Federal Emergency Management Agency

Washington, D.C. 20472

AUG 26 1993

MEMORANDUM FOR: Federal Coordinating Officers
FEMA-993-DR, FEMA-994-DR, FEMA-995-DR, FEMA-996-DR, FEMA-997-DR, FEMA-998-DR, FEMA-999-DR, FEMA-1000-DR, AND FEMA-1001-DR

ATTENTION: Public Assistance Officers

FROM: Richard W. Krimm
Deputy Associate Director
State and Local Program and Support

SUBJECT: Federal Levee Policy

Attached is a memorandum from the Office of Management and Budget that describes the procedures Federal agencies should follow when evaluating and reviewing repair and restoration projects for levees. These procedures require agencies with authority to fund levee repairs to notify relevant Federal agencies about proposed levee restoration projects and receive their comments on same. Further, each agency should consider and present to the applicant nonstructural alternatives to the extent practical when developing eligible projects.

More importantly, the procedures are not "intended to deny any party access to existing programs for levee repair and restoration, to create unexpected delays, or to force alternatives to repair and restoration on unwilling participants." We interpret this to mean that the levee owner must decide which project option to implement.

We have determined that the coordination among relevant agencies should occur at the Disaster Field Office (DFO). The Washington level forum, the Interagency Levee Rehabilitation Task Force, which previously consisted of the U. S. Army Corps of Engineers (USACE), the U.S. Soil Conservation Service (SCS), and FEMA, will continue to coordinate headquarter policy and interaction. The FEMA levee coordinator will facilitate the review process at each DFO. You are requested to provide space to any agency that wishes to participate in the levee review process. Currently, the U.S. Environmental Protection Agency (EPA) and the U.S. Fish and Wildlife Service (FWS) have indicated they would participate in the process. The DFO team will make all appropriate decisions; however, where the team needs additional guidance or issue resolution, the question should be elevated to the Interagency Levee Rehabilitation Task Force.

FEMA, USACE, SCS, EPA and FWS met on Tuesday, August 24, 1993 to discuss implementation of the new procedures. The respective levee policies of the FEMA, USACE and SCS, which were shared with you previously, will remain unchanged. A copy of FEMA's levee policy is attached. The task force agreed that the initial focus should be on eligible levees and that levees should be divided into three categories in priority order: levees that protect life and/or property of significant economic value (urban levees); agricultural levees that protect rural communities, isolated homes, highways, railroads, and high value farmlands; and agricultural levees that protect farmlands. We do not anticipate that relevant agencies will advance alternatives to repairing levees which protect urban areas. However, mitigation of the adverse effects of urban levee repairs should be fully considered. Borrow and disposal sites should avoid areas of environmental concern, and contaminated materials must be appropriately handled.

Agricultural levees which protect rural communities and isolated housing should be considered in the light of elevation or relocation projects under consideration to meet floodplain management requirements. Levee options generally should not consider raising the level of protection to achieve floodplain management requirements. Review teams should give full consideration to nonstructural alternatives for agricultural levees that only protect farmlands. Nonstructural alternatives should include viable Federal programs, i.e. those with appropriate authority and funding, that the levee owner may consider. USACE has developed specific procedures which will insure that nonstructural options proposed by other agencies can be presented to project sponsors. The USACE team member at each DFO will brief the other agency representatives on this process.

EPA and FWS will provide staff to the DFO as soon as possible so that proposed work can proceed. You should initiate coordinated reviews of applications as soon as possible to develop review procedures with participating agencies. The Interagency Levee Rehabilitation Task Force will meet again soon to develop further guidance on implementing the new procedures. We will share any new information with you as it becomes available.

We appreciate your contributions to the levee task force to date. If you have questions about these procedures, please call Larry Zensinger at (202) 646-3684 or James Walke at (202) 646-2751.

Attachments

cc: USACE
SCS
EPA
FWS

FEMA POLICY FOR LEVEE REPAIR

1. Levee must be owned by eligible applicant (State or local government or certain private nonprofit organization).

2. Levee must be an actively used and maintained facility.

3. Levee must not be eligible for repair under another Federal agency's program.

   If USACE does not approve repairs under PL 84-99 for levees that do not meet their maintenance standard, FEMA would also deny assistance for the same reason.

   If USACE does not approve repairs under PL 84-99 because it determines that the level of damage is considered maintenance, and therefore the responsibility of the local sponsor, FEMA will not fund the repair effort.

   Levees that do not meet USACE or SCS definition of a "flood control work" may be considered by FEMA.

4. Eligible work will be to restore levees to predisaster condition.

5. Dewatering of areas behind levees by breaching the levees or pumping is eligible if there was a threat to health and safety or improved property; or if required to facilitate a Federal repair project. Breaches would be eligible for repair.

6. Removal of flood fight measures placed on the levees can be eligible if such removal is necessary to eliminate a health and safety threat, to operate the levees as a public facility or to repair the facility.

7. All eligible work must comply with all Federal, State, and local regulations (e.g., the National Environmental Policy Act and E.O. 11988).

8. The cost share will be 75% Federal and 25% nonFederal.

9. Secondary levees riverward of the primary levees are not eligible unless they protect human life.

10. Cost effective hazard mitigation measures may be considered on a cost-shared basis.

August 25, 1993

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF MANAGEMENT AND BUDGET
WASHINGTON, D.C. 20503

August 23, 1993

To: Army Corps of Engineers
Federal Emergency Management Agency
Department of Agriculture
Department of Transportation
Department of Interior
Department of Housing and Urban Development
Environmental Protection Agency
Small Business Administration
Other Relevant Agencies

From: T.J. Glauthier, Associate Director, Natural Resources, Energy and Science, Office of Management and Budget

Katie McGinty, Director, White House Office of Environmental Policy

Re: Procedures for Evaluation and Review of Repair and Restoration Projects for Levees

The purpose of this guidance is to ensure the proper consideration of relevant options for repair, reconstruction, and other alternatives to levee restoration necessitated by flood damage. It also is intended to ensure that relevant organizations have the opportunity to comment on project specifications and suggest appropriate modifications. The overall goal is to achieve a rapid and effective response to the damaged flood control system that will minimize risk to life and property, ensure a cost-effective approach to flood damage mitigation and floodplain management, and protect important environmental and natural resource values.

This guidance should be viewed as an opportunity to allow consideration of alternatives with input from Federal, State, and local interests. It is not intended to deny any party access to existing programs for levee repair and restoration, to create unexpected delays, or to force alternatives to repair and restoration on unwilling participants. Nor does this contravene any existing statutory or other requirements.

In acting upon applications for levee repair and restoration of damages incurred as a result of the Midwest floods of 1993, responsible Federal agencies shall follow procedures below:

- At the time of initiating evaluation of proposals for repair and restoration of flood-damaged levees, each agency shall notify the appropriate agencies represented in the Disaster

Cat. 1 - repair immediately - urban levees, fed. & non-fed. Review definition of "urban" - it could be construed to mean "any area not in agricultural or FWS use. A density limit might be useful (# of structures/mile^2; # of residences or population/mile^2 eg.). Also, cultural & historical sites.

For all structures that do not fit the above category:

1. Have Corps (WES?) run a model to determine 100 year floodway based on conveyance and storage allowing a stage rise of 1 inch in urban areas and 6 inches in rural/ag. areas.

2. All non-urban levees outside of the floodway should be in Category 2 - repair in short term if Cat. 2 criteria are met.

3. All non-urban levees within the floodway should go through an options analysis performed by a multi-agency team in cooperation with property owners. (this work can be done while Cat. 1 structures are being repaired)

Cat. 2 - repair soon (after Cat. 1 levees & before end of construction season) All non-urban levees above the modeled floodway in Corps justification criteria 1-4 & Constitutional provision. (offer landowners other options, as well)

Alter criteria 4 to include a more rigorous

economic analysis, including the value of the crop (some bottomlands are extremely productive when not under water); the frequency of anticipated floodings & % of growing seasons when a crop would fail due to flooding if levee is repaired to pre-flood condition. (many of levees were built to protect land from ~20 year event & flood during more severe events. Many of these levees were topped w/ sand bags 3 feet high to protect farmland during the flood); average annual disaster relief, crop insurance, & flood insurance payments on property protected by levee; & value of adjacent properties at risk if levees are not repaired.

This analysis could be done during construction of Cat. 1 levees.

Cat. 3 - repair only after consideration of all options. All non-urban levees that are within the modeled 100-year floodplain & do not protect historically or culturally significant sites should be subjected to an inter-agency options evaluation in cooperation w/ landowners. Sites behind levees should first be ranked based on

1. Economic factors - does value of property at risk exceed costs of maintaining it? (See economic factors above).
2. Environmental factors - how valuable

i.e. don't repair if more appropriate options can be instituted

and biodiversity if returned to floodplain/wetland uses? Consider corridor value (linking refuges; proximity to existing wildlife areas), value as fish habitat, presence or potential presence of T&E or rare/declining species, presence & restoration potential of rare, declining, &/or regionally significant biological communities (e.g. bottomland hardwoods, prairies, etc.)

3. Hydrologic criteria - importance of area in reducing flood risks upstream & downstream if returned to floodplain uses.

Assign a rating to each ~~Cat. 3~~ property protected by Cat. 3 levees. If the Benefit:Cost (economic analysis) is low & potential biological & hydrological values are high, rate as a priority for negotiation w/ landowners. Develop a correlation between preferred options & rankings.

Example

	High Priority for negotiation or purchase					High priority for repair
Ranking (base on economic, biological, hydrological criteria)	1	10	20	40	50	60

⇧

Correlation

⇩

Options	Purchase property in fee, give to FWS	Purchase conservation easement, restore wetlands	Install overflow channel behind levee	Purchase flowage easements, reconstruct levee w/ spillway	Repair or improve levee

Options to include in negotiations w/ landowners:

1. Full repair or improvement of existing levee
2. Full repair of levee, but modify w/ spillway or

pipes so they can be used to reduce flood crests during major floods but farmed most years. (Fresh layer of silt deposited by flood could increase productivity of farmland & counteract subsidence of leveed floodplain due to compaction)

3. Repair levee w/ modifications + lower elevation. These levees would be overtopped first in large events + more frequently (say 1 in 5 years) than levees under 2 above. Purchase flowage easement from farmers

4. Relocate ~~levee~~ levee out of ~~floodplain~~ floodway. Compensate property owner for loss of land/crops during flood years in previously protected portions of his/her property. ~~[illegible]~~

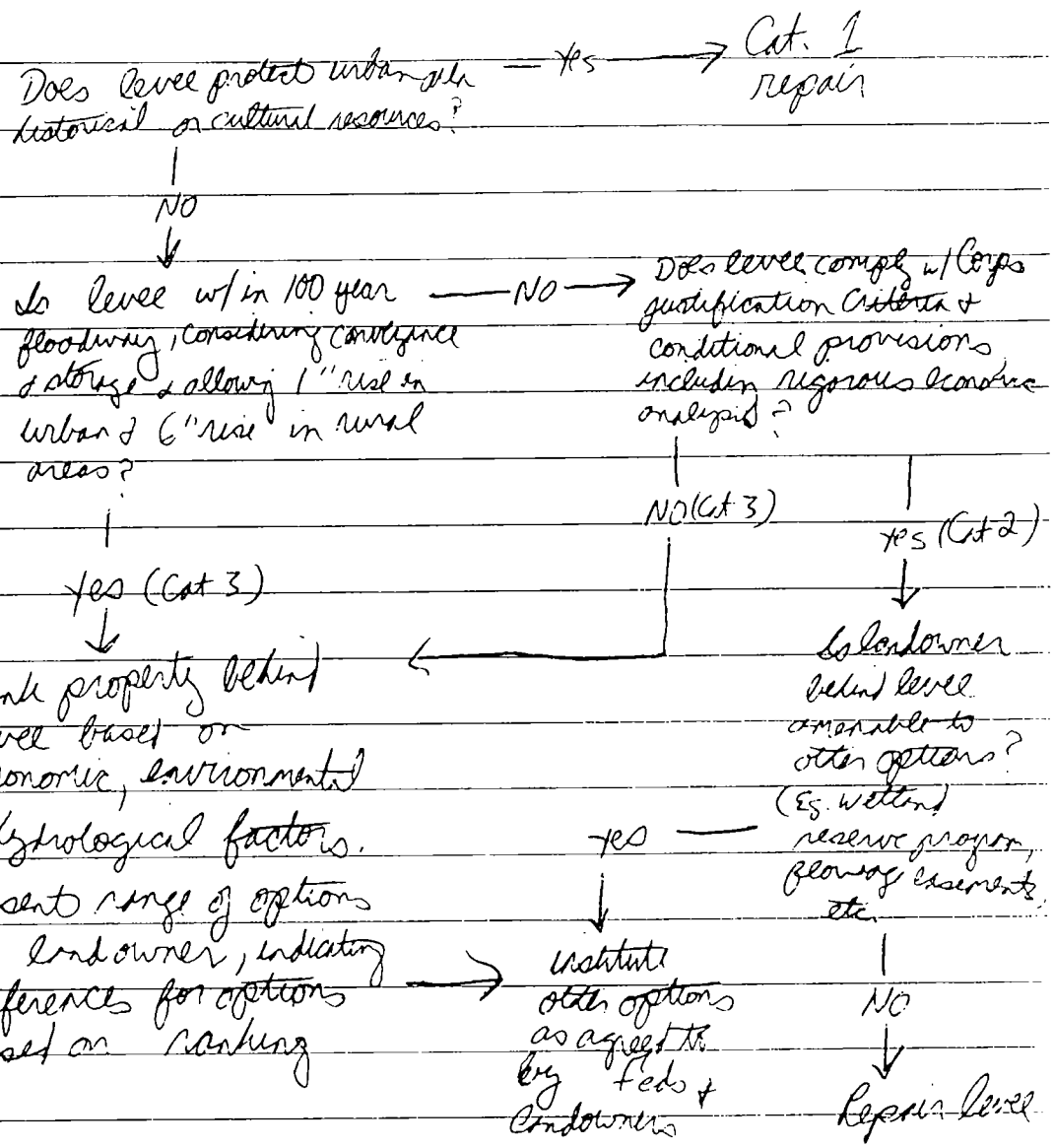
5. Don't repair levee, or significantly lower elevation. Enroll floodplain property in Wetland Reserve program (or Private Lands program) & restore wetlands. Property owner retains title.

6. Swap flood-~~[illegible]~~ prone property for FmHA property in upland areas. Don't repair levee - do restore wetlands.

7. Transfer FmHA-owned property that is flood prone to the FWS ~~as~~ for use in refuge system.

8. Acquire flood-prone land from willing sellers. Donate to wildlife refuge system. Restore floodplain ecosystem.

Decision tree
(see following pages for explanation)



DEPARTMENT OF THE ARMY
U.S. Army Corps of Engineers
WASHINGTON, D.C. 20314-1000

23 AUG 1993

REPLY TO
ATTENTION OF:

CECW-OE-D (500-1-1b)

MEMORANDUM FOR Deputy Director of Civil Works for the Upper Mississippi River Basin

SUBJECT: Levee Rehabilitation Program - 1993 Midwest Floods

1. Reference CECW-OE-D memorandum, dated 6 Aug 93, Subject: Levee Rehabilitation Policy and Guidance - Public Law 84-99.

2. The purpose of this memorandum is to forward policy and guidance as discussed in paragraph 2 of referenced memorandum. This memorandum will serve as a basic policy framework for levee rehabilitation under Public Law (PL) 84-99 as the result of the 1993 Midwest Flood. Field implementation of this guidance should allow for a logical, flexible approach to expediting the levee repair program while maintaining important documentation of project eligibility determinations.

3. In some cases, there may be alternatives to rehabilitation which meet all of the following criteria: 1) they are acceptable to the local sponsor; 2) they do not represent a substantial increase in Federal costs above the rehabilitation alternative; 3) they provide appropriate flood protection and environmental outputs. In order to ensure that such alternatives are not overlooked, the Corps will coordinate with Federal agencies and the project sponsor through processes described in Enclosure 1. This additional step is not intended to deny any party access to existing programs for levee rehabilitation, to create unacceptable delays, or to force alternatives to rehabilitation on unwilling participants. Rather it should be viewed as an opportunity to allow considerations of alternatives with input from project sponsors, and with their full consent.

4. Inherent in our assessment process must be an awareness and sensitivity to opportunities to identify possible applications of Section 1135 of the Water Resource Development Act of 1986 for fish and wildlife habitat restoration at Federal projects.

5. To address critical needs for immediate closure of breached levees we have developed a fast track approach to repair breaches in levees where there exists substantial risk for damages to urban and agricultural properties. Enclosure 2 is a flow chart and narrative describing the conditions and criteria for the fast track process. Initial repair would include filling in breaches back to original levee height without the preparation of a full Rehabilitation Project Report (a short form report is

required). Public sponsorship and cost share requirements must also be met. Decision regarding final repair will follow the normal report preparation procedure.

6. PL 84-99 Levee Rehabilitation Policy is affirmed as follows:

a. Environmental Policy. All PL 84-99 Rehabilitation actions will conform to the National Environmental Policy Act (NEPA) and applicable environmental regulations. District Commanders shall also meet the requirements in Chapter 7, paragraph 7-33.b.(10) of ER 1105-2-100 (Endangered Species Act) to the fullest practical extent.

b. Cost Share. The 80/20 cost share requirement is retained for non-Federal levee repair. The Corps will allow sponsors to use discretionary funds from other Federal agencies provided the granting agency confirms in writing that there are no legal or policy constraints. There is no cost share for repair of Federally constructed levees.

c. Public Sponsorship. There is no change in the requirement for public sponsorship for non-Federal levees.

d. Engineering and Maintenance Guidelines. There is no waiver of the guidelines for non-Federal levees as written in Appendix E of ER 500-1-1. Owners whose levees were previously determined ineligible will not receive Corps assistance under PL 84-99.

e. Economic Justification. Qualification criteria and procedures for justification of initial repair of levee breaches are covered in paragraph 5 and enclosure 2. Economic justification procedures and other requirements for permanent repairs are as directed in ER 500-1-1.

f. Deliberate Levee Cuts. Repair of deliberate levee cuts will not be carried out by the Corps under PL 84-99. An exception will be made for those levees that were deliberately breached to protect the integrity of the structure and thereby reduced the overall anticipated damages. In those cases only, repairs may be accomplished under PL 84-99 if the cut was made in consultation with the Corps of Engineers.

g. Dewatering. Costs associated with dewatering will continue to be borne by the local interests. Costs associated with dewatering may be eligible for assistance from FEMA under the Stafford Act.

h. Repair of Secondary Levees. Secondary levees will not be repaired under PL 84-99 except as provided in paragraph 5-1.r. of ER 500-1-1 to protect human life.

i. Reconstruction in-Kind versus Betterments. Rehabilitation assistance is limited to pre-flood conditions. Set backs would be permitted if a new alignment is less expensive and is environmentally acceptable. Modifications or betterments will not be considered as a part of emergency repairs.

j. Retention of Flood Fight Measures. Emergency measures conducted under PL 84-99 flood fight actions are temporary and must be removed by the local sponsor. Exceptions may be made for measures such as stability or seepage berms if they contribute to the structural integrity of the unit and are environmentally acceptable.

7. In order to assist in your efforts, a series of definitions has been prepared for your use (see enclosure 3). If further definitions are required, please advise this office.

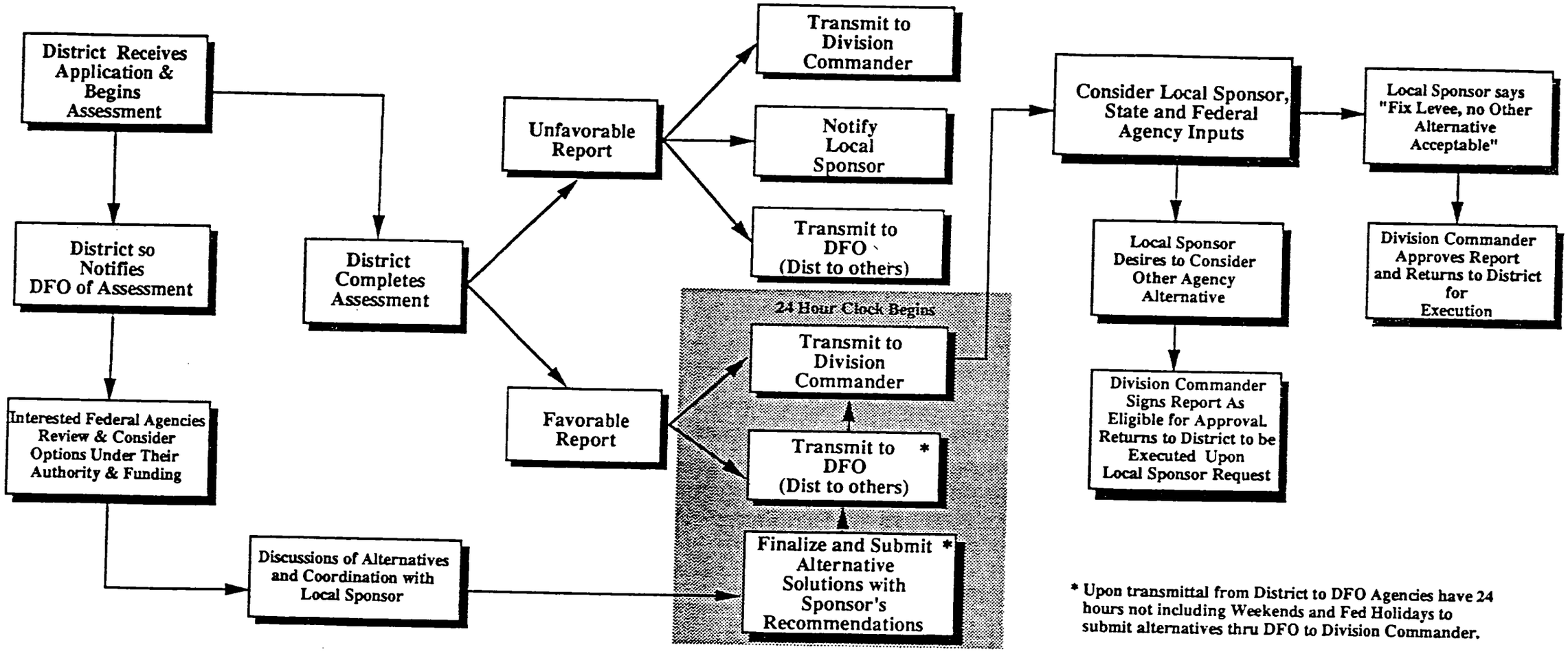
8. Your office is developing a levee database for management of this effort, which will be used as the single source of information by all of us who will be addressing these issues. Enclosure 4 provides a categorization of levees along with the available eligibility programs.

9. My point of contact on this action is Mr. Ed Hecker, Chief, Readiness Branch (202) 272-0251.

4 Encls

STANLEY G. GENEGA
Brigadier General, USA
Director of Civil Works

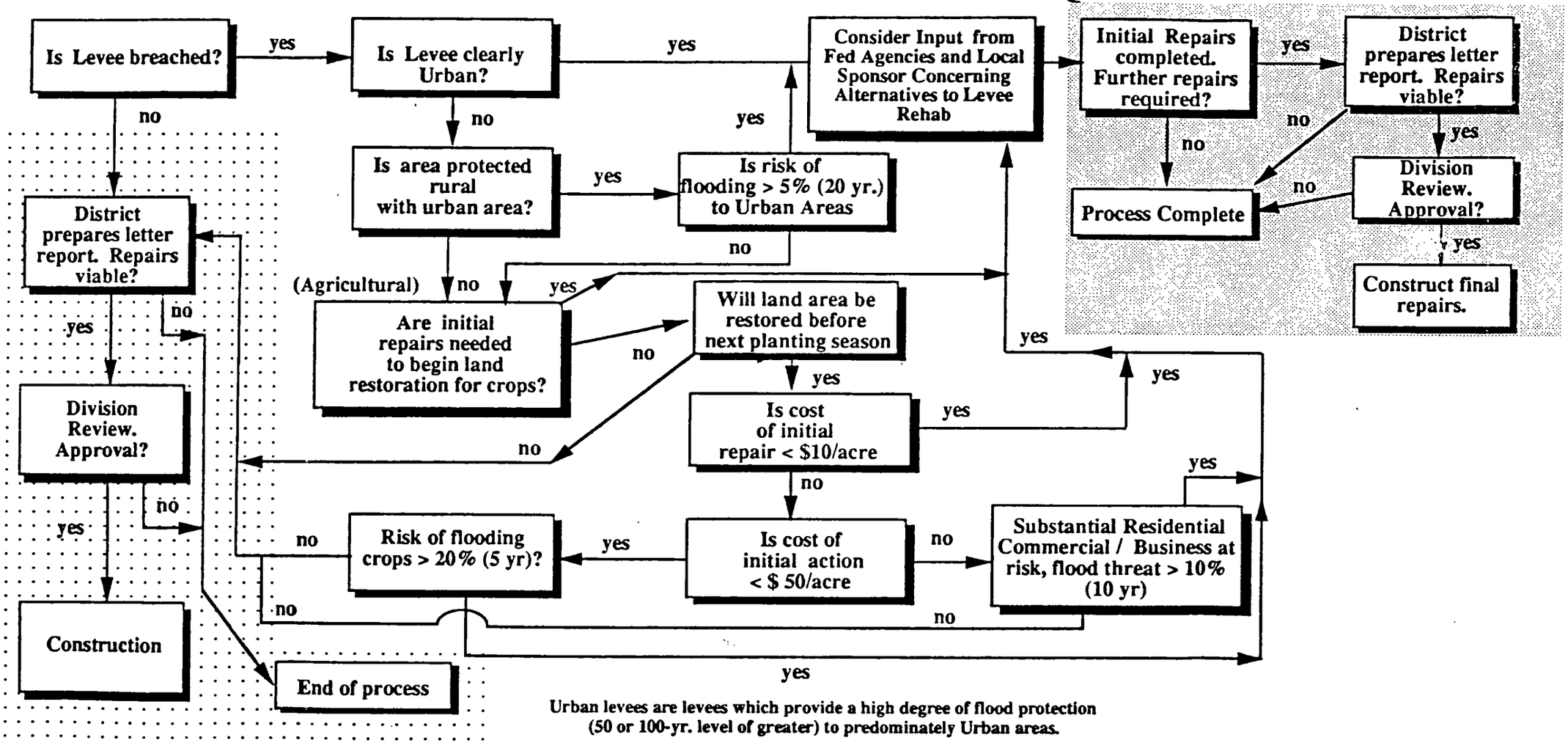
DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS - CIVIL WORKS
APPLICATION FOR LEVEE REHABILITATION RECEIVED



* Upon transmittal from District to DFO Agencies have 24 hours not including Weekends and Fed Holidays to submit alternatives thru DFO to Division Commander.

Enclosure 1

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS - CIVIL WORKS
FAST TRACK LEVEE REHABILITATION PROJECT REQUIREMENTS



Urban levees are levees which provide a high degree of flood protection (50 or 100-yr. level of greater) to predominately Urban areas.

Enclosure 2

PROCEDURES FOR JUSTIFICATION FOR EMERGENCY REMEDIAL ACTIONS

Introduction. The following justification criteria for expedited decisions for closing levee breaches have been developed to reduce the threat of recurrence of substantial flood damages to life and property until decisions can be made regarding full restoration of damaged levees. They have been developed in light of the short time which may be available in some areas to accomplish construction before the winter season makes construction activities impossible. **THESE PROVISIONS SHOULD NOT BE USED FOR FULL RESTORATION DECISIONS OR WHERE THERE IS SUFFICIENT TIME TO PREPARE A FULL REHABILITATION REPORT.**

Justification Criteria. The closing of breached levee sections may be undertaken for the following P.L. 84-99 qualified levees where the conditional provisions are met.

1. Federal and Non-Federal Urban levees where the threat to life and property is considered greater than was present in the pre-flood condition.

2. Federal and Non-Federal levees which protect predominately agricultural land but have one or more Urban areas where the risk of flooding in the current condition to Urban areas is greater than 5 percent (20-yr or more frequent flood event would cause damages to properties in Urban areas). A determination must be made that in the breached condition, actual physical damages would be caused in the urban area by the occurrence of a 5 percent chance flood event.

3. Federal and Non-Federal Agricultural levees which must have the breaches filled to drain lands and/or initiate land restoration and crop production. There must be documentation that Department of Agriculture officials familiar with the area believe that such actions can and will be initiated within the next six months.

4. Federal and Non-Federal Agricultural levees where lands are likely to be returned to crop production by the next planting season, and,

1) The cost of remedial action is less than $10 per acre, or,

2) The current risk of substantial flooding to residential, commercial, public, and industrial properties is greater than 10 percent (10-yr or more frequent flood event would cause damages to developed properties), or,

3) The cost of remedial action is less than $50 per acre protected and the risk of flooding is greater than 20 percent chance (5-yr or more frequent flood event would flood croplands). The number of acres protected is the land area behind the levee which is lower than the pre-flood levee height.

Other Conditional Provisions.

1. Appropriate environmental compliance procedures are met

2. An engineering judgement is made that there is reasonable expectation that the levee could withstand a flood event for the next year below the top of the low point of the temporarily repaired levee.

3. All breaches in a continuous levee which affect the residual risks and other conditions specified in the Justification Criteria must be filled and the costs included in the justification decision.

Note: Risk of flooding as used in the justification criteria pertains to the risk of actual lands and properties being flooded and not the level of protection afforded by the breached levee.

DESIGNATED DEFINITIONS FOR LEVEE REHABILITATION INFORMATION

Levee: A structure of earth or stone built parallel to a river to protect land from flooding.

Federal Levee: A levee system constructed by a Federal Agency such as the U.S. Army Corps of Engineers, the Soil Conservation Service, or the Bureau of Reclamation. Levees actually constructed by non-Federal interests, but incorporated into a Federal system by specific Congressional action (Law) are also designated as Federal levees. Previous rehabilitation or reconstruction of a non-Federal levee under an emergency authority by a Federal agency does not make the levee a Federal levee.

Non-Federal Levee: Any levee system constructed by other than a Federal agency which is operated and maintained by a Public Sponsor.

Urban Levee: Levees which provide a high degree of flood protection (50 or 100 year level or greater) to predominately Urbanized areas.

Urban Areas: Urban areas are cities, towns, or other incorporated or unincorporated political subdivisions of States that provide general local government for specific population concentrations, and occupy an essentially continuous area of developed land containing such structures as residences, public and commercial buildings, and industrial sites.

Public Sponsor: A legal subdivision of a state or a state government; local unit of government; qualified Indian Tribe, Alaska Native Corporation or tribal organization; or a state chartered organization, such as a levee board.

Deliberate Levee Cut: A deliberate cut made in a levee to protect the integrity of the structure threatened by overtopping from forecasted river stages and to reduce overall anticipated damages expected to occur to the existing structure by the current flood event. Deliberate levee cuts are made upon judgement by the local interest.

Dewatering Levee Cut: This is an intentional cut in a levee which is considered an engineering/construction method used to dewater the area immediately behind a levee where pumping is not feasible or timely

Dike: In most areas of the U.S., an earthen structure built partway across a river for the purpose of maintaining a navigation channel. In other areas, the term is used synonymously with *levee.*

DESIGNATED DEFINITIONS FOR LEVEE REHABILITATION INFORMATION
(Continued)

Flood Plain: The portion of a river valley that has historically been inundated by a river during floods. The Corps of Engineers encourages local governments to zone their flood plains against development and thereby avoid property damage and reduce obstruction to passage of flood waters.

Floodway: Designated land left clear of development for the passage of flood waters.

Flood Stage: The height of a river above which damages begin to occur. Normally the level at which a river overflows its banks.

Hundred Year Flood: More accurately referred to as a "one percent chance flood," a flood of a magnitude which, according to historical statistics, has one chance in 100 of occurring in any given year. (This does not mean that, once such a flood occurs, the location will not experience another flood for the next 99 years!)

Major Flood: A general term indicating high water that causes extensive inundation and property damage, usually characterized by evacuation of people and animals and closure of highways.

Saturation: A condition in soil which all space between soil particles is filled with water. Such conditions occur after prolonged periods of rainfall, snowmelt and force any additional rainfall to run off into streams. Saturation also occurs in earthen levees during extremely long periods in which the flood waters remain above flood stage, a condition that can cause the levees to weaken.

Work In-Kind: This is the part of the sponsor's cost share that is other than cash.

