section was sized for each levee district such that the area protected would be filled within 24 hours. For the case where the existing levee system is below the 25 year flood level, the levee system would be raised to that level. Assumptions for haul distance to dispose of material is 1/4 mile and haul distance from borrow areas 1 mile. Areas disturbed by levee construction would be seeded with grasses. Surfaces on levees would be provided with one lane crushed stone surfacing. Relief wells impacted would be replaced. An estimated quantity for the number of gravity drains and closure structures either being replaced, modified or new was provided. An assumption was made on the number of pump stations requiring upgrades and a lump sum cost was assumed for impacts to other structures, road, and railroad and utility relocations. This estimated cost is $141,000,000 which includes $4,000,000 real estate costs as shown in the first table herein column "N" row 24.

REAL ESTATE COSTS
All Agricultural Levees @ 25 year flood protection

Non-Structural Cost

Real Property	$	167,277,025
Contingencies	$	41,819,256
Total Real Property	$	209,096,281
Call		**$ 209,000,000**
Acquisition Cost	$	54,240,000
PL 91-646 Cost	$	179,828,000
Title III Payments	$	3,390,000
Total Non-Structural Cost	$	446,458,000
Call		**$ 447,000,000**

Structural Cost

Right of Way	$	447,300
Damages to the Remainder	$	67,095
Contingencies	$	128,599
Total	$	642,994
Call		**$ 643,000**
Acquisition Cost	$	600,000
PL 91-646 Cost	$	375,000
Title III Cost	$	37,500
Total Right of Way	$	1,655,500
Call		**$ 1,660,000**

Borrow

Land Value	$	976,250
Contingencies	$	244,063
Subtotal	$	1,220,313
Call		**$ 1,220,000**
Acquisition Cost	$	320,000
Total Borrow Cost	$	**1,540,000**

Disposal Areas

Land Value	$	457,500
Contingencies	$	114,375
Subtotal	$	571,875
Acquisition Cost	$	96,000
PL 91-646 Cost	$	60,000
Subtotal Acquisition Cost	$	156,000
Total Disposal Area Cost	$	**728,000**
TOTAL STRUCTURAL COST	$	3,928,000
Call		**$ 4,000,000**
TOTAL PROJECT COST	$	**451,000,000**

Real Estate Comments: Agricultural Levees @ 25 year protection

In the areas that have higher than the 25 year protection, this alternative will require the acquisition of an estate similar to the one described for the degradation of all agricultural levees discussed previously. This estimate is $4,000,000 and is included in the $141,000,000 estimate shown in the first table herein column "n" row 25. In addition this alternative will required the acquisition of right of way for levee construction, borrow areas and disposal areas. The estates utilized to prepare this portion of this alternative are standard estates. The real estate cost estimate is $451,000,000 as shown in the first table herein column "N" row 25.

COST ESTIMATE. (Oct 94 P.L.) FLOODPLAIN MANAGEMENT ASSESSMENT STUDY
09 March 1995 RAISE LEVEES TO 1993 FLOOD EVENT
File: FPMA1.wk4

Item	Quantity	Unit	Unit Price	Estimated Amount
RAISE LEVEE				
Mob. and Demob.	Sum	Job		$190,000,000
Levee Embankment-Assume 1 mile haul				
(Borrow needed-62,000 Acres)	300,000,000	CY	$6.00	1,800,000,000
Establishment of Turf	18,000	ACRE	1,200.00	21,600,000
Crushed Stone Surfacing	1,300,000	TON	15.00	19,500,000
Levee Closure Structures	50	EACH	500,000	25,000,000
Gravity Drains, Avg Size 48" RCP	675	EACH	350,000	236,250,000
Relief Wells	22,000	EACH	25,000	550,000,000
Pump Stations, Use an avg cost per st	40	EACH	2,000,000	80,000,000
Other Structures & Relocations, Roads				
Utilities, Pipelines, Railroads	SUM	JOB		250,000,000
Subtotal				$3,172,350,000
Contingencies - 50%				1,586,175,000
Subtotal				$4,758,525,000
Engineering and Design - 15%				713,778,800
Construction Management - 10%				475,852,500
TOTAL				$5,948,000,000
REAL ESTATE COST:				122,600,000
TOTAL PROJECT COST:				$6,071,000,000

Design Comments: Raise Levees to 1993 Flood Event

This plan consists of raising the level of protection of a given levee district to the 1993 flood level. Borrow for the levee raises was assumed to be hauled an average 1 mile. The portions of the levees raised would be seeded with grasses. A one lane road surface of crushed stone would be provided. An assumption was made of the number of closure structures that would be required and/or replaced. An assumption was made of the number of gravity drains which would be required and/or replaced. An assumption was also made to handle under seepage concerns. Basic assumption was made that any embankment over 20 foot in height would require one relief well per 150 lineal feet of levee. An assumption was made on the number of pump stations new or modified to handle the flood protection level. In addition, a lump sum cost was assumed for impacts to other structures, road, railroads and utility relocations. This estimated total cost is $6,071,000,000 which includes $122,600,000 real estate costs as shown on the first table herein column "O" row 24.

