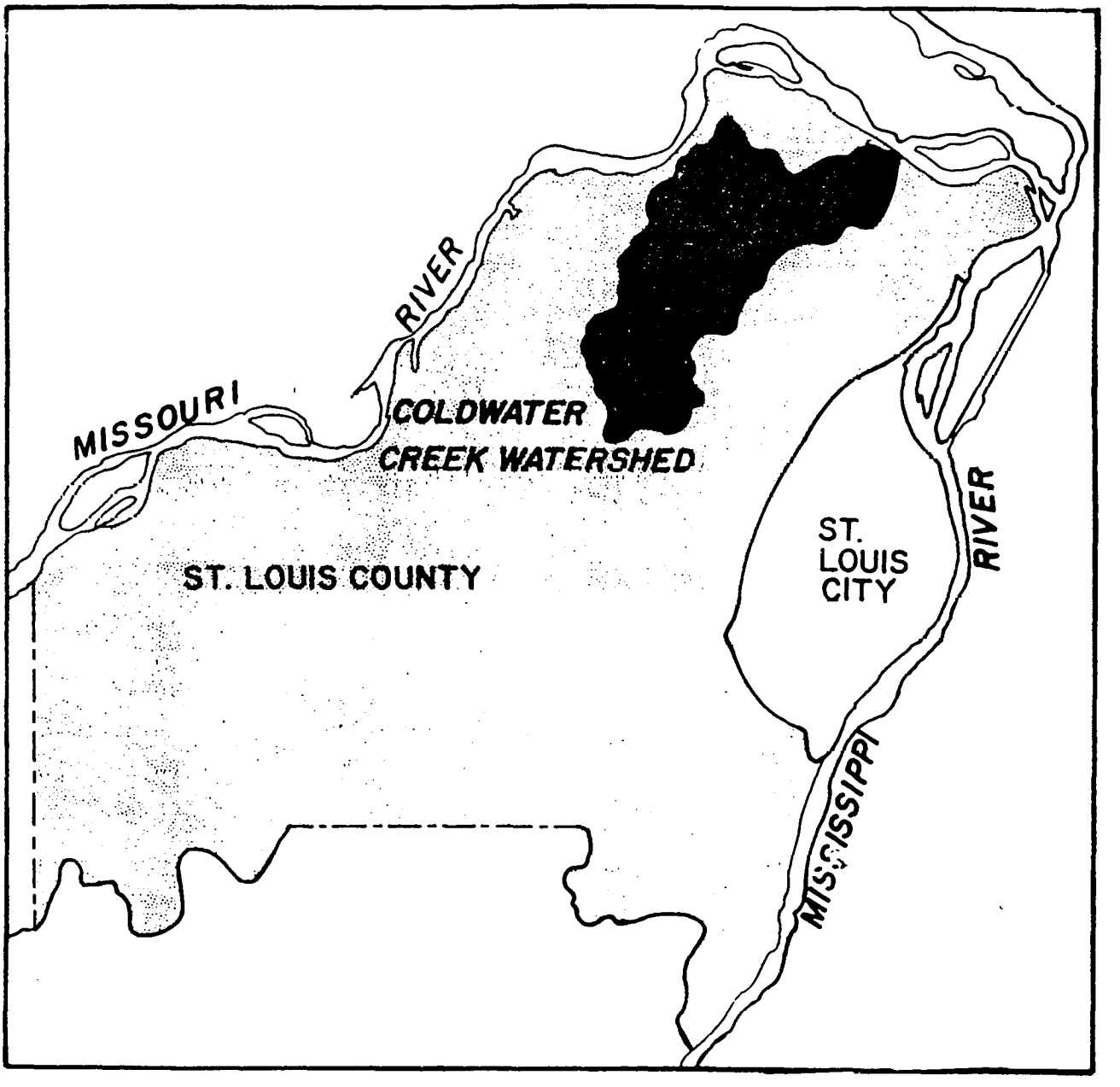
COLDWATER CREEK, MISSOURI

FEASIBILITY REPORT AND ENVIRONMENTAL IMPACT STATEMENT



US Army Corps of Engineers
St. Louis District
Lower Mississippi Valley Division
Leaders in Customer Care

MAY 1987

DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
210 TUCKER BLVD., NORTH
ST. LOUIS, MISSOURI 63101-1986

REPLY TO
ATTENTION OF

COLDWATER CREEK, MISSOURI
FEASIBILITY REPORT AND
ENVIRONMENTAL IMPACT STATEMENT

May 1987

U.S. Army Corps of Engineers
St. Louis District
Lower Mississippi Valley Division

FEASIBILITY REPORT AND ENVIRONMENTAL IMPACT STATEMENT

COLDWATER CREEK, MISSOURI

Proposed Plan for Flood Control and Related Purposes
for Coldwater Creek in St. Louis County, Missouri

The responsible lead agency is the U.S. Army Corps of Engineers, St. Louis District.

Abstract: The purpose of this study is to determine the feasibility of urban flood damage reduction and related improvements in the Coldwater Creek watershed in St. Louis County, Missouri. A full range of structural and nonstructural flood damage reduction measures were considered in the initial phase of the study. Related recreation and environmental measures were also developed. The most effective measures were then combined into three plans. The plans include identical urban flood control projects in the upper two thirds of the stream, but differ in the way they address induced damages in the downstream area. Plan 2 essentially eliminates the induced damages, and is the National Economic Development (NED) plan and the recommended plan. It includes 10 miles of channel widening, enlarging the opening through a downstream railroad embankment, two small levees, a flood forecasting and warning system, and recreation features along the channel widening project. The total first cost of Plan 2 at October 1986 price levels is $20,265,000. The annual benefits for the plan are $2,883,847, and the annual costs are $1,847,547. Plan 2 has net annual benefits of $1,036,300 and a B/C ratio of 1.56. The Metropolitan St. Louis Sewer District has provided a letter of intent to be the non-Federal sponsor for the project.

SEND COMMENTS TO THE
DISTRICT ENGINEER,
ATTENTION LMSPD-U,
BY

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FEASIBILITY REPORT AND ENVIRONMENTAL IMPACT STATEMENT

SECTION 1 - SUMMARY

This section discusses the major factors which influenced the decisions documented in this report.

1.1 MAJOR CONCLUSIONS AND FINDINGS

A wide variety of structural and nonstructural urban flood damage reduction measures were examined in the initial phase of the Coldwater Creek study. Related recreation and environmental measures were also examined. The most effective measures were then combined into three plans. Plan 2 was found to have the greatest net tangible benefits and was selected as the National Economic Development (NED) plan. It is also the recommended plan for the following reasons; (1) it provides substantial urban flood protection along the main channel of Coldwater Creek in the highly developed middle and upper areas of the creek; (2) it results in essentially no induced flood damages, and (3) it is the most acceptable plan to the local sponsor, local elected officials, and downstream property owners.

Plan 2 includes; (1) widening of 10 miles of the main channel of Coldwater Creek, with grass covered banks, trees at the outer edge of the right-of-way in some locations, riprap on the banks in some locations, one short segment with concrete sides, and concrete channel linings under six bridges, (2) enlarging the opening through a downstream railroad embankment with five 8-foot diameter tunnels, (3) two small levees that provide additional flood protection for five buildings in the historic Old St. Ferdinand's Shrine area in Florissant, and for the basements of seven homes on Foxtree Drive in Hazelwood, (4) a flood forecasting and warning system, and (5) two picnic areas and a hiking and biking trail on one side of most of the widened channel.

The major positive environmental impacts of Plan 2 are reduction of flood damages to over two thousand structures, reduced flooding of the historic Old St. Ferdinand's Shrine, reduced streambank erosion along widened channels, and increased recreational opportunities. The most significant negative environmental impacts of Plan 2 occur in the stream segments where the channel will be widened. These include destruction of riparian vegetation, and adverse effects on the aquatic communities. It should be noted that without a project the aquatic communities in Coldwater Creek are poor in quality and are expected to remain in a degraded condition.

1.2 AREAS OF CONTROVERSY

Radioactive materials are located at two storage sites adjacent to Coldwater Creek downstream from Lambert Airport. Characterization studies done by the U.S. Department of Energy (DOE) in 1986 found radioactive materials in the sediments in the Coldwater Creek channel. This contamination is located in about a 1.5 mile segment of the main channel immediately downstream from Lambert Airport. The DOE is currently undertaking studies to define the downstream end of contamination. The DOE

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has also developed a remedial action plan for the two radioactive material storage sites, the contamination in the creek, and other contamination in the vicinity of the sites.

There are two direct interfaces between the DOE remedial action plan and the Corps project. These are the DOE cleanup of radioactive materials in and adjacent to the creek in a channel segment that will be widened by the Corps, and the DOE cleanup of radioactive materials in areas where the Corps will dispose of material excavated from the channel. The Department of Energy is scheduled to complete their remedial action in these interface areas before Corps construction is initiated. The Corps of Engineers will continue to coordinate with the Department of Energy during design and construction of the Corps project, and will adjust its design and construction schedule as necessary to accomodate the DOE project. The Corps will not proceed with construction in the radioactive contamination area until the DOE completes its remedial action work and verifies that the Corps can construct the flood control project without creating a radiological hazzard.

1.3 UNRESOLVED ISSUES

The only unresolved issue at this time is the impact that radioactive materials will have on the proposed Corps of Engineers flood control and recreation project. This issue is expected to be resolved by the remedial action program of the Department of Energy prior to construction of the Corps project, by Corps coordination with the Department of Energy and other appropriate agencies before and during construction of the project, and by Corps monitoring for residual radioactive contamination during construction of the Corps project.

SECTION 2 - STUDY INFORMATION

2.1 STUDY AUTHORITY

The Coldwater Creek study was authorized by the United States Congress as part of the St. Louis Metropolitan Area, Missouri and Illinois study. Study authorities that apply to Coldwater Creek include United States Senate Public Works Committee Resolutions dated October 4, 1966, July 15, 1970, and October 2, 1972, and United States House of Representatives Public Works Committee Resolutions dated July 29, 1971 and October 12, 1972. Copies of these resolutions are presented in APPENDIX A.

The Coldwater Creek study was initiated in October 1980, when specific Congressional funding for the study was received. It is one of several interim responses to the resolutions listed above.

2.2 STUDY PURPOSE AND SCOPE

The broad water resources objectives in the Congressional resolutions listed above were addressed by the St. Louis Metropolitan Area, Missouri and Illinois Summary Report and Background Information Report, which were published in September 1977.

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The purpose of the Coldwater Creek study is to determine the feasibility of urban flood damage reduction and related improvements in the Coldwater Creek watershed in St. Louis County, Missouri. The primary focus of the study is urban flooding problems. It also addresses streambank erosion problems, outdoor recreation opportunities, and environmental quality concerns, as they relate to flood damage reduction improvements. Flooding is generally defined as surface water flooding from the main channel of Coldwater Creek and from its major tributaries. The study area is shown on PLATE 1.

2.3 PLANNING PROCESS

The planning process used in the Coldwater Creek study included the following steps: identification of the problems and opportunities; development of relevant information through inventories, forecasts, and analyses; formulation of alternative plans; evaluation of the effects of the plans; comparison of the alternative plans; and selection of a recommended plan. The study involved several iterations of these steps in order to improve basic information or to refine alternative plans. Public participation was an essential part of the planning process and was used in each step of the study.

2.4 FEDERAL OBJECTIVE

The Coldwater Creek study was guided by the following Federal objective described in the Water Resources Council's Economic and Environmental Principals and Guidelines for Water and Related Land Resources Implementation Studies.

> The Federal objective of water and related land resources project planning is to contribute to national economic development consistent with protecting the Nation's environment, pursuant to national environmental statutes, applicable executive orders and other Federal planning requirements.

2.5 PRIOR STUDIES AND REPORTS

Prior Corps of Engineers studies and reports that pertain to the Coldwater Creek study are listed below.

a. Special Flood Hazard Information Study, Fountain Creek, Florissant, Missouri, January 1974.

b. Unpublished draft report entitled Flood Control and Floodplain Management in Ten Sub-Areas, completed in 1975 as part of the St. Louis Metropolitan Area, Missouri and Illinois study.

c. Summary Report and Background Information Appendix, St. Louis Metropolitan Area, Missouri and Illinois study, September 1977.

d. Reconnaissance Report, Coldwater Creek, Missouri, January 1982.

e. Aquatic Biological Inventory, Coldwater Creek, St. Louis, Missouri, September 1982, prepared by the U.S. Fish and Wildlife Service for the St. Louis District.

Other agencies' studies and reports that pertain to the Coldwater Creek study include, but are not limited to, the following:

a. The Coldwater Creek Drainage Survey, Phase I, Storm-Water Management Program, prepared for the Metropolitan St. Louis Sewer District (MSD) by Havens & Emerson, Inc. and Harland Bartholomew and Associates, Inc. dated January 1981.

b. Various plans of the Metropolitan St. Louis Sewer District for concrete channel projects and storm sewers on tributaries of Coldwater Creek.

c. Flood Insurance Studies for St. Louis County (unincorporated areas), Black Jack, Florissant, Hazelwood, St. Ann, Breckenridge Hills, and Overland.

d. The 201 Sanitary Sewerage Facilities Plan for the Coldwater Creek watershed prepared for MSD by Zurheide-Hermann, Inc., published in May 1981.

e. The 208 Coldwater Creek Watershed Toxic Agent Study accomplished by the East-West Gateway Coordinating Council and published in January 1983.

f. The St. Louis County Linear Parks Plan developed for the St. Louis County Department of Parks and Recreation by John Lark and Associates in 1979.

g. A biological study of the lower part of Coldwater Creek by Steve Orzell, published in April 1975.

h. Reports on radioactive materials stored in areas adjacent to Coldwater Creek, published by the U.S. Department of Energy in November 1986, September 1986, July 1985, August 1983 and September 1979, and by the U.S. Nuclear Regulatory Commission in September 1979.

2.6 EXISTING WATER PROJECTS

There are no existing Corps of Engineers flood protection projects in the Coldwater Creek watershed. However, many channel and storm sewer improvements have been constructed in this highly urban area. These projects have been built with funds from local municipalities, St. Louis County, the Metropolitan St. Louis Sewer District, the State of Missouri, and the Federal government. The sources of funding varied for each specific improvement. The more important channel improvements are shown on PLATE 1.

2.7 THIS REPORT

This Coldwater Creek feasibility report was prepared by the St. Louis District, Corps of Engineers. The final Environmental Impact Statement is integrated into this planning report. All the statutory requirements on information to be included in Environmental Impact Statements have been

met. The required information can be located by referring to the table of contents and to the index in TABLE 23. This report will be filed with the Environmental Protection Agency as required.

The Coldwater Creek feasibility report must be reviewed and approved by the Corps' Lower Mississippi Valley Division, the Board of Engineers for Rivers and Harbors, the Office of the Chief of Engineers, and the Office of the Secretary of the Army. Elected officials, local interests, state and Federal agencies, the Governor of Missouri, and the Office of Management and Budget are asked to comment on the report during this review process. The report may then be provided to the Congress for its consideration regarding what actions, if any, should be taken by the Federal Government. If Congress and the President should decide to authorize a Corps of Engineers project, funds must then be included in the Federal budget to provide for preconstruction engineering and design, the preparation of plans and specifications, and ultimately, construction of the authorized plan of improvements.

In addition to the information presented in this report, more specialized study documentation such as computer output and technical engineering, economic, and environmental data is available for inspection at the St. Louis District, Corps of Engineers, Urban Studies Branch, 210 Tucker Boulevard North, St. Louis, Missouri.

SECTION 3 - BASE CONDITIONS/AFFECTED ENVIRONMENT

This section of the report describes existing and future conditions in the study area, problems and opportunities that are related to the Corps of Engineers program, the objectives of the study, and constraints that effect the results of the study.

3.1 EXISTING CONDITIONS IN THE STUDY AREA

This part of the report describes existing base conditions that pertain to flood control and recreation improvements, and existing significant environmental resources that must be considered to comply with Federal law. Significant environmental resources and the affects of various plans on these resources are also described in TABLE 17.

3.1.1 Location and Size. The Coldwater Creek basin lies in the northern part of St. Louis County, Missouri. The 47 square mile watershed has an elongated shape, with a 19.5 mile long main channel and relatively short tributary streams (see PLATE 1). Coldwater Creek generally flows north between Overland and Florissant and then east to the Missouri River. The stream flows through Overland, Breckenridge Hills, and St. Ann, and under Lambert-St. Louis International Airport. It then passes through Hazelwood, Florissant, unincorporated St. Louis County and along the northern edge of Black Jack before joining the Missouri River. The mouth of Coldwater Creek is at mile 6.9 on the Missouri River.

In addition to unincorporated areas of St. Louis County the following municipalities are within the Coldwater Creek watershed: Berkeley, Black Jack, Breckenridge Hills, Bridgeton*, Bridgeton Terrace, Calverton Park,

Edmundson, Ferguson*, Florissant, Hazelwood, Kinloch*, Overland*, St. Ann, St. John*, Sycamore Hills*, and Woodson Terrace. Asterisk (*) indicates that less than 50 percent of the municipality is in the watershed. The municipalities are shown on PLATE 2.

3.1.2 Climate. The St. Louis region's climate is temperate and humid. The mean annual temperature is 56° F, and the average annual amount of precipitation is 33.9 inches. Snowfall accumulation is usually 16 to 17 inches per year. The mid-day relative humidity is between 50 to 60 percent in the summer and about 55 to 65 percent in the winter. Because of the region's geographic location, rapid weather changes are common due to the interaction of continental polar and maritime tropical air masses. Rainstorms usually move from the west to the east as they travel through the area.

3.1.3 Geology and Topography. A shallow, oval-shaped depression called the Florissant Basin is a major feature of the Coldwater Creek watershed. Geologically, the Florissant Basin can be described as lowland area filled with glacial age (Pleistocene) lake bottom sediments, deposited under standing water conditions. The stratified sands, silts, and clays can be up to 100 feet deep in places, and are most often covered by a layer of loess which is 5 to 25 feet thick. The basin is approximately 10 miles long on its north-south axis and 3 1/2 miles wide on its east-west axis. It is bounded on the north and west by the steep bluffs of the Missouri River, and on the south and east by rolling uplands which are typical in the eastern and central west parts of St. Louis County.

Just northwest of the mouth of Coldwater Creek is a sinkhole (karst) area overlain by loessial soils. This area exhibits internal drainage directly into the ground water system.

The area which surrounds the mouth of Coldwater Creek and extends west to New Halls Ferry Road formed over extensive solution limestone beds of Mississippian age. These beds are pure, dense, massively bedded grey to light grey limestones that have been altered somewhat by weathering. The degree of weathering is reflected on the landscape by the deep course Coldwater Creek takes through the area. Two layers of loess with a total thickness of 20-50 feet cover this entire area.

Coldwater Creek flows through the entire Florissant Basin, which is nearly level and has slopes of less than 5 percent and elevations ranging from 480 to 620 feet national geodetic vertical datum (NGVD). The high point in the watershed, 720 feet NGVD, is located in the extreme southwest area in Overland and the low point, approximately 400 feet NGVD, is located where Coldwater Creek joins with the Missouri River.

3.1.4 Soils. Most of the Coldwater Creek watershed is covered by materials which were deposited under standing water or lake bottom conditions (lacustrine environment). These lake bed deposits include fine sand, silt, clay and organic sediment up to 100 feet thick that have been covered by a 5 to 25 foot thick layer of loess. The lacustrine soil under the loess has a very high water content and is somewhat compressible. Due to the relatively impermeable nature of the soil within the lacustrine

environment, the internal drainage is poor. These soils also exhibit low strength.

Surficial material in the downstream segment of Coldwater Creek consists of two layers of loessial soils over bedrock. The upper layer is silt-rich and ranges from 0-10 feet thick. The lower layer is a thicker clay-rich loess ranging from 20-50 feet thick. Lower permeability and slope stability values result from the higher clay content of the lower layer of loess. The most serious engineering problem in this area is slope failure, generally through soil creep, which may increase in rate of movement until slides occur. This usually occurs along the contact between the loess units and is accentuated where water saturates the materials.

3.1.5 History (Historic Properties). Archaeological evidence recovered within the Coldwater Creek watershed suggests that the region has been occupied by man for at least 10,000 years, see TABLE 1. Remains of the extinct mammoth (Mammuthus sp.) have also been found at several locations within the watershed. There are thirteen prehistoric Indian sites within the watershed registered with the Missouri State Historic Preservation Office (SHPO).

TABLE 1
CULTURAL OCCUPATIONS WITHIN THE COLDWATER CREEK AREA

American Period	1804	-	Present
Spanish Regime	1764	-	1804
French Period	1673	-	1764
Historic Amerindian	1500	-	ca. 1800
Mississippian	A.D. 900	-	1500
Woodland	1000 B.C.	-	A.D. 900
Archaic	8000 B.C.	-	1000 B.C.
Paleo-Indian	(?) 12000 B.C.	-	8000 B.C.

French and Spanish farmers began to settle the Florissant Valley soon after the founding of St. Louis in 1764. Until the early nineteenth century, Indians were sometimes troublesome to the early settlers. A town was located on the banks of the creek known to the French as Riviere Le Biche, to the Spanish as Rio Fernando, and from the beginning of the nineteenth century as Coldwater Creek. The village eventually became known as Florissant.

After the Louisiana Purchase in 1804, the fertile valley attracted an influx of American and Irish immigrants. The village, at that time known as St. Ferdinand, remained basically agricultural in character with community life centering around the church. In 1820, the old log church was replaced by a new brick structure located between Fountain Creek and Coldwater Creek (Old St. Ferdinand's Shrine). The present forepart and tower were added during the period of 1877-1884. It was here that the venerable Mother Duchesne established an Indian school for girls in 1825 and where Father Peter J. DeSmet was ordained in 1827. The church and adjacent convent and rectory is on the National Register of Historic Places.

Old St. Ferdinand's Shrine

During the decades of 1840 and 1850, there was a great immigration of Germans to the United States and some found their way into the Florissant Valley. The 1900's have been a period of growth and urbanization in the watershed. In 1910, the Aero Club of St. Louis built Kinloch Aviation Field in an area west of Graham Road. In 1928, the Board of Alderman of the City of St. Louis acquired the airfield and renamed it Lambert Field.

Following World War II, the need for housing and the subsequent building boom spread to the watershed. With the proliferation of single family dwellings came the creation of a number of municipalities. The cities of Hazelwood, St. Ann, St. John, Edmundson, and Breckenridge Hills were incorporated during this period.

The growth experienced in the watershed is reflected by the growth of the City of Florissant. In the Spanish census of 1797, there were 40 people in Florissant; the census of 1950 counted 3,737. Along with several annexations, by 1960 the population had increased 921 percent to 38,166 and by 1970 by 73 percent to 65,908.

3.1.6 Population. The total population in the Coldwater Creek watershed in 1980 was approximately 158,000 persons. This represents a decline from the 1970 population of about 177,000 persons. The decline was caused by a reduction in the average number of persons per household.

3.1.7 Employment. An estimated 74,000 persons are employed in the Coldwater Creek watershed. The most important center of economic activity in the watershed is an area that includes the Lambert-St. Louis International Airport, the McDonnell Douglas Corporation facilities, and the Hazelwood industrial complex. This area is the second largest employment center in the St. Louis metropolitan area, and employs more than 60,000

persons. The most significant employer within the area is the McDonnell Douglas Corporation (an aeronautical, astronautical, and electronics manufacturer) with about 25,000 employees. Other significant employers within this industrial-commercial-transportation complex are the Ford Motor Company (3,100 employees) and Lambert-St. Louis International Airport (5,100 employees).

More than 90 percent of the almost 2,200 businesses in the Coldwater Creek watershed can be classified as commercial. Two large regional shopping centers, Jamestown Mall and Northwest Plaza, represent a concentration of about 100 commercial employers, with over 1,500 employees at each center.

3.1.8 Existing Land Use. Only a few farms remain at the north end of the Coldwater Creek watershed. These farms and scattered vacant parcels are the only remaining undeveloped land in this rapidly urbanizing area. The existing land use is shown on PLATE 3.

Some strip commercial development exists along major arterials, especially along Lindbergh Boulevard (U.S. Highway 67), where such development extends for several miles, and along St. Charles Rock Road and Woodson Road. In more recent years, much of the area's commercial growth has been concentrated in shopping centers. Northwest Plaza and Jamestown Mall are located in the southwest and the northeast parts of the watershed, respectively.

Most of the Coldwater Creek watershed north of Interstate Highway 270 (I-270) is developed in typical suburban residential land use patterns. With the exception of the old section of the City of Florissant and a few other small unincorporated communities, the watershed north of I-270 urbanized after World War II. South of I-270, the Coldwater Creek watershed is totally urbanized, and in general, development is older than that found north of I-270.

While most of the land in the southern half of the watershed is used for residential development, the 2,000-acre Lambert-St. Louis International Airport has had a major influence on land use. Major concentrations of industrial and commercial development are found in the vicinity of the airport, including the McDonnell Douglas-Hazelwood industrial area and a hotel complex built to serve air travelers.

3.1.9 Taxes. Property tax is the chief local source of tax revenues for municipal and county governments and the Metropolitan St. Louis Sewer District.

3.1.10 Property Values. Residential development in the area can generally be described as middle class. Industrial and some commercial developments have very high values.

3.1.11 Community Cohesion. Community cohesion in the Coldwater Creek area is typical of large highly-developed urban areas.

3.1.12 Public Facilities/Services. The Metropolitan St. Louis Sewer District is responsible for channel maintenance along Coldwater Creek, and has constructed erosion and flood control improvements when the needed resources are available. Municipal and county police and fire departments provide emergency services during floods.

3.1.13 Radioactive Material Storage Sites. Radioactive materials are located at two storage sites adjacent to Coldwater Creek downstream from Lambert Airport. The St. Louis Airport Storage Site includes 21.7 acres and is bordered on the south by the Norfolk and Western Railroad, on the north and east by McDonnell Boulevard, and on the west by Coldwater Creek. According to U.S. Department of Energy reports dated September 1986, August 1983 and September 1979, the site was purchased by the Federal government in 1946 and used as a storage area for residues generated by the Mallinckrodt Chemical Works during their uranium processing operations from 1946 to 1953. Radium-bearing waste materials were stored at the site from the 1940's to the late 1960's. In 1973 ownership of the property was transferred by quitclaim deed from the Atomic Energy Commission to the City of St. Louis. The 1985 Energy and Water Development Appropriations Act authorizes the U.S. Department of Energy (DOE) to acquire the property from the city for use as a permanent disposal site for the waste already on-site, contaminated soil in the ditches surrounding the site, and the waste from the Hazelwood Interim Storage Site about one mile to the north. However the city has not yet transferred ownership of the site to the Department of Energy.

The Hazelwood Interim Storage Site is located adjacent to Coldwater Creek at 9200 Latty Avenue in the City of Hazelwood. According to a U.S. Department of Energy report dated November 1986 and a U.S. Nuclear Regulatory Commission report dated September 1979, in 1966 uranium ore residues and uranium- and radium-bearing process wastes were purchased and moved from the airport site to the Latty Avenue site by a private mining and milling company. Much of the material was then shipped to Canon City, Colorado. Shipments to Canon City continued until 1973. Analysis of soil samples taken during a Nuclear Regulatory Commission investigation of the Latty Avenue site in 1976 indicated the presence of uranium- and thorium-bearing residues. A 1984 Oak Ridge National Laboratory survey found contamination on the north and south shoulders of Latty Avenue almost all the way from the site to Hazelwood Boulevard. Properties adjacent to the Hazelwood Interim Storage Site were also found to be contaminated

As part of the research and development decontamination program authorized by Congress in the 1984 Energy and Water Appropriations Act, the Department of Energy is conducting remedial action at the Hazelwood Interim Storage Site and at vicinity properties. The remedial action project is divided into two phases. Phase I was conducted in 1984 and 1985 and consisted of radiological characterization and cleanup of the vicinity properties and storage of the contaminated materials in the interim storage pile on the Hazelwood Interim Storage Site. In Phase II the Hazelwood Interim Storage Site is to be decontaminated. Consideration is being given to moving all the contaminated material to the St. Louis Airport Storage Site.

Characterization studies done by the Department of Energy in 1980 found radioactive materials in the sediments in the Coldwater Creek channel. This contamination is located in about a 1.5 mile segment of the main channel immediately downstream from Lambert Airport. The DOE is currently undertaking studies to define the downstream end of contamination.

3.1.14 Air Quality. According to the St. Louis County Health Department, the study area meets all the national standards for air quality except for ozone during summer months caused by organic compound emissions and for an occasional carbon monoxide problem in St. Ann.

3.1.15 Noise. The main sources of noise pollution in the Coldwater Creek watershed are the Lambert-St. Louis International Airport and the interstate highways, I-70, I-170 and I-270, which cross the area.

3.1.16 Recreation. The urban composition of parks in the Coldwater Creek area is well developed and diverse. This section of the report provides information on the existing recreation facilities within the basin in unincorporated St. Louis County and in several local communities.

a. St. Louis County. The St. Louis County Department of Parks and Recreation has three parks within the basin boundary.

(1) Fort Bellefontaine County Park. Fort Bellefontaine County Park (36 acres) is on a landfill on the left bank of Coldwater Creek between River Mile 1.2 and 1.64.

(2) Coldwater Creek County Park. Coldwater Creek County Park (234 acres) lies principally on the right bank of the stream and extends from River Mile 0.0 to River Mile 1.25. The county has formulated no time table for the development of this recently acquired area. The preliminary intention is to develop the park to display and enhance the formidable ecological and natural features in the area. The park includes extensive existing trails and limestone structures that were erected by the Works Progress Administration (WPA) in the 1930's, as well as high quality areas of climax flora.

(3) Veteran Memorial County Park. A small part of Veteran Memorial County Park (246 acres) lies in the Coldwater Creek drainage area. It offers picnicking, playgrounds, tennis courts, ice rink, swimming pool, some trails, community meeting rooms and concert facilities.

b. Local Communities. All of the cities within the basin boundary except Edmundson have park and recreation departments. Commensurate with the size of the cities, population and availability of space, they have developed parks that provide a wide and diverse selection of recreation opportunities for their citizens.

To analyze the potential for recreation features associated with a Corps of Engineer flood control plan, the Corps designated three Recreation Market Areas (RMA) that center on the main channel of Coldwater Creek. RMA 1 extends from New Halls Ferry Road to Lambert Airport, RMA 2 extends from

upstream of the airport to Midland Boulevard, and RMA 3 is along lower Coldwater Creek between Old Halls Ferry Road and New Halls Ferry Road.

(1) Florissant. Florissant has ten parks with a total of 119.3 acres within RMA 1. Recreation facilities include softball fields, football/soccer fields, tennis courts, multi-use courts, playgrounds, and picnic shelters and tables.

(2) Hazelwood. Hazelwood maintains eight parks with a total of 72.3 acres within RMA 1. These include softball fields, football and soccer fields, tennis and racquetball courts, picnic shelters and tables, and 1.8 miles of trails.

(3) Berkeley. Berkeley has two parks with a total of 61.4 acres in RMA 1. The largest is the Berkeley athletic complex on McDonnell Boulevard, which has six softball fields, two football/soccer fields, a picnic shelter with eight tables and a playground.

(4) St. Ann. St. Ann maintains three developed parks with a total of 77.4 acres in RMA 2. The principal developments are St. Ann Park and the St. Ann Golf Course, which are contiguous developments in the floodplain. St. Ann's parks include softball fields, multi-use and tennis courts, and picnic shelters and tables.

(5) Edmundson. Edmundson has one undeveloped 3.4 acre park in RMA 2.

(6) Woodson Terrace. Woodson Terrace has two parks with a total of 16.8 acres in RMA 2. Recreation features include a swimming pool, softball and baseball fields, a football/soccer field, tennis and multi-use courts, and picnic shelters and tables.

(7) Breckenridge Hills. Breckenridge Hills has two parks with a total of 3.3 acres in RMA 2. Facilities include picnic shelters and tables, playgrounds, basketball courts, tennis courts, and a softball field.

(8) Area Between New Halls Ferry and Old Halls Ferry Road. Although parts of Florissant and unincorporated St. Louis County are located in RMA 3, neither has any parks in the area.

3.1.17 Floodplain and Stormwater Management Ordinances. Floodplain zoning ordinances that comply with the Federal Flood Insurance Program requirements are in effect in the unincorporated area of St. Louis County and in the communities located along the main channel of Coldwater Creek, including Overland, Breckenridge Hills, St. Ann, Hazelwood, Berkeley, Florissant and Black Jack. These ordinances restrict or control development that would significantly increase flood levels, and are particularly restrictive in floodway areas that include the stream and a high velocity flood area adjacent to the stream. Development is normally allowed in the floodplain area outside of the designated floodway (in the floodway fringe), but this development must be elevated on fill or by some other method so that it would not be damaged by a 100-year flood (a large flood that has a one percent chance of occurring in any one given year). A description of

available information on floodways and floodplains along the main channel of Coldwater Creek is presented in TABLE 2.

TABLE 2

AVAILABLE FLOODWAY AND FLOODPLAIN MAPS
ALONG THE MAIN CHANNEL OF COLDWATER CREEK

Community	Floodway Map Prepared	Floodplain Map Prepared
Overland	No	Yes
Breckenridge Hills	Yes	Yes
Unincorporated St. Louis County (Upstream of Airport)	No	Yes
St. Ann	No	Yes
Hazelwood	Yes	Yes
Berkeley	No	No
Florissant	Yes	Yes
Black Jack	Yes	Yes
Unincorporated St. Louis County (Downstream of Airport)	Yes	Yes

St. Louis County also has stormwater detention policies that are applied to large new developments in unincorporated areas. These policies require developers to control runoff so that downstream flood problems will not be aggravated by the grading, parking lots, etc. associated with developments. The policies have officially been in effect since 1975.

3.1.18 Stream and Floodplain Characteristics. According to the records of the St. Louis County Court, on 2 June 1927, a drainage district was established (Drainage District No. 2 "A" of St. Louis County) with powers of a corporation for public purposes, as was provided by Article 4, Chapter 28, of the Revised Statutes of Missouri, 1919. The expressed purpose of the district was "the straightening, widening, deepening, or altering of Fountain and Coldwater Creeks and the establishment and organization of a Drainage District in St. Louis County, Missouri." Most of the main channel of Coldwater Creek (except south of St. Charles Rock Road and east of Lewis and Clark Boulevard) was realigned to a more curvilinear shape by the drainage district. The drainage district was annexed by the Metropolitan St. Louis Sewer District in 1956.

Coldwater Creek is enclosed for approximately 6,000 feet under Lambert-St. Louis International Airport. The enclosure consists of a double box culvert with each side measuring 10 ft. by 15 ft. Storm sewers that drain various sections of airport property lead into the double box culvert.

Over the past two decades many segments of tributaries to Coldwater Creek have been concrete lined or placed in storm sewers. For a period of time these projects were funded 50% by the local community and 50% by the Metropolitan St. Louis Sewer District. With the advent of Federal revenue sharing with the States, the State of Missouri began a policy of contributing one third of the cost of these channelization projects, and MSD

and the local community contributed one third each. Due to cutbacks in Federal and State programs, it appears that the State of Missouri contributions to these projects will be very limited in the foreseeable future. Concrete channel segments have been constructed on tributary streams in Overland, St. Ann, Hazelwood and Florissant, and on the main channel of Coldwater Creek in Overland. PLATE 1 shows the existing types of stream channels in the watershed.

In 1981, the Airport Authority completed construction of several flood control measures at Lambert-St. Louis International Airport. A levee was built to protect the field maintenance area, which includes storage yards, maintenance equipment, vehicles, garages and maintenance shops. The levee provides approximately a 15-year level of protection. Several small retention ponds and improved drainage facilities were also built to help protect airport facilities from frequent floods.

There is very little development in the 100-year floodplain of the main channel of Coldwater Creek from its confluence with the Missouri River to the vicinity of New Halls Ferry Road. Between New Halls Ferry Road and Lambert Airport the floodplain includes single family residential areas, apartment complexes, large commercial developments, several industrial buildings and several open space areas. Upstream of Lambert Airport there are some open areas in the floodplain, particularly the St. Ann park and golf course, but the remainder of the floodplain is essentially fully developed with single family residential and commercial development.

3.1.19 Water Supply. Municipal and industrial water for the Coldwater Creek area is supplied by the St. Louis County Water Company. The company's North Plant and Central Plant, which are both on the Missouri River, serve the Coldwater Creek area. The company distributes the water throughout the watershed except in the City of Florissant. Florissant purchases its water from the St. Louis County Water Company, but operates and maintains its own distribution system.

3.1.20 Wastewater Collection and Treatment. Many sewers within the Coldwater Creek sanitary system were constructed to serve isolated areas as the watershed developed. These areas were previously served by small independent sewage treatment plants. When the Metropolitan St. Louis Sewer District constructed the Coldwater Creek interceptor system and treatment plant in 1965, most of these plants were eliminated and the flow to each was diverted to the interceptor sewer for conveyance to the Coldwater Creek sewage treatment plant.

The Coldwater Creek sewage treatment plant is located on the main channel of Coldwater Creek approximately 4.7 miles upstream from the mouth of the stream. The treatment plant provides secondary level wastewater treatment and serves the entire watershed with its population of 158,000 persons and major commercial and industrial centers. The yearly average daily flow to the plant is approximately 26 million gallons daily (MGD) with wet weather springtime daily flows averaging in excess of 35 MGD.

3.1.21 Water Quality. Water quality in Coldwater Creek is generally very poor. Pollutants enter the stream in stormwater runoff from

residential areas, commercial and industrial facilities and from Lambert-St. Louis International Airport.

A September 1979 U. S. Department of Energy (DOE) report on the St. Louis Airport Storage Site for radioactive materials compares water quality studies made in 1976, 1978 and 1979. The report indicates that no detectable increase in the radionuclide content of water in Coldwater Creek can be attributed to runoff from the airport storage site. The DOE Calendar Year 1985 St. Louis Airport Site Annual Site Environmental Report published in September 1986 describes the monitoring results in Coldwater Creek just downstream from the site. The average concentrations of radioactive materials were well below the DOE Derived Concentration Guides for the radionuclides in water. Characterization studies done in 1986 found radioactive materials in the sediments in the Coldwater Creek channel in a 1.5 mile segment immediately downstream from Lambert Airport.

Coldwater Creek receives point wastewater discharges under National Pollution Discharge Elimination System (NPDES) permits from three industrial facilities which discharge non-polluted cooling water, from two small non-industrial sewage treatment facilities and from the large regional Coldwater Creek sewage treatment plant. TABLE 3 lists point discharges into Coldwater Creek.

TABLE 3

EXISTING WASTEWATER FACILITIES AND DISCHARGES
IN THE COLDWATER CREEK WATERSHED

	Plant	Type of Facility or Discharge	Rated Capacity (MGD)	1981 Loading (MGD)
1.	Coldwater Creek	Activated Sludge	20.8	26.1
2.	St. James Estates	Extended Aeration	0.015	0.019
3.	Pallotine Novitiate	Extended Aeration	0.017	No Discharge
4.	Wagner Electric Corp.	Cooling Water	0.0030	0.0028
5.	Ford Motor Car Assembly Plant	Cooling Water	0.17	0.135
6.	McDonnell-Douglas	Cooling Water	1.90	1.90

Coldwater Creek periodically receives raw sewage discharges from bypasses at the treatment plant and at other locations in the sewer system. These occur during wet weather periods when excessive infiltration and inflow enter into the collection system. These bypasses result in a deterioration of the in-stream water quality of Coldwater Creek. Excessively high infiltration and inflow within the collection system also

result in the periodic overloading of the Coldwater Creek treatment plant, which is now operating beyond its rated capacity. This results in a decrease in plant unit performances and operating efficiencies, leading to a poorer effluent water quality and degradation of the water quality within the stream. During the low stream flow periods of the year the discharge from the treatment plant makes up about 80 percent of the flow in the stream below the plant outfall.

A Federal Environmental Protection Agency 208 Toxic Agent Study on Coldwater Creek was completed by the East-West Gateway Coordinating Council in January 1983. A monitoring program included sampling at eight stream locations to determine the relative magnitude of point and nonpoint source loadings of 129 priority toxic pollutants. Based on sampling results the study concluded that Coldwater Creek is relatively free of priority pollutant contamination. Only four priority pollutants were consistently in violation of the EWGCC/MSD water quality criteria: chromium, lead, cyanide, and copper. In addition, one insecticide, endosulfan, was detected to be in excess of short term criteria in one dry weather monthly sample.

The Toxic Agent Study also reported that nonpoint sources contribute excessive pollutant concentration during storm runoff but may not cause measurable toxicity effects due to short retention time in the creek. During storm events, the time of travel from the headwaters of Coldwater Creek to the mouth is about 10 hours. Another finding of the study was that analysis of precipitation samples revealed that heavy metals and certain organic compounds were prevalent in the atmosphere and were being washed out during storm events.

Even though the toxic agent study indicated that Coldwater Creek was relatively free of priority pollutants, other recent studies of the aquatic fauna indicate that the stream is severely polluted (see section on Aquatic Communities). The nature and source of this pollution is not known but could result from short term events such as pollutants carried in storm water (i.e., salt, oil, antifreeze etc). These would not be detected in sampling conducted later in the year, but the aquatic fauna populations would be depressed.

3.1.22 Aquatic Communities. A qualitative survey of the aquatic benthic invertebrate fauna at six sites along Coldwater Creek was performed in March of 1981 for the East-West Gateway Coordinating Council. An extremely low diversity of aquatic organisms was found during the study. The fauna was made up of pollution tolerant sludge worms (Tubificidae) and blood worms (Chironomidae). A one-day, 100-yard, reconnaissance of the stream conducted for the U. S. Department of Energy on 31 August 1978 below the airport revealed the presence of only snails (Physa), midge larvae (Chironomidae) and two fathead minnows. A fishery survey at eight collection sites along the length of Coldwater Creek was conducted in March of 1977, but no fish were captured (Keevin, 1978). Field sampling conducted by the U. S. Fish and Wildlife Service in August 1981 indicated that the stream supported limited populations of such pollution tolerant fish species as fathead minnows, golden shiners and black bullheads. These studies indicate that the poor water quality of Coldwater Creek has limited the species diversity and type of aquatic organisms present in the watershed.

The main channel, upstream of the Lambert-St. Louis Airport, had the largest number of benthos taxa collected (11). This portion also suffered the least from domestic and industrial pollutants. There were several sites on the tributaries of Coldwater Creek that did not have the polluted characteristics of the main channel. The study area does contain several small lakes and ponds which probably support a more diverse benthic invertebrate fauna and do support fish populations.

Data on public use of Coldwater Creek for enjoyment of the fishery or wildlife resources is not available from the Missouri Department of Conservation (MDC), rather it is lumped in a larger classification of zoogeographic region.

3.1.23 Terrestrial Communities. The major habitat types in the project area are described below. Terrestrially related species information can be found in the survey reports of Orzell (1975) and St. Louis County Department of Planning (1975). TABLE 4 and PLATE 4 describe the vegetative cover in the watershed.

TABLE 4

Coldwater Creek Watershed
Vegetative Cover Analysis

Vegetative Cover Category	Sizes in Acres	Percent
Urban/No (Or Very Little) Vegetation	4,650	76.1%
Urban/Some (Or Significant) Vegetation	2,000	
Suburban/New Residential Subdivisions	13,542	
Suburban/Old Residential Subdivisions	2,762	
Agriculture	4,050	13.4%
Open Space/Scrub-Scattered Trees	800	5.7%
Open Space/Only Grasses-Old Fields	919	
Forest (Deciduous)	1,118	3.8%
Forest/Coniferous (Evergreen)	17	
Miscellaneous/Golf Courses	175	0.8%
Miscellaneous/Cemeteries	50	
Wetlands	65	0.2%
Total	30,148	100.0%

SOURCE: April 1975 aerial photographs (1:24,000). Interpretation by St. Louis County Department of Planning.

a. Urban and Suburban Areas. Industrial and commercial urban habitat has very little value to most wildlife species, while the wildlife habitat value of residential or suburban development is extremely variable and is dependent upon the attitude and land use practices of the landowner.

b. Agricultural Areas. This classification includes fields with major crops, such as corn, soybean, alfalfa, and wheat, truck farms and residential plots. Species of plants of a weedy nature often invade these croplands.

c. Open Space. Much of the remaining open non-forested areas in the Coldwater Creek watershed include pastures, vacant properties, abandoned fields and road right-of-ways. There are no undisturbed prairies remaining along the stream corridor. There is a considerable degree of diversity in the vegetation of non-forested areas, simply because these sites all exhibit varying degrees of human disturbance.

d. Forest. The majority of forest vegetation is found in the eastern, less developed portion of the watershed. In the majority of the watershed, it is restricted to a narrow band of riparian (creek-side) forest adjacent to Coldwater Creek and its tributaries. The quality of the riparian forest varies from fair to poor from the headwaters down to New Halls Ferry Road; and from here to the mouth the quality of the forest improves, occurring in wider bands and becoming more diverse. Bottomland forest represents the major portion of the component.

e. Miscellaneous Areas. In miscellaneous vegetation areas (golf courses, cemeteries, etc.) habitats are extremely varied. Species abundance and diversity is a direct reflection of land use and available habitat. For example, sections of a golf course may contain upland and bottomland forests or old fields and the fauna present reflects these habitats.

f. Wetlands. Wetland areas include ponds and lagoons scattered throughout the watershed.

3.1.24 Threatened, Rare and Endangered Species. The U.S. Fish and Wildlife Service commented in their Planning Aid letter of 14 August 1981:

> "It is believed highly unlikely that the project will impact, either adversely or beneficially, any federally listed threatened or endangered species. We thus believe it will be unnecessary to address this further. If, however, circumstances change, such as the discovery of an endangered plant, etc., then this agency would need to be notified immediately. At that point, some alternative course of action pertaining to endangered species would be necessary."

In 1985 the Missouri Department of Conservation was contacted. Their search of available records did not reveal any sensitive species or communities. They suggested that it may be necessary to perform site specific investigations.

3.1.25 Natural Resources. There are no significant natural resources in the watershed.

3.1.26 Aesthetics. The visual appearance of Coldwater Creek changes greatly from the headwaters to the downstream area. Upstream from the

airport the creek flows through residential and commercial areas. Above Baltimore Avenue the stream is concrete lined. Downstream from this point the creek for the most part has an earthen channel. In St. Ann it passes through open space including a golf course and park. In many areas the creek channel has been degraded by refuse and debris. There is usually some vegetation adjacent to the channel with the best stand of trees in St. Ann Park.

After passing under the airport, Coldwater Creek flows through some athletic fields and an industrial area south of I-270. The water often has an oil sheen and the creek continues to be badly littered. Industrial refuse is often in evidence. Creekside vegetation varies from no trees at all to a few stands.

Between I-270 and Lindbergh Blvd. the creek passes through a commercial and residential area and has some open land on one side. The Metropolitan Sewer District removed trees from the creek banks in this area in 1984 to improve channel capacity. The stream segment downstream from Lindbergh Blvd. has residential areas on the left and St. Ferdinand Park on the right. Trees are generally limited to the residential side. This reach has some severe erosion problems.

As Coldwater Creek continues downstream from New Halls Ferry Road the natural qualities begin to improve. Between New and Old Halls Ferry Roads the right descending bank has good stands of trees in many places. Between Old Halls Ferry Road and U.S. 367, the floodplain becomes much less developed and natural forest vegetation is in evidence in most locations. However just downstream from Old Halls Ferry Road, the Coldwater Creek sewage treatment plant discharges into the stream. Below this point the creek has a distinct sewage odor for the rest of its length.

Below U.S. 367 the creek cuts through limestone bluffs as it approaches the Missouri River. This section is characterized by much steeper relief, limestone outcroppings and a rock creek bed in places, and heavily forested slopes. Much of this area is in public ownership and it gives the appearance of being in a rural, Ozark setting. However, the smell of the sewage still pervades this reach.

3.1.27 Prime Farmland. The U.S. Soil Conservation Service has determined that there is no prime, unique or otherwise important farmland in the project area.

3.2 FUTURE CONDITIONS IN THE STUDY AREA WITHOUT CORPS PROJECT

This section of the report describes the future for those base conditions and significant environmental resources that are projected to undergo important changes. For the environmental resources not described in this section future conditions are not significantly different from existing conditions.

3.2.1 Population Projections. The technique used for projecting the future population of the Coldwater Creek study area incorporates Office of Business and Economic Research Services (OBERS) data and historical

population figures as base information. Using 1972 OBERS projections, Volume 3, Water Resources Subarea 0714 (Mississippi-Kaskaskia-St. Louis), ratios of the historic population of the study area to the historic population of the OBERS subarea were averaged. The resultant percentage was applied to OBERS projections for the years 1980 thru 2020.

OBERS population projections were extended to the year 2040 thru the use of a curve fitting computer program employing the least squares technique. Forecast figures for 1990 thru 2040 were then reduced by 4.96% to adjust the figures to 1980 historical data. Resultant population projections for the Coldwater Creek study area are as follows:

*	1960	121,214
*	1970	176,673
*	1980	158,000
	1990	162,000
	2000	168,000
	2010	172,000
	2020	177,000
	2030	184,000
	2040	189,000

* Historical figures

3.2.2 Community/Regional Growth (Future Land Use). According to the guidelines for future development provided in the St. Louis County General Plan, the major change in Coldwater Creek north of I-270 will be the conversion of agricultural land to residential uses. The General Plan indicates that land adjacent to Coldwater Creek should be kept as open space. Presently vacant or mixed-use lots in the area bounded by I-270, I-170, I-70 and Lindbergh Boulevard will most likely experience the expansion of the facilities of existing major industries, such as McDonnell Douglas Corporation. In general, no other major land use changes are anticipated for the Coldwater Creek watershed. Projected land use is shown in PLATE 5.

Future land use in the presently undeveloped parts of the Coldwater Creek floodplain will be governed by floodplain zoning ordinances that severely limit development in the floodway area and control development in the floodway fringe.

3.2.3 Future Effects on Historic Properties. The change from agricultural to residential land use is expected to destroy any archaeological sites that may be present. The historic Old St. Ferdinand's Shrine will continue to sustain flood damages.

3.2.4 Future Conditions of Radioactive Material Storage Sites. The U.S. Department of Energy (DOE) has developed a remedial action plan for the two radioactive material storage sites adjacent to Coldwater Creek, contamination in the creek, and other contamination in the vicinity of the sites. If this plan is implemented, in the future the Hazelwood Interim Storage Site will be decontaminated and returned to unrestricted private use, the St. Louis Airport storage Site will be a safe permanent location

where radioactive material is stored, and Coldwater Creek and other contaminated areas will be decontaminated. Implementation of the plan is dependent on DOE acquisition of the St. Louis Airport Storage Site, other agency review, processing of environmental impact studies, and Federal funding.

3.2.5 Future Recreation.

a. State of Missouri. The State Comprehensive Outdoor Recreation Plan (SCORP) was developed in support of the national outdoor recreation objectives described in Public Law 88-578. The SCORP, which is updated every four years, shows a general outdoor recreation deficiency in future decades for the St. Louis County urban area.

b. St. Louis County. In general support of the Missouri SCORP, in 1979 St. Louis County had John Lark & Associates examine four streams for their linear park potential. Coldwater Creek was one of those studied. The plan identified the opportunity and need for 32 miles of trails. No means of implementation of the plan has been achieved to date. The area presently under study by the Corps of Engineers includes a portion of the St. Louis County plan. The State of Missouri and St. Louis County have expressed the hope that the Corps study may satisfy some of the recreation needs in the north county area.

c. Local Communities.

(1) Berkeley. The community's 1979 Comprehensive Plan addressed the existing and future recreation demands and needs for the city. The plan provides for no new park acres. However, the need for a community recreation building, jogging trail and exercise trail is identified.

"Recreation Spaces - Community Places 1982-2000" (1983) by the St. Louis County Department of Parks and Recreation identifies a need for 3 football/soccer fields, 14.1 miles of hiking trails and 7.6 miles of biking trails in Planning District EB which includes the Berkeley area.

Additions and improvements to Berkeley's recreation fabric are made on a yearly basis. Attempts to improve the recreation components are dependent on budget constraints within the goal identified by the Comprehensive Plan.

(2) Florissant. The community's 1983 Capital Improvement Plan identifies the status of recreation within the city and projects future needs. This plan states that the city should provide a neighborhood park (15 acres) near Jana School, River Mile 8.6, for better distribution of park facilities, and three other 5 acre parks in the city. Besides the additional recreation features in these parks the study stresses the need for establishing hiking and biking trails in the existing and future parks as connectors from park to park. "Recreation Spaces - Community Places" shows a need for 45 miles of hiking trails, 22 miles of biking trails and 2 picnic shelters in Planning District 1B, which includes the Florissant and Hazelwood areas.

The City of Florissant is proceeding to implement the Capital Improvement Plan. The yearly budget provides capital, as available, to improve the recreation mix of the city; however, at present no long term funding is established to complete the adopted plan.

(3) Hazelwood. In 1982, the city adopted a Master Plan for recreation prepared by Booker & Associates of St. Louis. The plan recommends the establishment of a 5 acre mini-park, a 20 acre metropolitan park, and 20 acres of linear parks. One such linear connection under study proposes to connect St. Cyn Park to Aubuchon Park. Hazelwood at present provides money from the annual budget to forward the goals of the Master Plan. "Recreation Spaces - Community Places" lists Hazelwood in the same Planning District, 1B, as Florissant and therefore the same overall deficiencies apply.

(4) St. Ann, Breckenridge Hills, Edmundson and Woodson Terrace. All of these communities are highly developed and no vacant land is available for recreational development. St. Ann, Breckenridge Hills, and Woodson Terrace provide some funds in their budgets to update equipment and facilities. Edmundson has not scheduled development for its park area. The recreation planning guide for St. Louis County assigns this area to zone 2C and notes the following deficiencies: biking trails - 16.1 miles, and nature/hiking trails 32.5 miles.

(5) Area Between New Halls Ferry Road and Old Halls Ferry Road. St. Louis County and the City of Florissant have no parks in this area and have no plans to develop parks. Within the Planning District deficiencies exist for biking trails (20.1 miles) and hiking/nature trails (26.7 miles).

(6) Summary. In general the cities within the study area show a commitment to the development of recreation opportunities for their citizens. Most of the Coldwater Creek basin is a developed part of the metropolitan complex. Therefore, while there are significant needs for additional outdoor recreation development, the availability of open land for new parks is severely limited in the developed cities. Future budgets within local agencies are impossible to predict at present. Without a Corps project in this area, expectations would be that a commitment to recreation may continue. Major increases in the quantities of the recreation opportunities are hopeful but by no means certain.

3.2.6 Planned Concrete Channels. The Metropolitan St. Louis Sewer District has been constructing concrete channels on Coldwater Creek and its tributaries for the past two decades. Additional segments are planned for lower Fountain Creek, upper Paddock Creek and several other tributaries. Construction of these projects is uncertain and is dependent on the availability of funds from MSD, the local community, and perhaps the State of Missouri. Availability of Federal funds through community block grants and revenue sharing is also an important and uncertain factor.

3.2.7 Future Wastewater Collection and Treatment. The Section 201 wastewater facilities plan for the Coldwater Creek area calls for sewer system rehabilitation projects, upgrading and expanding the Coldwater Creek sewage treatment plant at Mile 4.5 on the stream, and construction of a discharge pipe to take the effluent from the plant directly to the Missouri

River. Detailed design for the discharge pipe is currently underway and it is expected to be constructed in the near future.

3.2.8 Future Water Quality. The Missouri Department of Natural Resources has classified Coldwater Creek as a "protected" stream. This means that no new discharges of effluents other than non-contact cooling water will be allowed, and the renewal of permits which allow the discharge of effluents that may be polluted will be discouraged.

The Metropolitan St. Louis Sewer District plans to intercept all point sources of pollution (St. James Estates and Pallotine Novitiate) within two to three years and provide treatment at the Coldwater Creek sewage treatment plant. Since the plant will no longer discharge into Coldwater Creek, water quality will be significantly improved in the lower 4.7 miles of the stream.

In general, non-point sources of pollution are expected to increase in the future as the basin continues to develop.

3.2.9 Future Aquatic Communities. The composition of the aquatic ecosystem is, in a large part, dependent on the water quality. Even though the point sources will be eliminated from Coldwater Creek in two to three years, it is unlikely that the condition of the aquatic community will improve appreciably. Aquatic sampling upstream of the airport where there are no known point sources of pollution indicated a polluted condition. Nonpoint pollution is expected to keep the aquatic ecosystem in a degraded condition.

3.2.10 Future Terrestrial Communities. The land use change from agricultural to residential will also change the wildlife communities associated with each land use type accordingly. Since the wildlife found in a suburban habitat varies, depending on how the yards are planted, it is not possible to predict the quality of the resulting habitat. These changes will generally degrade the value of the wildlife habitat.

The riparian habitat and stream corridor are expected to remain essentially as they are since development is prohibited in the floodway; however, habitat quality may be degraded periodically by clearing and snagging.

3.2.11 Future Aesthetics. The sewage odor problem in Coldwater Creek should be mostly eliminated by the planned discharge pipe that will take the effluent from the Coldwater Creek sewage treatment plant directly to the Missouri River.