LEVEE CATEGORIES/FUNDING					
	PL-99	O&M GENERAL	FEMA	SCS	PRIVATE
FFU		X			
FFA		X			
FLU	X				
FLA	X				
LPU	X				
LFA	X				
LNU			X*	X	X
LNA			X*	X	X

1st LETTER

F = FEDERALLY CONSTRUCTED

L = LOCALLY CONSTRUCTED

2nd LETTER

F = FEDERALLY MAINTAINED

L = LOCALLY MAINTAINED

P = LOCALLY MAINTAINED, ELIGIBLE FOR ASSISTANCE

N = LOCALLY MAINTAINED, NOT IN THE CORPS LEVEE REHABILITATION PROGRAM

3rd LETTER

U = URBAN

A = AGRICULTURE

* MUST BE STATE OR LOCAL GOVERNMENT OWNED

ENCLOSURE 4

PL 84-99 Rehabilitation Policy

- **Environmental Policy**
  - Conform to NEPA
  - Conform to Other Applicable Environmental Regs (i.e., Endangered Species Act)
- **Cost Share**
  - 80/20 Non-Federal Projects
  - 100/0 Federal Projects
- **Engineering and Maintenance Guidelines**
  - Must be flood control structure
  - Must be maintained

- **Deliberate Levee Cuts**
  - Not repaired under PL 84-99
  - Exception for cuts which reduced damages/Corps Recommendation
- **Dewatering**
  - Local Interest Cost
  - May be reimbursable by FEMA
- **Secondary Levees**
  - Not Eligible
  - Exception for protection of human life
- **Betterments**
  - Not eligible

- **Retention of Flood Fight Measures**
  - Must be removed
  - Exception for measures that contribute to structural integrity of unit (i.e., seepage berms)

REHABILITATION ALTERNATIVES

- **Cooperative Effort of Many Federal Agencies**

  - EPA
  - FEMA
  - DOI
  - USDA
  - HUD
  - SBA
  - DOC
  - DOT

- **Offers Alternatives to Rehab When**
  - Acceptable to Local Sponsor
  - Not Big Increase in Cost
  - Provides Flood Protection
  - Meets Environmental Concerns

DFO COORDINATION PROCESS

- **Completed Reports Being Provided to EPA/F&WL Representatives for Immediate Review**

- **EPA/F&WL Will Be Provided Information on All Active Projects So That Their Alternative Review Can Be Initiated**

- **An Interagency Public Affairs Program Is Being Initiated**

USACE DFO ACTIVITIES

- **Active Teams in IL, IA, MO (1-2 people)**
- **POCs for Other States**
- **Corps Projects Listed in DFO Database**
- **Completed Reports Have Been Forwarded to DFO Teams for Review**

- **Sponsor Notification**
  - Currently in Process of Notifying Sponsors
  - Verbal Notification to be Complete by 25 Aug
  - Written Notification to Follow

APPLICATION PROCESS

- **District Office (DO) Receives Application**
  - Begins Assessment
  - Prepares Report
- **Concurrently DO Notifies DFO**
  - Other agencies consider options
  - Discuss with sponsors

APPLICATION PROCESS (Cont'd)

- **Report Is Unfavorable**
  - DO Notifies Division Office
  - DO Notifies Local Sponsor
  - DO Notifies DFO

APPLICATION PROCESS (Cont'd)

- **Report Is Favorable**
  - Transmit to Division Office
  - Transmit to DFO
  - Other Federal agencies submit alternative solutions

24 HOUR CLOCK

APPLICATION PROCESS (Cont'd)

- **Local Sponsor Decides "Fix Levee"**
  - Division approves report
  - District constructs

  or

- **Local Sponsor Decides "Try Alternative"**
  - Division returns report to DO
  - Sponsor works with other agency on alternative

FAST TRACK PROCESS

- **Fast Track for Breached Levees When**
  - **Substantial Risk to Urban and Agricultural Properties**

- **Fast Track Qualifications**

  1. Urban Levees

  2. Agricultural with Some Urban Area
     - Risk of flooding > 5%

  3. Agricultural Levees
     - Breaches must be filled to restore crop production

- **Fast Track Qualifications**

4. **Agricultural Levees**
   - **Lands are to be restored to crop production by next planting, and**

   - **Cost of repairs < $10/acre, or**

   - **Cost of repairs < $50/acre and**
   - **Risk of flooding > 20%, or**

   - **Risk of flooding > 10%**
     (with residential/commercial business)

SECTION 1135 ALTERNATIVE

- **Environmental Enhancement of Federal Projects**
- **Annual Appropriation Limit of $25 Million (per project limit of $5M)**
- **40 Studies Currently in Program**
  - 1 Construction project completed in 1992
  - 5 On-going construction projects
  - 4 Projects in P&S phase
  - Several others in review phase
- **Corps Prepares Report to be Reviewed by ASA-CW and Submitted to OMB for Approval**

Rehab Status Report

Damaged Levees	NCD		MRD			
	NCR	NCS	MRO	MRK	LMVD	Total
Federal	12	1	9	6	12	40
Non-Fed Elig	6	2	26	110	20	164
Total	18	3	34	116	32	204
Reports Complete	8	0	6	2	10	26
Reports Approved	0	0	3	2	10	15
Initial Repairs Started	0	0	0	1	0	1

Department of the Army
U.S. Army Corps of Engineers--Civil Works
Tabulation of Levees

/12/93

Category	LMS		LMM		NCS		NCR		MRK		MRO		Total	
	Damaged	Total	Damaged	Total	Damaged	Total	Damaged	Total	Damaged	Total	Damaged	Total	Damaged	Total
Fed Constructed/Fed Maintained	0	0	0	3	0	0	3	8	0	3	0	1	3	15
Fed Constructed/Local Maintain	12	42	0	0	1	32	9	65	6	45	8	30	37	214
Total Federal	12	42	0	3	1	32	12	73	6	48	8	31	*40*	229
Non-Fed/Local Maintain & Eligible	20	27	0	0	2	83	6	22	110	110	26	26	164	268
Non-Fed not Eligible (See Note 3)	19	20	0	2	0	*10*	13	163	*700*	*700*	147	184	*879*	*1079*
Total non-Federal	39	47	0	2	2	*93*	19	185	*810*	*810*	173	210	*1043*	*1347*
Total	51	89	0	5	3	*125*	31	258	*816*	*858*	181	241	*1083*	*1576*

Notes:

1. "Damaged" levees include those that have breached or were overtopped. There may be additional levees that were not breached or overtopped that were damaged. These will require damage surveys to identify.

2. "Non-Fed/Local Maintain & Eligible" levees in the impacted area (within counties declared a disaster area) that were included in the districts' lists of levees that met the requirements for assistance under PL 84-99.

3. "Non-Fed not Eligible" levees include: a). those levees that were determined to be ineligible for assistance under PL 84-99, and b). those levees for which no application was submitted. The numbers are almost certainly incomplete (the actual total may be over 2000). Most are privately owned agricultural levees. Some of these levees may be eligible for assistance from the Department of Agriculture, Soil Conservation Service.

4. Current rough estimate of the total length of non-federal eligible levees is 1800 miles and the length of non-federal ineligible levees is 4000 miles.

Numbers in *Italic* are estimates

POTENTIAL ALTERNATIVES TO LEVEE REBUILDING

(August 24, 1993)

The following is a partial list of Federal programs which may be available as alternatives or additions to levee reconstruction or repair. The list is not complete and the agencies should review this list and provide addition, or deletion recommendations.

Department of Agriculture:

Wetland Reserve Program -- permanent easements.

Conservation Reserve Program -- property easements.

Small Watershed Program (P.L. 566) -- non-structural protection.

FmHA debt restructure easements

FmHA inventory property easements and transfers

Waterbank

Department of Interior:

National Wildlife Refuge System -- purchase land.

Partners for Wildlife -- private lands habitat restoration program.

Fish and Wildlife Wetland Easement Acquisition Program

Federal Emergency Management Agency:

Section 404 of the Stafford Act -- buy out program, also available to purchase easements.

Section 1362 of the National Flood Insurance Program -- buy out insured policy holders who are subject to repeated flooding.

Environmental Protection Agency:

Wetlands Restoration -- grants.

Corps of Engineers:

Section 1135 of the 1986 Water Resources Development Act, the improvement of the environment at completed Corps projects.

Housing and Urban Development:

Community Development Block Grant Program -- grants.

Section 203 (h), Mortgage Insurance for Disaster Victims -- relocations.

Small Business Administration:

Disaster Loans -- rebuilding.

SEC. 1135. PROJECT MODIFICATIONS FOR IMPROVEMENT OF ENVIRONMENT. * 33 USC 2294 note.

(a) The Secretary is authorized to review the operation of water resources projects constructed by the Secretary before the date of enactment of this Act to determine the need for modifications in the structures and operations of such projects for the purpose of improving the quality of the environment in the public interest.

(b) The Secretary is authorized to carry out a ~~demonstration program in the two-year period beginning on the date of enactment of this Act~~ program for the purpose of making such modifications in the structures and operations of water resources projects constructed by the Secretary ~~before the date of enactment of this Act~~ which the Secretary determines (1) are feasible and consistent with the authorized project purposes, and (2) will improve the quality of the environment in the public interest. The non-Federal share of the cost of any modifications carried out under this section shall be 25 percent.

(c) The Secretary shall coordinate any actions taken pursuant to this section with appropriate Federal, State, and local agencies.

(d) Not later than two years after the date of enactment of this Act, the Secretary shall transmit to Congress a report on the results of the review conducted under subsection (a) and on the demonstration program conducted under subsection (b). Such report shall contain any recommendations of the Secretary concerning modification and extension of such program. Reports.

(e) There is authorized to be appropriated not to exceed $25,000,000 to carry out this section.

SEC. 1136. WHITEWATER RIVER, CALIFORNIA.

* As amended. In addition, there is a $5 million cap on the cost of individual projects that can be done without further authorization.

SEC1135 24 AUG M93

ITEM	FY 93 APP	FY 94 BUD	FY 94 HOUSE	FY 95 REQ
SECTION 1135	7,500	7,500	7,500	7,500
KISSIMMEE RIVER, FL	8,000	0	5,000	0
YOLO BASIN WETLANDS, CA	1,400	2,063	2,063	4,120
ANACOSTIA RIVER, MD	700	0	700	0
TOTAL	17,600	9,563	15,263	11,620
CEILING	25,000	25,000	25,000	25,000
BALANCE	7,400	15,437	9,737	13,380

TUESDAY, JULY 20, 1993

Science Times

The New York Times

The High Risks of Denying Rivers Their Flood Plains

Losing trust in levees, experts now favor more natural flood controls.

By WILLIAM K. STEVENS

FOR decades Americans have insisted on settling next to rivers and streams, like moths drawn to a flame, just as people have throughout history. And to protect their cities and farms, engineers have tried to ward off the inevitable flood waters with levees, flood walls, dams, dikes and diversion channels. To some extent this ambitious attempt to bend nature to human desires has worked.

But nature still wins often enough, as this month's destructive floods in the upper Mississippi valley vividly testify. Even the gains have come at enormous cost to the ecology of flood plains, some experts say, and in some cases control measures have perversely resulted in worse flooding.

By cutting off the flood plain's waters, levees and diversion channels have destroyed and degraded stream-side habitats that contain some of the country's richest biological resources. They have also prevented the flood plain from performing one of its most important natural functions: flood control. By storing and slowing flood waters, the plain reduces their force and height. Containing this water in a narrowly corseted channel, as is commonly done to protect farms and urban settlements, has the opposite effect. It raises both the velocity and the height of the flood and makes it all the more frightening and destructive when it breaks through defenses, as it has repeatedly done in the Midwest.

These realizations are leading flood-plain managers at all levels of government toward a different approach: cooperating with nature rather than trying to subdue it. The emphasis increasingly is on keeping new development away from the flood plain, preserving or restoring its ecosystems and letting water flow as freely as possible so that natural flood-control mechanisms can work.

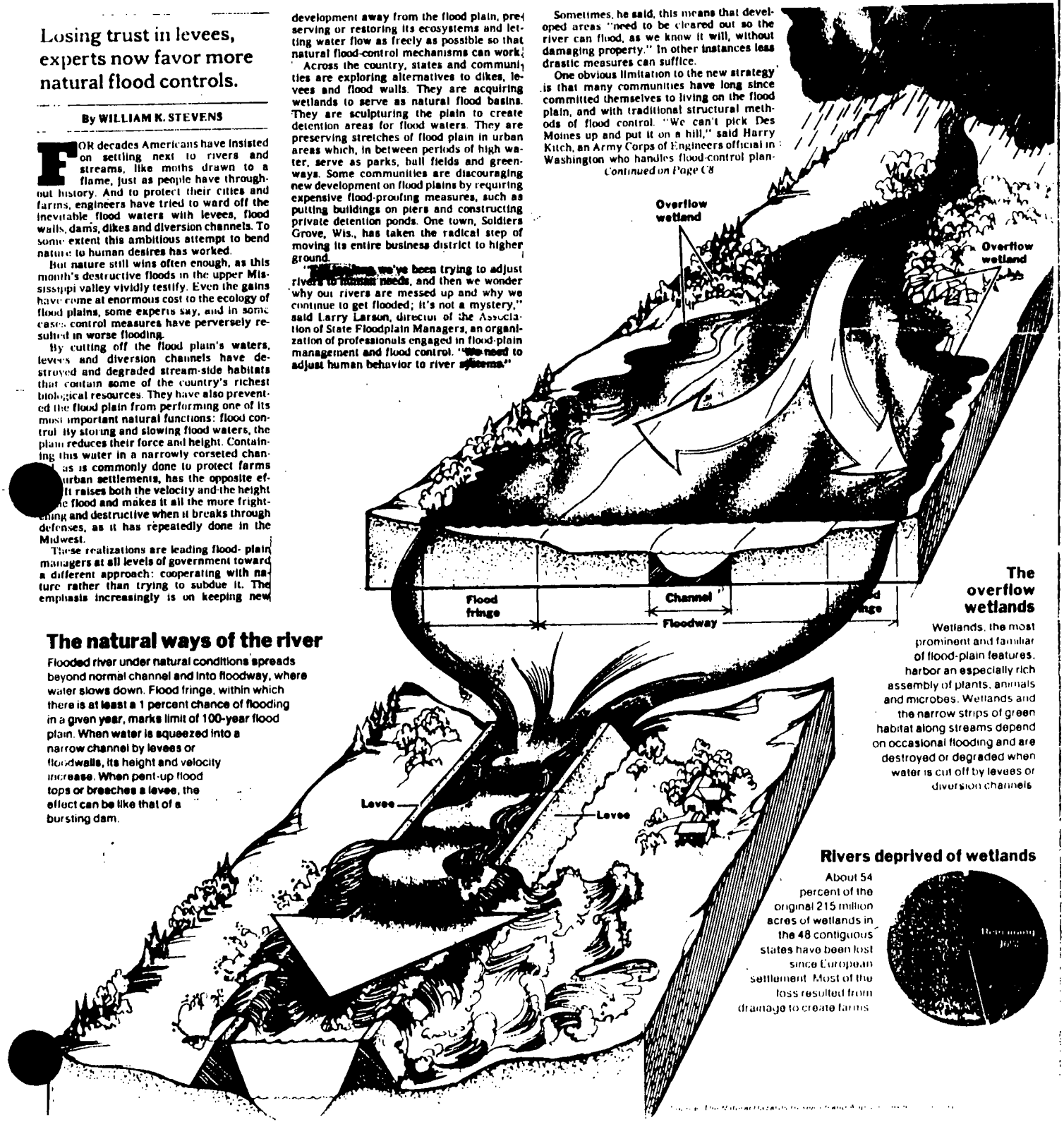
Across the country, states and communities are exploring alternatives to dikes, levees and flood walls. They are acquiring wetlands to serve as natural flood basins. They are sculpturing the plain to create detention areas for flood waters. They are preserving stretches of flood plain in urban areas which, in between periods of high water, serve as parks, ball fields and greenways. Some communities are discouraging new development on flood plains by requiring expensive flood-proofing measures, such as putting buildings on piers and constructing private detention ponds. One town, Soldiers Grove, Wis., has taken the radical step of moving its entire business district to higher ground.

"[illegible] we've been trying to adjust rivers to human needs, and then we wonder why our rivers are messed up and why we continue to get flooded; it's not a mystery," said Larry Larson, director of the Association of State Floodplain Managers, an organization of professionals engaged in flood-plain management and flood control. "We need to adjust human behavior to river systems."

Sometimes, he said, this means that developed areas "need to be cleared out so the river can flood, as we know it will, without damaging property." In other instances less drastic measures can suffice.

One obvious limitation to the new strategy is that many communities have long since committed themselves to living on the flood plain, and with traditional structural methods of flood control. "We can't pick Des Moines up and put it on a hill," said Harry Kitch, an Army Corps of Engineers official in Washington who handles flood-control plan-

Continued on Page C8



The natural ways of the river

Flooded river under natural conditions spreads beyond normal channel and into floodway, where water slows down. Flood fringe, within which there is at least a 1 percent chance of flooding in a given year, marks limit of 100-year flood plain. When water is squeezed into a narrow channel by levees or floodwalls, its height and velocity increase. When pent-up flood tops or breaches a levee, the effect can be like that of a bursting dam.

The overflow wetlands

Wetlands, the most prominent and familiar of flood-plain features, harbor an especially rich assembly of plants, animals and microbes. Wetlands and the narrow strips of green habitat along streams depend on occasional flooding and are destroyed or degraded when water is cut off by levees or diversion channels.

Rivers deprived of wetlands

About 54 percent of the original 215 million acres of wetlands in the 48 contiguous states have been lost since European settlement. Most of the loss resulted from drainage to create farms.

Risk of Denying Rivers Their Flood Plains

Continued From Page C1

ning in the central United States. The more natural approach to flood control might seek its greatest success where new development is poised to move onto the flood plain. But particularly for areas already developed, Mr. Kitch said, "you're going to end up with a balance" of structural and natural methods.

Flood-control projects of the future are likely to involve the tricky and contentious issue of just what balance should be struck. A classic example is the long-running controversy about floods along the Passaic River watershed in northern New Jersey. Towns have existed in the watershed's lower reaches for years, while other parts of the basin are only now becoming ripe for development.

The basin is one of the most flood-prone in the country. Over the past decades, various portions of it have been declared Federal disaster areas seven times. Some flooding occurs almost every year, and the Corps of Engineers estimates that a record flood, like that of 1903, would cause $2 billion in damages.

Under a joint Federal-state project authorized by Congress but not yet finally approved by the state, the Corps of Engineers has proposed a hybrid solution. The Passaic's flood waters would be shunted underneath developed areas through a $2 billion, 20-mile-long tunnel terminating in Newark Bay. The idea of the tunnel, corps officials say, is to avoid disturbing the land. The plan also calls for the state to buy up more than 5,000 acres of wetlands on the flood plain to serve as a catchment to reduce flood volume and speed. As a result, the plan might also prevent some development.

The burst levees on the Mississippi may block the return of the flood waters.

Critics say the plan comes down too little on the side of nature. They favor sharply restricting development in the entire central and upper basin, buying out flood plain residents and acquiring far more natural flood storage acreage than the plan now calls for. Critics also raise fears about the ecological impact of a rush of fresh flood waters into the marine environment of Newark Bay. Some oppose the construction of the tunnel under any conditions. The issue has divided politicians and citizens and has become an issue in the New Jersey Governor's race. Gov. Jim Florio, a democrat, has refrained from taking a position for or against the tunnel, pending an environmental impact study to be completed by the Corps of Engineers in 1995; his Republican opponent, Christine Todd Whitman, is against the tunnel, arguing that that buying out flood plain residents would be less expensive. The corps argues the opposite.

Flood plains, the subject of this and many other disputes across the country, are among the most productive ecosystems in the world. When flooded in spring, they become breeding grounds for fish. Most flood plain acreage is wetlands, and about half the country's endangered species require wetland habitat. The riparian zone along rivers is home to distinct assemblages of soils, microbes plants and animals that depend on high water tables and occasional flooding.

People originally settled along rivers because they provided water, transport and power. That is no longer true, "but now the city is there," said Mr. Larson. Later, people were drawn to flood plains because land there was cheaper. By 1991, according to an interagency Federal task force on flood plains that issued a report last year, flood-plain land in 17,000 communities occupied more than 145,000 acres and included nearly 10 million households and $390 billion in property.

This large-scale development, according to the task force, has come at "a high price extracted annually in deaths, personal injury and suffering, economic loss and damage to or destruction of natural and cultural resources." Despite extensive and expensive efforts over the years to control floods through public works (the Corps of Engineers has built 10,500 miles of levees and flood walls alone), inflation-adjusted flood damages per capita were almost 2.5 times as great in the period from 1951 to 1985 as from 1916 through 1950.

Part of this may be attributed to a growing ratio of construction to population, but levees themselves evidently contribute to the escalation. They are the most common type of flood-control measure, and when they fail, as they have many times in the Mississippi basin in recent weeks, they make the damage worse. The Federal task force noted that a breached levee, like a breaking dam, can release a large wave at high velocity on communities that believe they are protected. Images from the Mississippi basin this past week have grimly borne this out. The remaining levee system may subsequently prevent water from draining back into the river, prolonging the flood. The task force reported that levee or flood-wall failure is involved in one-third of all flood disasters.

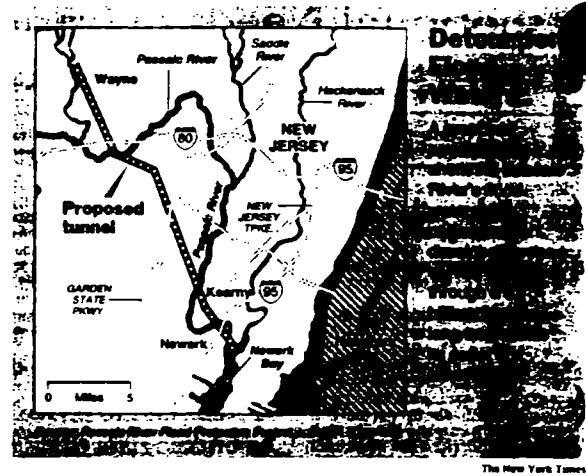
When a river's flow is constricted, its sediments are no longer deposited to fertilize the flood plain but instead may be dropped within the narrow river channel just outside the levee. This in time raises the height of the river, and the levee must be heightened in turn. "In general, a river wants to recreate itself as a river with a flood plain; it's rising in response to these rising levees," said James T.B. Tripp, an expert on floods with the Environmental Defense Fund. "River systems have a way of adjusting themselves in response to human manipulation of the flood plain in ways that can never be entirely foreseen."

A better approach, according to the emerging new wisdom, is to get the river to work for you rather than against you. The new approaches may be best suited to smaller rivers, but these spawn most of the flash floods, and flash floods are responsible for three-fourths of all Presidentially declared disasters.

After a 1984 flash flood killed 13 people and caused $180 million in property damage in Tulsa, Okla., for instance, the city and the Corps of Engineers collaborated to create a more natural flood-control system. They scooped out a series of permanent lakes in a greenway corridor set aside in Tulsa's Mingo Creek flood plain. Most of the lakes are dry, and when there is no flood the lake bottoms are occupied by soccer and baseball fields and tennis courts. When there is a flood, the lakes store and slow down the water. They are connected by a network of "trickle trails" that serve as jogging paths in dry times and low-flow flood channels in wet ones.

At the same time, development in the flood plain is strictly regulated. Developers must build their own detention ponds to make up for the increased flow that paving causes. Buildings in harm's way must be flood-proofed, usually with raised piers. One result is that developers have been discouraged from building in the flood plain — a counterforce, possibly, to whatever incentive to development may be provided by Federal disaster relief and flood insurance.

Only 15 to 30 percent of the nation's flood-prone structures are actually insured by the supposedly self-financing National Flood Insurance Program, according to the flood plain task force. Disaster relief is available to an uninsured property only once; if the property is flooded a second time and is still uninsured, owners are on their own.



The New York Times

Natural Flood Control a Success

The Tulsa system has been tested by storms that would have been expected to cause serious flooding in earlier years and has passed with flying colors, said Jack Page, who oversees development for the city. He sees "more acceptance of 'soft' engineering; we're getting away from the concrete and the pipes and are leaving the channel in a natural state." The Corps of Engineers says it considers the Tulsa project a model.

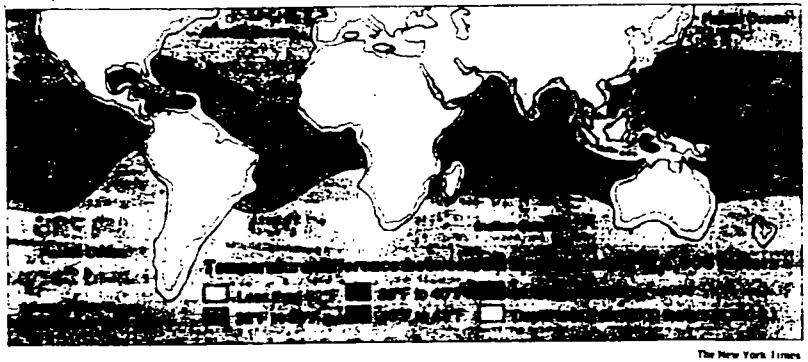
Rivers have a way of adjusting themselves in response to human manipulation.

Other localities have moved in this direction as well, often with corps involvement. As a pioneering alternative to dams and levees in the Charles River basin of metropolitan Boston, for example, the corps purchased or secured easements on 8,500 acres of wetlands to contain floods while also providing wildlife habitat and promoting recreation. The system was tested by major floods in 1979 and 1982 and each time performed effectively.

The city of Littleton, Colo., established a 625-acre park in its flood plain to attenuate floods rather than allow the South Platte River to be channeled. And in the San Francisco Bay area community of North Richmond, citizens successfully brought about the creation of a naturally meandering flood channel and restored the stream-side ecosystem in a way that would maintain ecological health while accommodating once-in-a-century floods.

In the end, if Mr. Larson and Mr. Tripp are right, there simply may be no way to protect against the very worst floods, no matter what strategy is employed. "We've got to figure out some way to help people understand that Mother Nature will reclaim what's hers from time to time," said Mr. Larson. "We must keep that in mind when we go to build our communities and cities and try to find a way to live in harmony with nature."

To which Mr. Tripp adds: "We can try and manage these river systems to some degree, but we've got to be prepared to accommodate ourselves to the river. If we think we can do things to rivers so they will never flood, we're naive."



The New York Times

Correction: Water Temperature Differences

A map in Science Times last Tuesday showing the temperature differences between deep ocean water and surface water misstated them. This is a corrected version.

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF MANAGEMENT AND BUDGET
WASHINGTON, D.C. 20503

August 23, 1993

To: Army Corps of Engineers
Federal Emergency Management Agency
Department of Agriculture
Department of Transportation
Department of Interior
Department of Housing and Urban Development
Environmental Protection Agency
Small Business Administration
Other Relevant Agencies

From: T.J. Glauthier, Associate Director, Natural Resources, Energy and Science, Office of Management and Budget

Katie McGinty, Director, White House Office of Environmental Policy

Re: Procedures for Evaluation and Review of Repair and Restoration Projects for Levees

The purpose of this guidance is to ensure the proper consideration of relevant options for repair, reconstruction, and other alternatives to levee restoration necessitated by flood damage. It also is intended to ensure that relevant organizations have the opportunity to comment on project specifications and suggest appropriate modifications. The overall goal is to achieve a rapid and effective response to the damaged flood control system that will minimize risk to life and property, ensure a cost-effective approach to flood damage mitigation and floodplain management, and protect important environmental and natural resource values.

This guidance should be viewed as an opportunity to allow consideration of alternatives with input from Federal, State, and local interests. It is not intended to deny any party access to existing programs for levee repair and restoration, to create unexpected delays, or to force alternatives to repair and restoration on unwilling participants. Nor does this contravene any existing statutory or other requirements.

In acting upon applications for levee repair and restoration of damages incurred as a result of the Midwest floods of 1993, responsible Federal agencies shall follow procedures below:

- At the time of initiating evaluation of proposals for repair and restoration of flood-damaged levees, each agency shall notify the appropriate agencies represented in the Disaster

Field Office (DFO), so that interested agencies may contribute to the evaluation process. The Federal Emergency Management Agency shall provide space at its DFOs for representatives of relevant agencies.

- In evaluating applications for levee repair and restoration in the region of the Midwest floods of 1993, each agency shall consider, to the extent practical, nonstructural alternatives and design modifications that could provide greater local benefits of flood control, reduction of future potential flood damages to the applicant and adjacent upstream and downstream localities, lower long-term cost to the Federal government, and natural resource protection. Agencies are encouraged to include other interested agencies during their evaluation process, to the extent practicable.

- Prior to final action on each application, project proposals shall be made available for review and comment to other Federal and State agencies and local interests represented at the applicable DFO for a minimum period of 24 hours (excluding weekends and holidays). Comments are to be made available to the projects' applicants. Agencies shall take these comments into consideration when making final project decisions.

- On a monthly basis, each agency shall report to the Office of Management and Budget and the Office on Environmental Policy on the status of levee repair and restoration, including: applications received, comments received, and actions taken.

MODEL FOR ACTION -- INTERAGENCY ALTERNATIVE FLOOD CONTROL COMMITTEE

A) **Interagency Coordination**

Change the name of the Levee Reconstruction and Wetlands Committee to the **Alternative Flood Control Committee.**

Break up the Alternative Flood Control Committee into five subcommittees:

1) Economic Analysis

2) Emergency Priorities

3) Alternative Flood Control Science

4) Key Agency Programs and Authorities for Coordination of Disaster Mitigation Teams

5) Data Needs

(Participation should not be limited to Federal Agencies).

B) **Coordination with NGOs**

C) **Coordination with States and State Compacts**

We need a Comprehensive River Plan.

The River Floodway Concept - A Reasonable and Common Sense Alternative for Flood Control

Prepared by

Jerry L. Rasmussen
Large River Fisheries Coordinator
and
Jim Milligan
Fisheries Resources Office Supervisor

Region 3
U.S. Fish & Wildlife Service
Columbia, MO 65293

The lengthy quotation which follows was taken from the: Missouri Basin States Association. 1983. Missouri River Flood Plain Study - Final Report, Billings, MT. It builds a good case for implementing a floodway on the Missouri River, and elsewhere, in response to the "Great Flood of 1993". Figure 1, shown below, captures the concept.

> "The need for increased levels of flood plain management along the Missouri River has been recognized by state and federal water resource planners and managers for many years. Development of the flood plain along 753 river miles, covering nearly 2 million acres in five states (South Dakota, Iowa, Nebraska, Kansas, and Missouri) has given rise to a wide varicty of management problems. Of fundamental concern to flood plain planners and managers, is the slow but continual loss of floodway conveyance capacity and evidence that river stages are increasing during periods of flooding. This loss has been attributed to bank stabilization and navigation structures, accretion of land in and along the channel, construction of agricultural and other private levees within the floodway, and construction of facilities in the floodway that are related to public, commercial, or industrial development. The weak, fragmented and inconsistent legal and administrative framework has been another major concern. Authority for management of the flood plain is divided vertically among various levels of governments, geographically by five states, and functionally through various state and federal agencies which makes it difficult to achieve a coordinated, compatible approach.

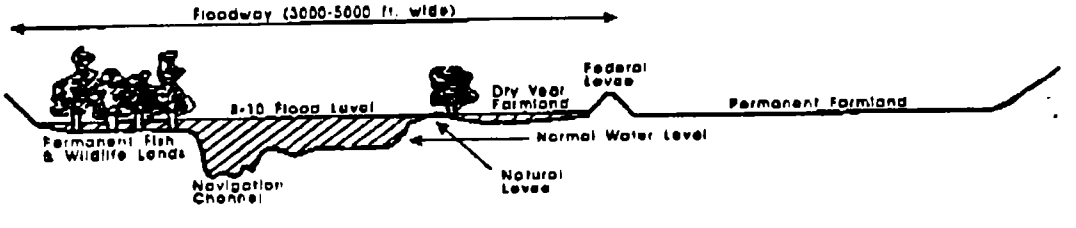


Figure 1. Hypothetical floodway showing various possible land uses. Any mix of the navigation channel and other land use could occur along any given river reach.

'In the study area, encroachment takes the form of residential, commercial, industrial and farm structures, transportation and utility systems, levees and river control structures, and recreational facilities. Throughout the study area, the bank stabilization project has been the most pervasive improvement which has reduced the carrying capacity of the channel and floodway. Through it, the overall channel width has been progressively narrowed, and numerous secondary channels (chutes) have either been silted in or closed off by successional processes into forested or other wetlands. The lateral dikes induce increased hydraulic resistance along the banks and have also narrowed flow width. Furthermore, the channel areas land ward of the protruding dikes have progressively filled, creating accretion land. This land is then converted to crop land, which then is often protected by levees.