REAL ESTATE COSTS
Raise Levees to 1993 Flood Event

NON-STRUCTURAL COST	**$**	**0**

Structural Cost

Right of Way

Land Value	$	15,935,350
Damage to the Remainder	$	2,390,303
Contingencies	$	4,581,413
Total Real Property	$	22,907,066
Call	**$**	**23,000.000**
Acquisition Cost	$	13,272,000
PL 91-646 Cost	$	8,295,000
Title III Payments	$	829,500
Total (ROW)	$	45,396,500
Call	**$**	**46,000,000**

Borrow Areas

Land Value	$	48,437,500
Contingencies	$	12,109,375
Total Real Property	$	60,546,875
Call	**$**	**61,000,000**
Acquisition Cost	$	15,600,000
Total Borrow Cost	$	**76,600,000**
Total Structural Cost	**$**	**122,600,000**
TOTAL PROJECT COST	**$**	**122,600,000**

Real Estate Comments: Raise Levees to 1993 Flood Event

This alternative consists of raising all levees to an elevation equal to the 1993 flood. This estimate utilized standard estates to estimate the value of the right of way necessary to construct the levee's. This cost estimate is $122,600,000 and is included within the $6,071,000,000 estimate shown on the first table herein column "O" row 24.

COST ESTIMATE. (Oct 94 P.L.) FLOODPLAIN MANAGEMENT ASSESSMENT STUDY
09 March 1995 URBAN LEVEES (500 YEARS) - CAPE GIRARDEAU
File: FPMA3.wk4

Item	Quantity	Unit	Unit Price	Estimated Amount
URBAN LEVEE				
Mob. and Demob.	Sum	Job		$1,630,000
Levee Embankment-Raise Levee 2 feet				
for 0.4 miles-Haul distance 1 mile	18,200	CY	$6.00	109,200
Establishment of Turf	6	ACRE	1,200.00	7,200
RAISE FLOODWALL 2 FEET (1.1 Miles)				
Remove existing Floodwall	17,600	CY	150.00	2,640,000
Concrete Floodwall	23,000	CY	450.00	10,350,000
Reinforcing Steel	1,400	TON	2,000.00	2,800,000
Waterstop	28,000	LIN FT	18.00	504,000
Foundation H-Pile	261,500	LIN FT	35.00	9,152,500
Subtotal				$27,192,900
Contingencies - 50%				13,596,450
Subtotal				$40,789,350
Engineering and Design - 15%				6,118,400
Construction Management - 10%				4,078,900
TOTAL				$51,000,000

Real Estate Comments: Raise Urban Levees (500) years

No real estate estimate follows this alternative because it has been assumed that the existing project right of way will be generally sufficient to accommodate the increase project performance.

Design Comments: Raise Urban Levees (500) years

This plan consists raising the level of protection to one community, Cape Girardeau, Missouri. The existing floodwalls were assumed to be completely removed and replaced to accommodate the higher level of protection. No costs have been included for any increased interior drainage requirements or improvements to closure structures. A small section of earthen levee would be raised and seeded as required. This estimated total cost is $51,000,000 as shown on the first table herein column "P" row 24.

COST ESTIMATE. (Oct 94 P.L.) FLOODPLAIN MANAGEMENT ASSESSMENT STUDY
09 March 1995 PROTECT CRITICAL FACILITIES
File: FPMA8.wk4

Item	Quantity	Unit	Unit Price	Estimated Amount
CRITICAL FACILITY - ONE SITE				
Mob. and Demob.	Sum	Job		$146,000
Levee Embankment-Assume 1 mile haul				
(Borrow needed-49 Acres)	236,100	CY	$6.00	1,416,600
Establishment of Turf	13	ACRE	1,200.00	15,600
Levee Closure Structure	1	EACH	500,000	500,000
Gravity Drain, 48" RCP	1	EACH	350,000	350,000
Subtotal				$2,428,200
Contingencies - 50%				1,214,100
Subtotal				$3,642,300
Engineering and Design - 15%				546,300
Construction Management - 10%				364,200
TOTAL				$4,550,000
REAL ESTATE COSTS:				170,000
TOTAL PROJECT COST:				$4,720,000