3.3 PROBLEMS AND OPPORTUNITIES RELATED TO THE CORPS PROGRAM

3.3.1 Flooding Problems. The flooding problems along Coldwater Creek result from intense rainfall within the drainage basin. Essentially no flooding problem results from the Missouri River backing into the stream. Even a 500-year flood on the Missouri River would only back about 1.6 miles up Coldwater Creek in an area where the floodplain is narrow, wooded and undeveloped.

a. Past Flooding. High water and threatening floods are nearly an annual occurrence along Coldwater Creek. Recent damaging floods occurred on 14 June 1957, 30 April 1970, 14 July 1978, 11 April 1979, 16 September 1980, 21 June 1981, 4 July 1982, 10 July 1982 and 3 October 1986. The highest floods downstream from the airport were the 1957 and 1979 floods. Homeowners in Breckenridge Hills in upper Coldwater Creek indicate that the 1982 floods were the highest they have seen in the past 20 years. The total rainfall at Lambert Airport for the 14 June 1957 storm was 4.74 inches in 14 hours, and for the 10, 11 April 1979 storm was 4.90 inches in 20 hours. The hourly rainfall that contributed most to these floods is shown in TABLE 5.

TABLE 5

HOURLY RAINFALL DATA
LAMBERT-ST. LOUIS INTERNATIONAL AIRPORT

14 June 1957		11 April 1979	
4 - 5 P.M.	0.00 in.	2 - 3 P.M.	0.01 in.
5 - 6 P.M.	1.32 in.	3 - 4 P.M.	0.41 in.
6 - 7 P.M.	1.38 in.	4 - 5 P.M.	1.35 in.
7 - 8 P.M.	0.29 in.	5 - 6 P.M.	0.64 in.
		6 - 7 P.M.	0.18 in.

b. Potential Flooding. During the past forty years the Coldwater Creek watershed has changed from a predominately rural area to a highly urban area with many concrete channels on tributary streams. Flood levels from a given storm will be higher on Coldwater Creek now as a result of this development.

To define the flooding problem on Coldwater Creek, the Corps of Engineers utilized both existing and future (fully developed) land use maps prepared by the St. Louis County Planning Department. Hydrology and hydraulics studies were made and flood profiles were developed for both the existing conditions and the future conditions, assuming no Corps flood control project is implemented. To be conservative, St. Louis County's runoff controls that apply to large developments in unincorporated areas were assumed to be ineffective. Future conditions flood profiles were found to be the same as existing conditions profiles in the highly developed area upstream from Lambert airport, and they were slightly higher than the existing conditions profiles in the area downstream from the airport. Future conditions flood profiles can be found on PLATES 6, 7 and 8, and the areas flooded by the future conditions 10-year flood, 100-year flood, and Standard Project Flood (SPF) are shown on PLATES 9 through 15. The Standard Project Flood is defined as the flood that may be expected from the most severe combination of meteorological and hydrological conditions considered reasonably characteristic of an area, excluding extremely rare combinations.

Potential flood damages were determined by comparing the future conditions 2, 5, 10, 25, 50, 100, 500-year flood and the Standard Project

Flood profiles to the development in the floodplain. Basic information utilized in this effort included mapping developed by the Corps in 1981. The maps consist of photographic coverage of the entire watershed and 2-ft. contours in the floodplain area. All the buildings in the floodplain were inventoried. This inventory includes an identification number on each structure on the maps, the first floor elevation (nearly all structures were instrument surveyed), the type of structure (e.g., one story with basement), the value of the structure, the stream mile location of the building, the street address, and other information. The St. Louis District's Urban Damage II economics computer model was used to compare flood heights with the inventoried structure data.

Potential flood damages were defined for the main channel of Coldwater Creek and for the larger tributaries in the developed part of the watershed. TABLE 6 shows the number of units damaged and the structure and content flood damages for segments of the main channel and the tributaries. The locations of the stream segments are shown on PLATE 1. Potential flood damages at Lambert-St. Louis Airport were considered. Buildings at the north and south ends of the airport were grouped in segments CC-7 and CC-9 respectively. Damages in the airport runway area (CC-8) were not quantified. The main loss is the runway area would result from delays in takeoffs and landings when the runways are flooded. However, even if the flooding was remedied, delays would still occur due to severe weather conditions.

3.3.2 Streambank Erosion Problems. Much of the Coldwater Creek watershed is covered by thick layers of wind-blown loess soils. These soils are highly erodible when disturbed and have contributed to streambank erosion problems along the stream.

The St. Louis District assessed the streambank erosion problems along the main channel of Coldwater Creek, and organized the findings by the stream segments shown on PLATE 1. Erosion is moderate along the main channel upstream of the airport in stream segments CC-9 and CC-10. Bank stabilization may be needed to protect residential and commercial developments in this area since there is very little unoccupied land between the creek and the buildings, fences, parking lots, etc. There are moderate to major erosion problems in segment CC-7 downstream from the airport. Some businesses in this industrial area are in danger of losing substantial portions of land. In segments CC-5 and CC-6 there is minor to moderate erosion. Downstream from New Halls Ferry Road in segments CC-1 through CC-4 the stream is experiencing moderate to severe erosion, however much of this erosion is located in wooded and undeveloped areas.

The Corps of Engineers has an opportunity to reduce streambank erosion problems in stream segments where flood control projects are proposed. For example, channel widening projects could include vegetation on the streambanks and heavy rock at the toe of the slope.

3.3.3 Recreation Needs and Opportunities. Use of flood prone lands for outdoor recreation is generally a compatible and desirable land use.

TABLE 6

COLDWATER CREEK AND TRIBUTARIES
STRUCTURE AND CONTENT FLOOD DAMAGES FOR FUTURE CONDITIONS WITHOUT A CORPS PROJECT
(OCTOBER 1985 PRICE LEVEL)

	Approximate Number of Units Damaged By Flood Event			Structure and Content Damages By Flood Event ($1,000)1/			Structure and Content Average Annual Damages ($1,000)1/
	10 year	100 year	SPF	10 Year	100 Year	SPF	
Main Channel							
CC-1	1	1	1	8	14	16	1
CC-2	0	22	93	0	145	4,024	7
CC-3	0	1	57	0	24	1,871	3
CC-4	4	7	140	27	53	2,743	13
CC-5	20	258	694	46	1,445	11,738	55
CC-6	140	297	667	2,418	10,045	25,497	704
CC-7	203	261	554	1,679	4,332	15,370	594
CC-8 (Airport)	--	--	--	--	--	--	--
CC-9	56	293	428	354	2,509	6,777	157
CC-10	126	215	265	480	1,413	2,797	200
CC-11	13	35	61	22	126	221	10
TOTAL	563	1,390	2,960	5,034	20,106	71,054	1,744
Paddock Creek	0	26	210	0	77	1,218	3
Daniel Boone Creek	1	51	86	1	142	360	3
Fountain Creek	5	36	72	19	153	497	8
Anthony Creek	1	10	21	1	23	128	1

1/ These damage figures were developed by the St. Louis District's Urban Damage II computer model. The Urban Damage II output, which is based on June 1982 real estate appraisals, was updated to October 1985 prices by multiplying the output by 1.35. The thirty five percent increase in real estate values is based on a study of sale prices of properties in the study area in 1982 and 1985.

"Recreation Spaces - Community Places 1982-2000," published by the St. Louis County Department of Planning and Department of Parks and Recreation, details the existing recreation facilities and the projected deficiencies through the year 2000. This information is more complete and detailed than that presented in the Missouri State Comprehensive Outdoor Recreation Plan (SCORP).

Comparison of existing and planned recreation facilities with the projected demand for recreation shows that there are unmet needs for the following facilities: sports fields, picnic tables, picnic shelters, playgrounds, and bicycling and hiking trails. These facilities are adaptable to the types of space provided by flood control plans and are approved to be cost shared through the Corps of Engineers program. They conform to the "stand alone" principle of cost shared features and they are not vendable.

3.3.4 Environmental Problems and Opportunities.

a. Water Quality. There are serious water quality problems along Coldwater Creek. A Corps flood control and recreation project could slightly improve water quality by reducing streambank erosion, and could slightly worsen water quality because of increased temperatures due to less shade in some segments. Opportunities for low flow augmentation do not exist in this particular study area.

b. Aquatic Communities. Aquatic communities are very degraded along Coldwater Creek. The primary factor limiting aquatic life is poor water quality. The opportunities for a Corps flood control and recreation project to improve or worsen this condition are very slight.

c. Terrestrial Communities. Terrestrial communities in the Coldwater Creek area have been adversely impacted over the years by urbanization. A great deal of the remaining wildlife habitat, especially in the more heavily developed areas, is along the frequently flooded streams.

Witter et al (1981) reports that a substantial number of household members in St. Louis participate in nature oriented activities: neighborhood walk (64%), feed birds near home (55%) and watch birds near home (49%). On the other hand 13% reported that they had wildlife-related problems around their residence in the last several years. Ninety-three percent of the respondents in the three-city area (St. Louis, Kansas City and Springfield, MO) described the wildlife around their homes as "enjoyable" rather than "pests". In addition, 28% of the urban Missourians were interested in improving chances to see wildlife around their homes.

Based on the foregoing, there are three opportunities for a Corps flood control and recreation project: (1) preserve remaining non-urbanized land; (2) enhance the existing terrestrial habitat; and (3) create new terrestrial habitat.

d. Radioactive Material Storage Sites. The U.S. Department of Energy has developed a remedial action plan for the two radioactive material storage sites adjacent to Coldwater Creek, radioactive contamination in the

sediments in a segment of Coldwater Creek, and contamination in the vicinity of the two sites. The Department of Energy will complete remedial action work in areas that interface with a Corps of Engineers project before Corps construction is initiated in these areas.

e. Litter and Debris. A Corps flood control and recreation project could increase litter and debris problems by improving public access to the creek, and the project could reduce the problem by allowing increased public surveillance of commercial and industrial activities and through regular maintenance of the project.

f. Cultural Resources. The Old St. Ferdinand's Shrine in Florissant is subject to flooding from both Coldwater Creek and Fountain Creek. The Shrine is on the National Register of Historic Places. Archeological sites along Coldwater Creek are subject to damage from streambank erosion, from general development and from construction projects along the creek. Opportunities exist to protect cultural resources from flooding and streambank erosion, and also to tie these resources to recreation plans so that they will be better understood and appreciated by the public.

g. Aesthetics. Assuming the sewage odor downstream from the sewage treatment plant will be eliminated because of the planned outfall sewer to the Missouri River, the two most prominent aesthetic problems along Coldwater Creek are the litter and debris in the stream and the lack of riparian vegetation in some locations. A Corps flood control and recreation project can have both positive and negative effects on aesthetics. For example channel widening can include landscaping in an area that has no existing trees on the banks, or it can take trees from an area that has existing high quality riparian vegetation.

3.4 PLANNING OBJECTIVES

The planning objectives for the Coldwater Creek study are listed below. Measures and plans examined in the study address one or more of these objectives.

a. Reduce the economic losses and social disruption from headwater flooding along Coldwater Creek.

b. Improve the management of the floodplain along Coldwater Creek.

c. Increase the understanding of residents and businessmen as to the nature and extent of flood problems and the possibilities of individual action to reduce flood losses, such as floodproofing and the purchase of flood insurance.

d. Reduce the adverse impacts of streambank erosion along Coldwater Creek.

e. Increase the quantity and quality of outdoor recreation opportunities in the Coldwater Creek watershed by utilizing project lands and integrating any proposed Corps recreation facilities with local recreation areas.

f. Safeguard and improve the quality of the environment in the Coldwater Creek watershed, including ecological and cultural resources.

3.5 PLANNING CONSTRAINTS

The following constraints effect the planning objectives.

a. Urban development in the upper part of the watershed is a constraint on the objective of reducing flood damages. Certain flood damage reduction measures, such as detention basins, are uneconomical because of urban development.

b. Limitations in the Corps of Engineers program are a constraint on the objective of reducing flood damages. The Coldwater Creek study does not address sanitary sewer backup problems in the existing separate sanitary sewer system, and does not address storm drainage problems above the points on the main channel and tributary streams where the 10-year flood discharge is less than 800 cubic feet per second. On the main channel this point is at mile 19.5.

c. Limitations in the Corps of Engineers program constrain the objective of reducing streambank erosion. In general, the Corps can only implement streambank protection measures in flood control project areas.

d. Limitations in the Corps of Engineers program constrain the outdoor recreation and environmental quality objectives. Recreation facilities and environmental measures can only be implemented by the Corps of Engineers on flood control project lands or mitigation lands.

e. Poor water quality is a constraint on environmental and recreation objectives.

f. Unacceptable levels of radioactive materials in a flood control project area would preclude construction of the project in that area. A U.S. Department of Energy remedial action project would remove this constraint.

SECTION 4 - PLAN FORMULATION

A flood damage reduction plan recommended by the Corps of Engineers must be (1) economically feasible and (2) acceptable to the local sponsor and the affected public. A plan is economically feasible when the annual benefits from the project are greater than the annualized project costs.

The first iteration of the plan formulation effort for Coldwater Creek was a search for economically feasible flood control measures. Measures were developed for the high damage areas of the stream and their economic benefits were compared to project costs. The economically feasible measures were then refined in an effort to get improved results. In the second iteration of the plan formulation effort the most feasible measures were combined into more comprehensive plans. Generally a measure should be economically feasible as a last added increment to a plan. The plan that produces the greatest net economic benefits is called the National Economic Development (NED) plan.

Another objective of the plan formulation effort for Coldwater Creek was to examine a wide variety of flood control measures so that all reasonable concepts would be considered. These include both structural and non-structural measures.

For purposes of plan formulation, the assumptions were made that radioactive materials will be removed from the flood control project area prior to construction of the flood control project, and that the removal of radioactive contamination will not effect the design of the flood control project. It was also assumed that the radioactive contamination problem will be resolved in such a manner that recreation activities could safely be pursued along the flood control project.

Outdoor recreation plan formulation was broadly conceived initially, then focused on flood control measures based on the Corps ability to cost participate on recreation measures proposed for lands obtained primarily for flood control purposes.

4.1 FLOOD DAMAGE REDUCTION AND RELATED MEASURES

The development of urban flood damage reduction measures was based on the physical situation in the watershed, the location and extent of flood damages, the desire to consider all reasonable alternatives, and public involvement.

Several physical factors greatly affected plan formulation. The watershed is long and narrow and the tributaries are relatively small when compared to the main channel. In the developed part of the watershed, most of these tributaries have been converted to concrete channels by state and local interests. As can be seen in TABLE 7, flood damages are low on the tributaries. As a result, the Corps and the Metropolitan St. Louis Sewer District decided that the Corps study should concentrate on the main channel.

The dominant physical feature in the upper part of the Coldwater Creek watershed is Lambert-St. Louis Airport. Coldwater Creek travels under the airport in twin 10 ft. by 15 ft. concrete box culverts. The capacity of these 6,000 ft. long culverts is exceeded by the 5-year flood. Water then begins to pond in low lying areas in the south part of the airport. As flood frequencies increase, the excess water overtops additional taxiways and runways and fills more low lying parts of the airport moving north on the airport property. For extremely rare floods, some water will flow overland through the airport and enter the Coldwater Creek channel north of the airport. However, this water will not effect peak discharges in the main channel downstream from the airport. The approximate peak flows for future without project conditions in the main channel of Coldwater Creek just upstream and just downstream from the airport culvert are shown in TABLE 7. Channelization plans upstream from the airport generally were found to have little or no effect on peak flows downstream from the airport.

TABLE 7

APPROXIMATE PEAK FLOWS IN COLDWATER CREEK
UPSTREAM AND DOWNSTREAM FROM LAMBERT AIRPORT

FUTURE (SAME AS EXISTING) CONDITIONS WITHOUT A CORPS PROJECT

Flood Frequency	Discharge (CFS) At Mile 15.8 Upstream From Airport	Discharge (CFS) At Mile 13.8 Downstream From Airport
2-year	3,800	3,900
5-year	6,200	4,200
10-year	7,800	4,400
25-year	9,600	4,600
50-year	11,000	4,800
100-year	12,300	4,900
500-year	14,500	5,100
Standard Project Flood	17,800	5,600

Many flood damage reduction measures were considered during the first iteration. The measures were screened based on such factors as engineering feasibility, hydraulic effects, level of protection, and economic feasibility. Some measures were screened out relatively quickly. The more promising measures were designed and evaluated in more detail.

Costs and benefits for the most important measures are presented in TABLES 8, 9 and 10. The costs and benefits were developed at October 1984 price levels, and the costs were amortized at the 8 3/8 percent interest rate in effect in fiscal year 1984. The economic benefit categories considered in the first iteration included reduction in flood damages, enhanced value of land, streambank protection, and fill benefits.

4.1.1 Nonstructural Measures. Nonstructural measures examined in the study included demolition of highly floodprone buildings, floodproofing of buildings, and a flood forecasting and warning system.

The concept of demolition or relocation of highly floodprone buildings is attractive because it is a permanent solution to the flooding problem for those buildings, it creates open space, it can help preserve or enhance the natural environment, and it doesn't require expenditures for maintenance. The Corps of Engineers can recommend this type of solution if it is economically feasible.

To test the relocation or demolition concept in the Coldwater Creek area, several groupings of highly floodprone buildings were examined. None of them were found to be economically feasible. The smallest most highly floodprone group examined was designated as Measure D-1. In includes the eight residential structures that are flooded above the first floor by the main channel 2-year flood. The eight homes are in Breckenridge Hills and are scattered along the stream both north and south of St. Charles Rock Road. For these eight single family residential homes, moving the structure was estimated to be more expensive than demolition. In October 1984 prices

TABLE 8
COSTS OF FLOOD DAMAGE REDUCTION AND RELATED MEASURES
October 1984 Price Level $

Measure	Total First Cost	Annual Interest and Amortization 8-3/8% For 100 Years	Annual Operation and Main.	Annual Replacement Cost	Total Annual Cost
(C-1) Standard Project Flood Channel (Mile 1.63 to 13.80)	104,574,700	8,760,000	101,000	3,000	8,864,000
(C-2) 25-Year Channel (Mile 7.83 to 13.80)	37,556,600	3,143,487	40,500	12,909	3,196,896
(C-3) Small Channel (Mile 1.63 to 7.83)	7,921,400	664,000	20,200	1,300	685,500
(C-5) 10-Year Channel (Mile 7.83 to 13.70)	12,580,300	1,054,000	10,000	7,800	1,071,800
(C-8) 15-Year Channel (Mile 7.83 to 13.70)	15,808,700	1,324,300	10,000	7,800	1,342,100
(C-9) Channel Segment 1/ (Mile 5.86 to 7.83)	2,987,500	250,300	7,500	1,100	258,900
(C-10) 5-Year Channel (Mile 7.83 to 13.70)	10,435,400	874,173	10,000	7,800	891,973
(C-20) 5-Year Channel (Mile 15.58 to 15.99, 16.48 to 17.68 and 17.75 to 18.30)	2,683,800	224,822	4,500	1,905	231,227
(C-21) 2-Year Channel (Same Miles as C-20)	2,244,700	188,039	4,500	1,905	194,444
(C-22) 10-Year Channel (Same Miles as C-20)	3,915,000	327,960	4,500	1,905	334,365
(CS-1) Clearing and Snagging (Mile 1.64 to 7.83)	150,800	12,600	10,000	0	22,600
(L-5) Small Levee 2/ (Mile 1.87 to 1.90, Right)	94,000	7,900	500	49	8,449
(L-6) Small Levee 2/ (Mile 10.06 to 10.10, Left)	20,400	1,700	500	49	2,249
(L-7) Small Levee 2/ (Mile 10.35 to 10.45, Right)	18,100	1,562	500	49	2,111
(L-8) Small Lovee 2/ (Mile 11.72 to 11.84, Left)	24,500	2,053	500	49	2,602
(L-14) Small Levee 3/ (Mile 17.20 to 17.24, Left)	69,800	5,673	500	126	6,299
(D-1) Demolition of 8 Homes (Mile 17.23 to 18.06, Scattered)	338,000	28,300	0	0	28,300
(R-1) Recreation Facilities 2/ (Mile 7.83 to 13.80)	600,000	50,262	1,000	323	51,585
(R-2) Recreation Facilities 3/ (Mile 15.58 to 15.99, 16.48 to 17.68 and 17.75 to 18.30)	150,000	12,566	260	26	12,852
(R-3) Recreation Facilities 4/ (Mile 5.86 to 7.83)	135,000	11,309	200	26	11,535

1/ Includes five 8 ft. diameter tunnels through railroad embankment at Mile 1.63.
2/ Associated with Measure C-5.
3/ Associated with Measure C-20.
4/ Associated with Measure C-9.

TABLE 9
ANNUAL ECONOMIC AND RECREATION BENEFITS FROM FLOOD DAMAGE REDUCTION AND RELATED MEASURES
October 1984 Price Level $

	Measure	Reduction in Flood Damages [1]	Enhanced Value of Land [2]	Streambank Protection Resulting From Flood Control Project	Fill [3] Benefits	Recreation Benefits	Total Annual Benefits
(C-1)	Standard Project Flood Channel (Mile 1.63 to 13.80)	1,335,656	Undetermined	336,710	Undetermined	N.A.	1,672,366
(C-2)	25-Year Channel (Mile 7.83 to 13.80)	1,156,929	Undetermined	171,537	Undetermined	N.A.	1,328,466
(C-3)	Small Channel (Mile 1.63 to 7.83)	54,585	Undetermined	171,537	Undetermined	N.A.	226,122
(C-3)	Small Channel [4] (Mile 1.63 to 7.83)	143,583	Undetermined	171,537	Undetermined	N.A.	315,120
(C-5)	10-Year Channel (Mile 7.83 to 13.70)	1,103,007	290,700	162,406	70,700	N.A.	1,629,580
(C-8)	15-Year Channel (Mile 7.83 to 13.70)	1,135,193	290,700 (est)	162,406	83,700	N.A.	1,671,999
(C-9)	Channel Segment [4] (Mile 5.86 to 7.83)	139,429	0	54,504	Undetermined	N.A.	193,933
(C-10)	5-Year Channel (Mile 7.83 to 13.70)	954,307	145,350	162,406	52,700	N.A.	1,314,763
(C-20)	5-Year Channel (Mile 15.58 to 15.99, 16.48 to 17.68, and 17.75 to 18.30)	218,131	Undetermined	59,761	0	N.A.	277,892
(C-21)	2-Year Channel (Same Miles as C-20)	117,368	Undetermined	59,761	0	N.A.	177,129
(C-22)	10-Year Channel (Same Miles as C-20)	248,401	Undetermined	59,761	0	N.A.	308,162
(CS-1)	Clearing and Snagging (Mile 1.64 to 7.83)	19,411	N.A.	N.A.	N.A.	N.A.	19,411
(CS-1)	Clearing and Snagging [4] (Mile 1.64 to 7.83)	69,782	N.A	N.A.	N.A.	N.A.	69,782
(L-5)	Small Levee [4] (Mile 1.87 to 1.90, Right)	3,683	N.A.	N.A.	N.A.	N.A.	3,683
(L-6)	Small Levee [4] (Mile 10.06 to 10.10, Left)	1,349	N.A.	N.A.	N.A.	N.A.	1,349
(L-7)	Small Levee [4] (Mile 10.35 to 10.45, Right)	5,151	N.A.	N.A.	N.A.	N.A.	5,151
(L-7)	Small Levee [5] (Mile 10.35 to 10.45, Right)	4,478	N.A.	N.A.	N.A.	N.A.	4,478
(L-7)	Small Levee [6] (Mile 10.35 to 10.45, Right)	3,094	N.A.	N.A.	N.A.	N.A.	3,094

TABLE 9 (Continued)

	Measure	Reduction 1/ In Flood Damages	Enhanced 2/ Value of Land	Streambank Protection Resulting From Flood Control Project	Fill 3/ Benefits	Recreation Benefits	Total Annual Benefits
(L-8)	Small Levee 4/ (Mile 11.72 to 11.84, Left)	2,731	N.A.	N.A.	N.A.	N.A.	2,731
(L-8)	Small Levee 5/ (Mile 11.72 to 11.84, Left)	2,701	N.A.	N.A.	N.A.	N.A.	2,701
(L-8)	Small Levee 6/ (Mile 11.72 to 11.84, Left)	2,700	N.A.	N.A.	N.A.	N.A.	2,700
(L-14)	Small Levee 7/ (Mile 17.20 to 17.24, Left)	4,684	N.A.	N.A.	N.A.	N.A.	4,684
(D-1)	Demolition of 8 Homes (Mile 17.23 to 18.06; Scattered)	17,003	N.A.	N.A.	N.A.	N.A.	17,003
(R-1)	Recreation Facilities (Mile 7.83 to 13.80)	N.A.	N.A.	N.A.	N.A.	210,808	210,808
(R-2)	Recreation Facilities (Same Miles as C-20)	N.A.	N.A.	N.A.	N.A.	78,933	78,933
(R-3)	Recreation Facilities (Mile 5.86 to 7.83)	N.A.	N.A.	N.A.	N.A.	65,660	65,660

1/ Includes reductions in damages to structures, contents and miscellaneous facilities; reductions in flood insurance administrative costs; affluence factors applied to future cortent values; and reductions in governmental and individual costs resulting from flood emergencies.
2/ Includes enhanced value of undeveloped land due to its being freed from the 100 year flood, and reduction in the potential fill costs to develop land subject to flooding but outside the floodway.
3/ Includes increased value of land in areas where channel excavation material is used for fill.
4/ Benefits are incremental additional benefits gained from adding this measure to Measure C-5.
5/ Benefits are incremental additional benefits gained from adding this measure to Measures C-5 plus CS-1.
6/ Benefits are incremental additional benefits gained from adding this measure to Measures C-5 plus C-9.
7/ Benefits are incremental additional benefits gained from adding this measure to Measure C-20.

TABLE 10
SUMMARY OF EVALUATION
FLOOD DAMAGE REDUCTION AND RELATED MEASURES
October 1984 Price Level $

	Measure	Total Annual Benefits	Total Annual Cost	Net Annual Benefits (+) or Costs (-)	Benefit/Cost Ratio	Level of Protection
(C-1)	Standard Project Flood Channel (Mile 1.63 to 13.80)	1,672,366	8,864,000	-7,191,634	0.19	SPF
(C-2)	25-Year Channel (Mile 7.83 to 13.80)	1,328,466	3,196,896	-1,868,430	0.42	25-Year
(C-3)	Small Channel (Mile 1.63 to 7.83)	226,122	685,500	-459,378	0.33	100-Year
(C-3)	Small Channel 1/ (Mile 1.63 to 7.83)	315,120	685,500	-370,380	0.46	100-Year
(C-5)	10-Year Channel (Mile 7.83 to 13.70)	1,629,580	1,071,800	+557,730	1.52	10-Year
(C-8)	15-Year Channel (Mile 7.83 to 13.70)	1,671,999	1,342,100	+329,899	1.25	15-Year
(C-9)	Channel Segment 1/ 2/ (Mile 5.86 to 7.83)	193,933	258,900	-64,967	0.75	100-Year
(C-10)	5-Year Channel (Mile 7.83 to 13.70)	1,314,763	891,973	+442,790	1.47	5-Year
(C-20)	5-Year Channel (Mile 15.58 to 15.99, 16.48 to 17.68, and 17.75 to 18.30)	277,892	231,227	+46,665	1.20	5-Year
(C-21)	2-Year Channel (Same Miles as C-20)	177,129	194,444	-17,315	0.91	2-Year
(C-22)	10-Year Channel (Same Miles as C-20)	308,162	334,365	-26,203	0.92	10-Year
(CS-1)	Clearing and Snagging (Mile 1.64 to 7.83)	19,411	22,600	-3,189	0.86	50-Year
(CS-1)	Clearing and Snagging 1/ (Mile 1.63 to 7.83)	69,782	22,600	+47,182	3.09	25-Year
(L-5)	Small Levee 1/ (Mile 1.87 to 1.90, Right)	3,683	8,449	-4,766	0.44	5-Year
(L-6)	Small Levee 1/ (Mile 10.06 to 10.10, Left)	1,349	2,249	-900	0.60	100-Year
(L-7)	Small Levee 1/ (Mile 10.35 to 10.45, Right)	5,151	2,111	+3,040	2.44	100-Year 8/
(L-7)	Small Levee 3/ (Mile 10.35 to 10.45, Right)	4,478	2,111	+2,367	2.12	100-Year 8/
(L-7)	Small Levee 4/ (Mile 10.35 to 10.45, Right)	3,094	2,111	+983	1.47	100-Year 8/

TABLE 10 (Continued)

	Measure	Total Annual Benefits	Total Annual Cost	Net Annual Benefits (+) or Costs (-)	Benefit/Cost Ratio	Level of Protection
(L-8)	Small Levee [1] (Mile 11.72 to 11.84, Left)	2,731	2,602	+129	1.05	25-Year [8]
(L-8)	Small Levee [3] (Mile 11.72 to 11.84, Left)	2,701	2,602	+99	1.04	25-Year [8]
(L-8)	Small Levee [4] (Mile 11.72 to 11.84, Left)	2,700	2,602	+98	1.04	25-Year [8]
(L-14)	Small Levee [5] (Mile 17.20 to 17.24, Left)	4,684	6,299	-1,615	0.74	50-Year
(D-1)	Demolition of 8 Homes (Mile 17.23 to 18.06, Scattered)	17,003	28,300	-11,297	0.60	Less Than 2-Year [7]
(R-1)	Recreation Facilities [1] (Mile 7.83 to 13.80)	210,808	51,585	+159,223	4.09	N.A.
(R-2)	Recreation Facilities [5] (Mile 15.58 to 15.99, 16.48 to 17.68, and 17.75 to 18.30)	78,933	12,852	+66,081	6.14	N.A.
(R-3)	Recreation Facilities [6] (Mile 5.86 to 7.83)	65,660	11,535	+54,125	5.69	N.A.

[1] Associated with Measure C-5.
[2] Includes five 8 ft. diameter tunnels through railroad embankment at Mile 1.63.
[3] Associated with Measures C-5 plus CS-1.
[4] Associated with Measures C-5 plus C-9.
[5] Associated with Measure C-20.
[6] Associated with Measure C-9.
[7] Measure (D-1) includes demolition of all homes flooded above the first floor by the 2-year flood. However, a 2-year flood would still damage commercial buildings and the basements of other homes.

[8] Level of protection with 0.5 feet of freeboard. Other levels of protection shown for small levees are based on zero freeboard.

the cost of purchasing the eight properties was estimated to be $322,000 and the cost to demolish them and restore the lots was $16,000, for a total cost of $338,000. As can be seen in TABLE 10, the annual benefits for Measure D-1 were found to be less than the annual cost. No economically feasible relocation or demolition measures were found in the Coldwater Creek area.

The concept of floodproofing buildings was also considered in the Coldwater Creek study, but no floodproofing plans were developed in detail. Example floodproofing alterations include: permanent closures such as closing up basement windows with glass blocks; temporary closures such as putting panels over doorways; applying waterproof material to exterior masonry walls; building floodwalls in the interior of large commercial buildings; modifying the sanitary sewer system, etc. Floodproofing techniques were formulated for many buildings flooded by the 10-year flood. However, a widespread Corps of Engineers floodproofing project was not found to be practical for Coldwater Creek because, (1) topography and the patterns of development result in only very small groups of buildings subject to frequent flooding (say 10-year flood above the first floor), (2) it would be extremely difficult to meet stringent Corps design standards when altering a variety of types of structures, (3) a floodproofing project would probably leave occupied buildings that are inaccessible during a flood, and (4) it would be extremely difficult for a single local sponsor to take full responsibility for operating and maintaining this type of project. Floodproofing measures should more logically be implemented and operated by the individual owners of the buildings.

A flood forecasting and warning system was considered for Coldwater Creek. A relatively simple plan includes the installation of a series of staff gauges in the main channel of the stream, say at Ashby Road in St. Ann, McDonnell Boulevard in Hazelwood, and Lindbergh Boulevard in downtown Florissant. It also includes use of the rainfall station at Lambert Airport and installation of an additional rainfall station in or west of the uppermost portion of the drainage basin. The system includes development of a report that will be used as a basic preparedness plan. This report will include charts that relate rainfall data and staff gauge readings to various flood frequency profiles; maps that describe the areas that would be flooded at several flood frequencies, such as the 10, 25 and 100-year levels; and a system of communication between emergency response officials. By observing rainfall data and the rising flood levels in the stream, and by being aware of projected continuing rainfall, authorities could expect flooding in certain areas and issue warnings to property owners in these areas. In addition, authorities could communicate with other communities along the stream to give or get more advance warning of rising flood levels. Development and implementation of this flood forecasting and warning system would involve materials, technical studies, report preparation, and manpower for coordination and education programs for the communities. The cost for developing and implementing the plan is estimated to be $70,000 in October 1985 prices. The annual cost of $6,539 includes $6,039 for interest and amortization at 8-5/8 percent, and $500 for annual operation and maintenance. Annual benefits were not quantified for the flood forecasting and warning system, but were considered to be equal to or greater than the low annual cost of the system.

4.1.2 Small Levees. In the first iteration small earthen levees were considered for groups of buildings flooded by the 10-year flood. Levees were not considered practical for some groups of buildings because of lack of space between the buildings and the creek, topography that requires high levees to give buildings protection, unstable streambanks, utilities and other physical development along the levee alignment, or encroachment in zoned floodway areas. The levees were designed with five-foot-wide crowns and 3 horizontal to 1 vertical side slopes.

Only a few small levees were found to be economically promising, and these were examined in combination with channel widening measures. The fill material for this group of levees would come from channel excavation. These levees, numbered L-5, L-6, L-7, L-8 and L-14, are described in TABLES 8, 9 and 10 and on PLATE 16.

Levees L-7 and L-8 were found to be economically feasible with certain channels in place. Levee L-7 would provide additional flood protection for five buildings including the historic Old St. Ferdinand's Shrine in Florissant. Levee L-7 was considered, even though it will probably be located in a zoned floodway, because this small levee protects buildings that are on the National Register of Historic Places. Levee L-8 would provide additional protection for the basements of seven homes on Foxtree Drive in Hazelwood. The levees are each a maximum of 5 feet high and are shown on PLATES 30 and 31.

4.1.3 Detention Dams. The purpose of detention dams is to hold back the peak flows from severe rainfall events and to discharge the water more gradually over a relatively long period of time. The reservoir areas behind the dams can either contain small permanent pools of water (for fishing, etc.) with additional area for storing flood water, or they can be dry during normal times (for field sports, etc.) and utilize the entire area for periodic flood water storage.

Detention dams have not been proposed for Coldwater Creek. The watershed area upstream of Lambert Airport is essentially fully developed. The middle section of the watershed is also highly developed. No effective and economical locations for detention dams could be located in either of these areas. The downstream part of the Coldwater Creek watershed has large undeveloped areas. However, in this area tributary streams enter the main channel of Coldwater Creek downstream from the channel segments with high flood damages. In addition, during a typical flood the peak flows from these downstream tributaries currently enter the main channel and move downstream before the peak flow from the main channel arrives. Detention dams on the lower tributaries could delay peak flows on the tributaries so that they are more coincidental with the peak flows on the main channel.

4.1.4 Diversion Tunnel and Channel. The study considered the concept of diverting part of the Coldwater Creek flow at Lambert Airport and taking this flow to the Missouri River west of the airport. This diversion would reduce flooding at the airport and for some distance upstream of the

diversion point. The diversion would also result in small reductions in flooding downstream from the airport and have minimal adverse environmental effects on Coldwater Creek.

The Corps of Engineers conducted a brief study of the diversion concept and found that the costs of such a project would be high. Diversion of 10,000 cfs would involve a major tunnel about 12,000 feet long and channel improvements and possibly levees to take the flow across the Missouri River floodplain. Costs for this type of project could range from $25,000,000 to $30,000,000 in October 1984 prices. Flood damage reduction benefits from such a project would not be great enough to offset the high project costs.

4.1.5 Channel Widening. A wide variety of channel improvements was considered for Coldwater Creek. The location and amount of potential flood damages were the main guides in this channel plan formulation effort.

As can be seen in TABLE 6 the highest flood damages in the Coldwater Creek area are along the main channel in Florissant and Hazelwood in channel segments CC-6 and CC-7. There are also high damages along the main channel upstream of the airport in St. Ann and Breckenridge Hills in segments CC-9 and CC-10. Segment CC-5 has moderate flood damages, with the highest concentration of damages located upstream of Paddock Creek. Flood damages are low on the tributary streams and in main channel segments CC-1, CC-2, CC-3, CC-4, CC-8 and CC-11. See PLATE 1 for the location of these segments.

The total flood damages in a given stream segment indicate the type and size of channel improvements that may be economically justified in the area. Because of low flood damages and existing channel projects, channel improvement measures were not formulated for the tributaries of Coldwater Creek, for the airport area, or for the main channel in Overland in the CC-11 segment.

Even in the high damage areas, flood damages along Coldwater Creek are not great enough to economically justify long lengths of high cost improvements such as concrete lined channels or major gabion projects. Lower cost designs were found to be feasible, such as widened grass lined channels with riprap along the toe of the slope. The channel would be widened but not deepened because of sanitary sewer crossings. Channel slopes would be relatively steep so that less right-of-way would be required, and the channel improvements would be sized to minimize relocation of utilities, purchase of buildings, and alterations to bridges. For some typical channel cross-sections see PLATE 17.

a. Channel Widening Downstream from the Airport. The highest damage area downstream from the airport was addressed by several plans that extend from New Halls Ferry Road (Mile 7.83) to McDonnell Boulevard (Mile 13.70). Several sizes of channel widening measures were analyzed and these are described in TABLES 8, 9 and 10 and on PLATE 18. Measure C-1 is a very large channel designated to handle the standard project flood (SPF). Measure C-2 lowers the 25-year flood so that it is essentially non-damaging. Measure C-5 has the same effect on the 10-year flood. Measure C-8 has 3 horizontal to 1 vertical channel side slopes and provides about a 15-year level of protection. The side slopes for the other channel

measures are 2 horizontal to 1 vertical. Measure C-10 provides about a 5-year level of protection. The right-of-way needed for the channel projects would be purchased in fee title and would include ten feet on each side of the channel for maintenance access.

Measure C-5 produces the greatest net economic benefits. This channel has grass covered banks with riprap at the toe of the slope to control erosion. It includes a 960-foot long segment downstream from Paddock Creek that has vertical concrete walls halfway up the sides of the channel and grass covered slopes above the walls. See PLATE 17. There are also concrete walls under the St. Denis Avenue bridge and riprap just downstream from the bridge at the confluence of Coldwater Creek and Fountain Creek. The measure includes placement of a geotextile ground stabilizing fabric on the channel slopes for 100 feet up and downstream from the concrete channel segment at Paddock Creek, at the confluence of Coldwater and Fountain Creeks, and where the channel bottom width changes at the Norfolk and Western Railroad spur upstream of Interstate 270. With Measure C-5 in place, a 10-year flood would be essentially non-damaging through the length of the measure. Higher floods, such as the 25 through 500 year floods, would be lower because of Measure C-5 but would still result in flood damages. Measure C-5 is described in detail on PLATES 28 through 32.

Hydraulics and economics studies found that Measure C-5 would substantially reduce flood heights and flood damages in the high damage areas in Florissant and Hazelwood upstream from New Halls Ferry Road. The area downstream from New Halls Ferry Road has developed rather recently and nearly all of the buildings in this area are at or above the existing conditions 100-year flood level. Measure C-5 would raise the future conditions 100-year flood level in this area between 2 and 4 feet, depending on location. Downstream from New Halls Ferry Road the number of units damaged by the 100-year flood would be increased from about 30 under future conditions without a project, to about 150 with Measure C-5 in place.

Measure C-9 is designed to essentially eliminate flood damages in lower Coldwater Creek that would be induced by Measure C-5. Measure C-9 includes enlarging the opening through the Burlington Northern Railroad embankment at Mile 1.63 with five 8-foot diameter tunnels. These tunnels alleviate increased flooding upstream from the embankment that would result from higher discharges from Measure C-5. Measure C-9 also includes a channel widening segment from Old Halls Ferry Road (Mile 5.86) to New Halls Ferry Road (Mile 7.83) to reduce increased flooding in this area. The project has grass side slopes with riprap at the toe of the slopes, and it includes concrete channel linings under the Lindbergh Boulevard and New Halls Ferry Road bridges. Downstream from New Halls Ferry Road the number of units flooded by the 100-year flood is about 30 under future conditions without a project, about 150 under future conditions with Measure C-5, and about 30 under future conditions with Measure C-5 and C-9 in place. Measure C-9 is shown in detail on PLATES 24, 27 and 28.

In addition to Measure C-9, other concepts were also considered to reduce the induced flood damages resulting from Measure C-5. Small levees were considered but generally were infeasible. Because of sloping backyards, levees would have to be relatively high to provide any protection

for homes in this downstream area. Clearing and snagging was also considered and is described in section 4.1.5 of this report.

b. Channel Widening Upstream from the Airport. Channel plan formulation upstream from the airport initially focused on several small channel widening segments. Measure C-20 is a combination of those segments that were economically feasible. It begins at the airport (Mile 15.58) and extends through St. Ann and Breckenridge Hills to Breckenridge Avenue (Mile 18.30). No improvements are included in the upper part of St. Ann Park and in the St. Ann Golf Course (Mile 15.99 to 16.48), or at the St. Charles Rock Road culvert (Mile 17.68 to 17.75). Measure C-20 includes concrete channel linings under Wright, Geraldine and Isolda Avenues. Measure C-21 is a smaller project located in the same stream segments as C-20. Measure C-22 is a larger channel and would cost substantially more because bridges would have to be replaced at Wright, Geraldine, and Isolda Avenues. Measure C-20 was found to have greater net benefits than C-21 or C-22. See TABLES 8, 9 and 10 and PLATE 18 for more information on the costs, benefits and locations of these measures. Measure C-20 is shown in detail on PLATES 33, 34 and 35.

4.1.6 Clearing and Snagging. Clearing and snagging involves removing debris from the stream channel and clearing brush and trees from the bottom and sides of the channel. No clearing would take place beyond the point where the channel sides meet normal ground level. Clearing and snagging improves the hydraulic efficiency of the channel. Costs for the measure also include costs for periodic maintenance. Measure CS-1 is clearing and snagging between the Burlington Northern Railroad crossing (Mile 1.63) and New Halls Ferry Road (Mile 7.83). It would partially offset the increase in flood heights caused by Measure C-5. Downstream from New Halls Ferry Road the number of units flooded by the 100-year flood is about 30 under future conditions without a project, about 150 under future conditions with Measure C-5, and about 110 under future conditions with Measure C-5 and CS-1 in place. The costs and benefits for Measure CS-1 are shown in TABLES 8, 9 and 10. The limits of CS-1 are shown on PLATE 18.

4.1.7 Recreation Measures. Three recreation measures, R-1, R-2 and R-3 were developed in association with channel widening measures C-5, C-20, and C-9 respectively. Measure R-1 consists of a 5.97 mile long seven-foot-wide crushed stone hiking and biking trail in the right-of-way along one side of channel C-5, a 4 foot high chain link fence between the trail and residential areas, seven fords where the trail crosses tributary streams, and two picnic areas. One picnic area is located at River Mile 10.2 on a small peninsula of project land at the confluence of Fountain Creek with Coldwater Creek in Florissant. Picnic facilities include a picnic shelter and six picnic tables. The other picnic area is located at River Mile 11.8, southeast of Foxtree Drive adjoining St. Cin Park in Hazelwood. The picnic area is on project land, an uneconomic remnant of a parcel being purchased for parts of levee L-8 and channel C-5. This parcel is owned by the Metropolitan St. Louis Sewer District and the picnic area will be permanently dedicated to recreation use. Picnic facilities include a picnic shelter and ten picnic tables. The trail provides linkage between the Berkeley athletic complex; St. Cin Park in Hazelwood; and Duchesne Park, Old St. Ferdinand's Shrine, and St. Ferdinand Park in Florissant. Measure R-2

initially included a recreation trail along one side of all the channel segments in Measure C-20. Recreation trails in St. Ann Park and upstream of St. Charles Rock Road were subsequently deleted from Measure R-2 at the request of the local communities. The final Measure R-2 consists of 1.20 miles of trail along one side of channel C-20. It also includes one ford and a fence separating the trail from residential property, but it does not include any picnic sites. Measure R-3 is a 1.97 mile long trail along one side of channel C-9. It includes fencing at the rear of residential lots and does not include any picnic sites. Recreation Measures R-1, R-2 (final) and R-3 are shown on PLATE 19 and in greater detail on PLATES 24 through 35. Their initial costs and benefits are shown in TABLES 8, 9 and 10.

4.1.8 Environmental Measures. Under the Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (U.S. Water Resources Council, 1983), the planning approach of having coequal economic and environmental objectives was replaced by the Federal objective "... to contribute to national economic development consistent with protecting the Nation's environment pursuant to national environmental statutes, applicable executive orders, and other Federal planning requirements." This change in policy occurred since the Coldwater Creek Reconnaissance Report was prepared. Environmental measures must now (1) be associated with measures that contribute to economic development, or (2) offset adverse environmental effects of the plan. The following environmental measures were considered for Coldwater Creek.

a. Widening Channel On One Side. Widening the channel on one side preserves the natural stream bank as well as the riparian (creek-side) vegetation on one side of the stream. The natural stream bank will preserve part of the aquatic habitat. The riparian vegetation will continue to provide habitat for a variety of wildlife, especially birds and small mammals. Widening the channel on one side may also be more cost effective than conventional channelization if less right-of-way needs to be purchased and only one side needs to be maintained (mowed).

Any decision to widen the channel on one side has been deferred until the detailed design phase of the Coldwater Creek project. This concept is most feasible in stream segments that have open space on one or both sides of the channel. There are a number of factors that limit its feasibility along Coldwater Creek. One is the presence of a sanitary sewer main adjacent to the left descending bank. Another is the presence of structures near the creek. Existing streambank erosion would also effect the design of such a channel. The reaches listed below have a potential for widening on one side (see PLATE 20).

Measure	Creek Mile	Length (Miles)
C-5	9.1 - 9.9	0.8
	10.8 - 11.6	0.8
	13.2 - 13.7	0.5
C-20	15.7 - 15.99	0.29
C-9	5.86 - 7.83	1.97
	Total	4.36 Miles

b. Wildlife Plantings. A variety of trees would be planted in appropriate stream segments in the right-of-way of Measures C-5, C-9 and

C-20. These trees would be in the outer two feet of the right-of-way, and would provide visual as well as wildlife benefits.

As currently designed, channel widening measures include grass covered side slopes. Consideration will be given to using other vegetation that may require less maintenance and provide better cover for wildlife.

Channel Measures C-5 and C-9 include the purchase of temporary easements away from the stream for the placement of excavated material. These fill areas would be seeded to prevent erosion. Portions of the fill areas could be planted in species of vegetation preferred by resident wildlife. For fill areas expected to be developed in the future, these plantings would provide temporary wildlife benefits.

c. Aquatic Habitat (Grade Control) Structures. These in-stream structures that produce pools and aquatic sanctuaries are not presently included in any channel widening measure. They will not be proposed unless further technical studies show they are needed to stop the stream bottom from degrading or for mitigation.

d. Fish Ponds. Off-channel pools created to increase the number and types of aquatic life were not included in any plan because detention sites were not feasible and because there were no other opportunities to create ponds as part of flood control works.

e. Land Acquisition. The Corps of Engineers cannot now share in the cost of land acquisition, including greenbelts and protection of cultural resources, unless the land is being acquired as part of a flood damage reduction project or for mitigation.

f. Fish and Wildlife Management. The management of lands, vegetation and aquatic habitat to the benefit of fish and wildlife would be accomplished on project lands if it doesn't interfere with other project purposes.

g. Litter/Debris Clean-Up and Control. Litter and debris will be cleaned up during project construction. There will also be some clean-up during normal maintenance activities.

h. Cultural Resource Measures. Prior to the placement of excavated material, all potential containment areas shall be assessed by professional archaeologists to ensure that significant archaeological remains are not inadvertently buried during these earthmoving activities. Should significant remains be identified as a result of these inspections, coordination with both the Missouri State Historic Preservation Officer and the Advisory Council on Historic Preservation shall be initiated.

4.2 FLOOD DAMAGE REDUCTION AND RELATED PLANS

Flood damage reduction and recreation measures were developed during a first iteration of the planning effort and are described in Section 4.1 of this report. Flood damage reduction and recreation plans were developed in a second iteration by combining several measures as appropriate. TABLE 11

shows the measures that are included in the three plans developed for Coldwater Creek.

TABLE 11

MEASURES INCLUDED IN PLANS 1, 2 AND 3

Plan 1	Plan 2	Plan 3
CS-1 Clearing & Snagging	-	-
-	C-9 Channel & Tunnels	-
C-5 Channel	C-5 Channel	C-5 Channel
C-20 Channel	C-20 Channel	C-20 Channel
L-7 Small Levee	L-7 Small Levee	L-7 Small Levee
L-8 Small Levee	L-8 Small Levee	L-8 Small Levee
R-1 Recreation	R-1 Recreation	R-1 Recreation
R-2 Recreation	R-2 Recreation	R-2 Recreation
-	R-3 Recreation	-
Flood Forecasting and Warning System	Flood Forecasting and Warning System	Flood Forecasting and Warning System

For the flood damage reduction plans, refinements were made in the design of some measures and in cost and benefit analyses. Because of these refinements the costs and benefits of the plans are not directly comparable to the costs and benefits of their component measures.

Measure C-5 was refined by incorporating an improved transition at its downstream end, a replacement foot-bridge at St. Cin Park, and Missouri State Highway Department plans to remove the Dunn Road bridge over Coldwater Creek and build a bridge at Taylor Avenue. These design changes resulted in slight changes in the cost estimate for Measure C-5 and in the with-project hydraulics and flood damage reduction benefits. Measure C-20 was refined by adding replacement footbridges at St. Ann Park, Elsa Avenue and Rex Avenue. The costs and benefits of Measure R-2 were modified because recreation trails in St. Ann Park and south of St. Charles Rock Road were deleted at the request of the local communities. For Plan 2 the benefits for Measures L-7 and L-8 were modified to account for 0.5 feet of freeboard.

Certain environmental costs were added to Measures C-5, C-9 and C-20. A cost was added to Measure C-5 to monitor for radioactive contamination during construction of parts of the channel segment. Costs were added to Measures C-5, C-9 and C-20 for planting a variety of trees in the outer two feet of the right-of-way in appropriate channel segments.

Other refinements in the analyses of Plans 1, 2 and 3 include (1) slight refinements in unit costs used in the cost estimates, (2) updating of the costs and benefits from October 1984 to October 1985 price levels, (3) use of 8-5/8 percent in determining annual interest and amortization costs, and (4) changes in the benefits analysis. The No Corps Action Plan and Plans 1, 2 and 3 are described in the sections that follow.

4.2.1 No Corps Action Plan. The No Corps Action Plan is based on no Corps of Engineers project along Coldwater Creek. This plan is the same as the future without a project condition.

Flooding problems will continue along Coldwater Creek, with the potential for flooding worsening slightly in the area downstream from the airport as urban development continues. Frequent flooding will occur in the lowest lying areas that have experienced flooding in the past. On relatively rare occasions, disastrous floods like the 25, 50, or 100-year floods will occur. These floods will result in widespread damage and possible personal injury and loss of life.

It is projected that local interests will not construct major flood protection projects along the main channel of Coldwater Creek, but streambank protection projects will be built (and in some cases rebuilt) in locations where sanitary sewers and other physical improvements are threatened by streambank erosion. Outdoor recreation needs are projected to remain largely unsatisfied.

4.2.2 Plan 1. Plan 1 is a combination of Measures CS-1, C-5, L-7, L-8, C-20, R-1, R-2 and a Flood Forecasting and Warning System. As can be seen in TABLE 10, in the first planning iteration these measures were found to have the highest net economics benefits. Plan 1 is shown on PLATE 21.

4.2.3 Plan 2. Plan 2 is a combination of Measures C-9, C-5, L-7, L-8, C-20, R-1, R-2, R-3 and a Flood Forecasting and Warning System. Measure C-9 was included in Plan 2 so that the plan would result in essentially no induced flood damage. Measure C-9 was not economically justified in the first planning iteration, but was found to be justified in the more detailed economic analysis in the second iteration. In the second planning iteration, Plan 2 was found to have the highest net economic benefits. Plan 2 is shown on PLATE 22 and on PLATES 24 through 35.

4.2.4 Plan 3. Plan 3 is a combination of Measures C-5, L-7, L-8, C-20, R-1, R-2 and a Flood Forecasting and Warning System. Plan 3 is the same as Plan 1 except Plan 3 does not include clearing and snagging in the downstream part of Coldwater Creek (CS-1). Although CS-1 is economically justified, it is not included in Plan 3 because of adverse environmental effects and concerns about streambank erosion and visual effects. Plan 3 is shown on PLATE 23.

4.2.5 Economic Costs and Benefits of Plans. TABLE 12 presents a line item breakdown of the costs of Plans 1, 2 and 3, and the costs of the component measures of each plan. These costs have been refined somewhat from the figures presented in TABLE 8, and they have been updated to October 1985 price levels. The cost to develop a Flood Forecasting and Warning

System is included in each plan. TABLE 13 presents non-Federal and Federal cost sharing by project purpose for each plan. TABLE 14 shows the annual costs of Plans 1, 2 and 3.

The benefits of Plans 1, 2 and 3 are based on more detailed benefits analysis than that used in the first iteration for the various flood damage reduction and related measures. Several parts of this benefits analysis were developed by the St. Louis District subsequent to the first planning iteration.

In the second iteration reductions in flood damages to structures and contents from Plans 1, 2 and 3 were quantified by the St. Louis District's Urban Damages II computer model. The output from the model was updated to October 1985 price levels. The Urban Damage II analysis differs from that presented for the first iteration measures. In the first iteration the computer program determined benefits to individual structural units and to the contents of the units. The program then added 15 percent to account for the following miscellaneous benefits: reduction in damages to yards, fences, shrubs, and automobiles; reductions in flood insurance administrative costs; affluence factors applied to future content values; and reductions in governmental and individual costs resulting from flood emergencies. In the second iteration the 15 percent was <u>not</u> added to the structure and content benefits computed by the Urban Damage II model because these miscellaneous benefits were examined individually.

TABLE 15 presents the results of the second iteration analysis of the benefits of Plans 1, 2 and 3. These include the Urban Damage II structure and content benefits, reductions in vehicle damages, reductions in damages to residential and commercial infrastructure, reductions in police assistance, reductions in damages to parks and to bridges, reductions in stream bank erosion, reductions in Flood Insurance Administration overhead, affluence factors, land enhancement, benefits from project fill materials, reduced fill requirements due to lowering the 100-year flood, aesthetics benefits, and recreation benefits. No benefits were developed for the Flood Forecasting and Warning System that is part of each plan.

In the second iteration the channel and levee components of the plans were examined incrementally. Channel Measures C-9, C-5 and C-20 were found to have higher net benefits under the more detailed benefits analysis than they showed in the first planning iteration. Measure C-9 was not economically justified in the first iteration but was justified under the more detailed economic analysis.