'Analysis of discharge/stage trends plotted over the past 30 years provide an indication of the effect of encroachments on the flow characteristics of the channel and adjacent over bank areas. These curves between Omaha and the mouth indicate rotation, with stages shifting upward in the higher discharge range. In Reach 2, the Nebraska City gaging station is illustrative. At normal flows of 30,000 to 40,000 cfs, stages have been constant over time. At 100,000 cfs, however, there has been a 4 to 5 ft. rise since the 1930's. In addition, channel capacity has been reduced from 150,000 to about 90,000 cfs. At St. Joseph in Reach 3 a similar trend was observed, although a channel cutoff does confuse the situation somewhat. In Reach 4, for conditions near bankful at 200,000 cfs, rises of 2 to 3 ft. are indicated at the Waverly and Boonville gaging stations. At Hermann, while no clear indication of a rising trend occurs at flows 300,000 cfs or less, a 3 to 4 ft. increase is indicated at discharges of 400,000 to 500,000 cfs. Near the mouth of the river, the Missouri River Flood Plain River Stage and Levee Inventory Study did not analyze stage/discharge trends- or project estimated effects of the 1844 flood onto today's condition. However, data in the 1974 Baseline (Vol. II) study by the Corps of Engineers, Kansas City District, indicates that the 1844 flood would now crest about 10 ft. higher at Boonville and 12 ft. higher at Hermann. An unpublished river stage/discharge study by C.B. Belt, Washington University (1980) provides data at St. Charles. It was estimated that a 5 ft. stage increase would occur under a bankful discharge of 200,000 cfs, while a 7 to 8 ft. stage rise would occur at 500,000 cfs.

'Historically the Pick-Sloan plan and the bank stabilization and navigation project have been the catalyst for development along the Missouri River. They did not, however, provide a comprehensive approach to flood plain management or development. The Pick-Sloan Plan was authorized to provide a 3,000-ft. flow way from Sioux City, Iowa to Kansas City, Missouri and a 5,000-ft. flow way from Kansas City to St. Louis. The concept was structural in approach as Congress did not contemplate supplemental regulation. While the plan progressed in the 50's and 60's, it ground to nearly a standstill in the 70's, largely due to economic considerations and lack of local acceptance by levee districts and a few landowners along the riverbank who would be adversely affected. By contrast, the bank stabilization project did not encounter difficulties and was completed in 1980.

'As an operational flood plain management tool, the Pick-Sloan Plan is no longer considered viable because: (1) adequate returns in terms of flood loss savings do not

exist for structural measures, and (2) the NFIP (National Flood Insurance Program) approach, nonstructurally oriented, is now being emphasized. The Pick-Sloan Plan utilized the concept of equal and opposite levee setback for flow way encroachment, or the idea that equal amounts of land on opposite sides of the river would be dedicated to flow way purposes. Under this concept, the property owners can easily determine how far they can encroach into the flood plain as a levee defines the floodway border. The bank stabilization project was not conceived to provide either flood plain management or flood control benefits. However, it did stabilize the banks, prevented the destruction of considerable development from bank erosion, and has made the flood plain appear a safer place for development"

The Pick Sloan Plan which created the large Missouri River reservoirs in the Dakotas and Montana thus also authorized a floodway from Sioux City, IA to the mouth at St. Louis, MO. As stated in the above quotation from the Missouri Basin States Association, this floodway was not completed, in large part, because of landowner opposition. These same landowners will now (in 1993), undoubtedly look to the government to assist in the recovery of private lands and property that perhaps could have been protected had the proposed Pick-Sloan floodway been implemented.

The following questions thus beg to be answered:

(1) Should society pay flood damages to landowners who are reported (by the Missouri Basin States Association) to have prevented completion of the Pick-Sloan floodway?

(2) Should the Pick-Sloan floodway be implemented now to prevent future losses?

The latter seems to be the "common sense approach" to future flood damage reduction. Large portions of the Missouri River floodplain between Sioux City and St. Louis experienced extensive flooding in 1951, 1952, 1973, 1984, and 1986; and now again in 1993. When is enough, enough!

Pick-Sloan should thus be re-evaluated in light of the current flood, environmental considerations, increasing flood stages, and escalating damage claims. Implementation of the Pick-Sloan floodway would not only provide flood control benefits, but significant benefits to fish and wildlife species; possibly even heading off the impending listing of endangered species.

The floodway (Figure 1) authorized by Pick-Sloan between Sioux City, Iowa and Kansas City, Missouri was 3000 ft. wide. Average width of the Missouri River channel in that reach is 700 ft., leaving 2300 additional feet needed to complete the authorized floodway (in theory 1150 feet on each side of the river). This corridor, stretched over the 383 mile reach in question totals 106,857 acres in area. Pick-Sloan authorized a 5,000 ft. flood way from Kansas City to the mouth at St. Louis. Average width of the River channel in this reach is 1200 ft., leaving an additional 3800 feet needed to create the authorized floodway (in theory 1900 feet on each side of the river). This corridor stretched over the 367 mile reach in question totals 169,042 acres in area. Total acreage authorized for a floodway from the head of navigation, just above Sioux City, Iowa to the mouth is thus 275,899 acres. This would provide a significant amount of flood storage capacity.

Missouri River bank stabilization and navigation projects have caused the direct loss of 100,300 acres of aquatic and 374,300 acres of terrestrial habitat in the floodplain between Sioux City and St. Louis. Those losses have occurred in the 300,000 acres formerly covered by the natural river and an adjacent 364,000 acres of active floodplain erosion zone.

Channelization has also shortened this reach by approximately 127 miles (1980 USFWS Coordination Act Report). Much of this loss is attributable to accretion of land in formerly diverse floodplain habitat and its subsequent conversion to private land and intensive agriculture. The vast majority of this land is now also protected by levees which contribute to further floodplain encroachment, development and habitat losses.

Aquatic riverine habitat losses have directly impacted native Missouri River fishes. The pallid sturgeon is federally-listed as endangered and five other species (lake sturgeon, paddlefish, sicklefin chub, sturgeon chub and blue sucker) are C-2 candidates under review for listing. Many other native Missouri River fish stocks are severely depleted.

River biologists generally equate the current threatened status of these fish stocks to losses in quantity and quality of habitats such as sloughs, chutes, backwaters, braided channels, wetlands, etc. Isolation of the river from its floodplain through levee and dike encroachment and flow modification to eliminate the natural hydrograph (periodic seasonal flood pulses) have reduced nutrient and carbon inputs, while restricting access to seasonally flooded spawning and nursery habitat. The result is an expanding list of endangered, threatened and depleted fishes.

There are two essential elements to achieve optimum restoration and recovery of Missouri River fish stocks. The first of these is re-establishing some measure of the natural hydrograph which includes a spring flood pulse. The Corps of Engineers Master Manual review (currently underway) is looking at a large number of Missouri River operating alternatives. Some of these are environmental quality (EQ) alternatives which require implementation of a modified natural hydrograph.

The second essential element is to restore and re-create quantity and diversity of riverine habitats and insure access to seasonal habitats and nutrient inputs through overbank flooding. This can best be accomplished through implementation of a floodway concept (Figure 1) involving setback levees to provide floodway capacity as envisioned in the original Pick-Sloan Plan.

The estimated costs of implementing the floodway concept are great, but shrink quickly in comparison to the estimated $12 billion dollars [reported by the St. Louis Post-Dispatch (8-6-93)] needed for damage recovery from the 1993 flood, and to the $25 billion [reported by the Kansas City Star (7-17-93)] spent by the Corps of Engineers since 1927 to build the existing levees, dams, and channels along the Missouri River, Mississippi River and their tributaries.

Fee title acquisition of the entire Missouri River floodway would involve 275,899 acres at an estimated cost of $231,755,160. Flood easements could be used in lieu of acquisition on some lands, thereby allowing it to remain in agriculture, but subject to periodic flood losses. Additional costs may be incurred for levee construction at the limits of the designated floodway.

Cost estimates are based upon recent acquisitions of $1,100/acre for levee protected cropland, $600/acre for unprotected cropland and $300/acre for forest, wetland and shrub land. It is further assumed that approximately 60% of the acreage is in levee protected cropland, 20% is unprotected cropland and 20% is forest, wetland, shrub, etc.

A quarter of a billion dollar investment in such a floodway is thus a rather reasonable and insignificant one-time cost for future protection against repeating the estimated billions lost to this flood. The "Great Flood of 93" can provides a rare opportunity to serve the national interest by re-evaluating and pursuing the long overdue floodway alternative on the Missouri and other large rivers, while avoiding future human and economic loss. Many costly and pervasive problems could be resolved in this single, all-encompassing action.

Recurrent flood damages, economic losses and government disaster relief costs would be greatly reduced or eliminated. Many natural resource and endangered species issues could be resolved without the great expense and controversy of listing. Most of the economic values associated with the river such as recreation, water supply and hydropower would be unaffected or enhanced. Flood control would be enhanced, but there would be some loss of navigation benefits and agricultural production within the floodway. Some of this could likely be mitigated by providing for agricultural farming leases in dry years when water in the system does not occupy the entire floodway.

Implementation of the floodway concept also provides a grand opportunity to implement national objectives for biodiversity and ecosystem based management, while avoiding another of the costly, divisive and controversial "train wrecks" Interior Secretary Babbitt has referred to in reference to the spotted owl/developmental issue in the Northwest.

The current flood was, without a doubt a great human and economic disaster, however, if our leaders chose, the flood can also provide the stimulus necessary to focus public attention on an opportunity to get out in front of the flooding problem, and address many controversial issues at one time. Implementation of some form of the floodway can do just that. Strong, decisive leadership at state, local, and federal levels will be needed to make this happen!

8/24/93

Programmatic Environmental Impact Statement (PEIS) Addressing Long-Term Recovery from the Great Flood of '93

INTRODUCTION: There exists a requirement for a dual track process to address both the emergency rehabilitation of some 500 levees along the Mississippi/Missouri River system that were breached or otherwise damaged as a result of the 1993 midwest floods and a collateral effort to review the situation affecting the remaining 1000 - 1200 levees in the longer term. The Disaster Field Office (DFO) coordination and approval process, established by the Office of Environmental Policy/Office of Management and Budget (OEP/OMB), installed "on-the-ground" decision-making authority and dispute resolution elevation mechanisms for the emergency mode which has been agreed upon and implemented among the appropriate governmental bodies. This paper outlines a parallel track based upon the recognized process of programmatic environmental impact statements (PEIS). This dual process offers both dispute resolution and intergovernmental coordination for the longer term issues while allowing the immediate emergency levee rehabilitation work to proceed at a timely pace.

PURPOSE: The PEIS would serve as a catalyst bringing the federal agencies together with local sponsors and local, state, and Tribal governments to develop a programmatic-level, comprehensive approach to coordinated long-term recovery and subsequent management of the greater Mississippi River System (including the Missouri River) floodplain and watershed impacted by or contributing to the flood. The National Environmental Policy Act (NEPA) process, generally understood by the federal agencies, and recognized by the public as a coordination tool, provides a mechanism to assess the broad alternatives available.

The PEIS would address working within the current system of federal policies, practices and programs and it would look to revise those policies, practices and programs through legislative changes or changes within agency purview and, thereby, serve to unify the federal and states' floodplain management policies with each other and with other national goals (e.g., address wetlands losses). It would serve as a mechanism to address avoidance and minimization of flood damages from repeat flood disasters while enhancing potential ecological values. It would also serve to address flood impact minimization to landowners formerly protected by levees that are not receiving federal rehabilitation assistance. It would guide development of site-specific options. Its analyses would be at a programmatic level.

The simultaneous goals of the PEIS effort would be:

- To reduce repeated flood loss damages and thereby reduce the cost of the flood events to individuals and publicly sponsored works (e.g., roads, sewage treatment plants, levees)

- To restore the natural and beneficial functions and values of the Upper Mississippi and Missouri River floodplains

DRAFT

and watersheds, and

- To coordinate federal actions and responsibilities and coordinate these with state, tribal and local responsibilities and actions.

MANAGEMENT OF THE PEIS: We would recommend that the Corps of Engineers be the Lead Agency responsible for preparation of the PEIS due to its in-house planning and engineering expertise and experience with implementing the National Environmental Policy Act (NEPA). The OEP/OMB would provide oversight. While the Corps is nominally the lead, the nature of the proposal requires conferring upon FEMA, USDA, EPA, HUD, DOI, and DOT full and active involvement as the Cooperating Agencies. The Cooperating Agencies would assist by identifying alternatives, performing research and analysis necessary to frame the alternatives and their impacts, and in writing sections of the PEIS. Other agencies may also wish to become involved as Cooperating Agencies.

An Interagency PEIS Planning Team, with the Corps representative being the Project and Team Manager, is suggested. The Interagency PEIS Planning Team would be composed of 2 representatives (one from headquarters and one from the field or regional office) knowledgeable of their agencies' issues, programs, and capabilities. The agency representatives would be responsible for coordinating PEIS support activities with the remainder of their agency.

There may also be a need for a non-governmental body, i.e., independent panel, to review data and models used in PEIS analyses.

ISSUE RESOLUTION: The unique interagency character of this proposal requires that a mechanism be established at the outset of this effort to raise and resolve interagency disputes. Issues unable to be resolved via consensus by the Interagency PEIS Planning Team could be raised by any Team Member to its counterpart member of the Office of Environmental Policy/Office of Management and Budget Long-Term Recovery Task Force for consideration and resolution. Where resolution is not possible, that issue will be identified in the draft PEIS for public comment.

PUBLIC COORDINATION: Involvement of national and local elected representatives including tribal, state, and local governments, non-governmental organizations and the general public is critical to the success of the PEIS to address coordinated and comprehensive approach to long-term recovery of the impacted ares. Public coordination and consultation would occur throughout the PEIS planning effort. Beyond normal NEPA scoping procedures, regional workshops are recommended.

TIME FRAME: It is anticipated that with full interagency support the PEIS process could be completed in ten (10) months. To meet this admittedly optimistic timeframe will require expeditious handling of issues, activities, mobilization of federal research laboratories, dedication of a large number of staff, and contractor assistance. A rough breakdown of the actions follows:

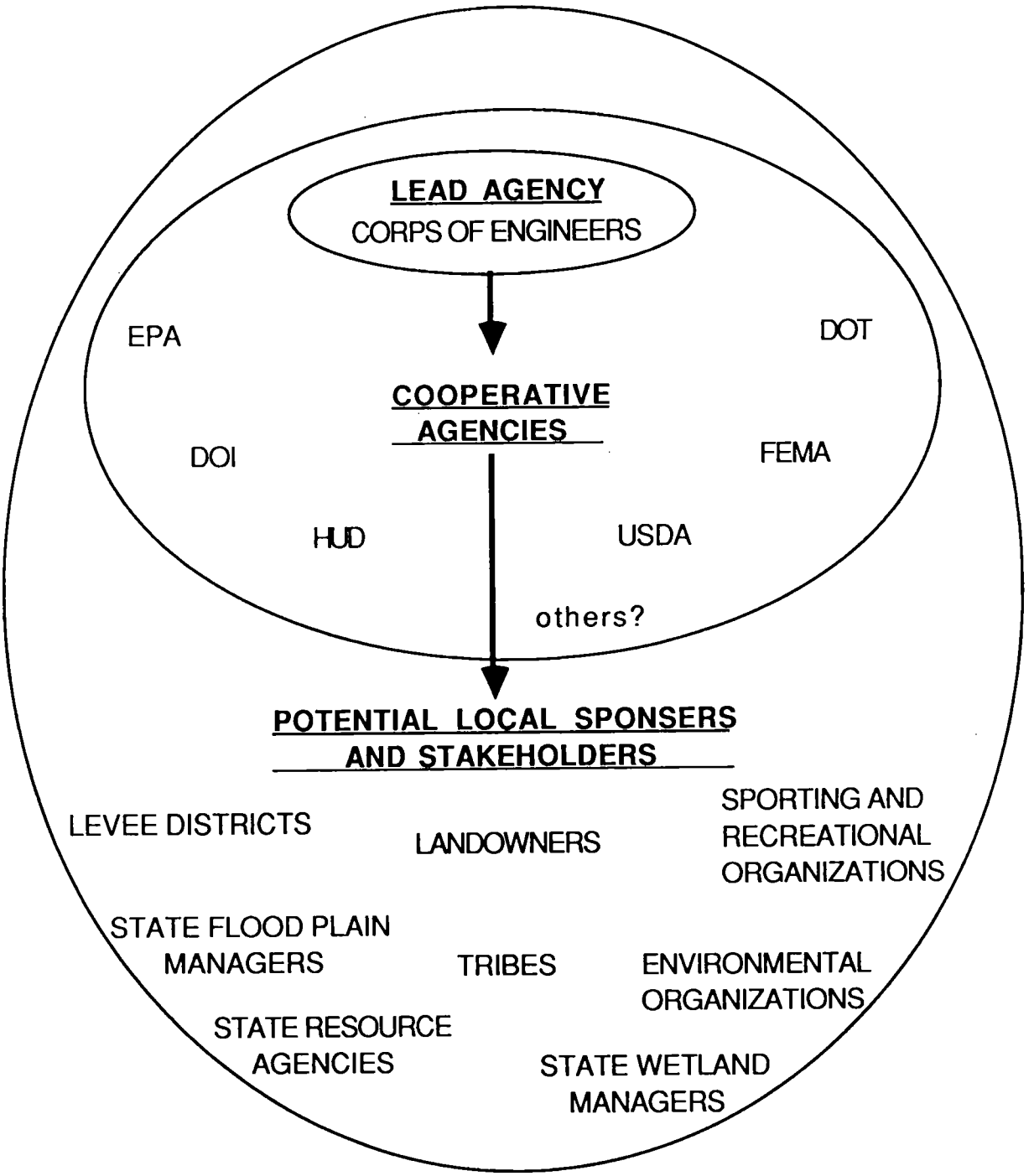
- Scoping (Sept 1 - Oct 31)
- Analysis/Modeling (Sept 1 - Dec 15)
- Draft EIS preparation (Sept 1 - Jan 31 (Notice of Availability)
- Public Review (45 days, ends March 15)
- Final PEIS preparation (March 15 - April 30)
- Public Review (30 days, ends June 1)
- Record of Decision (June 30)

Public coordination and consultation would occur throughout the PEIS planning effort.

ATTACHMENTS: A Management Heirarchy Schematic and a descriptive framework for the PEIS are attached.

RECOVERY PROGRAMMATIC ENVIRONMENT IMPACT STATEMENT

Schematic representation of
Management Heirarchy



DRAFT

Programmatic Environmental Impact Statement on the Long-Term Recovery and Management of the Upper Mississippi and Missouri Rivers Watersheds

NOTE: This proposed draft outline provides the basic structure for a Programmatic Environmental Impact Statement (PEIS) and examples of some of the issues that could be addressed in the PEIS. The examples are not intended to be a comprehensive list of all the issues, policy questions and environmental values that would be addressed in the PEIS.

EXECUTIVE SUMMARY

Summary of key conclusions and findings including unavoidable impacts, irreversible and irretrievable commitment of resources, relationship between short-term and long-term uses of resources, site-specific versus policy questions, maintenance of long-term productivity, and impacts of the no-action alternative. It identifies areas of controversy and unresolved issues. the Executive Summary summarizes how environmental laws (e.g., the National Environmental Policy Act (NEPA), Clean Water Act, Endangered Species Act, Farmland Protection and Policy Act, Stafford Disaster Assistance Act, Fish and Wildlife Coordination Act, National Historical Preservation Act, etc.), executive orders (E.O. 11990, Protection of Wetlands, and E.O. 11988, Floodplain Management), and other policies were considered.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACRONYMS AND ABBREVIATIONS

1.0 INTRODUCTION

1.1 PURPOSE AND NEED FOR THE PEIS

A PEIS would be an appropriate vehicle to serve as a catalyst bringing the federal agencies together with state resource, planning and regulatory agencies, Tribal governments and other potential local sponsors to develop a comprehensive approach to long-term recovery and subsequent operation and management of the greater Mississippi River System (including the Missouri River). The process, generally understood by the federal agencies and recognized by the public as a coordination tool, provides a mechanism to assess the broad alternatives available. It would address working within the current system of federal policies,

practices and programs and it could look at options to revise those policies, practices and programs through legislative changes or changes within agency purview and, thereby, serve to unify the federal and states' floodplain management policies and other national goals (e.g., address wetlands losses). It could also serve to develop a process for developing site-specific options.

The simultaneous goals of this effort are:

- To reduce repeat flood loss damages and thereby reduce the cost of the flood events to individuals and publicly sponsored works (e.g., roads, sewage treatment plants, levees)

- To restore the natural and beneficial functions and values of the Upper Mississippi and Missouri River floodplains and watersheds, and

- To coordinate responsibilities between federal agencies and with state, Tribal and local agencies or entities.

1.2 FUNCTION AND SCOPE OF THIS DOCUMENT

This section describes the Council on Environmental Quality (CEQ) regulations for implementing the procedural provisions of the National Environmental Policy Act (NEPA) including §1501.2 which directs agencies to "integrate the NEPA process with other planning at the earliest possible time to ensure that planning and decisions reflect environmental values, to avoid delays later in the process, and to head off potential conflicts." The scope of the proposed PEIS will be based on, but not unduly limited by, programmatic issues raised by federal, state and local agencies and the public (including landowners, environmental groups and businesses) throughout the process of developing the PEIS. This PEIS addresses a programmatic coordinated, comprehensive approach to long-term recovery with greater levels of coordinated management of the watershed to take advantage of its natural and beneficial values. **The level of detail would be consistent with a programmatic analysis.**

1.3 AREAS OF CONTROVERSY

1.4 ISSUES TO BE RESOLVED

1.5 REGULATORY, POLICY AND ASSISTANCE FRAMEWORK

1.6 RELATIONSHIP TO PREVIOUS AND ONGOING NEPA ACTIONS (e.g., Corps' Upper Missouri River Master Manual, Lock and Dam 26

activities, Mississippi River Fish and Wildlife Restoration activities) The relationship of this PEIS to ongoing studies and NEPA actions would be explained in this section.

2.0 PROPOSED ACTION AND ALTERNATIVES

This section describes the current situation (no action alternative) and the proposed alternatives to it.

2.1 PROPOSED ACTION: TO BE DEVELOPED

This section describes the establishment of a unified federal policy regarding the recovery and subsequent management of the floodplains of the Upper Mississippi and Missouri Rivers.

2.2 NO ACTION ALTERNATIVE: PRE-FLOOD POLICIES AND PRE-FLOOD AND POST-FLOOD CONDITIONS

This section establishes the basis for comparing the impacts of proposed alternatives. It discusses the probable events and environmental impacts that will occur under existing plans and policies.

2.3 ALTERNATIVES: Any number of alternatives that are reasonable and serve to sharply define the programmatic issues. This section describes the wide variety of federal environmental and financial policy and program options that should be examined and possibly pursued. Issues meriting discussion within the context of one or more alternatives include:

- actions that reduce the rate of inflow from the watershed (e.g., restoration of wetlands, improved soil and water retention practices)
- siting and design of federal, state, and local government and other publicly owned or sponsored facilities with natural flood control and non-structural flood risk minimization measures
- utilization of and targeting federal programs that would assist floodplain management and flood loss reduction (e.g.,
    - the Corps' Pick-Sloan authorization to secure 3000 ft. to 5000 ft of the width of Missouri floodway;
    - the DOI's Partners of Wildlife effort [Fish and Wildlife Act of 1956], North American Waterfowl Management Plan program [North American Wetlands Conservation Act of 1989], and targeting National Wildlife Refuge System acquisitions;
    - the USDA's Wetlands Reserve Program and Farmers Home Administration wetland easement and land transfers for conservation purposes [Agricultural Credit Act of 1987];
    - the FEMA's programs of relocation and buy out of property; and

- sales by the Resolution Trust Corporation).
- strengthening and reinforcing levees and dikes in urban and industrial areas
- alternative levee design and construction methods
- relocation of floodplain structures through new and existing incentive programs
- putting incentive programs on an even keel with rebuild to pre-flood options
- flood proofing floodplain dependent structures (e.g., waste water treatment plants, drinking water treatment facilities, existing toxic/hazardous waste sites and solid waste landfills)
- requirements that runoff and flood storage capacity be built into projects qualifying for federal assistance, permits, or licenses.
- using wetlands as natural flood retention basins
- exploring the true costs of federal payments associated with current operations along the river (e.g., crop insurance vs. levee rehabilitation; improved water quality vs. drinking water treatment costs)
- federal, state and local acquisition of wetlands in higher order streams to assist continued functions
- obtaining commitments on floodplain management from local governments
- identifying areas suitable for greenways (floodways in urban areas that serve recreation and other natural and beneficial uses)
- coordinated authority for floodplain activities (e.g., a floodplain management act similar to the Coastal Zone Management Act)
- moving businesses and residences to higher grounds (relocation program of Upton-Jones Act)
- flood proofing residences and businesses
- providing additional storm water retention ponds in urbanized and sub-urbanized areas to assist addressing non-point source water quality issues and asynchronization of flood peaks
- coordinated federal position on farming/crop insurance in areas between federal levees
- coordination on river flows management
- flexibility to manage rivers to allow for periodic low flow flood events (e.g., allowing predictable 5-year flood events to benefit endangered species habitat)
- sewage treatment plant construction and enhancement priorities and opportunities
- solid and hazardous waste monitoring, management or removal

2.4 COMPARISON OF ALTERNATIVES

This section compares in brief the environmental effects of

the alternatives. The impacts of long-term recovery efforts would look at the relationship of reconstruction activities to flood peaks, duration, and associated flood damages encountered in areas with high expected economic value, areas with significant risk to human health and safety, or areas with significant cultural or historic sites. It would focus on both the economic and environmental feasibility of incorporating alternative approaches to reducing flood risk, flood damages, and federal payments associated with natural disaster events (such as flood and drought).

2.4.1 COMPARISON OF ALTERNATIVES - OVERVIEW

2.4.2 COMPARISON OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES

A comparative summary of the impact analyses presented in Chapter 5. It includes impacts to environmental values, floodplains, wetlands, sediment/soil impacts, natural systems, reconstruction integrating pollution prevention and energy efficient values into its planning and recovery efforts, and environmental equity.

3.0 CONSULTATION AND COORDINATION

This section describes the way in which the scope of the document was developed, the level and type of interagency and intergovernmental coordination during preparation of the document, and further stages of public participation that will occur.

4.0 AFFECTED ENVIRONMENT

This section identifies the pre-flood, current and reasonably foreseeable future conditions of the environment that might be impacted by alternatives proposed in the PEIS. It will focus primarily on the upper Mississippi and Missouri Rivers' watersheds, floodplains, and aquatic habitat (only where significant potential impacts have and may again occur).

4.1 Geology/Soils/Sediment/Hydrology (e.g., data on watersheds' soil types, erosion, flood risk, flood peaks and duration, floodplain storage)
4.2 Land use (includes identification of Prime and Unique farmlands)
4.3 Socioeconomics
- 4.3.1 Demographic Characteristics
- 4.3.2 Employment and Income
- 4.3.3 Agricultural Characteristics
- 4.3.4 Economic Diversification
- 4.3.5 Insurance Programs
  - 4.3.5.1 Flood Insurance

4.3.5.2 Crop Insurance
4.3.6 Commercial Shipping
4.3.7 Recreational Uses
4.4 Biological Resources
4.4.1 Terrestrial Habitats/Ecosystems (including Endangered and Special Status Species)
4.4.2 Aquatic Habitats/Ecosystems (including Endangered and Special Status Species)
4.5 Transportation
4.5.1 River (i.e., navigation issues)
4.5.2 Surface (e.g., road, rail, including bridges)
4.5.3 Pipeline
4.5.4 Air (i.e., commercial and general aviation airports)
4.6 Hazardous/Municipal Waste and Toxic Chemicals
4.6.1 Control of Hazardous Chemicals
4.6.2 Municipal Solid Waste
4.6.3 Emergency Response Procedures
4.7 Air Quality
4.8 Water Quality
4.8.1 Drinking Water
4.8.1.1 Private Wells
4.8.1.2 Treatment facilities
4.8.2 Sewage Treatment
4.8.3 Instream Water Quality
4.8.4 Sediment Quality
4.9 Human Health and Safety
4.10 Cultural Resources
4.11 Visual resources
4.12 Recreation Resources
4.13 Others

5.0 ENVIRONMENTAL EFFECTS

This section discusses the direct, indirect and cumulative impacts of each alternative.

5.1 ANALYTICAL METHODS

This section describes the methodology and procedures for analyzing potential environmental impacts for elements defined in 4.1 through 4.12, above.

5.2 ALTERNATIVE 1: PROPOSED ACTION

5.2.1 Geology/Soils/Sediment/Hydrology
- Impacts to soil characteristics (nutrient, erosion, compaction, etc.)
- Stream erosion and deposition patterns
- Flood storage impacts
- Hydrograph impacts

5.2.2 Land use (includes identification of Prime and Unique farmlands)
- Impacts of varying levels of flood protection

on land use
- Impacts of alternative recovery measures on land use
- Floodplain management

5.2.3 Socioeconomic
- Shifts in population due to shifts in policy, levels of protection
- Impacts of relocation
- Shifts in employment opportunities and income
- Shifts in agricultural production (crops, values)
- Shifts in recreation opportunities
- Federal savings from policy/program changes

5.2.4 Biological Resources
- Effects on special habitats and species
- Watershed planning benefits to habitat, water quality, etc.
- Flood storage capacity of natural areas
- Hydrological impacts on biological resources

5.2.5 Transportation
- Effects on availability, cost, choices, siting
- Speed requirements
- Siting of airport facilities

5.2.6 Hazardous /Municipal Waste and Toxic Chemicals
- Current practices/situation
- Siting effects
- Changes in quantity/character of waste in flood zone
- Changes in probability of incidents

5.2.7 Air Quality
- Air quality impacts of open burning
- Traffic flow impacts
- Indoor air quality

5.2.8 Water Quality/Quantity
- Effects of policies on drinking and wastewater treatment plant location and technology
- Effects on ground water quality and quantity
- Effects on river water quality and quantity
- Effects on river sediment quality
- Cost savings from increased water quality (lower treatment costs)

5.2.9 Human Health and Safety
- Effects of floods of various levels on life, injury, property safety
- Effects on disease vectors

5.2.10 Cultural Resources
- Effects on historical, tribal, architectural and other cultural resources

5.2.11 Visual resources
- Changes in visual quality

5.2.12 Recreation Resources

- Changes in recreational opportunities, access, quality

5.2.13 Others

5.3 ALTERNATIVE 2: NO ACTION ALTERNATIVE
Effects of continuing the status quo regarding policies, priorities, procedures, projects, and reports on the status of short-term recovery efforts. This analysis includes the same elements as Alternative 1, above.

5.4 ALTERNATIVE 3 (and all other alternatives): This analysis includes the same elements as Alternative 1, above.

6.0 ENVIRONMENTAL COMMITMENTS
This section pulls together and describes all commitments to avoid, minimize or mitigate adverse effects.

7.0 REFERENCES

8.0 LIST OF PREPARERS
This section identifies the people and agencies that will have substantial input in the preparation of the document primarily by providing data, coordination or review.

9.0 INDEX

10.0 APPENDIXES (as necessary)

Table of Contents for August 25, 1993 Meeting Materials

DEPARTMENT OF THE INTERIOR
ALTERNATIVE FLOOD CONTROL STRATEGIES

Statement of Principles

The Federal response to the 1993 flood should focus on both the restoration of traditional flood risk protections (i.e., levees, drainage and diversion facilities) and the use of alternative flood control measures.

Reconstruction priority should be placed on residential, industrial or commercial lands, areas with significant risk to human health or safety, or areas with cultural or historic sites.

Reconstruction in other areas must be proceeded by a careful assessment of:

- the relationship of reconstruction activities to flood peaks, duration, and associated flood problems encountered in residential, industrial or commercial lands, areas with significant risk to human health or safety, or areas with cultural or historic sites; and

- the economic and environmental feasibility of incorporating alternative approaches to reducing flood risk into the flood control system for the area (e.g., floodplain floodwater storage, increasing flood water retention, and wetland restoration in the watershed). Economic analysis should include an evaluation of all costs and benefits over time associated with the alternative.

Efforts to address flood control systems should include actions to reduce the rate of inflow from the watershed (e.g., restoration of wetlands and improved soil and water retention practices). The entire watershed should be considered when determining where reconstruction and alternative flood control measures will be implemented.

Reconstruction efforts should emphasize local cost-sharing as reflected in the Water Resources Development Act of 1986. Waivers of cost-share provisions should be considered if such waivers promote alternative flood control strategies.

Repairs to Department of the Interior facilities and lands must conform to these principles, and should be designed with natural flood control and floodplain compatible management strategies as a primary consideration.

Using its existing authorities and capabilities, DOI will work with other Federal agencies to reduce or eliminate, to the extent possible, the potential for future flood-related problems and/or associated disaster payment outlays.

