

**The Great Flood of 1993
Post Flood Report
Upper Mississippi River Basin
Rock Island District
Appendix B**

I. Introduction

A. Authority

This report on the floods which occurred in the Rock Island District in the Upper Mississippi River basin from March through August of 1993 has been prepared in accordance with ER 500-1-1p and the Rock Island District Natural Disaster Procedures. Specific authority for preparing this report was provided by HQUSACE letter to Division Engineer, North Central Division, dated August 18, 1993, subject, "Post Flood Report-1993 Mississippi River Basin".

B. Purpose and Scope

The objective of the Post Flood Report is to present an accurate picture of the Great Flood of 1993 in the Rock Island District. Included in the report is a description of the:

- 1) flood potential which existed in the CENCR portion of the Upper Mississippi River basin during March 1 through August 31, 1993;
- 2) flooding which occurred;
- 3) nature of the NCR emergency activities undertaken;
- 4) resources utilized (man-years and dollars);
- 5) findings, conclusion and recommendations; and,
- 6) data collected and recorded for future reference in:
 - a) future flood control, water management, engineering and design;
 - b) improving proficiency during potential future flood emergencies.

C. Description of the Upper Mississippi River Basin, Rock Island District

1. Physical Characteristics

The Mississippi River rises in the lake and forest country of north-central Minnesota, near Itasca, Minn., and flows north, east and then south through timbered landscape to Minneapolis-St. Paul. At this point it leaves the northern woodlands and lakes and meanders southward past fertile prairies and many villages and cities. Along the way, tributaries that drain lands to the east and to the west join the Mississippi River and add to its flow. From its headwaters to the confluence with the Ohio River, the Mississippi River is 1,366 miles in length. The boundary between the North Central and Lower Mississippi Valley Divisions is located about nine miles downstream from Hannibal, Mo. The drainage area upstream from this boundary is about 137,500 square miles. The Rock Island District is one of five districts that make up the North Central Division. The Rock Island District covers 78,318 square miles and includes 314 miles of the Mississippi River from Guttenberg, Iowa, downstream to Saverton, Mo. and 268 miles of the Illinois Waterway from Lake Street in downtown Chicago and the Thomas J. O'Brien Lock on the Calumet River to the LaGrange Lock and Dam, southwest of Beardstown, Ill. (see Plate 1).

2. Climate

The climate within the Rock Island District is generally of the continental type, which varies somewhat from the northern to the southern extremities. Southern Minnesota, the southwest corner of Wisconsin, Iowa and northern Illinois have cold, humid winters and hot summers. Missouri and southern Illinois have warm, temperate, climates with hot summers and comparatively mild winters.

a. Precipitation

The annual precipitation generally increases from about 28 inches in the northwest reaches of the basin to about 36 inches to Hannibal, Mo. The eastern side of the Rock Island District generally receives more precipitation than the western side. The basin as a whole has an annual average precipitation of approximately 32 inches, or about 1,700 acre-feet of water per square mile.

b. Temperature

The average monthly temperatures for the Upper Mississippi River basin within the Rock Island District for the months of January, April and July are shown in Plate 2. It indicates the temperatures typical of winter, spring and summer, respectively. The temperature variation with latitude is greater in the winter than in the summer. The January temperature range is more than 10 degrees F. i.e., from less than 20 degrees F. in the north to over 30 degrees F. in the south, whereas the range for July is somewhat less than 10 degrees F, i.e., about 70 degrees F. in the north to 80 degrees F. in the south.

3. Hydrology

Nearly all surface water runoff in the Upper Mississippi River basin is supplied by precipitation falling within its boundaries, with only minor amounts contributed through municipal and industrial withdrawals of water and diversion from Lake Michigan (3,200 cfs) and from subsurface aquifers whose sources are outside the basin. The average annual precipitation over the basin is 31.7 inches. Of this amount, an estimated 24.2 inches return to the atmosphere by means of evaporation and transpiration. The remaining 7.5 inches pass out of the basin as surface water runoff via the Mississippi River.

Runoff is subject to seasonal variations of temperature and precipitation. The months of highest runoff are generally March through June, roughly paralleling the monthly precipitation pattern. The average monthly flows then generally taper off, except for a widespread increase in late summer or early fall, reaching minimum values during the winter months. The March and April flows in the northern half of the basin are augmented by the melting of snow which has accumulated during the winter months. Monthly flows in the southern portion of the basin are relatively high during the winter months compared to the northern parts because annual precipitation is more evenly distributed and temperatures are more moderate.