TABLE 12

COSTS OF PLANS 1, 2, and 3
October 1985 Price Level ($1,000)

COST ACCOUNT NUMBER	Structural Flood Control Measures						Nonstructural Flood Control Measures	Recreation Measures			
	CS-1	C-5	C-9	C-20	L-7	L-8	FLOOD FORECASTING SYSTEM	R-1	R-2	R-3	TOTAL
PLAN 1											
01 Lands and Damages		2,896.0		405.0	5.0	10.0					3,316.0
02 Relocations		92.0		406.0							498.0
09 Channels and Canals	125.0	8,162.0		1,503.0							9,790.0
11 Levees and Floodwalls					12.0	12.0					24.0
14 Recreation								475.0	64.0		539.0
20 Perm Operating Equip							35.0				35.0
30 Engineering and Design	14.0	1,000.0		216.0	1.7	1.7	20.0	57.0	8.0		1,318.4
31 Supervision and Admin	11.0	750.0		170.0	1.3	1.3	15.0	38.0	5.0		991.6
TOTAL	150.0	12,900.0	-	2,700.0	20.0	25.0	70.0	570.0	77.0	-	16,512.0
PLAN 2											
01 Lands and Damages		2,896.0	624.0	405.0	5.0	10.0					3,940.0
02 Relocations		92.0	82.0	406.0							580.0
09 Channels and Canals		8,162.0	1,893.0	1,503.0							11,558.0
11 Levees and Floodwalls					12.0	12.0					24.0
14 Recreation								475.0	64.0	110.0	649.0
20 Perm Operating Equip							35.0				35.0
30 Engineering and Design		1,000.0	232.0	216.0	1.7	1.7	20.0	57.0	8.0	15.0	1,551.4
31 Supervision and Admin		750.0	169.0	170.0	1.3	1.3	15.0	38.0	5.0	10.0	1,159.6
TOTAL	-	12,900.0	3,000.0	2,700.0	20.0	25.0	70.0	570.0	77.0	135.0	19,497.0
PLAN 3											
01 Lands and Damages		2,896.0		405.0	5.0	10.0					3,316.0
02 Relocations		92.0		406.0							498.0
09 Channels and Canals		8,162.0		1,503.0							9,665.0
11 Levees and Floodwalls					12.0	12.0					24.0
14 Recreation								475.0	64.0		539.0
20 Perm Operating Equip							35.0				35.0
30 Engineering and Design		1,000.0		216.0	1.7	1.7	20.0	57.0	8.0		1,304.4
31 Supervision and Admin		750.0		170.0	1.3	1.3	15.0	38.0	5.0		980.6
TOTAL	-	12,900.0	-	2,700.0	20.0	25.0	70.0	570.0	77.0	-	16,362.0

TABLE 13

NON-FEDERAL AND FEDERAL COST SHARING FOR PLANS 1, 2 AND 3
October 1985 Price Levels ($1,000)

	PLAN 1	PLAN 2	PLAN 3
1. NON-FEDERAL COSTS			
a. Structural Flood Control			
01 Lands and Damages	$3,316.0	$3,940.0	$3,316.0
02 Relocations	498.0	580.0	498.0
30 Engr & Design for 02 (12% of 02)	60.0	70.0	60.0
31 Supervision & Admin for 02 (9% of 02)	45.0	52.0	45.0
Subtotal	3,919.0	4,642.0	3,919.0
Cash Payment (5% of Non-Fed plus Fed Str Flood Control not incl $145.0 Radiological Monitoring)	783.0	925.0	775.0
Total Structural Flood Control	4,702.0	5,567.0	4,694.0
b. Nonstructural Flood Control			
20 Permanent Operating Equipment (25%)	9.0	9.0	9.0
30 Engr & Design for 20 (25%)	5.0	5.0	5.0
31 Supervision & Admin for 20 (25%)	4.0	4.0	4.0
Total Nonstructural Flood Control	18.0	18.0	18.0
c. Total Flood Control	4,720.0	5,585.0	4,712.0
d. Recreation			
14 Recreation Facilities (50%)	269.5	324.5	269.5
30 Engr & Design for 14 (50%)	32.5	40.0	32.5
31 Supervision & Admin for 14 (50%)	21.5	26.5	21.5
Total recreation	323.5	391.0	323.5
e. Total Flood Control plus Recreation	5,043.5	5,976.0	5,035.5
2. FEDERAL COSTS			
a. Structural Flood Control			
09 Channels and Canals	9,790.0	11,558.0	9,665.0
11 Levees and Floodwalls	24.0	24.0	24.0
30 Engr & Design	1,173.4	1,381.4	1,159.4
31 Supervision & Admin	888.6	1,039.6	877.6
Subtotal	11,876.0	14,003.0	11,726.0
Less Non-Federal Cash Payment	(783.0)	(925.0)	(775.0)
Total Structural Flood Control	11,093.0	13,078.0	10,951.0
b. Nonstructural Flood Control			
20 Permanent Operating Equipment (75%)	26.0	26.0	26.0
30 Engr & Design for 20 (75%)	15.0	15.0	15.0
31 Supervision & Admin for 20 (75%)	11.0	11.0	11.0
Total Nonstructural Flood Control	52.0	52.0	52.0
c. Total Flood Control	11,145.0	13,130.0	11,003.0
d. Recreation			
14 Recreation Facilities (50%)	269.5	324.5	269.5
30 Engr & Design for 14 (50%)	32.5	40.0	32.5
31 Supervision & Admin for 14 (50%)	21.5	26.5	21.5
Total Recreation	323.5	391.0	323.5
e. Total Flood Control plus Recreation	11,468.5	13,521.0	11,326.5
3. NON-FEDERAL PLUS FEDERAL COSTS			
a. Structural Flood Control	15,795.0	18,645.0	15,645.0
b. Nonstructural Flood Control	70.0	70.0	70.0
c. Total Flood Control	15,865.0	18,715.0	15,715.0
d. Recreation	647.0	782.0	647.0
e. Total Flood Control Plus Recreation	$16,512.0	$19,497.0	$16,362.5

TABLE 14
ANNUAL COSTS OF PLANS 1, 2 AND 3
October 1985 Price Level $

	Plan 1	Plan 2	Plan 3
Annual Interest and Amortization, 8 5/8%, 100 years	$1,424,490	$1,682,006	$1,411,550
Annual Operation and Maintenance	39,300	40,000	29,300
Annual Replacement Cost	10,196	10,930	10,196
Total Annual Cost	$1,473,986	$1,732,936	$1,451,046

TABLE 15
ANNUAL ECONOMIC AND RECREATION BENEFITS 1/
PLANS 1, 2 AND 3

October 1985 Price Level, 8 5/8%, 100 Years

BENEFIT CATEGORY	PLAN 1	PLAN 2	PLAN 3
Structure and Content	$1,477,061	$1,549,365 2/	$1,426,038
Vehicles	96,734	112,135	71,767
Residential Infrastructure	69,920	78,696 2/	61,205
Commercial Infrastructure	50,233	69,145 2/	45,412
Police Assistance	4,276	4,168	4,168
Parks	868	868	868
Bridges	174,904	192,897	165,440
Erosion	222,165	276,672	222,165
FIA Overhead	43,090	54,560	38,874
Affluence	118,112	123,254 2/	114,953
Land Enhancement	36,419	36,419	36,419
Fill	51,950	51,950	51,950
Reduced Fill	2,916	2,916	2,916
Aesthetics	24,501	24,501	24,501
Recreation	254,657	322,917	254,657
Total	$2,627,806	$2,900,463	$2,521,333

1/ Benefits were not developed for the Flood Forecasting and Warning System associated with Plans 1, 2 and 3.

2/ Benefits account for 0.5 feet of freeboard in Levees L-7 and L-8, and for the use of Fountain Creek profiles for Levee L-7.

TABLE 16 compares the annual benefits and annual costs for Plans 1, 2 and 3. The net annual benefits and the benefit to cost ratio are presented for each plan.

TABLE 16
COMPARISON OF BENEFITS 1/ AND COSTS
PLANS 1, 2 AND 3
October 1985 Price Level

	Total Annual Benefits	Total Annual Cost	Net Annual Benefits (+) or Costs (-)	Benefit/ Cost Ratio	Level of Protection
Plan 1	$2,627,806	$1,473,986	+$1,153,820	1.78	10-Year
Plan 2	$2,900,463	$1,732,936	+$1,167,527	1.67	10-Year
Plan 3	$2,521,333	$1,451,046	+$1,070,287	1.74	10-Year

1/ The benefits in this table do not include the benefits of a Flood Forecasting and Warning System.

4.2.6 Level of Protection of Plans. With Plan 1, 2 or 3 in place, a future conditions 10-year flood would result in relatively low flood damages. As can be seen in TABLE 6, without a project this flood will cause about $5,034,000 in structure and content damages along the main channel of Coldwater Creek. With Plan 1 in place the future conditions 10-year flood would cause about $389,000 in structure and content damages, a 92 percent reduction. With Plan 2 or Plan 3 in place, this flood would cause about $365,000 or $438,000 in damages, which would be 93 and 91 percent reductions, respectively. Based on these results, Plans 1, 2, and 3 are each considered to provide a 10-year level of protection overall. However, it should be noted that in Breckenridge Hills the plans provide only about a 5-year level of protection.

Levee Measures L-7 and L-8 are associated with Plans 1, 2 and 3. With 0.5 feet of freeboard, Levee L-7 provides 100-year and Levee L-8 provides 25-year protection for the buildings behind the levees.

Channel widening in Plans 1, 2 and 3 would reduce flood heights and damages for all flood frequencies. The low levees would provide additional protection. Without a project, the average annual structure and content damages from flooding on the main channel of Coldwater Creek are $1,744,000 (see TABLE 6). Plans 1, 2 and 3 would reduce these average annual damages to about $267,000, $201,000 and $318,000, which are 85, 88 and 82 percent reductions, respectively.

4.2.7 Environmental Effects of Plans. TABLE 17 displays a summary of the base environmental conditions, the future conditions without a project (the No Action alternative), and the environmental impacts of Plans 1, 2 and 3. All the environmental resources required to be examined by Federal law are listed in this table. TABLE 18 shows the relationship of each alternative to environmental requirements. Additional description of those

TABLE 17
COMPARATIVE ENVIRONMENTAL IMPACTS OF ALTERNATIVES

Significant Resources	Base Condition and Alternatives				
	Base Condition	Future Without	Plan 1	Plan 2	Plan 3
*Air Quality	Meets all national standards except ozone in summer & localized carbon monoxide	No significant change	No significant impact	No significant impact	No significant impact
*Noise	Noise concentrated near airport and interstate hyways	No significant change	Minor adverse during construction	Same as Plan 1	Same as Plan 1
*Water Quality	Poor - sewage effluent and non-point pollution	Although the sewage effluent will be removed, nonpoint pollution will continue and water quality will be poor.	Less erosion and sedimentation in channelized areas and more in area cleared & snagged (C & S)	Less erosion and sedimentation in channelized areas	Same as Plan 2
Land Use (Acres)	Available:				
Urban	6,650	6,650	6,719	6,720	6,719
Residential Subdivision	16,304	20,354	20,354	20,354	20,354
Agriculture	4,050	0	0	0	0
Open Land	1,719	1,719	1,769	1,788	1,769
Forest	1,134	1,134	1,062	1,053	1,062
Other	290	290	243	232	243
Totals	30,147	30,147	30,147	30,147	30,147
*Man-Made Resources					
(Structures Flooded Along Main Channel)					
10 yr. Flood	536	563	106	111	125
100 yr. Flood	1,320	1,390	697	510	763
*Natural Resources	No significant resources	No change	No impact	No Impact	No Impact
Aquatic Communities	19.5 miles main channel (4.0 miles undisturbed) poor species diversity	No significant change	Negligible adverse impact to 8.03 miles from channelization and 6.19 miles from C & S (1.64 miles left undisturbed)	Negligible adverse impact to 10.0 miles of stream from channelization (4.0 miles left unaltered)	Negligible adverse impacts to 8.03 miles of stream from channelization (4.0 miles left unaltered)

TABLE 17 (Continued)
COMPARATIVE ENVIRONMENTAL IMPACTS OF ALTERNATIVES

Significant Resources	Base Condition and Alternatives				
	Base Condition	Future Without	Plan 1	Plan 2	Plan 3
Terrestrial Communities (Riparian Habitat)	7.83 miles - good 11.67 miles - fair to poor	Possible adverse impacts from future clearing and snagging	1.64 miles - good 17.86 miles - fair to poor Negligible adverse impact	5.86 miles - good 13.64 miles - fair to poor Negligible adverse impact	7.83 miles - good 11.67 miles - fair to poor Negligible adverse impact
Threatened, Rare and Endangered Species	None present	No change	No impact	No impact	No impact
*Aesthetics	Sewage odor in lower 5 miles Visual Quality: 7.83 miles - good 11.67 miles - fair	Sewage odor removed. Possible deterioration of visual quality due to clearing and snagging	Visual Quality: 1.64 miles - good 17.86 miles - fair	Visual Quality: 5.86 miles - good 13.64 miles - fair	Visual Quality: 7.83 miles - good 11.67 miles - fair
*Community Cohesion	Typical urban cohesion	No Change	No significant impact	No significant impact	No significant impact
*Public Facilities/ Services	Some channel improvements and flood emergency services	Small increase in channel improvements	Increase in main channel improvements and flood emergency services	Similar to Plan 1	Similar to Plan 1
*Employment	High employment area	No significant change	Jobs Created 1/ Year 1 394 Year 2 296 Year 3 296	Jobs Created 1/ Year 1 349 Year 2 232 Year 3 232 Year 4 232	Jobs Created 1/ Year 1 400 Year 2 293 Year 3 293
*Taxes	Property tax is main local source	Increase in property tax	No or slight increase ir property tax. Increase in state and local sales tax revenues. 2/ Year 1 $1,145,434 Year 2 859,076 Year 3 859,076	No or slight increase in property tax. Increase in state and local sales tax revenues. 2/ Year 1 $1,013,484 Year 2 675,656 Year 3 675,656 Year 4 675,656	No or slight increase property tax. Increase in state and local sales tax revenues 2/ Year 1 $1,162,103 Year 2 851,211 Year 3 851,211
*Property Values	Middle class residential and high value industrial and commercial	No change	+$2,457 3/ Some downstream property values may decrease.	+$5,123 3/	+3,656 3/ Some downstream property values may decrease.
*Displacements			None	None	None

TABLE 17 (Continued)
COMPARATIVE ENVIRONMENTAL IMPACTS OF ALTERNATIVES

Significant Resources	Base Condition and Alternatives				
	Base Condition	Future Without	Plan 1	Plan 2	Plan 3
*Community/Regional Growth 1/	Highly developed urban area	More residential and industrial/ commercial development	Minor increase in development Year 1 $20,367,278 Year 2 15,272,459 Year 3 15,272,459	Minor increase in development Year 3 $18,017,493 Year 2 12,011,662 Year 3 12,011,662 Year 4 12,011,662	Minor increase in development Year 3 $20,659,686 Year 2 15,132,644 Year 3 15,132,644
Radioactive Wastes	U.S. Department of Energy is studying 2 sites and a segment of creek channel	DOE plans to remove radioactive materials from the flood control project area	No significant impacts because DOE plans to undertake remedial action	Same as Plan 1	Same as Plan 1
Historic Properties	Old St. Ferdinand's Shrine on the National Register of Historic Places has a 2 yr. level of flood protection.	Old St. Ferdinand's Shrine continues to have a two year level of flood protection. Some archeological sites lost due to development.	Old St. Ferdinand's Shrine has a 100 yr. level of flood protection. Channel widening and placement of excavated material may impact presently unknown archaeological sites.	Same as Plan 1	Same as Plan 1
Recreation	353.9 acres of parks in cities along the main stem of the creek. There is a need for more trail development in the basin.	No significant change	Provides 7.17 miles of hiking & biking trail and 2 picnic areas. Plan 1 would add 18.8 acres to existing recreation lands.	Provides 9.14 miles of hiking & biking trail and 2 picnic areas. Plan 2 would add 23.6 acres to existing recreation lands.	Same as Plan 1
Prime, Unique or Otherwise Important Farmland	None present	No change	No Impact	No Impact	No Impact

*Resources identified in Section 122, 1970 River and Harbor Act, P.L. 91-611.

1/ Number of jobs created (by construction period) including multiplier effects.
2/ State and local sales tax revenues (by construction period) including multiplier impacts of construction expenditures.
3/ Capitalized value (8 5/8%) of average flood control benefits per residential structure.
4/ Construction expenditures with multiplier effects.

TABLE 18
RELATIONSHIP OF COLDWATER CREEK FLOOD CONTROL
PLANS TO ENVIRONMENTAL REQUIREMENTS

Guidance	Plan 1	Plan 2	Plan 3
Archaeological and Historic Preservation Act, as Amended, 16 U.S.C. 469, et seq.	PC[1/]	PC[1/]	PC[1/]
Clean Air Act, as Amended, 42 U.S.C. 7609	FC	FC	FC
Clean Water Act, as Amended, 33 U.S.C. 466, et seq.	PC[2/]	PC[2/]	PC[2/]
Endangered Species Act, as Amended, 16 U.S.C. 1531, et seq.	FC	FC	FC
Fish and Wildlife Coordination Act, as Amended, 16 U.S.C. 661, et seq.	FC	FC	FC
National Environmental Policy Act, as Amended, 42 U.S.C. 4321, et seq.	FC	FC	FC
National Historic Preservation Act, as Amended, 16 U.S.C. 470a, et seq.	PC[1/]	PC[1/]	PC[1/]
Rivers and Harbors Act, 33 U.S.C. 401, et seq.	FC	FC	FC
Flood Plain Management, E.O. 11988	FC	FC	FC
Principles and Guidelines for Planning Water and Related Land Resources, Water Resources Council, March 10, 1983	FC	FC	FC
River and Harbors and Flood Control Act of 1970, Public Law 91-611, Section 122	FC	FC	FC

FC - Full Compliance; PC - Partial Compliance

1/ Full compliance shall be achieved concurrent with the completion of channel improvements. Compliance shall require coordination with the Missouri State Historic Preservation Officer, and (if significant material remains are identified) the Advisory Council on Historic Preservation.

2/ A Clean Water Act, Section 404(b) evaluation (see APPENDIX B) is being circulated for public review with this report. A Section 401 application for clean water certification from the state will be issued for separate review. These processes must be complete in order to achieve full compliance with the Clean Water Act.

NOTE: Only laws pertaining to resources found in the study area are listed in this table.

environmental effects found to be significant is presented for each plan in the following sections.

a. No Action - See Section 3.2 (Future Conditions in the Study Area Without Corps Project) and Section 4.2.1 (No Corps Action Plan).

b. Plan 1.

(1) Man-Made Resources - With Plan 1 in place, 457 units would no longer be flooded by the 10 year flood and 693 units would no longer be flooded by the 100 year flood. However, about 80 units downstream of New Halls Ferry Road that are presently not flooded by a 100 year flood would be flooded with Plan 1 in place. In addition, the Flood Forecasting and Warning System may allow people time to move some property from areas that would be flooded.

(2) Water Quality - In the short term there will be increased sedimentation during construction. In the project area, sedimentation from erosion will be decreased after the project is in place; however, it may increase in the CS-1 reach due to the removal of vegetation by clearing and snagging. The increased flows and velocity downstream of the project will increase erosion.

(3) Land Use - The new channels will be about 42.9 acres larger than the old channel with an additional 19.5 acres cleared for right-of-way. The disposal areas will cover 47.4 acres of crops, 71.4 acres of open land, and 9.8 acres of forest/brush. About 69.6 acres of undeveloped open land is likely to be developed because of decreased flooding.

(4) Aquatic Communities - 8.03 miles of stream will be adversely impacted by the channelization and 6.19 miles by clearing and snagging. The clearing of riparian vegetation and ground disturbance associated with the proposed stream channelization will further impact the existing disturbed aquatic ecosystem. All water-dependent species in Coldwater Creek within the stream segments to be channelized will be destroyed or displaced during construction.

In general, numerous secondary impacts are also associated with stream channelization. When riparian vegetation or channel morphology is modified, stream biota may be affected by elevated sediment loads during construction, increased water temperature, disruption of aquatic food webs, and decreased habitat and species diversity (Karr and Schlosser, 1978). Although these impacts will occur to some degree, it should be noted that the existing aquatic ecosystem is extremely degraded due to poor water quality conditions. The existing aquatic biota consists of species which are tolerant of poor stream conditions. Pollution tolerant aquatic species would be expected to recolonize the stream when the physical aspects of the channel have stabilized and as the food chain and suitable temperatures regimes are restored. Stream recovery rates are highly variable (Congdon, 1971; Tarplee et al., 1971). The plan will have a negligible adverse impact on fishery resources.

(5) Terrestrial Communities - The most significant impact on the terrestrial ecosystems will be the loss of 8.03 miles (62.4 acres) of riparian (creek-side) vegetation due to channelization. The quality of this habitat varies from poor to fair and is especially poor between I-270 and Lindbergh Avenue where the Metropolitan Sewer District has recently removed most of the habitat. Nevertheless the habitat that remains is, in most cases, the only remaining natural habitat in the vicinity.

The change from riparian forest to mowed grass will cause a loss of habitat for a number of wildlife species, especially song birds such as the cardinal, black-capped chickadee, brown thrasher, blue jay, Carolina wren and downy woodpecker, and mammals such as the muskrat, beaver, red fox, raccoon, opossum, gray squirrel, least shrew and little brown bat. In addition reptiles and amphibians will be adversely effected including the following species: small mouthed salamander, American toad, eastern garter snake and black rat snake.

Species of wildlife that would utilize the mowed grass areas are those which would most likely be found to use suburban lawns. These include the robin, meadow lark, starling, house sparrow, common grackle, common night hawks, eastern mole, house mouse, and eastern cottontail rabbit. An attempt will be made to regulate mowing schedules to minimize damage to nesting wildlife in the spring and early summer.

An additional 6.19 miles of creek will lose its in-bank vegetation by clearing and snagging (Measure CS-1). The riparian habitat in this reach is of good quality. Another adverse impact will result from the disposal areas which change 47.4 acres of cropland and 9.8 acres of forest/brush to open land. A total of 69.6 acres of open land will also be subject to development.

The adverse effects of the plan will be partially offset by planting a row of trees along the widened channel, possibly using wildlife preferred vegetation on the channel banks instead of grass, and, where possible, widening the channel on one side only. As a result the plan will have a negligible adverse impact on wildlife resources.

(6) Historic and Prehistoric Sites - Placement of fill material removed during channel widening has the potential to impact presently unknown archaeological sites. Prior to placement of fill material, each containment area shall be evaluated by a professional archaeologist. Should significant archaeological remains be identified during this process, appropriate cultural resources compliance activities and coordination shall be initiated. The combination of channel widening and levee L-7 will protect Old St. Ferdinand's Shrine from up to a 100 year flood.

Construction of earthen levees will effect approximately 1.2 acres of land. It is possible that during this process presently unknown archaeological sites may be effected. Prior to construction, these areas will be evaluated in the manner described in the paragraph above.

(7) Noise - Minor, temporary impacts are expected during construction.

(8) Aesthetics - Where the widened channels are constructed, the visual view will change from a stream that is lined with trees in some areas to a larger channel with grass banks and a row of trees along the outside edge of the right-of-way (8.03 miles). Initially the litter and debris will be removed and this will be an improvement; however, depending on the level of maintenance litter and debris may accumulate in the future as it has in the past. The trees along the right-of-way will reduce the adverse aesthetic impacts of the project.

An adverse visual impact will occur in the reach that will be cleared and snagged (6.19 miles) where the trees and shrubs in the channel will be removed and only stumps will remain. This will be especially adverse because this reach of Coldwater Creek has some of the more attractive forests adjacent to it.

(9) Recreation - Features will provide 7.17 miles of hiking and biking trails, 16 picnic tables, 2 picnic shelters and 4 foot high chain link fence in selected locations.

(10) Property Values - Property values will increase where the flooding problem is reduced in the upper two thirds of the stream. In the lower part of the creek some property values will decline because of induced flooding.

c. Plan 2.

(1) Man-Made Resources - With Plan 2 in place, 452 units would no longer be flooded by the 10 year flood and 880 units would no longer be flooded by the 100 year flood. Downstream of New Halls Ferry Road the 100 year flood would damage essentially the same number of structures with Plan 2 as would be damaged if no project was constructed. In addition, the Flood Forecasting and Warning System may allow people time to move some property from areas that would be flooded.

(2) Water Quality - In the short term there will be increased sedimentation during construction. After completion, the new channel will decrease the amount of erosion occurring in the project area.

(3) Land Use - The new channels will be about 46.5 acres larger than the old channel with an additional 24.3 acres cleared for right-of-way. The disposal areas will cover 57.6 acres of crops, 81.4 acres of open land, and 9.8 acres of forest/brush. About 69.6 acres of undeveloped open land is likely to be developed because of decreased flooding.

(4) Aquatic Communities - 10.0 miles of channelization will result in a negligible adverse impact on the fishery resources. Impacts to the aquatic ecosystem would be similar to those described for Plan 1.

(5) Terrestrial Communities - The most significant impact on the terrestrial ecosystems will be the loss of 10.0 miles (70.8 acres) of riparian (creek-side) vegetation due to channelization. The quality of this habitat varies from poor to good and is especially poor between I-270 and Lindbergh Boulevard where the Metropolitan Sewer District has recently

removed most of the habitat. Nevertheless the habitat that remains is, in most cases, the only remaining natural habitat in the vicinity. The best habitat is found from New Halls Ferry Road downstream to Old Halls Ferry Road. The qualitative impacts to wildlife species composition will be similar to those described for Plan 1, and Plan 2 will also have a negligible adverse impact on wildlife resources.

Another adverse impact will result from the disposal areas which change 57.6 acres of cropland and 9.8 acres of forest/brush to open land. Future land use practices will determine if this land remains open. 69.6 acres of open land will also be subject to development.

About 10 acres will be cleared of underbrush to provide flow access to the five-8 ft. diameter tunnels through the railroad embankment. This should not be a significant impact since the underbrush and ground cover have been greatly degraded by off-the-road vehicles.

(6) Historic and Prehistoric Sites - Same as Plan 1.

(7) Noise - Minor, temporary impacts are expected during construction.

(8) Aesthetics - Where the widened channels are constructed, the visual view will change from a stream that is lined with trees in some areas to a larger channel with grass banks and a row of trees along the outside edge of the right-of-way (10.0 miles). Initially the litter and debris will be removed and this will be an improvement; however, depending on the level of maintenance littor and debris may accumulate in the future as it has in the past. The trees along the right-of-way will reduce the adverse aesthetic impacts of the project.

The new channel will have the greatest adverse visual impacts along the section of stream between New Halls Ferry Road and Old Halls Ferry Road which has an attractive natural forest bordering the stream.

(9) Recreation - Features will provide 9.14 miles of hiking and biking trails, 16 picnic tables, 2 picnic shelters and 4 foot high chain link fence in selected locations.

(10) Property Values - Property values will increase where the flooding problem is reduced in the upper two thirds of the stream.

d. Plan 3.

(1) Man-Made Resources - With Plan 3 in place 438 units would no longer be flooded by the 10 year flood and 627 units would no longer be flooded by the 100 year flood. However, about 120 units downstream of New Halls Ferry Road that are presently not flooded by a 100 year flood would be flooded with Plan 3 in place. In addition, the Flood Forecasting and Warning System may allow people time to move some property from areas that would be flooded.

(2) Water Quality - In the short term there will be increased sedimentation during construction. The new channel will decrease the amount of erosion occurring in the project area.

(3) Land Use - The new channels will be about 42.9 acres larger than the old channel with an additional 19.5 acres cleared for right-of-way. The disposal areas will cover 47.4 acres of crops, 71.4 acres of open land, and 9.8 acres of forest/brush. About 69.6 acres of undeveloped open land is likely to be developed because of decreased flooding.

(4) Aquatic Communities - 8.03 miles of channelization will result in a negligible adverse impact on the fishery resources. Impacts to the aquatic ecosystem would be similar to those described for Plan 1.

(5) Terrestrial Communities - The most significant impact on the terrestrial ecosystems will be the loss of 8.03 miles (62.4 acres) of riparian (creek-side) vegetation due to the channelization. The quality of this habitat varies from poor to fair and is especially poor between I-270 and Lindbergh Avenue where the Metropolitan Sewer District has recently removed most of the habitat. Nevertheless the habitat that remains is, in most cases, the only remaining natural habitat in the vicinity. The qualitative impacts to wildlife species composition will be similar to that described for Plan 1, and Plan 3 will also have a negligible adverse impact on wildlife resources.

Another adverse impact will result from the disposal areas which change 47.4 acres of cropland and 9.8 acres of forest/brush to open land. Some 69.6 acres of open land will also be subject to development.

(6) Historic and Prehistoric Sites - Same as Plan 1.

(7) Noise - Minor, temporary impacts are expected during construction.

(8) Aesthetics - Where the widened channels are constructed, the visual view will change from a stream that is lined with trees in some areas to a larger channel with grass banks and a row of trees along the outside edge of the right-of-way (8.03 miles). Initially the litter and debris will be removed and this will be an improvement; however, depending on the level of maintenance litter and debris may accumulate in the future as it has in the past. The trees along the right-of-way will reduce the adverse aesthetic impacts of the project.

(9) Recreation - Same as in Plan 1.

(10) Property Values - Same as Plan 1.

4.2.8 Completeness. Completeness is the extent to which a given alternative plan provides and accounts for all necessary investments or other actions to ensure the realization of the planned effects.

Plans 1 and 3 are incomplete because they result in induced flood heights and flood damage downstream of New Halls Ferry Road. Some property owners would be required to participate in the Federal Flood Insurance Program and perhaps would have reduced property values because of Plans 1 and 3.

Construction of about a 1.5 mile segment of channel widening in Plans 1, 2 and 3 is dependent on action by the U.S. Department of Energy. The Corps of Engineers flood control project can be built in this area after the DOE removes radioactive material from the project area.

4.2.9 Effectiveness. Effectiveness is the extent to which an alternative plan alleviates the problems and achieves the opportunities specified in Section 3.3 of this report.

Plans 1, 2 and 3 are very effective in reducing average annual flood damages along the main channel of Coldwater Creek. However, flood damages will still be incurred when floods higher than the 10-year flood occur. In addition, Plans 1 and 3 will induce flood damages downstream from New Halls Ferry Road.

Plans 1, 2 and 3 are also effective in reducing streambank erosion problems along the main channel of Coldwater Creek in the segments where the channel would be widened. For nearly all of these segments riprap would be placed along the toe of the channel banks. The projects would be maintained in order to function as designed. Plans 2 and 3 would have no measurable effect on streambank erosion in the lower area of Coldwater Creek, since this area is projected to experience moderate to severe erosion even with no project constructed. Plan 1, which includes clearing and snagging in this downstream area, may induce some streambank erosion problems in the cleared stream segment.

Plans 1, 2 and 3 include recreation features that partially meet some recreation needs identified for the planning area. Plan 2 fulfills more of the need for hiking and biking trails than the other plans because it includes an additional segment of trail between Old Halls Ferry Road and New Halls Ferry Road.

Plans 1, 2 and 3 would have very little effect on the environmental problems and opportunities identified, except that all three plans would provide flood protection for the Old St. Ferdinand's Shrine buildings which are on the National Register of Historic Places. Plan 1 would have more adverse environmental effects than the other plans because it includes a segment of clearing and snagging between the Burlington Northern Railroad (Mile 1.63) and New Halls Ferry Road (Mile 7.83).

4.2.10 Efficiency. Efficiency is the extent to which an alternative plan is a cost effective means of alleviating the specified problems and realizing the specified opportunities, consistent with protecting the Nation's environment. Plans 1, 2 and 3 are all highly efficient in terms of benefits generated as compared to project costs.

4.2.11 Acceptability. Plan 2 is the plan that is most acceptable to the local sponsor and the affected public. It provides the most flood protection, the most streambank protection, and the most recreation features, and it essentially eliminates induced flood damages in the lower area of Coldwater Creek.

Plans 1 and 3 may not be acceptable because of induced flood damage in the lower area of the stream.

4.2.12 National Economic Development Plan. Plan 2 has the greatest net tangible benefits and is the National Economic Development (NED) Plan.

4.2.13 Sensitivity Analysis of NED Plan Formulation. The selection of the NED plan was based on the detailed second iteration analysis of both costs and benefits. However, the measures carried into the second iteration were selected based on their performance in the first iteration. This raises the question, if the detailed cost and benefit information used in the second iteration had been available in the first iteration, would different measures have been selected for the NED candidate plans? The sensitivity analysis that follows shows that no measures were mistakenly excluded from the second iteration analysis.

Changes in costs between the first and second iterations are not significant. However, benefits did change significantly between the two iterations. More detailed benefit analysis techniques were developed and utilized during the second iteration. The sensitivity analysis that follows utilizes the results of the second iteration benefits analysis and applies these results to appropriate first iteration measures. The sensitivity analysis is presented in TABLE 19.

The first iteration benefits are presented in TABLE 9, Reduction in Flood Damages includes structure and content damage reduction plus fifteen percent that accounts for the related benefits described in TABLE 9 footnote 1. The second iteration benefits are presented in TABLE 15. Structure and Content benefits include only structure and content damage reduction. Related benefits were analyzed on an individual basis. A summation of these related benefits for Plan 2 (including Vehicles, Residential Infrastructure, Commercial Infrastructure, Police Assistance, Parks, Bridges, FIA Overhead, Affluence, and Aesthetics) yields a figure that is 43 percent of the Structure and Content figure. Similar computations for Plan 1 and Plan 3 yield 39 percent and 37 percent, respectively. The sensitivity study percented in TABLE 19 shows Reduction in Flood Damages equal to the first iteration benefits with 15 percent removed and with 40 percent added to reflect the detailed related benefits listed above.

In TABLE 9 the first iteration Enhanced Value of Land benefits include the enhanced value of undeveloped land that is freed from the 100-year flood, plus the reduction in cost to fill land for development in the area still subject to the 100-year flood but outside the floodway. The "enhanced value of undeveloped land" benefit was based on a real estate market value increase approach. In the second iteration this benefit was reduced sharply by limiting the benefit to the cost to fill the same land parcels to the future condition without project 100-year flood level, and then by

TABLE 19

SENSITIVITY ANALYSIS OF THE POTENTIAL OF SELECTED FIRST ITERATION MEASURES TO BE INCLUDED IN THE NED PLAN
October 1984 Price Levels ($1,000)

Measure	Annual Benefits Revised for Sensitivity Analysis: Reduction In Flood Damages	Enhanced Value Of Land	Streambank Protection	Fill Benefits	Total Benefits	Total Annual Cost	Net Annual Benefits (+) Or Costs (-)	Benefit/ Cost Ratio
C-2	1,408	30	172	61	1,671	3,197	-1,526	0.5
C-3	175	4	172	0	351	686	-335	0.5
C-5 1/	1,343	29	162	52	1,586	1,072	+514	1.5
C-8	1,382	30	162	61	1,635	1,342	+293	1.2
C-9 1/	170	4	55	0	229	259	-30	0.9
C-10	1,162	25	162	38	1,387	892	+495	1.6
C-20 1/	266	6	60	0	332	231	+101	1.4
C-21	143	3	60	0	206	194	+12	1.1
C-22	302	6	60	0	368	334	+34	1.1
CS-1 1/	85	2	0	0	87	23	+64	3.8

1/ Detailed second iteration benefit and cost studies were accomplished for each of these measures. C-2, C-5, C-8 and C-10 are channel measures located in the middle, highest-damage part of Coldwater Creek. C-2 and C-8 have significantly lower net benefits than C-5, and C-10 has slightly lower net benefits but it provides only a 5-year level of protection. C-3, C-9 and CS-1 are intended to reduce induced damages in the downstream part of Coldwater Creek. Both C-9 and CS-1 were carried forward to the second iteration. C-9 is a channel and tunnel measure that yields better economic results than C-3 and essentially eliminates induced damages. CS-1 is a clearing and snagging measure that only partially reduces induced damages. C-20, C-21 and C-22 are channel measures upstream of the airport. Measure C-20 has significantly greater net benefits than the others.

discounting this figure over five years to reflect the assumption that development would not occur immediately after project construction. In the second iteration the "reduction in the cost to fill land" benefit was also reduced by discounting it over a five year period. In TABLE 15 the second iteration Land Enhancement and Reduced Fill benefits for Plan 2 total to a figure that is 3 percent of the Structure and Content benefit. Similar computations for Plan 1 and Plan 3 also yield 3 percent. The sensitivity study presented in TABLE 20 shows Enhanced Value of Land equal to 3 percent times the first iteration structure and content benefits, that is 3 percent times the first iteration Reduction in Flood Damages with 15 percent removed.

The Streambank Protection Resulting from Flood Control Project benefits in the first iteration TABLE 9 are the same as the Erosion benefits in the second iteration TABLE 15. The sensitivity study presented in TABLE 19 shows the same benefits for Streambank Protection that were developed in the first iteration.

The Fill benefits in the second iteration TABLE 15 apply only to the Measure C-5 component of Plans 1, 2 and 3. Measure C-20 was designed with the assumption that excavated material is disposed of on the open market at no cost to the project. Measure C-9 has disposal areas, but economic analysis found that there is enough open land in this area that the disposal sites are not needed for development. The Fill benefit in TABLE 15 is 27 percent lower than the Fill benefit for Measure C-5 in TABLE 9. The benefit is lower because in the second iteration certain fill sites were deleted from the group expected to generate economic benefits. For example, in the first iteration benefits were included for a disposal site on school property, and in the second iteration no benefits were included for this site. The sensitivity study presented in TABLE 19 shows Fill benefits for the measures in the same segment of Coldwater Creek as Measure C-5, with these benefits reduced by 27 percent.

Small levee measures were not examined in this sensitivity study. Several second iteration benefits do not apply to the small levees. A summation of the second iteration benefits for Vehicles, Police Assistance, FIA Overhead and Affluence yields a percentage of Structure and Content benefits that is similar to the percentage used for miscellaneous benefits in the first iteration. The small levees are therefore not sensitive to the more detailed second iteration benefits analysis.

The Recreation benefits in the first iteration are similar to the Recreation benefits in the second iteration. No sensitivity study was made for recreation measures.

4.2.14 Selection of the Recommended Plan. Plan 2 is the recommended plan. It was selected for the following reasons:

a. It provides substantial flood protection along the main channel of Coldwater Creek in the highly developed middle and upper areas of the creek.

b. It results in essentially no induced flood damages downstream from New Halls Ferry Road.

c. It is the most acceptable plan to the local sponsor (the Metropolitan St. Louis Sewer District), to local elected officials, and to downstream property owners.

SECTION 5 - DESCRIPTION OF THE RECOMMENDED PLAN

5.1 PLAN COMPONENTS

The recommended plan, Plan 2, has the following components: (The plan is described on PLATE 22 and in detail on PLATES 24 through 35.)

a. Measure C-5, which is channel widening between New Halls Ferry Road (Mile 7.83) and McDonnell Boulevard (Mile 13.70). Nearly all of this channel has grass covered sloped banks with riprap at the toe of the slope to control erosion. A 960-foot long stream segment with its upstream end at Paddock Creek has vertical concrete walls halfway up the sides of the channel and a sloped grass covered channel bank above the walls. See PLATE 17. There are also concrete walls under the St. Denis Avenue bridge and riprap just downstream from this bridge at the confluence of Coldwater Creek and Fountain Creek. A variety of trees are in the outer two feet of the project right-of-way in appropriate channel segments. During construction of the segment between McDonnell Boulevard and Interstate 270, the Corps will monitor for radioactivity.

b. Measure C-9, which is designed to essentially eliminate flooding problems in lower Coldwater Creek induced by Measure C-5. Measure C-9 includes enlarging the opening through the Burlington Northern Railroad embankment at Mile 1.63 with five 8-foot diameter tunnels. These tunnels alleviate increased flooding upstream from the embankment that results from higher discharges from Measure C-5. Measure C-9 also includes a channel widening segment from Old Halls Ferry Road (Mile 5.86) to New Halls Ferry Road (Mile 7.83) to reduce increased flooding in this area. This channel segment has sloped grass covered streambanks with riprap at the toe of the slope. Concrete channel linings are under the downstream Lindbergh Boulevard bridge and the New Halls Ferry Road bridge. A variety of trees are in the outer two feet of the project right-of-way in appropriate channel segments.

c. Measure L-7, which is a small levee that provides additional protection for four historic buildings in the Old St. Ferdinand's Shrine complex plus a Knights of Columbus building. The levee has a maximum height of 5 feet and 0.5 feet of freeboard.

d. Measure L-8, which is a small levee that provides additional flood protection for the basements of seven homes along Foxtree Drive. The levee has a maximum height of 5 feet and 0.5 feet of freeboard.

e. Measure C-20, which is an intermittent channel widening measure upstream from Lambert Airport. The first segment of this channel widening measure extends from just downstream of Interstate 70 (Mile 15.58) to a tributary downstream of Ashby Road (Mile 15.99). There is no project through the upper end of St. Ann Park and through the St. Ann Golf Course. Channel widening begins again at the upstream end of the St. Ann Golf Course (Mile 16.48) and extends to the downstream end of a double box culvert that runs under St. Charles Rock Road and the commercial and multifamily development north of the street (Mile 17.68). In this segment the channel is lined with concrete under the Wright, Geraldine and Isolda Street bridges. Even though the box culvert under St. Charles Rock Road is a constraint on flood flows, no improvement to it is proposed because of the high costs that would be involved. The Measure C-20 channel widening begins again upstream of St. Charles Rock Road (Mile 17.75) and ends at Breckenridge Avenue (Mile 18.30). A variety of trees is in the outer two feet of the project right-of-way in appropriate channel segments. No channel project is proposed between Breckenridge Avenue and Baltimore Avenue. This reach includes an undersized segment of concrete box culvert which is covered by two parking lots. An open concrete channel would be the most appropriate measure for this reach, but this type of measure is not economically justified. Measure C-20 has essentially no effect on flood flows downstream from the airport.

f. A Flood Forecasting and Warning System, which would includes the installation of a series of staff gauges in the main channel of the stream, say at Ashby Road in St. Ann, McDonnell Boulevard in Hazelwood, and Lindbergh Boulevard in downtown Florissant. It also includes use of the rainfall station at Lambert Airport and installation of an additional rainfall station in or west of the uppermost portion of the drainage basin. The system includes development of a report that will be used as a basic preparedness plan. This report will include charts that relate rainfall data and staff gauge readings to various flood frequency profiles; maps that describe the areas that would be flooded at several flood frequencies, such as the 10, 25 and 100-year levels; and a system of communication between emergency response officials. By observing rainfall data and the rising flood levels in the stream, and by being aware of projected continuing rainfall, authorities could expect flooding in certain areas and issue warnings to property owners in these areas. In addition, authorities could communicate with other communities along the stream to give or get more advance warning of rising flood levels. Development and implementation of this flood forecasting and warning system would involve materials, technical studies, report preparation, and coordination and education programs for the communities.

g. Recreation Measures R-1, R-2 and R-3, which are associated with channel widening measures C-5, C-20 and C-9, respectively. Measure R-1 consists of a 5.97 mile long seven-foot-wide crushed stone hiking and bicycling trail in the right-of-way along one side of channel widening measure C-5; a 4 foot high chain link fence between the trail and residential areas; seven fords where the trail crosses tributary streams; and two picnic areas, one at the confluence of Fountain Creek with Coldwater Creek in Florissant and the other in the Foxtree Drive area in Hazelwood. Measure R-2 consists of 1.20 miles of trail along one side of channel

widening measure C-20. It also includes one ford and a fence but does not include any picnic sites. Measures R-3 is a 1.97 mile long trail along one side of channel widening measure C-9. It includes the fence and does not include any picnic sites.

h. The environmental features in Plan 2 include monitoring for radioactivity during construction of a segment of Measure C-5, and planting trees in the outer edge of the right-of-way in appropriate segments of Measures C-5, C-9 and C-20. Where possible, the channel will be widened from one side to preserve the natural vegetation on the other side. If possible, wildlife preferred vegetation will be used on the channel banks instead of grass.

5.2 DESIGN AND CONSTRUCTION CONSIDERATIONS

Plan 2 is a relatively simple plan designed to be cost effective and yet substantially reduce urban flood damages along the main channel of Coldwater Creek. No buildings are taken and no bridges replaced as a result of this channel widening project. The channel is not deepened because sanitary sewer laterals cross under the stream. The widened channel is designed so that a sanitary sewer main running parallel to the stream is affected as little as possible.

Channel side slopes of 1 vertical to 2 horizontal were selected in order to minimize the right-of-way required for the project. Preliminary geotechnical studies, including data from scattered soil borings along the stream, indicate that the channel banks will be stable with these slopes and with riprap protecting the toe of the slope from washing. Additional geotechnical studies will be made during the preconstruction engineering and design phase of the project.

Concrete channel lining is very costly and its use in Plan 2 is limited to lining under six undersized bridges and to the concrete walled channel segment where Paddock Creek enters the main channel. To save cost the concrete walls in the segment at Paddock Creek are half the full height of the channel.

The five 8-ft diameter tunnels designed to enlarge the opening at the Burlington Northern Railroad embankment (Mile 1.63) were developed at a preliminary level of detail without any boring or other information on the composition of the embankment materials. The cost estimate for the tunnels was developed with assistance from a tunneling expert from St. Louis, and is based on manual tunneling procedures, installation of galvanized liner plate with tar on the outside, grouting between the liner plate and the excavated surface, coating the liner plate with tar on the inside after installation, and concreting the invert of the tunnels 6 to 8 inches deep. The final design to enlarge the opening through the railroad embankment will be coordinated with the Burlington Northern Railroad during the preconstruction engineering and design phase of the project.

Preconstruction engineering and design will also include a full examination of the potential for widening the channel on one side only in certain parts of the stream. This would reduce adverse environmental impacts and may result in lower real estate and operation and maintenance costs. The concept includes extra widening on one side of the channel and

riprap placed at the toe of the slope on both sides of the channel. (See PLATES 17 and 20.) Because of the riprap, some bank stabilization benefit also accrues to the side of the channel where no excavation would take place. The decision to widen the channel on one side only will be based on detailed field surveys that relate the existing channel to the sanitary sewer main adjacent to the channel; detailed geotechnical studies; detailed hydraulic design; detailed real estate studies; and coordination with the local sponsor, the affected communities, affected homeowners, and environmental interests. The typical channel cross section may also be modified in certain stream segments due to new geotechnical information, or to incorporate existing channel improvements into the project, e.g., gabion and concrete retaining walls upstream of St. Charles Rock Road.

In preconstruction engineering and design Levees L-7 and L-8 will be designed in detail and additional freeboard will be considered. An alternative to Levee L-8 will also be considered, i.e., to make excavated material available to homeowners along Foxtree Drive so they can fill their backyards as part of a private, coordinated floodproofing project. Filling in the backyards is not feasible as a Corps project because of the high real estate cost of dealing with each property owner, and because additional work would be needed to floodproof each house.

The primary construction difficulty associated with the project will be access of heavy equipment and trucks to the channel and temporary disturbance of backyards and other land. In addition to the actual construction of the channel, levee and recreation features of the plan, the project will also include restoration of areas that are disturbed during the construction project.

A tentative schedule for the review, design and construction of the recommended plan is shown on PLATE 46. A schedule for the Department of Energy remedial action program is also shown. Of course, both schedules are subject to change.

The preliminary opinion of the Department of Energy is that only small scattered deposits of radioactive material will be excavated from the creek channel by the DOE during the remedial action program. The channel cross section would be essentially unchanged. The DOE also expects the remedial action program to result in a safe environment that is compatible with the outdoor recreation features of the Corps plan.

The Corps will continue to coordinate with the DOE and other agencies during the design and construction of the recommended plan, and will adjust its design and construction schedule as necessary to accomodate the DOE project. The Corps will not proceed with construction in the radioactive contamination area until the Department of Energy completes its remedial action work and verifies that the Corps can construct the flood control project without creating a radiological hazzard.

As an extra safety factor, the Corps plans to monitor for radioactivity while constructing part of the flood control project. The type and extent of monitoring will be determined during preconstruction engineering and design of the project in consultation with the Department of Energy and other agencies.

5.3 OPERATION, MAINTENANCE AND REPLACEMENT CONSIDERATIONS

The primary operation and maintenance consideration for Plan 2 is to keep the channel functioning as designed. Debris and silt will be removed as necessary. Debris will also be removed from the tunnels through the railroad embankment at the downstream end of the project. For hydraulic purposes, trees and shrubs cannot be allowed to grow in the channel. The upper channel slopes will be covered by grasses or some other suitable ground cover. The grass will be cut annually, and special four wheel drive mowers or equipment with telescoping boom mowers may be needed for the relatively steep 1 vertical to 2 horizontal slope. In the riprap area of the channel, saplings and brush will be removed on a five-year cycle. Replacement or repair of riprap, bedding and concrete works will also be needed at long term intervals.

The channel project includes ten feet of land on each side of the stream on the flat areas adjacent to the channel slopes. These 10-feet-wide right-of-way strips will be used for the access of maintenance equipment. The hiking and biking trail located on one of the strips will require maintenance. The two picnic areas also require regular maintenance and longer term repairs.

The two low levees in Plan 2 have to be mowed several times per year. Levee embankment repairs will be needed on an infrequent basis. In addition, the flood forecasting and warning system requires maintenance of rainfall and stream gages as well as some annual coordination efforts.

5.4 PLAN ACCOMPLISHMENTS

Plan 2 significantly reduces urban flood damages along the upper two thirds of the main channel of Coldwater Creek, while essentially not inducing flood damages along the downstream one third of the creek. With Plan 2, the 10-year flood is lower and it results in low flood damages. Rarer floods are also lower but they still cause substantial flood damages. A summary of plan accomplishments is presented in TABLE 20.

TABLE 20

SUMMARY OF ACCOMPLISHMENTS OF THE RECOMMENDED PLAN

	Future Conditions Without Project	Future Conditions With Plan 2
Approximate Number of Units Damaged by Flooding On Main Channel		
10-Year Flood	563	111
100-Year Flood	1,390	510
Standard Project Flood	2,960	1,735

TABLE 20 (Continued)

SUMMARY OF ACCOMPLISHMENTS OF THE RECOMMENDED PLAN

	Future Conditions Without Project	Future Conditions With Plan 2
Approximate Flood Damages to Structures and Contents On Main Channel (Oct 1985 Price Level)		
10-Year Flood	$ 5,034,000	$ 365,000
100-Year Flood	20,106,000	2,526,000
Standard Project Flood	71,054,000	25,178,000
Average Annual Damages	$ 1,744,000	$ 201,000

5.5 UPDATED COSTS AND BENEFITS

The costs and benefits of the recommended plan, Plan 2, updated to October 1986 price levels are shown in TABLE 21. All costs and benefits were updated using appropriate indices.

TABLE 21

COSTS AND BENEFITS OF RECOMMENDED PLAN (PLAN 2)
October 1986 Price Levels, 8-7/8% Interest, 100 Year Life

PROJECT FIRST COSTS

1. NON-FEDERAL COSTS	
a. Structural Flood Control	
01 Lands and Damages	$4,082,000
02 Relocations	601,000
30 Engr & Design for 02 (12% of 02)	72,000
31 Supervision & Admin for 02 (9% of 02)	54,000
Subtotal	4,809,000
Cash Payment (5% of Non-Fed plus Fed Str Flood Control not incl $150,000 Radiological Monitoring)	958,000
Total Structural Flood Control	5,767,000
b. Nonstructural Flood Control	
20 Permanent Operating Equipment (25%)	9,000
30 Engr & Design for 20 (25%)	5,000
31 Supervision & Admin for 20 (25%)	4,000
Total Nonstructural Flood Control	18,000
c. Total Flood Control	5,785,000
d. Recreation	
14 Recreation Facilities (50%)	336,000
30 Engr & Design for 14 (50%)	41,000
31 Supervision & Admin for 14 (50%)	27,000
Total Recreation	404,000
e. Total Flood Control Plus Recreation	6,189,000

TABLE 21 (Continued)

COSTS AND BENEFITS OF RECOMMENDED PLAN (PLAN 2)
October 1986 Price Levels, 8-7/8% Interest, 100 Year Life

2.	FEDERAL COSTS	
	a. Structural Flood Control	
	09 Channels and Canals	11,975,000
	11 Levees and Floodwalls	25,000
	30 Engr & Design	1,431,000
	31 Supervision & Admin	1,077,000
	Subtotal	14,508,000
	Less Non-Federal Cash Payment	(958,000)
	Total Structural Flood Control	13,550,000
	b. Nonstructural Flood Control	
	20 Permanent Operating Equipment (75%)	27,000
	30 Engr & Design for 20 (75%)	16,000
	31 Supervision & Admin for 20 (75%)	11,000
	Total Nonstructural Flood Control	54,000
	c. Total Flood Control	13,604,000
	d. Recreation	
	14 Recreation Facilities (50%)	336,000
	30 Engr & Design for 14 (50%)	41,000
	31 Supervision & Admin for 14 (50%)	27,000
	Total Recreation	404,000
	e. Total Flood Control Plus Recreation	14,008,000
3.	NON-FEDERAL PLUS FEDERAL COSTS	
	a. Structural Flood Control	19,317,000
	b. Nonstructural Flood Control	72,000
	c. Total Flood Control	19,389,000
	d. Recreation	808,000
	e. Total Flood Control Plus Recreation	$20,197,000

ANNUAL COSTS

Annual Interest and Amortization	$1,792,847
Annual Operation and Maintenance	41,300
Annual Replacement Cost	10,923
Total Annual Cost	$1,845,070

ANNUAL BENEFITS

Structure and Content	$1,487,390
Vehicles	104,286
Residential Infrastructure	80,663
Commercial Infrastructure	70,874
Police Assistance	4,176
Parks	890
Bridges	197,334

TABLE 21 (Continued)

COSTS AND BENEFITS OF RECOMMENDED PLAN (PLAN 2)
October 1986 Price Levels, 8-7/8% Interest, 100 Year Life

ANNUAL BENEFITS

Erosion	282,482
FIA Overhead	58,958
Affluence	123,254
Land Enhancement	38,094
Fill	54,340
Reduced Fill	3,050
Aesthetics	23,521
Recreation	341,548
Total	$2,870,860

COMPARISON OF BENEFITS AND COSTS

Annual Benefits	$2,870,860
Annual Costs	1,845,070
Net Annual Benefits	$1,025,790
Benefit/Cost Ratio	1.56

5.6 SUMMARY OF ECONOMIC, SOCIAL, AND ENVIRONMENTAL EFFECTS

5.6.1 Economic Effects. The total first cost of Plan 2 in October 1986 prices is $20,197,000, which includes $14,008,000 in Federal costs and $6,189,000 in non-Federal costs. The non-Federal costs include a cash payment of five percent of the structural flood control costs not including the cost of the radiological monitoring. This cash payment is to be paid during the construction period. The project's annual costs include $1,792,847 for interest and amortization at 8-7/8 percent over the 100-year project life, $41,300 for operation and maintenance, and $10,923 for replacements, totalling to $1,845,070. Plan 2 has total annual benefits equal to $2,870,860, net annual benefits equal to $1,025,790, and a benefit to cost ratio of 1.56. The primary output is urban flood damage reduction.

5.6.2 Social Effects. The major social effects of Plan 2 include (1) reductions in the personal suffering and community losses that result from flooding along Coldwater Creek, and (2) improved community life resulting from the recreation features of the plan.

5.6.3 Environmental Effects. The environmental effects of the recommended plan include effects on historic properties and effects on the ecology. The project has a positive effect on historic properties because it provides flood protection for the Old St. Ferdinand's Shrine which is on the National Register of Historic Places.

a. Any Adverse Environmental Effects Which Cannot Be Avoided Should the Proposal Be Implemented. The project has adverse effects on the terrestrial habitat along the stream corridor. In several segments this existing habitat is poor in quality. The ten miles of channel widening will result in the loss of 70.8 acres of riparian habitat. Part of this loss will be offset by planting trees at the edge of the channel right-of-way in most channel locations; by leaving one side of the channel undisturbed where this approach is found to be feasible during preconstruction, engineering and design; and by planting the new channel banks with wildlife preferred ground cover where possible.

An additional 70 acres of open land will be subject to development because of the reduced flooding resulting from the project. About ten acres of underbrush will be cleared in front of the tunnels through the downstream railroad embankment. The project also has some adverse effect on the potential for future good aquatic habitat in the stream, although aquatic habitat is unlikely to improve in the future due to projected poor water quality.

The adverse environmental impacts of the project are minimized by the measures and actions described above, consequently the project will have a negligible adverse impact on fish and wildlife.

b. The Relationship Between Local Short-term Uses of Man's Environment and the Maintenance and Enhancement of Long-term Productivity. The urban development and associated degradation of Coldwater Creek has been proceeding since the 1940's. Severe water quality problems, storage of radioactive wastes, channelization, and destruction of adjacent forests have taken their toll in the natural systems. Aquatic and terrestrial communities have been degraded, flooding has increased due to increased runoff, bank erosion has accelerated. In general, the short and long term productivity has been and continues to decrease.

The proposed flood control project will generally maintain and enhance long-term productivity by decreasing flooding and associated flood damages. The lower reaches of the creek which have the best remaining environmental features will not be disturbed. The best of this downstream area is in public ownerhsip and should be protected for the long term.

c. Any Irreversible and Irretrievable Commitments of Resources Which Would Be Involved in the Proposed Action Should It Be Implemented. There will be no signficant irreversible and irretrievable commitment of resources with the proposed plan. The project could be modified by future generations if they saw fit.

5.7 COMPLIANCE WITH EXECUTIVE ORDER 11988 (FLOODPLAIN MANAGEMENT)

The objective of Executive Order 11988 is to avoid to the extent possible the long and short term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct or indirect support of floodplain development wherever there is a practicable alternative. Under the Executive Order, the Corps of Engineers is required to provide leadership and take action to:

a. Avoid development in the 100-year floodplain unless it is the only practicable alternative;

b. Reduce the hazard and risk associated with floods;

c. Minimize the impact of floods on human safety, health and welfare; and

d. Restore and preserve the natural and beneficial values of the base floodplain.

Plan 2 was formulated in recognition of the Executive Order and the actions required of the Corps of Engineers. In general, the upper two thirds of the Coldwater Creek 100-year floodplain is highly developed and the downstream one third of the floodplain is relatively undeveloped. The recommended plan includes channel widening in the upper two thirds of the stream in order to reduce flood hazards and risks to existing development and to minimize the impacts of floods on human safety, health and welfare.

In reducing flood levels in the upper two thirds of the watershed, the project reduces the flood threat for some isolated undeveloped parcels of land. These will consequently have higher development potential. In addition, material excavated from the channel will be placed in selected fill areas along the stream. Some of these fill areas are within the 100-year floodplain and they will be filled to a point where the land would be more developable. These two consequences of the recommended plan, reduction of the flood threat for isolated land parcels and fill of other areas, are practicably unavoidable effects of a plan designed to reduce flood damages to existing development.

Implementation of Plan 2 will necessitate revising the Flood Insurance Studies for Breckenridge Hills, St. Ann, Hazelwood and Florissant. Both the floodplain areas and the floodways will be narrower in some areas. Levee Measure L-7, which provides additional protection for the historic Old St. Ferdinand's Shrine, will probably be in the revised floodway. Construction of this small levee may be dependent on the granting of a variance by the City of Florissant.

In the downstream one third of Coldwater Creek, Plan 2 includes limited channel widening and the construction of tunnels through a railroad embankment. One purpose of these features is to keep the with-project 100-year flood as close as possible to the without-project 100-year flood in this area. Since the 100-year floodplain will be essentially the same area with and without the selected plan, the natural and beneficial values of the floodplain will be preserved in the downstream area.

SECTION 6 - PLAN IMPLEMENTATION

6.1 INSTITUTIONAL REQUIREMENTS

The local cooperation requirements needed to implement the project will be met or arranged by the Metropolitan St. Louis Sewer District (MSD). These requirements include cost sharing, operation and maintenance of the

project after construction, and other requirements listed in Section 11 - Recommendations. In providing the land, easements and right-of-ways required for the project, MSD must comply with the provisions of Section 221 of the Rivers and Harbors Act of 1970 (P.L. 91-611), and with the provisions of the Uniform Relocations Assistance and Real Property Acquisition Policies Act of 1970 (P.L. 91-646).

The Federal contribution to the project depends on successful processing of the Coldwater Creek Feasibility Report and Congressional and Executive Branch authorization and funding of the project as described in SECTION 2.7 - THIS REPORT.