Design Comments: Construction of Ring Levees

This plan consists of providing a earthen levee around critical facilities identified within the St. Louis District. A typical 10 acre site was assumed to be the average area of the critical facility being protected. An average levee height was assumed to be 25 feet. Levee section consists of 1 on 3 side slopes, and a 10 foot crown. Average haul distance to get material was 1 mile. The levee would be vegetated with grasses. In addition one closure structure and one gravity drain was assumed to included for each site. The total estimated cost for one critical facility site is $4,720,000 which includes $170,000 real estate costs. The total cost for 18 sites is 18 times $4,720,000 which is &70,800,000 which is shown on the first table herein column "Q" row 24. The total cost for 231 critical sites is 231 times $4,720,000 which is $1,090,320,000 say $1,000,000,000 which is shown on the first table herein column "R" row 24.

REAL ESTATE COSTS
Protect Critical Facilities

RING LEVEES- One Typical

Right of Way	$	24,800
Borrow	$	73,500
Subtotal	$	98,300
Contingencies	$	24,575
Total	$	122,875
Acquisition Cost	$	40,000
PL 91-646 Cost	$	5,000
Total Cost/ Critical Site	$	167,878
Call	**$**	**170,000**
170,000 x 18 Levees	$	3,060,000
Call	**$**	**3,000,000**
TOTAL STRUCTURAL COST	**$**	**3,000,000**

Real Estate Comments: Construction of Ring Levees

This alternative consists of constructing ring levees around critical elements situated along the Rivers. This estimate was a standard reconnaissance level estimate, that included right of way for the levee and borrow area. The real estate estimate is $170,000 for each critical site.

COST ESTIMATE. (Oct 94 P.L.)
09 March 1995
File: FPMA6.wk4

FLOODPLAIN MANAGEMENT ASSESSMENT STUDY
RIVER DES PERES FLOOD PROTECTION
WEST LEVEE - HWY 55 TO MORGANFORD

Item	Quantity	Unit	Unit Price	Estimated Amount
REINFORCED EARTH CONTAINER WALL				
Mob. and Demob.	Sum	Job		$560,000
Embankment	32,000	CY	$6.00	192,000
Excavation (Existing Levee)	16,500	CY	5.00	82,500
Closure Structures	2	EACH	500,000	1,000,000
Gravity Drain Closure Structure	1	EACH	350,000	350,000
Concrete Panel Wall (Steel Straps, Concrete Foundation)	72,000	SF	100.00	7,200,000
Seeding	2	ACRE	1,200.00	2,400
Subtotal				$9,386,900
Contingencies - 50%				4,693,450
Subtotal				$14,080,350
Engineering and Design - 15%				2,112,100
Construction Management - 10%				1,408,000
TOTAL				$17,600,000
REAL ESTATE COSTS:				750,000
TOTAL PROJECT COSTS:				$18,350,000

COST ESTIMATE. (Oct 94 P.L.)
09 March 1995
File: FPMA7.wk4

FLOODPLAIN MANAGEMENT ASSESSMENT STUDY
RIVER DES PERES FLOOD PROTECTION
EAST LEVEE - HWY 55 TO MSD PLANT

Item	Quantity	Unit	Unit Price	Estimated Amount
REINFORCED EARTH CONTAINER WALL				
Mob. and Demob.	Sum	Job		$820,000
Embankment	44,000	CY	$6.00	264,000
Excavation (Existing Levee)	23,500	CY	5.00	117,500
Road Closure Structures	2	EACH	1,000,000	2,000,000
Railroad Closure Structure	1	EACH	1,000,000	1,000,000
84" Gated Control Structure				
with Hydraulic Operator	1	EACH	500,000	500,000
Concrete Panel Wall (Steel Straps,				
Concrete Foundation)	90,000	SF	100.00	9,000,000
Seeding	2	ACRE	1,200.00	2,400
Subtotal				$13,703,900
Contingencies - 50%				6,851,950
Subtotal				$20,555,850
Engineering and Design - 15%				3,083,400
Construction Management - 10%				2,055,600
TOTAL				$25,690,000
REAL ESTATE COSTS:				750,000
TOTAL PROJECT COSTS:				$26,440,000

REAL ESTATE COSTS
RIVER DES PERES CASE STUDY

NON-STRUCTURAL COST

Reach 0.0 to 1.63 (County)