Disaster Field Office Coordination

Prepared by: DOI Alternative Flood Control Strategies Workgroup

The Department encourages a "Unified Federal Response" to develop and implement a comprehensive river management program. Using our combined resources, the agencies of the Federal government have the ability to create a master plan for the river basin that accommodates economic, environmental and cultural concerns.

The Department of the Interior will continue to work with the Disaster Field Offices. Currently, Department representatives are working with the Corps of Engineers reviewing individual levee repair proposals. In addition, the Department is making staff available to participate as members of the interagency hazard mitigation teams as well as to participate as appropriate during the review of alternative approaches to levee reconstruction.

To facilitate rapid response and information transfer, the Department of the Interior has designated a point-of-contact (see attached list) in each flooded state to work with the Disaster Field Offices. These contacts will coordinate the review of levee reconstruction proposals authorized, funded or carried out by the Corps of Engineers, Soil Conservation Service or the Federal Emergency Management Agency. In the most heavily impacted states (Iowa, Illinois, Missouri) the Department of the Interior contacts will be co-located with the Disaster Field Offices.

Using its existing authorities and capabilities, DOI will work with other Federal agencies to reduce or eliminate, to the extent possible, the potential for future flood-related problems and/or associated disaster payment outlays.

8/19/93

Department of the Interior
Flood Response Contacts

State	Name	Address
North Dakota	Al Sapa	North Dakota State Office 1500 Capitol Avenue Bismarck, ND 58501 701/250-4481 701/250-4400 FAX
South Dakota	Stan Zschombler	South Dakota State Office 420 So. Garfield Avenue Pierre, SD 57501-4408 605/224-8693 605/224-9974 FAX
Kansas	Bill Gill	Kansas State Office 315 Houston, Suite E Manhattan, KS 66502 913/539-3474 913/539-8567 FAX
Nebraska	Steve Anschutz	Field Supervisor-NE/KS 203 W. 2nd Street, 2nd Floor Grand Island, NE 68801 308/381-5571 308/381-5512 FAX
Iowa	Jim Munsen	Walnut Creek NWR P.O. Box 399 Prarie City, IA 50228 515/994-2415 515/994-2104 FAX
Illinois	Rick Nelson	Rock Island Field Office 4469 48th Avenue Court Rock Island, IL 61201 309/793-5800 309/793-5804 FAX
Minnesota	Jim Fisher	Upper Mississippi NWR 51 East 4th Street Room 101 Winona, MN 55987 507/452-4232 507/452-0851 FAX

Wisconsin	Eldon McLaury	US Fish and Wildlife Service 700 Rayovac Drive Madison, WI 53711 608/264-5469 608/264-5472 FAX
Missouri	Jerry Rasmussen	Columbia Field Office 608 East Cherry Street Columbia, MO 65201 314/876-1911 314/876-1914 FAX

Suggested Alternatives to Levee Reconstruction

The following is a list of Federal programs that should be considered as alternatives to levee reconstruction or repair. This list was generated in response to the August 20, 1993 memorandum from T.J. Glauthier and K. McGinty.

Corps of Engineers

The Floodway on the Missouri River authorized by the **Pick-Sloan Plan** which was never implemented should be revisited. The floodway concept addresses the issues of recurrent flood damages, personal and economic losses, government disaster relief costs, natural resource and endangered species issues, and National objectives for biodiversity and ecosystem based management, while avoiding recurring costly, divisive and controversial developmental and environmental conflicts. Evaluate the potential for implementation of the floodway concept on other major river systems as well.

Revise Corps of Engineers policy to reflect the recognition by Upper Mississippi and Illinois River management agencies that there needs to be a balance between flood control and navigation and natural resources management missions. The Corps of Engineers 9-foot navigation channel authority dominates all other agencies and authorities such that wetlands protection and restoration, fish and wildlife, recreation, and water quality are secondary project purposes and suffer as a result.

Evaluate and recommend changes to current **Corps of Engineers Policy** relative to federal flood reduction strategies and the possibility of ecosystem management on the Upper Mississippi River.

Priorities for reconstruction. Each agency shall consider, to the extent practical, nonstructural alternatives and design modifications that could provide greater local benefits of flood control, reduction of future potential flood damages to the applicant and adjacent upstream and downstream localities, lower long-term cost to the Federal government, and natural resource protection.

Based on the analysis of hydrology, topography and economic benefits, the Corps of Engineers should consider **levee realignment** in conjunction with floodplain management.

Each reconstruction project should be analyzed for its potential contribution to downstream flooding, erosion, and sediment deposition. **Economic analysis** should include an evaluation of all costs and benefits over time associated with the project.

Reduce the rate of inflow from the watershed via **water delaying techniques** such as restoration of wetlands and improved soil and water retention practices. The entire watershed should be analyzed when determining where reconstruction and alternative flood control measures will be implemented.

Emphasize Section 1135 of the 1986 Water Resources Development Act which authorizes the improvement of the environment at completed Corps projects.

Department of the Interior

Partners for Wildlife Program -- The U.S. Fish and Wildlife Service administers the Partners for Wildlife program which provides financial and technical assistance to private landowners willing to restore wetlands and riparian habitat. In the disaster area alone, almost 2,000 landowners have been assisted in restoring over 65,000 acres of small wetlands. In FY93 and FY94 an additional 4,000-5,000 acres of restoration will occur each year. With over 21,000,000 acres of drained wetlands in the watershed a larger scale restoration program is needed for the rapid rate of runoff to be reduced. Our goal should be for every landowner in the watershed to be able to receive, on a voluntary request basis, technical and financial assistance to restore as many of the 21,000,000 acres of drained wetlands in the watershed as possible.

Land and Water Conservation Fund Act Acquisition Program -- The U.S. Fish and Wildlife Service and the National Park Service have the authorities to purchase lands for inclusion in the National Fish and Wildlife Refuge and Park Systems. These bureaus may wish to explore the possibility of acquiring from willing sellers lands that reduce future flood risk. Such risk reduction could be via acquisition of flood-prone lands or lands that have potential for wetland restoration.

Fish and Wildlife Wetland Easement Acquisition Program -- Consider acquisition, through purchase or lease, aquatic and wetland habitats created by the flood; realign any levee reconstruction to keep these habitats within the unprotected floodplain, thus enhancing flood storage capability; and place any such sites of extraordinary ecological value in the National Wildlife Refuge System.

Multi-objective River Management Program -- The National Park Service has prepared a report on Multi-Objective River Corridor Management in cooperation with the Association of State Wetland Managers and the Association of State Floodplain Managers. This study, in looking at eight case examples, illustrates innovative and successful strategies for multi-objective river corridor planning and management. A key feature of these case studies is the development of cooperative public and private partnerships. The National Park Service is entering into a cooperative agreement with the Association of State Floodplain Managers, Inc. to develop materials for Multi-Objective River Corridor Management, pursuant to the Wild and Scenic Rivers Act.

National River Corridors Program -- Consider establishing Missouri and Mississippi River floodways as National River Corridors which serve both environmental (native species preservation, biodiversity, and recreation) and economic (water supply, navigation, and compatible agriculture) interests, using a variety of existing authorities.

North American Waterfowl Management Plan -- The Plan is being implemented through innovative Federal-state-private partnerships to restore, enhance and

protect wetlands. Through the Draft Upper Mississippi-Great Lakes Joint Venture implementation plan, priority wetlands conservation strategies and locations in the floodplain area have been identified. Wetland projects reduce flood risk by retaining water on the land.

National Fish and Wildlife Foundation Act -- This Act has authorized $5 million annually to match non-Federal contributions for land acquisition.

Bureau of Indian Affairs Land Acquisition and Leasing Programs -- Numerous statutory authorities provide for the acquisition, disposal, and leasing of Indian lands for various purposes.

Department of Agriculture

Wetland Reserve Program -- Increase emphasis on the Wetland Reserve Program that authorizes the Secretary of Agriculture to purchase permanent conservation easements on wetlands and converted wetlands with a cropping history and to fund restoration on the easement lands.

Conservation Reserve Program -- Provides for 10 year conservation easements on Highly Erodible Soil.

Waterbank -- Pays landowners to hold water on a portion of their property to enhance spring and summer habitat for migratory birds.

Soil Conservation Service Small Watershed Program (P.L. 566) -- This program should be reviewed to determine how it could better contribute to on-farm soil and water retention in the upper watershed areas. The thrust would be to institute projects, jointly supported by USDA and DOI, that include wetland, prairie, and riparian restoration efforts as major aspects in addition to providing for additional temporary floodwater storage. There should be no stream channelization or modification associated with these projects.

Inventory Property Disposal Program -- The **Farmers Home Administration** review of inventory properties should involve careful screening of lands for transfer to state or Federal agencies for conservation purposes; placing restrictions on properties being resold so as to avoid high flood risk activities; and possibly instituting a land exchange process where landowners in high risk areas could exchange land for other less flood prone inventory lands.

Debt Restructure Program -- The **Farmers Home Administration** should emphasize the Debt Restructure program that allows loan holders to reduce their debt by offering long-term conservation easements on their properties.

Federal Emergency Management Agency

Section 1362 of the **National Flood Insurance Program** -- should buy out insured policy holders who are subject to repeated flooding.

Environmental Protection Agency

Clean Water Act Program -- should evaluate and recommend needed changes to the Environmental Protection Agency's Clean Water Act implementation (Section 401) on the Mississippi and Missouri Rivers to ensure full application of protection mechanisms when developing Federal flood control strategies as well as future Federal ecosystem management strategies.

EPA Grant Programs -- should increase wetland restoration grants.

Housing and Urban Development

Community Development Block Grant Program -- discourage new development grants in flood-prone areas.

Section 203(h), Mortgage Insurance for disaster victims -- focus on relocation.

Small Business Administration

Disaster Loans -- Encourage rebuilding outside the flooded area, where feasible.

Resolution Trust Corporation

The land disposal actions of the **Resolution Trust Corporation** and **Federal Deposit Insurance Corporation** should be reviewed to determine the extent to which they can contribute to reducing future high risk land uses in flood prone areas.

Multi-Agency Recommendations

Evaluation of Alternatives - (DOI, COE, USDA) Prior to implementing alternative flood control strategies, information should be compiled from the Geological Survey, Bureau of Reclamation, Corps of Engineers, Environmental Management Technical Center, and Soil Conservation Service for the purpose of preparing a **synthesis of available hydrologic data and model technology** for the purpose of determining flood stage and duration (a) under alternative levee configurations, (b) using floodplains for natural floodwater storage and passage, and (c) under various projections of upstream wetland restoration/floodwater retention. The project should be a cooperative effort involving all agencies having expertise in this area.

Floodplain Management -- Focus Federal involvement in floodplain management on multi-dimensional (structural and non-structural) approaches. Where cost effective, focus flood control measures on more natural, less costly, non-structural solutions, utilizing administrative measures and natural environmental and landscape features.

Executive Order 11988 -- Implement Executive Order 11988 on Floodplain Management to more effectively reduce or eliminate Federal agency actions that directly or indirectly induce future floodplain development. To achieve this goal consideration should be given to: (1) limiting emergency actions of federal agencies to those actions taken to avoid the "imminent loss of life" (e.g. maintenance of water supplies), or are an immediate threat to national security (e.g. failure of a bridge or navigation lock); and (2) ensuring that all other actions are completed in full compliance with NEPA, and other appropriate authorities such as the Fish and Wildlife Coordination Act.

Runoff storage (USDA, COE) -- Require that runoff storage capacity be built into any upland or protected floodplain project qualifying for federal loans or licenses. These would include levee and drainage districts, which currently provide no flood storage capacity and are allowed to pump interior drainage water into rivers, even during major flood events.

Policies and statutes -- Revise Federal agency policies and statutes to recognize natural flood storage and conservation/restoration of natural floodplain functions as major considerations.

Federal land demonstration projects -- Federal lands should be screened for their potential to include additional wetland-restoration-based floodwater retention projects/activities in their management/development plans where such would not conflict with the purpose for which the lands were acquired. These lands could also be utilized to test or demonstrate the potential benefits from such projects.

Disaster Assistance Programs -- Encourage relocation of flood plain structures through an incentive program (i.e. increased one-time disaster assistance payment). Flood-proof "water dependent" activities, sewage treatment plants, existing toxic waste sites, cultural sites, and natural heritage sites.

Current federal water management programs, for example those of the USDA and Corps of Engineers, need to be revised in the Upper Mississippi River basin, because they are at cross purposes, which results in net negative impacts to fish and wildlife resources and high taxpayer costs. For example, USDA continues to subsidize crop production in levee and drainage districts which are intended to move water quickly out of those areas, while the Corps of Engineers designs and builds flood control projects in the floodplain to compensate for the loss of natural flood storage. In addition, USDA programs encourage commodity crop practices that increase non-point source pollution impacts (chemicals and sediment) to DOI and state trustee fish and wildlife resources. Additional federal dollars area then spent by the Corps of Engineers, EPA, and the Fish and Wildlife Service to attempt to rectify pollution impacts to people and fish and wildlife.

Prepared by: DOI Alternative Flood Control Strategies Workgroup

DOI Programs and Capabilities to Assist in Flood Response

Department of the Interior (DOI) programs, capabilities and technical expertise are extensive and should be used in any post-flood action plan. The skills and information housed in the Department are available to the flood response agencies.

DOI bureaus have an extensive network of data gathering capabilities for providing the information necessary for enlightened decision-making. This includes data and interpretation on flood risk, flood peaks and duration, floodplain storage and other water retention techniques, water quality, detailed mapping of topography, soil types, erosion and other physical changes, and status of fish and wildlife quantity and quality and other aspects of the ecosystem. With proper funding this suite of physical and biological information can guide the decisions affecting the entire Mississippi River drainage area and specific areas within the system.

Resource Inventory and Analysis

(Mapping, monitoring, surveying, water quality, GIS, hydrology)

The National Wetland Inventory, under the Emergency Wetlands Resources Act of 1986 (P.L. 99-645), has prepared detailed wetland habitat maps, at the scale of 1:24,000 for the entire Upper Mid-West. A portion of the maps have been digitized. This digital data can be used in conjunction with other data in the geographic information system (GIS) to develop alternative flood control strategies. A report to Congress entitled "Wetlands, Losses in the United States 1780's to 1980's" documents wetland losses by state that have occurred over the last 200 years. Restoring these wetlands would provide flood storage during future floods.

Environmental Contaminants Program (USFWS), comprised of a network of field biologist and support personnel within Ecological Services, who apply toxicological information, bioassessment tools and techniques, and related technical assistance to address the myriad of contaminants problems confronting fish and wildlife and their habitat. The contaminants program coordinates with other Service programs, other Federal agencies, State agencies, non-government organizations, and the private sector as a means of sharing expertise, economizing, and developing the most effective solutions toward protecting environmental quality.

Geological Survey (USGS) USGS expertise includes: Data collection, analysis, and interpretation (including modeling) of environmental factors on earth science processes. Applicable expertise includes: geology, watershed runoff, geomorphology, streamgaging, sediment transport, water quality, toxic contaminants, ground water resources, mapping, and remote sensing. USGS also coordinates the preparation and dissemination of topographic maps, digital cartographic data, aerial photography and satellite imagery to support land resource planning and decision-making

at all levels of government. The USGS maintains an inventory of available maps and data to support Federal and State emergency response planning and disaster mitigation.

National Biological Survey. The National Biological Survey, a new bureau at the Department of the Interior effective at the start of Fiscal Year 1994, brings biological research, inventory and monitoring and information transfer capabilities to Federal alternative flood control efforts. The NBS will have the capability to undertake long and short term biological research - both applied and basic - as well as inventorying and monitoring fish and wildlife resources. Because the NBS is being created by combining the biological expertise of scientists from several Interior bureaus, it can offer the skills of biological scientists and technicians, veterinary medical scientists, physical scientists, mathematicians and statisticians, social scientists and museum specialists.

The NBS will focus on providing ecosystem information to resource managers, which could be of particular value to agencies involved in alternative flood control. Specifically, the NBS's National Fisheries Contaminants Research Center in Columbia, Missouri, and the NBS's Large Rivers and Aquatic Systems program are valuable resources in understanding the biota of the Mississippi in support of reconstruction.

Environmental Management Technical Center, Onalaska, Wisconsin. Congress authorized the Long Term Resource Monitoring Program (LTRMP) for the Upper Mississippi River System (UMRS) via the Water Resources Development Act of 1986. The Long Term Resource Management Plan is being implemented by the Environmental Management Technical Center located in Onalaska, Wisconsin.

Capabilities and Specialties include: technical expertise in physical, biological and chemical science providing sophisticated data collection, analysis and research on ecological issues; aerial photography using flight planning software and a high resolution camera equipment; use of satellite imagery for production and classifying scenes of land cover for the floodplain of the UMRS; digitizing data for inclusion in a spatial data base and for subsequent evaluation; use of global positioning systems to locate field study sites; computer analysis of spatial data using Geographic Information System software and technical staff; and production of cartographic products, technical reports, graphic designs and other documents.

Bureau of Reclamation (surveying). Reclamation has the capability to provide surveying staff and maintains state- of-the-art surveying equipment and technology. Reclamation also has computer-assisted capabilities for generating area-capacity data. The Great Plains Region maintains an indefinite quantities contract with a private surveying firm. **(hydrology)** Reclamation can provide assistance with respect to flood hydrology and general surface hydrology. **(water quality)** Laboratory capabilities include inorganic and organic analysis of water samples for

chemical, biological, and physical parameters of water samples. Reclamation has considerable aquatic sampling equipment including nets, electro-fishing boats, and other limnological sampling gear. Reclamation is currently providing technical support to the Corps of Engineers in response to the flood.

National Park Service. The National Park Service has personnel and facilities available through the **Water Resources Division** in Denver that can provide watershed management, hydrology expertise, floodplain delineation, wetlands delineation and rehabilitation, and have extensive GIS capabilities for accomplishing this. The **Denver Service Center** has extensive personnel and capabilities to plan, design, develop, restore and rehab facilities. In addition, the NPS has extensive inventories of cultural and historic sites in the flood area.

Interagency Support

Contracting and Construction Oversight

Reclamation Regional Offices can provide procurement and contracting services and construction oversight assistance for a wide range of related activities. Reclamation is currently providing technical support regarding damage assessment.

Procedural

Endangered Species Act; Fish and Wildlife Coordination Act; Clean Water Act; and National Environmental Policy Act technical assistance is being provided by the Fish and wildlife Service to assist with the primary flood response. The FWS is mobilizing staff in their Ecological Services Field Offices in St. Paul, MN, Rock Island, Marion, IL, and Columbia, MO, to assist the primary flood response agencies (Corps of Engineers, SCS, FEMA). Other Field Offices in Bismarck, ND, Pierre, SD, Grand Island, NB and Manhattan, KS, are also capable of assisting.

Fish and Wildlife Service biologists are prepared to assist Corps and SCS engineers with damage assessment surveys and reporting, environmental impact evaluation, and the development of measures to minimize the impacts to fish and wildlife resources from flood response actions.

FWS biologists will review and comment on environmental documentation prepared under the National Environmental Policy Act (NEPA); on Corps civil works projects and permit applications (Section 10/404, Clean Water Act) as well as remedial efforts under SCS Emergency Watershed Protection Program; and conduct evaluations and prepare recommendations pursuant to the Fish and Wildlife Coordination Act (FWCA).

FWS biologists will conduct interagency consultations under Section 7 of the Endangered Species Act to assist the primary agencies in their compliance with that Act during the flood response while minimizing adverse effects on endangered or threatened species. FWS biologists will help the States develop and fund projects to restore habitats for endangered and threatened species that have been damaged by the floods.

Fishery Assistance: The Service's Fishery Resource Offices in Winona, Minnesota; Carterville, Illinois; and Columbia, Missouri manage fishery resources on Service lands throughout the Mississippi River Wildlife and Fish Refuge and the Mark Twain National wildlife Refuge. The Fishery Offices also provide technical assistance to tribal fisheries management on the upper Missouri River, management expertise for inter-jurisdictional fisheries, monitoring of non-indigenous species such as zebra mussels, and assistance for listing and recovery of threatened and endangered fish such as pallid sturgeon and paddlefish on the Mississippi and Missouri Rivers.

1990 Farm Bill and Agricultural Credit Act of 1987. Technical assistance is being provided to the USDA and to private landowners. Major activities include: swampbuster, wetlands reserve, Farmers Home Administration wetland easement identification and FmHA land transfers for conservation purposes.

USDA will be making wetland determinations and will be reviewing on-site recovery actions in the disaster area so that farmers can begin repairs in a manner that does not conflict with the swampbuster statute. The Fish and Wildlife Service is prepared to assist, pursuant to statute, in these activities.

As the wetlands reserve program is implemented, either via normal appropriations or through disaster funds, the Service will provide assistance in site selection and will participate in the formulation of restoration plans.

When FmHA disposes of inventory property the Service is the technical agency charged with the identification of wetlands and restorable wetlands that need to be placed under permanent easement. In most cases the Service also implements the wetlands restoration actions that may be necessary and assumes easement administration responsibility. The amount of inventory property in the disaster area will increase and the Service will provide the added technical assistance support effort needed.

Under the **Agricultural Credit Act** of 1987 property is, subject to USDA determination and agreement, transferred from the FmHA inventory to state or Federal agencies for conservation purposes. Following the disaster it is likely that added interest in the transfer of high risk properties will occur. The Service is prepared to assist with identification of such property for transfer and is willing to assume administration or assist states in securing administration of such lands. The conservation use of such properties is compatible with flooding.

Incident Management

National Park Service, Ranger Activities Division, has two Type I All Risk Management teams (ARM) that respond to national disasters affecting NPS areas with skilled maintenance and technical personnel organized under the Incident Command System (recent deployment was for Hurricane Andrew in Florida).

Wetland Restoration

The **Partners for Wildlife** effort (under the Fish and Wildlife Act of 1956), is a private lands based restoration program based on voluntary landowner participation. Funds are appropriated to the "*Trust Species Habitats - Technical Assistance and Habitat Restoration*" component of the Fish and Wildlife Enhancement subactivity. Over the last 7 years approximately 10,900 landowners nationwide have participated in the restoration of over 200,000 acres of wetlands. In the disaster area alone, almost 2,000 landowners have been assisted in restoring over 65,000 acres of small wetlands. In FY93 and FY94 an additional 4,000-5,000 acres of restoration will occur each year. With additional availability of funding (i.e., $6,000,000) the annual restoration target could be 25,000 acres under this cooperative program. With over 21,000,000 acres of drained wetlands in the watershed a larger scale restoration program is needed for the rapid rate of runoff to be reduced. This is one available tool.

North American Waterfowl Management Plan (NAWMP) (implemented through the North American Wetlands Conservation Act of 1989) has as its goal protecting more than 6 million acres of existing wetland habitat in the United States by the year 2000. Under the plan, several million additional acres of wetlands will be restored and enhanced for migratory birds in Canada, Mexico, and the U.S. The primary goal of the NAWMP is, "To enhance and protect high quality wetland habitat in North America that supports a variety of wetland-dependent wildlife and recreational uses." The NAWMP is being implemented through innovative Federal-state-private partnerships within and between states and provinces, including the Services Partners for Wildlife Program. Through the Upper Mississippi-Great Lakes Joint Venture implementation plan, priority wetlands conservation strategies and locations in the watershed have been identified. In six major sub-watersheds of the Mississippi River, a total of 1.3 million acres are proposed for restoration (675,000 acres at an average cost of $500/acre) or acquisition (458,000 acres at an average cost of $1000/acre).

To date in the Upper Mississippi and Missouri Drainage Basins, through the North American Wetlands Conservation Act of 1989, the Plan has affected 117,000 acres in $39.5 million in projects of which two-thirds of the funding is in non-federal matching dollars.

Bureau of Reclamation. Reclamation personnel possess significant knowledge and expertise in aquatic, wetland and riparian ecology. Much of this experience is derived from wetland restoration projects. Capabilities include function, design, and modeling of wetlands and riparian systems for multiple use such as recreation, water quality improvement, fish and wildlife, erosion control, and salinity control.

Geological Survey. USGS is providing a watershed perspective to wetland restoration, i.e., put wetland restoration efforts in context with the topography and hydrology. USGS can provide existing photo-imagery to support flood mitigation efforts, and can perform satellite image analysis of flood, changes in stream pattern, changes in crop cover and other vegetative characteristics, land use, and land cover change. USGS has extensive capabilities for geographic information systems (GIS) for computer integration of earth science data, digital map and elevation data, and digital imagery to model natural phenomena, such as floods, in support of Federal and State planning and resource management decision-making.

Environmental Contaminants Program (USFWS), has conducted numerous natural resource damage assessments intended to support response and remedial activity. Evaluation of data/information during a natural resource damage assessment requires technical biological expertise centered around the resource and site specific restoration plans to restore injured habitats. The program has expertise in preparing response contingency plans, identifying remediation techniques, determining protective levels of contaminants, identifying restoration techniques, planning and implementation of habitat restoration, as well as coordination with other Federal, State and non-government agencies in these activities.

Mississippi Interstate Cooperative Resource Agreement (MICRA). The Fish and Wildlife Service and the Bureau of Reclamation are signatories to MICRA. MICRA encourages cooperative management of inter-jurisdictional fishery resources and was signed by the 28 Mississippi River basin states. The goal of the Agreement is to improve the conservation, development, management, and utilization of inter-jurisdictional fishery resources in the Mississippi River Basin through improved coordination and communication among management entities. Through cooperative programs, MICRA will consider the needs of both commerce and fisheries management on an ecosystem-wide basis.

Land Acquisition/Management

National Wildlife Refuge System lands in the floodplain of the disaster area cover approximately 265,000 acres. Management activities on these lands allow for implementation of alternative flood control strategies which are compatible with the purposes for which the refuge areas are established. The Fish and Wildlife Service has six proposed FY 1994

refuge acquisition projects in the floodplain (totaling 26,116 acres and $12,200,000). When completed these six projects are expected to cover 331,149 acres and cost approximately $178,000,000 at FY 1994 land values. The acquisition process, based on funding limitations will span many years. With added funding the process could be expedited.

The Fish and Wildlife Service has several additional land acquisition projects in the planning stage on the Illinois, Minnesota, Missouri and Mississippi Rivers. These proposals are primarily to protect remaining wildlife habitats along these rivers but can be expanded considerably to consider other purposes such as preserving natural flood storage areas. In addition there are other proposals in the watersheds of these big river systems that can be expanded to significantly store water in the upper reaches of these river watersheds and slow the flow rate by converting the land use from agriculture row crops to natural wildlife habitat.

National Park Service Land Resources Division provides mapping, appraisal, acquisition and land exchange services. Nine park units are located in the flood area.

Bureau of Indian Affairs. The Secretary of the Interior has the trust lead role for the Federal relationship with Indian Tribes. There are 89 Indian Tribes located within the 9 state flood designated region. Nine (9) of these Tribes have received flood damage to houses, schools, roads, farmland, ad conservation structures: i.e, the Menominee in Wisconsin; the Iowa, Kickapoo, Prairie Band of Potawatomi, and Sac & Fox of Kansas and Nebraska; and the Kaw, Otoe-Missouria, Tonkawa, and Ponca of Oklahoma. In addition, there are numerous Statutory authorities which provide for the acquisition, disposal and leasing of Indian lands for various purposes.

Federal Statutes Pertinent to DOI Involvement In The Flood Response

1. **Endangered Species Act of 1973 (16 U.S.C. 1531-1534), as amended.** The Endangered Species Act mandates that all federal agencies use their authorities to ensure that their activities do not jeopardize the continued existence of a threatened or endangered species. In addition federal agencies are to promote the protection and recovery of these species. All federal agencies must consult with the Fish and Wildlife Service to ensure compliance with ESA.

2. **Fish and Wildlife Act of 1956 (16 U.S.C. 742A-742J) as amended.** Under this authority the FWS carries out the voluntary private-lands-based habitat restoration program, commonly referred to as "Partners for Wildlife." The Act authorizes the Service to engage in activities that will promote "...the development, management, advancement, conservation, and protection of wildlife resources..."

3. **Fish and Wildlife Coordination Act of 1934, (16 U.S.C. 661-117) as amended.** The Act requires consultation with the Fish and Wildlife Service before U.S. waters are impounded, diverted, or otherwise controlled or modified to ensure wildlife receives equal consideration. In the category of water-related activities for which federal permits are required, wildlife agencies can make recommendations with respect to wildlife conservation and enhancement.

4. **Food, Agriculture, Conservation, and Trade Act of 1990.** The FACT Act amends the Food Security Act of 1985. The Act requires Department of Agriculture agencies (e.g., Farmers Home Administration, Agricultural Stabilization and Conservation Service, and Soil Conservation Service) to consult with the FWS to ensure conservation of important resources, especially wetlands. The Act authorizes Farmers Home Administration to (1) place conservation easements on properties held in their inventory, and (2) trade conservation easements for debt forgiveness. Under the "Swampbuster" provisions of the Act, wetlands cannot be converted to agriculture for the purpose of commodity crop production. USDA must consult with the FWS on "Swampbuster" issues. The Act authorizes the Secretary of Agriculture (USDA) to establish the Wetland Reserve Program to acquire permanent easements from willing landowners for the restoration and protection of wetlands. Easements on existing and former wetlands now in crop production will be acquired and the wetlands restored.

5. **Upper Mississippi Wild Life and Fish Refuge Act of 1924.** This Act authorizes the acquisition and establishment of the Upper Mississippi National Wildlife Refuge with the protection of wildlife as the primary purpose. The Refuge was established as mitigation for the navigation channel and set the precedent and is a classic example of a refuge preserving a floodplain in a natural condition. Structures on the

refuge counteract the sediment input caused by other structures/activities.

6. **Federal Aid in Wildlife Restoration Act of 1937, (16 U.S.C. 669-669i) as amended.** More commonly known at the Pittman-Robertson Act, serves as the principal mechanism for providing federal assistance to states for the acquisition, restoration, and maintenance of wildlife habitat; for the management of wildlife areas and resources; and for research into problems of wildlife management.

7. **Federal Aid in Fish Restoration Act of 1950, (16 U.S.C. 777-777k) as amended.** More commonly known as the Dingell-Johnson Act, is essentially identical to the Pittman-Robertson Act, except that it provides federal assistance to states for projects pertaining to fish.

8. **Water Resources Development Act of 1986.** The Act authorizes the Long Term Resource Monitoring Program for the Upper Mississippi River System. The monitoring is being implemented by the FWS Environmental Management Technical Center in Onalaska, Wisconsin in cooperation with the five Upper Mississippi River Basin States; Illinois, Iowa, Minnesota, Missouri and Wisconsin. The mission of the program is to provide high quality scientific and technical support in a timely and cost-effective manner.

9. **North American Wetlands Conservation Act of 1989 (16 U.S.C. 4401-4413)** This Act provides for a matching grant program with private partners to support wetland conservation projects.

10. **Migratory Bird Conservation Act of 1929 (16 U.S.C. 715-715d, 715e, 715f-715r) as amended.** This Act authorizes the FWS to acquire wetlands habitat for the conservation of North American waterfowl from the Migratory Bird Conservation Fund (a dedicated Fund containing deposits from Duck Stamp sales as well as other fees).

11. **Transfer of Certain Real Property for Wildlife Conservation Purposes Act.** This Act as amended provides that Federal surplus lands can be transferred to the Secretary of the Interior without reimbursement.

12. **Agricultural Credit Act of 1987.** This Act authorizes the Farmers Home Administration to transfer properties held in their inventory to Federal and state agencies for conservation purposes.

13. **Emergency Wetland Resources Act of 1986 (16 U.S.C. 3901-3931).** This Act authorizes the purchase of wetlands or interests in wetlands, which are not acquired under the authority of the Migratory Bird Conservation Act, consistent with National and Regional priority conservation plans and state concept plans using Land and Water Conservation Fund monies.

14. **Water Bank Act of 1970, as amended.** The Act provides that the Department of Agriculture will coordinate with the Department of the

Interior when entering into contracts with landowners to protect wetlands and retire adjoining agricultural lands.

15. **National Wildlife Refuge System Administration Act of 1966, as amended.** The Act allows for management practices on refuges which support the policy goals if they are consistent with the purposes for which the refuges are established.

16. **The Reclamation Act of 1902.** The Act restricts the Bureau of Reclamation's water resource activities to the 17 Western States. BR, however, can provide technical assistance to other agencies and outside parties in other geographical areas on a cost-reimbursable basis.

17. **Robert T. Stafford Disaster Relief and Emergency Assistance Act,** (Public Law 93 - 288) as amended. The Bureau of Reclamation may provide public works and engineering support to assist State(s) and local areas in needs related to lifesaving or life protection following a major disaster.

18. **Public Law 84-99** gives the Bureau of Reclamation authority to assist the COE in activities after a catastrophic event has occurred. These activities may include participation in levee rehabilitation inspection teams, survey teams, and construction inspection.