6.2 DIVISION OF PLAN RESPONSIBILITIES

Responsibilities for the plan will be shared by the Corps of Engineers and the Metropolitan St. Louis Sewer District. MSD will participate in the detailed design of the project, share project costs, obtain the lands for the project, and operate and maintain the project upon completion.

6.3 FINANCIAL ANALYSIS

The Metropolitan St. Louis Sewer District is responsible for the collection and treatment of sanitary sewage in the City of St. Louis and most of St. Louis County. It is also responsible for stormwater drainage in the City of St. Louis and the eastern portion of St. Louis County, including the Coldwater Creek watershed. MSD is a joint local sponsor of the Corps of Engineers City of St. Louis flood protection project, a system of levees, floodwalls and pump stations that protect the city from Mississippi River flooding. It also intends to be the local sponsor for potential future projects on Maline Creek and River Des Peres.

To fulfill its financial responsibilities as the local sponsor for the recommended plan, the Metropolitan St. Louis Sewer District will need to expend about $1,000,000 in FY92, $2,000,000 in FY93, $2,000,000 in FY94, $700,000 in FY95, and $500,000 in FY96. MSD will finance these expenses through a combination of the following methods: special subdistrict property taxes (MSD has an ongoing program to collect taxes for storm drainage improvements); bonds; and municipal, county and state contributions. MSD has demonstrated their ability to use these financing methods. Since 1974, MSD and other non-Federal interests have expended $65,000,000 on storm drainage improvement in the Coldwater Creek area.

6.4 VIEWS OF NON-FEDERAL SPONSOR

The Metropolitan St. Louis Sewer District supports construction of Plan 2 and has stated its intent to be the local sponsor of the project. A letter of intent from MSD is reproduced in APPENDIX C.

SECTION 7 - PUBLIC INVOLVEMENT, REVIEW AND CONSULTATION

Since the Coldwater Creek study was initiated in October 1980 the Corps of Engineers has involved Federal, state and local interests in the planning effort. A formal initial public meeting was not held for the Coldwater

Creek study because of the extensive public coordination program undertaken by the Metropolitan St. Louis Sewer District as part of their Coldwater Creek Drainage Survey completed in January 1981. The Corps of Engineers did sponsor a two-day field reconnaissance, which included a briefing and bus tour, on 3 and 4 December 1980. Fifty people representing many organizations joined in this field reconnaissance.

A draft Reconnaissance Report was distributed to the public in September 1981. Comments were received from Federal, state and local agencies, and these were incorporated in a final Reconnaissance Report dated January 198.

Over the course of the study many individual meetings and field trips were conducted with Federal, state and local interests including elected officials. A formulation - stage public meeting was held by the Corps of Engineers on 19 November 1985 at McCluer Senior High School in Florissant, Missouri. Fifty-nine people attended the meeting. The Corps of Engineers and the U.S. Department of Energy made formal presentations, and then the meeting was opened up for questions and comments from the public. The Department of Energy briefly described their studies and possible remedial actions at the two radioactive materials storage sites along Coldwater Creek. The Corps described the flooding problem along the stream, alternative solutions that were considered, and the plan tentatively selected as the best plan. The response at the public meeting was generally one of support for the proposed flood control project. No opposition was expressed. Some homeowners asked the Corps to examine additional flood control measures in the hope that they would be included in the final selected plan. Concern was expressed about the radioactive material storage sites, and some interests favored moving the material out of the urban area.

A draft Feasibility Report and Environmental Impact Statement dated October 1986 was distributed to the public for comment. The recommended plan described in the draft report reflected comments that were received at the formulation-stage public meeting. The final public meeting was held by the Corps of Engineers on 13 January 1987 at the Florissant City Hall. Sixty-seven people attended the meeting. Again, the Corps of Engineers and the U.S. Department of Energy made formal presentations, and then the meeting was opened up for questions and comments. The main purpose of the meeting was to get comments on the recommended plan presented in the draft report. A summary of the final public meeting and copies of letters commenting on the draft report are included in APPENDIX C.

The recommended plan in this final Feasibility Report and Environmental Impact Statement has been revised slightly because of comments on the draft report. The segment of recreation trail in St. Ann Park was deleted from the plan, several footbridge replacements were added to the plan, and a program of radiological monitoring during construction of part of the project was added to the plan.

Both the U.S. Fish and Wildlife Service and the Missouri Department of Conservation have conducted environmental studies on Coldwater Creek. The Fish and Wildlife Coordination Act Report prepared by the U.S. Fish and Wildlife Service is presented in APPENDIX D. This report makes the

following recommendations. Corps of Engineers responses follow each recommendation.

Recommendation 1. Stream widening should be limited to one bank of Coldwater Creek, where possible, preferably the bank with the least amount of vegetation. This would reduce the loss of riparian habitat and provide a continued source of habitat for wildlife. Fish and wildlife agencies should be contacted to obtain site specific information in vegetative clearing.

Response 1. The Corps of Engineers intends to follow this recommendation where possible. This concept will be examined in the preconstruction engineering and design phase of the project. There are a number of factors that limit the feasibility of this concept, including a sanitary sewer main adjacent to the channel and buildings near the creek. Existing streambank erosion also effects the design of such a channel.

Recommendation 2. Construction and maintenance of the enlarged channel should occur during the low flow stages.

Response 2. Concur in general. However, high flow conditions can occur at any time along Coldwater Creek.

Recommendation 3. Those areas adjacent to the channel should be planted with species that are beneficial to wildlife. This would provide wildlife food and cover as well as protection against subsequent erosion.

Response 3. In appropriate channel segments the outer two feet of the project right-of-way will be planted with a variety of trees that are beneficial to wildlife and aesthetically pleasing. Disposal areas will also be planted with a grass/forb mixture that will benefit wildlife. This benefit will be temporary for the disposal areas that are projected to be developed.

Planting the channel bank with a ground cover such as bird's foot trefoil or crown vetch instead of grass will be considered. These plants would not have to be mowed and would provide cover for wildlife.

Recommendation 4. An alternative measure to wholesale or large scale clearing and snagging along Coldwater Creek should be investigated by the St. Louis District, Corps of Engineers.

Response 4. The tentative recommended plan does not include clearing and snagging.

SECTION 8 - REPORT RECIPIENTS

This final Feasibility Report and Environmental Impact Statement is being furnished to the following agencies and organizations for review and comment. The draft report had also been furnished to these organizations and other interested parties.

U. S. Senate
U. S. House of Representatives

Advisory Council on Historic Preservation
Keeper of the National Register of Historic Places
U.S. Department of Agriculture
    Soil Conservation Service
U.S. Department of Commerce
U.S. Department of Energy
U.S. Department of Health and Human Services
U.S. Department of Housing and Urban Development
U.S. Department of the Interior
    National Park Service
    Fish and Wildlife Service
U.S. Department of Transportation
    Coast Guard
U.S. Environmental Protection Agency
Federal Emergency Management Agency
Kansas City District, Corps of Engineers, Planning Division
Kansas City District, Corps of Engineers,
    Regulatory Functions Branch
Missouri Department of Conservation
Missouri Department of Natural Resources
Missouri State Clearinghouse, Office of Administration
Missouri State Legislators
St. Louis County, Department of Planning
St. Louis County, Department of Highways and Traffic
Metropolitan St. Louis Sewer District
City of Blackjack
City of Florissant
City of Hazelwood
City of Berkeley
City of St. Ann
City of Breckenridge Hills

SECTION 9 - LIST OF PREPARERS

TABLE 22 lists the people primarily responsible for the preparation of this report.

SECTION 10 - INDEX AND REFERENCES

TABLE 23 is an index of the environmental subjects discussed in this Integrated Planning Report and Environmental Impact Statement. References are listed in TABLE 24.

TABLE 22
LIST OF PREPARERS

The following people were primarily responsible for preparing the Feasibility Report and Environmental Impact Statement.

Name	Discipline/ Expertise	Experience	Role in Preparing EIS
Mr. John Brady	Biology/Wildlife	12 years, Environmental Planning, St. Louis District.	EIS Coordinator, Effects on Environmental Resources.
Mr. J. Kevin Brown	Engineering/ Cost Estimates	3-1/2 years, Cost Engineering, St. Louis District.	Cost Engineering Studies
Mr. Lawrence Hamilton	Engineering/ Civil	13 years, Civil Engineering, St. Louis District.	Earth Work Design
Mr. Thomas M. Keevin	Biology/ Aquatic	6 years, Fisheries Biologist, St. Louis District.	Aquatic Studies
Mr. Michael Klosterman	Geology	13 years, Geological Studies, St. Louis District.	Geological Studies
Mr. Richard Mills	Engineering/ Hydraulic	17 years, Hydraulic Engineering, St. Louis District.	Hydrologic and Hydraulic Studies
Mr. Roy Mathiesen	Landscape Architect/ Recreation	12 years, Water Resources Master Planning, St. Louis District.	Recreation Planning
Mr. Dennis Morgan	Engineering/ Geotechnical	5 years, Geotechnical Engineering, St. Louis District.	Geotechnical Studies
Mr. F. Terry Norris	Archaeology/ Historic Sites	5 years, Field Archaeologist Southerr Illinois University; 9 years, Environmental Analysis Branch, SLD.	Cultural Resource Studies

TABLE 22 (Continued)
LIST OF PREPARERS

Name	Discipline/ Expertise	Experience	Role in Preparing EIS
Mr. Paul Olson	Aerial Photography/ Mapping	24 years Aerial Photography/ Mapping, St. Louis District.	Mapping
Ms. Carol Plambeck	Engineering/ Environmental Design	6 years Environmental Design, St. Louis District	Utility Relocation Planning
Mr. Darold Silcott	Real Estate/ Appraiser	13 years Real Estate Appraiser, St. Louis District	Real Estate Studies
Mr. Richard Rodakowski	Economics/ Regional Planning	14 years, Regional Planning, St. Louis District.	Economic Studies
Mr. David Shaw	Engineering/ Structural	23 years, Structural Engineering, St. Louis District	Structural Design
Mr. Melborne Stohl	Engineering/ Structural	12 years, Structural Engineering, St. Louis District.	Structural Design
Mr. James Zerega	Civil Engineering/ Water Resources Planning	16 years, Water Resources Planning, St. Louis and Nashville Districts	Study Manager

TABLE 23
ENVIRONMENTAL TOPICS INDEX

TABLE 24
REFERENCES

Congdon, J. C., 1971. Fish populations of channelized and unchannelized sections of the Chariton River, Missouri. pp. 52-62. In: Stream Channelization, a Symposium, Northcentral Div. Amer. Fish Soc., Spec. Pub.2.

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SECTION 11 - RECOMMENDATIONS

I have carefully considered the many significant factors related to the urban flooding problems and associated opportunities along Coldwater Creek, Missouri, and the alternative plans that address these problems and opportunities. These factors include the economic and social damages caused by flooding; the probability of worse flooding in the future; the flood damage to Old St. Ferdinand's Shrine, which is on the National Register of Historic Places; the natural environment along the stream corridor; the need to restore and preserve the natural and beneficial values of the floodplain, the radioactive material storage sites adjacent to the stream, the contamination in the stream, and the U.S. Department of Energy remedial action program planned for these areas; the need for certain recreation facilities in the area; the effectiveness of the alternative plans in reducing the flood potential and meeting other planning objectives; the costs of the plans and their economic benefits; and the acceptability of the plans to the local sponsor and other interests. In consideration of all these significant factors, I have determined that the following recommendations are in the public interest.

I recommend that a flood control and associated improvements project for Coldwater Creek, St. Louis County, Missouri, be authorized for implementation as a Federal project, generally in accordance with Plan 2, with such modifications as in the discretion of the Chief of Engineers may be advisable. The project shall be subject to the cost sharing and financing and other requirements of the Water Resources Development Act of 1986, P.L. 99-662, for this kind of project and as otherwise provided by law. At October 1986 price levels, the total first cost of Plan 2 is estimated to be $20,197,000 and its estimated annual operation, maintenance and replacement costs are $52,223. The estimated Federal first cost is $14,008,000. The non-Federal first cost is $6,189,000. The annual operation, maintenance and replacement costs are a non-Federal responsibility. This recommendation is made with the provision that, prior to project implementation, non-Federal interests enter into a binding agreement with the Secretary of the Army to meet the requirements as listed below. The non-Federal share of project costs shall not exceed fifty percent of the cost of the project assigned to structural flood control, not including the cost of radiological monitoring.

a. Provide without cost to the United States all lands, easements, and rights-of-way necessary for construction, operation and maintenance of the project, including suitable disposal areas, and all necessary relocations;

b. Hold and save the United States free from damages due to construction, operation, and maintenance of the project, except for damages due to the fault or negligence of the United States or its contractors;

c. Maintain, operate, replace, and rehabilitate in accordance with regulations prescribed by the Secretary of the Army and without cost to the United States, all flood control works; all flood forecasting, warning, and preparedness systems; and, all recreation facilities, open to all on an equal basis;

d. Pay during the construction of the project five percent of the cost of the structural project features assigned to flood control, not including the cost of radiological monitoring;

e. Pay such additional amounts as are necessary so that the total contribution of non-Federal interests for the structural flood control features of the project is not less than 25 percent of the total cost of the project assigned to structural flood control, not including the cost of radiological monitoring;

f. Pay twenty-five percent of the costs of the flood forecasting, warning, and preparedness system;

g. Pay fifty percent of the separable costs of recreation development;

h. Participate in and comply with applicable Federal flood plain management and flood insurance programs;

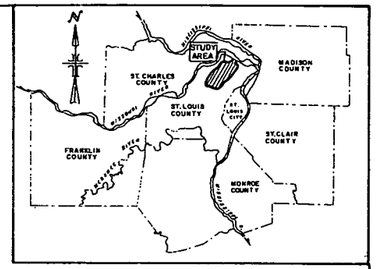
i. At least annually notify affected interests regarding the limitations of the protection afforded by the project;

j. Prevent future encroachment or conveyance modifications that would interfere with the proper functioning of the project for flood control, or require compensating actions that will allow the continued proper functioning of the project for flood control; and,

k. Prior to completion of construction, participate in the development of a flood preparedness plan for local implementation.

The recommendations contained herein reflect the policies governing formulation of individual projects and the information available at this time. They do not necessarily reflect program and budgeting priorities inherent in the local and state programs or the formulation of a national Civil Works construction program. Consequently, the recommendations may be modified before they are transmitted to the Congress as proposals for authorization and implementation funding. However, prior to transmittal to the Congress, the sponsor, the state, interested Federal agencies, and other parties will be advised of any modifications and will be afforded an opportunity to comment further.

Daniel M. Wilson
Colonel, Corps of Engineers
District Engineer



VICINITY MAP

LEGEND

NATURAL CHANNEL
ENLARGED EARTH CHANNEL
CONCRETE LINED CHANNEL OR ENCLOSED CONCRETE CONDUIT

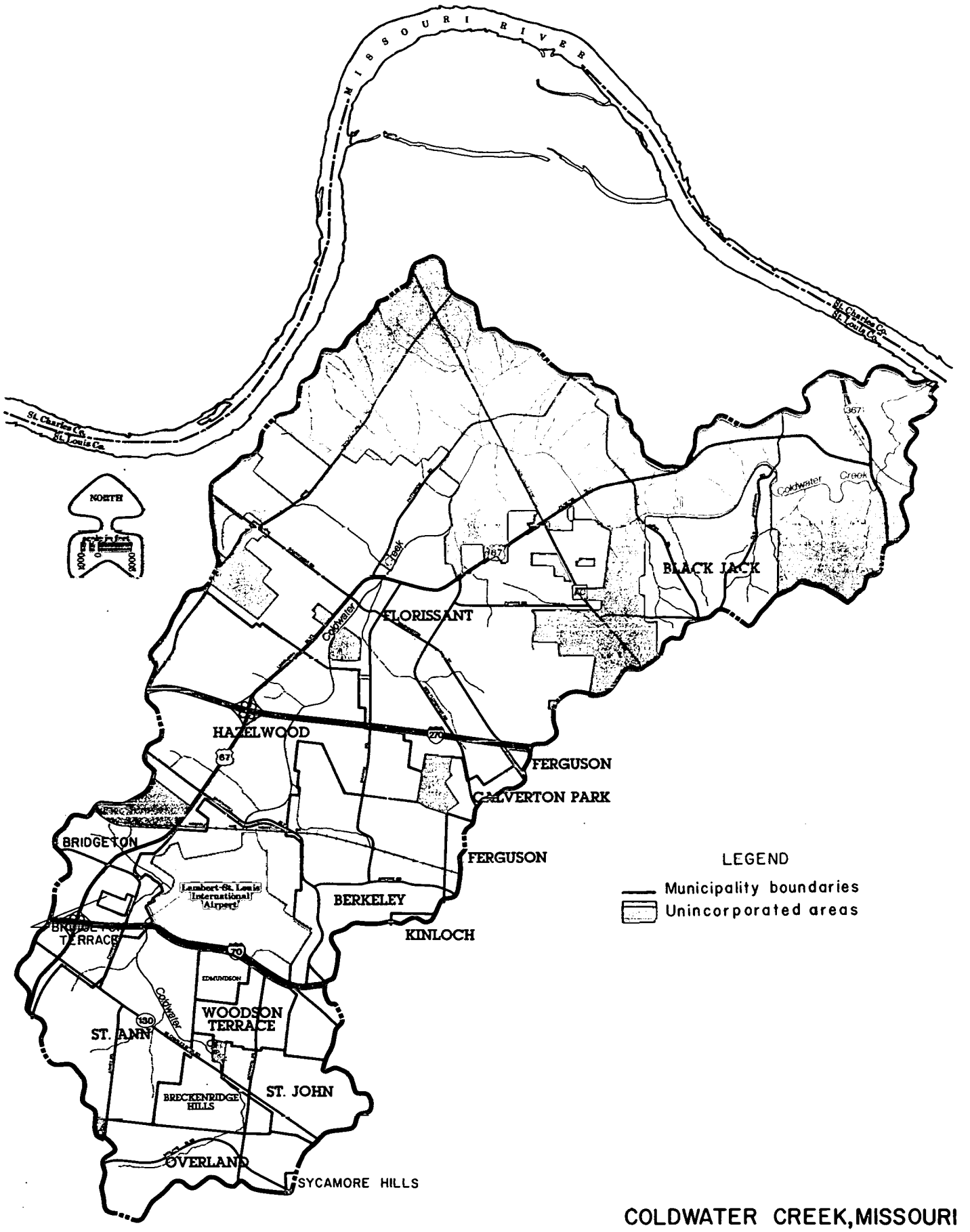
CC-1 LIMITS OF STREAM SEGMENTS

COLDWATER CREEK, MISSOURI

STUDY AREA
EXISTING CHANNELS
STREAM SEGMENTS

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

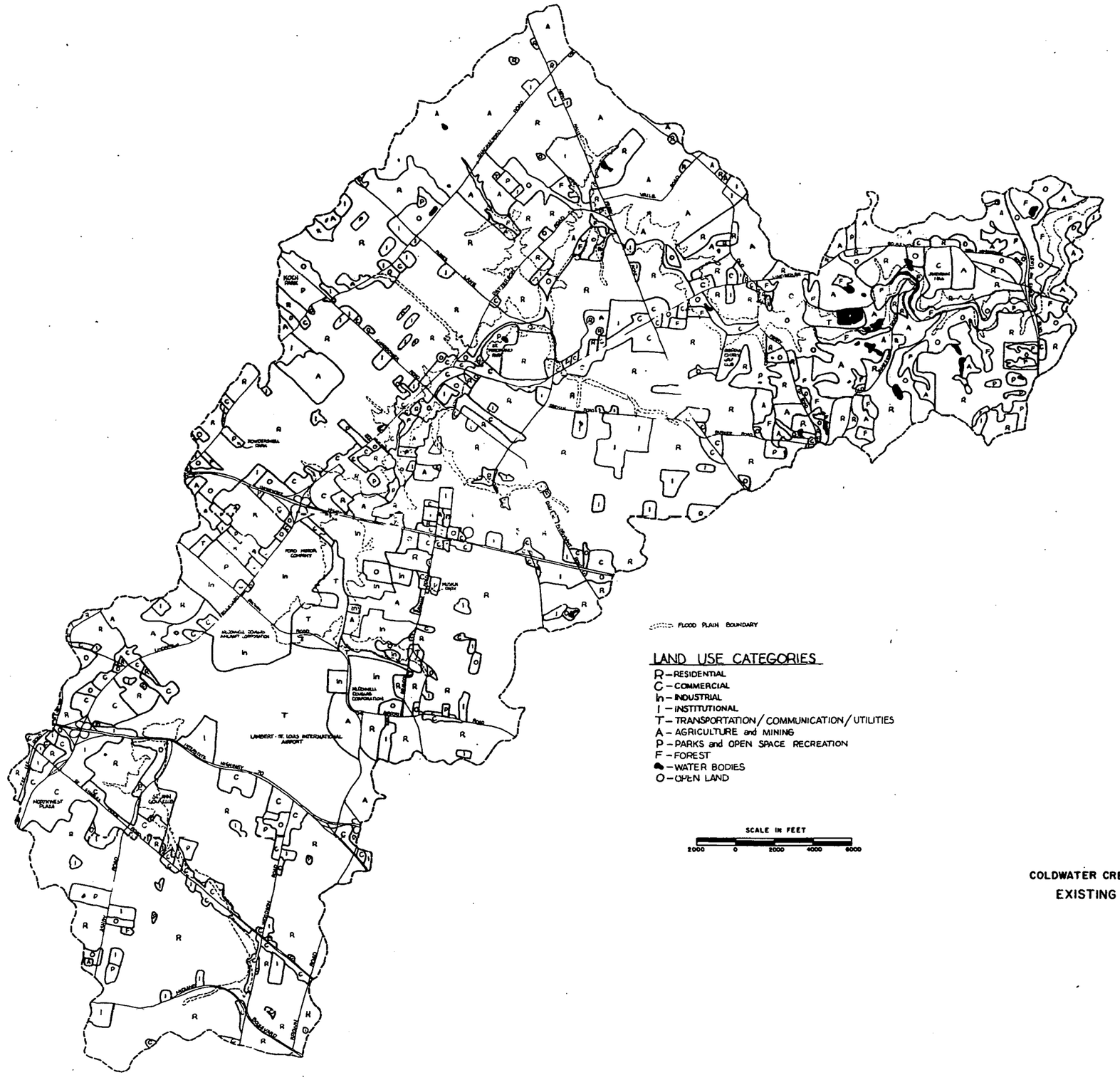
PLATE I



COLDWATER CREEK, MISSOURI MUNICIPALITIES

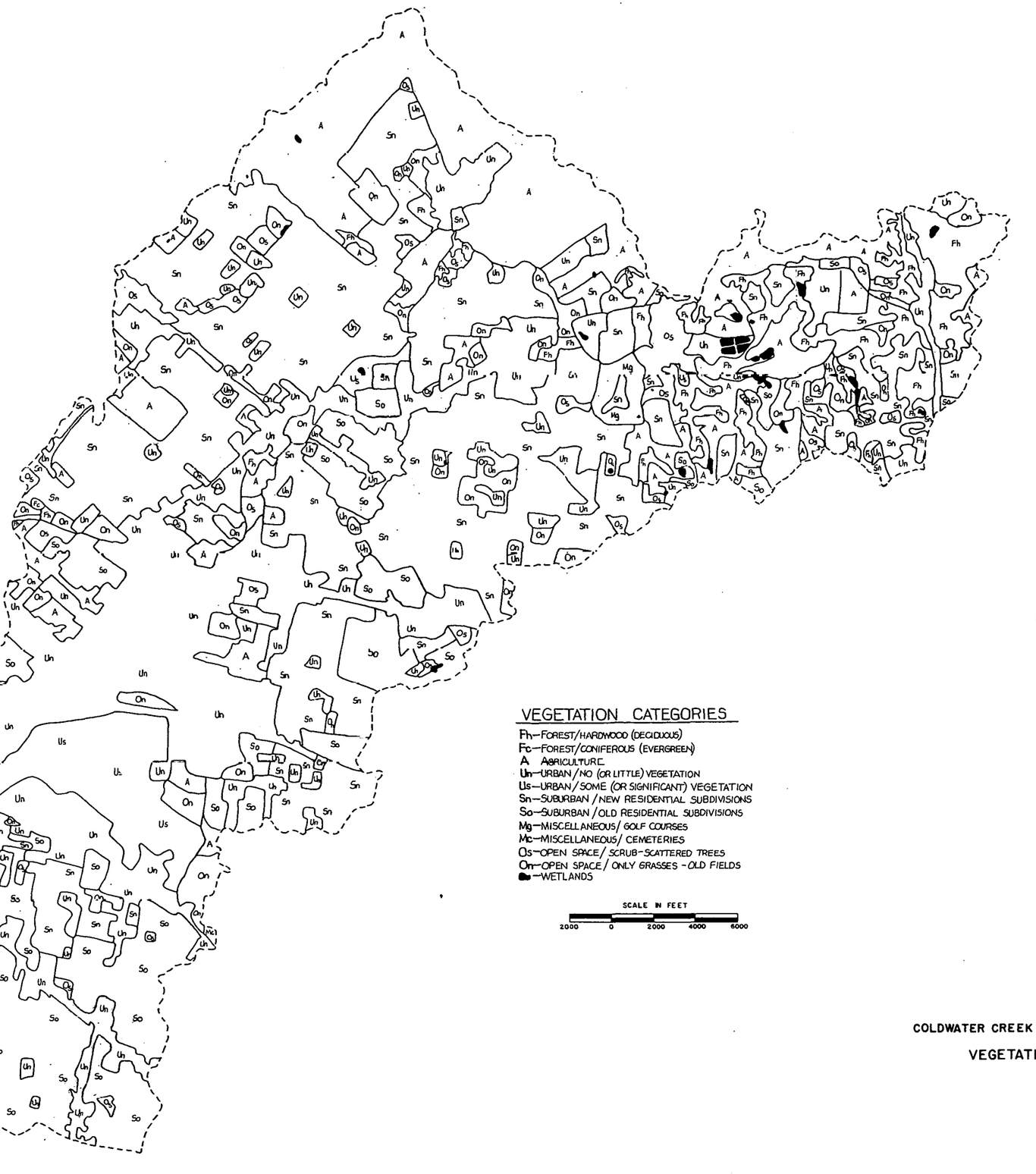
EAST-WEST GATEWAY COORDINATING COUNCIL

PLATE 2



COLDWATER CREEK WATERSHED
EXISTING LAND USE

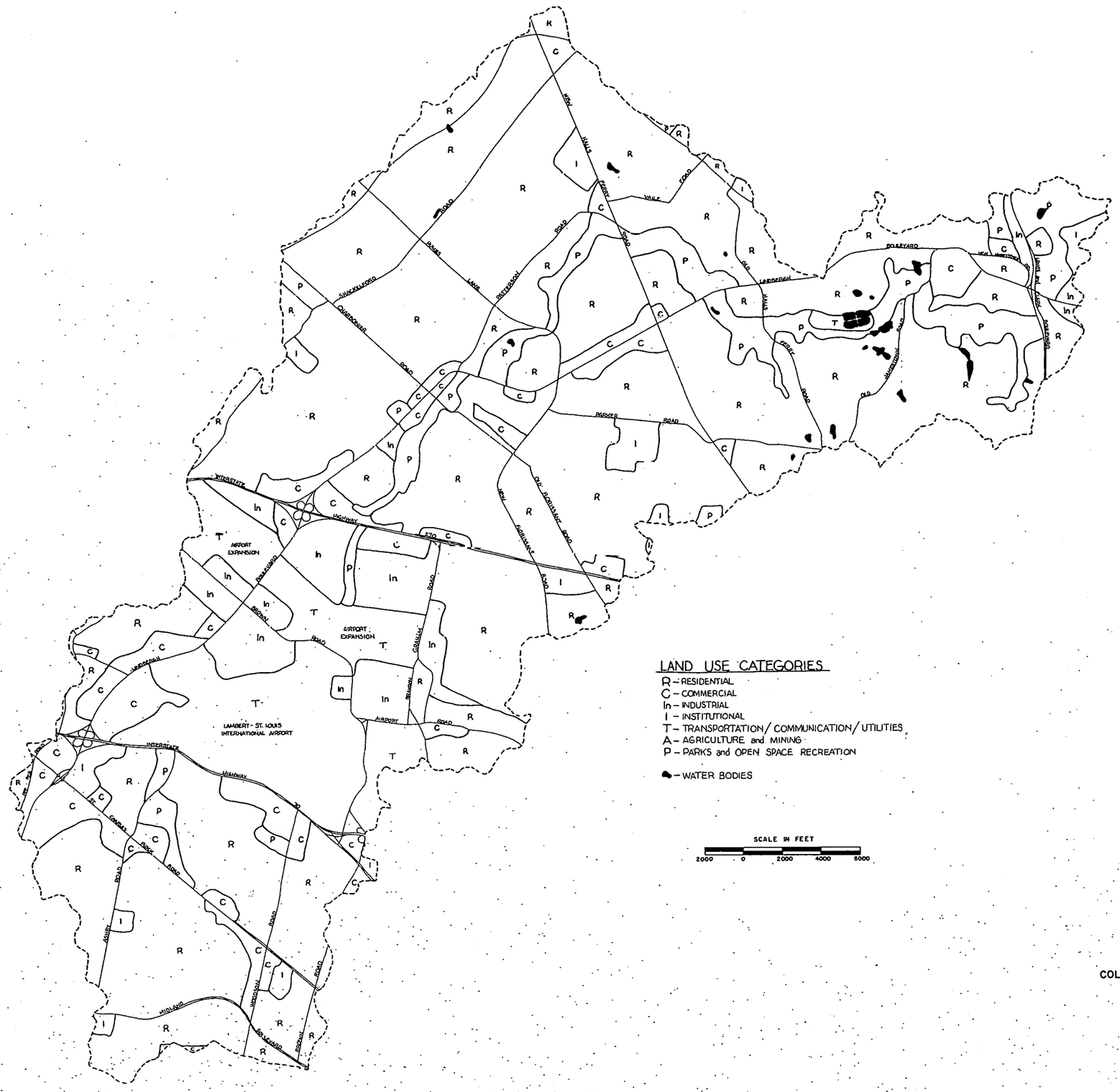
PLATE 3



COLDWATER CREEK WATERSHED

VEGETATION

PLATE 4



LAND USE CATEGORIES

R – RESIDENTIAL
C – COMMERCIAL
In – INDUSTRIAL
I – INSTITUTIONAL
T – TRANSPORTATION / COMMUNICATION / UTILITIES
A – AGRICULTURE and MINING
P – PARKS and OPEN SPACE RECREATION

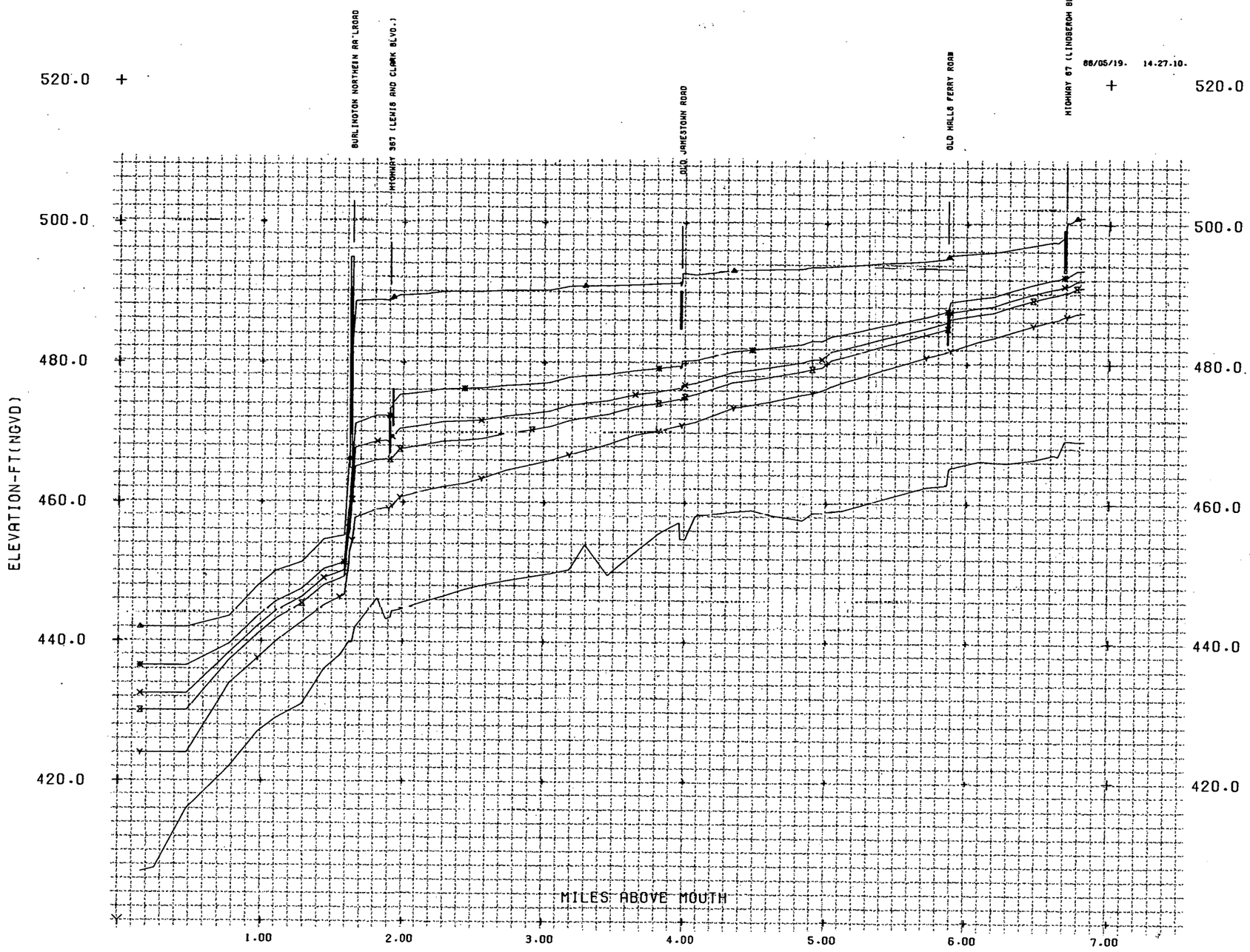
– WATER BODIES

SCALE IN FEET
2000 0 2000 4000 6000

COLDWATER CREEK WATERSHED

PROJECTED LAND USE

PLATE 5

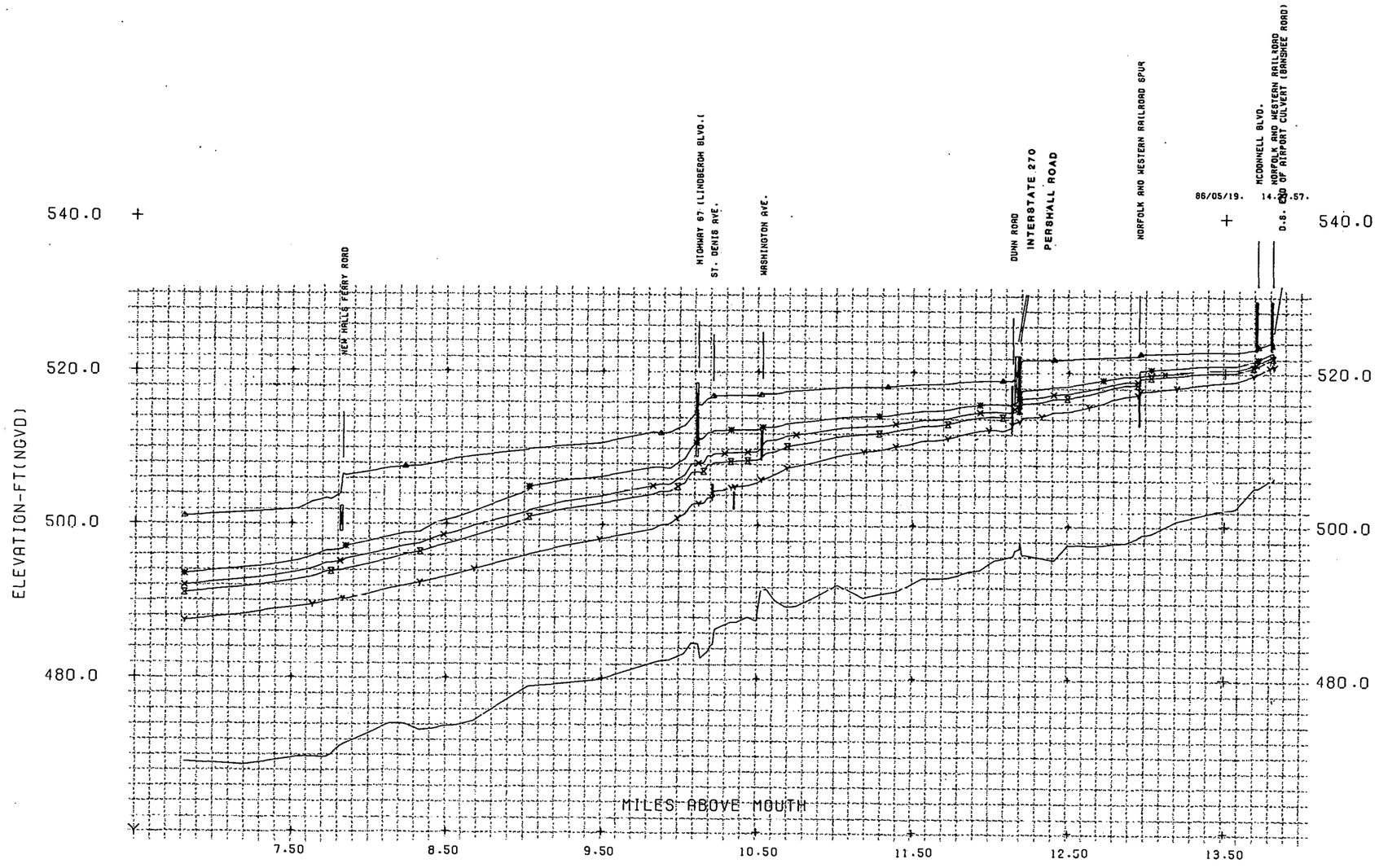


LEGEND

- △ STANDARD PROJECT FLOOD
- ✱ 1% PROBABILITY FLOOD
- × 4% PROBABILITY FLOOD
- ⧗ 10% PROBABILITY FLOOD
- Y 50% PROBABILITY FLOOD

WATER SURFACE PROFILES
COLDWATER CREEK
FUTURE CONDITIONS WITHOUT PROJECT

PLATE 0

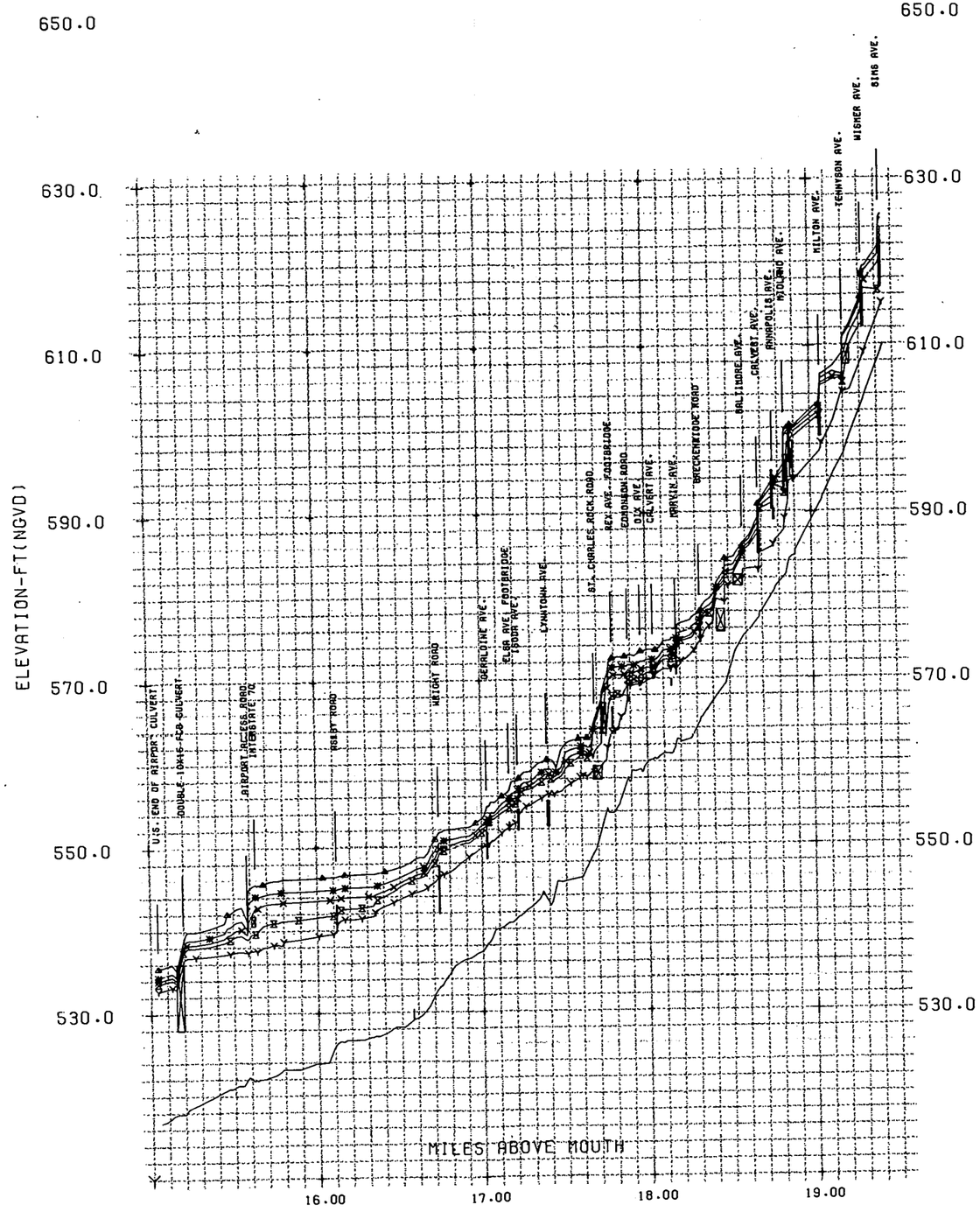


LEGEND

- △ STANDARD PROJECT FLOOD
- ✱ 1% PROBABILITY FLOOD
- × 4% PROBABILITY FLOOD
- ⧖ 10% PROBABILITY FLOOD
- Y 50% PROBABILITY FLOOD

WATER SURFACE PROFILES
COLDWATER CREEK
FUTURE CONDITIONS WITHOUT PROJECT

PLATE 7



LEGEND

- △ STANDARD PROJECT FLOOD
- ✱ 1% PROBABILITY FLOOD
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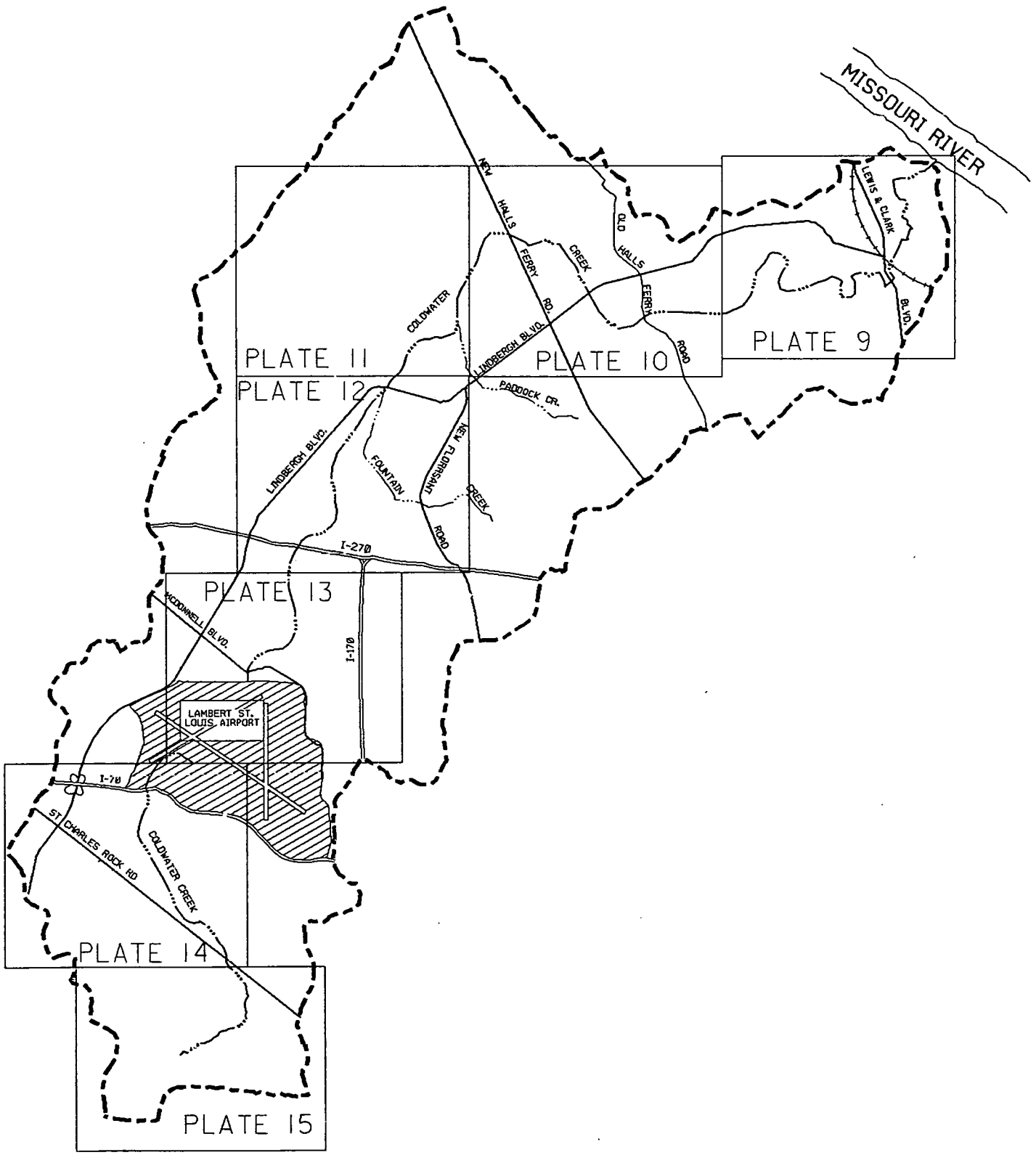
- Y 50% PROBABILITY FLOOD

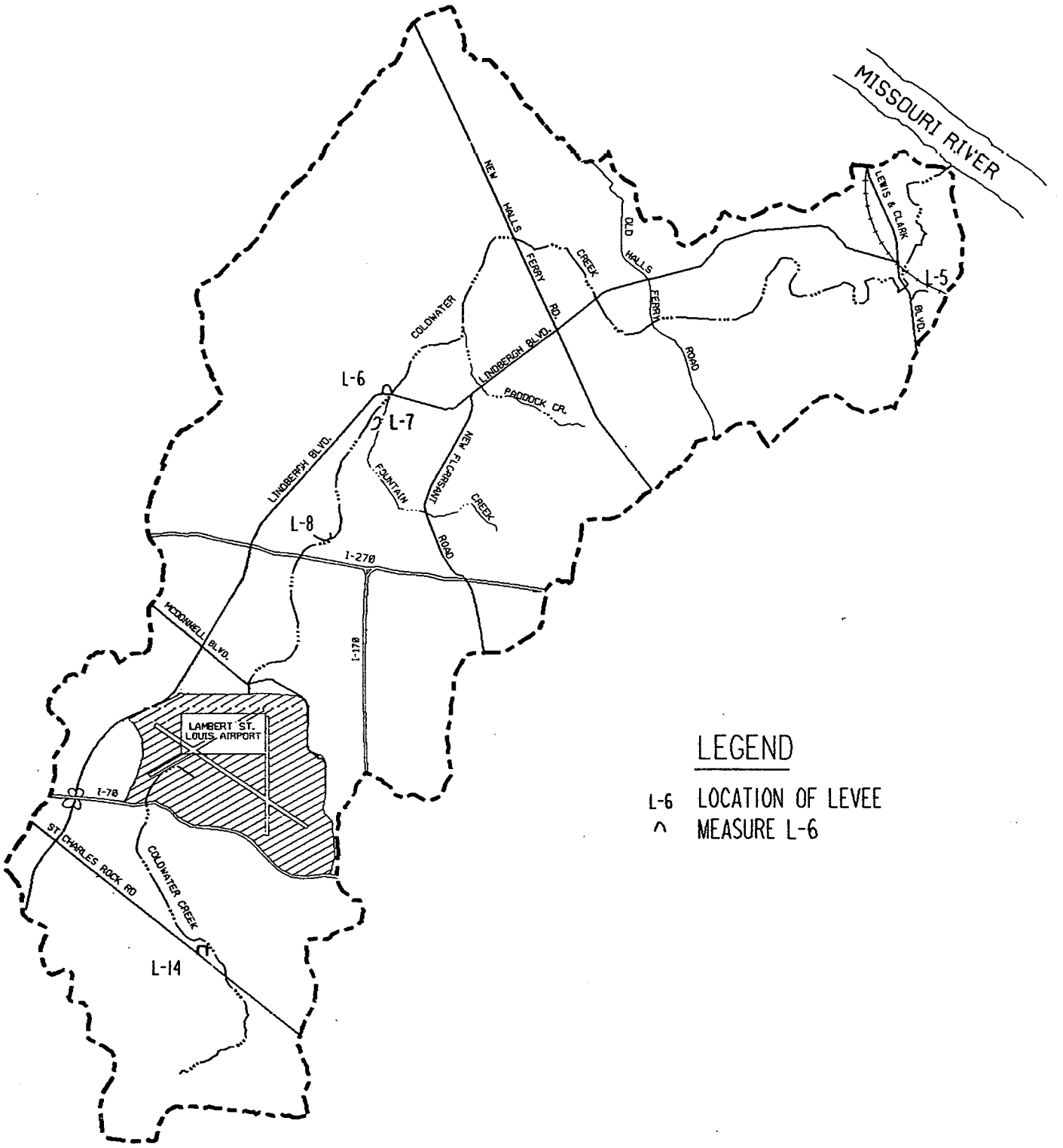
WATER SURFACE PROFILES
COLDWATER CREEK
FUTURE CONDITIONS WITHOUT PROJECT

PLATE 8



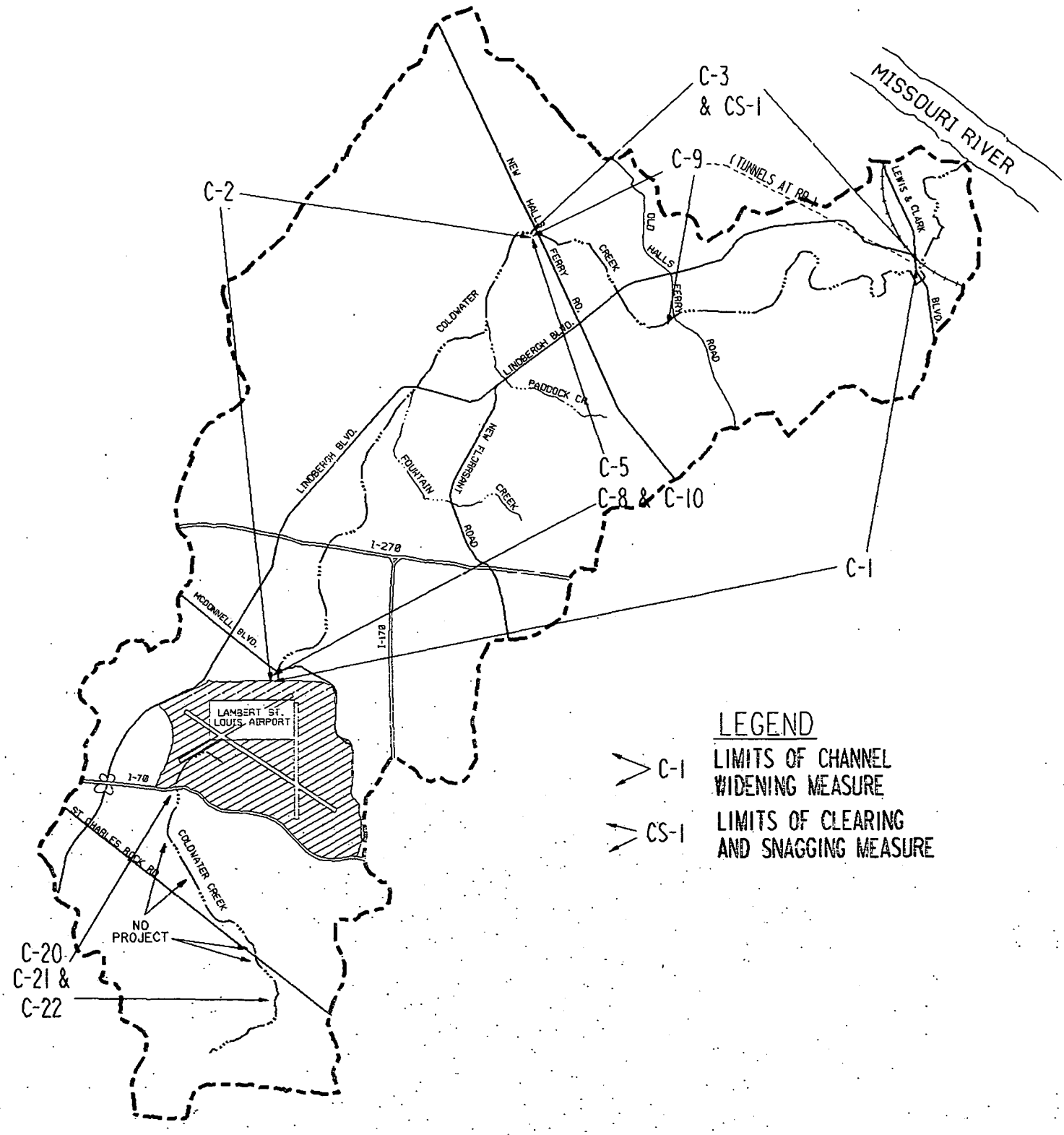
COLDWATER CREEK, MISSOURI
PLATE INDEX

PLATE 8A



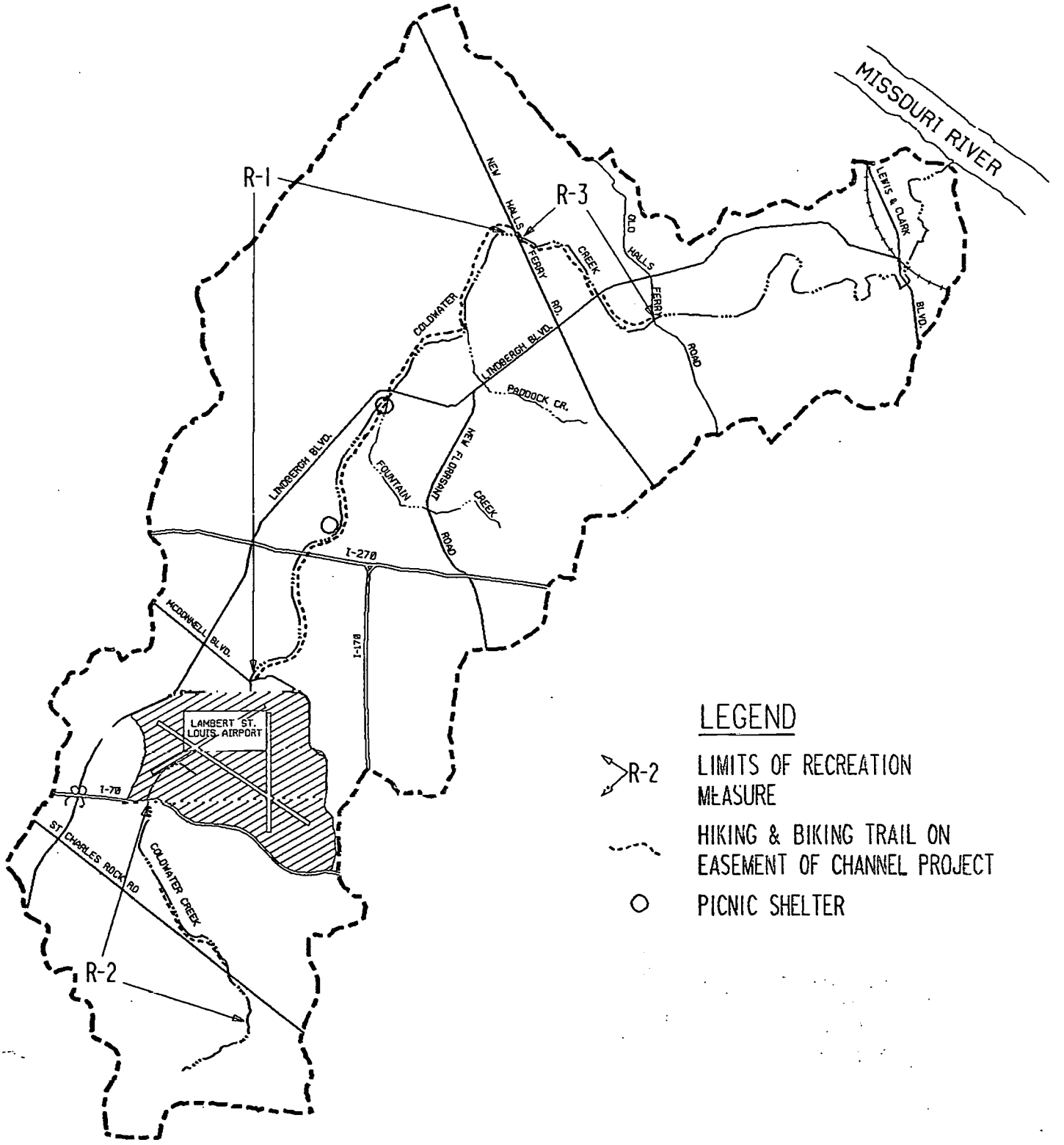
COLDWATER CREEK, MISSOURI
SMALL LEVEE MEASURES

PLATE 16



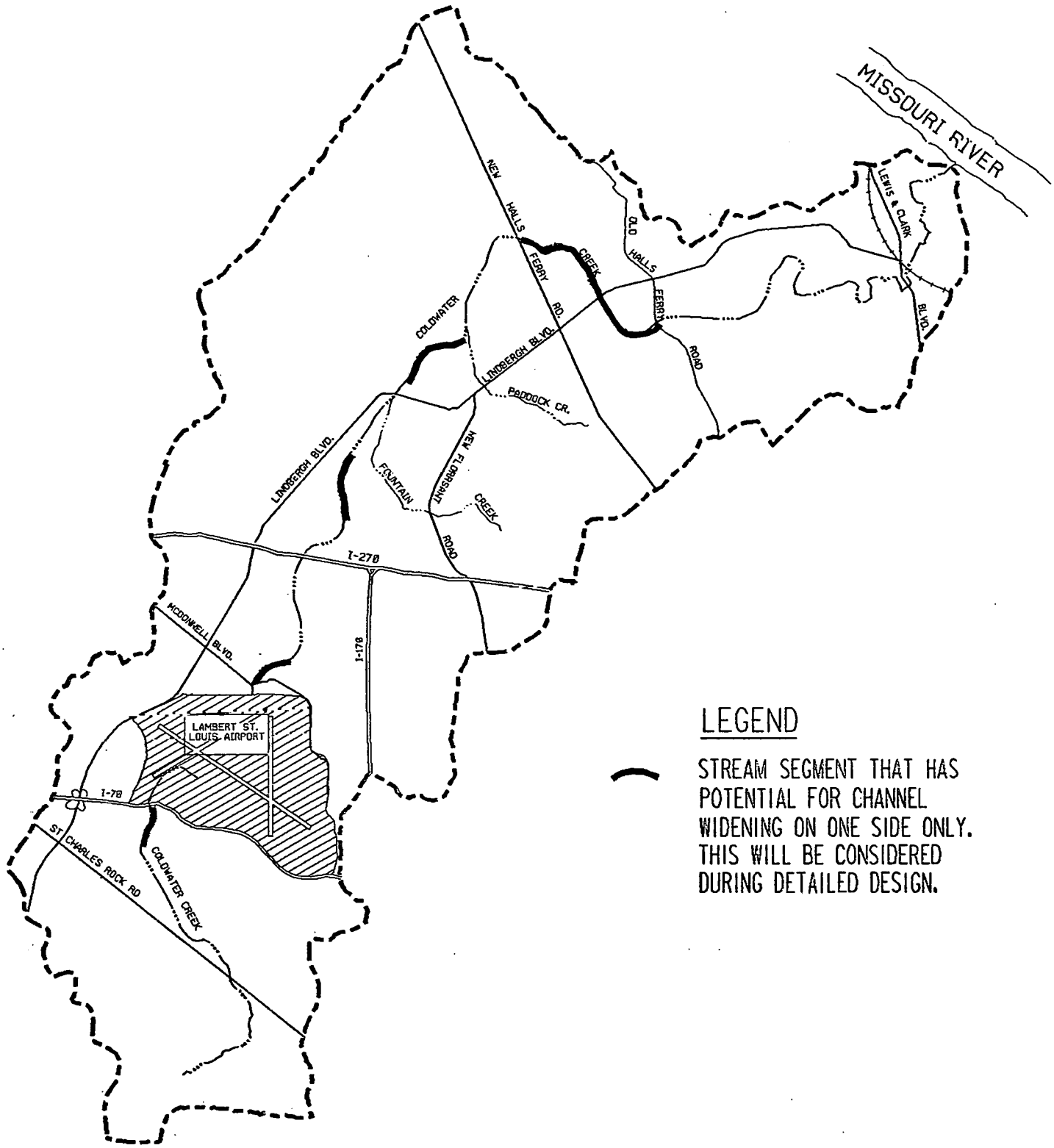
COLDWATER CREEK, MISSOURI
CHANNEL WIDENING MEASURES & CLEARING AND SNAGGING

PLATE 18



COLDWATER CREEK, MISSOURI.
RECREATION MEASURES

PLATE 19

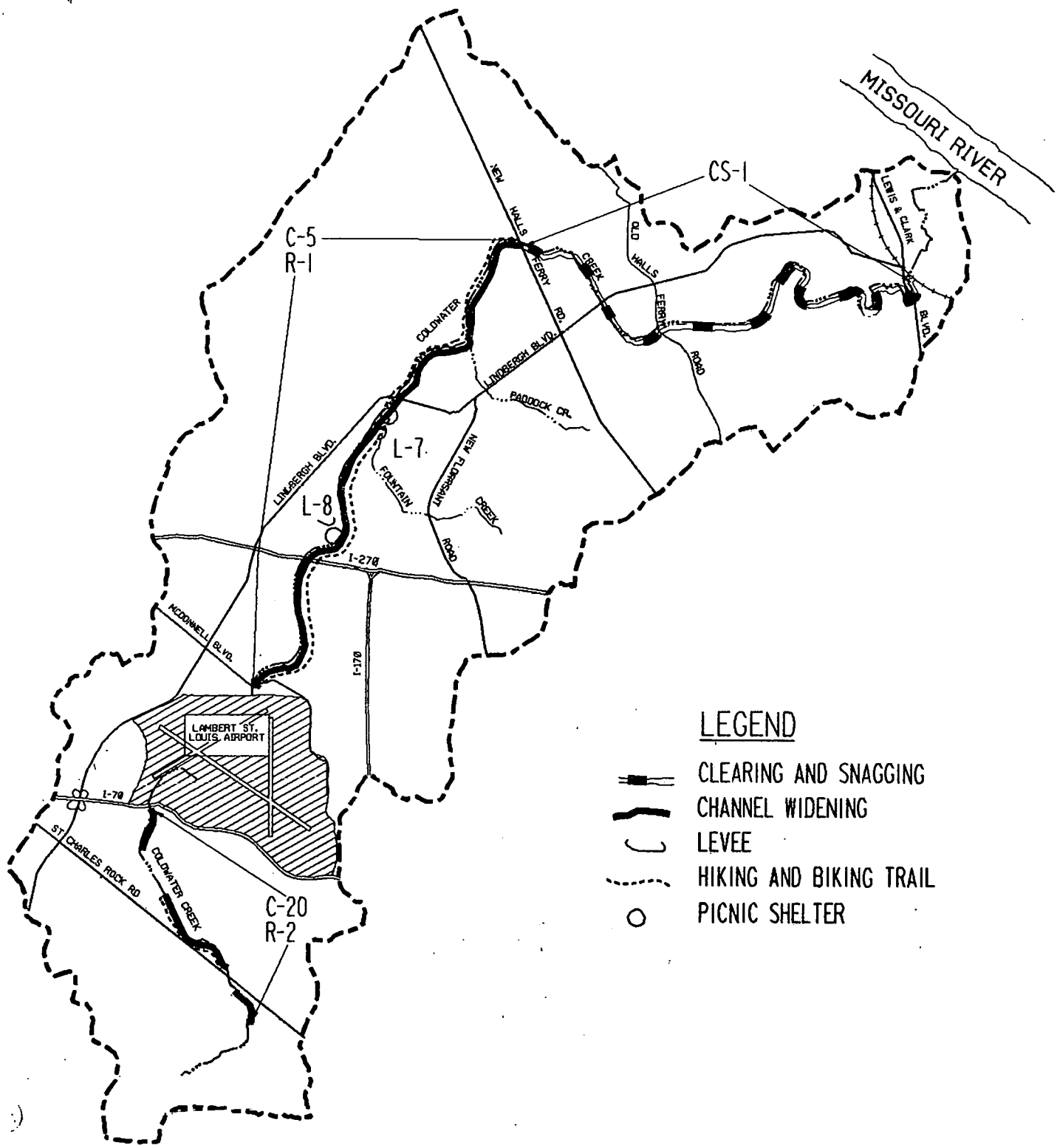


LEGEND

STREAM SEGMENT THAT HAS POTENTIAL FOR CHANNEL WIDENING ON ONE SIDE ONLY. THIS WILL BE CONSIDERED DURING DETAILED DESIGN.