Property Value	$	52,905,000
Contingencies	$	13,226,250
Subtotal Real Estate	$	66,131,250
Acquisition Cost	$	5,144,000
PL 91-646	$	12,372,594
Title III Payments	$	321,500
TOTAL	$	83,969,344
Call		**$ 84,000,000**

Reach 1.64 to 2.48 (County)

Property Value	$	21,515,000
Contingencies	$	5,378,750
Subtotal Real Estate	$	26,893,750
Acquisition Cost	$	2,648,000
PL 91-646	$	7,447,500
Title III Payments	$	165,500
TOTAL	$	37,154,750
Call		**$ 37,150,000**

Reach 2.49 to 2.80 (County)

Property Value	$	3,420,000
Contingencies	$	855,000
Subtotal Real Estate	$	4,275,000
Acquisition Cost	$	456,000
PL 91-646	$	128,500
Title III Payments	$	28,500
TOTAL	$	6,042,000
Call		**$ 6,040,000**

Reach 0.00 to 0.85 (City)

Property Value	$ 50,945,000
Contingencies	$ 12,736,250
Subtotal Real Estate	$ 63,681,250
Acquisition Cost	$ 3,504,000
PL 91-646	$ 9,245,000
Title III Payments	$ 219,000
TOTAL	$ 76,649,250
Call	**$ 76,700,000**

Reach 0.85 to 1.60 (City)

Property Value	$ 122,400,000
Contingencies	$ 30,600,000
Subtotal Real Estate	$ 153,000,000
Acquisition Cost	$ 12,240,000
PL 91-646	$ 33,191,250
Title III Payments	$ 714,000
TOTAL	$ 199,154,250
Call	**$ 199,000,000**

Reach 1.61 to 2.85 (City)

Property Value	$ 45,520,000
Contingencies	$ 11,380,000
Subtotal Real Estate	$ 56,900,000
Acquisition Cost	$ 4,987,000
PL 91-646	$ 13,931,250
Title III Payments	$ 307,000
TOTAL	$ 76,125,250
Call	**$ 76,000,000**

STRUCTURAL COST

Flood Wall (County) 1.64 to 2.48	$ 750,000
Flood Wall (City) 0.85 to 1.60	$ 750,000
TOTAL STRUCTURAL COST	**$ 1,750,000**

Real Estate Comments: River Des Peres Flood Protection

This estimate is a case study cost which priced out the alternatives of constructing a reinforced earthen wall or purchase of the structures with the River Des Peres area.

It should be noted that all of the cost estimates noted above are generic in nature and should not be construed as in-depth appraisals. A substantial amount of information utilized for these estimates were furnished by others, and while the assumption is made that it is correct, a large amount has not been verified by the appraiser.

River Des Pere Design Plan - This plan consists of providing protection to the 500 year flood for two sections of the levee system along River Des Pere. The first segment is identified as the West Levee which begins along the West side of River Des Pere at Morganford and terminates under Highway 55 at River Des Pere Drive. The second segment of protection is identified as the East Levee which begins underneath Highway 55 at Germania Avenue and continues along the east side of River Des Pere to high ground near the Metropolitan Sewer District Pump Station just east of Alabama Street. Both sections of protection will be constructed of a reinforced earth wall type system. The reinforced earth wall would consist of modular precast concrete facing panels connected with metallic strips and backfilled with appropriate backfill for structural support and minimal through seepage. This wall system would be aligned along the same alignment as the existing River Des Pere levee system and should require very little if any additional right-of-way. A portion of the backfill for the reinforced earth wall system would come from the degrading of the existing levee system and the remainder of material brought in from other sources. There may be a few small portions of conventional earthen type embankment where right-of-way and/or physical obstructions are not a problem. Typical side slopes for the embankment would be 1 vertical to 3 horizontal and a appropriate crown width provided.

The West Levee segment would require as a minimum two road closure structures. The first at River Des Pere and Highway 55 entrance ramp. The second at Morganford and River Des Pere road. It is anticipated that a minimum of one gravity drain control structure would be required along this segment.

The East Levee segment would require a minimum of three closure structures. The first at Germania Avenue and Highway 55 exit ramp. The second at the rail road intersection of the existing levee alignment which provides rail access to Monsanto Chemical Co.. And thirdly a road closure structure at the Alabama Avenue bridge. It is anticipated that a minimum of one gravity drainage structure would be required to control drainage through an existing 66-inch arch pipe just downstream of the intersection of Germania Avenue and Highway 55.

Additional costs are expected for relocations, utilities and other encounters, sewer rerouting and upgrades and pumping at the gravity drain locations, however, time did not allow for investigations to identify costs.