19. **National Park Service Organic Act of 1916** (16 U.S.C. 1). This Act gives the National Park Service the authority to manage over 360 natural and cultural areas.

20. **Historic Sites Act.** Expands the National Register of Historic Places and established a guaranteed loan program to direct grants for properties listed on the National Register, and a grants-in-aid program to the States and the National Trust for Historic Preservation for acquisition, restoration and preservation of historic properties.

21. **Archeological and Historical Preservation Act of 1974.** Authorizes the National Park Service to conduct a variety of activities to assist Federal agencies in identifying, evaluating, preserving, and/or salvaging architectural and archeological resources.

22. **National Parks and Recreation Act of 1978.** Created the Urban Park and Recreation Recovery Program (UPARR) which provides grants to local governments to rehabilitate existing indoor and outdoor recreation facilities.

23. **Snyder Act 1921.** (42 Stat. 208; 25 U.S.C. 13) This Act authorizes appropriations and expenditures for the administration of Indian Affairs, and for other purposes.

24. **Protection of Indians and Conservation of Resources Act of 1934.** (48 Stat. 984; 25 U.S.C. 461). This Act provides for the protection and

management of Indian natural resources from deterioration, to prevent soil erosion, assure full utilization, and like purposes.

25. **Geological Survey Organic Act of 1879** (20 Stat. 394; U.S.C. 31). This Act established the Geological Survey and provides for "the classification of the public lands, examination of geological structure, mineral resources, and products of the national domain." The USGS is authorized to perform surveys, investigations, and research covering topography, geology, hydrology, and the mineral and water resources of the United States and its Territories. These provide for the gaging of streams and determining the water supply of the United States, including the investigation of underground resources.

26. **Minnesota Valley National Wildlife Refuge Act.** This Act is a classic example of preserving a natural flood plain in an urban situation. Congress established the refuge for wildlife, education and recreation.

U.S. Army Corps of Engineers
Assistant Director of Civil Works
CECW-ZW (NPD,SPD,MRD,POD)

Date: 20 August 1993

To: Mr. Brian Burke, Domestic Policy Council

Subject: Floodplain management briefing

General Genega asked me to fax over to you a copy of our briefing.

Each graphic is followed by explanatory text.

Also included are some example projects that provide a lot more detail than you probably want, but they may prove useful.

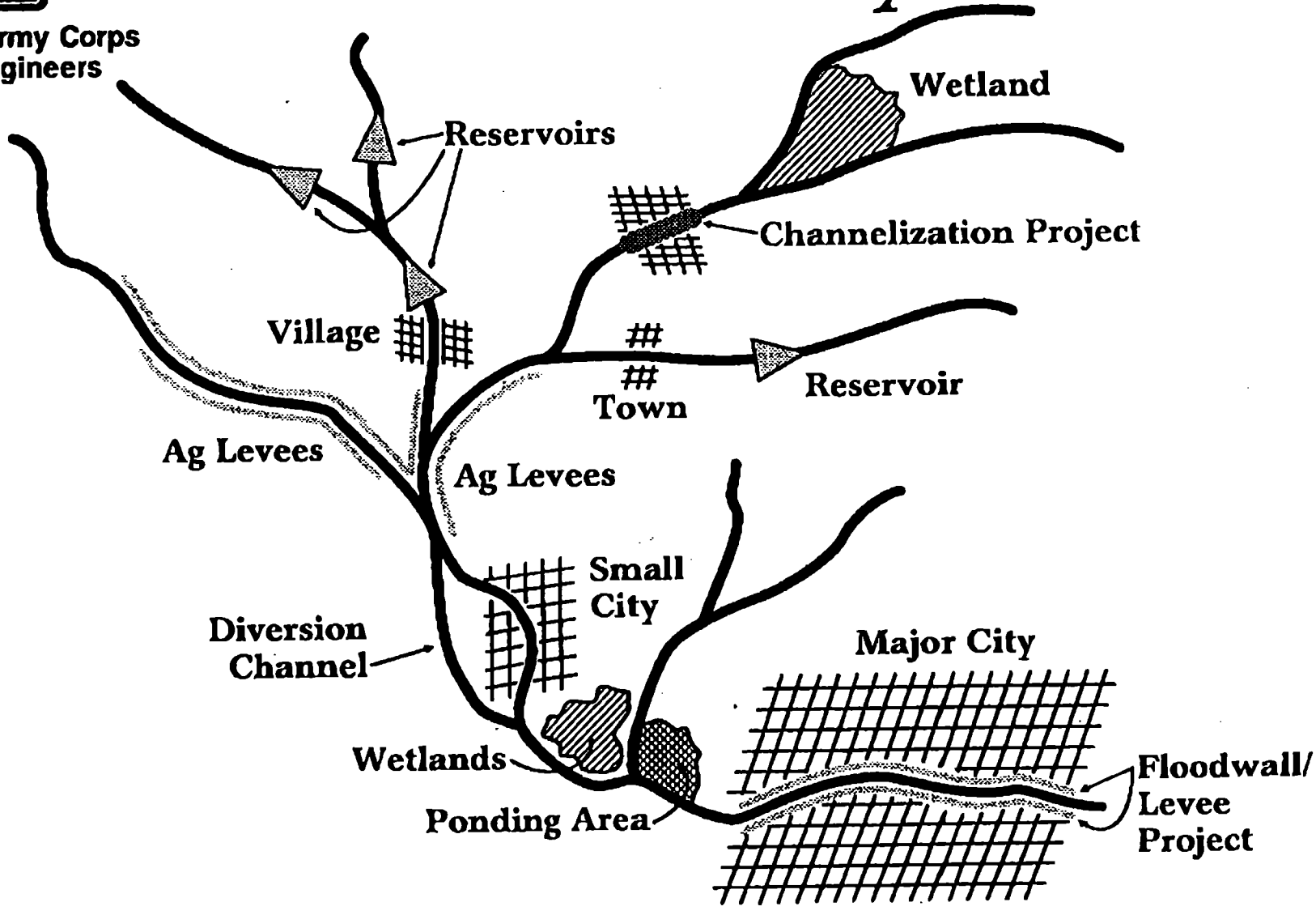
Please let me know at phone (202) 272-0108 or 0107 when received and if I can provide anything further.

Jeffrey B. Staser
LTC, EN

FAX TO 202 456 7028, ATTN:BRIAN BURKE

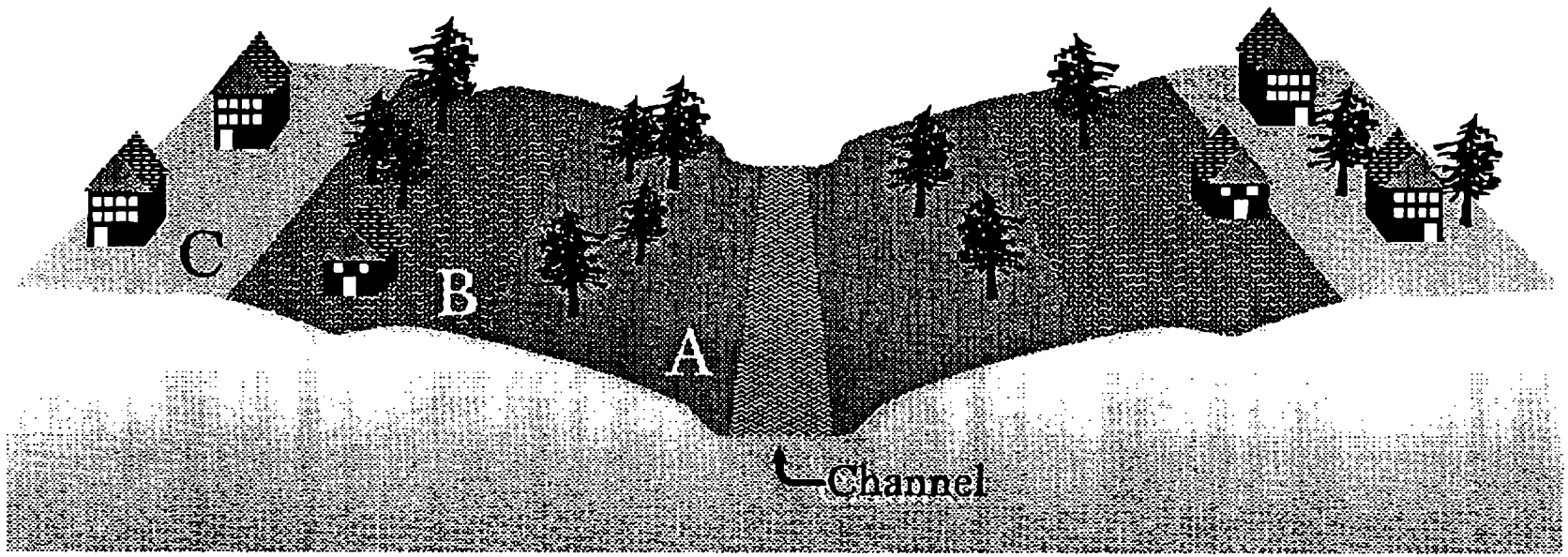
Flood Control System

US Army Corps of Engineers



Flood Plain Areas

US Army Corps
of Engineers



A Floodway includes channel and surrounding lowlands expected to flood often. Reserved for non-structural uses including wildlife preserves.

B Flood fringe extends plain to 100-year limit with 1% chance of flood each year. Structures locally regulated.

C 500-year floodplain extends to areas with $^1/_5$ of 1% chance of flooding.

CONCEPT
OF
FLOOD PLAIN MANAGEMENT

- FLOOD PLAIN MANAGEMENT:
  - It is a **decision making process** used to solve problems resulting from all magnitudes of floods.
  - Its goal is to achieve the **most appropriate use** of lands and waters subject to flooding by considering the **best mix of techniques** to reduce flood damages and to protect and restore the natural and cultural resources of the flood plain.
  - Flood damage reduction is achieved by using a **combination of structural and non-structural techniques.**
  - For planning purposes, this systematic approach to resolving flood problems is classified into four basic techniques for **Flood Plain Management.**

US Army Corps
of Engineers

Techniques for Flood Plain Management

- Modify the flood
- Modify structures and development in the flood plain
- Modify the adverse impacts of flooding
- Restore and preserve the natural and cultural resources of flood plains

TECHNIQUES FOR FLOOD PLAIN MANAGEMENT

- MODIFY THE FLOOD BY THE USE OF STRUCTURAL MEASURES

- MODIFY EXISTING STRUCTURES AND NEW DEVELOPMENT PERMITTED IN THE FLOOD PLAIN TO REDUCE THEIR SUSCEPTIBILITY TO BEING DAMAGED (NON-STRUCTURAL MEASURES)

- MODIFY THE IMPACTS WHEN FLOODING OCCURS BY TAKING ACTIONS THAT AID IN RECOVERY (ALSO CONSIDERED NON-STRUCTURAL MEASURES)

- PRESERVE AND RESTORE THE NATURAL AND CULTURAL RESOURCES OF THE FLOOD PLAIN

US Army Corps
of Engineers

Modify the Flood

- Techniques that modify the flood are commonly called "Structural Measures." They include:
  - Reservoirs
  - Diversions/cut-offs
  - Channel alterations
  - Levees/floodwalls

TECHNIQUES USED TO MODIFY THE FLOOD
(STRUCTURAL MEASURES)

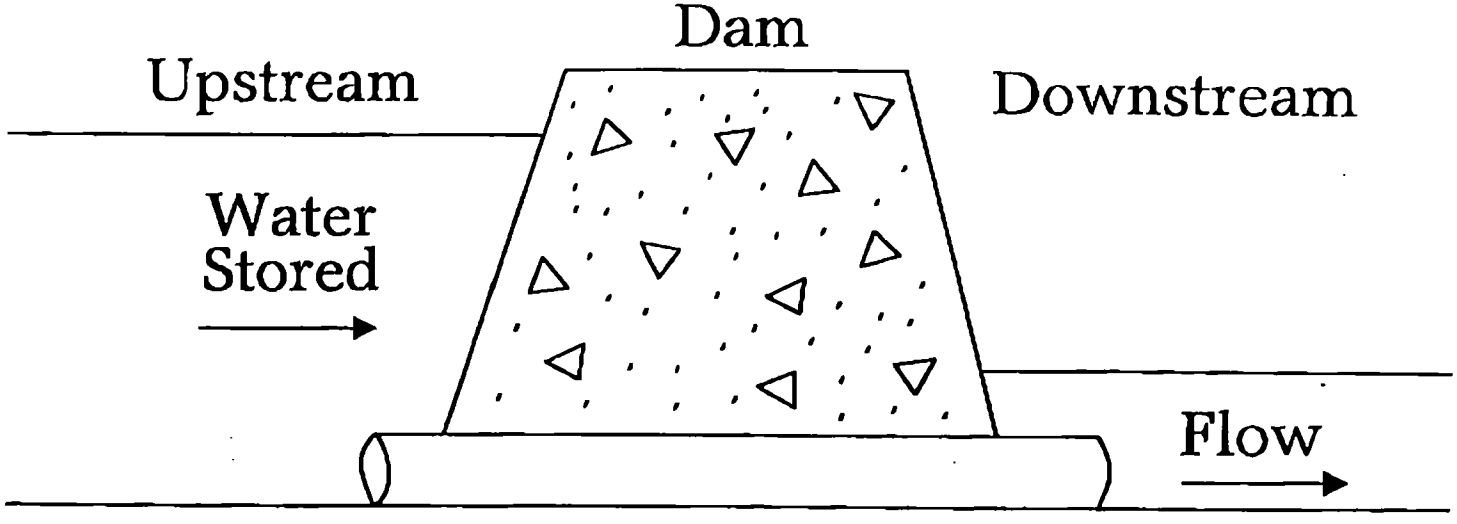
- Techniques that modify the flood are commonly referred to as "Structural Measures." They include:
  - Reservoirs
  - Diversions/Cut-Offs
  - Channel Alterations
  - Levees/Floodwalls

NOTE: These techniques are discussed in detail on the following pages.

US Army Corps
of Engineers

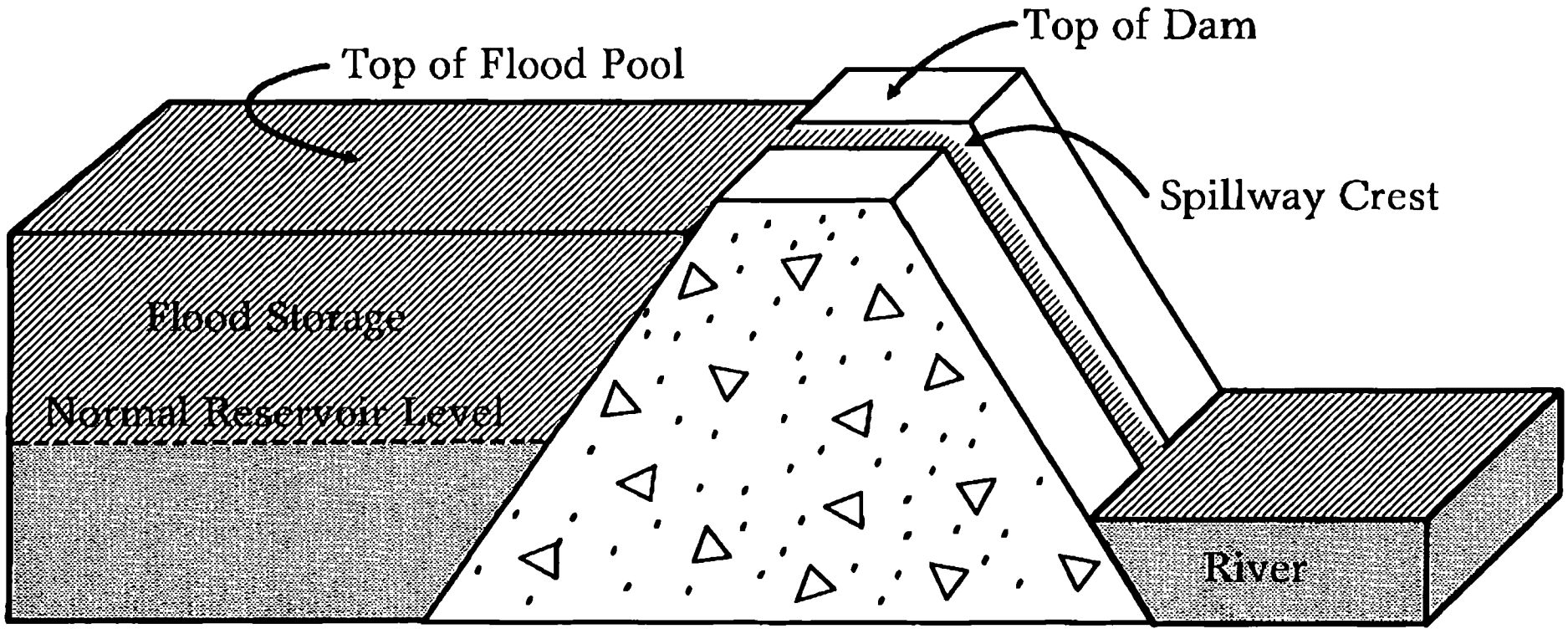
Reservoir

- Stores flood volume which is then released in downstream channel over longer period of time



Flood Control Dam

US Army Corps
of Engineers



TECHNIQUES USED TO MODIFY THE FLOOD (CON'T)

- RESERVOIRS
  - The basic components of a reservoir are the dam, the spillway, the outlet works, and the water storage area upstream of the dam.
  - There are two basic types of flood control reservoirs:

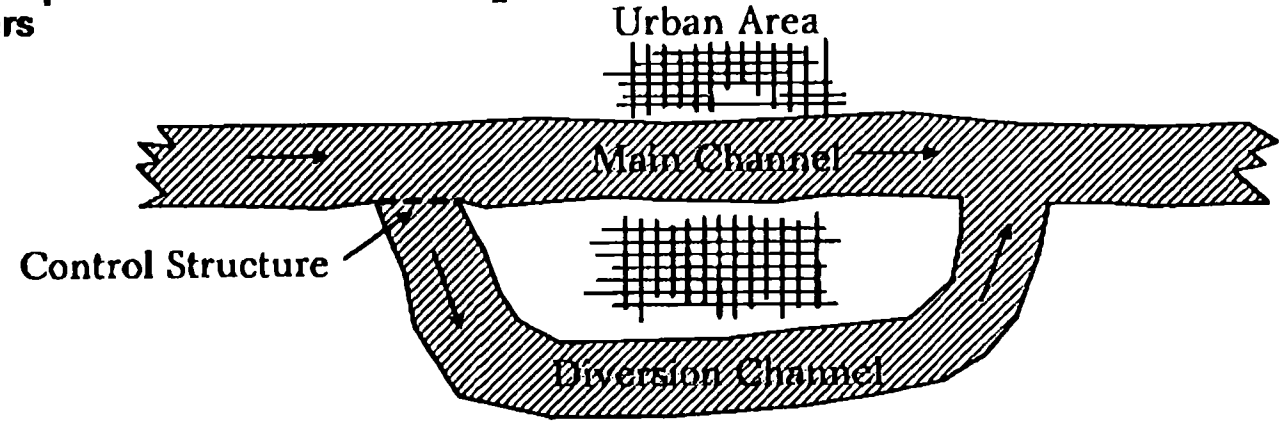
    Those that do not have a permanent pool in the water storage area and that only back up water during a flood event, and

    Those that maintain a permanent pool for purposes other than flood control such as water supply or recreation. Dry storage space above this permanent pool is retained (by law) and available to store flood waters.
  - When a flood comes, water that would otherwise continue downstream and cause damage is stored in the upstream pool. A low-level gated outlet works through the dam releases water at a rate that maintains the normal non-flood flow downstream from the dam.
  - Sometimes a flood is so large that the storage area upstream from the dam cannot hold all of it. In these cases, the outlet works gates are opened wider to let more flow out, and the downstream river may begin to flood over its banks.
  - If an extremely large flood occurs, the outlet works, even with all its gates open, cannot release the water from the pool as fast as it comes into the pool, and the water rises and flows over the spillway. In this situation, the operator of the dam is said to "lose control" of the flood, since an ungated spillway has no means to control the water flow, and extreme flooding can result downstream even though the water passes through a "flood control" reservoir.

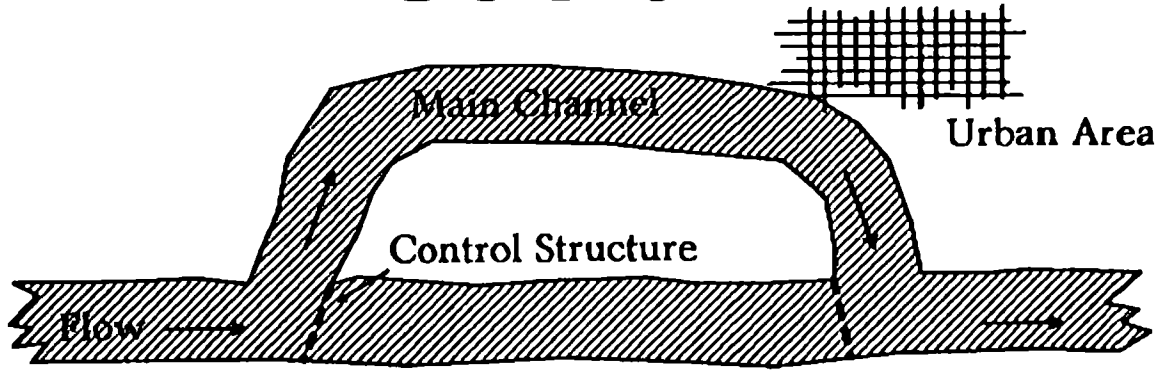
US Army Corps of Engineers

Diversion

- Reduces peak flow rate downstream



Cut Off



- During flood, flow bypasses main channel

TECHNIQUES USED TO MODIFY THE FLOOD (CON'T)

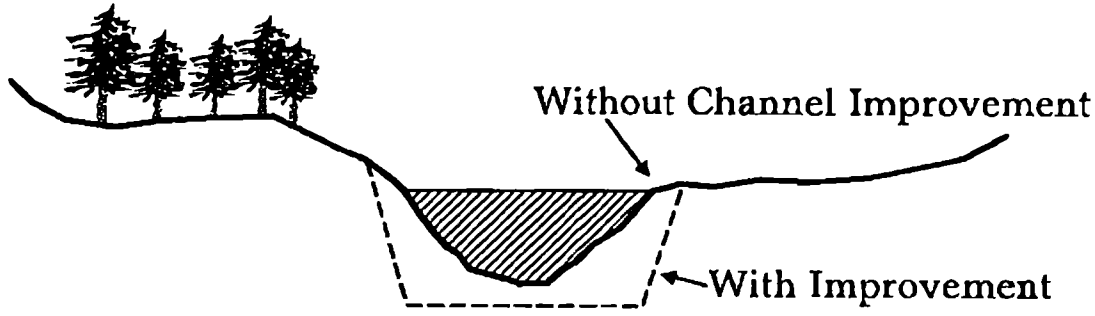
- DIVERSIONS/CUT-OFF CHANNELS

  - Additional areas for the river to flow in during flood are referred to as diversions. Sometimes this amounts to only a high flow area across a meander loop in the stream; sometimes this is a vast floodway (e.g., the Bird's Point/New Madrid Floodway). In any case, the flow cross-sectional area is increased, and the flood water surface elevation is decreased.

Channel Alteration

US Army Corps
of Engineers

- Reduces flood depths by making channel more efficient



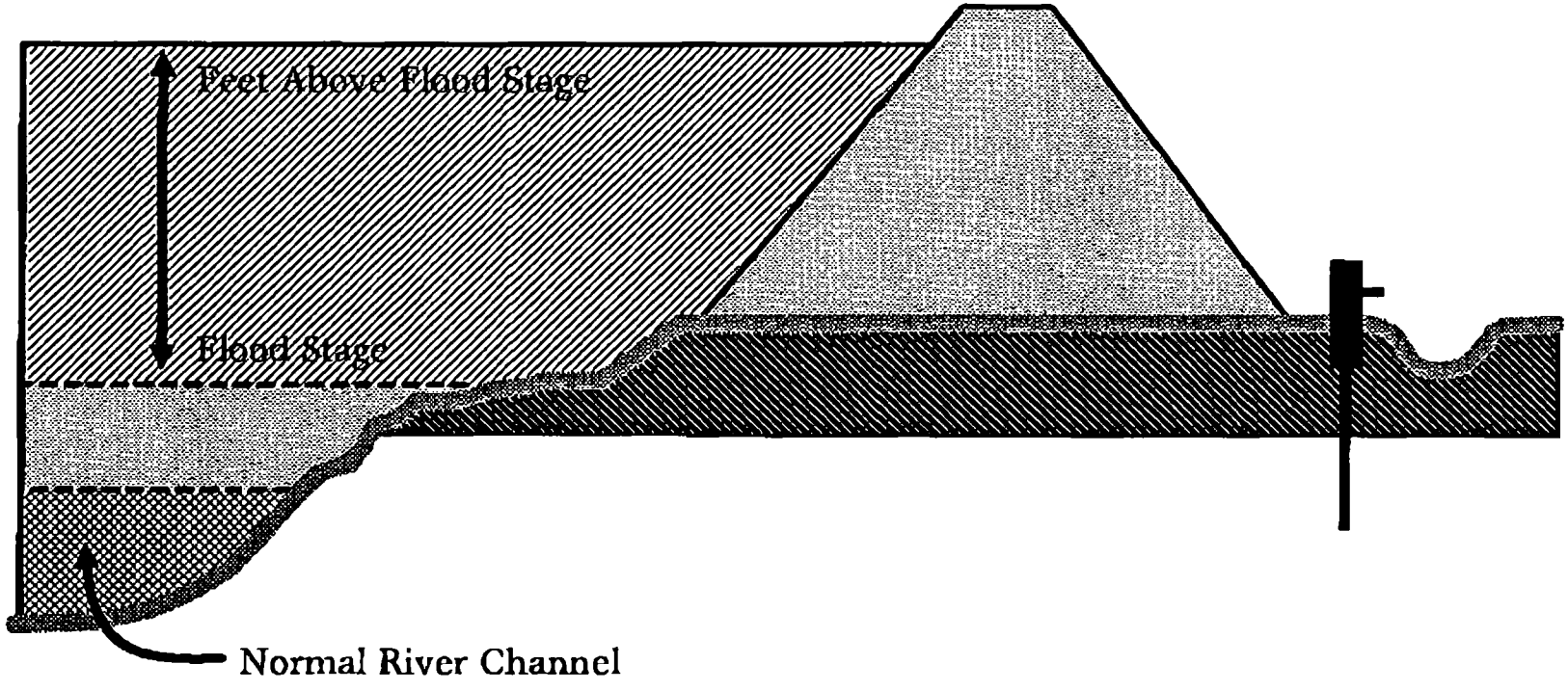
- Enlarging channel increases flow capacity.
- Clearing channel of vegetation/debris increases natural capacity.

TECHNIQUES USED TO MODIFY THE FLOOD (CON'T)

- CHANNEL ALTERATIONS
  - Excavating a bigger river channel causes the water in the channel to flow at a lower elevation and thus reduces flood heights. Since the river is usually carrying material with it as it flows, we have to be careful when designing a channel alteration that this excavation is not filled back in by the river before the flood comes or, sometimes, during the flood.

Levee

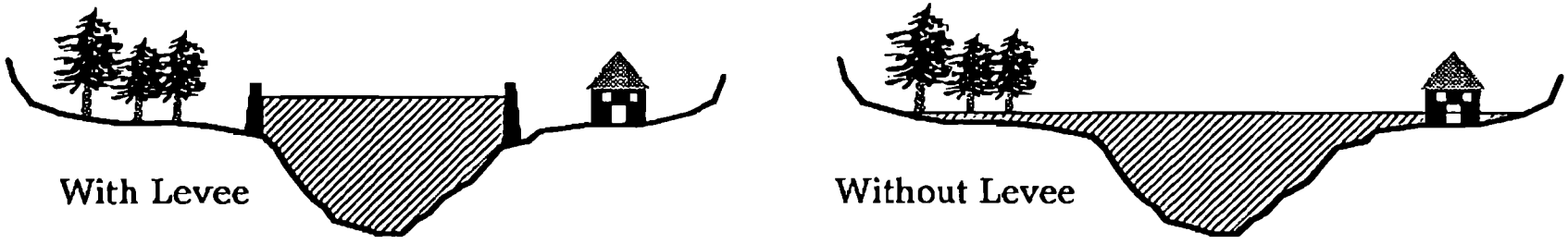
US Army Corps
of Engineers



US Army Corps
of Engineers

Levees/Floodwalls

- Blocks water from spreading over flood plain



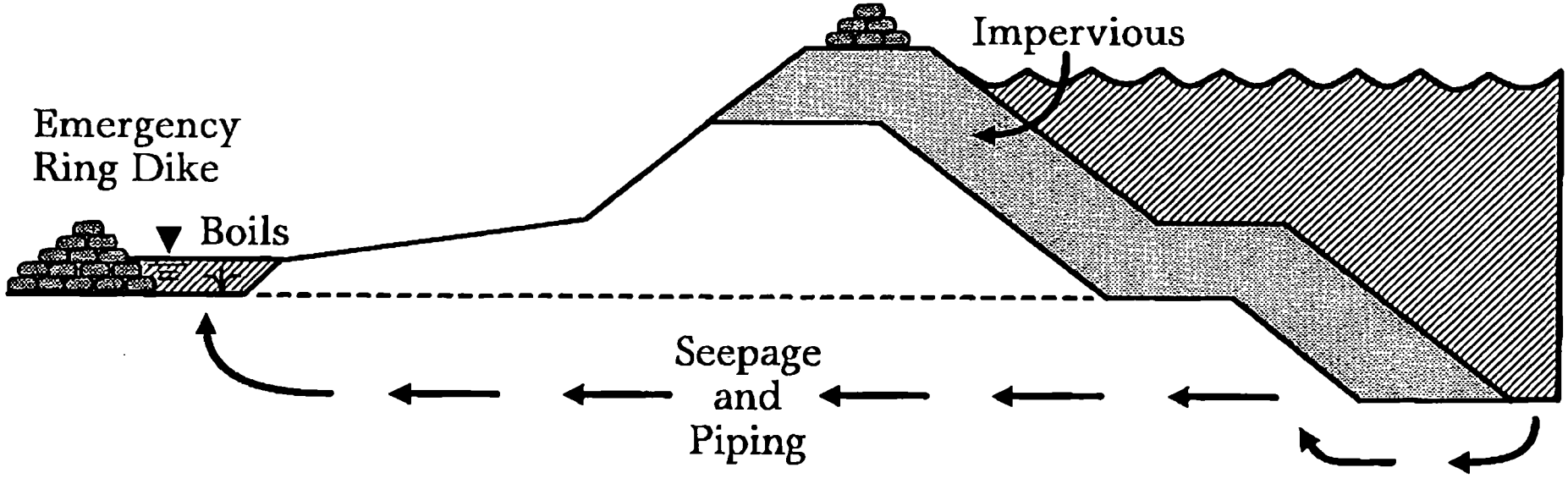
- With levee, flow is restricted but depth of water is greater between levees
- Without levee, flow spreads out over flood plain at a lesser depth but causes damages

Levee Failure (Example)

US Army Corps
of Engineers

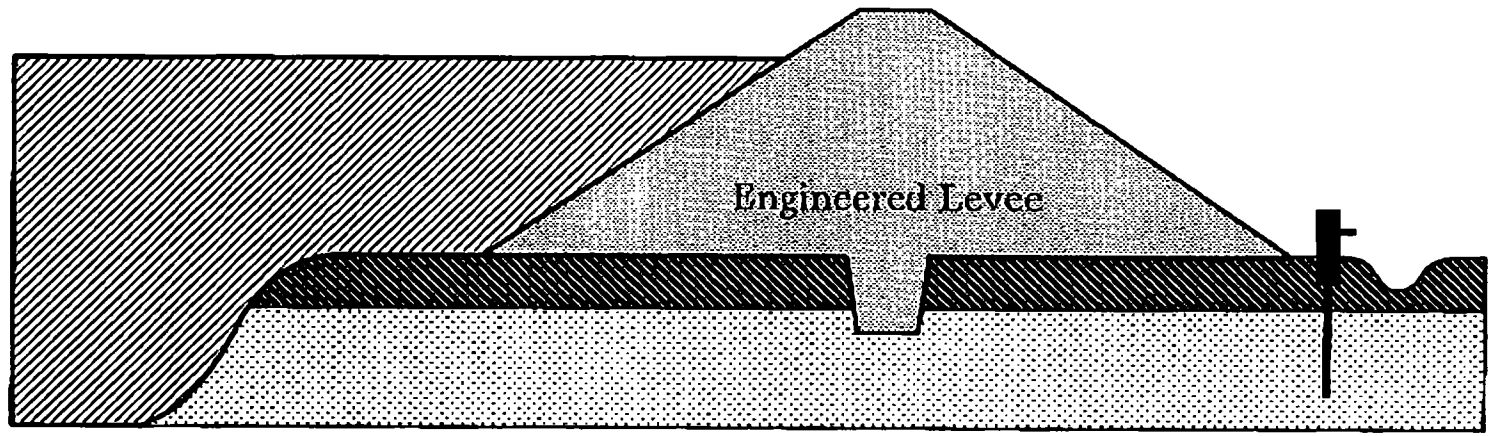
Elevations
(Chester Gage)