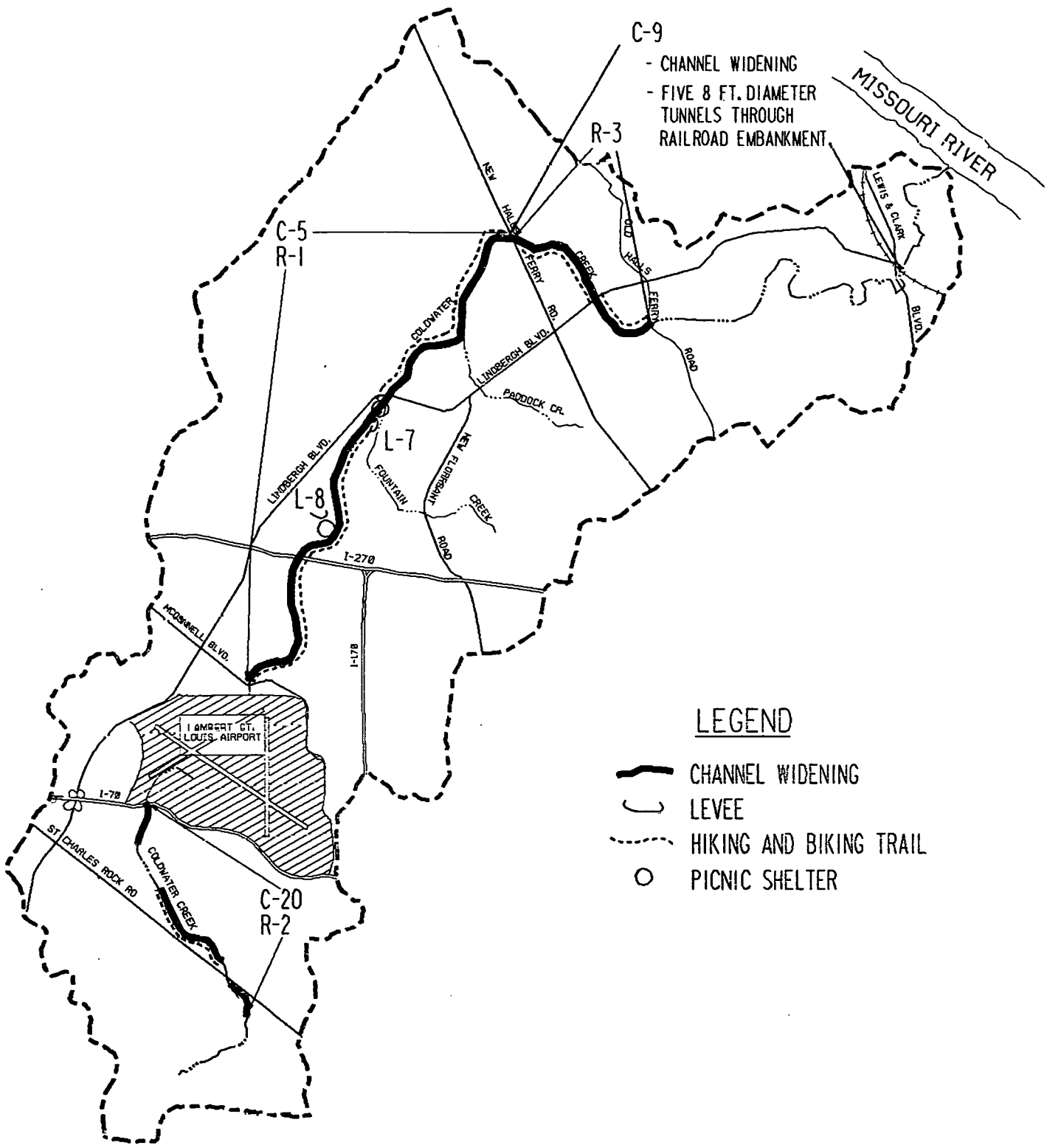
COLDWATER CREEK, MISSOURI
ENVIRONMENTAL MEASURES

PLATE 20



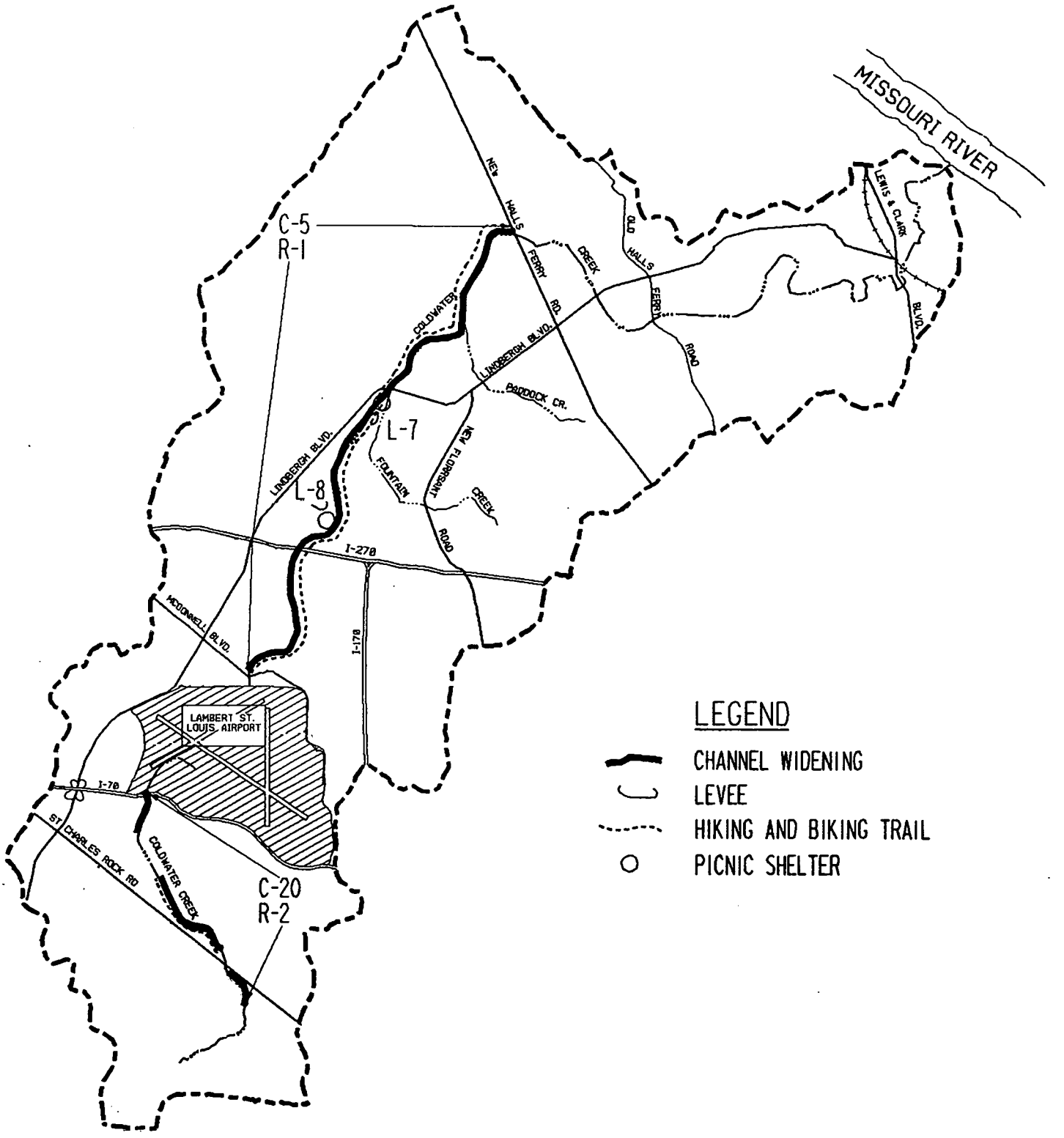
COLDWATER CREEK, MISSOURI
PLAN I

PLATE 21



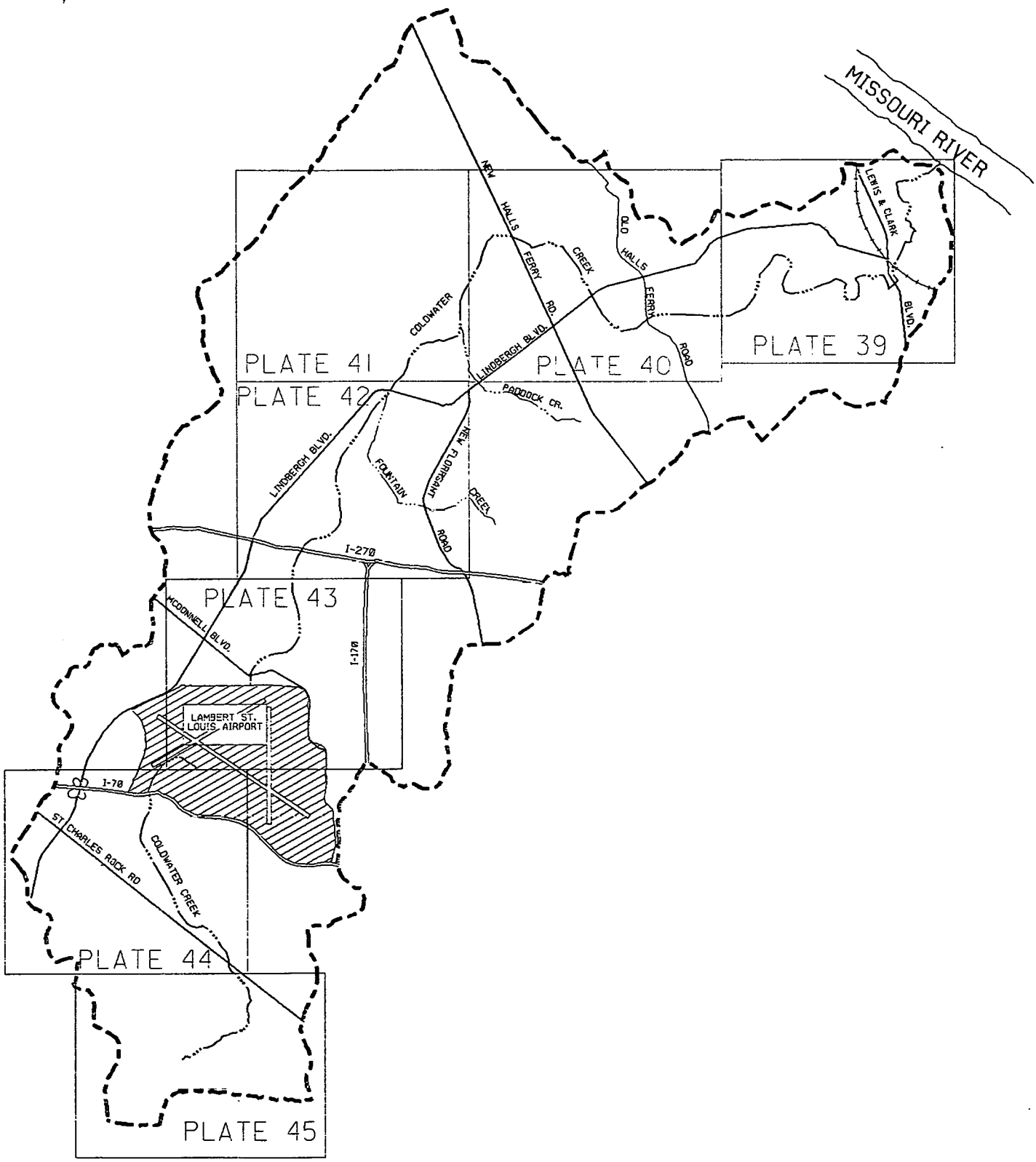
COLDWATER CREEK, MISSOURI
PLAN 2

PLATE 22



COLDWATER CREEK, MISSOURI
PLAN 3

PLATE 23



COLDWATER CREEK, MISSOURI
PLATE INDEX

PLATE 38A

TENTATIVE REVIEW, DESIGN AND CONSTRUCTION SCHEDULES
CORPS FLOOD CONTROL PROJECT FOR COLDWATER CREEK
DEPARTMENT OF ENERGY REMEDIAL ACTION PROGRAM

PLATE 46

United States Senate

Committee on Public Works

COMMITTEE RESOLUTION

RESOLVED BY THE COMMITTEE ON PUBLIC WORKS OF THE UNITED STATES SENATE, That the Board of Engineers for Rivers and Harbors, created under Section 3 of the River and Harbor Act approved June 13, 1902, be, and is hereby requested to review the report of the Chief of Engineers on the Mississippi River at St. Louis, Missouri, published as Senate Document Numbered 57, Eighty-fourth Congress, and other pertinent reports, with a view to determining whether any modifications of the recommendations contained therein are advisable at this time, with particular reference to providing improvements in the interest of flood control and other water and related land resource purposes, on tributary streams within the Metropolitan St. Louis Sewer District, St. Louis and vicinity, Missouri.

Adopted: July 15, 1970 /S/ _____
Jennings Randolph Chairman

(At the request of Senators Stuart Symington and Thomas F. Eagleton of Missouri)

United States Senate

Committee on Public Works

COMMITTEE RESOLUTION

RESOLVED BY THE COMMITTEE ON PUBLIC WORKS OF THE UNITED STATES SENATE, That the Board of Engineers for Rivers and Harbors, created under Section 3 of the River and Harbor Act approved June 13, 1902, be, and is hereby requested to review the report of the Chief of Engineers on the Mississippi River at St. Louis, Missouri, published as Senate Document Numbered 57, Eighty-fourth Congress, and other pertinent reports, with a view to determining whether any modifications of the recommendations contained therein are advisable at this time, with particular reference to providing improvements in the interest of flood control on tributary streams within the Metropolitan St. Louis Sewer District, St. Louis and vicinity, Missouri.

Adopted: October 4, 1966 /S/ _____
Jennings Randolph Chairman

(At the request of Senators Stuart Symington and Edward V. Long of Missouri)

Committee on Public Works

U.S. HOUSE OF REPRESENTATIVES

Washington, D.C. 20515

RESOLUTION

Resolved by the Committee on Public Works of the House of Representatives, United States, that the Board of Engineers for Rivers and Harbors, created under Section 3 of the River and Harbor Act approved June 13, 1902, be, and is hereby requested to review the report of the Chief of Engineers on the Mississippi River at St. Louis, Missouri, published as Senate Document Numbered 57, Eighty-fourth Congress, and other pertinent reports, with a view to determining whether any modifications of the recommendations contained therein are advisable at this time, with particular reference to providing a plan for the development, utilization, and conservation of water and related land resources of St. Louis County and the City of St. Louis, Missouri, including, but not limited to, consideration of the needs for flood control, wise use of flood plains lands, wastewater management facilities, regional water supply, water quality control, recreation, fish and wildlife conservation, and other measures for enhancement and protection of the environment on streams tributary to the Meramec, Missouri, and Mississippi Rivers.

Adopted: July 29, 1971

Attest: /S/ John A. Blatnik

Requested by: Hon. Ichord, Hon. Symington, Hon. Hungate

United States Senate

Committee on Public Works

COMMITTEE RESOLUTION

RESOLVED BY THE COMMITTEE ON PUBLIC WORKS OF THE UNITED STATES SENATE, that the Board of Engineers for Rivers and Harbors, created under Section 3 of the River and Harbor Act approved June 13, 1902, be, and is hereby requested to review the report of the Chief of Engineers on the Mississippi River between Coon Rapids Dam and the mouth of the Ohio River, published as House Document Numbered 669, Seventy-sixth Congress, third session, and other pertinent reports, with a view to determining whether any modifications of the recommendations contained therein are available at this time, with particular reference to providing a plan for the development, utilization, and conservation of water and related land resources of the metropolitan area of St. Louis, Missouri, with due consideration for the metropolitan planning activities in the area consisting of Franklin, Jefferson, St. Charles, and St. Louis Counties and the city of St. Louis in Missouri, and Madison, Monroe, and St. Clair Counties in Illinois. Such study to include, but not be limited to, consideration of the needs for flood control, wise use of flood plain lands, wastewater management facilities, including stormwater runoff, regional water supply, water quality control, recreation, fish and

wildlife conservation, protection and enhancement of esthetic qualities, and other measures for enhancement and protection of the environment on streams in the metropolitan area. Investigation to be conducted in cooperation with the East-West Gateway Coordinating Council, the States of Missouri and Illinois, local governmental entities, and other interested Federal, State, and local agencies, as appropriate.

Adopted: October 2, 1972 /S/ _____
Jennings Randolph Chairman

(At the request of Senators Symington and Eagleton of Missouri and Senators Percy and Stevenson of Illinois)

Committee on Public Works

U.S. HOUSE OF REPESENTATIVES

Washington, D.C. 20515

RESOLUTION

Resolved by the Committee on Public Works of the House of Representatives, United States, that the Board of Engineers for Rivers and Harbors, created under Section 3 of the River and Harbor Act approved June 13, 1902, be, and is hereby requested to review the report of the Chief of Engineers on the Mississippi River between Coon Rapids Dam and the mouth of the Ohio River, published as House Document Numbered 669, 76th Congress, 3rd Session, and other pertinent reports, with a view to determining whether any modifications of the recommendations contained therein are advisable at this time, with particular reference to providing a plan for the development, utilization, and conservation of water and related land resources of the metropolitan area of St. Louis, Missouri, with due consideration for the metropolitan planning activities in the area consisting of Franklin, Jefferson, St. Charles, and St. Louis Counties and the city of St. Louis in Missouri, and Madison, Monroe, and St. Clair Counties in Illinois. Such a study to include, but not be limited to, consideration of the needs for flood control, wise use of flood plain lands, wastewater management

facilities, including stormwater runoff, regional water supply, water quality control, recreation, fish and wildlife conservation, protection and enhancement of esthetic qualities, and other measures for enhancement and protection of the environment on streams in the metropolitan area. Investigation to be conducted in cooperation with the East-West Gateway Coordination Council, the States of Missouri and Illinois, local governmental entities, and other interested Federal, State, and local agencies, as appropriate.

Adpoted: October 12, 1972

Attest: /S/ _____
John A. Blatnik, M.C.
Chairman

Requested by: Hon. Melvin Price

APPENDIX B

CLEAN WATER ACT, SECTION 404(b) EVALUATION

A FLOOD CONTROL PROJECT ON COLDWATER CREEK
ST. LOUIS COUNTY, MISSOURI

SECTION 404 (b) EVALUATION REPORT ON THE EFFECTS OF THE DISCHARGE OF DREDGE AND FILL MATERIAL INTO WATERS OF THE UNITED STATES
(USING 24 DECEMBER 1980 GUIDELINES, 40CFR230)

1. INTRODUCTION.

The proposed construction of a widened channel on Coldwater Creek, St. Louis, Missouri, will involve placement of fill materials into waters of the United States. Section 404 of the Clean Water Act established a permit program for the purpose of regulating discharges of dredged and fill material into such waters. Under Section 404(b) of the Act, proposed discharges of dredged and fill material must conform to guidelines which are to be developed by the Administrator, Environmental Protection Agency. On 5 September 1975 in accordance with Section 404(b), the Environmental Protection Agency published regulations, 40 CFR 230, which outlines criteria and procedures for evaluating activities subject to Section 404. On 24 December 1980 revised Section 404(b) guidelines were published which became effective 30 March 1981. It is mandatory that the guidance be applied to all proposed discharges of dredged and fill material subject to approval under Section 404. This evaluation report discusses those features of the project that require regulation under Section 404 of the Clean Water Act. This is a planning level Section 404 evaluation. It is not being included to seek an exemption under the provisions of Section 404(r).

II. PROJECT DESCRIPTION.

A. Location. The Coldwater Creek basin lies in the northern part of St. Louis County, Missouri. The 47 square mile watershed has an elongated shape, with a 19.5 mile long main channel and relatively short tributary streams (see PLATE 1). Coldwater Creek generally flows in a northerly direction from its origin in Overland to a point north of Florissant and then eastward to its confluence with the Missouri River at mile 6.9 on the Missouri. The stream flows through Overland, Breckenridge Hills, and St. Ann, and under Lambert-St. Louis International Airport. It then passes through Hazelwood, Florissant and unincorporated St. Louis County and along the Northern edge of Black Jack before joining the Missouri River. Between the airport and Interstate 270 there is radioactive contamination in some of the sediments in the main channel. The U.S. Department of Energy is planning to remove the radioactive material that is a health threat prior to Corps construction in the area. For more information, see the Coldwater Creek, Missouri Feasibility Report and Environmental Impact Statement.

B. General Description. The proposal includes ten miles of channel widening along the main channel of Coldwater Creek. Generally, the channel banks will be layed back to a slope of 1 vertical to 2 horizontal. Rip-rap will be placed at the toe of the slopes in all segments of the flood control project except in two areas. No rip-rap is proposed for the St. Ann Park

area. In addition, no rip-rap would be required in a 960 foot long stream segment with its upstream end at Paddock Creek which would have verticle concrete walls halfway up the sides of the channel. Concrete would also be placed at 6 bridge crossings. The purpose of the rip-rap is to prevent erosion and stabilize the channel banks.

Approximately 70.8 acres of riparian vegetation will be cleared as part of the project. Detailed impacts of the portion of the project that is outside the jurisdiction of Section 404 is discussed in Sections 3.2.5 and 4.5 of the Feasibility Report. The U.S. Fish and Wildlife Service Draft Fish and Wildlife Coordination Act Report is included in Appendix D of the Feasibility Report.

C. Authority and Purpose. The Coldwater Creek, Missouri study was authorized by the United States Congress as part of the St. Louis Metropolitan Area, Missouri and Illinois study. Study authorities that apply to Coldwater Creek include United States Senate Public Works Committee Resolutions dated October 4, 1966, July 15, 1970, and October 2, 1972, and United States House of Representatives Public Works Committee Resolutions dated July 29, 1971 and October 12, 1972. The Coldwater Creek study was initiated in October 1980, upon receipt of specific Congressional funding for the study. It is an iterim response to the resolutions listed above.

The purpose of this study is to determine the feasibility of flood damage reduction and related improvements in the Coldwater Creek watershed in St. Louis County, Missouri. The primary focus of the study is flooding problems. It also addresses streambank erosion problems, outdoor recreation opportunities, and environmental quality concerns, as they relate to potential flood damage reduction improvements.

D. General Description of Dredged or Fill Material.

1. General Characteristics of Material (grain size, soil type). The rip rap is composed of approximately 7" diameter quarried rock with 1 1/2" rock for bedding.

2. Quantity of Material (cubic yards):

Creek Miles	Rip Rap	Concrete
5.86 - 7.83	7,000 cu. yd	242 cu. yd.
7.83 - 13.70	21,000	1,615
15.58 - 15.99	1,000	---
16.48 - 17.68	5,600	---
17.75 - 18.30	1,200	---
Total	36,000 cu. yd.	1,857 cu. yd.

3. Source of Material. Stone for riprap will come from nearby quarries. Concrete will come from local commercial sources.

E. Description of Proposed Discharge Sites.

1. Location. The placement sites will be the bottom of the improved Coldwater Creek channels between the following creek miles (see PLATE 22 and

PLATES 24-35): 5.86-13.70, 15.58-15.99, 16.48-17.68, 17.75-18.30. Concrete will be placed along a 950-foot segment with its upstream end at Paddock Creek as well as at the following bridge crossings: Lindsay Avenue, Lindbergh Boulevard, New Halls Ferry Road, Wright St., Geraldine St., and Isolda St.

2. Size. Approximately 17 acres along 10 linear miles of creek bottom will be covered by riprap. Approximately 29,500 sq. ft. of creek bottom will be covered by concrete at each of six bridge crossings and along one portion of channel that is highly erodible.

3. Type of Site (confined, unconfined, open water). The site is totally unconfined. It is the improved stream bottom.

4. Type of Habitat. The riprap and concrete will be placed on the widened channel bottom.

5. Timing and Duration of Discharge. After a construction start is obtained, the project will take place over 4 years. Construction will not take place during winter or high flow periods.

The economic project life of this project is 100 years. The riprap and concrete are expected to last at least this long.

F. Description of Disposal Method (hydraulic, drag line, etc.). Riprap rock will be placed with a crane and bucket working from on top of the ditch. Concrete will be poured into forms in the creek bottom.

III. Factual Determinations.

A. Physical Substrate Determinations.

1. Substrate Elevation and Slope. The placement of riprap and poured concrete will permanently effect the elevation and composition of approximately 17 acres of the widened and shaped channel bottom of Coldwater Creek. The fill material will be about 2 feet thick.

2. Sediment Type. The new channel where the riprap and concrete will be placed is primarily lean clay.

3. Dredged/Fill Material Movement. Any movement of the riprap and concrete is expected to be minimal.

4. Physical Effects on Benthos. Channelization of the stream will destroy any benthic organisms present. The placement of the riprap and concrete will occur after the channel has been widened and shaped. The benthic community that presently exists is degraded, especially downstream from the St. Louis airport, due to poor water quality.

5. Actions Taken to Minimize Impacts. Since the benthic community that presently exists in Coldwater Creek is extremely degraded due to poor water quality and since the water quality is not expected to improve, no actions are necessary.

B. Water Circulation, Fluctuation and Salinity Determinations.

1. Water.

a. Salinity - Not applicable.

b. Water Chemistry. The proposed fill materials are not expected to produce an adverse effect on the chemical properties of the water column.

c. Clarity, Color, Odor, Taste. These parameters will experience short term impairment during construction; however, the materials deposited in the creek are clean rock and cement and will not change any of these parameters.

d. Dissolved Gas Levels and Nutrients. The fill material contains no organic material and should not impact these parameters.

e. Eutrophication. A decrease in eutrophication should occur since the fill material will prevent erosion.

2. Current Patterns and Circulation.

a. Current Patterns and Flow - No significant impact.

b. Velocity - Slightly reduced.

c. Stratification - Not applicable.

d. Hydrologic Regime. No significant impact.

3. Normal Water Level Fluctuations (tides, river stage, etc.). No significant impact.

4. Salinity Gradients. Not applicable.

5. Actions that will be taken to Minimize Impacts. Since no major impacts are expected, no additional actions will be taken.

C. Suspended Particulate/Turbidity Determinations.

1. Expected changes in Suspended Particulates and Turbidity Levels in Vicinity of Disposal Site. Minor, temporary increases should occur during construction. Turbidity should decrease after the project is completed because of reduced erosion.

2. Effects (degree and duration) on Chemical and Physical Properties of the Water Columns.

a. Light Penetration. Increased turbidity during construction will decrease light penetration temporarily.

b. Dissolved Oxygen. No significant impact.

c. Toxic Metals, Organics, and Pathogens. The fill materials do not contain either toxic metals, organic materials, or pathogens.

d. Aesthetics. After construction, the fill material will decrease erosion and should improve the clarity of the water.

3. Effects on Biota. It should be noted that the existing, extremely degraded aquatic community will be destroyed by the stream channelization prior to placement of fill material.

a. Primary Production, Photosynthesis. Minor, temporary reduction during construction.

b. Suspension/Filter Feeders. Minor, temporary impacts during construction.

c. Sight Feeders. Minor temporary impacts during construction.

4. Actions taken to Minimize Impacts. Since no major impacts are expected, no additional actions will be taken.

D. Contaminant Determinations. The fill materials placed in the creek will not be contaminated with pollutants.

E. Aquatic Ecosystem and Organism Determinations. It should be noted that the existing, extremely degraded aquatic community will be destroyed by the stream channelization prior to the placement of fill material.

1. Effects on Plankton. No significant impacts.

2. Effects on Benthos. No significant impacts.

3. Effects on Nekton. No significant impacts.

4. Effects on Aquatic Food Web. No significant impacts.

5. Effects on Special Aquatic Sites. No significant impacts.

6. Threatened and Endangered Species. According to the U.S. Fish and Wildlife Service, none are present in the project area.

7. Other Wildlife. Channelization of the stream prior to placement of fill material will destroy most wildlife values. Placement of riprap will eliminate potential bank dens for muskrats and beaver; however, the riprap rocks will provide preferred substrate for certain aquatic invertebrates that may colonize the area after construction.

8. Actions to Minimize Impacts. Since no major impacts are expected, no additional actions will be taken.

F. Proposed Disposal Site Determinations.

1. Mixing Zone Determinations. A mixing zone should not be needed for this project since the fill materials, riprap, and concrete, will not mix with the water.

2. Compliance with Applicable Water Quality Standards. The proposed activities should not cause any violations of Missouri Water Quality Standards. All actions necessary to prevent water pollution, as required by the Missouri Department of Natural Resources, will be included in the plans and specifications.

3. Potential Effects on Human Use Characteristics.

a. Municipal and Private Water Supply. Not applicable.

b. Recreational and Commercial Fisheries. There are none present in the project area.

c. Water Related Recreation. The stream presently provides recreation for neighborhood children who play in the stream and adjacent vegetation. The project will provide a hiking/biking trail adjacent to the stream and improve public access.

d. Aesthetics. The fill material should improve aesthetics by reducing stream bank erosion.

e. Parks, National and Historical Monuments, National Seashores, Wilderness Areas, Research Sites and Similar Preserves. A few city parks are adjacent to Coldwater Creek. The placement of the fill materials will have no significant impacts on them.

G. Determination of Cumulative Effects on the Aquatic Ecosystem. As mentioned previously, the existing aquatic ecosystem is extremely degraded and will be destroyed by stream channelization prior to placement of fill materials. Therefore, no significant cumulative impacts are expected.

H. Determination of Secondary Effects on the Aquatic Ecosystem. There should be no significant secondary impacts on the aquatic ecosystem.

IV. Findings of Compliance with the Restrictions on Discharge of Dredged and Fill Material.

A. No significant adaptions of the guidelines were made relative to this evaluation.

B. Several alternative methods to channel widening for preventing flood damages were examined for the Coldwater Creek basin. These alternatives are discussed in the Integrated Planning Report and Environmental Impact Statement under "Flood Damage Reduction and Related Measures". The following measures were considered but were dropped because they lacked economic feasibility or had significant environmental or social impacts or engineering problems:

- Demolition or relocation of highly flood prone buildings.

- Flood proofing buildings.

- Detention dams.

- Clearing and Snagging.

Various alternative channel configurations and reaches were examined in addition to those selected. They are discussed in the cited section of the referenced report and are displayed in Tables 8-17. These measures were dismissed because they produced fewer net benefits than the selected measures.

C. The proposed construction activities for placing the riprap and concrete in Coldwater Creek should not result in any violations of the Missouri Water Quality Standards. These activities will be reviewed and evaluated by the Missouri Department of Natural Resources before the issuance of a 401 Water Quality Certification for this project.

D. The proposed placement of fill material will not harm any endangered or threatened species or their critical habitats.

E. The proposed disposal of fill material will not result in significant adverse effects on human health and welfare, including municipal and private water supplies, recreation and commercial fishing, plankton, fish, shellfish, wildlife, and special aquatic sites. The life stages of aquatic life and other wildlife will not be adversely affected. Significant adverse effects on aquatic ecosystem diversity, productivity and stability, and recreational, aesthetic and economic values will not occur.

F. Since no significant impacts are expected to occur to the aquatic ecosystem, no additional measures are needed.

G. On the basis of the guidelines the proposed disposal site for the discharge of fill material is specified as complying with the requirements of these guidelines.

DANIEL M. WILSON
COL, CE
Commanding

APPENDIX C

PUBLIC VIEWS AND RESPONSES

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Summary of the 13 January 1987 Public Meeting
on the Corps of Engineers' Flood Control Feasibility Study
For Coldwater Creek, Missouri

The meeting was held at the Florissant City Hall in Florissant, Missouri. Sixty-seven people attended the meeting, not including employees of the Corps of Engineers.

OPENING REMARKS - COLONEL DANIEL M. WILSON
DISTRICT ENGINEER
ST. LOUIS DISTRICT, CORPS OF ENGINEERS

For several years the Corps of Engineers has been involved in a study of the flooding related problems in the Coldwater Creek area. Many of you attended the Public Meeting that was held at the McCluer High School in November of 1985, and from our standpoint that Public Meeting was very productive. Its purpose was to give you an opportunity to comment on our plans as they were being developed, so that we could then take your comments and include them in our considerations as we proceeded with preparation of the plan. The October 1986 draft report describes the plan that we intend to recommend for authorization.

The two main purposes of this meeting are to describe the flood damage reduction plan for Coldwater Creek and to hear your comments on the plan. The results of this meeting will be reflected in the final report that will be ultimately submitted for approval and authorization.

The St. Louis District will complete the final feasibility report sometime within the next year. The report will be submitted to the Lower Mississippi Valley Division in Vicksburg, Mississippi. After a brief review there, it will be submitted to the Board of Engineering for Rivers and Harbors. Then it will go to the Office of the Chief of Engineers. At that time interested states and agencies will have an opportunity to make comments. Those comments will be incorporated into the Chief of Engineer's Report. That report is submitted to the Assistant Secretary of the Army for Civil Works. The report is coordinated with the Office of Management and Budget and then submitted to Congress. Once the report goes to Congress, we look for it to be included in a bill that would be passed as either an omnibus bill or a separate authorization. That bill goes to the President, and when he signs it, it becomes law. At that point, you have an authorized project.

After authorization, the detailed design must be completed and funds must be appropriated for the project. Then the project is constructed by the Corps. From the date of this meeting, it will probably be around five years before construction is initiated on the project.

Four things have to happen for a Corps of Engineers flood damage reduction project to be constructed, and this certainly applies in the case of Coldwater Creek. First of all, the project must be economically justified. That means that the benefits to be derived from the project must exceed the cost of putting the project in place. Our proposal for Coldwater Creek meets the economic justification requirement. Second, full consideration must be given to the environmental effects of the project and, again, we believe that we

have met that requirement. Third, the project must have a local sponsor. The local sponsor must be willing to share in the project construction costs and to operate and maintain the project once it is completed. In our case, the Metropolitan St. Louis Sewer District is the sponsor for the Coldwater Creek project. And finally, the project must be authorized and funded by the Congress and President in order for us to pursue it.

As I mentioned at the public meeting in November of 1985, we are fully aware that the Coldwater Creek flood control project runs adjacent to an area that contains radioactive material. We have been, and we will continue to be, in full coordination with the Department of Energy in regards to that radioactive area. I want you to be fully assured that neither the Corps of Engineers nor the Department of Energy have any desire to do anything that is going to create or extend a radioactive material hazard. We will be very cognizant and cautious of that particular hazard as we move forward with the project. I would ask you to keep in mind that this evening we really are here to address the Coldwater Creek flood control project and only the radioactive materials to the extent of the interface between the flood control project and the radioactive material site. If you have extensive questions or comments about the radioactive material site, you will have an opportunity to discuss those in a public meeting in the future that will be conducted by the Department of Energy.

U.S. DEPARTMENT OF ENERGY WORK - STEVE MCCRACKEN
SITE MANAGER
U.S. DEPARTMENT OF ENERGY
OAK RIDGE, TENNESSEE

The purpose of the Formerly Utilized Sites Remedial Action Program (FUSRAP) is to conduct radiological decontamination of sites that were formerly utilized by the Manhattan Engineering District and the Atomic Energy Commission, mostly in the 1950's and 1960's, where there is contamination that exceeds our current guidelines. Our objective is to carry out these activities in the interests of public health and safety and to restore currently contaminated sites to unrestricted use capacity. In the FUSRAP program there are currently 29 designated sites throughout the United States.

The two sites that are of interest to this meeting tonight are just north of the Lambert-Saint Louis Airport. They are the Hazelwood Interim Storage Site and the Saint Louis Airport Storage Site. We have already undertaken some interim activities at these sites to stabilize the material to prevent any further off-site migration of contaminants. The work that we have in progress is in three major areas. Characterization is our term for determining the extent of the problem and the volume of material that we are going to have to deal with. Remedial action is our term for the clean-up operation itself. And there is environmental monitoring. Characterization is in three areas: radiological, geological, and chemical. For radiological and geological we have gathered all the field data. Our report will be published beginning in the spring and through the end of this year. We have carried out just a small amount of chemical characterization. However, we are in the process of putting together an overall chemical characterization plan and we

will carry that out either this year or next year, depending upon availability of funds.

We have not carried out any remedial actions except for those activities that were immediately needed. We constructed a gabion wall adjacent to the St. Louis Airport Storage Site to prevent erosion from Coldwater Creek along one edge of the site. We have done a small amount of surface cleanup along Latty Avenue near the Hazelwood Interim Storage Site.

With environmental monitoring, we monitor the air, the surface water, the ground water and the creek sediment. The reason that we are doing this environmental monitoring in this interim period before we conduct the cleanup operation is to assure ourselves and the public that there is no immediate health threat. And the reports that we have published have indicated that that is, in fact, the case. And we have carried out, at I said before, a few remedial actions to minimize any problem.

The bulk of the work is still to be performed. The work that we have yet to conduct is excavation and restoration, disposal of contaminated waste, and finally, there will be independent verification by an independent contractor to assure that we have conducted the remedial action correctly and properly. There are many other steps that are required, not the least of which is the National Environmental Policy Act requirements. We examine various alternatives and select the best alternative to proceed with.

A little more than a mile of the Corps of Engineers project is affected by our work. That could increase somewhat. We will know the interface area better when we fully complete the characterization.

The areas that we are investigating include the SLAPS site, the Hazelwood Interim Storage Site, the ditches along McDonnell Boulevard, a segment of Coldwater Creek and the properties near the Hazelwood Interim Storage Site. These are the areas that we are investigating. That is not to say that this entire area is contaminated, although a significant portion of it may well be. The characterization data we have received to date indicates that we will have to go back and do some more sampling in Coldwater Creek to determine where the downstream end of the contamination is. We intend to go back and begin that in March.

The interface with the Corps of Engineers' work includes the creek itself, and the areas in the ball field and another location where the Corps of Engineers currently proposes to put their excess material that would come from the creek.

We have compared our planned schedule to the Corps of Engineers' schedule. With these planned schedules, we would foresee no problem in conducting our operations and being out of the way prior to the Corps of Engineers' coming in and doing their job. I think that we all recognize that it is possible, and some would say likely, that either or both of these schedules may change in the future. The important things are; first, that we remain aware of this interface so that, as we get nearer to the time that these projects would be carried out, we make sure that we are very well

coordinated; and second, that it is the DOE's intent to have the interface areas cleaned up so they would not affect the Corps' work.

FLOOD PROBLEM AND RECOMMENDED PLAN - JIM ZEREGA
STUDY MANAGER
ST. LOUIS DISTRICT, CORPS OF ENGINEERS

Mr. Zerega described the objectives of the study, the Coldwater Creek area, the flooding problem, and the recommended plan in the October 1986 draft Feasibility Report and Environmental Impact Statement.

QUESTION AND COMMENT PERIOD

JACK REHAGEN, MAYOR OF ST. ANN: The city wants the Corps to build levees adjacent to the proposed channel in St. Ann Park. These would replace existing levees. The city also wants the Corps to look into clearing and snagging from Ashby Road through the St. Ann Golf Course, and to delete the recreation trail in St. Ann Park.

JIM ZEREGA, CORPS OF ENGINEERS: The Corps can probably build the same type of levees adjacent to the proposed channel in St. Ann Park. This will be determined in the preconstruction engineering phase of the project. (Subsequent to the public meeting the Corps looked at the potential for clearing and snagging in the St. Ann Golf Course. The golf course maintenance crew clears out the channel periodically. It was decided not to attempt to include this cleaning and snagging in the recommended plan because of the small scale of this work and the environmental studies that would be required). The Corps will delete the recreation trail in St. Ann Park from the recommended plan.

TOM SCHNEIDER, FLORISSANT COUNCILMAN: Are there any homes that will be purchased because of the channel widening? Will retaining walls be built to save some homes? After the project is constructed, what steps will be taken if properties are endangered by erosion?

JIM ZEREGA, CORPS OF ENGINEERS: No homes would be purchased as part of the project. We require a little bit of the back yards in some areas of the project. Generally, the intent is not be use back yards, but to use the open side of the channel for enlargement. The only place where there is a concrete retaining wall is the area where Paddock Creek joins the main channel of Coldwater Creek. The purpose of the concrete retaining wall is to reduce the amount of right-of-way required so that homes would not be required to be purchased. In general, the earth channel with the riprap at the base of the slope is intended to be a stable project. So there should be no additional major problems of erosion along the stream, once the project is constructed. If there is a washout of some of the riprap along the stream and some erosion in certain areas, that problem would have to be resolved by the local sponsor through a regular maintenance program.

CHUCK KAISER, METROPOLITAN ST. LOUIS SEWER DISTRICT: When I speak as a local sponsor, I also speak for the many local officials and residents who have backed us in getting so much done. We have built many projects with the State of Missouri contributing one-third of the share, the local communities

one-third, and MSD one-third. Since 1974 we have spent $65,000,000 in the Coldwater Creek area, and in the next 18 months we hope to spend $24,000,000. We will find the 30 percent that is required for the Corps of Engineers project.

DOUGLAS PALMER, MAYOR OF HAZELWOOD: My concern is that we are looking at a five-year period before you even lift a shovel. Then you start at the one end of Coldwater Creek, and I would assume that it will probably be another five years before you get back into Hazelwood. In the report you state that a five and a half foot levee around some homes in Hazelwood could alleviate their problem. I wonder if this levee could be constructed early in the project, in the time frame of five years from now rather than eight or ten years down the road, so we can alleviate that problem for those particular people. Also, we look forward to the recreation part of the plan.

KAY DREY, COALITION FOR THE ENVIRONMENT: I continue to be very concerned about the two radioactive waste sites that are in the Coldwater Creek flood plain, and hope that the Corps will encourage the Department of Energy, if possible, to remove those wastes away from the Coldwater Creek area and away from north Saint Louis County. I also want to submit a couple of articles about radon gas, which is being emitted from those sites. I want to give you some articles about the radioactive dusts that are blowing from the airport site and the Latty Avenue site and vicinity properties, and from the sediment in the creek, particularly during dry times. I encourage you to be very cautious in your acceptance of the Department of Energy's assurances that this is all safe. I have a lot of questions about the Department of Energy's record and I think nationwide, people are increasingly being very suspicious of some of the pronouncements from the Department of Energy that everything is safe.

MARGARET HERMES: For the past two years, I have been researching the airport radioactive waste site and, while I have come across many alarming facts, such as the airport site having the highest reading on radon gas monitored at any of the FUSRAP sites, for me the most alarming fact is still the location of these highly radioactive materials in the flood plain of Coldwater Creek. The DOE proposals reported thus far have all called for the establishment of a permanent radioactive waste dump there in the flood plain. Storing radioactive wastes in a flood plain in an earthquake zone in a heavily populated urban area cannot be acceptable, even in an engineered cell. Coldwater Creek empties into the Missouri River above the intake for the City of Saint Louis' drinking water. Dr. William Hope, the former Director of Public Health for the City of Saint Louis, stated in a letter that the continued location of radioactive waste in the Coldwater Creek flood plain poses a threat to health. I am also concerned that the Department of Energy can be so definite as to the dates of implementation of its plans and so vague as to what those plans are. It is my hope that the Corps will assist in the development of a proposal to ensure the excavation and removal of all of those wastes from the flood plain.

DIANE BOUSQUETTE, LEAGUE OF WOMEN VOTERS: Regarding the DOE's attitude toward the radioactive wastes near the airport, they state on page 22, "If a significant problem is defined..." The choice of words concerns me. I don't

know what the DOE calls a significant problem, and I don't know exactly how, who, when, or where it would be defined. Then they state "Plans would be developed for remedial action..." There is no assurance that any action would be taken, simply that "plans would be developed...." There are a lot of openings, a lot of holes, a lot of vagueness there and I think that's something that has to be taken into account.

JIM ZEREGA, CORPS OF ENGINEERS: I think you are referring to the Coldwater Creek report and the way I described the radioactive problem. It was my term. Whether or not the problem is significant would be decided by the Department of Energy. It is a general term, but I thought it was fairly descriptive. If there is some problem that doesn't meet the standards of the Department of Energy, then they would prepare a remedial action plan, and implement that plan. This is what the Department of Energy has told us this evening.

DIANE BOUSQUETTE, LEAGUE OF WOMEN VOTERS: I don't think anyone is really sure just exactly what it would take to have the DOE consider a problem significant. I'm concerned about the DOE's attitude and about your vagueness and everyone's vagueness towards what is going to happen to this site. Is it going to continue to drain and leach radioactive water into Coldwater Creek indefinitely. Are we just going to pretend it isn't there and isn't happening?

COLONEL WILSON, CORPS OF ENGINEERS: Definitely we are not pretending it isn't there. We are very aware of it and, as I indicated earlier, whatever we do will be in concert with the Department of Energy so that we do not do something that is going to make a bad situation worse, or even to create a situation that wasn't there before.

PHYLLIS WOJCIECHOWSKI: I live at Redacted - Privacy Act and I am in the flood plain and have been paying flood insurance. As these improvements are being made, will you reassess the flood plain maps? I've heard that you are in the process, but every year when I go to the mortgage company, they say the maps have not been revised.

JIM ZEREGA, CORPS OF ENGINEERS: The flood plain is being redefined in the community of Florissant, based on the current conditions of the stream and the flood plain. My understanding is that this technical study is being wrapped up now. In the near future, there should be maps that are approved by the Federal Emergency Management Agency that would apply to the Florissant area. If the Corps flood control project gets authorized and constructed, then I expect that there would be a new study made to show what the reduced flood plain would be with the project in place.

WALTER KAISER: You propose a levee at the St. Ferdinand Shrine. The Shrine is very historical, very related to Florissant. But what about the 240 or so families that live up Saint Charles Street on the other side of Washington that that levee is going to affect?

JIM ZEREGA, CORPS OF ENGINEERS: The channel widening on Coldwater Creek will reduce flooding levels all across the flood plain, and so there should be a reduction in the flood threat in the area you are discussing. The levee around the Saint Ferdinand Shrine area would be located within the floodway of

Coldwater Creek. Perhaps there would be a compensation for that levee resulting from the channel widening, but I think that there would need to be a variance decided by the City of Florissant if they want to have that levee constructed around the Saint Ferdinand Shrine.

WALTER KAISER: What are the MSD and Corps proposals for the lower end of Fountain Creek? MSD constructed down so far and were supposed to continue with a concrete channel. If you are going to put this in, and leave Fountain Creek the way it is, gentlemen, you are creating more of a problem than you are resolving.

JIM ZEREGA, CORPS OF ENGINEERS: There is no proposal from the Corps of Engineers to improve the lower end of Fountain Creek. We think that, by enlarging Coldwater Creek, the water from Fountain Creek will be able to move away from the area more easily.

DAVID GROSSMAN, SIERRA CLUB: The Sierra Club has long been in opposition to flood plain development. It is unfortunate that many people have been unable to recognize the serious negative effects of continued development in the flood plain. I understand that Coldwater Creek is already significantly developed, but increased development only causes more and more severe damage. We are also significantly concerned about the radioactive waste sites on Coldwater Creek. And we are concerned about the statement by Colonel Wilson that there is no need for additional Public Meetings during the feasibility phase of this project, especially with the characterization study from the Department of Energy on its way out this spring. It seems like those ought to have been coordinated somewhat differently so that we could comment on this proposal based upon the characterization study from DOE. I would hope that there would be another opportunity for public comment in light of the DOE characterization study. The problems with the Saint Louis Airport Site are numerous and I would like to reiterate the problems with radioactive dust, with airborne contamination, which are the highest levels of all the FUSRAP sites. I am concerned about the linear park. The Sierra Club is in favor of many linear parks, but here, without knowing what the cleanup is going to entail, I wonder whether or not a sign would be in order for hikers and bikers not to touch the ground and not to breathe the air.

R. S. NIEHAUS: What happens to the Corps of Engineers' project if whatever is turned up in the DOE report is of a significant negative nature. Do I read in this report that it stops your project, that you will not proceed if what their report shows would be highly negative in terms of the spread of contaminated materials?

COLONEL WILSON, CORPS OF ENGINEERS: Absolutely, if it is going to involve creating a worse situation or spreading the material, we will not do it.

R. S. NIEHAUS: How do we as residents of the community have any input if there are no more hearings on the part of the Corps? Granted we can go to the DOE hearings, supposing they are held. How do we get our input? Write it down and send it to the Project Manager?

COLONEL WILSON, CORPS OF ENGINEERS: The most rapid way is to attend when the DOE has meetings. We will also be there and we will be fully aware of

what the DOE is doing every step of the way. Any time you have comments about the Corps project, even though the official closing date for comments on the Draft Feasibility Report is the second of February, certainly we would be more than happy to hear from you and we will also respond to you.

K. WENTZIEN, LEAGUE OF WOMEN VOTERS: I want to reaffirm our concern over the years about inappropriate development of the flood plain. I also want to reaffirm our concern about the radioactive sites. We are relying on the Corps to keep in close touch with the DOE, because I think you are in the best position to help them along in their assessment of that site and to clean it up and get it out of here. Lastly, I want to compliment the Corps for the orderly way you have proceeded with this Public Hearing, the advance notice that has been given, and the opportunity for the public to comment.

DON HESPEN: I am extremely happy, as will be the residents of Breckenridge Hills, that the Corps plan now includes a project in the area on the south side of St. Charles Rock Road.