The annual runoff as a percentage of the annual precipitation varies greatly over the basin. The headwaters of the Minnesota River yield less than 5 percent of the normal annual precipitation to runoff; northern Wisconsin and the southern tip of the basin yield up to 40 percent to runoff. The basin-wide ratio of average runoff to average precipitation is about 24 percent.

4. Economic Development

Economic development within the Rock Island District boundaries is diverse and dynamic. Basic industries such as agriculture and heavy equipment coexist with defense, technology, service and entertainment industries. Well-developed air, rail, waterway and highway transportation systems serve a five-state area of farmsteads, small towns and medium-size population centers.

5. Water Resources Development

As one of five districts that make up the North Central Division, the Rock Island District is responsible for administering federal water resource development programs in large portions of Iowa and Illinois and smaller portions of Wisconsin, Missouri and Minnesota.

The District operates and maintains 12 locks and dams on its portion of the mainstem Mississippi River and 8 locks and dams on the Illinois Waterway. It constructed and operates three flood control reservoirs in Iowa: Coralville Lake on the Iowa River, and Red Rock and Saylorville lakes on the Des Moines River.

The Coralville Lake project is located on the Iowa River upstream from Iowa City in Johnson County and is a part of the general comprehensive plan for flood control and other purposes in the Upper Mississippi River region. Construction began on this project in July 1949, and it was completed and put into operation in October 1958. The dam controls runoff from 3,115 square miles and provides protection to downstream reaches including the operation for the Mississippi River flood stages. The normal conservation pool at the dam is 683.0 feet National Geodetic

Vertical Datum (NGVD) with 42,200 acre-feet of storage. The flood control storage pool (elevation 712.0 feet) provides an additional 419,000 acre-feet of storage. The cumulative damages prevented since the project has been in operation (1959 through September 1993) are estimated at \$49.2 million.

The Red Rock Dam and the Lake Red Rock Project on the Des Moines River are chiefly in Marion County, but extend into Jasper, Warren and Polk Counties. The dam is approximately 60 miles downstream from the City of Des Moines.

The drainage area above the dam site is 12,323 square miles. A permanent lake of 265,500 acre feet storage area is formed behind the dam. With the flood control pool full (elevation 780.0 feet), the reservoir storage is 1,484,900 acre feet above the conservation pool of 742 feet NGVD. The net cumulative damage prevented since the project has been in operation (1969 through September 1993) is estimated at \$390.4 million. Flood protection is provided to 36,000 acres of agricultural lands in the Des Moines River basin and to the Cities and Towns of Ottumwa, Eldon, Eddyville, Keosauqua and Farmington.

In 1958, Congress authorized construction of Saylorville Lake on the Des Moines River about 11 miles upstream from the City of Des Moines. The principal purpose of the Saylorville Project is to furnish needed additional storage to supplement the flood control capacity of the downstream Red Rock Dam and Lake Red Rock and to provide flood protection to the City of Des Moines. The permanent conservation pool forms a lake with storage of about 90,000 acre-feet and extends some 17 miles upstream from the dam.

The reservoir has a total capacity of 676,000 acre-feet at full flood control pool elevation 890 feet and covers about 16,700 acres. The conservation pool was raised from 833 to 836 feet in 1983 to provide a water supply for the City of Des Moines and the Iowa Southern Utilities near Ottumwa, Iowa. The Saylorville Project has been in operation since April 1977. Estimated damages prevented (from 1977 to 1993) are \$156.3 million.

Along the Mississippi River, downstream from the mouth of the Des Moines River, levee districts and the cities of Quincy, Ill. and Canton, LaGrange, and Hannibal in Mo. also benefit from the combined operation of these three reservoirs.

Examples of other local flood control protection projects built by the Rock Island District include Waterloo, Evansdale, Des Moines, Clinton, Dubuque, Marengo, Marshalltown and Bettendorf, Iowa; Rockford, Fulton, East Moline, Rock Island, Milan, Ill., and Hannibal, Mo.

II. Synopsis of the Flood

The Great Flood of 1993 affected a large portion of the midwestern United States, crossing the boundaries of several Corps of Engineers districts, including: St. Paul (CENCS), Rock Island (CENCR), Omaha (CEMRO), Kansas City (CEMRK), and St. Louis (CELMS). Each of these districts experienced some degree of flooding during the spring and summer of 1993. In no single district, however, was the geographic extent of flooding as large as Rock Island District. Virtually every major stream exceeded flood stage at least once in the six months from March through August, and numerous historic river stages, flows and rainfall events were recorded.