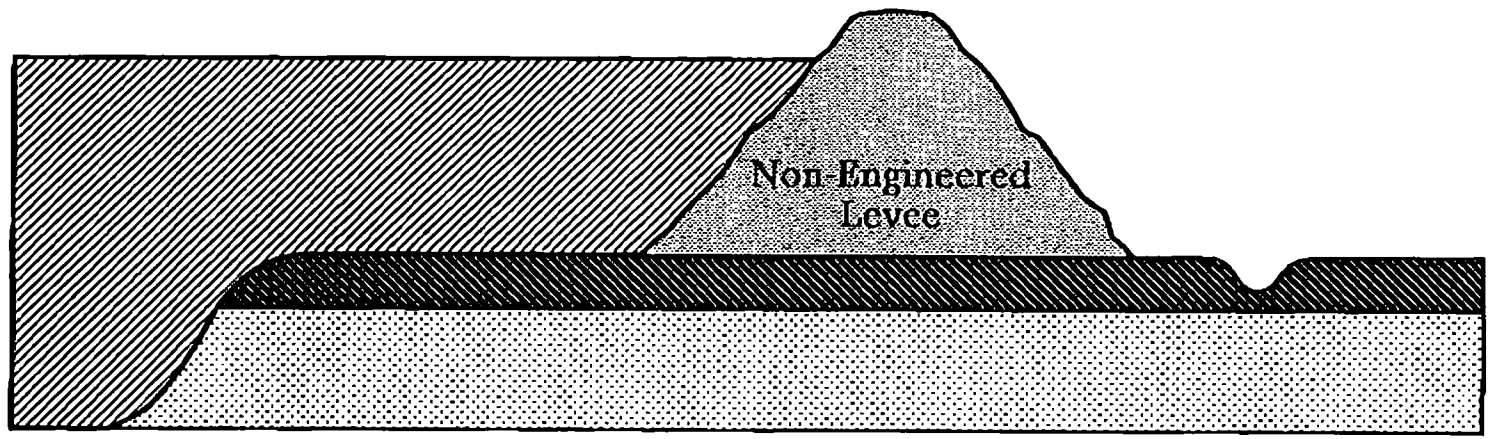
Design Water	46.6	(50 Yr.)
Top of Levee	48.6	
Actual Water	47.4	



Typical Levees

US Army Corps
of Engineers





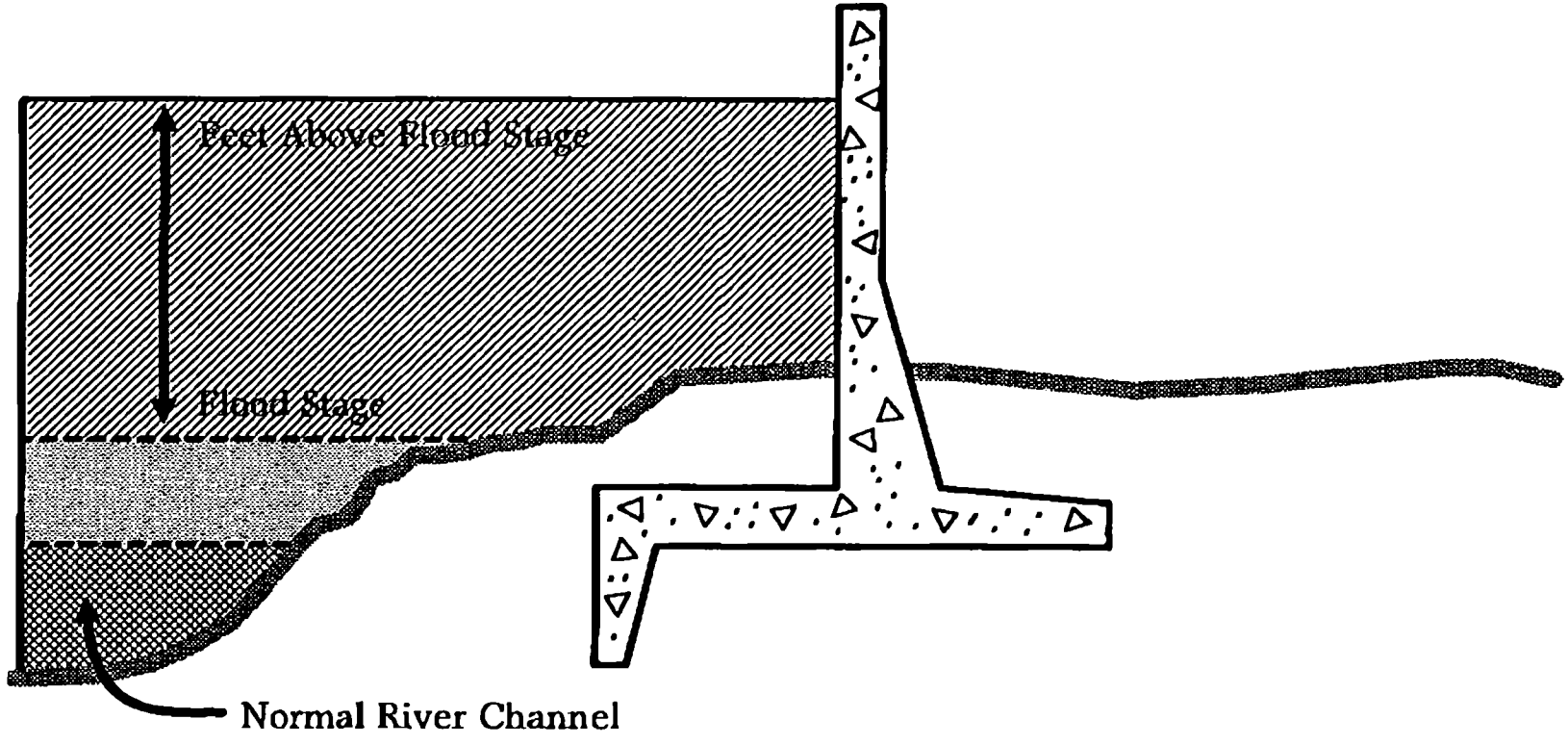
TECHNIQUES USED TO MODIFY THE FLOOD (CON'T)

- LEVEES/FLOODWALLS

  - Building levees/floodwalls alongside the river channel allows the water to rise higher than the natural river bank but keeps it off out of areas landward of the levee/floodwall. Levees are composed of earth, usually, but not always, with a relatively impervious central core surrounded by a more coarse, erosion-resistant shell. Concrete flood walls are built in urban areas where space for levees is not available. Unlike reservoirs, which store flood waters and reduce flows downstream, levees prevent water from going over the river's bank and into "natural" storage reservoirs which would be, unfortunately, flooded farms and towns. Levees/floodwalls have the opposite effect of storage reservoirs in that they tend to increase downstream flooding.

Typical Flood Wall

US Army Corps
of Engineers

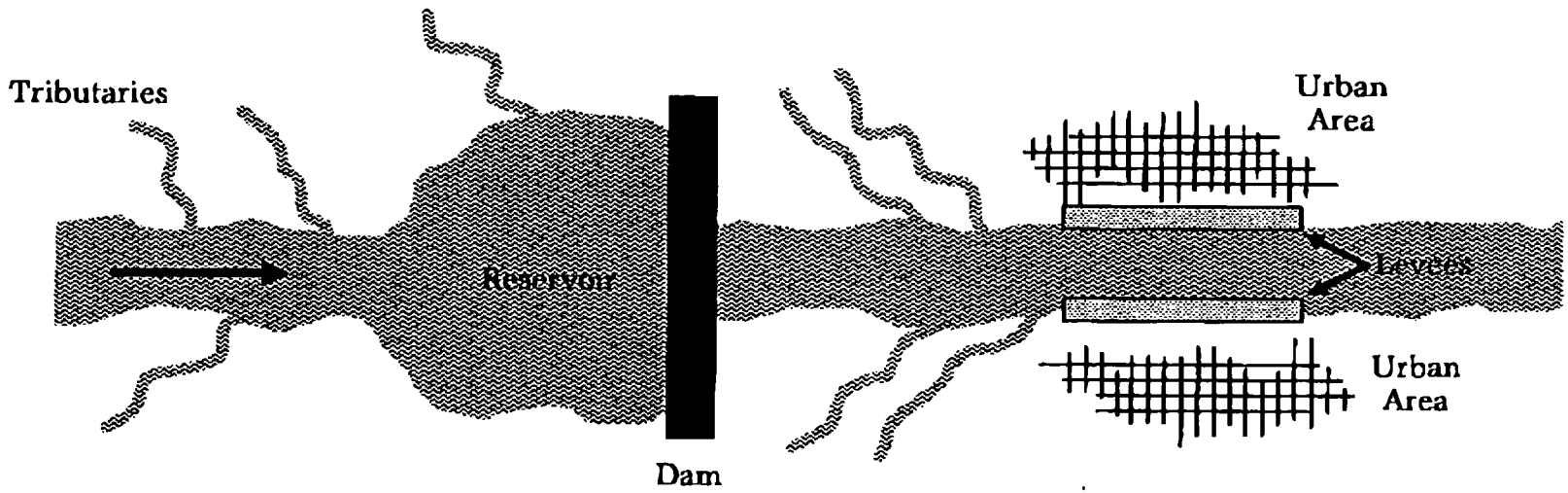


TECHNIQUES USED TO MODIFY THE FLOOD (CON'T)

- COMBINATIONS OF TECHNIQUES IS OFTEN THE BEST SOLUTION

US Army Corps of Engineers

Combination of Reservoir With Downstream Levee



TECHNIQUES USED
TO MODIFY STRUCTURES AND DEVELOPMENT IN THE FLOOD PLAIN
(NON-STRUCTURAL MEASURES)

- FLOOD PLAIN REGULATIONS
  - Used by states and local governments to control use and development in flood prone areas. In the form of:
    Zoning Ordinances,
    Building/Housing Codes, and
    Subdivision Regulations.

- FLOOD PROOFING
  - Alters design or construction of individual buildings to reduce flood damage by:
    Raising or moving the structure,
    Building barriers between the flood and structure,
    Sealing the building and/or raising its contents.

(NOTE: MORE INFORMATION ON THE NEXT PAGE)

- FLOOD WARNING AND PREPAREDNESS
  - Provides first alert and advance warning of impending flooding for early or immediate implementation of predetermined plans that:
    Evacuate people/property about to be flooded, and
    Protect and/or reduce damage to unmovable property.

- DISASTER PREPAREDNESS
  - Long range, extensive preparedness actives including:
    Development of plans for mitigation, warning, and emergency operations,
    Training for plan implementation,
    Exercises to test plans and evaluate readiness,
    Review and coordination of disaster programs,and
    Public information activities.

- DEVELOPMENT/REDEVELOPMENT POLICIES
  - To avoid inappropriate development and redevelopment in the flood plain, all levels of government use policies and programs that address:
    Design and location of services and utilities,
    Land acquisition and open space, and
    Permanent evacuation.

US Army Corps of Engineers

Modify Structures and Devlopment in the Flood Plain

- Flood plain regulations
- Flood proofing
- Flood warning and preparedness
- Disaster preparedness
- Development/redevelopment policies

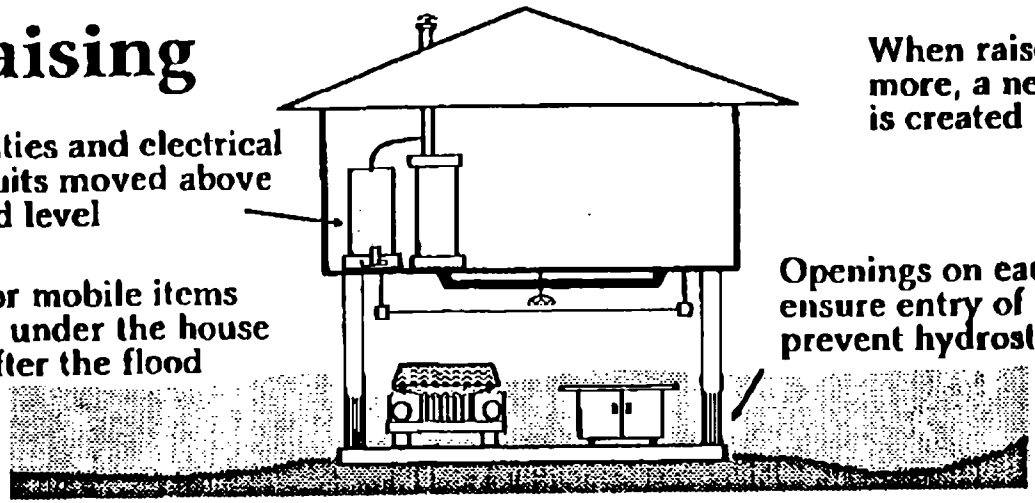
TECHNIQUES USED
TO MODIFY STRUCTURES AND DEVELOPMENT IN THE FLOOD PLAIN (CON'T)

- FLOOD PROOFING
  - Becoming a very effective tool.
  - Often is economically feasible alternative.

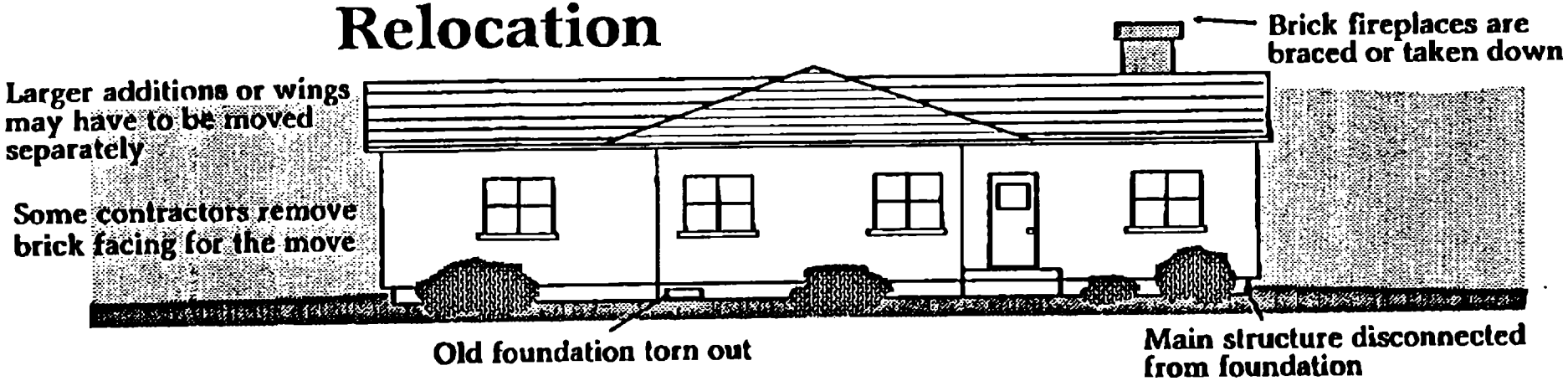
- RAISING OR MOVING THE STRUCTURE

US Army Corps of Engineers

Raising



Relocation



Relocation is an appropriate measure in high hazard areas where continued occupancy is unsafe, where owners want to be free from flood worries, or where communities have determined that the open space gained could be used for more appropriate flood plain activities.

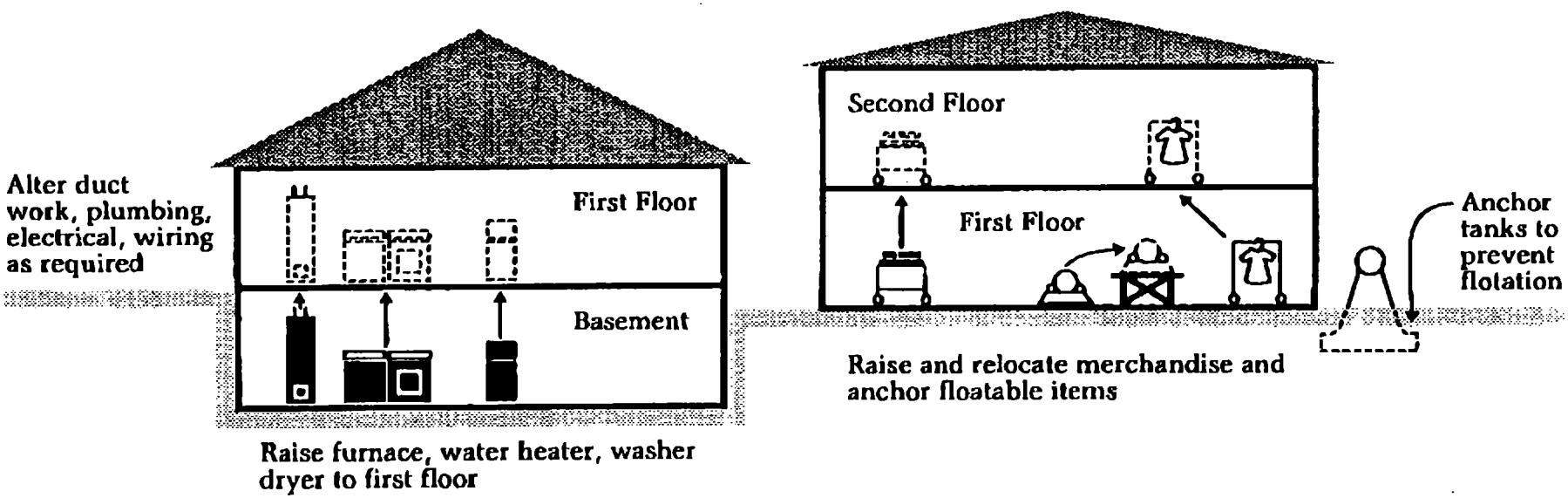
TECHNIQUES USED TO MODIFY STRUCTURES AND DEVELOPMENT IN THE FLOOD PLAIN (CON'T)

- FLOOD PROOFING (CON'T)
  - Sealing the building and/or raising its contents.

US Army Corps
of Engineers

Flood proofing

- Prevents damages of building interiors



- Flood proofing reduces vulnerability of exisiting development.

TECHNIQUES USED TO MODIFY THE ADVERSE IMPACTS OF FLOODING (NON-STRUCTURAL MEASURES)

- INFORMATION AND EDUCATION

  Activities for flood plain management have expanded dramatically since 1960, thus increasing the level of knowledge of both public officials and the general public. Thus, a variety of material is now available and additional work could be performed to further assist local governments and the general public on issues relating to human behavior and flood recovery actions.

- FLOOD INSURANCE

  This has been available since 1969 through the National Flood Insurance Program. Insurance payments partially offset the cost of damages caused by floods. Premiums are based on the location of a structure within the flood plain. Unfortunately, not all floodprone structures are normally insured.

- TAX ADJUSTMENTS

  Includes a variety of temporary tax reliefs for individuals and businesses that were damaged. This is done primarily at the state and local government level. Also, deductions on income taxes provide some measure of relief.

- FLOOD EMERGENCY MEASURES

  Flood emergency measures are typically carried out by local civil defense, police and fire departments, public works agencies, and public health personnel. These activities are carried out during and immediately after a flood may include removing people and property from areas about to be flooded; sandbagging around individual structures and constructing emergency dikes; search and rescue operations; and other steps to protect the health and safety of residents.

- POST FLOOD RECOVERY

  Many types of disaster assistance are available and are effective at restoring flood-damaged communities and individual properties to their preflood condition. Delaying reconstruction until new guidance to avoid future flood damages is promulgated is best done immediately after the flood event.

US Army Corps
of Engineers

Modify The Adverse Impacts of Flooding

- Information and Education
- Flood Insurance
- Tax Adjustments
- Flood Emergency Measures
- Post Flood Recovery

TECHNIQUES USED TO RESTORE AND PRESERVE THE NATURAL AND CULTURAL RESOURCES OF FLOOD PLAINS

- REGULATIONS
  - Regulatory measures are very effective in dealing with Natural and Cultural Resources. Measures that can be applied at all levels of government include:
    Federal regulations
    State regulations, and
    Local regulations (zoning, building codes, etc.)

- DEVELOPMENT AND REDEVELOPMENT POLICIES
  - Policies by all levels of government have full impact on where development occurs. These include:
    Design and location of services and utilities;
    Land rights, acquisition, and open space;
    Redevelopment; and
    Permanent Evacuation in Wildlife sensitive areas.

- INFORMATION AND EDUCATION
  - Technical information and Public education about the value of natural and cultural resources can result in developing a positive attitude by the public to support activities that restore and preserve natural and cultural resources.

- TAX ADJUSTMENTS
  - Tax adjustments can provide financial incentives. These are:
    Federal Tax benefits,
    Estate Tax benefits, and
    Donations of land or easements.

- ADMINISTRATIVE MEASURES
  - Administrative procedures by local authorities can have a major impact on natural resources. They are:
    Restrictions on Contracts,
    Restrictions on Loans,
    Restrictions on Permits and Licenses,
    Comprehensive Planning, and
    Classification Of Wetlands.

US Army Corps
of Engineers

Restore and Preserve the Natural and Cultural Resources of Flood Plains

- Regulations
- Development and redevlopment poilicies
- Information and education
- Tax adjustment
- Administrative measures

FLOOD PLAIN MANAGEMENT

AND THE

U.S. ARMY CORPS OF ENGINEERS

TABLE OF CONTENTS

A PRIMER ON

FLOOD PLAIN MANAGEMENT

FLOOD PLAINS are -- the lowlands adjoining the channels of rivers, streams, or other watercourses, or the shoreline of oceans, lakes, or other bodies of standing water, which have been or may be inundated by flood waters. The "100-year flood plain" is the area that would be inundated by a flood expected to occur once in 100 years.

Approximately 7% of the total area of the United States, or **178.8 million acres**, is within the 100-year flood plain. Almost all major cities are located on a river or at the mouth of a river. Most smaller communities have at least one stream within their boundaries.

FLOOD PLAIN MANAGEMENT is -- a decision making process that aims to make the most appropriate use of the lands and water subject to flooding. **The challenge of flood plain management is** to balance the need to minimize the loss of life and reduce the damage to property from flooding while also preserving and restoring the natural and cultural functions as much as possible.

FLOOD PLAIN MANAGEMENT TECHNIQUES include both structural and non-structural methods.

Structural Methods:

- Levees
- Flood walls
- Dams
- Flood diversion channels
- Channel improvements
- Detention Basins

Non-structural Methods:

- Flood proofing of existing structures
- Flood plain regulations to control use
- Relocation of neighborhoods or communities
- Flood warning and preparedness systems
- Evacuation plans
- Development of greenbelt facilities not susceptible to damage from flooding
- Redevelopment policies

By selecting the best mix of proven techniques, flood plain managers can tailor an approach that is practical, affordable, and likely to be successful at meeting the competing needs.

Compatibility with the risk to natural and cultural functions is achieved by modifying:

- the susceptibility of those functions to human activity,

- the impact of human activity, or

- the flooding

Compatibility with the risk to human life and property is achieved by modifying:

- human susceptibility to flood damage and disruption,

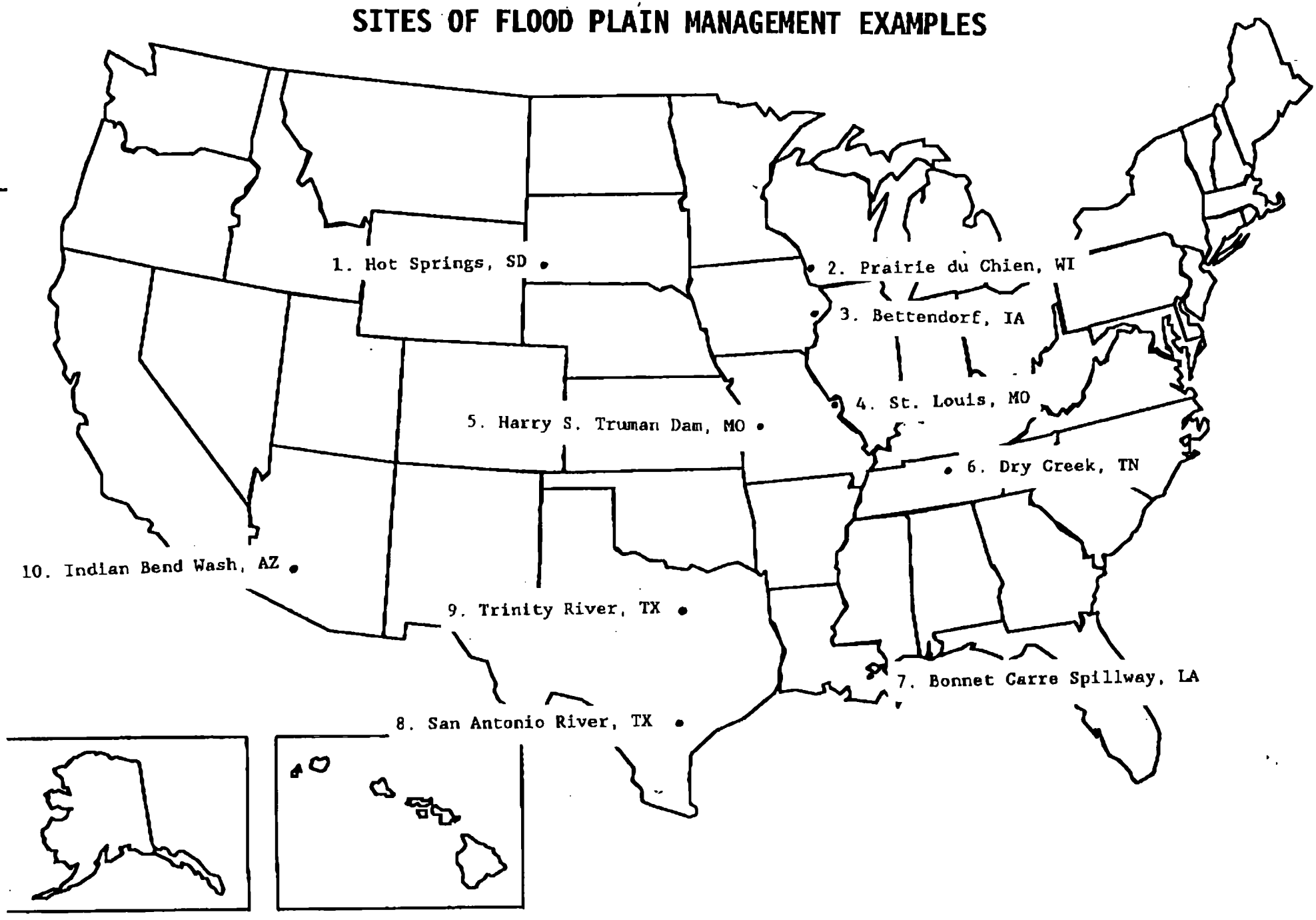
- the impact of flooding on individuals and the community, or

- the flooding.

The Corps of Engineers is a member of **The Federal Interagency Floodplain Management Task Force** and works with the other agencies to coordinate all Federal activities within the flood plain. An **Assessment Report** on flood plain management in the United States, prepared for that Task Force, is included with this primer.

At **Tab 2** are ten examples of Corps of Engineers flood control projects that incorporate various flood plain management techniques, both structural and non-structural.

SITES OF FLOOD PLAIN MANAGEMENT EXAMPLES



SUMMARY PAPER

1. Project: Hot Springs Flood Warning System, Cold Brook Dam Unit, Fall River Basin Project, Fall River, South Dakota

2. Purpose: Flood Warning

3. Location: Cold Brook Reservoir near Hot Springs, South Dakota

4. Authority: Flood Control Act of 1941

5. Date of Implementation: July 1990

6. Project Description: The project consists of one gage that sits at the reservoir of an existing Corps project (Cold Brook Dam)

7. Challenge and Solution: There was a concern that if the reservoir was very full and the outflow of the spillway was at its maximum, the community located downstream of the dam (Hot Springs, South Dakota) could be flooded. The flood warning system would allow local officials warning time to evacuate areas downstream of the dam if needed.

• Utilized Omaha District developed technology which reduced the cost and provided a reliable product. A patent request for this product has been requested. ASCE Civil Engineering June 1992 describes the flood warning system.

• The system has been designed so local officials can perform O&M with limited technical training.

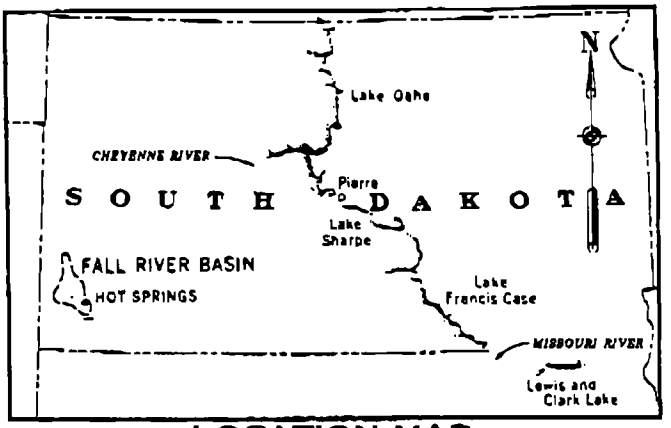
• The system uses phone lines to automatically transmit the warning to a maximum of eight people simultaneously. Spare parts for maintenance are easily obtainable through commercial resources available in any medium sized city.

8. Implementation Costs and Benefits: (1990 price levels): The system was installed for a total project cost of $7,000, of which $1,500 is the cost of the hardware.

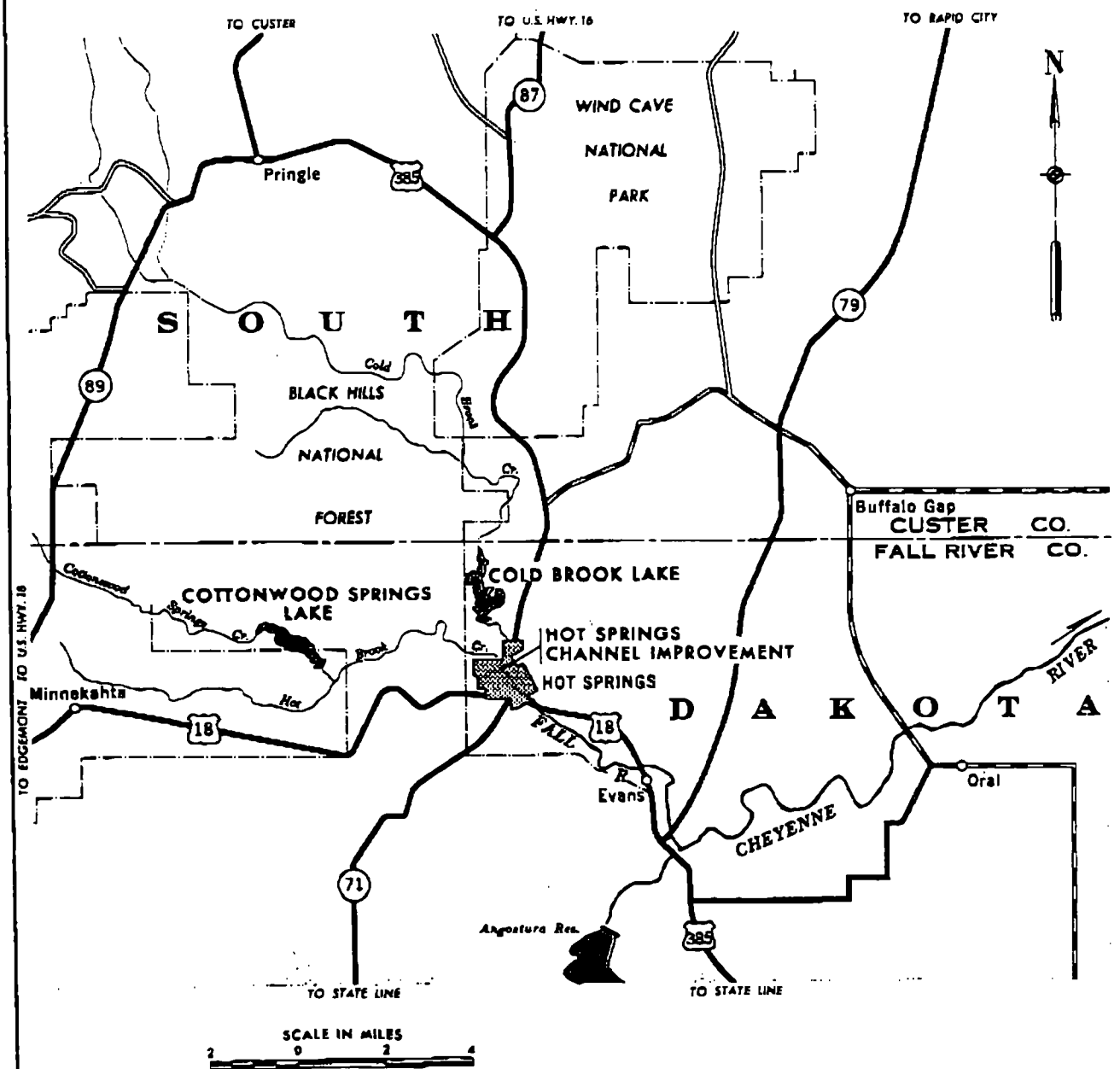
Cost Sharing: 100% Federal cost (O&M funds)

Benefits: Not available at this time.