DAVE REYNOLDS, FLORISSANT COUNCILMAN: Many homes in the flood plains of Daniel Boone Creek and Longview Creek have very little flooding at the present time. None that I can recall in the past 12 years. However, they are paying increased premiums as a result of the flood plain maps that were adopted, I believe in 1979. When this plan is in place, will it have any effect on the flood plains of the tributaries, such as Daniel Boone and Longview Creek?

JIM ZEREGA, CORPS OF ENGINEERS: If the project is constructed the Federal Emergency Management Agency would examine the main channel and the tributary streams to determine the effect of the project in reducing the flood plain area.

BOB GARRETT, FLORISSANT COUNCILMAN: At the November 1985 public meeting, I raised the question concerning Old Saint Ferdinand Shrine and the levee that was being proposed. The primary access to that site is down Saint Francis Street across Fountain Creek into the Shrine site. From the plans I see, the levee is going to be constructed across the roadway into the site. I am wondering what kind of access is going to be provided, if any.

JIM ZEREGA, CORPS OF ENGINEERS: Generally, the levee is on the borderline of being economically justified. So we had to keep the cost of the levee at a minimum in order to include it in the plan. At this point, we don't have a cost in for providing a ramp over the levee. We are aware that there is another road that comes into the St. Ferdinand Shrine area from Washington Street through another property. The final decision on access would have to be worked out in the preconstruction design phase of the project.

MOLLY BUNTON, ASSISTANT TO CONGRESSMAN CLAY: Can you tell me specifically what supports a no improvement situation from Old Halls Ferry east?

JIM ZEREGA, CORPS OF ENGINEERS: Generally, this area does not have a lot of flood damages. Most of the homes have been built at or above the 100-year flood level. So there is no need and no economic justification for a channel project in this area. There is a high level of environmental quality along

the channel, and we were pleased that there was no improvement required in this area.

TOM KRUSKA: My home is presently in the 100-year flood plain. Do you have an estimate for the decrease in height for the 100-year flood level with implementation of the project?

JIM ZEREGA, CORPS OF ENGINEERS: Yes, I do, but we can talk about it after the meeting. I have flood profiles which show the 100-year flood level without the project and the 100-year flood level with the project, all along the main channel of the stream.

TED CALLAS: Between Saint Cin Park and Chez Paree apartments, we have a small levee with a flap valve. If you widen the creek on our side, you are going to wipe that levee out. Are we going to be able to maintain that levee and flap valve?

JIM ZEREGA, CORPS OF ENGINEERS: If there is a levee along the stream channel, and the community wants to have that levee in place after the channel project is built, I would think we can put it there. We will address this during the detailed preconstruction engineering of the project.

COLONEL WILSON, CORPS OF ENGINEERS: Does anyone else desire to make a statement or ask a question at this time? That concludes the comments and questions. On behalf of the Saint Louis District, we want to thank you for coming and expressing your interest and your ideas and your support for the project. We will keep you informed as we progress with the study.

United States Department of the Interior

OFFICE OF ENVIRONMENTAL PROJECT REVIEW
175 WEST JACKSON BOULEVARD
CHICAGO, ILLINOIS 60604

February 6, 1987

ER-86/1454

Colonel Daniel M. Wilson
District Engineer
St. Louis District, Corps of Engineers
210 Tucker Boulevard, North
St. Louis, Missouri 63101

Dear Colonel Wilson:

The Department of the Interior (Department) has reviewed the Draft Feasibility Report and Environmental Impact Statement for Coldwater Creek, St. Louis County, Missouri. Consolidated Department comments are hereby provided for your consideration during future project planning phases.

Fish and Wildlife Service's concerns to minimize impacts to fish and wildlife resources have been resolved through cooperation in earlier project planning stages. The Service concurs with the recommended plan.

The Bureau of Mines reviewed the subject document to determine whether mineral resources were adequately considered. The draft report describes the geology of the area (page 6) and states that there are no significant mineral resources in the watershed (page 19). The Bureau has no objection to the draft report as written.

#1 The final environmental statement and feasibility report should demonstrate the completion of compliance with all mandates pertaining to the identification and protection of cultural resources except for the completion of an archaeological data recovery program, and should describe archaeological data recovery to be undertaken. The final should evidence the approval of the State Historic Preservation Officer that any archaeological data recovery described will adequately meet applicable compliance requirements and that compliance with all other pertinent cultural resources mandates has been satisfactorily completed.

Thank you for this opportunity to review and comment on the project documents. We look forward to continuing involvement as this project moves forward.

Sincerely yours,

Sheila Minor Huff

Sheila Minor Huff
Regional Environmental Officer

St. Louis District's Response to
United States Department of Interior
Letter Dated February 6, 1987

#1 The Corps telephoned Dr. David Given of the Department of the Interior in April, 1987, and Dr. Given said that the feasibility report and environmental impact statement is satisfactory. The report states that prior to construction affected areas shall be evaluated by a professional archaeologist and appropriate cultural resources compliance activities and coordination shall be initiated. This work will be undertaken during preconstruction engineering and design of the project.

The Draft Feasibility Report and Environmental Impact Statement has been coordinated with the State Historic Preservation Officer (Director of the Missouri Department of Natural Resources), and he has not suggested any changes to this approach.

87 · 046

Department of Energy
Oak Ridge Operations
P. O. Box E
Oak Ridge, Tennessee 37831

January 20, 1987

Colonel Daniel M. Wilson
Corps of Engineers
District Engineer
210 Tucker Blvd., North
St. Louis, MO 63101

Dear Colonel Wilson:

COLDWATER CREEK, MO. - FEASIBILITY REPORT AND ENVIRONMENTAL IMPACT STATEMENT

The Technical Services Division of the Department of Energy (DOE), in Oak Ridge, Tennessee, and our Prime Contractor, Bechtel National, Inc., have reviewed the referenced report and have no comment.

We recognize, as indicated in the report, that a portion of the proposed Coldwater Creek improvements project could be affected by the DOE's radiological decontamination effort at sites in the vicinity of the Lambert, St. Louis Airport. By mutual agreement, we intend to work closely with the Corps to assure proper coordination of our individual projects.

If you have any questions or require further input from the DOE, please feel free to call or write.

Sincerely,

S. Ahrends

S. W. Ahrends, Director
Technical Services Division

CE-53:McCracken

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION VII
726 MINNESOTA AVENUE
KANSAS CITY, KANSAS 66101

February 2, 1987

Colonel Daniel M. Wilson, USA
District Engineer
U.S. Army Engineer District, St. Louis
210 Tucker Boulevard, North
St. Louis, Missouri 63101-1986

Attention: LMSPD-U

RE: Draft Feasibility Report and Environmental Impact Statement, Coldwater Creek, St. Louis County, Missouri

Dear Colonel Wilson:

In accordance with our responsibilities under the National Environmental Policy Act and Section 309 of the Clean Air Act, Region 7 of the Environmental Protection Agency (EPA) has reviewed the above-referenced document. The project and statement are rated LO, indicating that the EPA lacks significant objections to the proposed project.

Investigation of our records of hazardous waste sites in the project area revealed there are three sites bordering the Coldwater Creek Floodplain that the draft environmental impact statement (EIS) did not consider. Those sites are as follows:

Address	CERCLA File No./Contaminate
o Bill Burtons Arena Site New Halls Ferry & Highway 140 North County, Missouri 63136	MOD 980687685/Dioxin
o Ford Motor Company 6250 Lindberg Avenue Hazelwood, Missouri 63042	MOD 006272876/Waste Solvents
o Paddock Stables 6344 Janet Lane Florissant, Missouri 63033	MOD 980972384/Dioxin

#1 Because the recommended alternative (Plan 2) will involve channel clearing with dredge material being removed from the floodway, EPA believes the Corps should take appropriate precautions to assure the proposed project would not disturb streambed sediments that contain toxic chemicals and that construction easements for equipment access avoid the contaminated areas. Additional information on the sites may be obtained from Gene Gunn at FTS 757-2856 or (913) 236-2856.

We appreciate the opportunity to review this draft statement. Please forward three copies of the Final EIS to this office. If you require additional discussion about our comments, please direct them to Tom Lorenz at (913) 236-2823.

Sincerely yours,

Thomas F. Lorenz

for Edward C. Vest
Chief, EIS Section

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VII
726 MINNESOTA AVENUE
KANSAS CITY, KANSAS 66101

APR 2 3 1987

Jim Zerega
Planning Division
St. Louis District Corps of Engineers
210 Tucker Blvd, North
St. Louis, Missouri 63101

Dear Mr. Zerega:

This letter provides the information you requested on three Superfund sites along Coldwater Creek. The three sites are Bill Burton Arena, Paddock Stables, and Ford Motor Company-Hazelwood.

The Bill Burton Arena site and Paddock Stables site were allegedly sprayed with dioxin contaminated waste oil, but it was determined that the oilings at these sites took place outside the time period during which contaminated loads of oil were available. The potential for contamination was so low that the sites were not sampled, and they were given a status of no further action need.

The Ford Motor Company site in Hazelwood is still under investigation. EPA files contain very little information on this site, and a site investigation is scheduled during FY 87. Later this year we should be able to assess the Ford site more accurately.

I have enclosed a copy of the limited site information now in the Ford Motor Company files. If you have further questions please call me at 913/ 236-2856.

Sincerely yours,

Gene Gunn

Gene Gunn
TECH
Superfund Branch
Waste Management Division

Enclosure

St. Louis District's Response to
United States Environmental Protection Agency
Letter Dated February 2, 1987

#1 Refer to the April 23, 1987, letter from EPA. The Corps plans to take no action regarding the Bill Burton Arena and Paddock Stables sites. During preconstruction engineering and design, we will coordinate with EPA to determine the disposition of the Ford Motor Company site.

PD // PD-U
PD-A

John Ashcroft
Governor

John A. Pelzer
Commissioner

State of Missouri
OFFICE OF ADMINISTRATION
Post Office Box 809
Jefferson City
65102

Stan Perovich
Director
Division of General Services

December 29, 1986

Colonel Daniel M. Wilson
District Engineer
Department of the Army
St. Louis District
Corps of Engineers
210 Tucker Boulevard, North
St. Louis, Missouri 63101

Attention: LMSPD-U

Dear Colonel Wilson:

Subject: 86120012 - Coldwater Creek, Missouri
Draft Feasibility Report and Environmental Impact Statement

The Missouri Federal Assistance Clearinghouse, in cooperation with state and local agencies interested or possibly affected, has completed the review on the above project application.

We are enclosing the comments received for your consideration and appropriate action. The remaining agencies involved in the review did not have comments or recommendations to offer at this time.

A copy of this letter is to be attached to the application as evidence of compliance with the State Clearinghouse requirements.

Sincerely,

Lois Pohl, Coordinator
Missouri Clearinghouse

LP:cm

Enclosure

cc: East-West Gateway Coordinating Council

MISSOURI
HIGHWAY AND TRANSPORTATION COMMISSION

P.O. Box 270
Jefferson City, Missouri 65102
Telephone (314) 751-2551

December 24, 1986

GENERAL: Application No. 86120012
A-95 Review

Ms. Lois Pohl
Coordinator of Local & Regional Planning
Division of State Planning & Analysis
Truman Building, Room 430
P.O. Box 809
Jefferson City, Missouri 65102

Dear Ms. Pohl:

Our review of the plans for flood control work by the Army Corps of Engineers on Coldwater Creek in St. Louis County indicates that the planned work could affect existing and/or planned highways. We would like to have the opportunity to review completed plans for these facilities to determine any impact on planned or existing highways. This review should be handled with our District Office at 329 South Kirkwood Road, Kirwood, Missouri 63122, telephone 314-966-3800. The District Office will be in position to issue necessary permits for any installations on state highway right-of-way.

#1

Sincerely yours,

Leland D. Fletcher
Assistant Chief Engineer
A-95 Review Agent

St. Louis District's Response to
Missouri Highway and Transportation Commission
Letter Dated December 24, 1986

#1 A copy of the draft feasability report was sent to the Missouri Highway Department District Office in Kirkwood. We will continue to coordinate with the District Office during preconstruction engineering and design.

JOHN ASHCROFT
Governor

FREDERICK A. BRUNNER
Director

Division of Energy
Division of Environmental Quality
Division of Geology and Land Survey
Division of Management Services
Division of Parks, Recreation, and Historic Preservation

STATE OF MISSOURI
DEPARTMENT OF NATURAL RESOURCES

OFFICE OF THE DIRECTOR
P.O. Box 176
Jefferson City, Missouri 65102
Telephone 314-751-4422

February 2, 1987

Colonel Daniel Wilson
St. Louis District Engineer
Corps of Engineers
210 Tucker Boulevard, North
St. Louis, MO 63101

Dear Colonel Wilson:

This department has reviewed the Draft Feasibility Report and Environmental Impact Statement prepared for flood damage reduction and related improvements for Coldwater Creek. We have the following comments to offer.

Recreation

We support the recreation measures incorporated into the Recommended Plan and also support the retention of that portion of Coldwater Creek between Old Halls Ferry Road and the mouth in its natural state. However, creek widening measures taken upstream from Old Halls Ferry Road could affect two existing St. Louis County parks.

#1 Upstream channel widening could cause more frequent or more prolonged flooding of recreation areas adjacent to Coldwater Creek in Coldwater Creek Park. Fort Bellefontaine Park, located atop an old landfill site, is currently being undercut by Coldwater Creek. To rectify this situation, St. Louis County intends to move that portion of the stream channel which skirts Fort Bellefontaine Park. Widening the channel upstream of Old Halls Ferry Road could intensify the undercutting process because of the potential for increased flow through the natural channel adjacent to Fort Bellefontaine Park. Such activity could negate St. Louis County's diversion activity.

Radioactive Material Storage Sites

#2 In Section 4 on page 31, it is stated, "For purposes of plan formulation, the assumption was made that Coldwater Creek has not been affected by the two radioactive material storage sites adjacent to the Creek." Sediments in Coldwater Creek should be

suspected to be contaminated in approximately a 3-mile segment downstream from the Norfolk and Western Railroad at the north side of St. Louis Airport. Any channel modifications conducted upstream of this segment prior to completion of U.S. Department of Energy (DOE) remedial actions at these sites could contribute to spreading of these radioactive contaminants.

#3 The DOE schedule for the Hazelwood Site indicates completion by FY 1993 and the schedule for the St. Louis Airport Site indicates completion by FY 1994. In the event that these schedules may be optimistic, the Corps should develop contingency plans in the event that the DOE work is not completed until a later date.

Floodplain Management/Flood Insurance

Since the Metropolitan St. Louis Sewer District intends to be the non-federal sponsor of the project, local municipal governments may have limited direct involvement in the plan implementation phase. The following comments are offered to further the direct involvement and community sense of responsibility of St. Louis County and the municipalities located in the Coldwater Creek Watershed.

All seven of the municipalities affected by the proposed plan and St. Louis County participate in the National Flood Insurance Program and regulate all excavating, filling, grading, paving, drilling and building in flood hazard areas identified by the Federal Insurance Administration. As required by federal regulations, all contractors performing tasks related to the implementation of this proposed plan shall apply to the appropriate local governmental jurisdiction for a floodplain development permit.

Upon completion of project work within any of the involved municipalities, the local governmental unit should request that the Federal Emergency Management Agency (FEMA) revise that municipality's Flood Insurance Study. Significant changes will be made in several of the affected communities by this project and maps of flood hazard areas along Coldwater Creek can be revised in accordance with new base flood elevations and water surface profiles.

Because all the measures included in Plan 2 are designed to mitigate flood hazards resulting from the historically increased flow of stormwater runoff caused by development (roofing and paving of the earth) which was previously allowed by these several communities, and because only St. Louis County government has stormwater detention policies, each of the affected municipalities should enact stormwater runoff control ordinances applicable to both new develpment and redevelopment

that would prevent further aggravation of stormwater runoff problems. This would assure that future development activities would responsibly account for generated runoff flows.

Because trash dumping within and adjacent to Coldwater Creek is a contributing factor to the flooding problem, each of the affected municipalities should enact and enforce anti-dumping ordinances. Enforcement of such ordinances could help provide funds for annual maintenance of the flood forecasting and warning system/plan. Conversely, failure to enact and enforce such an ordinance will contribute to the costs of maintenance of the project.

Local governments should contact FEMA Region VII, Kansas City, to request information on Section 1362 of the National Flood Insurance Act, which provides that flood-insured, flood-damaged buildings meeting certain criteria can be acquired by the federal government and removed from the flood hazard area. Such a project, on a multi-municipal "regional" basis, could do a great deal toward reducing future flood losses. Although it is stated on page 39 of the draft report that no economical demolition measures were found to exist, the FEMA criteria and the Section 1362 option should be made known. Several other St. Louis County locations have previously benefited from this program.

The report points out that a widespread Corps of Engineers floodproofing project is not feasible and that floodproofing measures are best implemented by individual property owners (page 40). It is recommended that individuals in the Coldwater Creek Watershed investigate the cost and availability of National Flood Insurance and investigate sources of information available from FEMA for flood protection of buildings.

Finally, we concur with other agencies recommending that channel widening be limited to one side of Coldwater Creek wherever possible.

This department concurs with the selection of Plan 2 as the recommended plan and I commend the St. Louis District staff for its thorough analysis of this watershed in northern St. Louis County.

Thank you for your consideration of these comments.

Sincerely,

DEPARTMENT OF NATURAL RESOURCES

Frederick A. Brunner, Ph.D., P.E.
Director

FAB:tlk

St. Louis District's Response to
Missouri Department of Natural Resources
Letter Dated February 2, 1987

#1 The Corps has coordinated with the St. Louis County Department of Parks and Recreation regarding the changes in the flood characteristics in the two parks if the Corps plan is constructed. Generally we consider these changes to be minor. The Corps project would not negate a St. Louis County diversion or erosion protection project at Fort Bellefontaine Park. The flood situation at the two county parks will be considered again during preconstruction engineering and design.

#2 Section 4 of the feasibility report has been revised to read, "For purposes of plan formulation, the assumptions were made that radioactive materials will be removed from the flood control project area prior to construction of the flood control project, and that the removal of radioactive contamination will not effect the design of the flood control project." The Department of Energy is conducting a detailed sediment sampling and testing program that will define the radioactive contamination problem in Coldwater Creek. The Corps of Engineers will not proceed with construction in the radioactive contamination area until the Department of Energy completes its remedial action work.

#3 If there is a delay in the Department of Energy work, we will adjust our design and construction schedule as necessary to accomodate the DOE project.

MISSOURI DEPARTMENT OF CONSERVATION

MAILING ADDRESS:
P.O. Box 180
Jefferson City, Missouri 65102-0180

STREET LOCATION:
2901 West Truman Boulevard
Jefferson City, Missouri

Telephone 314/751-4115
LARRY R. GALE, Director

50 YEARS of CONSERVATION
1937 • 1987

January 15, 1987

Colonel Daniel M. Wilson
District Engineer
St. Louis District, Corps of Engineers
210 Tucker Blvd., North
St. Louis, Missouri 63101

Re: Coldwater Creek Draft
Feasibility Report and EIS

Dear Colonel Wilson:

Thank you for the opportunity to review and offer comments on the Draft Feasibility Report and EIS for Coldwater Creek in northern St. Louis County. Members of my staff that participated in project studies and field trips indicate the report reflects many of the features and concerns discussed.

We compliment your staff for the development of this report and look forward to working with you on areas of mutual interest in the Coldwater Creek basin.

Sincerely,

Larry R. Gale

LARRY R. GALE
DIRECTOR

cc: U. S. Fish and Wildlife Service
Columbia, Missouri

RH PD-4 cor

EAST-WEST GATEWAY COORDINATING COUNCIL

911 WASHINGTON AVENUE
ST. LOUIS, MISSOURI 63101
314 421-4220 618 274-2750

January 16, 1987

Colonel Daniel M. Wilson
District Engineer
Corps of Engineers
210 Tucker Boulevard, North
St. Louis, MO 63101-1986

Attention: LMSPD-U

Dear Colonel Wilson:

The staff of East-West Gateway Coordinating Council, in its capacity as the designated regional clearinghouse, has reviewed the Draft Feasibility Report and Environmental Impact Statement for the Proposed Plan for Flood Control and Related Purposes for Coldwater Creek in St. Louis County, Missouri. Staff comments are listed below:

1. The EIS appears to satisfy all federal EIS requirements of Section 102(2)(C) of the National Environmental Policy Act of 1969 (Public Law 91-190).

2. The selected alternative, Plan 2, includes structural and non-structural control measures. Plan 2 is considered the most acceptable alternative by the local sponsor, Metropolitan St. Louis Sewer District (MSD), local elected officials, and downstream property owners.

3. The proposed Plan 2 was found to be consistent with the Year 2000 Land Use Plan and policies adopted by the East-West Gateway Coordinating Council.

4. MSD has agreed to participate in the detailed design of the project, share project costs, obtain the lands for the project and operate and maintain the project upon completion.

If you have any questions concerning this review, please do not hesitate to call.

Sincerely,

Les Sterman
Executive Director

LS/MC:bh

METROPOLITAN ST. LOUIS SEWER DISTRICT

2000 Hampton Avenue
St. Louis, MO 63139-2979
(314) 768-6200

June 25, 1987

Colonel Daniel M. Wilson
District Engineer
St. Louis District
Corps of Engineers
210 Tucker Boulevard, North
St. Louis, Missouri 63101

Dear Colonel Wilson:

The Metropolitan St. Louis Sewer District has reviewed the October 1986 draft feasibility report for Coldwater Creek, Missouri, and supports your selection of Plan 2 as the recommended flood control plan. This plan provides a reasonable level of flood protection and appears to be acceptable to the affected communities along the stream.

The District intends to be the "local sponsor" for this project. As such, we intend to take overall responsibility for providing the items of local cooperation, and to either directly fulfill these requirements or arrange for cooperation from other entities. We intend to meet the non-Federal cost sharing requirements for the project, including the provisions of the Water Resource Act of 1986 and other laws that may be applicable at the time of construction.

We understand that the items of local cooperation are as follows:

a. Provide all lands, easements, right-of-ways, relocations, and bridge replacements, including borrow areas and disposal areas for excavated material determined suitable by the Chief of Engineers and necessary for the implementation of the project:

b. Hold and save the United States free from damages due to construction, operation and maintenance of the project, excluding damages due to the fault or negligence of the United States or its contractors;

c. Maintain and operate all flood control, flood forecasting and warning, and recreation works without cost to the United States, open to all on a equal basis, in accordance with regulations prescribed by the Secretary of the Army;

d. Provide a cash contribution equal to five percent of the flood control cost not including the cost of the nonstructural flood forecasting and warning system, to be paid during the construction period;

e. Provide a cash or in-kind contribution equal to 50 percent of project costs for recreation;

f. Provide a cash or in-kind contribution equal to 25 percent of project costs for the flood forecasting and warning system;

g. At least annually notify affected interests regarding the limitations of the protection afforded by the project;

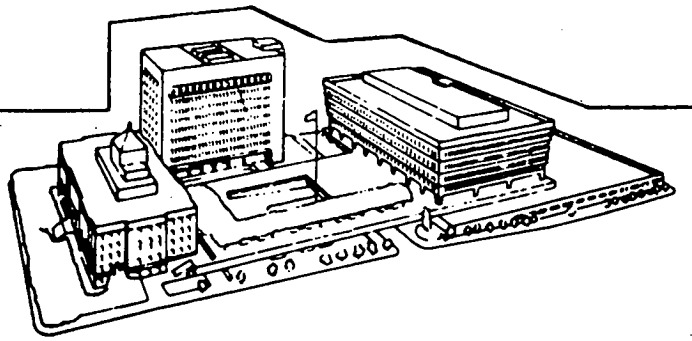
h. Prevent future encroachment that would interfere with the proper functioning of the project for flood control.

We look forward to the authorization and construction of this important project. Please let us know what might be done to expedite successful Federal action on this project.

Sincerely,

Robert J. Hagel,
Executive Director

RJH/FEJ/np



ST. LOUIS COUNTY, MISSOURI
GENE McNARY, COUNTY EXECUTIVE
DEPARTMENT OF PARKS AND RECREATION
WAYNE C. KENNEDY, DIRECTOR

January 30, 1987

Col. Daniel M. Wilson
District Engineer
St. Louis District Corps & Engineers
210 Tucker Blvd. North
St. Louis, Mo. 63101

RE: COLDWATER CREEK FLOOD CONTROL FEASIBILITY STUDY

Dear Col. Wilson:

The referenced study has been reviewed by St. Louis County Department of Parks and Recreation and we would like to offer the following comments:

#1 1. It appears that a higher frequency of flooding near the mouth of the creek would occur due to the upstream widening. This would result in shortened periods of trail usage during the year at St. Louis County Coldwater Creek Park. Is there any remedial measures that could be taken.

#2 2. At the railroad embankment east of Lewis and Clark Boulevard five (5) 8' diameter concrete culverts (tunnels) are proposed. St. Louis County would like to see that some of these culverts be designed to accommodate for trail passage to link the county trails with the future trails on the west side of the railroad tract. Ten (10) foot diameter tunnels with a flat bottom or 8' box culvert could be used to provide full 8' clearance.

#3 3. Ten foot (10') easement along the creek seems to be too narrow to accommodate an attractive trail. It is desirable to increase the width to 30' or 50' at points.

Thank you for giving us an opportunity to get involved in this project. We look forward to working with you in the future.

Sincerely,

Herbert Liu

Herb Liu
Advanced Planner

HL:ks

0094g

41 SOUTH CENTRAL AVENUE, CLAYTON, MISSOURI 63105 (314) 889-2863

St. Louis District's Response to
St. Louis County Department of Parks and Recreation
Letter Dated January 30, 1987

#1 The Corps has coordinated with the Department of Parks and Recreation and provided data that shows that the 2-year through 500-year floods would be slightly higher in Coldwater Creek Park if the proposed Corps project is constructed (about 1 to 3 feet higher). The duration of these floods is less than 24 hours. Generally, the flooding would be higher for part of a day every two years or so. We do not believe any remedial measures are necessary to protect trails that may be affected by this infrequent higher flooding. However, we will consider the situation again during preconstruction engineering and design.

#2 Final design of the tunnels will be completed during preconstruction engineering and design. As presently designed, each 8 ft diameter tunnel has a reinforced concrete slab in its invert. The slabs have a flat surface and are about nine inches deep at the invert, four feet wide, and 120 feet long. These tunnels could physically be used for pedestrian passage, but some type of permission to use the tunnels would probably be needed from the Burlington Northern Railroad and the Metropolitan St. Louis Sewer District.

#3 The ten foot easement is part of the flood control project and is needed for maintenance. Our regulations do not permit us to purchase single-purpose recreation lands. If St. Louis County or some other entity could purchase additional right-of-way, this would enhance the quality of the trail.

Copy to PL-U Rakulka
ED-HE Miller

LAMBERT-ST. LOUIS INTERNATIONAL AIRPORT

City of St. Louis Airport Authority / P.O. Box 10212 • St. Louis, Missouri 63145 • Telephone (314) 426-8000

January 21, 1987

Mr. James Zerega
U.S. Army Corps of Engineers
St. Louis District
210 Tucker Boulevard, North
St. Louis, Missouri 63101-1986

Dear Mr. Zerega:

I'd like to thank you for taking time to come to the Airport to review the Coldwater Creek Project with us. It was a very helpful and informative briefing.

Jim, the Airport is very concerned about one aspect of this project, and I feel that it is imperative that we inform you about it.

Our concern centers around Table 7 shown on page 33 of your report. In that table, you review flow into the Airport's twin tubes, and the discharge from those tubes. The capacity of the tubes is approximately 4,000 C.F.S., and is exceeded by a 5 year flood. Any additional water backs up at this point, and fills the low lying areas on and off Airport Property, and this can cause some damage in these low lying areas.

It is apparent from this report that the Corps is assuming that we will never increase the volume of flow across the Airport to alleviate this flooding problem, and it also apparent that you are designing the part of the project that is down stream from the Airport based on that assumption.

#1 I strongly believe that this decision puts the Airport into the very unenviable position of never being able to improve our own flooding condition, without passing that hardship onto those down stream from us. We like to think of ourselves as good neighbors to the surrounding communities, and this is something we would never want to do.

If you would want to sit down and review our position on this matter with us, please do not hesitate to contact me at 426-8019.

Sincerely,

Thomas W. Richter

Thomas W. Richter
Assistant Director of Airports
Planning/Engineering

TWR/mlb

Leonard L. Griggs, Jr.
Director of Airports

St. Louis District's Response to
Lambert-St. Louis International Airport
Letter Dated January 21, 1987

#1 The Corps of Engineers has coordinated with the airport, and will conduct a sensitivity study on the effect of increasing the size of the conveyance under the airport.

FRIENDS OF OLD ST. FERDINAND
INCORPORATED
1 RUE. ST. FRANCOIS P. O. BOX 222
FLORISSANT, MISSOURI 63032

January 21, 1987

Daniel M. Wilson
Colonel, Corps of Engineers
District Engineer
Department of the Army
St. Louis District, Corps of Engineers
210 Tucker Boulevard, North
St. Louis, MO 63101

Attention: LMSPD-U

Dear Colonel Wilson:

I would like to take this opportunity, as president of Old St. Ferdinands, to submit my observations and comments on your Coldwater Creek flood control proposal.

#1 A flood can be expected every two years with our present configuration. The widening of Coldwater Creek, as proposed, will protect us from the ten year flood. The addition of the levee to the widening will provide protection up to the 500 year flood level.

#2 Our concern is with the levee (L7) around the Shrine. The levee provides maximum protection but affects us the most. Our concerns are:

1). Access - the levee blocks our only public entrance.
2). Drainage - within the levee, drainage of rainwater or backed-up floodwater

The Friends of Old St. Ferdinand are concerned with protecting the Shrine from flood damage and would like to thank the Army Corps of Engineers for the interest it has taken.

Sincerely,

Robert E Zack

Robert E. Zack
President

St. Louis District's Response to
Friends of Old St. Ferdinand
Letter Dated January 21, 1987

#1 The flooding potential at Old St. Ferdinand's Shrine is shown below:

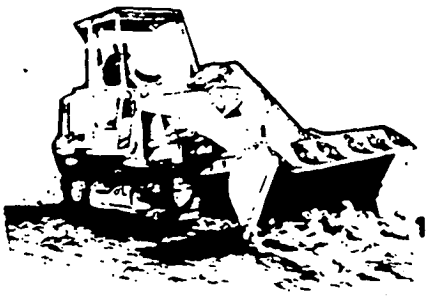
Existing conditions - Not damaged by 2-year flood (damaged by 5-year flood).

With widening of Coldwater Creek - Not damaged by 5-year flood (the 10-year flood on Fountain Creek would be at the first floor elevation of the convent).

With widening of Coldwater Creek plus small levee - Not damaged by 500-year flood (damaged by Standard Project Flood).

#2 As presently designed the levee does block the entrance to the parking lot from the bridge over Fountain Creek. Interior drainage would pass into Fountain Creek through a 30 inch corrugated metal pipe with a flap gate. When the creek is high and does not allow the flap gate to open, interior runoff will pond inside the levee. During preconstruction engineering and design, we will again consider the feasibility of improving vehicle access and interior drainage.

837-1607



Schaefer - Meyer Grading Division, Inc.

1545 N. HIGHWAY 67 — Suite A • FLORISSANT, MISSOURI 63031-6887

GRADING - EXCAVATING

January 26, 1987 REGISTERED MAIL

District Engineer
U. S. Army Corps of Engineers, St. Louis District
210 Tucker Blvd., North
St. Louis, MO 63101-1986

RE: Flood Control Feasibility Study
for Coldwater Creek, Missouri

ATTN: LMSPD-U

Gentlemen:

Thank you for sponsoring the meetings of October 13, 1986, and January 13, 1987, regarding the above-referenced project. They were both interesting and informative to me as an owner of property along Coldwater Creek. I own 15+ acres at the northwest intersection of Coldwater Creek and Old Halls Ferry Road with 1,700 feet of creek frontage. See attached sheet for location.

#1 It is my understanding that excess dirt may be available as a result of the channel widening. I may be willing to accept this dirt on my property if it becomes available.

#2 The plan for flood control includes five 8-foot diameter tunnels through the railroad embankment near Lewis & Clark Blvd. It is my understanding that this will only relieve the flooding back to about Old Jamestown Road. Further channel-widening along the upper portion of the creek will help the situation in that area. If the channel-widening stops at Old Halls Ferry Road bridge as planned, it is my opinion that flooding will increase on my property. I know from personal experience that the narrow opening beneath the Old Halls Ferry Road bridge constricts the flow of the creek during periods of heavy runoff. During these periods, the water is up to the bottom of the bridge deck. Unless tunnels are provided in the roadway embankment or the bridge lengthened to provide a greater opening for the creek, I feel that the road embankment and small opening beneath the bridge will act, as it has in the past, like a dam. If channel-widening upstream takes formerly flooded areas out of the floodplain, the velocity of flow will increase down to Old Halls Ferry Road where the flow is constricted. This will cause worse flooding on the upstream side of the bridge which includes my property. It is my hope that you will consider improvements at Old Halls Ferry Road which will relieve the flow constriction beneath this road.

Continued . . .

I would appreciate your taking the above comments into account when preparing your final recommendation and report.

If there are any questions or comments concerning the above, please feel free to call or write to me.

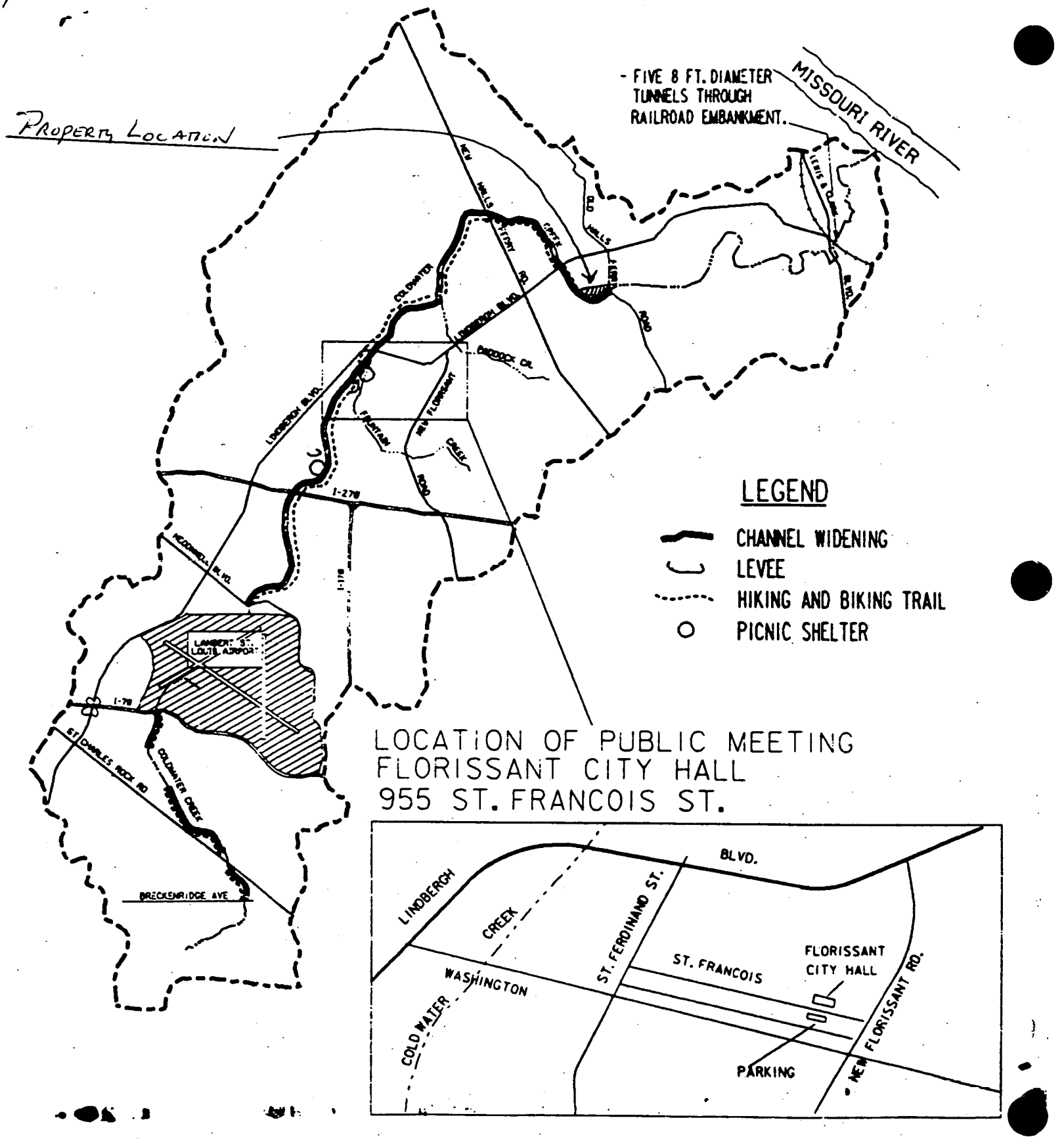
Very truly yours,

Ronald W. Schaefer

RWS:lm

cc: Mr. James Zerega

Enclosure



COLDWATER CREEK, MISSOURI

St. Louis District's Response to
Schaefer-Meyer Grading Division, Inc.
Letter Dated January 26, 1987

#1 During preconstruction engineering and design, we will consider using your property for disposal of excavated material. This possibility will be fully coordinated with you.

#2 Flooding at your property is essentially the same with the proposed project as it is without the project. With the project, the discharges for the various flood frequencies (5-year flood, 10-year flood, etc.) are slightly higher. However, for both without project and with project conditions, floods can bypass the bridge and flow across Old Halls Ferry Road in a low area south of the bridge. Changes to the Old Halls Ferry Road bridge do not appear to be economically feasible, but they will be considered again during preconstruction engineering and design.

January 8, 1987

Colonel Daniel M. Wilson
Department of the Army
St. Louis District, Corps of Engineers
210 Tucker Boulevard, North
St. Louis, Missouri 63101

Re: Flood Control Feasibility Study
Coldwater Creek
Coldwater Creek Outfall Sewer
MSD Contract No. E-548
R & A Project No. 2082
Fleming Project No. 85463
CDG Project No. 6352 A

Dear Colonel Wilson:

The Metropolitan St. Louis Sewer District (MSD) has contracted with the firms of Campbell Design Group - Russell & Axon, Inc. - Fleming Corporation, a Joint Venture for the design and preparation of bid documents for the Effluent Outfall Sewer for the Coldwater Creek Wastewater Treatment Plant. This project is a portion of the MSD's overall water pollution abatement program for the Missouri River. The purpose of the project is to discharge treated effluent from the treatment plant directly into the Missouri River. The proposed route of the Effluent Outfall Sewer may have an impact on the recommendations of the Coldwater Creek, Missouri Flood Control Feasibility Study (October, 1986) which your staff has prepared.

#1

Conceptual planning of an Effluent Outfall Sewer project is contained in the 1981 Facilities Plan for Coldwater Creek Watershed. This Facility Plan, which evaluated economic, environmental and technical feasibility for a 20-year planning period resulted in a recommendation that a 72-inch diameter effluent outfall sewer pipe be constructed along the channel of Coldwater Creek from the treatment plant to the Missouri River, a length of about 4.5 miles.

The Joint Venture is presently preparing the design of the Effluent Outfall Sewer. However, a potential change in alignment is being considered to avoid conflicts with present and future land uses in the project area. An alternative plan has been prepared to circumvent these conflicts and is presently being considered by MSD for inclusion in the final design. The alternative plan is contained in a Draft Copy of the Tunnel Alternatives Analysis, Coldwater Creek Outfall Sewer, October, 1986 as prepared by the Joint Venture.

Campbell Design Group Russell & Axon, Inc. FLEMING CORPORATION

40

319 N. Fourth Street Suite 700 St. Louis, Missouri 63102 314/231-9693

Through informal contact with the Joint Venture, Mr. Tom Zerega of your staff has requested a copy of the Draft Tunnel Alternatives Analysis. The Joint Venture has accommodated this request by arranging for a copy of this document to be forwarded to your office from MSD. Mr. Herman Brinkmann and Mr. Robert Butchko of MSD are our primary contacts on this project.

Should you have any questions regarding the Draft Tunnel Alternatives Analysis, you are welcome to contact either of the following individuals for further assistance.

Mr. Gerald V. Schwalbe, Project Manager
(Russell & Axon, Inc. - Phone # 231-9693)

Mr. Jerome C. Brendel, Project Coordinator
(Campbell Design Group - Phone # 781-4660)

Very truly yours,

CAMBPELL DESIGN GROUP

William C Uhl

William C. Uhl, P.E.
Project Engineer

cc: Herman Brinkmann, MSD
Russell & Axon, Inc.
Fleming Corporation
Campbell Design Group
Jim Zerega, COE

St. Louis District's Response to
Campbell Design Group
Letter Dated January 8, 1987

#1 Our proposed plan includes only one feature downstream from the Coldwater Creek Sewage Treatment Plant, which is to enlarge the opening through the Burlington Northern Railroad embankment at mile 1.63. We are very interested in the Effluent Outfall Sewer and will continue to coordinate with the Metropolitan St. Louis Sewer District on this project.

Mrs. Leo Drey
Redacted - Privacy Act
Redacted - Privacy Act

January 31, 1987

Colonel Daniel M. Wilson
District Engineer
St. Louis District, Corps of Engineers
210 Tucker Blvd., North
St. Louis, MO 63101

Attn: LMSPD-U

Regarding the Proposed Plan for Flood Control and Related Purposes for Coldwater Creek, St. Louis County, Missouri

Dear Col. Wilson:

The purpose of submitting these supplemental comments is to try to substantiate through documented data my concerns about the volume of contaminated, radioactive material still present within the Coldwater Creek floodplain, #1 sediment and banks, and nearby watershed properties. I would also like to suggest that these radioactive materials pose a continuing threat not only to the health of North County's current residents and employees, but also to the people who will be chosen to work under contract on the proposed Corps of Engineers Coldwater Creek flood control project.

The 14-month characterization study to be released shortly by Bechtel National, Inc., for the Department of Energy (DOE) will no doubt provide a new set of estimates of volume and of levels of contamination. And as monitoring equipment continues to become more sophisticated and sensitive in the future, additional estimates -- and new inconsistencies! -- will probably follow. In the meantime, however, since the Corps is scheduled to begin making decisions shortly about Coldwater Creek and its watershed, I would like to express the hope that as much caution as possible will be exercised to try to prevent causing an even greater dispersal of the North County's uranium-thorium wastes than has already occurred.

Enclosed as a part of this statement is a compilation of data and comments I prepared a year ago regarding the residues deposited within the Coldwater Creek watershed as the result of the first 15 years of Mallinckrodt Chemical Company's 25 years of processing uranium here in Metropolitan St. Louis -- processing that began exactly 45 years ago on April 24, 1942. Unfortunately, as I've commented before, the brilliant scientists who carried us into the Atomic Age were apparently never asked if they could get us out.

The residues of solid and liquid wastes had been trucked initially out to the 21.7-acre Airport Site from the Mallinckrodt plant seven days and nights a week from 1946 until approximately June 1957 when Mallinckrodt's Weldon Spring division took over (according to the Mallinckrodt publication: "Progress and Improvements," 1960-61, p. 4). While some of the Airport wastes had been dug up and removed to Latty Avenue a mile away during a 5-month period in 1966 (to be kiln-dried and sent by train to Colorado), and some had been sent to Fernald, Ohio, and Niagara Falls, a great deal remains at the Airport, Latty Avenue and in areas in between and beyond.

The most recent estimate published of the volume of wastes present at the Airport, Latty Avenue and their vicinity properties is 250,000 cubic yards. (Bechtel: Airport Site Environmental Report, 1985, p. 9) I believe that

#2 estimate will continue to grow, based on reports of remedial action experience at contaminated sites throughout the United States. The Corps' initial proposal to spread sediment dug up from the Creek's channel onto nearby flat land could result in increasing the contamination levels of that land.

1. Wind and water (erosion and flooding) over the past four decades have no doubt dispersed the materials beyond the sites and quite probably beyond the "vicinity properties" already acknowledged to be contaminated.

2. The leaching of radium and other radioactive substances into the subsoil within and contiguous to the sites has been documented. Contaminated soil and buried materials have been detected as deep as 15 feet below the current surface within the Airport Site (Weston, 1982, p. 3-5) and 14.5 feet below the ditch to the north of the fence (Bechtel, August 1983, p. 117).

3. Quite probably similar vertical leaching has occurred below the Creek bed and, laterally, beyond the banks.

Groundwater contamination has been documented at all the sites monitored over the years. After reviewing a series of Airport Site documents for the Coalition for the Environment, Thomas Aley, hydrogeologist and director of the Ozark Underground Laboratory at Protem, Missouri, summarized his findings in a paper dated April 9, 1985. He notes that appreciable amounts of radioactive wastes are commonly located at or below the water table at the Airport Site and "are thus routinely or periodically saturated with groundwater." He estimates that 5000 gallons per day of water percolates downward through the cover of the 21.7-acre site, and that an additional unknown volume of groundwater passes into and through the waste area from adjacent areas. He concurs with earlier reports that: "All groundwater discharges from the waste site will ultimately reach Coldwater Creek." (Weston had estimated the average daily groundwater discharge into the Creek at 450 gpd in its July 1979 report [p. 3-9] and reduced that estimate to 70-80 gpd in its January 1982 report [p. 1-3].)

The difficulties of comparing the monitoring results over the years in an effort to interpret the boundaries and extent of the general contamination and the specific location of "hot spots" can perhaps most readily be appreciated by focusing on one isotope which has been routinely detected in elevated amounts, namely, thorium-230. As I mention in my attached January 1986 compilation, thorium-230 is itself recognized as a health hazard and continues to release the notorious radon gas as long as the thorium remains radioactive -- for 10 or 20 times its 80,000-year half-life! Looking at the thorium-230 levels at the Airport Site, then, as an example, one finds that in the year 1985 sediment the Creek sample containing the highest concentration (170 picocuries per gram) was obtained in the first quarter of the year, just downstream from the site. (Bechtel: Environmental Monitoring Report, Revised Sept. 1985; pp. 14, 23, 24). According to the text, however, because the level of contamination was so much higher than other readings, it was "believed to be anomalous." (Ibid., pp. 23 fn., 24) For three reasons that reading does not seem anomalous to me:

1. the sample was collected during the period when the installation of the gabion wall was begun at the Airport. Construction equipment and

crews arrived on site on March 18, 1985. (See DOE's John Baublitz's letter of 8/14/85 to the Mo. Dept. of Natural Resources; Encl. 2, "Thorium-230 Concentration -- During Repair");

2. a sample containing 14,000 picocuries per gram of thorium-230 had been collected from the western boundary of the site (east bank of the Creek) prior to the gabion wall work (Ibid., "Pre-repair"); and

3. a sediment sample collected upstream of the Latty Avenue Site (downstream of the Airport) in 1985 contained 300 pCi/g (Latty Envir. Report, pp. 19 and 26); and in 1984, samples upstream of the Latty Site contained 230 and 540 pCi/g (Bechtel: Hazelwood Interim Storage [Latty] Site, p. 5).

-- Please note that the amount of thorium-230 normally found in Missouri soil would be about one pCi/g. Proposed DOE guidelines for remedial action sites require decontamination for thorium at 5 to 15 pCi/g in soil.

The levels of contamination detected in the Creek sediment are important not only as an indication of the hazard present during and after a flood, but also during times when the Creek is low or dry. Uranium and thorium and many of their daughter products emit alpha particles as they decay. While alpha particles cannot penetrate through skin the way gamma rays and beta particles can, they are the most radiotoxic once inhaled or ingested into the body. When the Creek floods onto neighboring lands and then recedes, uranium-contaminated sediment and suspended particles are left behind on the land. When dry they can become resuspended as respirable dust from the surface of the soil.

In addition, as the uranium and thorium isotopes decay, radon gas is released and dispersed. Radon gas can then be inhaled into the lungs (where it can convert into its hazardous, radioactive solid daughter products), or its solid daughters can attach quickly to airborne particles and dust which can also disperse and be inhaled.

Although radon has recently become a recognized hazard nationwide, the radon released from our St. Louis Mallinckrodt sites poses additional hazards. Because Mallinckrodt processed Belgian Congo (Zaire) pitchblende, some of the richest uranium ore in the world, the amounts of all isotopes of uranium and its daughters left behind in the tailings and related residues are far greater than in a comparable volume of tailings from other ore. "Congo ore tailings processed by Mallinckrodt retained an estimated 50 to 90% of the radon based on gamma surveys." (M.B. Sears, et al., "Correlation of Radioactive Waste Treatment Costs and the Environmental Impact... Milling of Uranium Ores," ORNL-TM-4903, Vol. 1, May 1975, p. 148).

In addition, however, other isotopes of radon are present in enriched quantities, as well. To quote from a January 18, 1984, letter to me from a Bechtel National official:

> The natural terrestrial concentration of uranium in most areas of the U.S. is approximately three parts per million. This is equivalent to about 1 pCi/g U-238 and 0.05 pCi/g U-235 and their respective daughters. Some of the pitchblende ore which was processed at the Destrehan Street Plant contained uranium in concentrations as high as 600,000 parts per million.
>
> This corresponds to 200,000 pCi/g U-238, and 10,000 pCi/g U-235 and

> their daughters. During the uranium processing, well over 90 percent of the uranium was removed from the feed material, but daughter products such as Ac-227 (and many others) remained in the residues.

One of the daughter products of uranium-235 is radon-219, an isotope only recently beginning to be recognized as a potential health hazard. Because it has an extremely short half-life (only 4 seconds) and its daughter products do, too -- and because in America it is normally present in relatively small amounts -- its radioactivity has been considered negligible in comparison with radon-222, a daughter of the naturally predominant uranium-238.

It was highly unexpected, therefore, in 1977 when Union Carbide/Oak Ridge National Laboratory personnel, performing a radiological survey of the Latty Avenue Site, found measurable quantities of airborne radon-219 and its daughters, and even reported that "it appears that the concentration of radon-219 daughters is higher than that of radon-222 daughters at some parts on the site, particularly in Building 1 [where the kiln had been located]. Little is known about the health hazards of radon-219 and its daughters, or of the actinides that produce them." (R.W. Leggett, et al., "Radiological Survey of the Property at 9200 Latty Avenue, Hazelwood, Missouri -- Interim Report," September 1977, p. 28)

The relatively high levels of radon-219 found at the Latty Site (and obviously, then, also present at the Airport Site and the Mallinckrodt plant site downtown, the sources of the Latty wastes) may well be present because of the enriched nature of the Belgian Congo ore, as described above.

But according to a paper published in the Health Physics Journal in September 1980, the elevated radon-219 levels may also be the result of the dumping at the Airport Site of a precipitate highly enriched in protactinium-231 (a radon-219 progenitor with a half-life of 32,500 years) which had come out of an ether solution during the uranium processing. [This was the processing technology that Mallinckrodt perfected in the earliest days of the Manhattan Project.] (D.J. Crawford: "Radiological Characteristics of Radon-219," Vol. 39, p. 450).

As described in the enclosed note on radon-219 by Mr. Crawford, of Oak Ridge National Laboratory, the failure to account for the possible presence of radon-219 daughters could result in faulty estimates of radon-222 concentrations. (Health Physics, Vol. 41, July 1981, pp. 165-171). Similar observations had been made in the 1977 ORNL radiological survey report on the Latty Site. It was mentioned that the presence of radon-219 and its daughters (from the uranium-235 decay series) and of radon-220 and its daughters (from thorium-232, also processed by Mallinckrodt) "creates interference and will yield erroneous estimates of these [radon-222] concentrations." (p. 23) All three radon isotopes were apparently found in measurable concentrations at the Latty Site (p. 22) and therefore are still present.

#3 Perhaps the Bechtel characterization study on the North County sites currently in progress will present data on all three radon isotopes and their daughters. I certainly hope that monitoring equipment adequate to detect all the most worrisome and persistent isotopes will be available during any widening and channeling work the Corps may undertake. I also hope the people who are empowered to make decisions about our St. Louis environment will admit that we've measured and remeasured enough, that the contamination is real, and that the wastes should be removed from the midst of our metropolitan area.

Sincerely,

Kay Drey

Enclosures

St. Louis District's Response to
Mrs. Kay Drey
Letter Dated January 31, 1987

#1 The Corps of Engineers is also concerned about any health threat that may be associated with radioactive materials in and adjacent to Coldwater Creek. Our intent is to ensure that the proposed flood control project does not constitute a health hazard to the general public or to the contractors that construct the project.

#2 We are recommending construction of the project under the assumption that any health threatening contamination in the flood control project area will be removed by the Department of Energy prior to construction of the Corps of Engineers project. Actual construction of the Corps of Engineers project is several years away. During design and construction the Corps will work with the Department of Energy and other agencies to ensure that the flood control project does not disperse health threatening radioactive wastes.

#3 We intend to monitor for radioactive contaminants during construction of part of the flood control project. The type and extent of monitoring that is appropriate will be determined during the preconstruction engineering and design of the project in consultation with the Department of Energy and other agencies.

Note: Several articles on radioactive wastes and problems associated with these wastes were submitted for the record by Mrs. Kay Drey. The Corps provided a copy of the articles to the Department of Energy for information. The articles are not reproduced in this report but they are available for review in the St. Louis District office.

January 22, 1987

Col. Daniel M. Wilson
U.S. Army Corps of Engineers, St. Louis District
210 Tucker Boulevard, North
St. Louis, Missouri 63101-1986

re. the Draft Feasability Report and Environmental Impact Study
Proposed Plan for Flood Control and Related Purposes for
Coldwater Creek in St. Louis County, Missouri

Dear Col. Wilson,

Following the public hearing held in Florissant on January 13, I mentioned that I concur with statements expressing distrust in the U.S. Department of Energy based upon the DOE's track record in radioactive waste management. In support of this position I'm enclosing copies of various documents and clipppings which I hope can be made part of the official record.

Most of the enclosures address DOE negligence and mismanagement. In studying the Airport Site I have come acrosss DOE misrepresentation as well. A DOE study on the Airport Site published in April, 1986 reveals that gamma dose rates were measured as high as 2,087 millirems per year at sampling location 2, on the fence line on McDonnell Boulevard, compared to 100 millirems per year from natural background radiation. A revised edition of the report (Sept, 1986) attempts "to clarify what could appear to be an excessive dose at sampling location 2, which assumed a continuous occupancy." The entire spiral -bound 50-page text was reprinted to add that "assuming limited occupancy," the dose at the site boundary would be 6 millirems per year.

The DOE report was supposed to examine radiation data, not downplay the data. Anyway you read either the original or the revised version, you will find that contamination at the Airport Site is so extreme along the fence line that the radiation dose measures 2,087

millirems as compared to an estimated 100 millirems in nature. That's more than twenty times background.

A similar revision and reprinting (Nov., 1986) was made on the April, 1986 report on the Latty Avenue Site in Hazlewood "to clarify what could appear to be an excessive dose rate at sampling location 6." The new rate was greatly reduced by calculating the exposure level at 2 hours per week, based on "the presence of a parking area at this location."

Unfortunately, as the developer of nuclear weapons and the federal advocate for nuclear power, it's in the DOE's best interest to downplay
#/ the hazards of radioactive waste. It is my hope that the Army Corps of Engineers will act as advocate for the health and safety of metropolitan St. Louis residents and challenge the DOE to excavate and remove all radioactive wastes from the developed floodplain of Coldwater Creek.

I appreciate the opportunity to speak at the Corps's public hearing and to add these comments to my statement. I enjoyed meeting you and other members of the Corps.

Yours sincerely,

Margaret Hermes

St. Louis District's Response to
Margaret Hermes
Letter Dated January 22, 1987

#1 The St. Louis District does not intend to comment on the Department of Energy remedial action plans for radioactive wastes in the Coldwater Creek area, accept where they may interface with the proposed Corps of Engineers project. The overall Department of Energy plan may be reviewed by the Kansas City District if a Corps of Engineers permit is required under Section 404 of the Clean Water Act, as amended.

Note: Several documents on the Department of Energy were submitted for the record by Margaret Hermes. The Corps provided a copy of the articles to the Department of Energy for information. The articles are not reproduced in this report but they are available for review in the St. Louis District office.

PD

Redacted - Privacy Act

January 29, 1987

Col. Daniel M. Wilson
U.S. Army Corps of Engineers, St. Louis District
210 Tucker Boulevard, North
St. Louis, Missouri 63101-1986

Dear Col. Wilson,

It occurred to me that perhaps you missed seeing the enclosed article when it ran in PD Magazine. It offers, I think, more evidence of the Department of Energy's neglect and mismanagement in dealing with local radioactive waste sites. The final page calendar is a chronology of deception rather than protection.

Yours sincerely,

Margaret Hermes

St. Louis District's Responses to
Margaret Hermes
Letter Dated January 29, 1987

Note: An article on the Department of Energy was submitted for the record by Margaret Hermes. The Corps provided a copy of the article to the Department of Energy for information. The article is not reproduced in this report but is available for review in the St. Louis District office.

APPENDIX D

FISH AND WILDLIFE COORDINATION ACT REPORT

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
Columbia Field Office
P.O. Box 1506
Columbia, Missouri 65205

IN REPLY REFER TO:

May 21, 1987

Colonel Daniel M. Wilson
District Engineer
St. Louis District, Corps of Engineers
210 Tucker Boulevard, North
St. Louis, Missouri 63101

Dear Colonel Wilson:

Please find enclosed the Final Fish and Wildlife Coordination Act Report for the Coldwater Creek Flood Control Project, St. Louis, St. Louis County, Missouri.

As always, we appreciate the opportunity to work with you and your staff and look forward to continued coordination on this project and other water resource development projects.