9. History of Project Performance: To date, the flood warning system has not been activated. Currently, the lake level is within 1 foot of triggering the system. Similar designs have been implemented at other projects and have performed successfully when tested this spring and summer. The five flood warning systems, other than the one at Cold Brook Dam, have been tested this year and have performed as designed.



LOCATION MAP



FLOOD CONTROL PROJECT

FALL RIVER BASIN SOUTH DAKOTA

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA
30 SEPT 1977

SUMMARY PAPER

1. Project: Praire du Chien, Wisconsin

2. Purpose: Provide appropriate flood control - local protection measures to St. Feriole Island and low-lying mainland portions of the city subject to frequent flooding as a result of the 1965 flood of record, causing estimated damages of $2.5 million.

3. Location: The city of Praire du Chien, Wisconsin is located in southwest Wisconsin on the Mississippi River.

4. Authority: The Water Resources Development Act of 1974 (P.L. 91-646) provided for evacuation and flood proofing of structures.

5. Date of Implementation: 1986

6. Project Description: The project included: acquisition of 122 residences and 2 commercial properties, flood proofing of 4 residences (raised-in-place); relocation assistance to all residential and commercial business property owners affected by acquisition; and floodplain regulation of approximately 175 structures remaining in the regulatory floodplain. The local sponsor of the project was the city of Praire du Chien, which made available, at cost, improved lots within the city limits for relocatees to move their residences or construct a new dwelling.

7. Challenge and Solution: The original plan was to acquire all residences in the 10 year floodplain, which included all of St. Feriole Island, and raise all residential structures in the 10 to 100 year floodplain, which would have included more than 200 structures. However, due to cost-sharing policy problems that occurred during implementation of the raisings portion of the project, this element of the project was abandoned after 4 residential structures were raised-in-place. As a result, all residential structures on St. Feriole Island were aquired and demolished, as well as 2 commercial structures, and relocation assistance was provided to affected property owners (as previously described) in accordance with P.L.91-646. The island is now a significant recreational and historical resource, and the businesses remaining on the island are primarily recreation and tourism related.

8. Implementation Costs and Benefits: (Sep 1983 price levels)

Cost Sharing

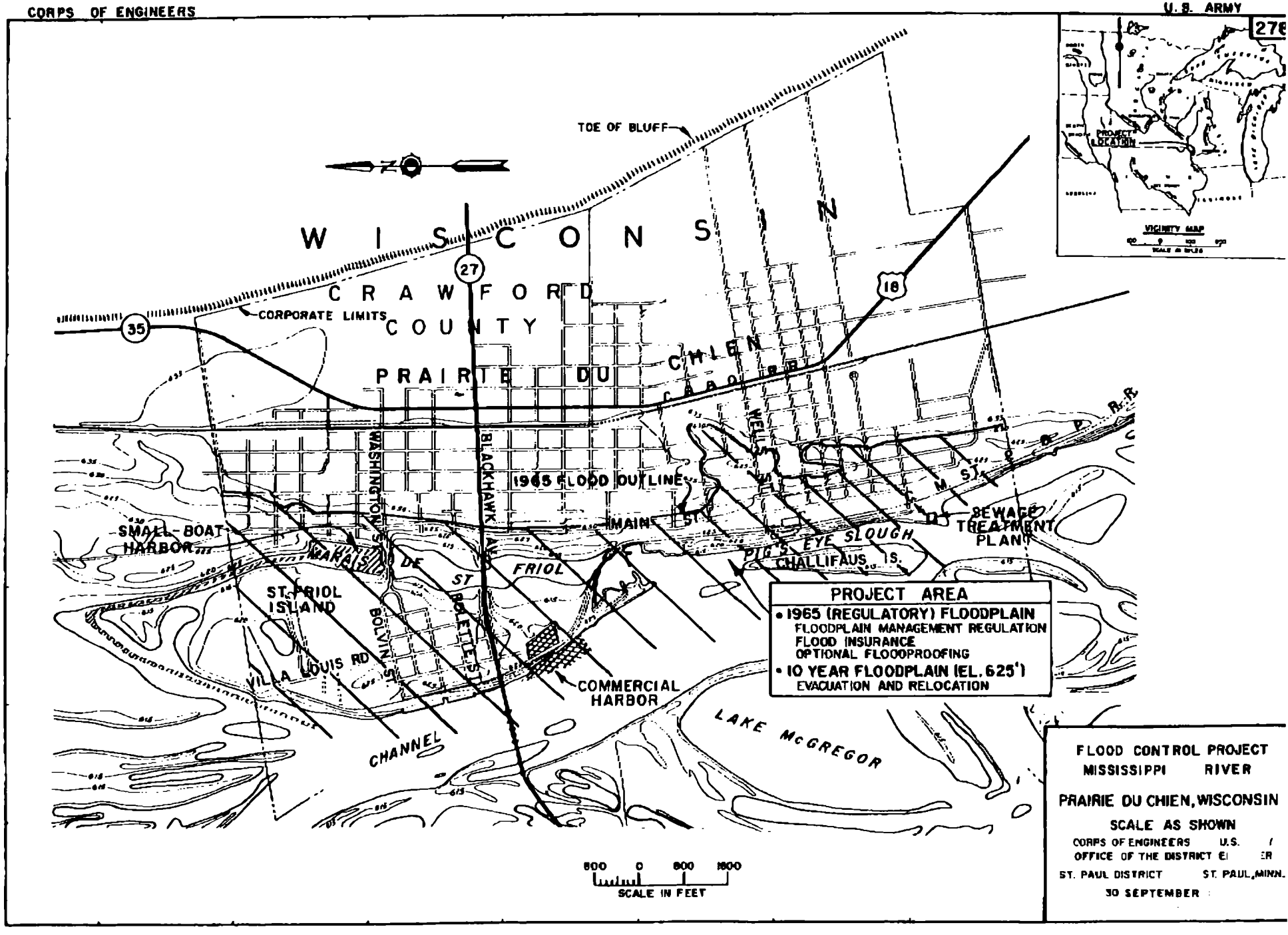
Federal	$ 3,685,000
Non-Federal	$ 920,000
Total	$ 4,605,000

Benefits $ 7,368,000

9. History of Project Performance: Project is performing as expected. As a result of the current 1993 flood event, it is estimated that $800,000 in damages have been prevented from this single event thus far.

CORPS OF ENGINEERS

U.S. ARMY



PROJECT AREA

- 1965 (REGULATORY) FLOODPLAIN
  FLOODPLAIN MANAGEMENT REGULATION
  FLOOD INSURANCE
  OPTIONAL FLOODPROOFING
- 10 YEAR FLOODPLAIN (EL. 625')
  EVACUATION AND RELOCATION

FLOOD CONTROL PROJECT
MISSISSIPPI RIVER

PRAIRIE DU CHIEN, WISCONSIN

SCALE AS SHOWN

CORPS OF ENGINEERS U.S. /
OFFICE OF THE DISTRICT E ER
ST. PAUL DISTRICT ST. PAUL, MINN.

30 SEPTEMBER

SUMMARY PAPER

1. Project: Bettendorf, Iowa

2. Purpose: Provide appropriate flood control - local protection measures to the Bettendorf, Iowa metropolitan area, subject to frequent flooding as a result of the 1965 flood of record, causing estimated damages of $1.3 million.

3. Location: The city of Bettendorf, Iowa is located on the right bank of the Mississippi River in Scott County, Iowa, and is one of the Quad Cities, along with Davenport, Iowa, and East Moline, Moline, and Rock Island, Illinois.

4. Authority: Flood Control Act of 1968 (P.L. 90-483)

5. Date of Implementation: 1987

6. Project Description: The project consists of approximately three miles of levee, 2,200 feet of concrete floodwall, two pump stations, two new railroad bridges across Duck creek, eight gatewells and two ponding areas, together with an early warning system for the entire project.

7. Challenge and Solution: The project was constructed under five major contracts commencing in July 1982. The last and most significant construction contract for the project was awarded to Foley Construction Company in September 1985, and included the area from I-74 downstream to and including the 10th Street tie-off. This was a unique area in that it involved close coordination between the City and Park Board on several items of the City's Master Plan for the River Front Park Area. This reach also involved coordination of a unique section of concrete folding wall.

8. Implementation Costs and Benefits: (Jan 1986 price levels)

Cost Sharing

Federal	$ 14,500,000
Non-Federal	$ 1,510,000
Total	$ 16,010,000

Benefits $ 36,823,000

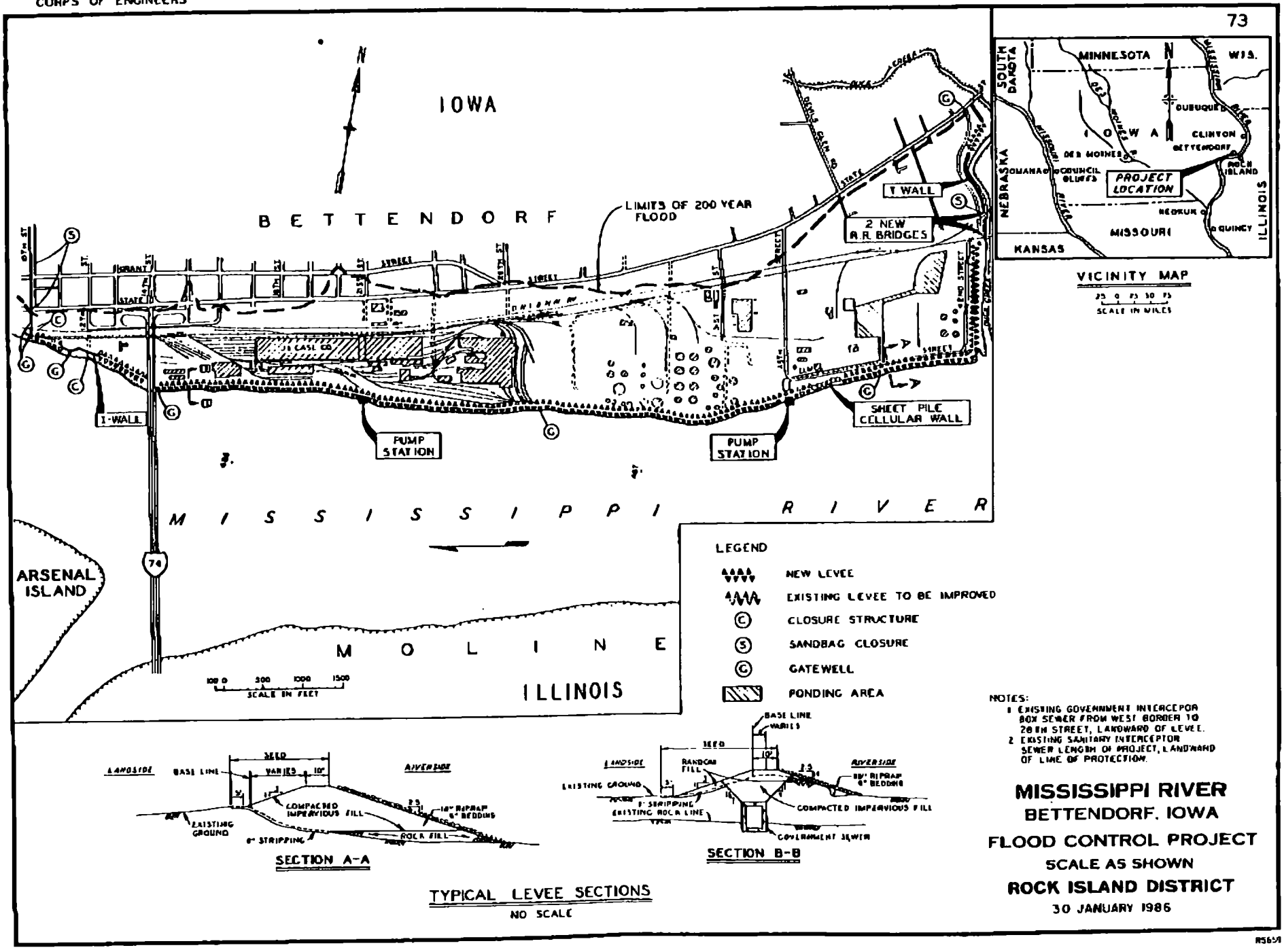
9. History of Project Performance: The project is performing as expected in providing a high degree of protection against floods on the Mississippi River and Duck Creek for Bettendorf. Estimated damages prevented since completion of the project total approximately $8.6 million. Additional estimated damages prevented as a result of the current 1993 flood event total approximately $11.7 million thus far.

NOTE: The city of Davenport, Iowa, located immediately downstream of Bettendorf, was also provided an opportunity to participate in a flood protection project. However, in October 1984, the city of Davenport indicated that would be unable to participate in the proposed project for financial reasons.

CORPS OF ENGINEERS

U.S. ARMY

73



TYPICAL LEVEE SECTIONS

NO SCALE

NOTES:

1. EXISTING GOVERNMENT INTERCEPTOR BOX SEWER FROM WEST BORDER TO 28TH STREET, LANDWARD OF LEVEE.
2. EXISTING SANITARY INTERCEPTOR SEWER LENGTH OF PROJECT, LANDWARD OF LINE OF PROTECTION.

MISSISSIPPI RIVER
BETTENDORF, IOWA
FLOOD CONTROL PROJECT
SCALE AS SHOWN

ROCK ISLAND DISTRICT

30 JANUARY 1986

RS658

SUMMARY PAPER

1. Project: Mississippi River at St. Louis, Missouri (St. Louis Floodwall).

2. Purpose: To provide flood protection to the city of St. Louis.

3. Location: St. Louis, Missouri.

4. Authority: Public Law 256, dated 9 August 1955.

5. Date of Implementation: Project completed in August 1963.

6. Project Description: Project consists of 21,200 feet of earth levee, 34,000 feet of reinforced concrete floodwall, closure structures, seepage control measures, 28 pumping stations, alterations to 44 sewer systems and crushed stone road surfacing for the earth levee portion.

7. Challenges and Solutions: The challenge was to provide adequate flood protection to an urban area consisting of 3,160 acres of commercial and industrial development within the City of St. Louis. Solution was to provide levees and a floodwall in an unobtrusive manner.

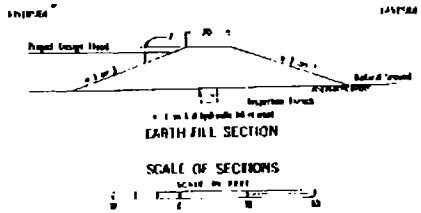
8. Implementation Cost and Benefits: The total cost of the project was $79,505,200 which includes a $1,832,500 non-Federal contribution. The project was economically justified at 3 1/4%.

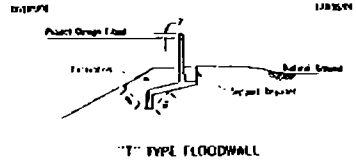
9. History of Project Performance: The project has performed to expectations. There has been no failure or overtopping of the project.

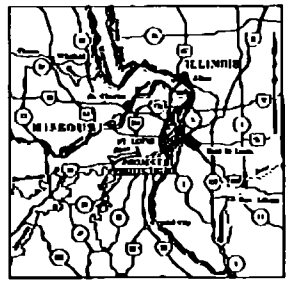
CORPS OF ENGINEERS

U. S. ARMY

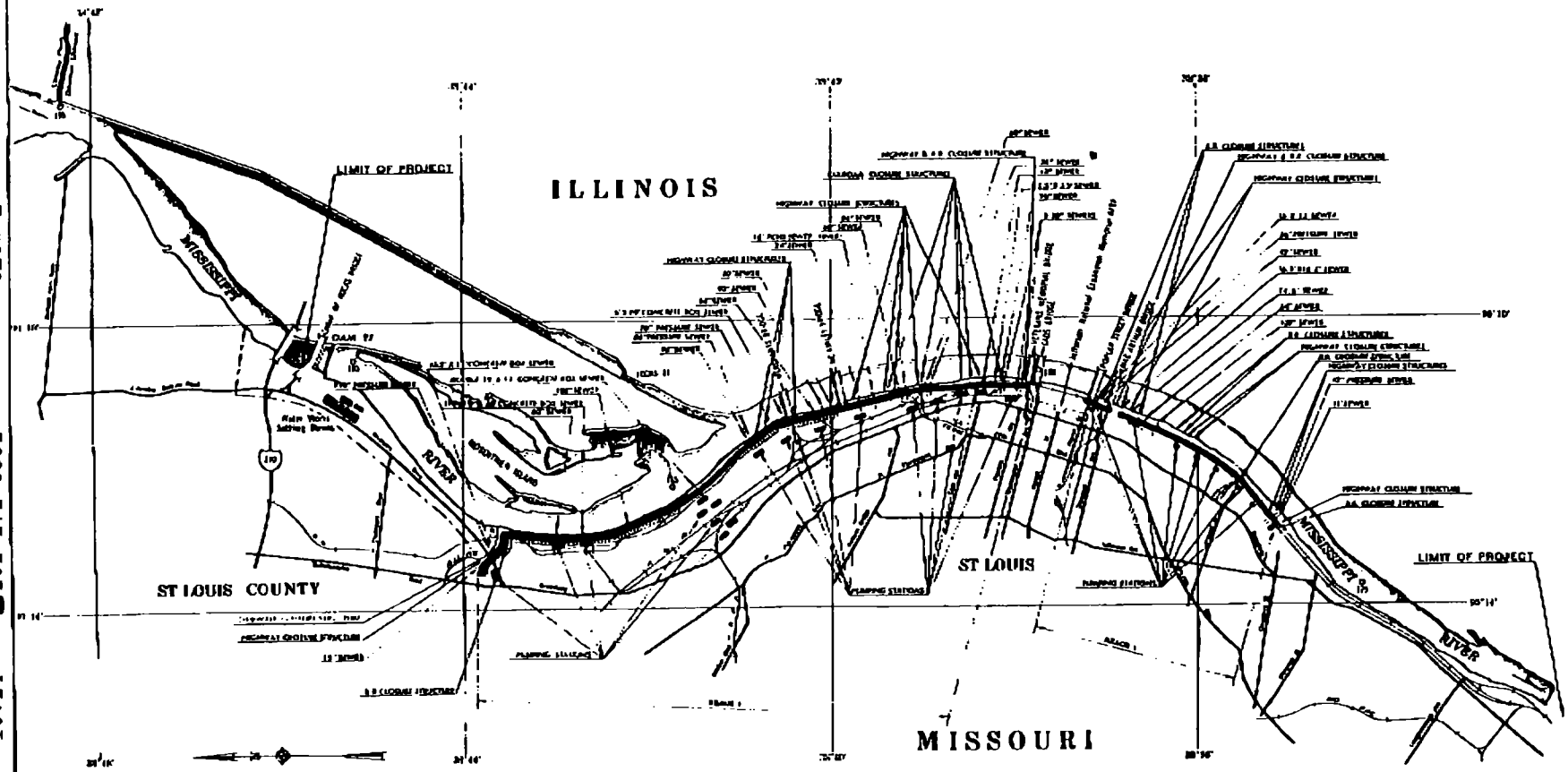
272







VICINITY MAP



LEGEND

Project flood protection constructed (52d grade)

Detailed investigated on river

Note
Seepage relief wells
13 installed in Reach 3
57 installed in Reach 4

FLOOD CONTROL PROJECT
MISSISSIPPI RIVER
MISSISSIPPI RIVER
AT ST. LOUIS, MISSOURI

U. S. ARMY ENGINEER DISTRICT, ST. LOUIS
CORPS OF ENGINEERS
ST. LOUIS, MISSOURI
JUNE 30, 1971

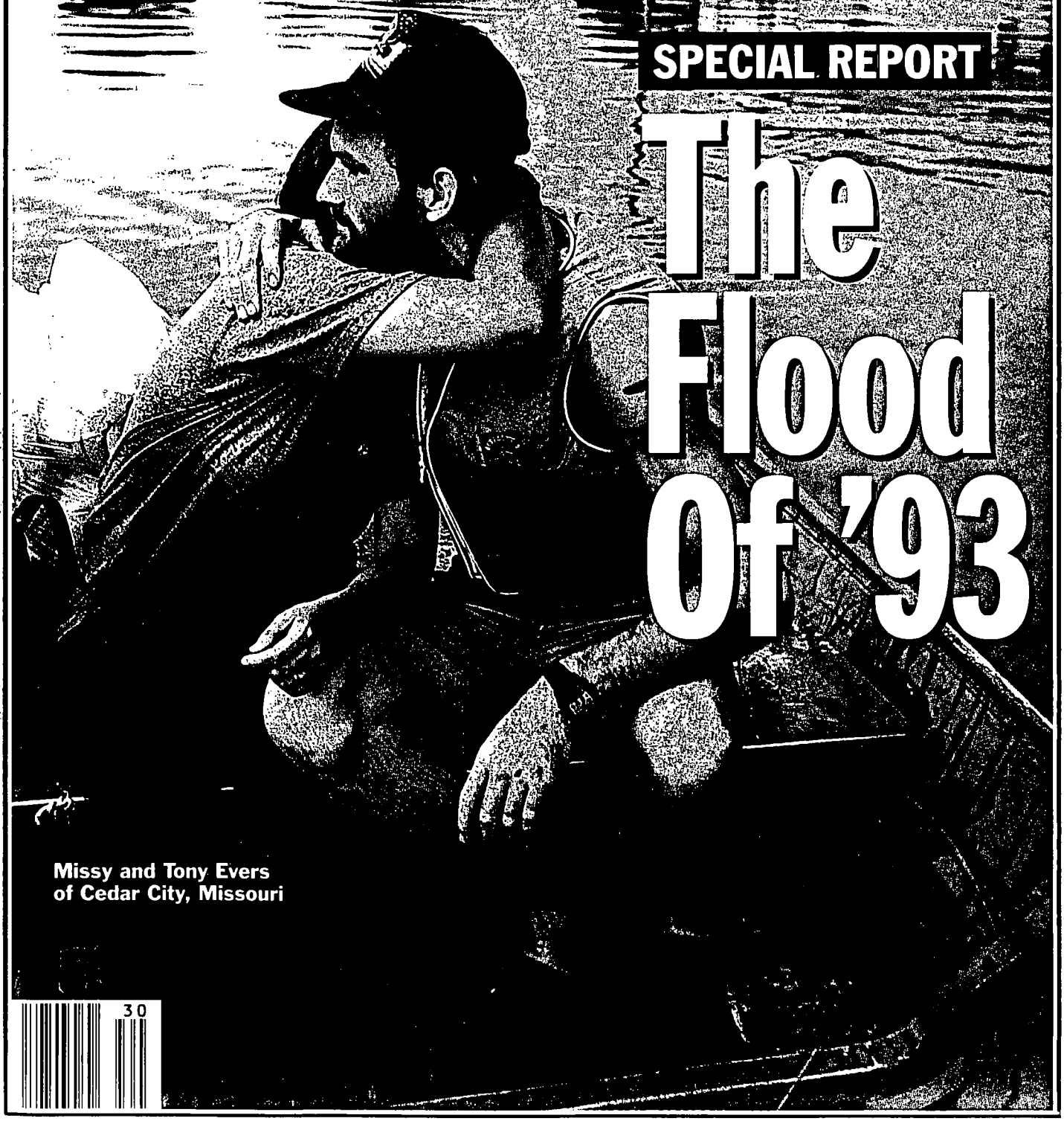
JULY 26, 1993 $2.95

TIME

BORN GAY
Science Finds a Genetic Link

SPECIAL REPORT

The Flood Of '93



Missy and Tony Evers
of Cedar City, Missouri

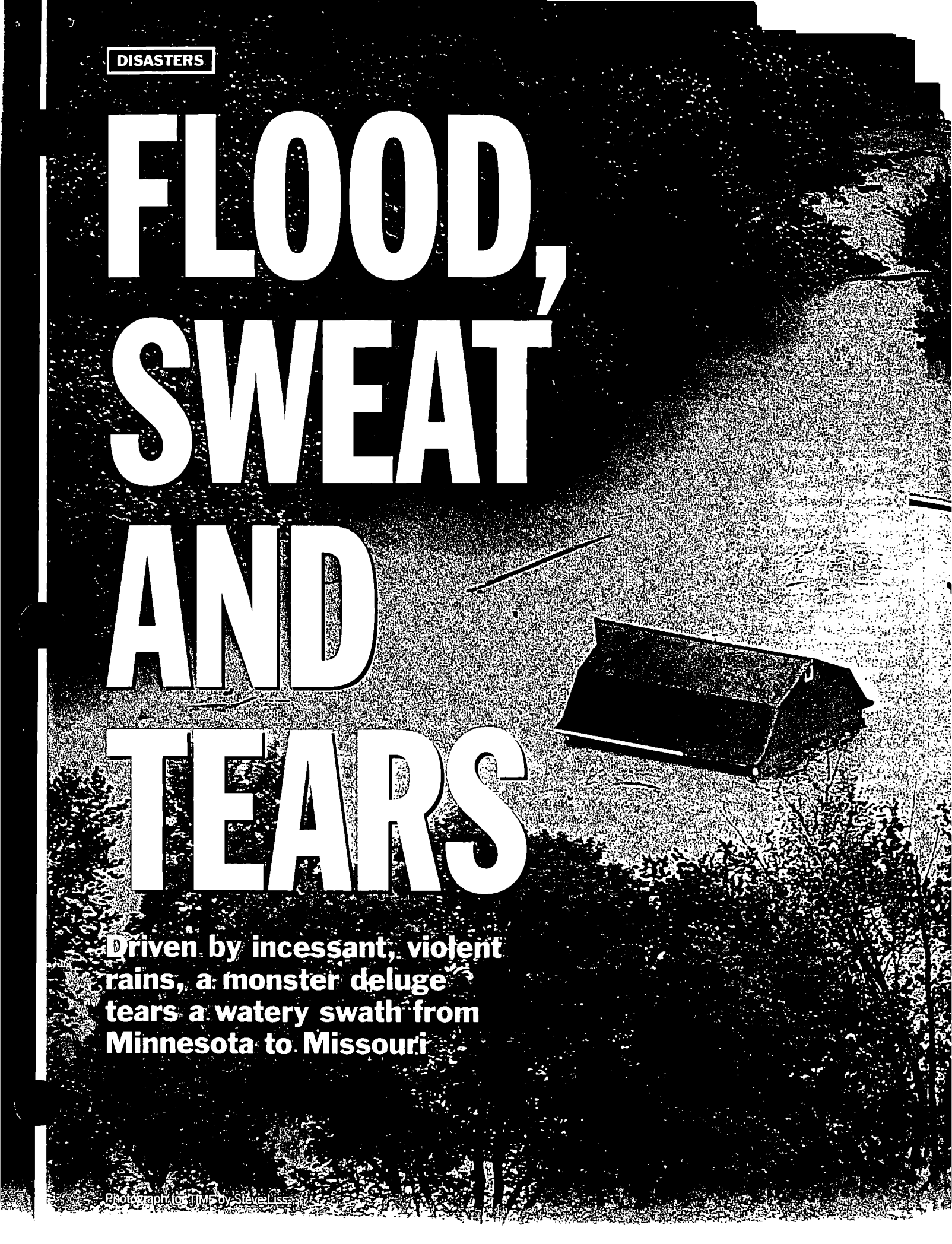
30

10090

DISASTERS

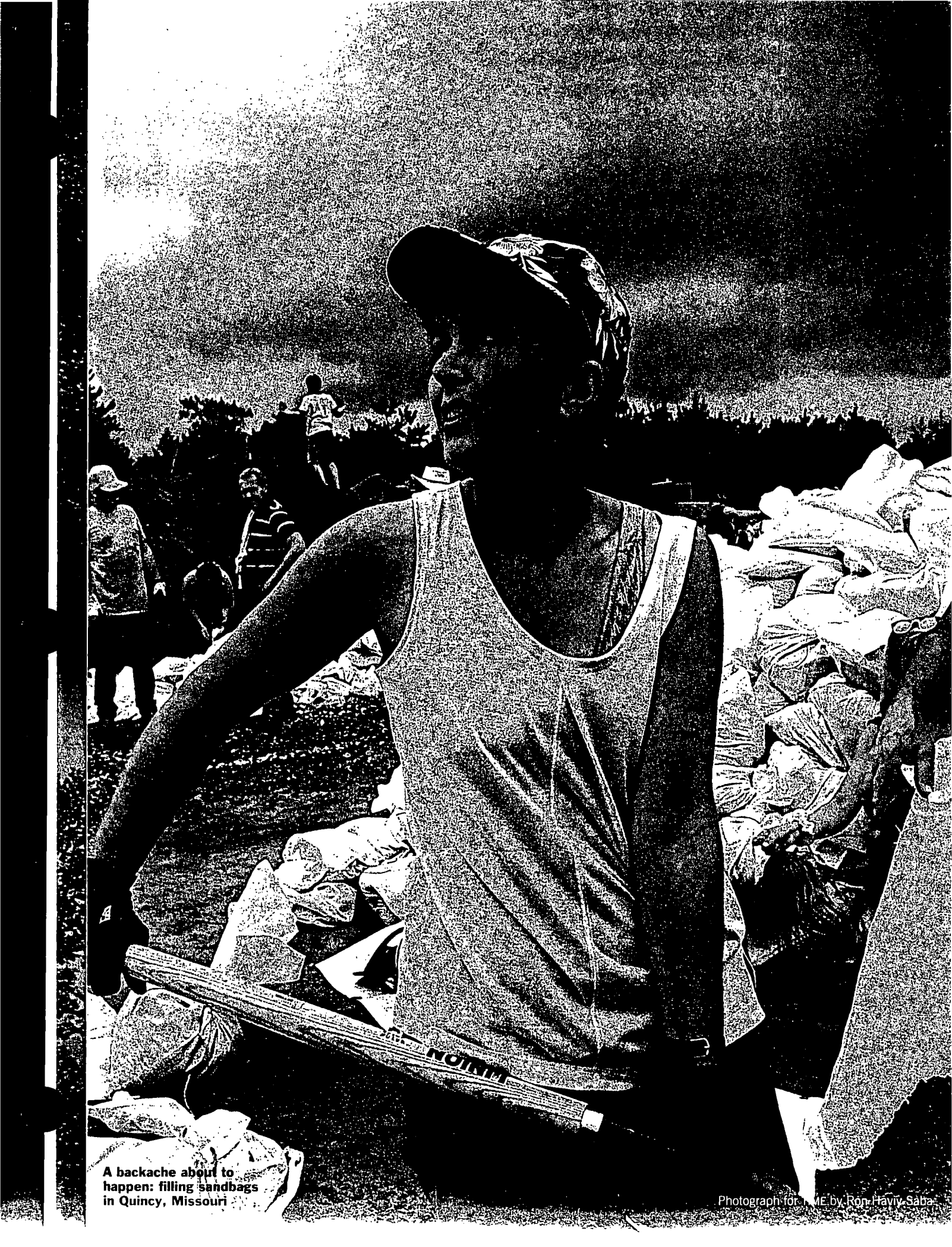
FLOOD, SWEAT AND TEARS

Driven by incessant, violent rains, a monster deluge tears a watery swath from Minnesota to Missouri



Photograph for TIME by Steve Liss

The roof of a barn pokes forlornly above flooded I-80 in Iowa.



A backache about to happen: filling sandbags in Quincy, Missouri

Photograph for TIME by Ron Haviv/Saba

By GEORGE J. CHURCH

THE WORST IS SUPPOSED TO BE OVER THIS WEEKEND. THE FLOOD CREST ON THE MISsissippi, 46 ft. above normal (and 3 ft. above the highest ever recorded before), was scheduled to pass St. Louis, Missouri, on Monday. It should roll by Cairo, Illinois, about 180 miles to the south, by Friday. There, the Ohio joins the Mississippi, which moves into a broader, deeper channel that should be able to carry all the water pouring in from upstream without overflowing the levees, dikes and dams south of Cairo. The people, businesses and farms lining the Father of Waters for the roughly 600 miles south to New Orleans should be safe. Upstream, houses, roads and fields should begin to resurface above the new lakes and inland seas covering parts of nine states inundated by the Mississippi, the Missouri and tributary rivers, streams and creeks that nobody outside the immediate area had ever heard of before last week.