If you have any questions regarding this report, please contact Dr. Mamie A. Parker, Columbia Field Office, (314) 875-5374, P. O. Box 1506, Columbia, Missouri, 65205.

Sincerely yours,

Joe Ticger

Joe Ticger
Field Supervisor

FINAL
FISH AND WILDLIFE COORDINATION ACT REPORT

Coldwater Creek
Flood Control Project
St. Louis, County, Missouri
May, 1987

Prepared
for
U.S. Army Corps of Engineers
St. Louis District
St. Louis, Missouri

Prepared
by
Dr. Mamie A. Parker
and
Richard Szlemp
U.S. FISH AND WILDLIFE SERVICE
Columbia Ecological Services Field Office
Columbia, Missouri

Introduction

This report consitutes the final Fish and Wildlife Coordination Act (FWCA) report for the Coldwater Creek, Missouri Flood Control Project, conducted by the St. Louis District, U.S. Army Corps of Engineers. This report was prepared under the authority of and in accordance with the Fish and Wildlife Coordination Act (16 U.S.C. 661 et seq.), the National Environmental Policy Act of 1969 (42 U.S.C. 4321-4327), the Endangered Species Act of 1973, (16 U.S.C. 1531-1543), as amended, and the U.S. Fish and Wildlife Service Mitigation Policy.

The study was authorized by the United States Congress as part of the St. Louis Metropolitan Area, Missouri and Illinois Study. Study authorities that apply to Coldwater Creek include United States Senate Public Works Committee Resolutions dated October 4, 1966, July 15, 1970, and October 2, 1972, and United States House of Representative Public Works Committee Resolutions dated July 29, 1971, and October 12, 1972.

The St. Louis District completed a reconnaissance study of flooding and related problems and opportunities in the Coldwater Creek watershed in September, 1981. That report indicated that there were economically feasible alternatives to protecting the area from flood damages. In addition, the area has significant environmental and recreational problems and opportunities. Therefore, further study of the area was recommended by the District Engineer.

The Fish and Wildlife Service (Service) provided the St. Louis District with a Planning Aid Letter on August 14, 1981. The Service conducted a biological inventory on aquatic and terrestrial resources in the area and submitted a report on the same to the St. Louis District during August, 1981. The draft FWCA report was submitted to the District in March, 1986. Correspondence regarding Federally Threatened and Endangered Species is discussed in the Endangered Species section of this report.

Project Alternatives

In addition to the No Action alternative, the St. Louis District, Corps of Engineers developed two plans. A display of the features in the plans is shown in tabular form in Table 1. The following features are common to both of these plans.

Channel Modification

Coldwater Creek would be widened with rock riprap placed in erodible areas. In several locations, such as bridge crossings, concrete lined channels are planned.

Channel widening and a group of five 8-foot diameter tunnels would be placed through a railroad embankment at mile 1.63. The purpose of these features is to reduce flooding frequency that would otherwise be increased by upstream channel improvements.

Levee

A small levee would be constructed to protect the historical Old Ferdinand's Shrine near the confluence of Coldwater and Fountain Creek.

Clearing and Snagging

Clearing and snagging would occur in the channel downstream of the improved channels to decrease projected induced flood frequencies.

Other Project Features
Miscellaneous

Two picnic areas and an 8-foot wide trail would be constructed on one side of the improved channel. The trail would be made of crushed, rolled limestone.

The channel right-of-way would include the widened channel in addition to a 10-foot wide strip of land on each side of the channel for maintenance and repair.

Table 1. St. Louis District, Corps of Engineers
Potential Channel Modification for Coldwater Creek

Channel Reach	Feature	
	Plan 1	Plan 2
1.63		Channel widened and five 8-foot diameter tunnels through railroad embankment
1.64-7.83	Clearing and snagging	
5.86-7.83		10-foot strip of land on each side of channel
7.83-13.80	Picnic area and recreational trail	Picnic area and recreational trail
10.35-10.45	Small levee	Small levee
13.80-17.68	Channel widened	Channel widened

DESCRIPTION OF STUDY AREA

The Coldwater Creek basin lies in the northern part of St. Louis County, Missouri. The 47 square mile watershed has an elongated shape with an 18.7 mile long main channel known as Coldwater Creek and several relatively short tributary streams (fig.1). The creek originates in Overland, a northern suburb of St. Louis, and flows in a northerly direction through Breckenridge Hills, St. Anne, under Lambert-St. Louis International Airport in a double 10 foot by 15 foot box culvert, through Hazelwood to a point north of Florissant. Then, it turns in an easterly direction and flows through unincorporated St. Louis County and along the northern border of Black Jack where it joins the Missouri River at river mile 6.9.

Most of the Coldwater Creek watershed is composed of Pleistocene age lake bottom deposits composed of fine sand, clay and organic sediment that is relatively impermeable. This is overlain by a 5 to 25 foot layer of loess.

The downstream segment of Coldwater Creek consists of two layers of loessial soils over bedrock. The upper layer is silt rich and ranges from 0-10 feet thick, while the lower layer is clay-rich with low permeability and ranges from 20-50 feet thick.

Approximately 75% of the 47 square mile watershed is developed, resulting in a large amount of impermeable surfaces such as roofs, concrete streets, parking lots, driveways, and sidewalks. These features, combined with the limited permeability and water holding capacity of the local soils, produce large amounts of free-flowing surface runoff. As a result, periods of heavy rainfall, even if only of short duration, quickly fill the tributaries and creek banks, producing flooding without warning. This occasionally results in damage to commercial and residential properties. This condition could worsen with expanding urban development in the lower part of the drainage basin.

Fish and Wildlife Resources without Project Conditions

Aquatic Resources

In August, 1981, an aquatic biological inventory was undertaken (Nash, 1982). The inventory addressed conditions in the main channel of Coldwater Creek and over twelve of its tributaries. Benthos and fish were sampled at seven sites along the length of the main channel. A total of nineteen benthos associated taxa and six fish taxa were collected.

Table 2. Taxonomic groups and common name of benthos organisms collected in Coldwater Creek. St. Louis County, Missouri. 1981

Group	Common Name
Annelidea	
Hirudinea	
Rhynchobdellida	
Golssiphonidae	Leeches
Piscicolidae	Leeches
Oligochaeta	
Plesiopora	
Tubificidae	Aquatic earthworms
Arthropoda	
Crustacea	
Decapoda	
Orconectes	Fresh water crayfish
Isopoda	
Asellota	Fresh water sowbugs
Insecta	
Coleoptera	
Chrysomelidae	Leaf beetles
Diptera	
Chironomidae	Midges
Anthomydiae	Root Maggot flies
Tabanidae	Horse flies
Tetanoceratidae	March flies
Ephemeroptera	
Caenidae	Mayflies
Hemiptera	
Corixidae	Water boatman
Galestocoridae	Toad bugs
Neuroptera	
Corydalidae	Dobsonflies
Odonata	
Libellulidae	Dragonflies
Mollusca	
Gastropoda	
Basommatophera	
Ancylidae	Limpets
Physidae	Pouch snails

In terms of numbers of benthos specimens, samples were dominated by Tubificids and Chironomids. These organisms, along with the snail (Physa) are considered very tolerant of organic pollution. The tubificids and snail were found throughout the reaches of the creek with relatively even distributions, whereas the chironomids were found in greater numbers in the lower reaches. A taxonomic list of all the benthic organisms found is given in Table 2.

A total of 221 fish was collected in the Coldwater Creek inventory, representing six taxa (Table 3). Of this total, 214 or 97% were fathead minnows, Pimephales promelas. The other taxa were represented by only one or two individuals. The majority of the fathead minnows were found in the upper reaches of the creek, above the entrance of the airport culvert near Interstate Route 70. They are very tolerant of high temperature and turbidity as well as low oxygen levels. However, they also appear to be intolerant of competition by other fish and are seldom found together with a variety of other fishes.

From a water quality standpoint, most of the organisms collected from Coldwater Creek have been described as pollution tolerant or able to adapt to either polluted or non-polluted waste situations. Because of its location Coldwater Creek receives a variety of water pollutants, including those of direct discharge and run-off from industrial, commercial, airport facilities, varying degrees and qualities of sewage treatment discharges, and run-off from small farms and residential streets, lawns and gardens. The polluted nature of Coldwater Creek is reflected by the relatively low diversity and high numbers of those taxa present as well as the absence of those taxa that are restricted to non-polluted streams such as Plecoptera (stoneflies) and Tricoptera (caddisflies).

Furthermore, there are many physical pollutants within the creek and its tributaries. Shopping carts are most numerous, followed by discarded tires, other auto parts, appliances, furniture, as well as many miscellaneous items of residential trash.

Terrestrial Resources

There are no significant amounts of contiguous vegetative cover in the Coldwater Creek watershed. The land uses are: approximately 76% urban/residential area with varying degrees and types of vegetation present; 13% is agricultural; 6% is open space; 4% is forest; 0.8% is golf course and cemeteries; wetlands comprise about 0.2%.

Table 3. Taxonomic groups and common names of fish collected in Coldwater Creek.

Group	Common Name
Cypriniformes	
Cyprinidae	Golden shiner
	Red shiner
	Fathead minnow
	Carp
Ictaluridae	Black bullhead
Perciformes	
Centrarchidae	Bluegill

The most extensive forested habitat begins east of the point where Old Halls Ferry Road crosses Coldwater Creek and continues to its confluence with the Missouri River. This area has the highest value terrestrial wildlife habitat in the watershed. It is composed of bottomland floodplain forest tree species with a canopy of cottonwood and sycamore and an understory of boxelder, green ash, silver maple, blackberry and elms.

There are many shrubs and woody vines that are part of the understory vegetation. Elderberry, coralberry, pawpaw, and rough-leafed dogwood are common shrubs, whereas the woody vines present include Virginia creeper, trumpet creeper, poison ivy, raccoon grape, winter grape, and Korean bush honeysuckle.

Another area where there is an appreciable amount of stream corridor vegetation is an approximately 1.5 mile section upstream from where New Halls Ferry Road crosses Coldwater Creek.

Upstream from this area until the creek reaches Lambert-St. Louis Airport, there are intermittent small thick patches of trees and shrubs of various statures.

Very limited amounts of stream-side woody vegetation are evident upstream of the airport, and there are numerous types of debris that are associated with the commercial/urban nature of the area. Litter of all kinds is scattered throughout the drainages. Due to the steep, highly eroded banks of the creek and its backyard location within a highly urbanized area, it becomes a back-door alley or type of "public dump". However, because of its location and scarcity, even such marginal forested habitats become valuable.

Numerous small mammals occur in the riparian forested areas. These include the white-footed, deer, and house mice, short-tail and least shrew, and eastern mole. Larger mammals include the fox and gray squirrel, cottontail rabbit, groundhog, opossum, raccoon, skunk, red fox, and white-tailed deer.

A variety of birds use the various habitats in the watershed. The most abundant are those typically associated with urban environments, such as starlings, house sparrows, blackbirds, common grackles, blue jays, cardinals, robins, chickadees, and juncos. Many different sparrows, warblers, flycatchers, woodpeckers, and swifts also occur in the project area.

Common amphibians include the chorus frog, cricket frog, spring peeper, bull frog, and gray tree frog, Fowler's and American toads, the small-mouthed, spotted, and eastern tiger salamanders.

Some of the reptiles present are the eastern box turtle, five-lined skink, fence lizard, garter snake, and black rat snake.

These marginal quality of forested habitats are utilized by many Missouri urbanites participating in nature oriented activities. A 1980 survey by a Missouri Department of Conservation contractor indicated that feeding or watching birds and other wildlife near their homes, photographing wildlife, wild flowers, trees or other natural things, and hiking are the leisure pursuits most enjoyed by approximately one fourth of the urban adults in the state.

Endangered Species Comments

To facilitate compliance with Section 7(c) of the Endangered Species Act of 1973, as amended, Federal agencies are required to obtain from the Fish and Wildlife Service information concerning any species, listed or proposed to be listed, which may be present in the area of a proposed action. Therefore, we are furnishing you the following list of species which may be present in the concerned area:

Endangered
bald eagle (Haliaeetus leucocephalus)

There is no designated critical habitat in the project area at this time.

The scope and nature of the subject project indicates that diurnal perches, roost sites, food sources, or other preferred habitat will not be affected. Therefore, the project will not affect the bald eagle or the gray bat. This precludes the need for further action on this project as required under Section 7 of the Endangered Species Act of 1973, as amended. Should this project be modified or new information indicates endangered species may be affected, consultation should be reinitiated.

Fish and Wildlife Resources with Project Conditions

The selected alternative, Plan 2, involves Coldwater Creek in several locations. Concrete-lined channels are proposed at bridge crossings. A small levee with a maximun height of 5 feet that would protect 4 historic buildings is also included in the plan. In appropriate channel segments a

variety of trees will be planted on each side of the channel (see table 1). Additionally, a Flood Forecasting and Warning Plan and recreation measures are incorporated within the selected alternative.

The Coldwater Creek Flood Control Project would cause some impact to both fish and wildlife resources. In the upper watershed, where the wildlife habitat is the least abundant, losses to wildlife will not be substantial. However, in the areas further downstream where the stream and floodplain are wider and wildlife habitat is present, losses to wildlife will be greater.

Although the upper watershed is commercially, and industrially developed, the lower watershed is less altered by development and has a more natural and rural appearance. Even though this lower section of the watershed is moderately forested and provides higher value terrestrial habitat resources, the aquatic resource values in this same area are significantly lower than in the upper section. Due to the generally poor quality and continuous discharge of sewage treatment plant effluent, the water and substrate are chemically and physically contaminated such that they severely limit which aquatic organisms may inhabit the area. As urban development continues, more land will be cleared and the water quality will deteriorate as a result of increased run-off and effluent discharges. Therefore, every effort should be made to preserve the remaining undeveloped areas by providing guidance to the local interests and encouraging a reduction of the quantity and/or an improvement in the quality of the sewage effluent discharges. This would also reduce potential public health hazards.

Clearing and snagging along Coldwater Creek would decrease the present values by destroying the remaining breeding areas for many fish and wildlife species. Aquatic communities will suffer as a result of instream habitat degradation. In comparing the flood control features, we are most opposed to the project feature which involves wholesale clearing and snagging. The Corps should investigate other measures, such as selectively removing blockages, rather than denuding the entire creek bank.

Furthermore, in areas in which channel modification activities are not to take place, we would encourage the removal of the accumulated debris that exists in the creek channel. We believe this might be best accomplished through inter-agency cooperation between the Corps of Engineers, county and local agencies, and bordering residents. This could also result in the removal of potential safety hazards.

The widening of the channel would require the removal of the remaining narrow corridors of vegetation adjacent to the stream. This would cause some disruption of habitat for small mammals and other ground nesting species, remove escape and winter cover, interrupt travel lanes and destroy food sources for some wildlife species. Due to the scarcity of food and cover in the Coldwater Creek watershed, these species cannot relocate temporarily and would be in direct competition for food and cover with existing inhabitants. When possible, stream widening should be limited to one bank of Coldwater Creek, preferably the side where the least amount of trees are present. Wildlife habitat could be partially restored and the scenic nature of the channel improved by adding plantings favorable to wildlife along the channel. This would also aid in reducing soil erosion.

Aquatic communities, particularly the benthic community will suffer as a result of streambank and instream habitat degradation. Channel modification would also cause disruption in fish territoriality and orientation. Additionally, toxic chemicals that were bound to bottom sediments may be disturbed during the construction phase. Channel work should be scheduled during periods of low stream flows.

CONCLUSION

While we have stated that overall habitat losses will not be great in some reaches of Coldwater Creek, habitat losses will undoubtedly occur if the project is implemented. The Service's major goal for this project is to ensure, in accordance with the provisions of the Fish and Wildlife Coordination Act, that "...wildlife conservation shall receive equal consideration and be coordinated with other features of water resource development programs...". In our March 1986 draft FWCA we stated that this goal could be met through the inclusion of the following recommendations:

1. Stream widening should be limited to one bank of Coldwater Creek, where possible, preferably the bank with the least amount of vegetation. This would reduce the loss of riparian habitat and provide a continued source of habitat for wildlife. Fish and wildlife agencies should be contacted to obtain site specific inform ation in vegetative clearing.

2. Construction and maintenance of the enlarged channel should occur during the low flow stages.

3. Those areas adjacent to the channel should be planted with species that are beneficial to wildlife. This would provide wildlife food and

cover as well as protection against subsequent erosion.

4. An alternative measure to wholesale or large scale clearing and snagging along Coldwater Creek should be investigated by the St. Louis District.

The draft Feasibility Report and Environmental Impact Statement indicates that the St. Louis District intends to follow these recommendations by (1) limiting stream widening to one bank only where possible; (2) avoiding wholesale or large scale clearing and snagging; (3) avoiding construction and maintenance activities during the low flow stages; and, (4) planting the channel bank with a ground cover such as bird's foot trefoil or crown vetch which will not be mowed and will provide cover for wildlife species.

We appreciate the opportunity to work with the St. Louis District, Corps of Engineers on the Coldwater Creek Flood Control Project. We hope that the information contained herein will contribute to viable solutions of the problems.

If you have any questions regarding this response or if we can be of any further assistance, please contact Dr. Mamie Parker or Richard Szlemp, Columbia Field Office, P. O. Box 1506, Columbia, Missouri 65205, (314)875-5374 or (FTS)276-5374.

REFERENCES

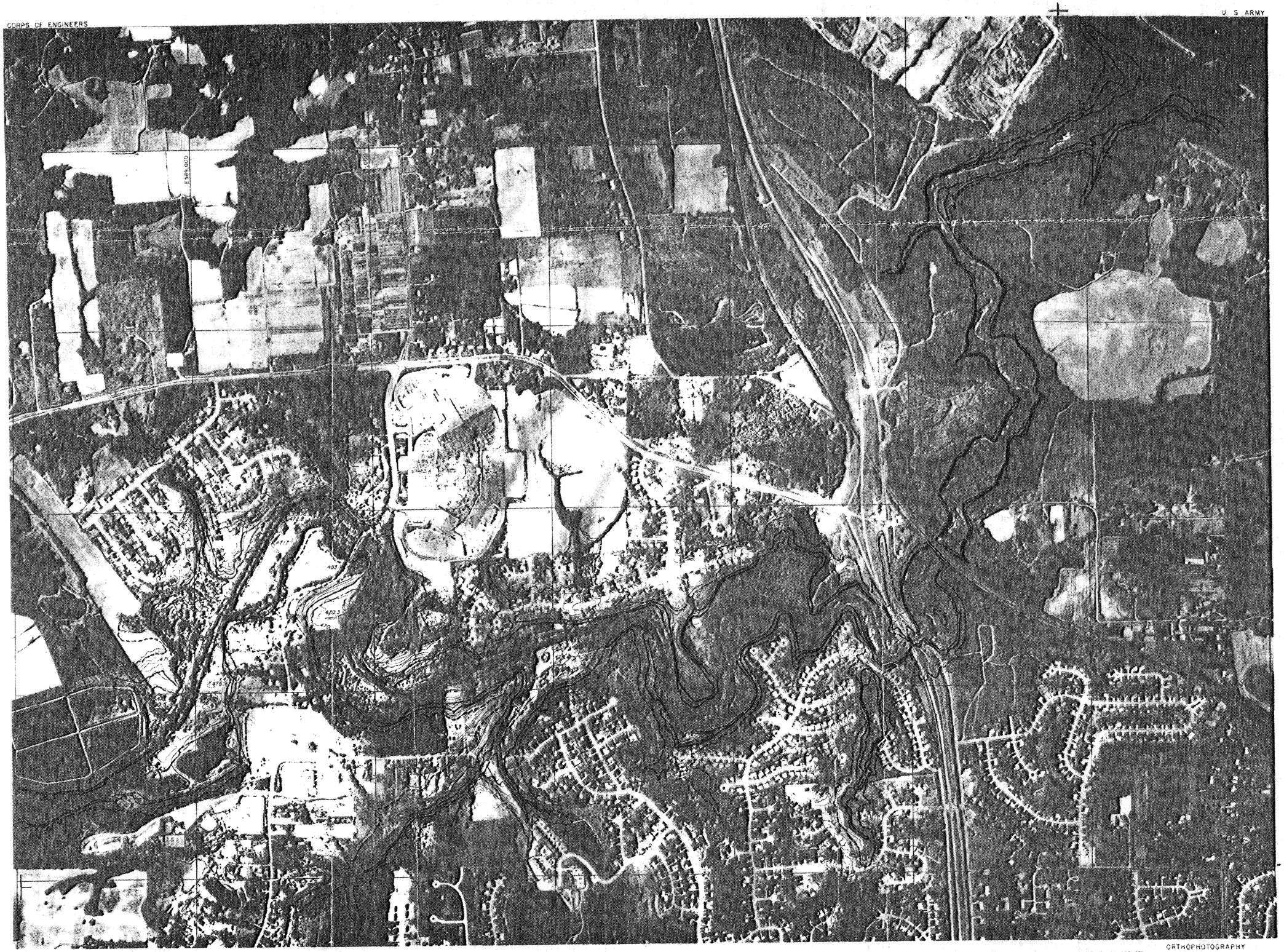
Urban Interest in Wildlife, Opinion Research Division, Fleishman-Hillard, Inc. for the Missouri Department of Conservation, 1980.

Coldwater Creek, Missouri Reconnaissance Report, U.S. Army Corps of Engineers, St. Louis District, 1981.

Aquatic Biological Inventory, Coldwater Creek, St. Louis, Missouri. Tom Nash. U.S. Fish and Wildlife Service, 1982.

CORPS OF ENGINEERS

U. S. ARMY



NOTE

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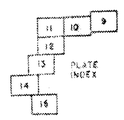

SCALE IN FEET

800 400 0 400 800

200 100 0 200

SCALE IN METERS

TRANSVERSE MERCATOR PROJECTION
MISSOURI STATE PLANE COORDINATE SYSTEM EAST ZONE

CONTOUR INTERVAL 2 FEET

FUTURE CONDITIONS - MAIN CHANNEL FLOODING
STANDARD PROJECT FLOOD ----------
1% PROBABILITY FLOOD ----------
10% PROBABILITY FLOOD - - - - -

ORTHOPHOTOGRAPHY
COLDWATER CREEK AREA
ST LOUIS, MISSOURI
TOPOGRAPHIC MAPPING

U S ARMY ENGINEER DISTRICT ST LOUIS
CORPS OF ENGINEERS
ST LOUIS, MISSOURI

PLATE 9

CORPS OF ENGINEERS

U. S. ARMY

NOTE

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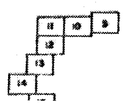


SCALE IN FEET

900 400 0 400 800

200 100 0 200

SCALE IN METERS

TRANSVERSE MERCATOR PROJECTION
MISSOURI STATE PLANE COORDINATE SYSTEM EAST ZONE

FUTURE CONDITIONS - MAIN CHANNEL FLOODING

STANDARD PROJECT FLOOD

1% PROBABILITY FLOOD

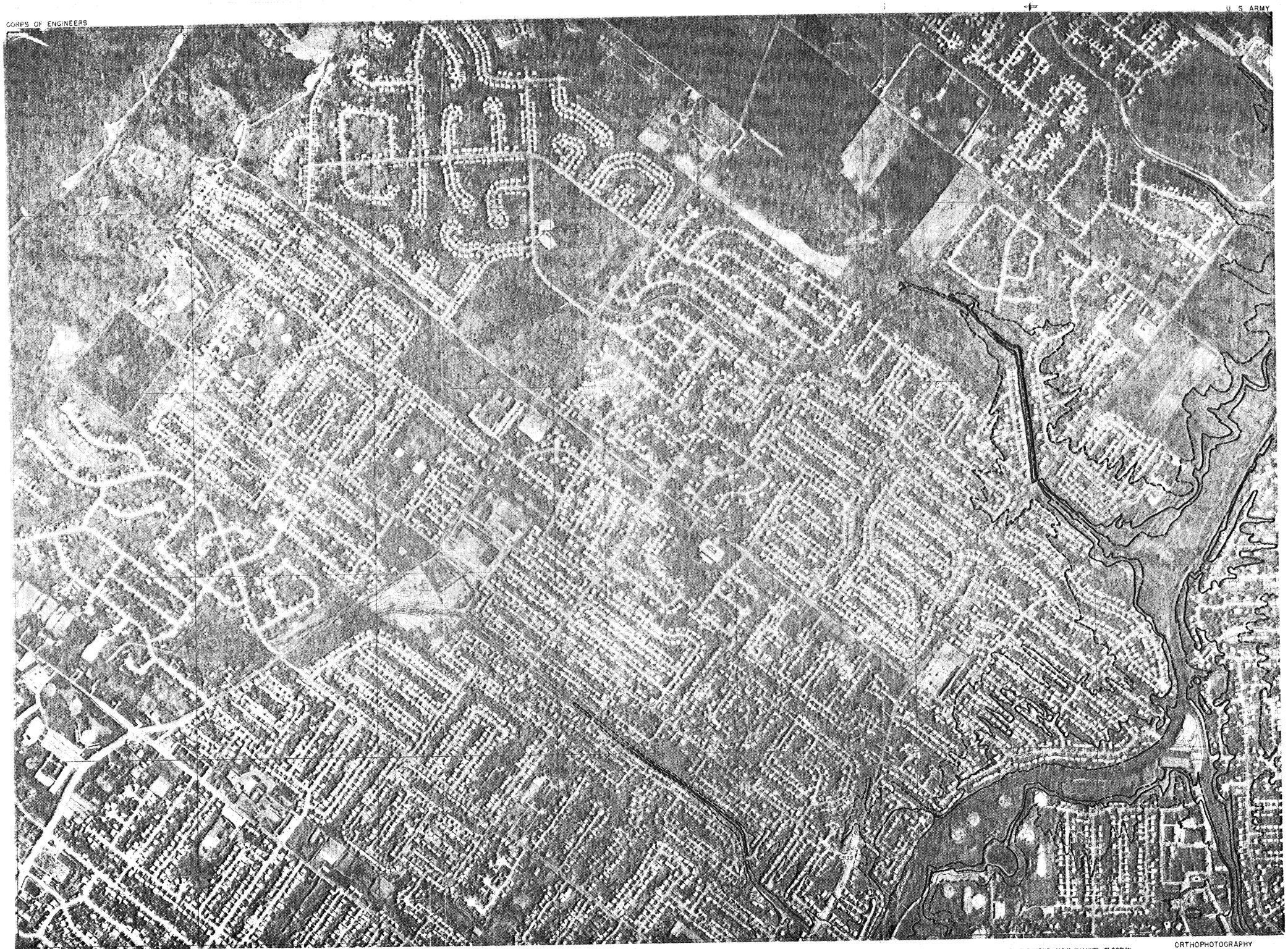
10% PROBABILITY FLOOD

ORTHOPHOTOGRAPHY
COLDWATER CREEK AREA
ST LOUIS, MISSOURI
TOPOGRAPHIC MAPPING

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

CORPS OF ENGINEERS

U. S. ARMY



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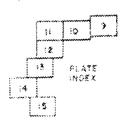

SCALE IN FEET

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200 100 0 200

SCALE IN METERS

TRANSVERSE MERCATOR PROJECTION
MISSOURI STATE PLANE COORDINATE SYSTEM EAST ZONE

CONTOUR INTERVAL 2 FEET

FUTURE CONDITIONS - MAIN CHANNEL FLOODING
STANDARD PROJECT FLOOD
1% PROBABILITY FLOOD
10% PROBABILITY FLOOD

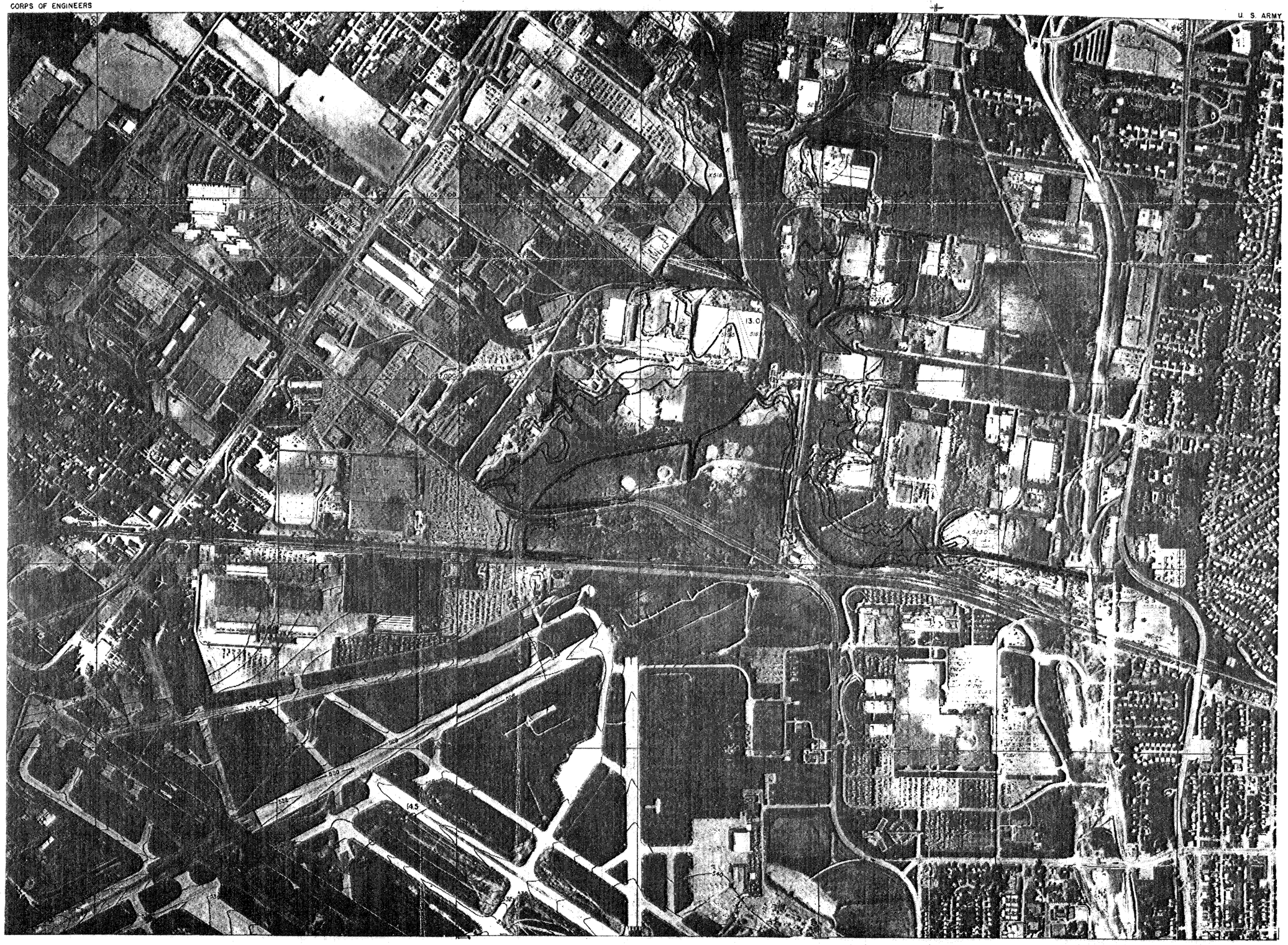
ORTHOPHOTOGRAPHY
COLDWATER CREEK AREA
ST LOUIS, MISSOURI
TOPOGRAPHIC MAPPING

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

PLATE 11

CORPS OF ENGINEERS

U. S. ARMY



NOTE

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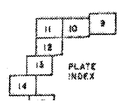
NOTE

CONTOURS IN AIRPORT AREA ARE APPROXIMATE, BASED ON AIRPORT AUTHORITY PROJECT MAPS AND OTHER INFORMATION. DRAWN BY CORPS OF ENGINEERS, SEP 83.



SCALE IN FEET

800 400 0 400 800

200 100 0 200

SCALE IN METERS

TRASVERSE MERCATOR PROJECTION
MISSOURI STATE PLANE COORDINATE SYSTEM EAST ZONE

FUTURE CONDITIONS - MAIN CHANNEL FLOODING
STANDARD PROJECT FLOOD ------
1% PROBABILITY FLOOD ———
10% PROBABILITY FLOOD — — —

ORTHOPHOTOGRAPHY
COLDWATER CREEK AREA
ST. LOUIS, MISSOURI
TOPOGRAPHIC MAPPING

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

ORTHOPHOTOGRAPHY
COLDWATER CREEK AREA
ST LOUIS, MISSOURI
TOPOGRAPHIC MAPPING
U S ARMY ENGINEER DISTRICT ST LOUIS
CORPS OF ENGINEERS
ST LOUIS,MISSOURI

PLATE 14

FUTURE CONDITIONS-MAIN CHANNEL FLOODING
STANDARD PROJECT FLOOD
1% PROBABILITY FLOOD
10 % PROBABILITY FLOOD

SCALE IN FEET
800 400 0 400 800

TRANSVERSE MERCATOR PROJECTION
MISSOURI STATE PLANE COORDINATE SYSTEM EAST ZONE
CONTOUR INTERVAL 2 FEET

SCALE IN METERS
200 100 0 200

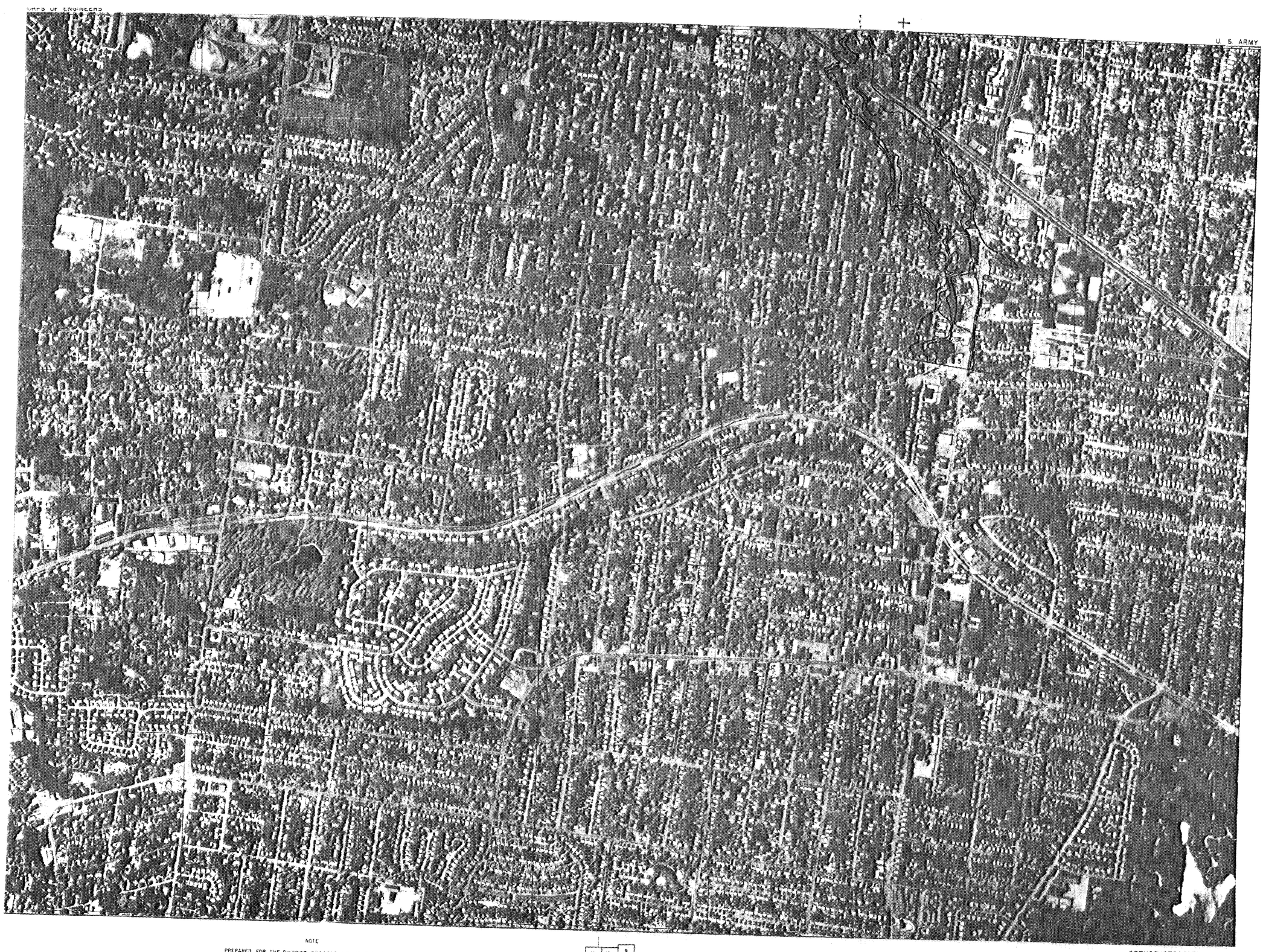
PLATE INDEX

NOTE
CONTOURS IN AIRPORT AREA ARE APPROXIMATE, BASED ON AIRPORT AUTHORITY PROJECT MAPS AND OTHER INFORMATION. DRAWN BY CORPS OF ENGINEERS, SEP 83

NOTE
PREPARED FOR THE DISTRICT ENGINEER, ST LOUIS DISTRICT CORPS OF ENGINEERS ST LOUIS, MISSOURI PHOTOGRAMMETRIC COMPILATION IN 1981 BY SURDEX CORP. CHESTERFIELD, MISSOURI AERIAL PHOTOGRAPHY FLOWN IN 1981 HORIZONTAL AND VERTICAL CONTROL BY U.S.C.&G.S. U.S.G.S. MAPS

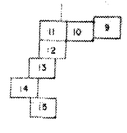
U S ARMY

CORPS OF ENGINEERS



NOTE

PREPARED FOR THE DISTRICT ENGINEER, ST LOUIS DISTRICT CORPS OF ENGINEERS ST LOUIS, MISSOURI PHOTOGRAMMETRIC COMPILATION IN 1981 BY SURDEX CORP, CHESTERFIELD, MISSOURI AERIAL PHOTOGRAPHY FLOWN IN 1981 HORIZONTAL AND VERTICAL CONTROL BY U.S.C.&G.S., U.S.G.S, & M.S.D.



SCALE IN FEET

800 400 0 400 800

200 100 0 200

SCALE IN METERS

TRANSVERSE MERCATOR PROJECTION
MISSOURI STATE PLANE COORDINATE SYSTEM EAST ZONE

FUTURE CONDITIONS – MAIN CHANNEL FLOODING

STANDARD PROJECT FLOOD -------

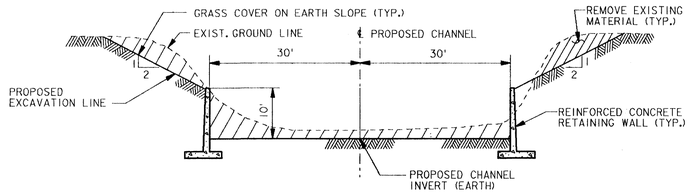
1% PROBABILITY FLOOD ———

10% PROBABILITY FLOOD - - - -

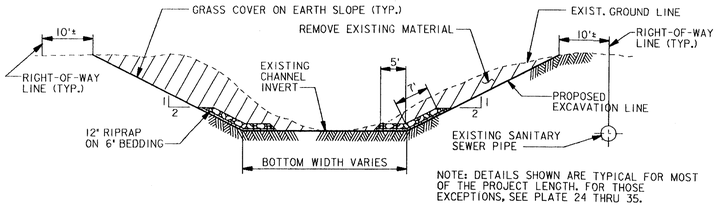
ORTHOPHOTOGRAPHY
GOLDWATER CREEK AREA

ST LOUIS, MISSOURI
TOPOGRAPHIC MAPPING

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

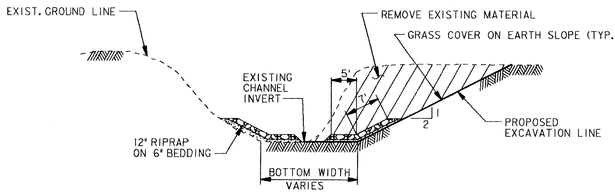


TYPICAL SECTION SHOWING CHANNEL WIDENING NEAR PADDOCK CREEK JUNCTION

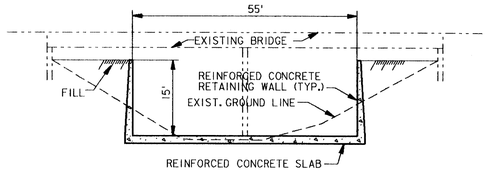


NOTE: DETAILS SHOWN ARE TYPICAL FOR MOST OF THE PROJECT LENGTH. FOR THOSE EXCEPTIONS, SEE PLATE 24 THRU 35.

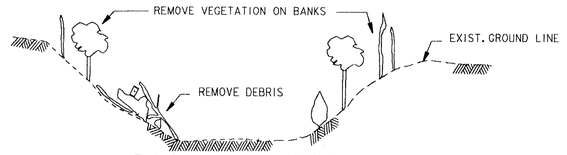
TYPICAL SECTION SHOWING CHANNEL WIDENING



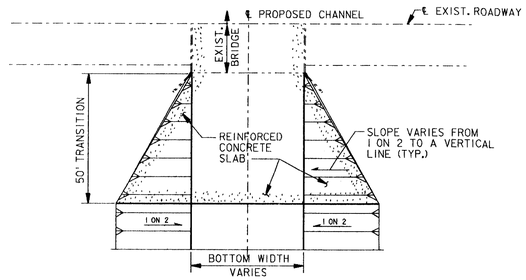
TYPICAL SECTION SHOWING CHANNEL WIDENING ON ONE SIDE ONLY



TYPICAL SECTION SHOWING CHANNEL WIDENING AT ST. DENIS AVE



TYPICAL SECTION SHOWING CLEARING AND SNAGGING



PLAN VIEW OF TYPICAL CHANNEL TRANSITION DETAIL

COLDWATER CREEK, MISSOURI

TYPICAL CHANNEL CROSS SECTIONS

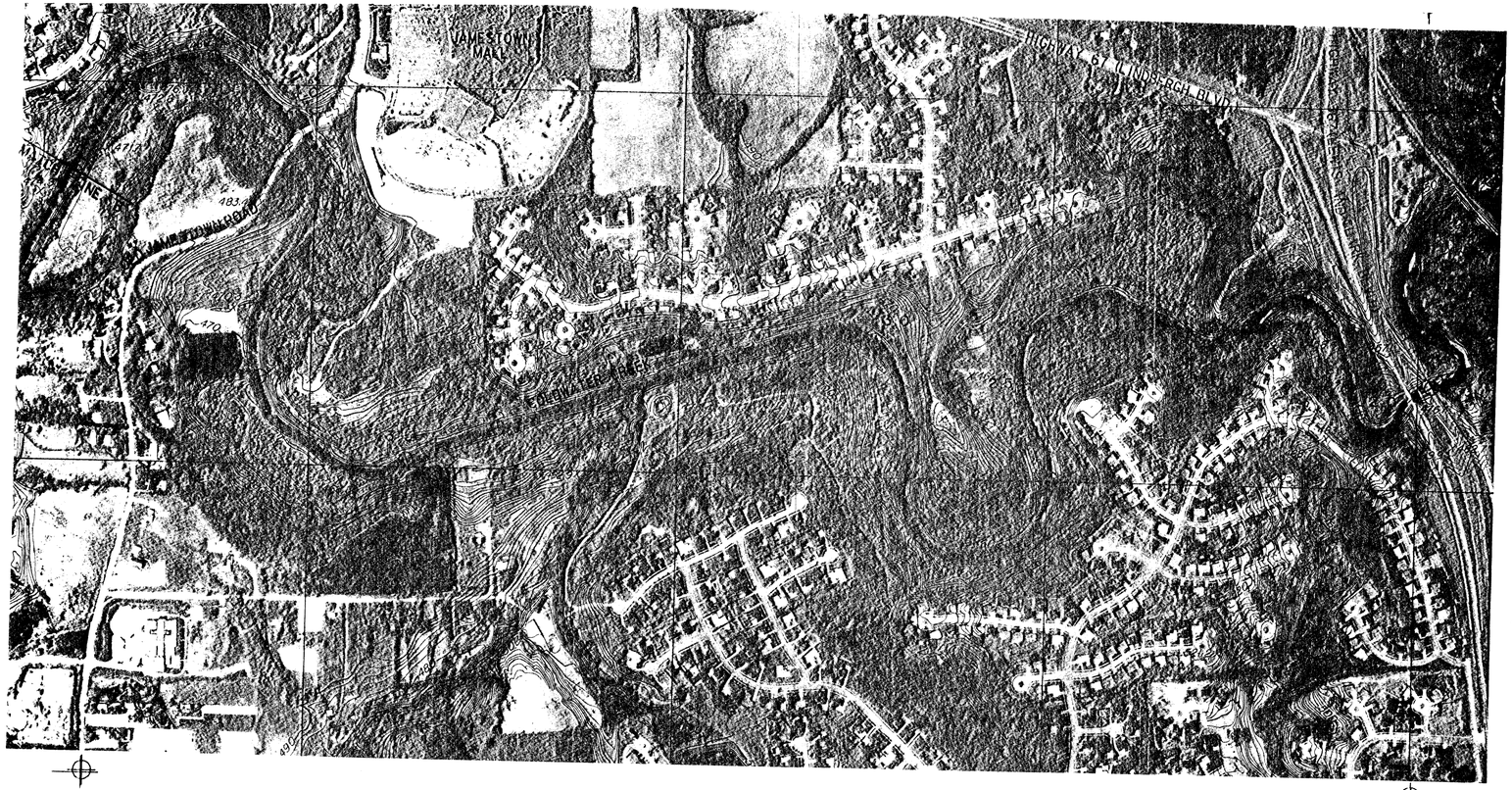
LEGEND

- WIDENED CHANNEL
  - 1 VERTICAL ON 2 HORIZ. SIDE SLOPES
  - GRASS SLOPES WITH RIPRAP AT TOE
  - 10FT PERMANENT EASEMENT ON EACH SIDE
  - EXCAVATED MATERIAL WILL BE PLACED IN CERTAIN OPEN AREAS
- CONCRETE CHANNEL
- CONCRETE RETAINING WALLS
- LEVEE
- TRAIL IN 10FT EASEMENT
- TRAIL FORD
- PEDESTRIAN BRIDGE
- PICNIC SHELTER
- CHAIN LINK FENCE

SCALE: 1" = 400'

400' 0 400'

COLDWATER CREEK, MISSOURI
LAYOUT OF PLAN 2



N

LEGEND

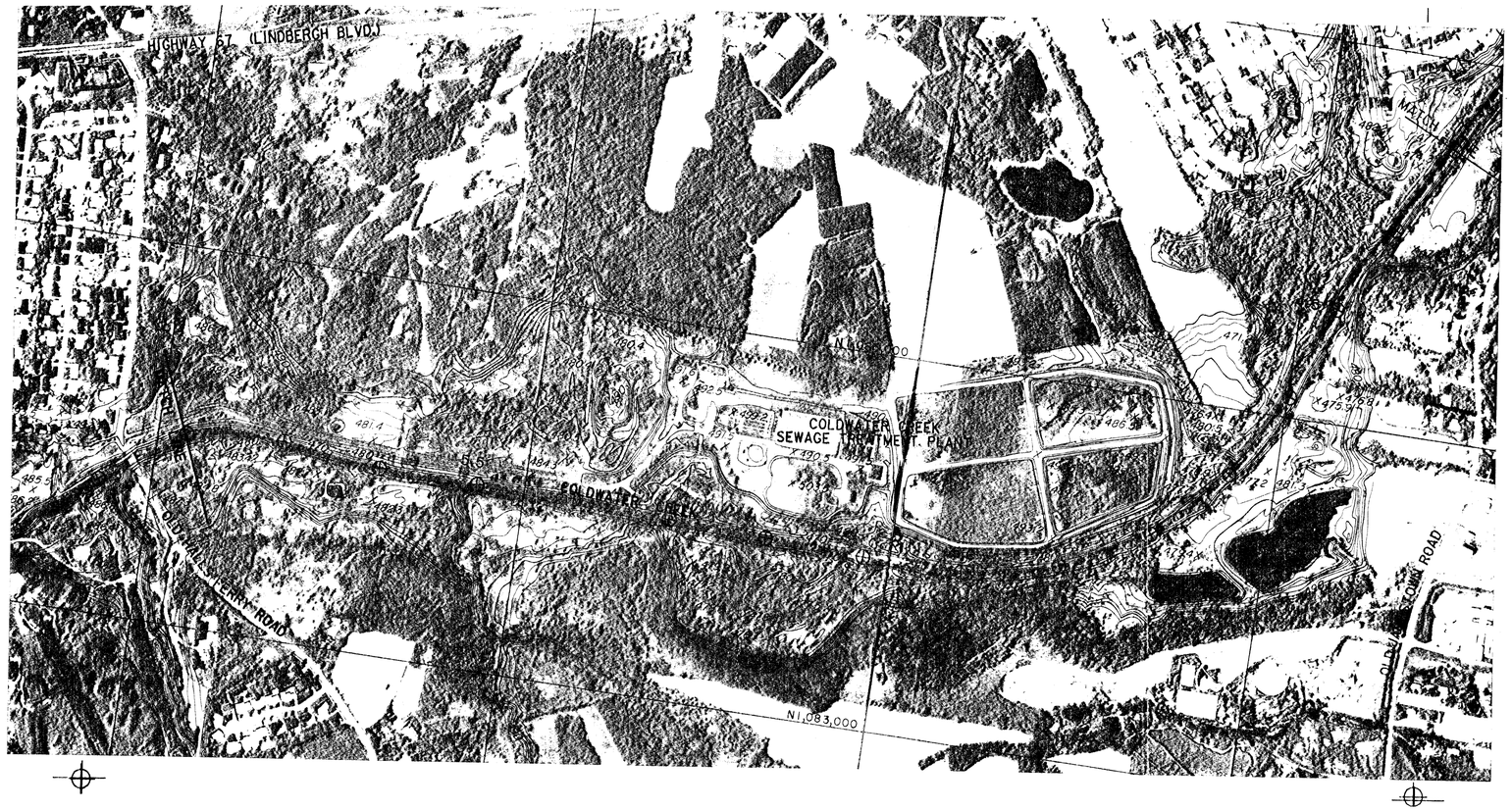
- WIDENED CHANNEL
  - 1 VERTICAL ON 2 HORIZ. SIDE SLOPES
  - GRASS SLOPES WITH RIPRAP AT TOE
  - 10FT PERMANENT EASEMENT ON EACH SIDE
  - EXCAVATED MATERIAL WILL BE PLACED IN CERTAIN OPEN AREAS
- CONCRETE CHANNEL
- CONCRETE RETAINING WALLS
- LEVEE
- TRAIL IN 10FT EASEMENT
- TRAIL FORD
- PEDESTRIAN BRIDGE
- PICNIC SHELTER
- CHAIN LINK FENCE

SCALE: 1" = 400'

400' 0 400'

COLDWATER CREEK, MISSOURI
LAYOUT OF PLAN 2

PLATE 25



N

LEGEND

- WIDENED CHANNEL
  - 1 VERTICAL ON 2 HORIZ. SIDE SLOPES
  - GRASS SLOPES WITH RIPRAP AT TOE
  - 100FT PERMANENT EASEMENT ON EACH SIDE
  - EXCAVATED MATERIAL WILL BE PLACED IN CERTAIN OPEN AREAS
- CONCRETE CHANNEL
- CONCRETE RETAINING WALLS
- LEVEE
- TRAIL IN 100FT EASEMENT
- TRAIL FORD
- PEDESTRIAN BRIDGE
- PICNIC SHELTER
- CHAIN LINK FENCE

SCALE: 1" = 400'

400' 0 400'

COLDWATER CREEK, MISSOURI
LAYOUT OF PLAN 2

PLATE 26

LEGEND

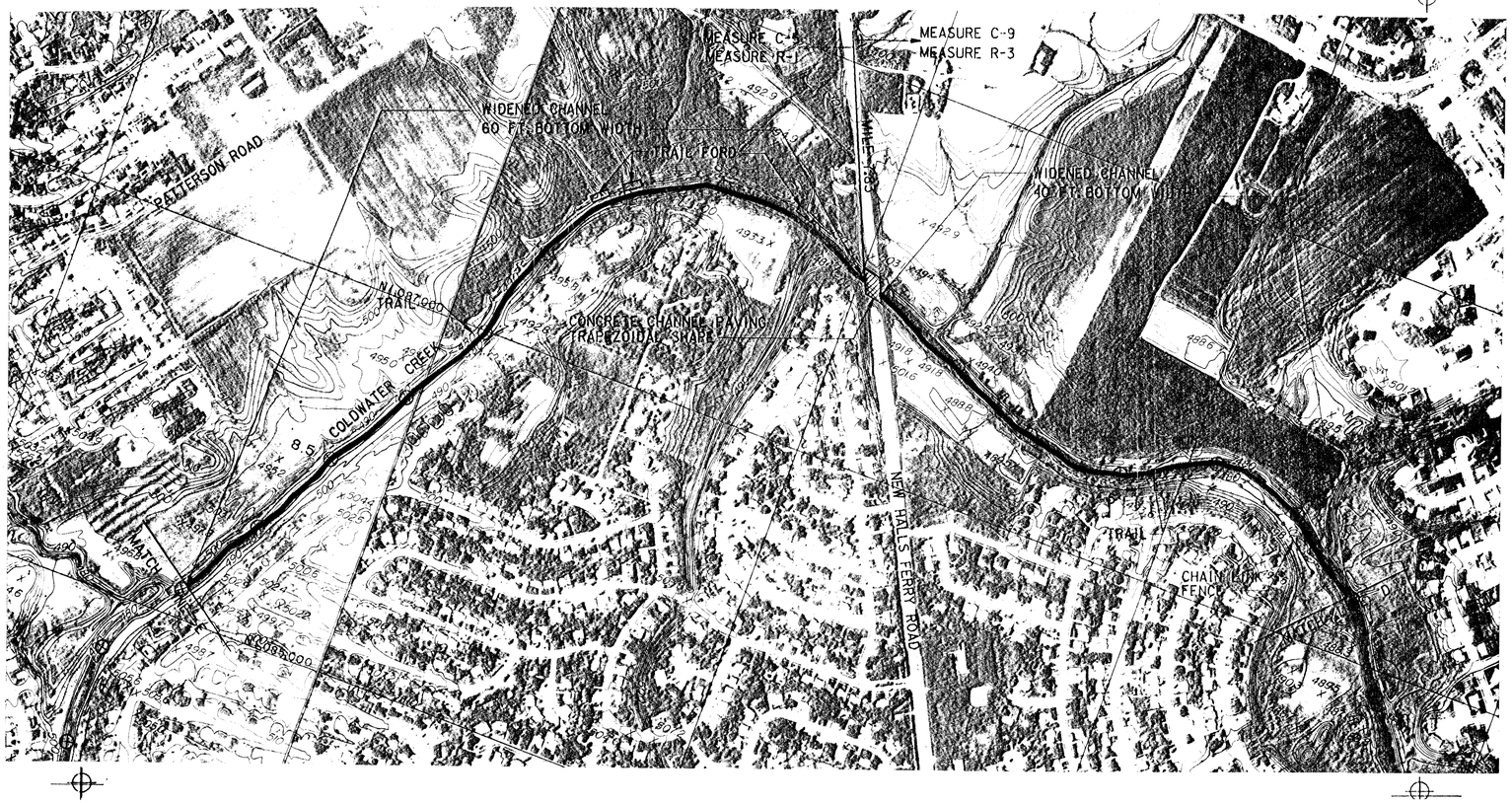
- WIDENED CHANNEL
  - 1 VERTICAL ON 2 HORIZ. SIDE SLOPES
  - GRASS SLOPES WITH RIPRAP AT TOE
  - 10FT PERMANENT EASEMENT ON EACH SIDE
  - EXCAVATED MATERIAL WILL BE PLACED IN CERTAIN OPEN AREAS
- CONCRETE CHANNEL
- CONCRETE RETAINING WALLS
- LEVEE
- TRAIL IN 10FT EASEMENT
- TRAIL FORD
- PEDESTRIAN BRIDGE
- PICNIC SHELTER
- CHAIN LINK FENCE

SCALE: 1" = 400'

400' 0 400'

COLDWATER CREEK, MISSOURI
LAYOUT OF PLAN 2

PLATE 27



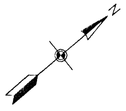
LEGEND

- WIDENED CHANNEL
  - 1 VERTICAL ON 2 HORIZ. SIDE SLOPES
  - GRASS SLOPES WITH RIPRAP AT TOE
  - 10FT PERMANENT EASEMENT ON EACH SIDE
  - EXCAVATED MATERIAL WILL BE PLACED IN CERTAIN OPEN AREAS
- CONCRETE CHANNEL
- CONCRETE RETAINING WALLS
- LEVEE
- TRAIL IN 10FT EASEMENT
- TRAIL FORD
- PEDESTRIAN BRIDGE
- PICNIC SHELTER
- CHAIN LINK FENCE

SCALE: 1" = 400'

400' 0 400'