If. But. Only.

If . . . sunshine finally puts an end to the rains that have been lashing the upper Midwest and swelling the rivers for the past three months, in amounts often difficult to believe (an inch in only six minutes last week at Papillion, Nebraska). Otherwise the crest could be even higher than predicted; continued rain caused forecasts of the expected maximum height at St. Louis to be raised a full foot within two days late last week. On Saturday, thunderstorms dropped an additional 5 in. of rain on central Iowa. A dangerous second crest could chase the big one down the Mississippi, and secondary rivers could burst their banks in areas so far spared. That happened last Thursday night in Fargo, North Dakota. The Red River, engorged by a daylong deluge, rose 4 ft. in six hours, rampaging into town and causing sewage to back up into homes and Dakota Hospital.

Another if: more levees, soaked and pounded by rushing waters for weeks, could give way as the crest approaches or even after it passes. Early last Friday morning the Missouri River poured over the top of a railroad embankment being used as a levee in St. Charles County, Missouri, northwest of St. Louis. Its waters mingled with those swirling south from the Mississippi 20 miles sooner than usual, forcing several hundred people to join the 7,000 who had already evacuated. Then, Friday night, the Mississippi broke though a sand levee at West Quincy, Missouri, forcing closing of the Bayview Bridge about a quarter-mile away—the last span that was open over a 200-mile stretch of the river where it flows between Missouri and Illinois. The bridge will be closed for weeks, whatever happens, an indication that worse may yet come before the worst is over.

But . . . even with few or no additions, the Great Flood of '93 is already one of the all-time monsters. It might go down as the worst of all in the U.S. by many measures: height of flood crest, area inundated (close to 17,000 sq. mi., vs. 12,700 in the awesome flood of 1937 along many of the same rivers) and property damage. Government estimates skyrocketed in little more than a week from $500 million to as much as $8 billion, and the final tally might be higher still.

DIANA WALKER FOR TIME

COMFORT: President Clinton consoles Christina Hein in flood-ravaged Des Moines

The big exception: the death toll, 26 late last week, was only a hair above the 23 killed by the mammoth flood of 1973 in many of the same areas, and only a tenth of the 250 who perished in the 1937 flood—to say nothing of the record 2,100 drowned on the single day of May 31, 1889, in Johnstown, Pennsylvania. Main reasons: abundant warnings, evacuation plans well worked out in advance, the lack of flash floods and above all the fact that over the years most population centers have been protected by levees and dams built high and strong enough to hold against the pounding of a once-in-a-century flood. Hold they did: with few exceptions, the cities flooded were those protected only by privately built levees that were not well constructed. The waters that flooded agricultural land mostly broke through or swept over levees not as tall as those guarding the cities.

Only . . . statistics, and even the view from rooftop level, give little idea of the sheer extent of inundation. That can really be glimpsed only from the air, as by the crew of a U.S. Coast Guard Dolphin helicopter that flew over the St. Louis area last week to survey the damage and scout

places where it might later land to evacuate flood victims. The seemingly endless expanse of water made visual navigation difficult by submerging the landmarks pilots usually look for. Long stretches of highway and railroad tracks were invisible; river islands had disappeared; the river channels themselves could not be distinguished from the water that had spread onto once dry land. Mountains of strip-mined coal that usually glisten in the sun south of St. Louis poked only their very tips above the water. At the Kirkwood Athletic Association complex in Kirkwood, Missouri, only the dugout roofs could be seen above the water covering baseball diamonds, and a nearby golf course looked like a series of small green islands lost in a sea. At the Shrine of Our Lady of the Rivers in St. Charles County, a statue of the Virgin Mary appeared to be dancing on the waves.

STEVE LISS FOR TIME

EVACUATION: Fleeing the flood in Cedar City, Missouri

Even if the rain and flooding stop completely now, it may take a month in some areas for all that water to flow back into the rivers, through the levees it came around or over. (Yes, through. The water might go back through holes eroded in the levees or through gravity drains that are closed during floods but reopened to allow a backflow into the river.) Then comes the monumental task of cleanup. The receding waters will leave behind all manner of wreckage. Examples: the floating chicken coops and broken tree branches Paul Rice has to steer his flat-bottomed boat past to reach his submerged home in St. Charles County. Or the lumber, three ice chests and four plastic garbage cans he has plucked from the waters around his house and placed on his roof—still a foot above the waterline. In some areas, agricultural chemicals and human and animal wastes will be mixed with the debris. And of course, mud—tons and tons and tons of mud.

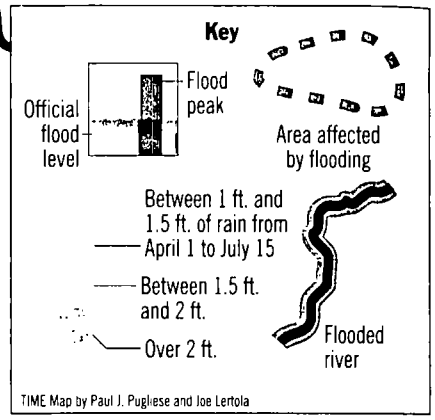
While throwing sandbag on top of sandbag on top of sandbag to erect makeshift barriers against the water, some people nonetheless wondered what could be done with all that sand—or, for that matter, the bags—once the waters subside. The Army Corps of Engineers calculates that it has distributed 26.5 million bags through the flood area, and each has been filled with roughly 35 lbs. of sand; they can't just be left in piles all over the place.

Piling up the bags has been good therapy for people eager to do something to combat the floods while keeping their minds off their losses. "All we can do is sandbag," said John Boerding, 50, who figured that more than half his 2,000-acre crop of soybeans, corn and wheat in St. Charles County had already been destroyed by late last week, and was worried that his home would sink as well. "What else can we do? Most people in this area don't even have flood insurance." But even if there are no outbreaks of disease because of the filth in the waters, the Midwest will shortly be suffering one of the world's worst collective backaches from the unaccustomed labor of filling the bags and muscling them into place.

Elizabeth Smith, assistant professor of psychiatry at Washington University in St. Louis, who has done extensive research into the psychological effects of disasters, expects emotional as well as physical pain among flood survivors. Many, she notes, have been under stress for weeks, since flooding started in some areas as far back as April. People who go through that, Smith notes, react in a different way from those who survive one-shot traumas like fires or plane crashes: they do not experience flashbacks to the disaster or extreme jumpiness but instead suffer prolonged "depression, sadness and feelings of hopelessness." She adds that even people who were only near, not in, the floods may feel a new sense of vulnerability.

Perhaps, but in the middle of the disaster Midwesterners showed a stunning good humor, resilience and neighborly spirit. It was especially notable in the Iowa capital, Des Moines, which was hit possibly harder than any other big city. A flood along the Raccoon River at the beginning of last week knocked out the city's water-treatment plant. Officials expect to send water for bathing and flushing toilets coursing through the pipes again this week, but there will be no running water

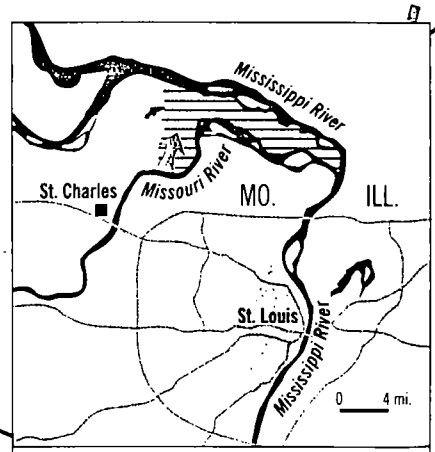
THE EXTENT OF THE DAMAGE



TIME Map by Paul J. Pugliese and Joe Lertola

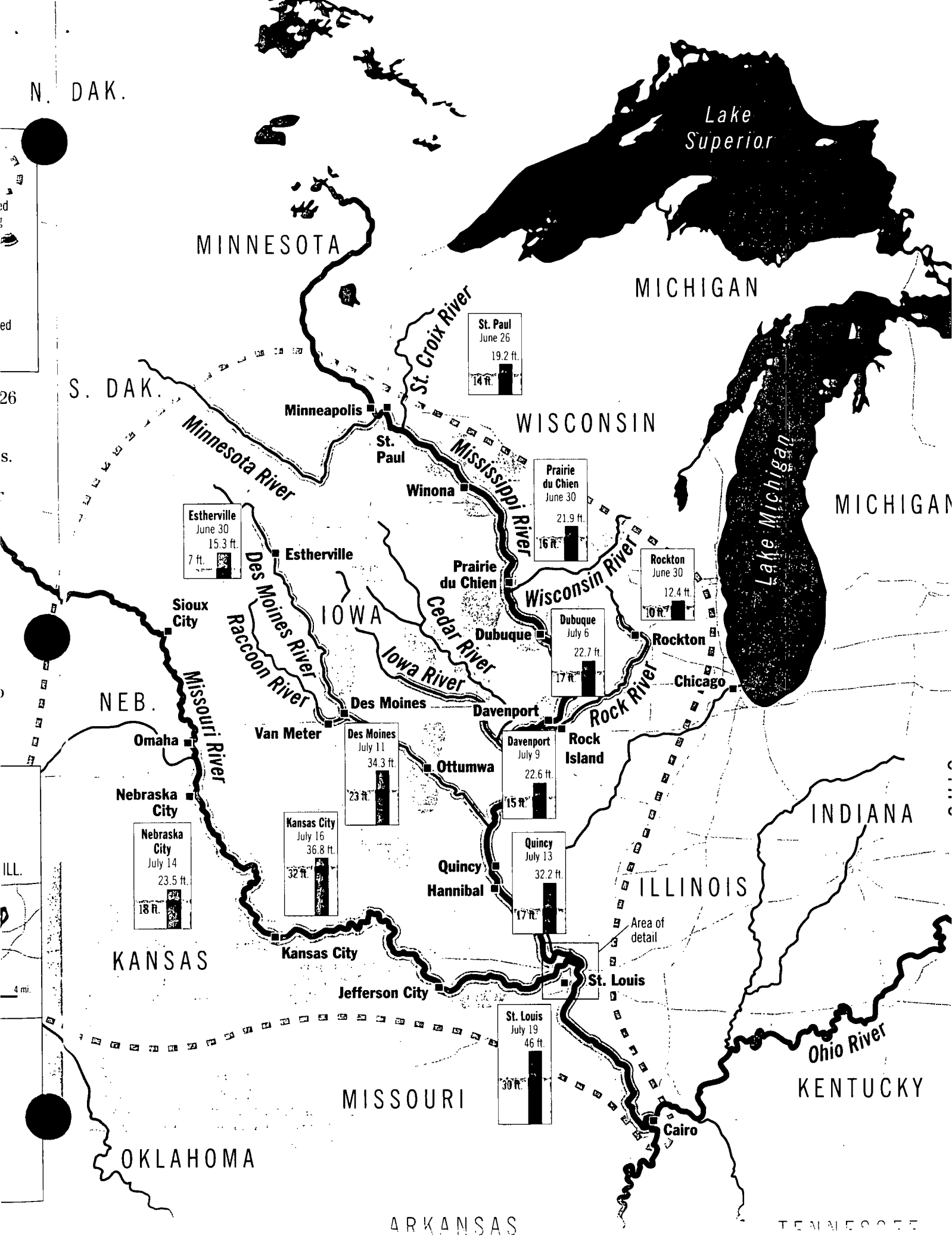
The flood has killed at least 26 people, caused an estimated $8 billion in damage and covered over 10 million acres. Clinton declared more than 200 counties federal disaster areas, including all 99 counties in Iowa.

The Mississippi River drainage basin covers over 1,250,000 sq. mi., collects water from 40% of the contiguous U.S. and dumps 100 trillion gal. of water into the Gulf of Mexico.



The Missouri River broke through a levee near St. Charles on July 16. Floodwaters surged northward, merging with Mississippi backwaters 20 miles upstream from their normal confluence.

Source: National Weather Service Climate Analysis Center (NOAA)

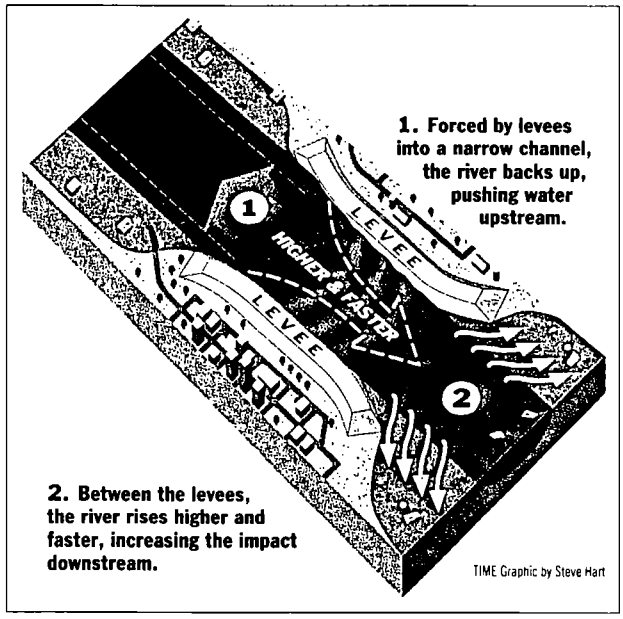

N. DAK.
Lake Superior
MINNESOTA
MICHIGAN
St. Croix River
St. Paul
June 26
19.2 ft.
14 ft.
S. DAK.
Minneapolis
St. Paul
WISCONSIN
Minnesota River
Mississippi River
Prairie du Chien
June 30
21.9 ft.
16 ft.
Winona
Lake Michigan
MICHIGAN
Estherville
June 30
15.3 ft.
7 ft.
Estherville
Des Moines River
Prairie du Chien
Wisconsin River
Rockton
June 30
12.4 ft.
10 ft.
Sioux City
IOWA
Cedar River
Dubuque
Dubuque
July 6
22.7 ft.
17 ft.
Rockton
Raccoon River
Iowa River
Rock River
Chicago
NEB.
Missouri River
Des Moines
Davenport
Van Meter
Omaha
Des Moines
July 11
34.3 ft.
23 ft.
Davenport
July 9
22.6 ft.
15 ft.
Rock Island
Ottumwa
Nebraska City
INDIANA
Nebraska City
July 14
23.5 ft.
18 ft.
Kansas City
July 16
36.8 ft.
32 ft.
Quincy
July 13
32.2 ft.
17 ft.
Quincy
Hannibal
ILLINOIS
Area of detail
KANSAS
Kansas City
St. Louis
Jefferson City
St. Louis
July 19
46 ft.
30 ft.
Ohio River
KENTUCKY
MISSOURI
Cairo
OKLAHOMA
ARKANSAS
TENNESSEE

LEVEES: DO THEY WORK TOO WELL?

A RIVER VIEW IS A PRICELESS ASSET, OR SO THE RESIDENTS OF DAVENPORT, Iowa, believed. Now, however, they are realizing that their postcard vistas came at a price. Two weeks ago, the town, which had chosen not to build a levee, was swamped by millions of gallons of murky water. Yet while Davenport flooded, the business district of nearby Rock Island, Illinois, barely got its feet wet. Reason: in 1971 Rock Island decided to build a rock-and-clay floodwall.

In spite of the impression created by images of levees and houses being overrun by rising waters, the mounds of earth and rock built to contain the Mississippi around population centers have by and large worked. At week's end, along 600 miles of swollen, surging river, most major levees continued to hold.

The problem, ironically, is that the enormous system of levees built up over more than 200 years may be working too well. As the flood recedes and cities like Davenport begin the dismal task of cleaning up, sharp questions are being raised about the wisdom of the nation's approach to flood control, and the cost, both financial and environmental, of a program that relies on man-made structures to contain the mighty river. Over the past seven decades, the U.S. Army Corps of Engineers has spent billions of dollars constructing an elaborate flood-control network, including 7,000 miles of levees, along the Mississippi and the rivers that feed it. The system was intended to protect the communities that sprang up on the river's edge, and most of the time it has. But many environmentalists believe that, over the years, the corps's attempts to control the Mississippi have backfired. Left to its own devices, a flooding river spreads horizontally, filling its natural floodplain and enriching it with fertile, alluvial soil. Along the Mississippi, however, this pattern of natural flow has been increasingly blocked by a patchwork of levees.



The effect is that an increasingly pent-up river rises higher, moves faster downstream, and is more prone to back up like a clogged drain, increasing the pressure on unfortified areas. "The water has to go somewhere," says aquatic ecologist Richard Sparks of the Illinois Natural History Survey, "and if we don't allow it to spread out, the only direction it can go is up."

Nowhere are these effects more dramatic than in the Mississippi Delta, which used to be replenished every year with rich alluvial deposits. Now the soil, laden with nutrients, is carried by the river, bypasses the Delta and falls into the Gulf of Mexico, where it is contributing to algae blooms and threatening the fisheries. The Delta is sinking, with the result that the levees keeping the river at bay have to be periodically raised.

But it is ordinary human activity—not just the Corps of Engineers—that has robbed the Mississippi basin of its most precious resource: the wetlands and riparian forests that once absorbed excess rainwater like so many giant sponges. In fact, the displacement of this natural flood-control system by an artificial one may, over time, increase the number of record-busting floods.

Even critics of the corps concede that protecting existing cities and towns is appropriate. Hannibal, Missouri, can only be thankful that it has just completed construction of a new $8 million floodwall, without which the Mark Twain home and museum would now be underwater. But absolutely critical to stemming future flood losses, a federal task force concluded last year, is protection of riverine floodplains from further development. In some cases it may even prove cost effective to relocate entire flood-prone communities. "We need to start giving land back to the river," says Larry Larson, head of Wisconsin's floodplain program. "If we don't, sooner or later the river will take it back."

—By J. Madeleine Nash/Chicago

safe to drink for an additional three weeks or so. Meanwhile, residents seeking water for any purpose last week had to line up for supplies trucked in from outside and dispensed at 100 different locations (limit: 2 gal. to a customer); they were forbidden to enter office buildings because sprinkler systems could not protect them from fire. Downtown at times looked like a city under military occupation: deserted except for National Guardsmen who patrolled the streets while helicopters buzzed overhead. President Clinton, who toured flooded areas many times during his 12 years as Governor of Arkansas, flew in Wednesday and declared, "I've never seen anything on this scale before."

Yet as a chain of about 100 people heaved sandbags to protect the water-treatment plant in West Des Moines from further flooding, the atmosphere was downright festive. Jokes flew (most popular: the state motto, "Iowa—A Place to Grow," should be changed to "Iowa—A Place to Row"). Valerie Kenworthy, 15, explained her presence: the scene "looked cool on TV so I came down." At Iowa Methodist Medical Center, the only designated trauma center serving the city, president David Ramsey explained why trauma cases are actually down: "People are helping out and are not out on motorcycles drinking beer and acting crazy." Hospital workers were busy carrying buckets of water for patients. "Our arms are six inches longer," joked emergency-room manager Linda Shoemaker. "We carry buckets here and go home and carry more." Lining up for water at a Des Moines parking lot, Donna Bailey was upbeat in describing her family's coping strategy: "Every surface is covered with bowls of water. And we flush the toilets with rainwater we keep in the bathtub." Doug Riggs, on vacation from his job as a social worker in Marshalltown, drove 75 miles into Des Moines to help out and found himself managing a shelter at Shepherd of the Valley Lutheran Church. But at week's end only 25 flooded-out people had arrived; many more had found family, friends or neighbors to take them in.

Downriver the story was the same. Mayor Chuck Scholz of Quincy, Illinois, was startled and touched to find two girls who looked to be a mere eight to 10 years old clutching shovels and waiting to board a bus carrying volunteers to work at a nearby sandbagging site. At Ste. Genevieve, Missouri, south of St. Louis, volunteer inmates from the Farmington Correc-

NAJLAH FEANNY—SABA FOR TIME

SANDBAGS AWAY! Army helicopter crew helps build levee for Des Moines

tional Center heaved sandbags side by side with people from the neighborhood. "Man, these guys can throw sandbags like you wouldn't believe!" marveled Gerald Basler, a highway-maintenance worker. "Some of these guys can catch them in midair with one hand!" Ken Novak, who is serving eight years for first-degree assault, showed a reciprocal friendliness. "We had one lady who had tears in her eyes, she was so happy to see guys from prison coming to help," Novak related. "I told her my shoulder was clean and I'd give it to her to cry on."

There will be more tears later, and not of joy or friendliness, as the damages mount. Already, amid the determined good cheer, there are those like Mike Johnson who curse the river, the skies, the dams and levees upstream (for holding altogether too well and increasing pressure downriver), and the government. Mike, an out-of-work machine operator, and his wife Roberta and three children were ordered out of their two-story brick house in the St. Louis suburb of Lemay on July 9 at 3:30 a.m. Every day since, Mike has returned to the house in a neighbor's boat to inspect it; late last week 6 ft. of water sloshed around the living room. The family, plus two Chow show dogs and two Persian cats, is living in Mike's blue 1992 Bronco; Mike sleeps on the roof. Nearby, the roof of the family's second car, a 1977 Cutlass, is barely visible above the water. "It's a goner," says Mike.

The Rooney brothers live only a few dozen yards away from each other in St. Charles County, but the Great Flood is treating them quite differently. Walter Rooney's three-story house sits in 11 ft. of water, yet Rooney, 64, is able to pop a cold beer from the fridge, kick back in his air-conditioned second-story sitting room and listen to music, all thanks to a power line that hasn't been turned off. His brother Ray, 60, isn't so fortunate. "That's my house over there," he says, pointing to a blue roof just above the waterline. "I left my house in the 1973 flood, and they stole everything I had. There's no way I'm leaving this time." So he sits on Walter's second-story porch, just 1 ft. above the Mississippi, and watches debris from Minnesota and Wisconsin, Iowa and Illinois float by. "If it looks interesting, I'll grab it," he says.

Despite stunning TV pictures of flooded city streets, though, most of the inundation has affected thinly populated farmland. For example, the 7,000 people evacuated last week from the 40% of St. Charles County that was expected to be underwater shortly contrasted with 55,000 residents of the city of St. Charles who sat high and, so far, dry on elevated land.

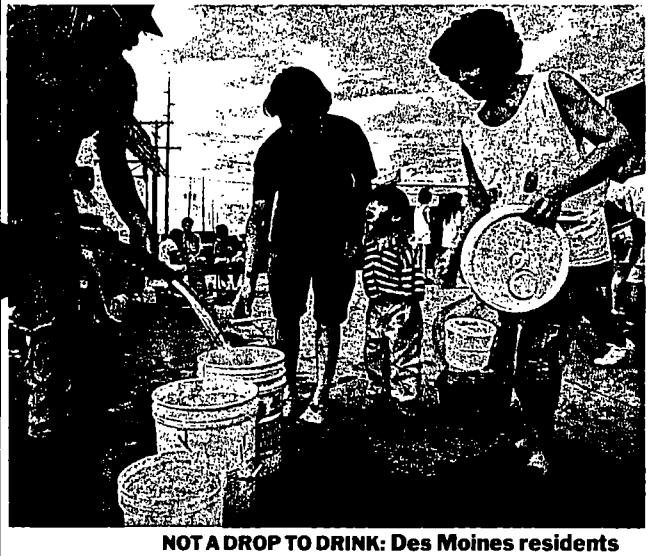
But—there always seems to be a but—much of the drowned farmland is normally among the most fertile acreage on earth, and prospective crop losses are spectacular: $1.5 billion worth of soybeans in Illinois; $1 billion of corn in Iowa. "There is still time to recover," says Victor Lespinasse, a Dean Witter grain analyst in Chicago. "But none of us is ever going to forget how the rains came in the summer for the first time, out of nowhere. And we will never feel the same about our place on earth." He is referring to the flood's menacing peculiarity. It is an anomaly in the Mississippi basin that it came in July, giving farmers less time to recover than previous inundations, which almost always came in late winter or early spring. Summers in the area are usually noted for searing heat and Saharan drought rather than for rains on which Noah's ark might float.

Suffering and losses may be eased this time because the Federal Emergency Management Agency is moving with uncharacteristic speed and vigor. From its creation 14 years ago right through Hurricane Andrew in Florida last summer,

AFTER THE DELUGE: HEALTH HAZARDS

IF HURRICANES ARE MOTHER NATURE'S BARROOM BRAWLERS, SWIFTLY FINISHing their business and heading for the door, floods tend to behave more like unwanted houseguests: they park themselves in the living room, tear up the furniture, and generally make a nuisance of themselves for weeks or months before finally having the decency to pack up and hit the road. That's not good news for residents of the Mississippi River Valley, who long after floodwaters have crested will play host to a chocolate-colored inland sea sprawling across the spine of the Midwest—a stagnant, festering stew of industrial waste, agricultural pesticides and raw sewage that laminates buildings in goo and provides a superb growing environment for bacteria. The entire floodplain, says Anita Walker in Des Moines, Iowa, will be a "muddy, stinky, awful mess to clean up."

As the Great Flood of '93 recedes, it is likely to leave in its wake a rash of health problems ranging from disease to chemical pollution. A variety of infections related to sanitation and hygiene, all spread by floodwater, are already giving health officials headaches. Thanks to at least 18 breached sewage plants, microbes have penetrated the nearly 800 miles of piping that keeps the Des Moines area's 250,000 residents supplied with drinking water; it will take a month to disinfect the system. Tetanus is another concern, especially for sandbaggers and rescuers slogging through the slimy silt and sewage-invested waters. And then there is encephalitis, a viral disease that inflames the spinal cord and brain and can produce a combination of low-grade fever, seizures and even coma. It is transmitted by mosquitoes, whose numbers are expected to explode along the saturated bottomlands in the coming weeks.



ALEX QUESADA—MATRIX FOR TIME

NOT A DROP TO DRINK: Des Moines residents fill jugs from water trucked into the city

So far, there have been no major outbreaks of illness. Health officials say such traditional scourges as cholera and typhoid are unlikely to pose a significant threat, and authorities insist that clean water and uncontaminated food—which so far have been available in most areas—will ensure that a full-scale epidemic doesn't take place. "There's a misperception that every time there is a disaster, people are at risk," says Mitchell Cohen of the Centers for Disease Control and Prevention. "The key elements are providing safe water and safe food. Health authorities know this controls any infectious-disease problem."

Less predictable, however, are the effects of the farm pesticides and industrial chemicals churning in the silt-encrusted swamps and ponds marooned by subsiding rivers. While hydrologists anticipate that the sheer volume of water will dilute and neutralize any toxicity, no one knows what dangers, if any, are posed by toxic runoff from hundreds of submerged factories, fuel-storage facilities and waste dumps. "Think of all this stuff making a witches' brew of new compounds," says Kevin Coyle, president of American Rivers, an environmental group in Washington. "We have no precedent."

There is, however, plenty of precedent for the nightmare that awaits residents when the waters finally recede. Denizens of the river valley who have endured previous temper tantrums of the Mississippi are all too well acquainted with the thick, claylike layers of earth that will coat the inside of houses, barns and machinery, delaying repairs and driving up the cost of recovery. Farmers have an appropriate term for the stuff: they call it gumbo. —*By Kevin Fedarko.*

Reported by Marc Hequet/St. Paul and David Seideman/New York

FEMA built a reputation for bumble-footed sluggishness. Democratic Senator Ernest Hollings once called its officials "the sorriest bunch of bureaucratic jackasses." Under a new administrator, James Lee Witt, however, FEMA has moved quickly to set up offices in at least eight flooded states. Regional staffs actually went into some areas before flooding became serious to help state officials apply for disaster assistance. Witt has since started a daily morning conference call with state emergency managers and directed FEMA workers to respond immediately to state requests—indeed, not to wait until asked but to approach state officials with lists of things that the agency thinks might be needed and that it can supply, such as the water-purification equipment that was delivered to a hospital in Des Moines within 24 hours.

Bill Clinton has also been trying to move fast. Last Wednesday he cut short a Hawaiian vacation to fly to Des Moines, where someone along his motorcade route held up a sign reading ALOHA, BILL. WELCOME TO THE OTHER BIG ISLAND. The President announced that he will ask Congress to put up an additional $2.5 billion for flood relief, which will have to be borrowed and will add to the budget deficit. On Saturday, he returned to the area with nearly half his Cabinet to talk about the region's needs, and promised to send federal troops if necessary. Clinton is determined not to get caught in the same bind as George Bush, who reacted slowly to hurricanes in Florida, Hawaii and South Carolina and got himself blamed not only for failing to relieve suffering but also for slowing economic recovery in those areas. But the President and his aides insisted that Washington could not make up flood losses dollar for dollar: states, local governments, private charities and the victims themselves will have to bear much of the cost. Said Chris Edley Jr., a program associate director for the Office of Management and Budget: "For farmers, the point is to make sure that it's not a disastrous year. The object is to get them through the crisis, not make them whole."

Even before the rains stopped and the rivers crested, a debate was breaking out about how to handle the next flood. "There are two extremes," observed Brigadier General Stanley Genega, director of civil works for the Corps of Engineers. "There are the folks who say we ought to remove everything from the banks of the rivers and let nature take its course. On the other extreme are folks who urge us to line the river with levees and control the whole thing. The real answer is, there has to be some balance." An unexceptionable sentiment, no doubt—but where to strike that balance? Should the levees that gave way be rebuilt and made higher? Or should they be left alone, on the assumption that they give people living behind them a false sense of

RON HAVIV—SABA FOR TIME

A child clutches her father in fear as water rises toward an ironic sign

security, and emphasis be shifted to waterproofing buildings and moving them to higher ground? In theory, it might be advisable to try to discourage people from building or farming on floodplains—but how, given that they are very fertile and scenic?

The debate is all the more vexing because it involves trying to outguess Mother Nature—a futile endeavor, as evidenced by the wild unlikelihood of devastating rain in July, which nonetheless happened. The consistent pattern of late 20th century flooding in the U.S. has been a decline in deaths proportionate to the area inundated, but a startling rise in property damage, due to increased building and farming on the floodplains and inflation in dollar values. Beyond that, all is as uncertain as the exact height of the flood crest and the precise time it will pass St. Louis. A 1955 book, *A Treasury of Mississippi River Folklore*, quotes an obscure orator, one S.S. Prentiss, as saying, "When God made the world, He had a large amount of surplus water which he turned loose and told to go where it pleased; it has been going where it pleased ever since and that is the Mississippi River." No doubt it will continue to go pretty much where it pleases for centuries to come. ***—Reported by Jon D. Hull/St. Charles, Staci D. Kramer/St. Louis, J. Madeleine Nash/Chicago and Elizabeth Taylor/Des Moines***

IF YOU THINK THE WEATHER IS BAD ...

WEATHER IS ALMOST IMPOSSIBLE TO PREDICT MORE THAN A week or two in advance. But when it comes to climate—the long-term weather averages that make the U.S. temperate and the tropics torrid—scientists are confident that they understand the overall pattern. Over the past million years or so, the planet has swung between ice ages lasting on the order of 100,000 years and interglacial periods of about 10,000. During each phase, the climate is pretty steady. It's the stability of the current interglacial epoch, which began 10,000 years ago, that made the invention of agriculture, and thus the rise of civilization, possible.

Now it looks as though the concept of long-term stability may be wrong. According to two articles in last week's *Nature*, deep holes drilled into the ancient ice of Greenland have brought up evidence of sudden, dramatic swings in climate during the last interglacial period, about 120,000 years ago. Several times, average global temperatures dropped as much as 25°F, plunging the planet back into ice-age conditions, and stayed there for tens or hundreds of years before recovering. And the changes happened not over centuries, as scientists would have predicted, but in as little as a decade. The tranquillity of recent centuries may be a climatic fluke.

The discovery, says British scientist David Peel, coauthor of one of the reports, is "staggering." Worldwide temperature shifts of a few degrees over half a century—the kind envisioned in theories of global warming—would disrupt weather patterns, change sea levels and be difficult for animal and plant life to adjust to. The changes Peel measured, though, are roughly three times as severe and rapid.

One ominous sign: normal temperatures during the last interglacial epoch were about 4°F warmer than they are this time around, and levels of carbon dioxide in the atmosphere were significantly higher. As humans pump more and more CO_2 into the air and temperatures rise, the planet will approach the state it was in back then. And if those conditions tend to be inherently unstable—an idea scientists consider plausible—people may someday look back on the early 1990s as an idyllic time when the weather was benign.

—By Michael D. Lemonick. Reported by Barry Hillenbrand/London