COLDWATER CREEK, MISSOURI
LAYOUT OF PLAN 2



LEGEND

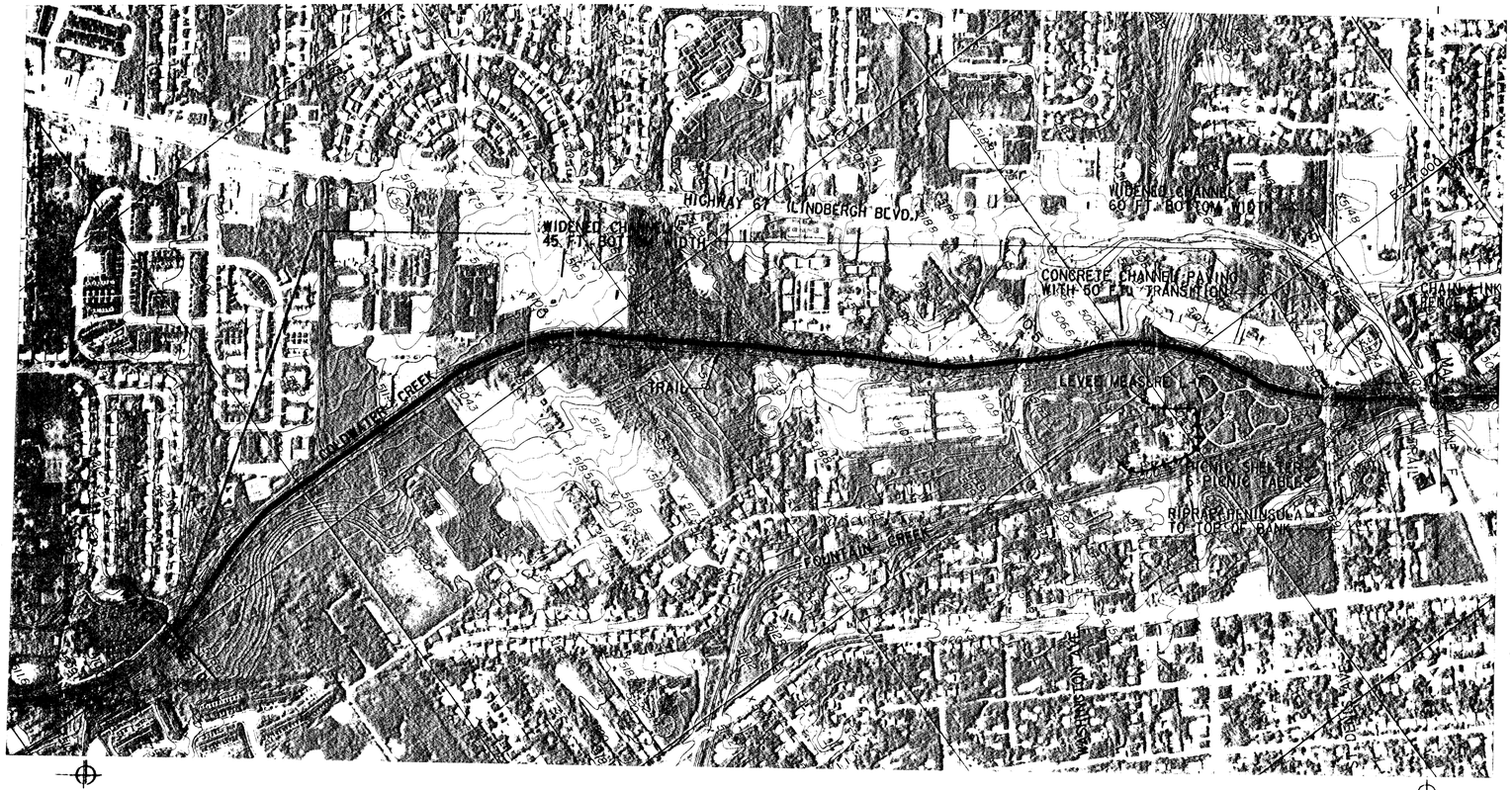
- WIDENED CHANNEL
  - 1 VERTICAL ON 2 HORIZ. SIDE SLOPES
  - GRASS SLOPES WITH RIPRAP AT TOE
  - 10FT PERMANENT EASEMENT ON EACH SIDE
  - EXCAVATED MATERIAL WILL BE PLACED IN CERTAIN OPEN AREAS
- CONCRETE CHANNEL
- CONCRETE RETAINING WALLS
- LEVEE
- TRAIL IN 10FT EASEMENT
- TRAIL FORD
- PEDESTRIAN BRIDGE
- PICNIC SHELTER
- CHAIN LINK FENCE

SCALE: 1" = 400'

400' 0 400'

COLDWATER CREEK, MISSOURI
LAYOUT OF PLAN 2

PLATE 29



LEGEND

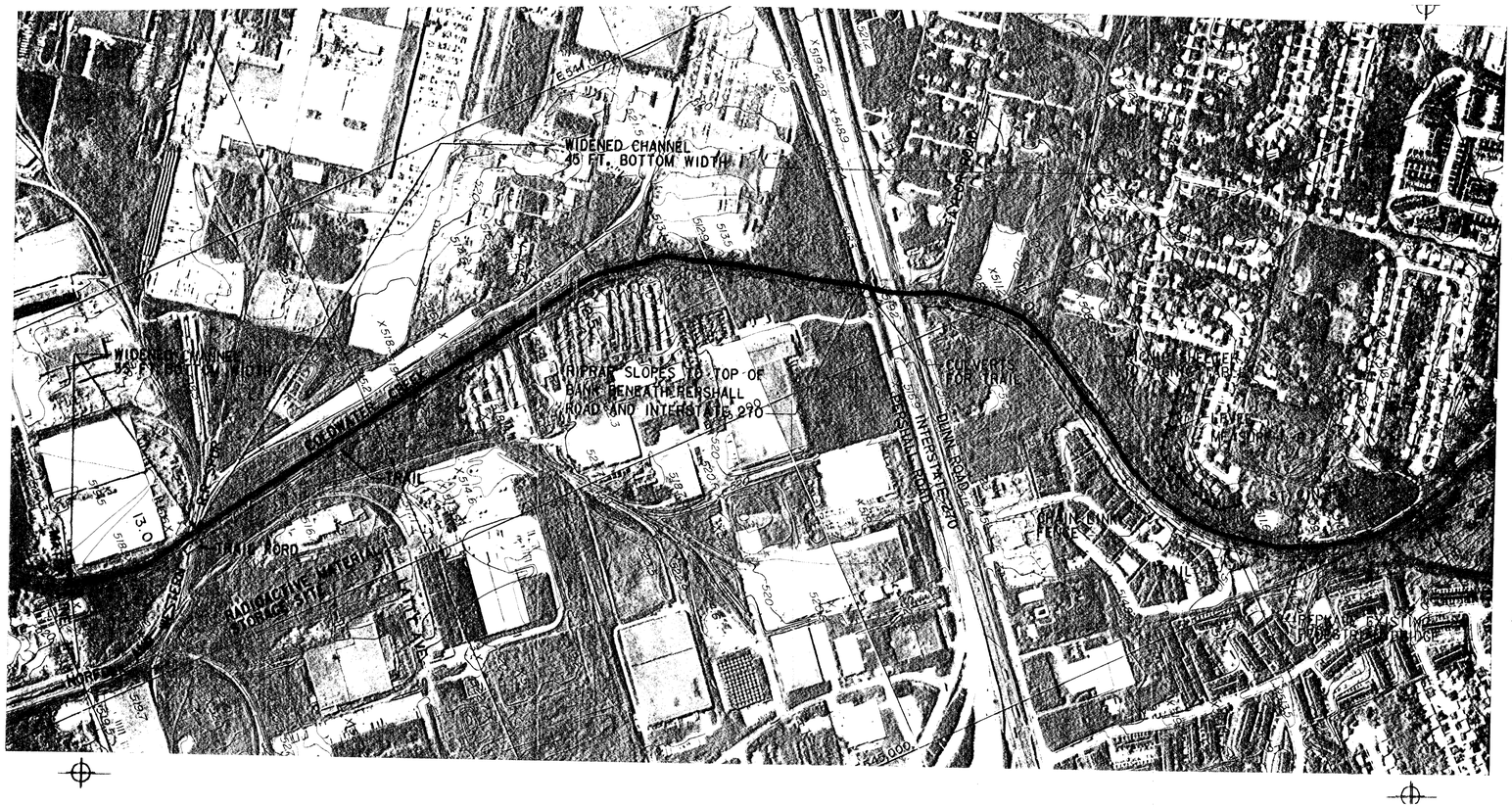
- WIDENED CHANNEL
  - 1 VERTICAL ON 2 HORIZ. SIDE SLOPES
  - GRASS SLOPES WITH RIPRAP AT TOE
  - 10FT PERMANENT EASEMENT ON EACH SIDE
  - EXCAVATED MATERIAL WILL BE PLACED IN CERTAIN OPEN AREAS
- CONCRETE CHANNEL
- CONCRETE RETAINING WALLS
- LEVEE
- TRAIL IN 10FT EASEMENT
- TRAIL FORD
- PEDESTRIAN BRIDGE
- PICNIC SHELTER
- CHAIN LINK FENCE

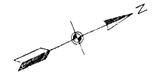
SCALE: 1" = 400'

400' 0 400'

COLDWATER CREEK, MISSOURI
LAYOUT OF PLAN 2

PLATE 30





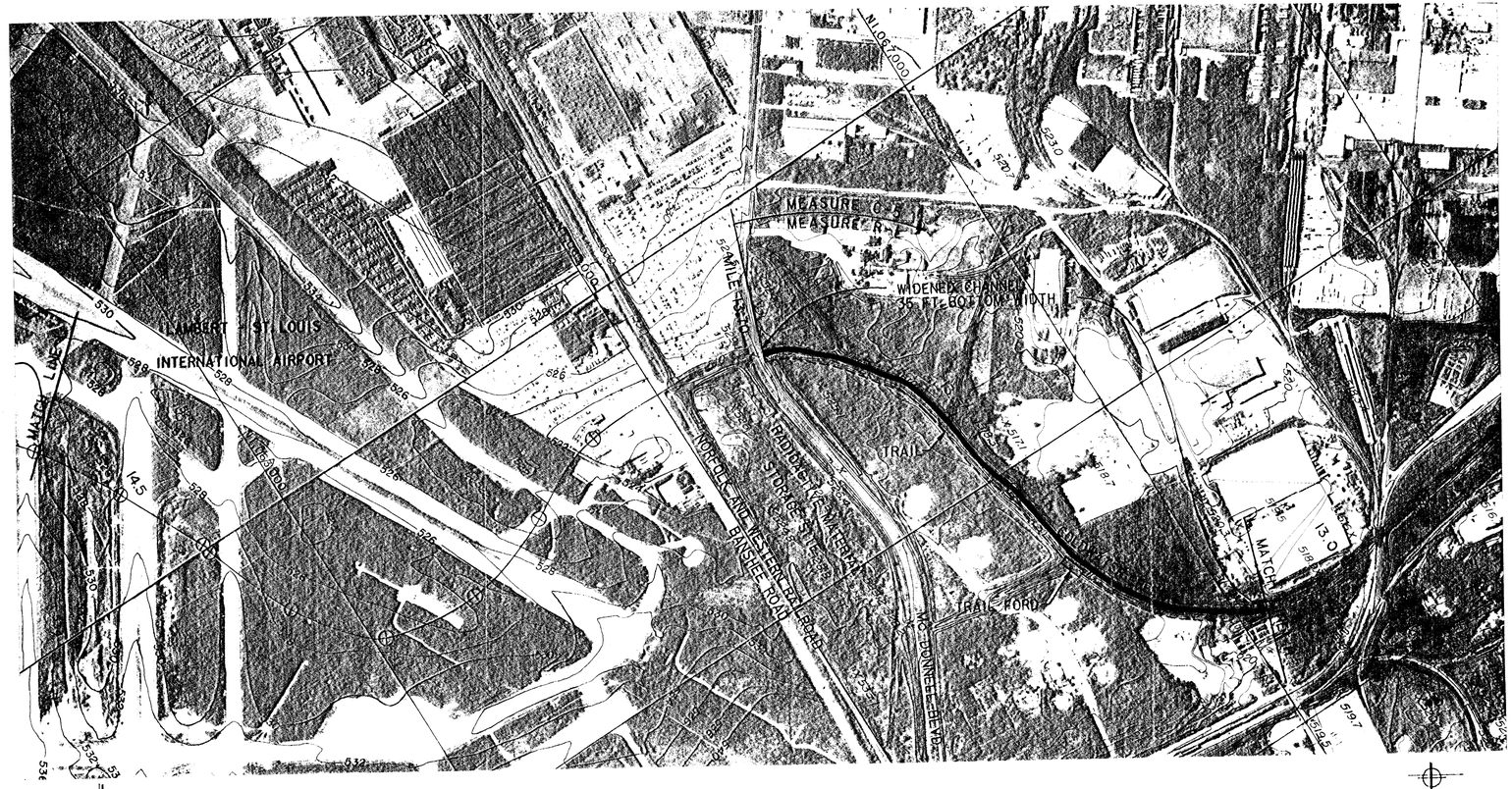
LEGEND

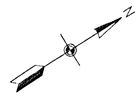
- WIDENED CHANNEL
  - 1 VERTICAL ON 2 HORIZ. SIDE SLOPES
  - GRASS SLOPES WITH RIPRAP AT TOE
  - 100FT PERMANENT EASEMENT ON EACH SIDE
  - EXCAVATED MATERIAL WILL BE PLACED IN CERTAIN OPEN AREAS
- CONCRETE CHANNEL
- CONCRETE RETAINING WALLS
- LEVEE
- TRAIL IN 100FT EASEMENT
- TRAIL FORD
- PEDESTRIAN BRIDGE
- PICNIC SHELTER
- CHAIN LINK FENCE

SCALE: 1" = 400'

400' 0 400'

COLDWATER CREEK, MISSOURI
LAYOUT OF PLAN 2





LEGEND

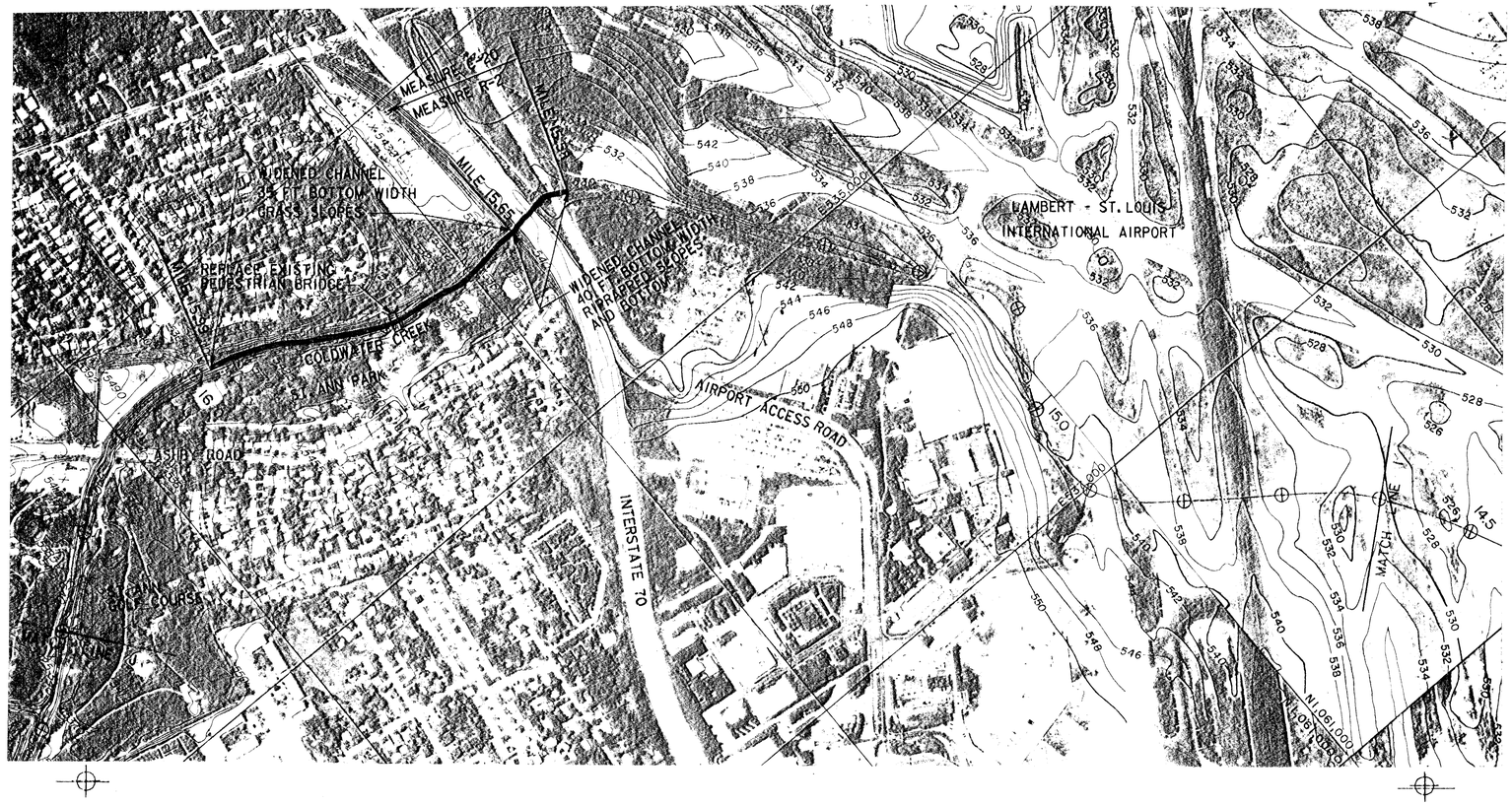
- WIDENED CHANNEL
  - 1 VERTICAL ON 2 HORIZ. SIDE SLOPES
  - GRASS SLOPES WITH RIPRAP AT TOE
  - 10FT PERMANENT EASEMENT ON EACH SIDE
  - EXCAVATED MATERIAL WILL BE PLACED IN CERTAIN OPEN AREAS
- CONCRETE CHANNEL
- CONCRETE RETAINING WALLS
- LEVEE
- TRAIL IN 10FT EASEMENT
- TRAIL FORD
- PEDESTRIAN BRIDGE
- PICNIC SHELTER
- CHAIN LINK FENCE

SCALE: 1" = 400'

400' 0 400'

COLDWATER CREEK, MISSOURI
LAYOUT OF PLAN 2

PLATE 32



LEGEND

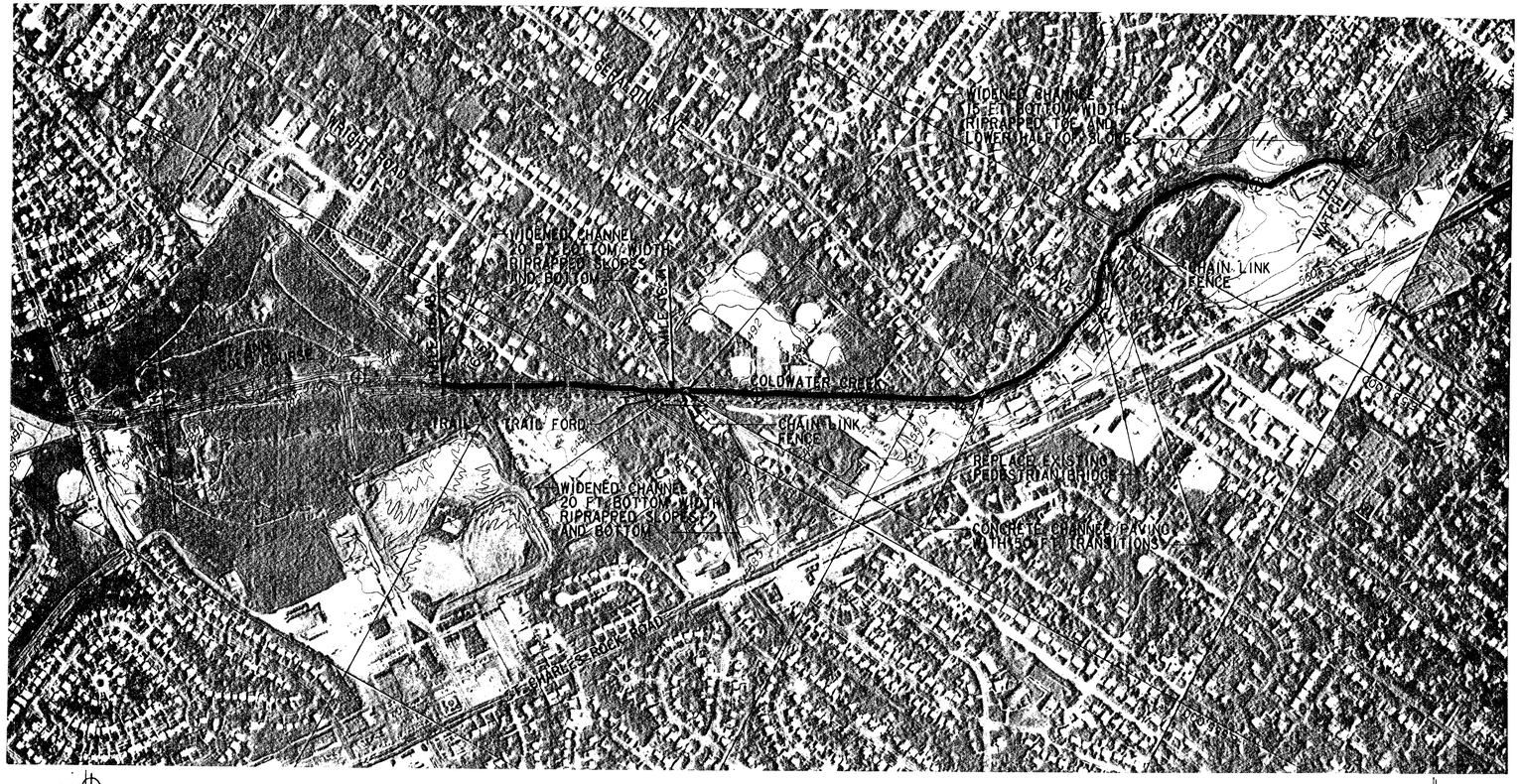
- WIDENED CHANNEL
  - 1 VERTICAL ON 2 HORIZ. SIDE SLOPES
  - 10FT PERMANENT EASEMENT ON EACH SIDE
  - NO DISPOSAL AREAS ASSOCIATED WITH MEASURE C-20
- CONCRETE CHANNEL
- CONCRETE RETAINING WALLS
- LEVEE
- TRAIL IN 10FT EASEMENT
- TRAIL FORD
- PEDESTRIAN BRIDGE
- PICNIC SHELTER
- CHAIN LINK FENCE

SCALE: 1" = 400'

400' 0 400'

COLDWATER CREEK, MISSOURI
LAYOUT OF PLAN 2

PLATE 33



LEGEND

- WIDENED CHANNEL
  - 1 VERTICAL ON 2 HORIZ. SIDE SLOPES
  - 10FT PERMANENT EASEMENT ON EACH SIDE
  - NO DISPOSAL AREAS ASSOCIATED WITH MEASURE C-20
- CONCRETE CHANNEL
- CONCRETE RETAINING WALLS
- LEVEE
- TRAIL IN 10FT EASEMENT
- TRAIL FORD
- PEDESTRIAN BRIDGE
- PICNIC SHELTER
- CHAIN LINK FENCE

SCALE: 1" = 400'

400' 0 400'

COLDWATER CREEK, MISSOURI
LAYOUT OF PLAN 2

PLATE 34

LEGEND

- WIDENED CHANNEL
  - •1 VERTICAL ON 2 HORIZ. SIDE SLOPES
  - •10FT PERMANENT EASEMENT ON EACH SIDE
  - •NO DISPOSAL AREAS ASSOCIATED WITH MEASURE C-20
- CONCRETE CHANNEL
- CONCRETE RETAINING WALLS
- LEVEE
- TRAIL IN 10FT EASEMENT
- TRAIL FORD
- PEDESTRIAN BRIDGE
- PICNIC SHELTER
- CHAIN LINK FENCE

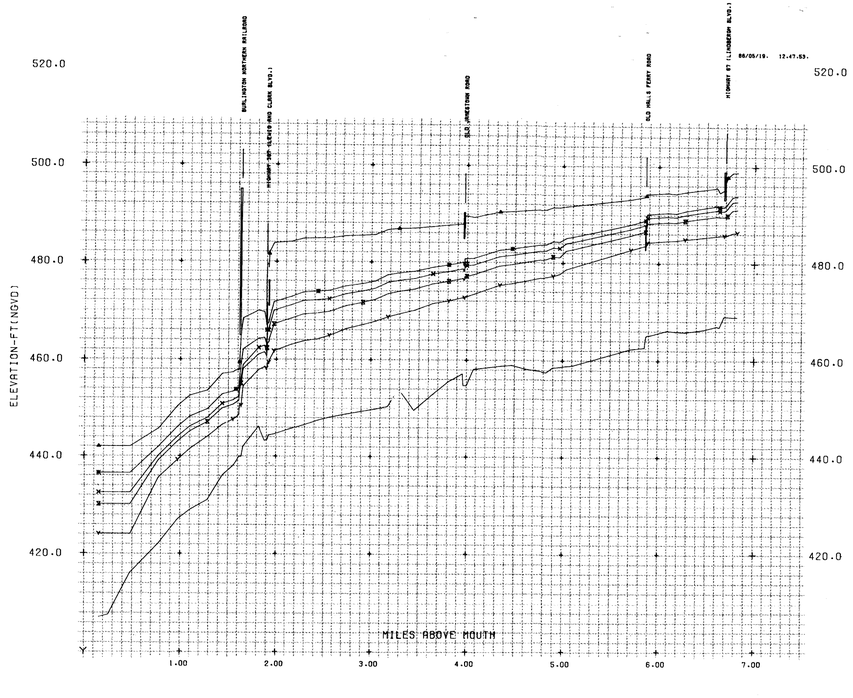
SCALE: 1" = 400'

400' 0 400'

COLDWATER CREEK, MISSOURI

LAYOUT OF PLAN 2

PLATE 35

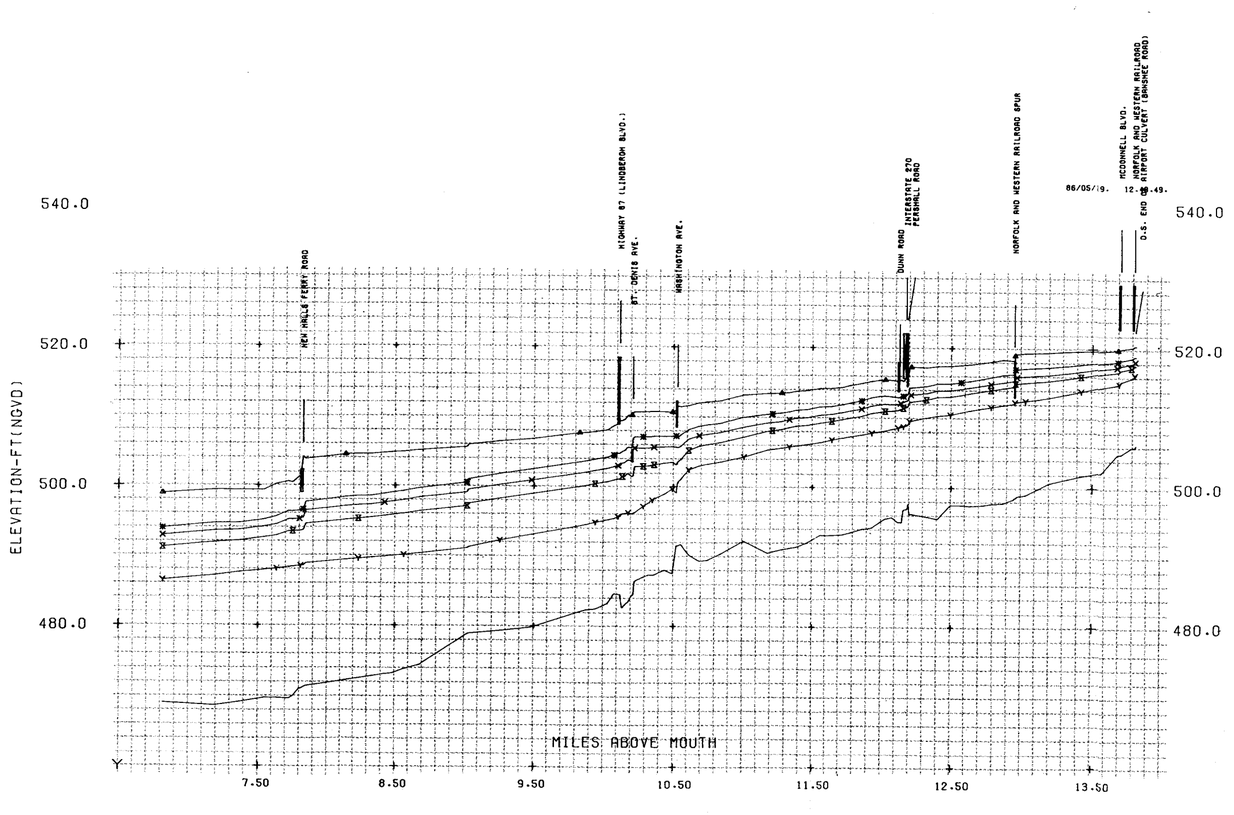


LEGEND

- Δ STANDARD PROJECT FLOOD
- ✱ 1% PROBABILITY FLOOD
- X 4% PROBABILITY FLOOD
- Z 10% PROBABILITY FLOOD
- Y 50% PROBABILITY FLOOD

WATER SURFACE PROFILES
COLDWATER CREEK
FUTURE CONDITIONS WITH PLAN 2

PLATE 36

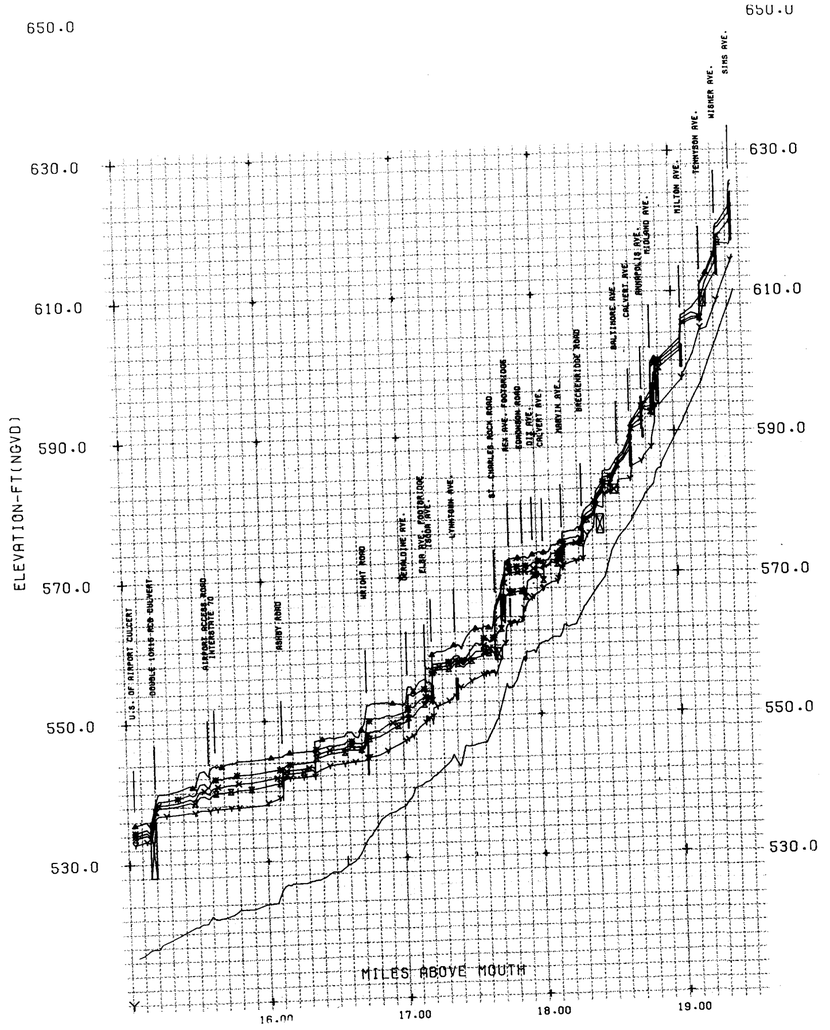


LEGEND

- △ STANDARD PROJECT FLOOD
- ✱ 1% PROBABILITY FLOOD
- × 4% PROBABILITY FLOOD
- ⧗ 10% PROBABILITY FLOOD
- Y 50% PROBABILITY FLOOD

WATER SURFACE PROFILES
COLDWATER CREEK
FUTURE CONDITIONS WITH PLAN 2

PLATE 37

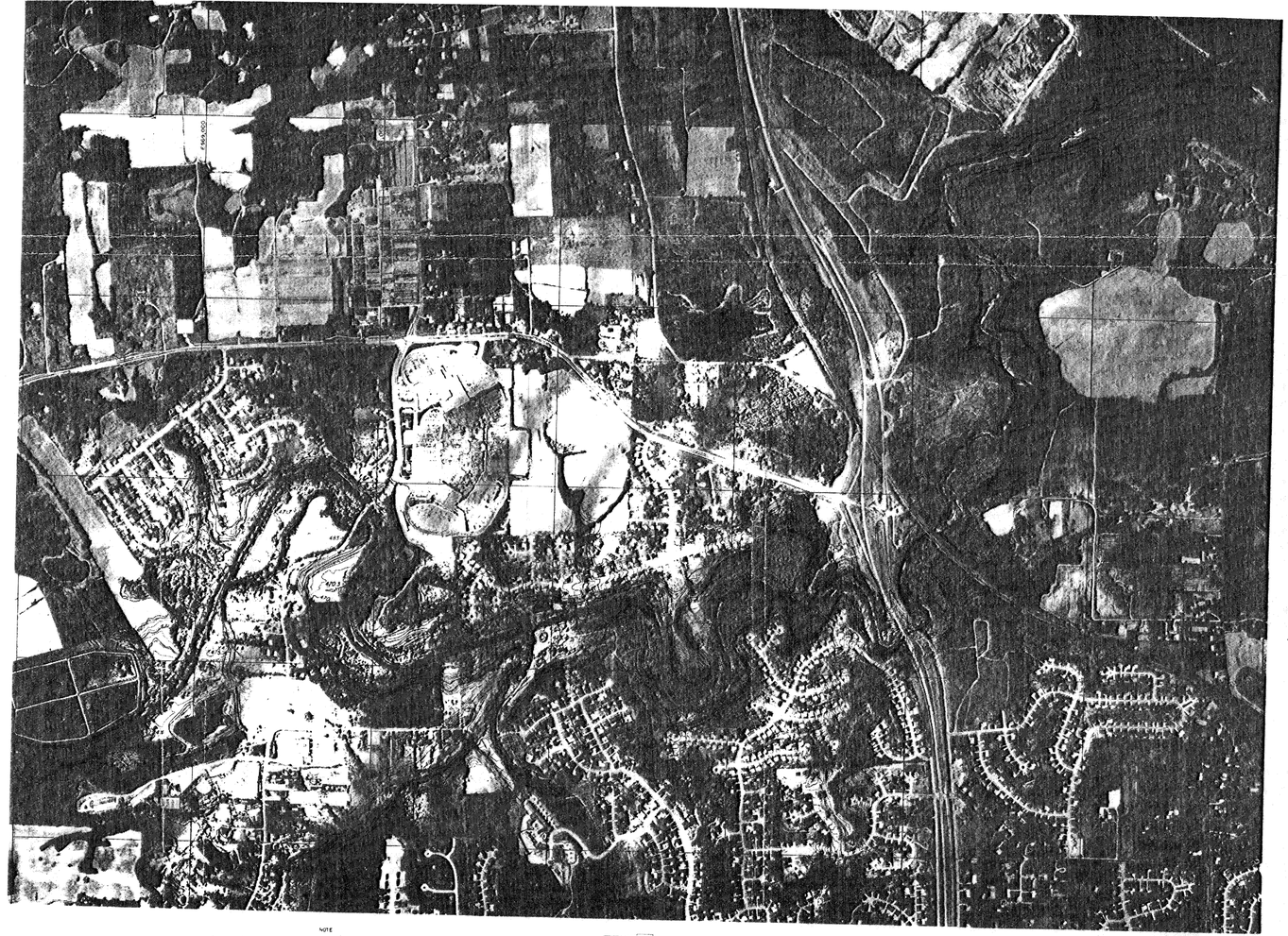


LEGEND

- △ STANDARD PROJECT FLOOD
- ✱ 1% PROBABILITY FLOOD
- × 4% PROBABILITY FLOOD
- ⧖ 10% PROBABILITY FLOOD
- Y 50% PROBABILITY FLOOD

WATER SURFACE PROFILES
COLDWATER CREEK
FUTURE CONDITIONS WITH PLAN 2

PLATE 38



NOTE

PREPARED FOR THE DISTRICT ENGINEER, ST LOUIS DISTRICT CORPS OF ENGINEERS ST LOUIS, MISSOURI PHOTOGRAMMETRIC COMPILATION IN 1961 BY SURDEX CORP, CHESTERFIELD, MISSOURI AERIAL PHOTOGRAPHY FLOWN IN 1961 HORIZONTAL AND VERTICAL CONTROL BY U.S.C.&G.S., U.S.G.S., & M.S.D.

PLATE NOTE

SCALE IN FEET
800 400 0 400 800
200 0 200
SCALE IN METERS

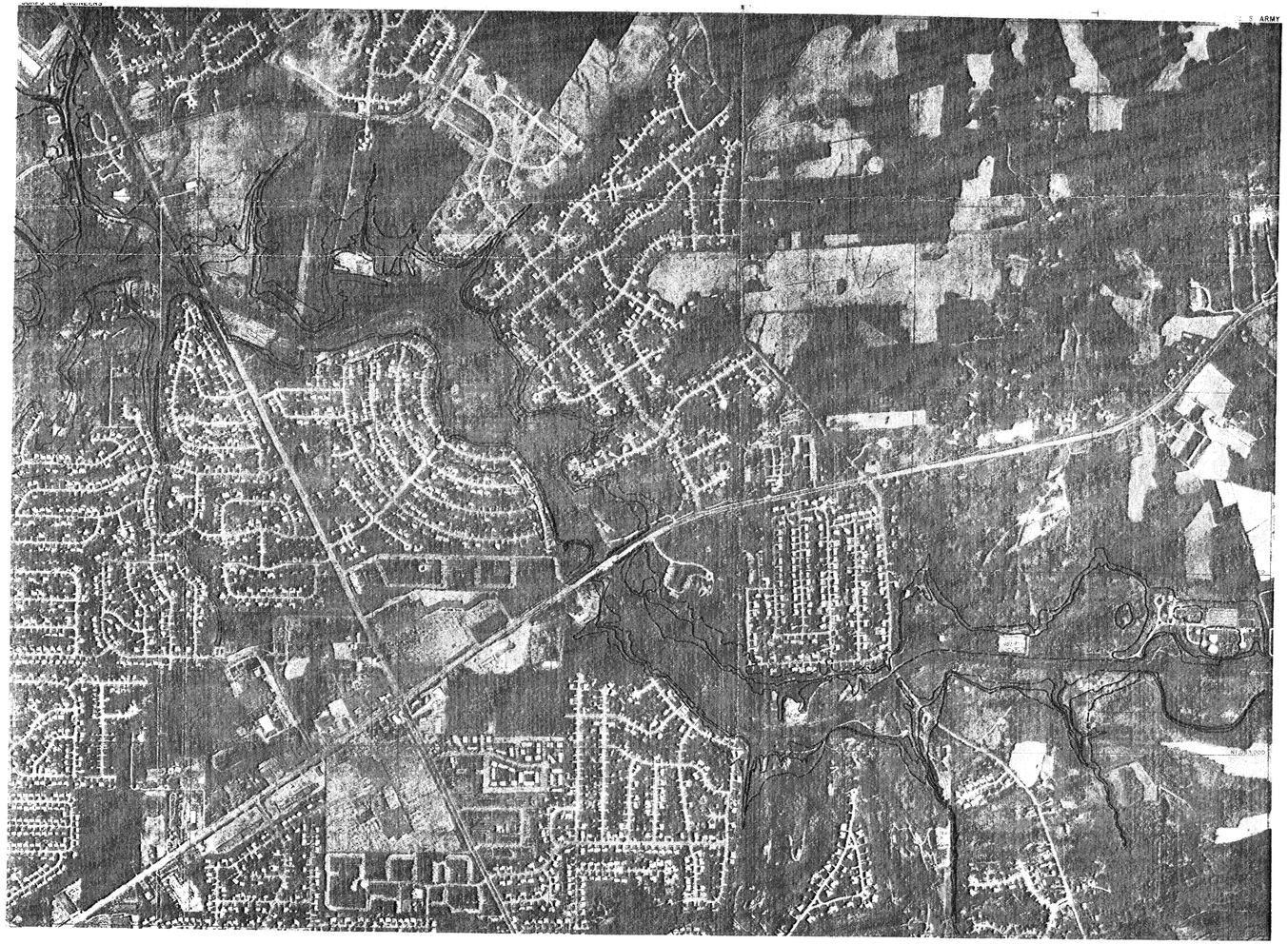
TRANSVERSE MERCATOR PROJECTION
MISSOURI STATE PLANE COORDINATE SYSTEM EAST ZONE

CONTOUR INTERVAL 2 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD)

FUTURE CONDITIONS WITH PROJECT
- MAIN CHANNEL FLOODING
STANDARD PROJECT FLOOD
1% PROBABILITY FLOOD
10% PROBABILITY FLOOD

ORTHOPHOTOGRAPHY
COLDWATER CREEK AREA
ST LOUIS, MISSOURI
TOPOGRAPHIC MAPPING
U S ARMY ENGINEER DISTRICT ST LOUIS
CORPS OF ENGINEERS
ST LOUIS, MISSOURI

PLATE 39



NOTE

PREPARED FOR THE DISTRICT ENGINEER, ST. LOUIS DISTRICT CORPS OF ENGINEERS ST. LOUIS, MISSOURI PHOTOGRAMMETRIC COMPILATION IN 1981 BY SURDEX CORP., CHESTERFIELD, MISSOURI AERIAL PHOTOGRAPHY FLOWN IN 1981 HORIZONTAL AND VERTICAL CONTROL BY U.S.C.&G.S., U.S.G.S., & M.S.D.

PLATE INDEX

SCALE IN FEET

SCALE IN METERS

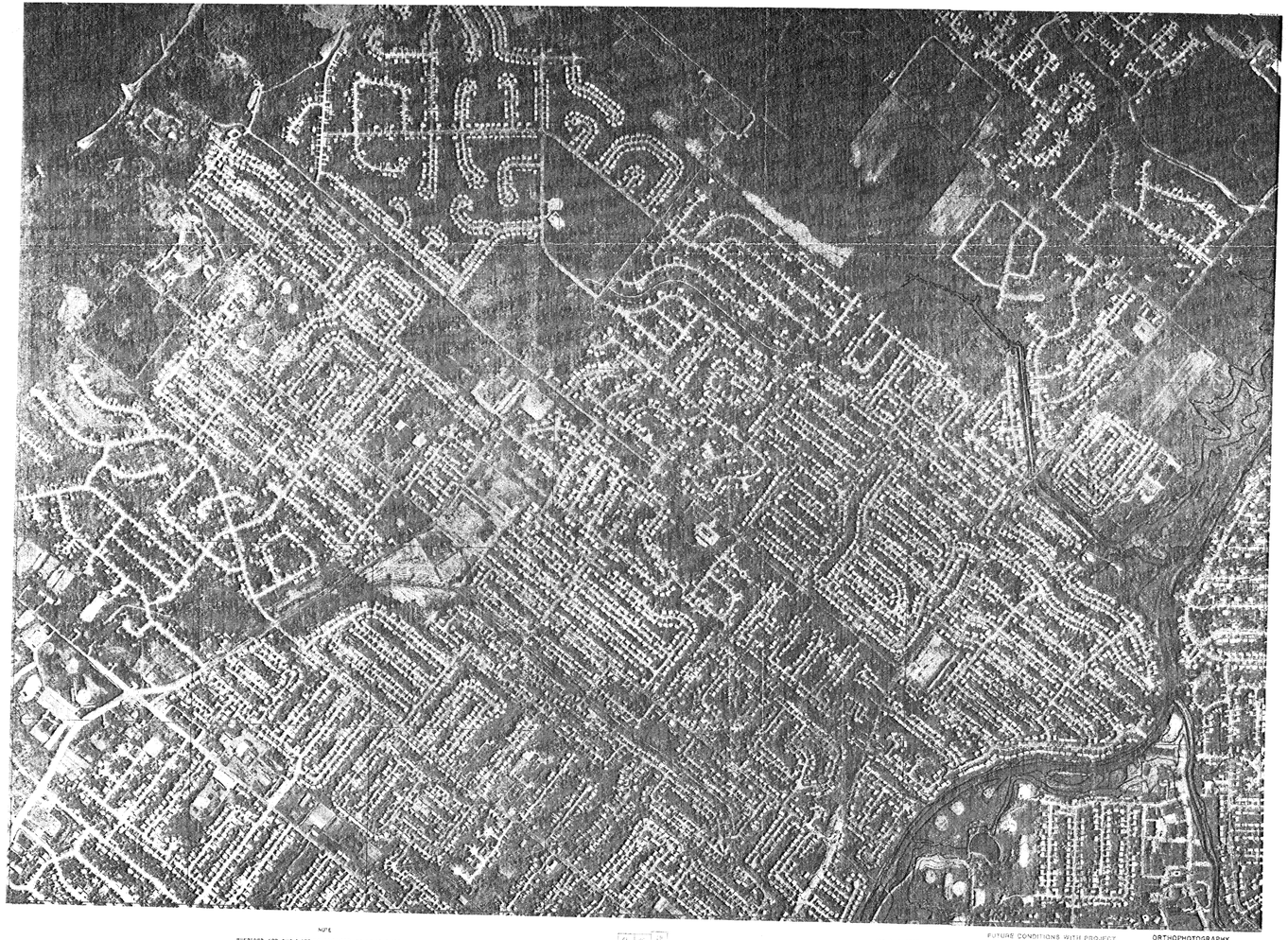
TRANSVERSE MERCATOR PROJECTION
MISSOURI STATE PLANE COORDINATE SYSTEM EAST ZONE

CONTOUR INTERVAL 2 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD)

FUTURE CONDITIONS WITH PROJECT
- MAIN CHANNEL FLOODING
STANDARD PROJECT FLOOD
1% PROBABILITY FLOOD
10% PROBABILITY FLOOD

ORTHOPHOTOGRAPHY
COLDWATER CREEK AREA
ST. LOUIS, MISSOURI
TOPOGRAPHIC MAPPING
U.S. ARMY ENGINEER DISTRICT, ST. LOUIS
CORPS OF ENGINEERS
ST. LOUIS, MISSOURI

PLATE 40



NOTE

PREPARED FOR THE DISTRICT ENGINEER, ST LOUIS DISTRICT
CORPS OF ENGINEERS ST LOUIS, MISSOURI PHOTOGRAMMETRIC
COMPILATION IN 1981 BY SURDEX CORP, CHESTERFIELD, MISSOURI
AERIAL PHOTOGRAPHY FLOWN IN 1981 HORIZONTAL AND
VERTICAL CONTROL BY USC&GS, USGS, & MSD

PLATE AREA

SCALE IN FEET
800 400 0 400 800
200 100 0 200
SCALE IN METERS

TRANSVERSE MERCATOR PROJECTION
MISSOURI STATE PLANE COORDINATE SYSTEM EAST ZONE

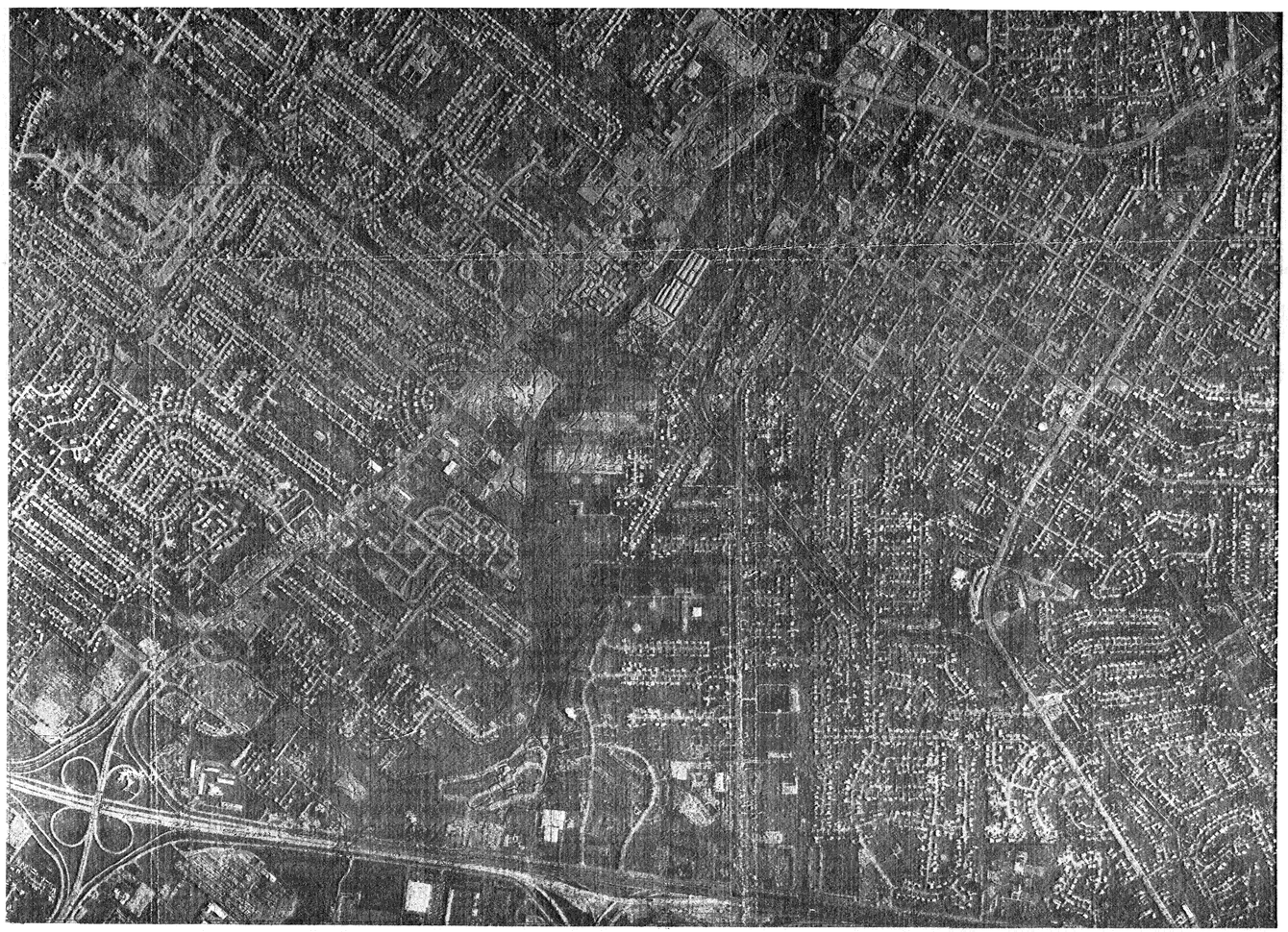
CONTOUR INTERVAL 2 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD)

FUTURE CONDITIONS WITH PROJECT
- MAIN CHANNEL FLOODING
STANDARD PROJECT FLOOD
1% PROBABILITY FLOOD
10% PROBABILITY FLOOD

ORTHOPHOTOGRAPHY
COLDWATER CREEK AREA
ST LOUIS, MISSOURI
TOPOGRAPHIC MAPPING

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

PLATE 41



NOTE

PREPARED FOR THE DISTRICT ENGINEER, ST LOUIS DISTRICT CORPS OF ENGINEERS ST LOUIS, MISSOURI PHOTOGRAMMETRIC COMPILATION IN 1981 BY SURDEX CORP, CHESTERFIELD, MISSOURI AERIAL PHOTOGRAPHY FLOWN IN 1981 HORIZONTAL AND VERTICAL CONTROL BY U.S.C.&G.S., U.S.G.S., & M.S.D.

INDEX TO MAPS

SCALE IN FEET
800 400 0 400 800
200 100 0 200
SCALE IN METERS

TRANSVERSE MERCATOR PROJECTION
MISSOURI STATE PLANE COORDINATE SYSTEM EAST ZONE

CONTOUR INTERVAL 2 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD)

FUTURE CONDITIONS WITH PROJECT
- MAIN CHANNEL FLOODING
STANDARD PROJECT FLOOD - - - - -
1% PROBABILITY FLOOD ———
10% PROBABILITY FLOOD - - - -

ORTHOPHOTOGRAPHY
COLDWATER CREEK AREA
ST LOUIS, MISSOURI
TOPOGRAPHIC MAPPING
U.S. ARMY ENGINEER DISTRICT ST. LOUIS
CORPS OF ENGINEERS
ST. LOUIS, MISSOURI

PLATE 42

U. S. ARMY

NOTE

PREPARED FOR THE DISTRICT ENGINEER, ST. LOUIS DISTRICT CORPS OF ENGINEERS, ST. LOUIS, MISSOURI PHOTOGRAMMETRIC COMPILATION IN 1981 BY SURDEX CORP., CHESTERFIELD, MISSOURI. AERIAL PHOTOGRAPHY FLOWN IN 1981. HORIZONTAL AND VERTICAL CONTROL BY U.S.C.&G.S., U.S.G.S. & M.S.D.

NOTE

CONTOURS IN AIRPORT AREA ARE APPROXIMATE, BASED ON AIRPORT AUTHORITY PROJECT MAPS AND OTHER INFORMATION DRAWN BY CORPS OF ENGINEERS, SEP 85.

PLATE INDEX

SCALE IN FEET

SCALE IN METERS

TRANSVERSE MERCATOR PROJECTION
MISSOURI STATE PLANE COORDINATE SYSTEM EAST ZONE

CONTOUR INTERVAL 2 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD)

FUTURE CONDITIONS WITH PROJECT
- MAIN CHANNEL FLOODING
STANDARD PROJECT FLOOD - - - -
1% PROBABILITY FLOOD ——
10% PROBABILITY FLOOD - - -

ORTHOPHOTOGRAPHY
COLDWATER CREEK AREA
ST. LOUIS, MISSOURI
TOPOGRAPHIC MAPPING
U. S. ARMY ENGINEER DISTRICT, ST. LOUIS
CORPS OF ENGINEERS
ST. LOUIS, MISSOURI

PLATE 43

CORPS OF ENGINEERS

U. S. ARMY

NOTE

PREPARED FOR THE DISTRICT ENGINEER, ST. LOUIS DISTRICT CORPS OF ENGINEERS ST. LOUIS, MISSOURI PHOTOGRAMMETRIC COMPILATION IN 1981 BY SURDEX CORP. CHESTERFIELD, MISSOURI AERIAL PHOTOGRAPHY FLOWN IN 1981 HORIZONTAL AND VERTICAL CONTROL BY U.S.G.S.\ U.S.C.S. & M.S.D

NOTE

CONTOURS IN AIRPORT AREA ARE APPROXIMATE, BASED ON AIRPORT AUTHORITY PROJECT MAPS AND OTHER INFORMATION OBTAIN BY CORPS OF ENGINEERS, SEP 83

PLATE INDEX

SCALE IN FEET

800 400 0 400 800

200 100 0 200

SCALE IN METERS

TRANSVERSE MERCATOR PROJECTION
MISSOURI STATE PLANE COORDINATE SYSTEM EAST ZONE

CONTOUR INTERVAL 2 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD)

FUTURE CONDITIONS WITH PROJECT
- MAIN CHANNEL FLOODING
STANDARD PROJECT FLOOD - - - -
1% PROBABILITY FLOOD ———
10% PROBABILITY FLOOD — — —

ORTHOPHOTOGRAPHY
COLDWATER CREEK AREA
ST. LOUIS, MISSOURI
TOPOGRAPHIC MAPPING

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

PLATE 44

NOTE

PREPARED FOR THE DISTRICT ENGINEER, ST LOUIS DISTRICT CORPS OF ENGINEERS ST LOUIS, MISSOURI PHOTOGRAMMETRIC COMPILATION IN 1981 BY SURDEX CORP, CHESTERFIELD, MISSOURI AERIAL PHOTOGRAPHY FLOWN IN 1981 HORIZONTAL AND VERTICAL CONTROL BY USC&GS, USGS, & MSD

SCALE IN FEET

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SCALE IN METERS

TRANSVERSE MERCATOR PROJECTION
MISSOURI STATE PLANE COORDINATE SYSTEM EAST ZONE

CONTOUR INTERVAL 2 FEET
NATIONAL GEODETIC VERTIAL DATUM OF 1929 (NGVD)

FUTURE CONDITIONS WITH PROJECT
MAIN CHANNEL FLOODING
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ORTHOPHOTOGRAPHY
COLDWATER CREEK AREA
ST LOUIS, MISSOURI
TOPOGRAPHIC MAPPING

U S ARMY ENGINEER DISTRICT ST LOUIS
CORPS OF ENGINEERS
ST LOUIS, MISSOURI

PLATE 45

FUSRAP Document Management System

Year: 00
ID: 4849
Further Info? ☐

Operating Unit: North County
Site:
Area:
MARKS Number: FN:1110-1-8100g

Primary Document Type: Site Management
Secondary Document Type: Reference Documents

Subject or Title: Coldwater Creek, Missouri - Feasibility Report and Environmental Impact Statement dated May 1987 and revised December 1987

Author/Originator:
Company: USACE
Date: 5/1/1987

Recipient (s):
Company (-ies):
Version: Final

Original's Location: Central Files
Document Format:
Confidential File? ☐

Include in which AR(s)?

- ☑ North County
- ☐ Madison
- ☐ Downtown
- ☐ Iowa

Comments:
SAIC number:
Bechtel ID:

ETL: 1.06
Filed in Volume: