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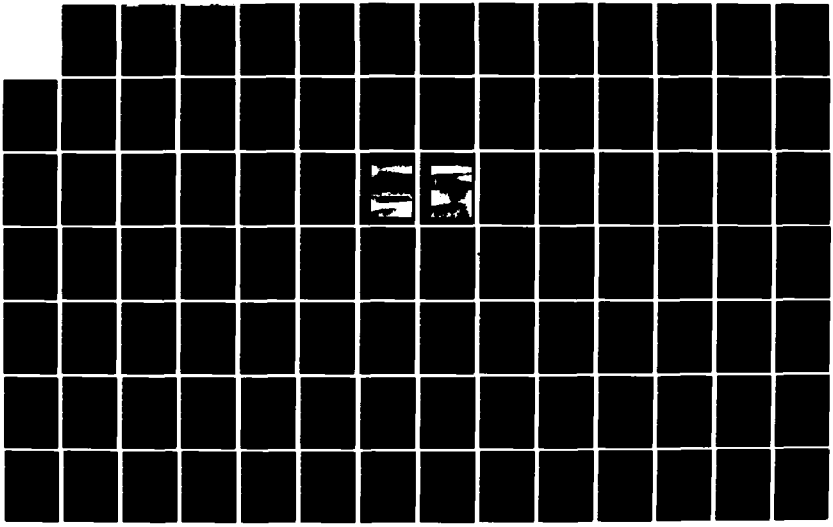

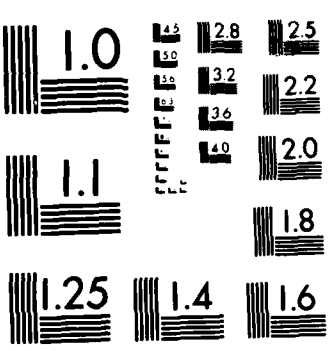

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Final Report

SUGAR CREEK BASIN

NORTH CAROLINA & SOUTH CAROLINA

FEASIBILITY REPORT AND ENVIRONMENTAL IMPACT STATEMENT FOR WATER RESOURCES DEVELOPMENT

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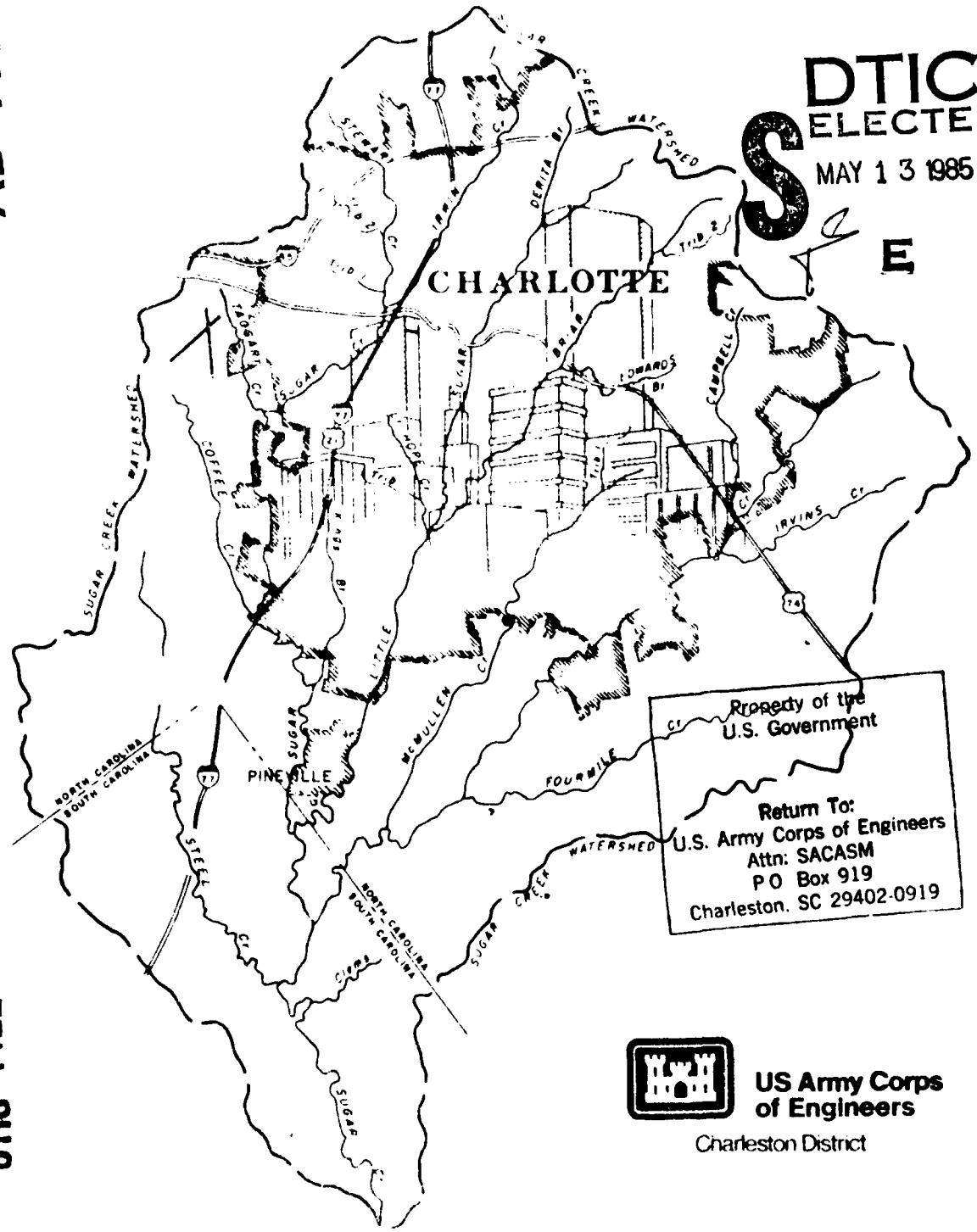

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REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER

2. GOVT. ACCESSION NO. AD-A153 981

3. RECIPIENT'S CATALOG NUMBER

4. TITLE (and Subtitle)

Sugar Creek Basin, North Carolina and South Carolina, Feasibility Report and Environmental Impact Statement for Water Resources Development

5. TYPE OF REPORT & PERIOD COVERED

Final

6. PERFORMING ORG. REPORT NUMBER

7. AUTHOR(s)

8. CONTRACT OR GRANT NUMBER(s)

9. PERFORMING ORGANIZATION NAME AND ADDRESS

Charleston District, U.S. Army Corps of Engineers
P. O. Box 919, Charleston, S. C. 29402

10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS

11. CONTROLLING OFFICE NAME AND ADDRESS

12. REPORT DATE

October 1982

13. NUMBER OF PAGES

625

14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)

U.S. Army, Chief of Engineers
Washington, D.C. 20314

15. SECURITY CLASS. (of this report)

Unclassified

15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for Public Release: Distribution Unlimited

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

Prepared in cooperation with the City of Charlotte, N.C.; Mecklenburg County, North Carolina and the U.S. Fish and Wildlife Service

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Flood Control
Environmental Impacts
Sugar Creek Basin
North Carolina and South Carolina

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Report of investigations to determine feasibility of providing flood control and related water resource improvements on various streams within the Sugar Creek Basin, North Carolina and South Carolina. The report recommends construction of a combination of structural and non-structural flood damage prevention measures and discusses the impacts of implementation.

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SUGAR CREEK BASIN

NORTH CAROLINA & SOUTH CAROLINA

A STUDY TO DETERMINE THE FEASIBILITY OF PROVIDING FLOOD CONTROL AND RELATED WATER RESOURCE IMPROVEMENTS ON VARIOUS STREAMS WITHIN THE SUGAR CREEK BASIN, NORTH CAROLINA AND SOUTH CAROLINA

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Charleston District

OCTOBER 1982

SYLLABUS

The purpose of this study was to determine present and future needs of the Sugar Creek Basin, North Carolina and South Carolina, for flood control and allied water resource needs. Inherent in the investigations was the development of the most suitable plan for addressing these issues.

Sugar Creek Basin covers approximately 270 square miles and includes the City of Charlotte, North Carolina, other portions of Mecklenburg County, North Carolina, and portions of Lancaster and York Counties, South Carolina, where it drains into the Catawba River about seven miles southeast of Fort Mill.

The dendritic nature of the basin's drainage pattern and the scattered nature of flood damage areas prevented the formulation of a single comprehensive water resource project to alleviate the area's water-related problems. In view of this, efforts were made to isolate damage areas and to tailor flood control alternatives to reduce damages in each individual area. After careful formulation and evaluation of potential solutions, a combination of structural and nonstructural plans were selected to alleviate flood damages experienced on seven of the basin's streams and tributaries. These plans include the removal of 193 residential structures from the various flood plains and construction of a total of approximately 7.3 miles of channel modifications. Additional structures would be removed as a mitigation measure in connection with channel modifications on Briar Creek. Inclusion of these structures increases the total number of structures proposed for nonstructural modification to 199.

Lands acquired during the implementation of the proposed plans would be purchased by the local project sponsors and would be subject to future regulation and development in a flood plain compatible manner. Portions

of this land would be landscaped for recreational and conservation purposes and are recommended for dedication to these uses or uses compatible with the conservation of natural resources. The proposed discharge sites for dredged or fill material have been specified through the application of Section 404(b)(1) guidelines, for submittal to Congress under the provisions of Section 404(r), PL 92-500, as amended.

Total first cost for implementing all selected plans is estimated to be $25,958,200 (1982$ value). Average annual cost of $2,222,700 when compared to annual benefits of $3,259,400 yields a benefit-to-cost ratio of 1.51 to 1. An additional first cost of approximately $995,000 would also be required to relocate affected families to non-flood plain sites. These costs are considered as financial costs to be shared by non-Federal interests, but are not included in the economic cost analysis.

SUGAR CREEK BASIN
NORTH CAROLINA AND SOUTH CAROLINA
FEASIBILITY REPORT FOR
WATER RESOURCES DEVELOPMENT

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SUGAR CREEK BASIN

NORTH CAROLINA AND SOUTH CAROLINA

FEASIBILITY REPORT

FOR

WATER RESOURCES DEVELOPMENT

Introduction

The purpose of this study, the results of which are presented in this feasibility report, is to determine present and future needs of the Sugar Creek Basin, North and South Carolina, for flood control, recreation, water quality and fish and wildlife conservation purposes. Inherent in the investigation is the development of the most suitable plan for alleviating these problems. The organization and format of this report is in compliance with established planning regulations and consists of a main report designed to fully support the essential analyses and conclusions of the study, to support the recommendations, and to enable reviewers to understand the rationale for the conclusions and recommendations. Detailed analyses relevant to the conclusions derived from the economic, environmental, social and engineering studies are contained in supportive appendixes which supplement the main report.

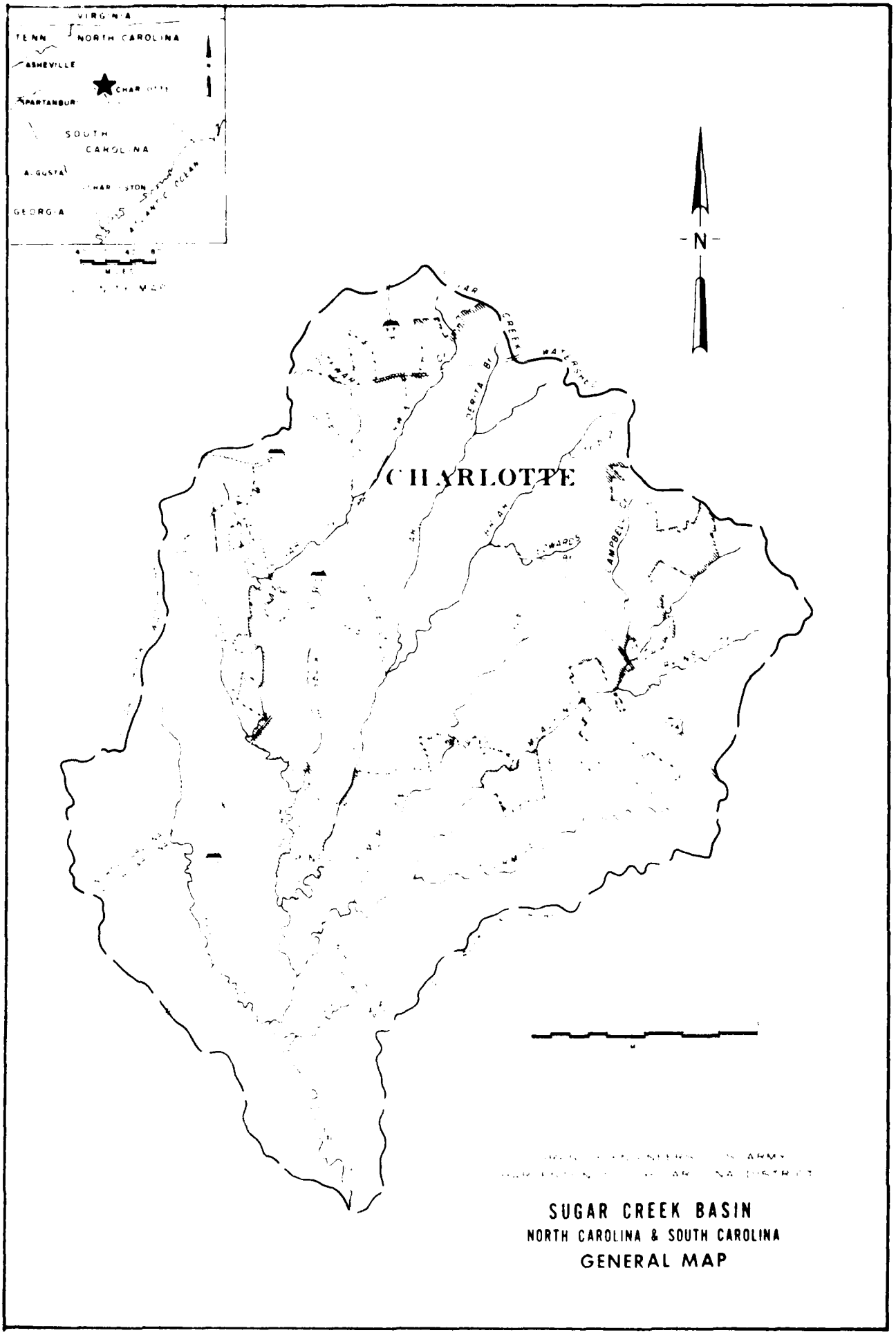
Study Authority

The study and report are in compliance with the following resolution adopted 4 November 1971 by the Committee on Public Works of the United States Senate which reads:

"RESOLVED BY THE COMMITTEE ON PUBLIC WORKS OF THE UNITED STATES SENATE, that the Board of Engineers for Rivers and Harbors, created under the Provisions of Section 3 of the Rivers and Harbors Act approved June 13, 1902, be, and is hereby, requested to review the report of the Chief of Engineers on the Santee River System, North Carolina and South Carolina, Published as Senate Document Number 189, Seventy-eighth 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 Sugar Creek Basin, North Carolina and South Carolina, in the interest of flood control and allied purposes."

Scope of the Study

The authorizing resolution directed that the study encompass the entire Sugar Creek Basin (See General Map, page 3). This area includes the major portion of the metropolitan area of Charlotte, North Carolina, and the town of Pineville, North Carolina. This report discusses in detail the present and projected water related problems and needs of the Sugar Creek Basin, considers alternatives for appropriate solutions, and presents a plan of improvement determined to be the most practicable, acceptable, and feasible. The study included detailed field investigations, hydrologic investigations, economic and environmental studies, and extensive coordination with Federal, State and local governmental units, as well as conservation and environmental groups, and other interested individuals. These studies were made in the depth and detail deemed sufficient to permit the comparison of alternative plans, the selection of the most suitable plan and the establishment of plan feasibility. Plans developed and studied were generally directed to meeting urban flood control needs. Other water and related land resource needs were also addressed in concurrent studies, as discussed in this report, or were determined to be outside the scope of current studies.


VIRGINIA
TENN
NORTH CAROLINA
ASHEVILLE
SPARTANBURG
SOUTH CAROLINA
AUGUSTA
GEORGIA
N
CHARLOTTE
SUGAR CREEK BASIN
NORTH CAROLINA & SOUTH CAROLINA
GENERAL MAP

Study Participants and Coordination

Charleston District was assigned the responsibility for the conduct and coordination of this study, consolidation of information from other agencies and local interest, formulation of a plan and preparation of this report. A multi-disciplinary team was used to accomplish these tasks. The team was composed of a project engineer, biologist, hydrologist, economist, cost estimator, and a foundations and material specialist. Additional assistance was provided by real estate appraisers, surveyors, and others as specific data and analyses were required.

Coordination was maintained with Federal, State and local officials, as well as the general public, throughout the study. The U. S. Fish and Wildlife report, which is required by law, is included in Appendix 5. A vigorous public involvement program was developed to inform interested parties of the progress of the study and to request comments and inputs for consideration.

A working level task force, consisting of state and local officials, was formed to assist in the evaluation of formulated plans, and the selection of the recommended plan. The task force included city, county and state representatives, including representatives of the Planning Board, Drainage Commission and Parks and Playgrounds Commission. Representatives of the Soil Conservation Service and the U. S. Geological Survey were also in attendance.

Three public meetings and a number of small workshops and meetings were utilized to develop communication with Federal, state and local representatives and other interested individuals and groups. An initial televised public meeting was held on 13 April 1972 to inform all concerned of the study initiation and to allow them opportunity to express their views. On 18 and 19 April 1979, Plan Formulation Conferences were held at which time all potential water resource alternatives were presented

and discussed prior to the selection of plans for recommendation. A final public meeting was held on 24 November 1981. During this meeting, selected plans and their impacts ere discussed. Transcripts of these meetings are available from the Charleston District office upon request.

PRIOR STUDIES

A number of reports have been prepared which cover segments within the basin or in which Sugar Creek Basin is a segment. These reports by the Corps and by others are briefly described below.

The report on the Santee River of North Carolina and South Carolina was published as House Document No. 96, Seventy-third Congress, First Session, 1933. It was recommended in this report that no Federal improvement of the streams be undertaken at that time except as authorized by existing projects.

A report on the Santee River, North Carolina and South Carolina, was published as Senate Document No. 189, Seventy-eighth Congress, Second Session, 1944. This report recommended building hydroelectric projects at five sites, a regulating dam at Columbia, South Carolina, and the Santee Reservoir.

In 1965, a Detailed Project Report on Sugar and Briar Creeks, North Carolina, was prepared under authority of Section 205 of the 1948 Flood Control Act, as amended. The report proposed channel improvement on Little Sugar and Briar Creeks.

In 1968, Flood Plain Information Reports, Volumes I and II, were prepared which included Irwin, McAlpine, and McMullen Creeks of the Sugar Creek Basin.

In 1970, a flood insurance study for Little Sugar and Briar Creeks was prepared.

On 7 June 1973, an unfavorable report was submitted on the Santee River System, North Carolina and South Carolina. The report concluded that further water resource improvements were not warranted for Federal participation at that time.

In July 1975, the University of North Carolina at Charlotte, Charlotte, North Carolina, published a report entitled, Measurement of Potential Flood Damages To Flood Prone Structures Within the City of Charlotte. The report recommended implementation of legislative nonstructural flood plain and regulatory measures.

The draft version of this feasibility report was prepared in September 1981 and circulated for review and comment. All pertinent comments received have been incorporated into this revised version for final review and authorization.

EXISTING PROJECTS

As discussed in the preceeding section a Detailed Project Report on Sugar and Briar Creeks, North Carolina, was prepared under authority of Section 205 of the 1948 Flood Control Act, as amended. This study resulted in the construction of approximately 0.76 miles of channel enlargements in the interest of flood damage reduction.

The completed project located downstream from the confluence of Little Sugar and Briar Creeks was designed with bottom widths varying from 50 feet in the lower reaches to 40 feet in the upper reaches. The average depth of cut as measured from low bank was approximately 15 feet with ride slopes ranging from IV:1.5H to IV:2H. Construction was completed in May 1978. Maintenance of this project is a local responsibility.

THE REPORT AND STUDY PROCESS

The organization and content of this report are in general compliance with instructions contained in Engineering Regulation (ER) 1105-2-60, other related guidance. In summary, the report consists of a main report designed to fully support the analyses and conclusions of the study; to support the recommendations; and to enable reviewers to understand the rationale for the conclusions and recommendations. Detailed analyses relevant to the conclusions derived in the main report are contained in supportive appendices which supplement the main report.

Feasibility studies were conducted consistent with the planning requirements of the Water Resource Council. An interdisciplinary planning team was utilized to address four functional planning tasks of problem identification, formulation of alternatives, impact assessment, and evaluation.

In general, the planning process consisted of the refinement of a large number of alternatives down to a few detailed plans and eventually to a recommended solution. During the planning process, the number of plans decreased while the level of detail at which they are examined increased.

The three basic planning stages were:

Stage 1, Delineation of Strategies. Efforts during Stage 1 centered on the identification of problems and needs in the study area, establishment of broad planning objectives, definition of public concerns, and formulation of a management program for conduct of the study;

Stage 2, Formulation of Alternatives. The planners and engineers performed the bulk of their work in Stage 2. Included in this stage were the detailed investigations of such factors as hydrology, hydraulics, costs, structural designs, and institutional analyses. Detailed environmental assessments and socio-economic studies were also accomplished. Stage 2 work eliminated non-viable plans, and formulated a limited number of alternatives which were carried forward in Stage 3;

Stage 3, Refinement of Plans. Stage 3 included the necessary refinement of plans and designs based on economic, engineering, environmental, and social concerns identified during the review at the conclusion of Stage 2. Emphasis was placed on a more thorough evaluation of these plans and the necessary arrangements for implementation.

National Objectives

Federal Water resource planning guidelines require that Federal and Federally-assisted water and related land resource planning be directed to address National Economic Development (NED) and Environmental Quality (EQ) as national objectives. NED is to be achieved by increasing the value of the nation's output of goods and services and improving national economic efficiency. The selection of a NED plan is achieved by maximizing net economic returns. The NED plan accomplishes the stated study objectives in a more economical manner than any other means of accomplishing these objectives. In order to be considered economically viable, a NED plan must have a benefit-to-cost ratio of at least 1.0 to 1. The benefit-to-cost ratio is a comparison of expected benefits to projected NED costs.

EQ enhancement would be achieved by the management, conservation, preservation, creation, restoration, or improvement of the quality of certain natural cultural resources and ecological systems.

In addition to the above, the impacts of proposed actions on the Regional Economic Development (RED) and Other Social Effects (OSE) were evaluated. Contributions to the RED account are established by measuring a proposal's effect on a region's income, employment, population, economic base, environment, and social development. Contributions to the OSE account are determined by establishing a proposal's effects on real income, security of life, health and safety, education, cultural and recreational opportunities, and other factors.

Environmental Setting and Natural Resources

The Sugar Creek Basin lies within the Central Piedmont Belt of the Piedmont Physiographic Province. Relief is low and the topography is characterized by low, rounded hills and valleys. The drainage pattern is dendritic with only minor structural control. The major tributaries to Sugar Creek are Little Sugar, Steele, Irwin, Briar, McMullen, Four Mile, Taggart, Coffey and McAlpine Creeks. Sugar Creek Basin covers 270 square miles and includes the City of Charlotte, North Carolina, other portions of Mecklenburg County, North Carolina, and portions of Lancaster and York Counties in South Carolina, where it drains into the Catawba River about seven miles southeast of Fort Mill.

Mecklenburg County receives an average of about 43 inches of rainfall per year. Generally, rainfall by months is well distributed throughout the year, and the driest weather occurs in the fall. Winter temperatures are changeable, alternating between mild and cool spells. Extreme cold is rare, and the annual freeze-free period is slightly over 230 days. Summers are long, with temperatures frequently reaching the low nineties.

Land within the Sugar Creek Basin is generally urban land consisting of soils with moderate to slowly permeable surface and subsurface layers, which have been dominantly altered and mixed in varying degrees and depths by urban and industrial development. Most of the soils in the basin are of low natural fertility, although the use of fertilizer increases yields and the amount of crop residue.

The water quality of the streams in the basin can best be described as substandard with isolated areas of fair to average. The most recent and complete data concerning water quality were provided by the Water Quality Planning Unit of the North Carolina Department of Natural Resources and Community Development. The large number of monitoring sites in the state and local networks, and the great number of observations made over a long period of time, provide adequate information on the water quality parameters most commonly measured. Water quality is generally poor in the highly industrialized and urbanized areas of the basin. At almost every site, fecal coliform organism counts at some time have exceeded North Carolina standards. At many sites there were numerous violations and/or excessively high counts. Dissolved oxygen measurements also exceeded standards at most of the monitoring sites, although the dissolved oxygen violations occurred less frequently

than the high fecal coliform counts. Several violations of pH and temperature standards were recorded.

The poor water quality has in general resulted in a low diversity of aquatic species due to the highly stressed environment. A survey of selected streams by the State of North Carolina Wildlife Resources Commission in 1963 and studies in 1976 by Cloutman and Olmstead, characterized the fish, fish food organisms, and vegetation found in the basin. Most of the streams are so badly polluted that most of the fishery has been eliminated. Bottoms are usually sand, silt, or clay, and vegetation is generally lacking. Creeks which are outside the urban area and which do not receive waters from the more polluted reaches upstream have some potential for sport fishing. Four Mile, Coffey and the lower reaches of McAlpine Creeks could be developed into good habitats for fish, if water quality were improved and the streams were protected from urban encroachment. Even Briar and McMullen Creeks inside the Charlotte city limits support populations of the more tolerant fish such as bluegill, redbreast, and catfish. A more detailed description of biological resources is contained in Appendix 5.

Human Resources

The City of Charlotte, North Carolina, is the major center of population which affects the development of the Sugar Creek Basin. Surrounding cities which have a smaller impact on the basin are Gastonia and Monroe, North Carolina, and Rock Hill, South Carolina. Numerous other small towns are in the general area, but the impact of the small towns [illegible].

Sugar Creek Basin forms a portion of the Santee River Basin and drains the City of Charlotte and Mecklenburg County, North Carolina, and portions of Lancaster and York Counties, South Carolina. The major portion of the basin is located in Mecklenburg County, including the major portion of the City of Charlotte. For this reason, general economic and statistical data presented in this section will be confined to available data for the City of Charlotte, Mecklenburg County and the Charlotte Standard Metropolitan Statistical Area (SMSA).

The City of Charlotte and Mecklenburg County have for the past four decades realized a rapid increase in total population. The county's population has increased from 151,826 in 1940 to 404,270 in 1980. The population of the City of Charlotte has increased from 100,899 in 1940 to approximately 314,447 in 1980. During the same 40-year period, population in North Carolina grew from 3.6 million to 5.8 million persons. The following tabulation shows 1980 population characteristics of the City of Charlotte compared with Mecklenburg County, the Charlotte SMSA and the State of North Carolina.

1980 POPULATION OF CHARLOTTE, MECKLENBURG COUNTY
CHARLOTTE SMSA AND NORTH CAROLINA

Characteristic	City of Charlotte	Mecklenburg County	Charlotte SMSA	State of North Carolina
Population	314,447 1/	404,270 1/	637,218 1/	5,843,665 2/
Percent increase 1970-1980	+30.4	+14.0	+8.20	+15.0

1/ Charlotte-Mecklenburg Planning Commission

2/ Preliminary data, U. S. Dept of Commerce, Bu. of the Census

Data on employed civilian workers by occupational group are available from the 1970 census of population. The largest group of workers in the City of Charlotte was clerical workers with about 23,300 or 22.0 percent of the total workforce so classified. Professional and technical were the second largest groups representing 14.8 percent of the total workforce. Of the total 105,871 workers in the City of Charlotte accounted for in the 1970 census, 45,547 (approximately 43%) were female.

Development and Economy

The following paragraphs discuss expected growth in the study area in relation to projected economic development of the Charlotte-Gastonia SMSA. Gaston County was added to the Charlotte SMSA following the 1970 census to form the Charlotte-Gastonia SMSA which was used for the latest OBERS projections. Where appropriate, reference is made to smaller economic units which are considered to be generally characteristic of the study area in terms of present and future economic activity.

The principal economic center of the Sugar Creek Basin is the City of Charlotte which serves as the center of local government and as a major commercial and retail center of the southeast United States. Intensive urbanization of the area is expected to continue based on the optimum market location of the city and its reputation as a leading financial and industrial center.

As shown in the [illegible] Department of Commerce publication, Projections - Economic Activity in North Carolina, Series E Population, published in April 1976, the population of the Charlotte-Gastonia SMSA is expected to increase from 55[illegible],767 in midyear 1970 to 944,500 by the year 2020. This represents a compound growth rate of just over 1 percent per year as compared to a predicted compound growth rate of 1.25 percent per year for

the State of North Carolina. Population projections for Mecklenburg County, the Charlotte-Gastonia SMSA and the State of North Carolina are shown in the following tabulation.

Population Trends

	1970	1980	1990	2000	2010	2020
Mecklenburg County	354,700	410,700	464,500	503,100	543,200	571,500
Charlotte-Gastonia SMSA	559,767	650,400	741,900	811,600	886,500	944,500
State of North Carolina	5,082,100	5,758,000	6,389,300	6,872,500	7,301,100	7,660,300

The level of civilian employment depends upon the number of civilians in the labor force who are successful in finding work. The following tabulation shows projected employment trends.

Employment Trends
Charlotte-Gastonia SMSA

	1970	1980	1990	2000	2010	2020
Midyear population	559,767	650,400	741,900	811,600	886,500	944,500
Employment/population ratio	.44	.47	.47	.48	.48	.46
Total employment	246,707	305,600	348,700	389,600	425,400	434,000

Future income estimates for the Charlotte-Gastonia SMSA are considered indicative of the Sugar Creek Basin. The following tabulation shows projected per capita income for the Charlotte-Gastonia SMSA and for North Carolina. Information presented in the following tabulation is based on 1967 dollars.

Income Trends

	1970	1980	1990	2000	2010	2020
Charlotte-Gastonia SMSA						
Per Capita Income (1967 $)	$3,369	$4,732	$6,104	$8,059	$10,475	$1[illegible],94[illegible]
Per Capita Income Relative (US - 1.00)	.97	.99	.99	.99	.98	.98
North Carolina						
Per Capita Income (1967 $)	$[illegible],[illegible]6	$4,028	$5,305	$7,131	$ 9,489	$11,876
Per Capita Income (US - 1.00)	.82	.84	.86	.87	.87	.90

An indication of the projected future growth, employment and per capita income for the Charlotte-Gastonia SMSA and the State of North Carolina is shown graphically on Figure 2.

TRANSPORTATION

Numerous Federal and state highways serve the Sugar Creek Basin. Interstate Highways 85 and 77 intersect within the basin limits. Rail passenger service is provided in Charlotte by the Southern Railway. Other rail lines serving the basin are the Seaboard Coast Line and the Norfolk Railroads. Over 300 trains pass through Charlotte weekly.

Douglas Municipal Airport is located in the western portion of the basin and is served by five commercial airlines. A customs station at the airport makes the city a port of entry and export.

Charlotte is also a major trucking center with over 60 trucking firms using the city as a base of operations. One-third of the nation's leading common carriers in terms of revenue have terminals in Charlotte, including four of the top five.

Local Government Finance

The City of Charlotte has been recognized for its effectiveness in money management. As a result, the leading bond rating services, Moody and Standard and Poor's, both rank Charlotte and Mecklenburg County bonds "AAA". These are the highest ratings obtainable. State of North Carolina bonds are also rated "AAA", adding even more stability to the City of Charlotte and Mecklenburg County.

Recreation

Eighty-seven parks occupy more than 1,500 acres in the city. Included are baseball and softball fields, tennis courts, skating rinks and football fields. Many of the parks in and around the city have playgrounds for children. Occasionally live music and special city-oriented events are featured in the larger parks. Three swimming pools, 15 community centers, a golf course, Park Center arena, and Memorial Stadium are all administered by the City Parks and Recreation Commission.

Mecklenburg County currently has over 900 acres under development in three parks plus two outstanding historic preservations. A listing of parks and recreational areas by type, location and size is contained in Appendix E.

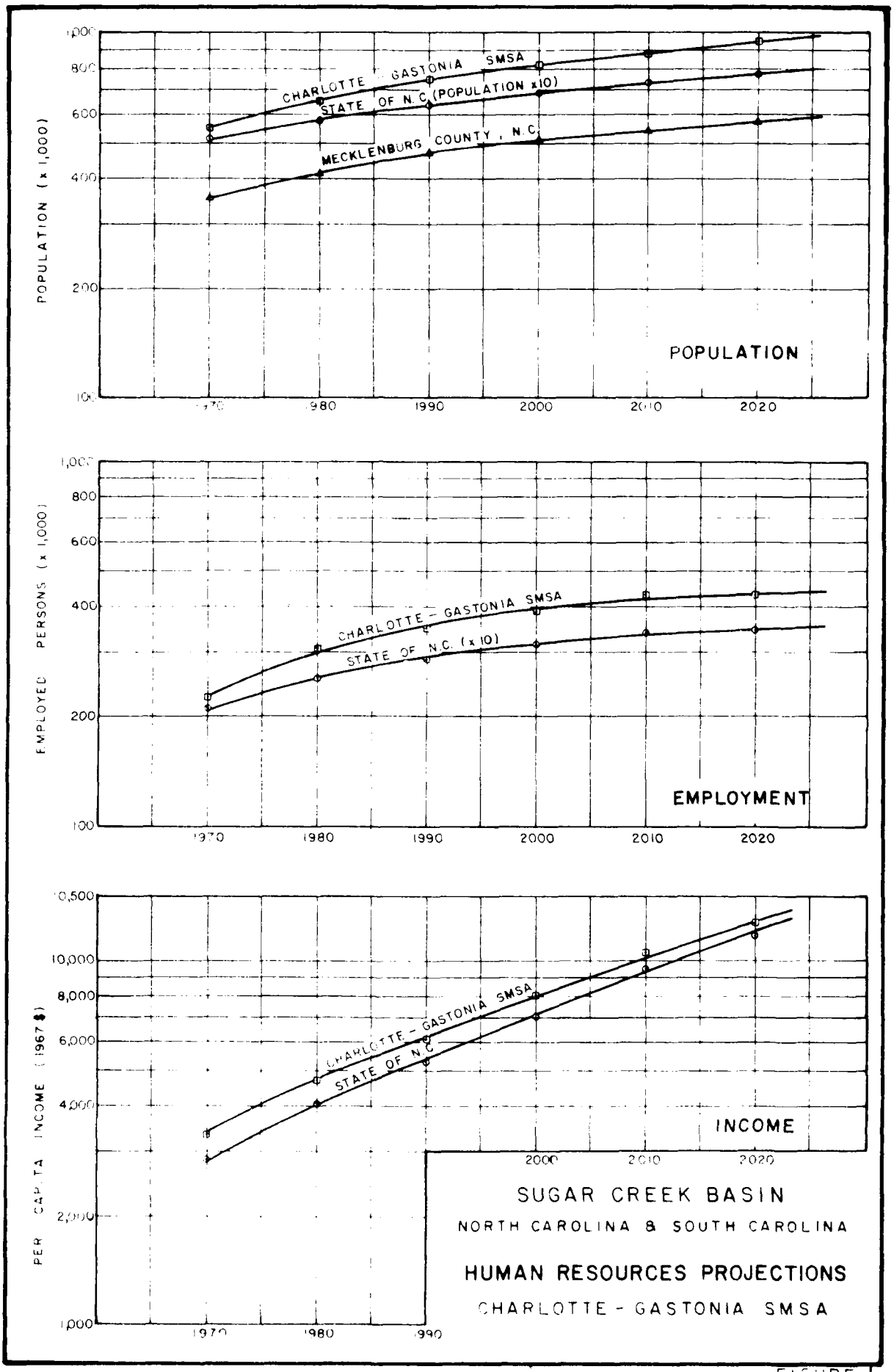

POPULATION (x 1,000)
1,000
800
600
400
200
100
CHARLOTTE - GASTONIA SMSA
STATE OF N.C. (POPULATION x10)
MECKLENBURG COUNTY, N.C.
POPULATION
1970
1980
1990
2000
2010
2020
EMPLOYED PERSONS (x 1,000)
1,000
800
600
400
200
100
CHARLOTTE - GASTONIA SMSA
STATE OF N.C. (x 10)
EMPLOYMENT
1970
1980
1990
2000
2010
2020
PER CAPITA INCOME (1967 $)
10,500
10,000
8,000
6,000
4,000
2,000
1,000
CHARLOTTE - GASTONIA SMSA
STATE OF N.C.
INCOME
1970
1980
1990
2000
2010
2020
SUGAR CREEK BASIN
NORTH CAROLINA & SOUTH CAROLINA
HUMAN RESOURCES PROJECTIONS
CHARLOTTE - GASTONIA SMSA

FIGURE 1

Parks are often located in the flood plains of streams in the Charlotte area due to the availability of flood prone lands and the nature of many park facilities which are little harmed by periodic flooding. Although the McAlpine Greenway is the only "greenway" in Mecklenburg County, there are many parks in Mecklenburg which are located in flood plains. Huntingtowne Farms Park is a 30-acre park along 0.8 of a mile of Sugar Creek. It is linear, has a natural appearance and has a few ballfields. Freedom Park is a 98-acre park along Little Sugar Creek with much of it in a flood plain. A portion of the park along the creek has a very natural appearance. The most active parts of the park -- the major ballfields and tennis courts -- are in the flood plain. Revolution Park and Clanton Park form a linear park including over two miles of Irwin Creek. Clanton Park, which is primarily in the flood plain, is almost totally undeveloped. Revolution Park is primarily a golf course, but it also includes a swimming pool and typical active sports areas on the fringe of the flood plain.

Land Use

In Sugar Creek Basin, land use by man is the strongest factor in determining the condition of natural resources. Sugar Creek and most of its tributaries drain land used for industrial, commercial and residential purposes. These uses have in common the emission of pollutants to the atmosphere and the related problems of rapid water runoff, low water retention, erosion, and discharge of effluents into receiving waters.

As part of the basin investigation, land use analysis studies were made to determine existing conditions and to predict future use based on existing use, growth patterns indicated by new construction, and projections made by the City of Charlotte and Mecklenburg County for the years 1995 and 2000. Additional information on future zoning, recreational planning and transportation was obtained from local officials. Further information concerning land use projections is contained in Appendix 1 of this report.

PROBLEMS, NEEDS AND OPPORTUNITIES

The following paragraphs discuss the water resource needs and problems in the Sugar Creek Basin. Preliminary investigations indicated that the major problems and needs are confined to flooding, water quality, recreation and the need to enhance and preserve the existing open spaces and environment.

Municipal and industrial water supply is not a problem in the Mecklenburg County area. An interview with the Director of the Charlotte-Mecklenburg Utilities Department established the fact that the present water supply provided by Lake Norman, located outside of the Sugar Creek Basin watershed, is adequate to meet the demand of the area for the foreseeable future. With this information, no further effort was exerted in the investigation of water supply needs.

Irrigation is also not considered to be a problem or need due to the urbanized nature of the basin. Sugar Creek is not navigable and due to the small size of the basin and to the lack of adequate reservoir sites, hydropower was not considered feasible at this time. Water quality problems are currently being addressed by other agencies and although identified as a problem in this report, solutions were not investigated.

Floodwaters cause considerable financial loss by damaging homes, businesses, industries, utilities, transportation facilities, and to a small degree, agricultural lands, equipment, and livestock. At times sewer systems are kept from operating properly by flood water, thus causing health and safety problems. Highways blocked by floodwaters increase the hazard of accidents and obstruct emergency traffic. Recreation parks and facilities within the basin are occasionally damaged by flood water. Figures 3 and 4 shows flooding which occurred in May 1976.

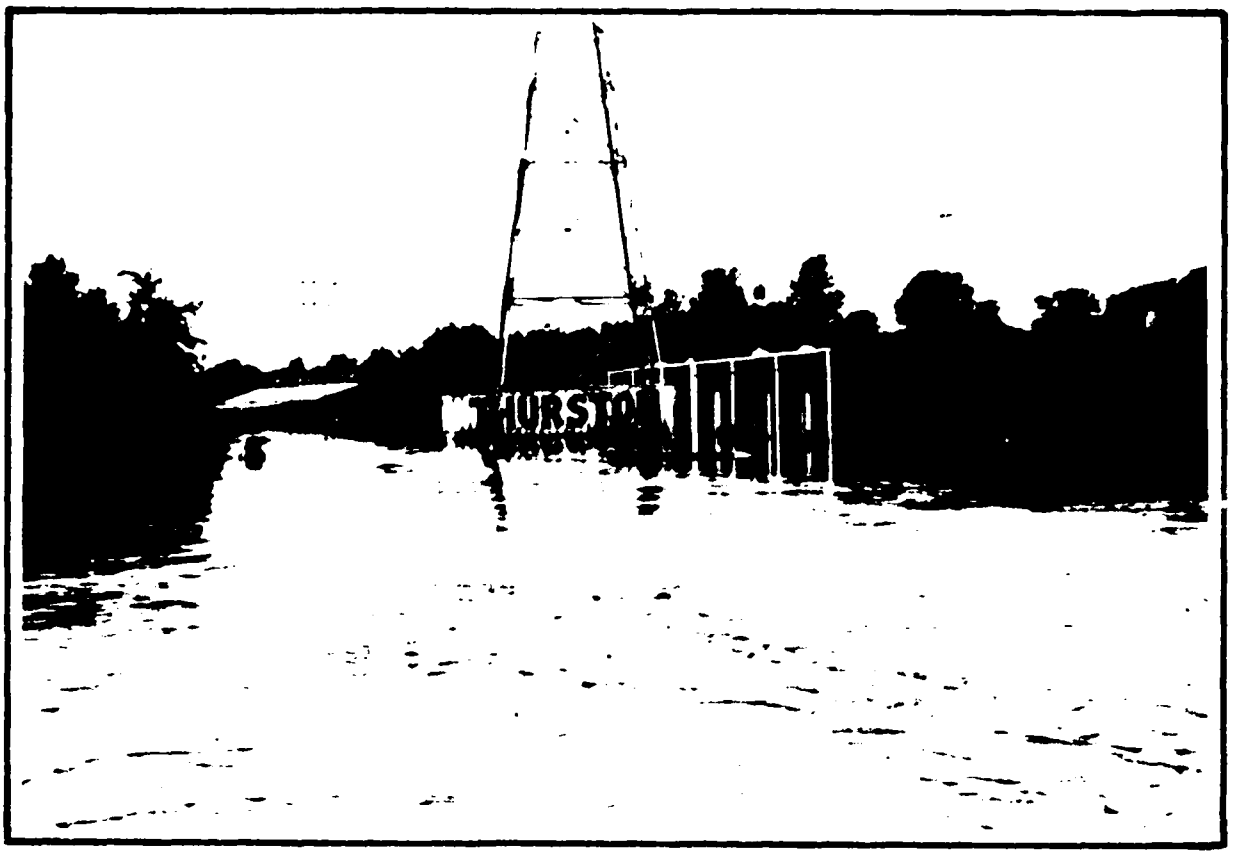
Flood Damages

Flood damages within the Sugar Creek Basin consist of both tangible and intangible damages. Tangible damages are those subject to monetary evaluation and include: physical damages or losses to property and improvements; emergency cost for flood damage prevention; and business, financial and wage losses in and adjacent to flood areas. Intangible damages are not susceptible to monetary evaluation and include: danger to human life; added inconvenience and human discomfort; injury and exposure during floods; creation of conditions detrimental to health and security; interruption of traffic, utility services and normal community activities; and the detrimental effects of frequent flooding on the appearances and aesthetic quality of the flood plain such as deposition of debris, etc.

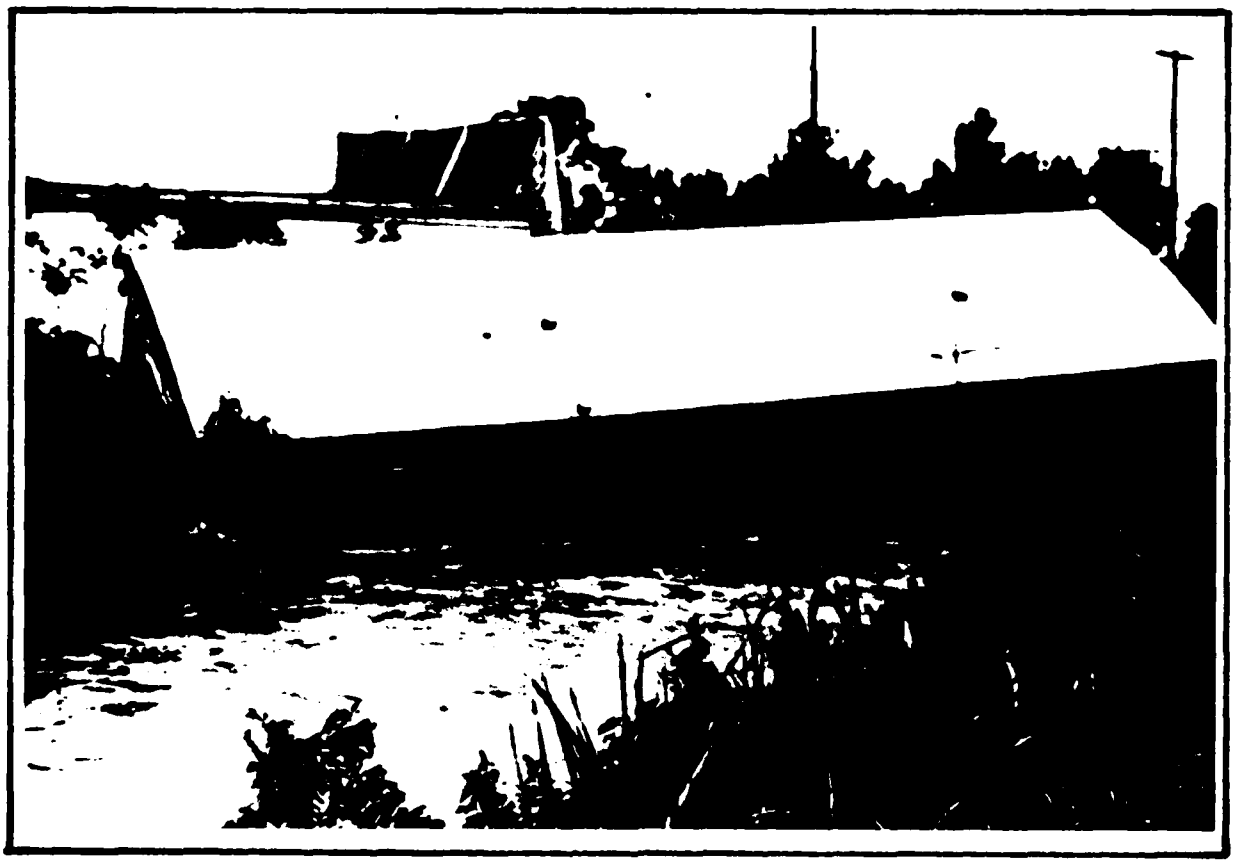
In order to compute economic damages, detailed field surveys were conducted to determine elevations of structures within the flood plain of the various basin streams. Flood damage computations consisted of the creation of a logical relationship between flood frequencies, flood stages and flood damages. Economic index stations were used in early stages of the study for high damage reaches. During later stages, the streams were modeled where the real location of individual properties were used in evaluating flood damages.

Limits of flooding for the following events were computed and damages associated with each event were estimated:

Magnitude of Flood	Probability of Occurrence	Magnitude of Flood	Probability of Occurrence
1000 YR	.0010	30 YR	.0333
500 YR	.0020	25 YR	.0400
200 YR	.0050	20 YR	.0500
100 YR	.0100	15 YR	.0667
80 YR	.0125	10 YR	.1000
60 YR	.0167	8 YR	.1250
50 YR	.0200	4 YR	.2500
40 YR	.0250	2 YR	.5000
		1 YR	1.0000



Flood Damages - Little Sugar Creek - Flood of 30 May 1975



Flood Damages - Little Sugar Creek - Flood of 30 May 1975

FIGURE 2

Flood Damages - Stewart Creek - Flood of 30 May 1975

Irwin Creek at Remount Road - Flood of 30 May 1975

FIGURE 3

The thousand year (1000 YR) flood is a flood of that has a 0.1 percent chance of being equaled or exceeded in any given year. Likewise, the one-hundred year (100 YR) flood is a flood or event that has a 1 percent chance of being equaled or exceeded. Any of the listed floods could occur in any given year. It can be seen from the listed mathematical probability of occurrence that as the magnitude of the flood increases, its probability of occurrence decreases.

Existing average annual damages for natural conditions were computed by first computing discharges for selected frequency storms and formulating a discharge frequency relationship. Discharges were then converted into stage, using computed backwaters, to form a stage-discharge relationship. Stage damage relationships were then established based on the projected depth of flooding and the value of the affected structure as obtained from available tax information. Average damages between successive selected frequencies were then multiplied by the incremental probability between these frequencies to obtain that part of the average annual damages contributed by storms falling within these frequency limits. Average annual incremental damages were totaled to obtain average annual damages.

An indication of the severity of flood damages in the Sugar Creek Basin is shown in Table 1 which illustrates the equivalent average annual flood damages (with affluence) for the period of analysis between the years 1990-2040. The equivalent average annual damages were derived by discounting procedures for the 50-year period at 7 5/8% interest rate and 1982 dollars. Since the value of money and the structure and contents expected to be damaged varies for any given year in the 50-year period, the estimated damages were discounted to obtain an average annual equivalent damage. The discounted damages were derived by estimating the expected damages associated with various frequency floods, utilizing the expected probability of occurrence to

TABLE 1

EQUIVALENT AVERAGE ANNUAL DAMAGES (1990-2040)

SUGAR CREEK BASIN, NORTH CAROLINA & SOUTH CAROLINA

Stream	Equivalent Average Annual Damages 1982$(1000)			
	Residential	Commercial/Industrial	Public/Semi-Public	Total
Briar Creek	$ 1,525.66	$ 84.68	$ 122.69	$ 1,733.03
Briar Tributary 2	63.52	0	0	63.52
Edwards Branch	21.11	275.12	0	296.23
Campbell Creek	4.66	0	.02	4.68
Kings Creek	8.35	0	0	8.35
Little Hope Creek	27.71	0	0	27.71
Little Hope Tributary	40.89	0	0	40.89
Little Sugar Creek	535.85	1,209.10	101.30	1,846.25
Derita Branch	3.75	78.98	0	82.73
McAlpine Creek	128.34	28.07	33.30	189.71
McMullen Creek	170.21	0	0	170.21
McMullen Tributary	34.58	0	0	34.58
Steele Creek	0	0	.04	.04
Stewart Creek	26.29	73.24	.02	99.55
Stewart Tributary 1	4.64	23.39	0	28.03
Stewart Tributary 2	34.90	0	0	34.90
Sugar/Irwin Creeks	163.33	52.14	0	215.47
Taggart Creek	.80	12.38	0	13.18
BASIN TOTALS	$ 2,794.59	$ 1,183.71	$ 257.37	$ 4,889.06

obtain the average for each year; applying the present worth factor for each yearly estimate of damages to convert all monetary values to a common base year; and then applying the capital recovery factor to obtain the estimated equivalent annual monetary damages. Detailed information describing damage computations procedures is contained in Appendix 4 to this report.

RECREATION AND PRESERVATION

A detailed analysis of recreation and preservation sites for the entire basin was not conducted as part of the study since it became apparent in the early stage of the study that implementable approaches to the area's water resource problems would be generally limited to the Charlotte-Mecklenburg area. The Charlotte-Mecklenburg Planning Commission has prepared an in-depth analysis of property and needs for recreational purposes and since this data is much more detailed and current than data from State Comprehensive Outdoor Recreation Plan (SCORP), it was utilized for the reduced study area.

A description of existing parks is contained in Appendix 5. By 1995, it is estimated that there will be an unsatisfied need for well over 5,000 acres of additional land for recreation and conservation. As the population continues to grow, there will be fewer open or undeveloped areas in the Charlotte-Mecklenburg area. Private lands to the south and east of Charlotte will continue to be put to residential, commercial and industrial uses as the urban area expands. There will be fewer areas capable of supporting wildlife or offering passive outdoor enjoyment.

In the Charlotte-Mecklenburg area, both the city and the county provide public parks and recreational service. Both have expressed an interest in greenway development to satisfy flood control and active recreation needs. The city is also interested in opportunities to improve flood plains in existing parks and to develop greenways connecting existing and proposed major parks.

Planning Constraints

The dendritic drainage pattern of the Sugar Creek Basin and the numerous man-made constrictions on various basin streams restrict potential flood control alternatives and eliminate the potential of implementing a major water resource project to address the identifed problems. For example, major flood control improvements on Briar Creek would not have any significant beneficial effect on flood damages occurring to structures on adjacent streams in the Sugar Creek watershed. Hence, each major damage area had to be individually assessed and localized corrective measures formulated. This concept of providing a series of localized flood protection projects could create problems with increased flood conditions downstream which must also be addressed and efforts made to mitigate any potential increase in downstream flood damages.

In addition, the urbanized nature of the watershed has resulted in numerous stream encroachments and constrictions. Constrictions generally occur at highway and railroad crossings which were inadequately designed or have insufficient flow capacity due to increased flood flows. These restrictions are numerous and would result in substantial increases in cost of flood control works if modification is required.

Planning Objectives

Planning objectives are the national, state and local water and related land resource management needs specific to a given study area that can be addressed to enhance the National Economic Development (NED) or the Environmental Quality (EQ). Establishing these objectives involves analyzing the range of public and professional concerns expressed about the use of water and related land resources in the area and translating them into specific objectives for the study. This was accomplished in the early stages of the Sugar Creek investigations. The major problems identified in the preceding sections concern flood damage reduction, improved water quality and enhancement of recreational opportunities. Since water quality problems were being addressed by others, this was not included as a planning objective. The planning objectives established for this investigation include the following:

Reduction of flood damages to structures located within the various flood plains of Sugar Creek Basin;

Establishment and preservation of conservation areas adjacent to basin streams; and,

Enhancement of recreational opportunities to residents of the area through the development of greenway parks and improvements or additions to established park facilities.

Formulation Of Preliminary Plans

This task provided for developing alternative resources management systems that address planning objectives. To help insure that the best overall plan was developed, a range of alternative plans were formulated. The following sections describe the formulation process and describe the various plans formulated.

MANAGEMENT MEASURES

A wide variety of technical and institutional means exist for managing water resources of the Sugar Creek Basin. As a basis for formulating alternative plans, a broad range of these means was examined to identify those which could address one or more of the planning objectives. Both structural and nonstructural means were given equal consideration, and the range of management measures were not constrained to those traditionally used by the Corps. Management measures considered as part of the Sugar Creek investigations include the following:

Nonstructural Measures	Structural Measures
Relocation of Structures	Channel Modification
Evacuation Planning	Bridge Modification
Flood Insurance	Levees/Floodwalls
Zoning & Mod. of Building Codes	Paved Channels
Regulation of Floodplain	Covered Floodways
Floodproof Structures	Reservoirs
Demolition	Combination Reservoir/Chan. Imp.
No Growth	
No Nothing [illegible]	

Plan Formulation Rationale

As previously stated, no single comprehensive water resource project could be formulated to alleviate the area's water resource problems due to the dendritic nature of the basin's drainage pattern and to the scattered nature of flood damages. With this in mind, efforts were made to isolate damage areas and to tailor flood control alternatives to alleviate damages in each damage reach. Attempts were made to incorporate recreational opportunities or conservation measures with each formulated plan. Both structural and nonstructural alternatives received equal consideration. Each localized alternative was formulated such that, if recommended, the alternative could be constructed independent of other alternatives or in conjunction with a series of localized projects to provide a comprehensive management system. If implementation of flood control measures created adverse conditions in downstream areas, all reasonable efforts were considered to mitigate the adverse effects of upstream improvements.

Plans of Others

The City of Charlotte and Mecklenburg County have been very progressive in the management of flood plain lands during recent years. On 27 November 1972, the city adopted floodway regulations, establishing development and land use regulations for certain flood hazard areas of the city, and providing for the administration, enforcement and amendment thereof. The County of Mecklenburg adopted similar regulations on 4 December 1972. All streams which have a drainage area greater than one square mile have had development controls placed on them.

Flood insurance is also available in Charlotte which enables those who are currently living in a flood prone structure to obtain low-cost, Federally-subsidized flood insurance.

The city has also actively pursued open space development of flood plain areas in an effort to develop various flood plains in a manner to minimize existing and future flood damages. Open space developments include greenways and community park facilities.

In addition, a "Self-Help Warning System" has been established for several streams within the Sugar Creek Basin. Essentially, the plan consists of establishing a timely warning system and preparing an efficient evacuation plan. The system consists of a series of rainfall and streamflow gauges, as well as flood warning sensor devices, located at strategic locations in the basin.

Analysis Of Plans Considered In Preliminary Planning (Stage 1 & 2)

In order to formulate alternative plans of action for the various Sugar Creek sub-basin areas, the initial step required the identification of high damage areas based on existing and projected future flood stages. This was followed by an evaluation of the causes of flooding. Basically, flood damages result from a combination of reasons. These reasons include the location of structures in areas subject to flooding; development of adjacent non-flood plain and upstream flood plain areas which result in increased storm runoff; and the development of man-made constrictions such as bridges and other flood plain encroachments which restrict the passage of flood flows. Once damage areas were identified and the cause of flooding was determined, then potential alternatives to alleviate flood damages were evaluated.

Flood control alternatives investigated for various areas of the Sugar Creek Basin in Stage 1 and 2 included a wide range of possibilities. As the studies progressed, some of the methods commonly used in flood control proved to be impractical or engineeringly unsound. However, during the early phases of planning an array of both structural and non-structural plans were evaluated which provided varying degrees of protection. The major categories of flood damage reduction measures evaluated were structural and nonstructural which are discussed in general terms in the following sections.

STRUCTURAL ALTERNATIVES

Structural alternatives considered for the Sugar Creek Basin offered a broad field of potential solutions to alleviate flood damages. These alternatives consisted of measures designed to modify floods by altering the natural environment. These alternatives included proposals to divert floods, to change the timing and duration of floods, or to restrict floods, from portions of the flood plain. Structural alternatives were formulated for all identified areas of concentrated damage. These alternatives were formulated without regard to implementation responsibility and were not limited to traditional flood control measures. Attempts were made to mitigate all adverse impacts of investigated alternatives.

The traditional channel modification alternatives evaluated for Sugar Creek Basin were generally designed to provide a minimum of a 10 year protection level. This criteria was established to provide a comparable degree of protection to that required of urban drainage systems and in most cases this criteria eliminated the majority of computed annual damages. Levee and floodwall alternatives were designed to provide protection from the Standard Project Flood since failure of such a system would present a hazard to human life. Typical reservoir alternatives were not feasible for Sugar Creek Basin due to the high density of residential and commercial development and to the lack of suitable sites. A dry reservoir concept,

however, was evaluated to provide flood storage capacity. This alternative was designed to provide 100 year flood storage capacity below the spillway crest. Provisions were also provided to pass the spillway design flood with 3 feet of freeboard to the top of the embankment. The general map on the next page identifies the general location and provides a brief description of each structural alternative considered in Stage 2.

NONSTRUCTURAL ALTERNATIVES

Nonstructural alternatives were formulated and evaluated for all damage areas identified within the basin. The concept of nonstructural alternatives was to modify flood damage susceptibility and included modifications to the cultural environment by adjustment in the pattern and mode of land use, by development policies and by assistance to affected individuals.

Nonstructural plans formulated for Sugar Creek Basin generally consisted of the removal of damageable properties from various frequency flood plains based on projected 2010 flood conditions. The removal of structures would be accomplished by either physically relocating the structure and contents or by relocating the contents and demolishing the structure. Nonstructural alternatives of flood proofing by raising building elevations or by such measures as small ring levees or walls were generally avoided since such measures would leave buildings inaccessible during flood periods and would result in an intensified rather than reduced long term public commitment to emergency evacuations.

Nonstructural plans evaluated during Stage 2 were manually computed following established policy and procedures. Flood plain structures were grouped by economic reaches to determine the economic justification

for nonstructural modification. These reaches were delinated based on uniform hydraulic conditions. All structures within the established flood plain limits of a stream reach evaluated for nonstructural solutions were included in the determination of economic feasibility in order to provide a comprehensive plan of improvement and a uniform level of protection. For example, if twenty structures were located within the flood plain limits, the feasibility of nonstructural alternatives was determined based on the cost and resultant benefits for the modification of all twenty structures without regard to the incremental justification of individual structures. Nonstructural alternatives for commercial and industrial structures were generally avoided due to the type of construction and to the location advantages of the structures in relation to market areas. Stage 2 evaluation of nonstructural alternatives did not include damage reductions for flood insurance premiums and deductibles and reductions for uninsurable items which exceeded flood insurance coverage limits. These damage reductions are required in accordance with established policy and were included in the final Stage 3 evaluation of nonstructural alternatives.

Summary Of Alternatives - Stages 1 & 2

Table 2 presents a summary of potential alternatives considered by stream sub-basin and designates the stage of investigation through which each alternative was carried. The referenced table is followed by a brief description, by sub-basin area, of each alternative evaluated through Stage 2 of the planning process. Further detailed information describing these alternatives is presented in Appendix 2 of this report. In general, regulatory nonstructural measures were dropped during Stage 1 since such measures have previously been implemented by local governing agencies. A commitment to the proper regulation of flood plain lands acquired during the implementation of any recommended water resource project, however, would be required before the project could be implemented. Use of project acquired lands for recreational and conservation purposes was highly encouraged.

McALPINE CREEK

(1) CHANNEL MODIFICATION
(2) LEVEE PROTECTION

McMULLEN CREEK

(3) LEVEE PROTECTION
(4) LEVEE PROTECTION

McMULLEN TRIB

(5) CHANNEL MODIFICATION

LITTLE HOPE & TRIB

(6) CHANNEL MODIFICATION

BRIAR CREEK

(8) CHANNEL MODIFICATION
(8A) CHANNEL MODIFICATION
(9) LEVEE PROTECTION

LITTLE SUGAR CREEK

(10) CHANNEL MODIFICATION
(11) CHANNEL MODIFICATION
(12) CHANNEL MODIFICATION
(13) COVERED FLOODWAY

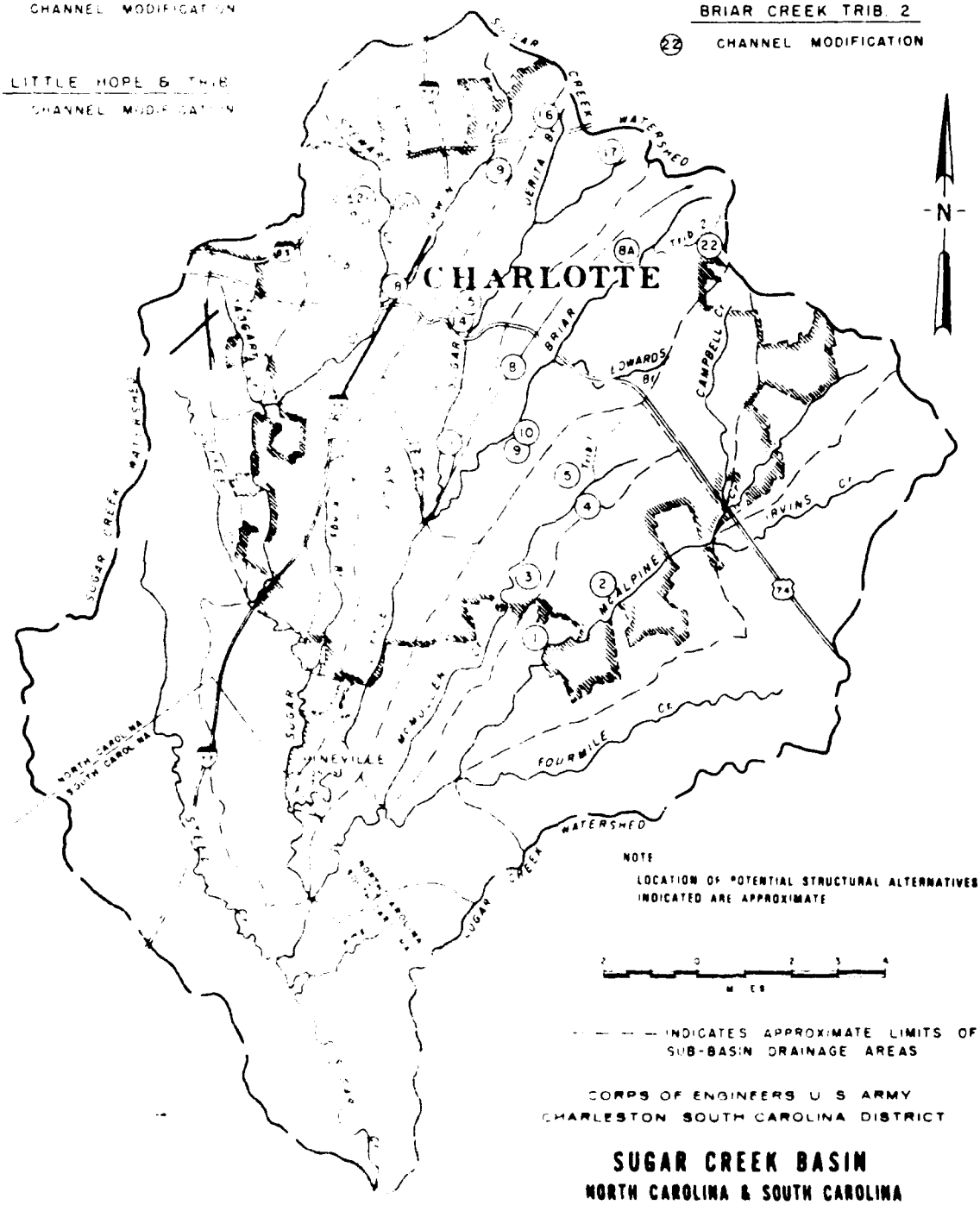
(16) FLOOD CONTROL & CHANNEL MODIFICATION
(17) FLOOD CONTROL RESERVOIR

SUGAR, IRWIN & STEWART CREEKS

(18) FLOODWALL & LEVEE PROTECTION
(19) LEVEE PROTECTION
(20) CHANNEL MODIFICATION
(21) CHANNEL MODIFICATION

BRIAR CREEK TRIB 2

(22) CHANNEL MODIFICATION



NOTE
LOCATION OF POTENTIAL STRUCTURAL ALTERNATIVES INDICATED ARE APPROXIMATE

MILES

— — — — INDICATES APPROXIMATE LIMITS OF SUB-BASIN DRAINAGE AREAS

CORPS OF ENGINEERS U S ARMY
CHARLESTON SOUTH CAROLINA DISTRICT

SUGAR CREEK BASIN
NORTH CAROLINA & SOUTH CAROLINA
GENERAL MAP
STRUCTURAL ALTERNATIVES
STAGE 2 EVALUATIONS

Economic data concerning Stage 2 alternatives were based on 1978 dollar values and an interest rate of 6-7/8% which was the prevailing rate when these alternatives were formulated. Alternatives carried into Stage 3 of the planning process were further refined before completing the process of selecting plans for recommendations. These refinements include a complete review of hydraulic conditions and the updating of economic values to reflect 1982 dollar values and an interest rate of 7-5/8%. More detailed information on Stage 2 evaluations is contained in Appendix 2.

TABLE 2

SUMMARY OF ALTERNATIVES
SUGAR CREEK BASIN

	ALTERNATIVE	McALPINE CREEK			CAMPBELL CREEK			McMULLEN CREEK			McMULLEN TRIBUTARY			BRIAR CREEK			EDWARDS BRANCH		
		STAGE 1	STAGE 2	STAGE 3	STAGE 1	STAGE 2	STAGE 3	STAGE 1	STAGE 2	STAGE 3	STAGE 1	STAGE 2	STAGE 3	STAGE 1	STAGE 2	STAGE 3	STAGE 1	STAGE 2	STAGE 3
NON-STRUCTURAL	Relocation of Structures	X	X	X	X	X		X	X	X	X	X		X	X	X	X	X	
	Evacuation Planning	X			X			X			X			X			X		
	Flood Insurance	X			X			X			X			X			X		
	Zoning & Mod. of Bldg. Codes	X			X			X			X			X			X		
	Regulation of Flood Plain	X			X			X			X			X			X		
	Floodproof Structures	X			X			X			X			X			X		
	Demolition	X	X	X	X	X		X	X	X	X	X		X	X	X	X	X	
	No Growth	X			X			X			X			X			X		
	Do Nothing (No Action)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
STRUCTURAL	Channel Modification	X	X					X			X	X		X	X	X			
	Bridge Modification										X	X		X	X	X			
	Levees	X	X					X	X					X	X				
	Paved Channels																		
	Covered Floodway																		
	Reservoirs																		
	Comb Reservoir/Chan. Imp.																		

TABLE 2

SUMMARY OF ALTERNATIVES

	ALTERNATIVE	BRIAR TRIB 2			LITTLE SUGAR CREEK			DERITA BRANCH			LITTLE HOPE CREEK			LITTLE HOPE TRIB			KINGS BRANCH		
		STAGE 1	STAGE 2	STAGE 3	STAGE 1	STAGE 2	STAGE 3	STAGE 1	STAGE 2	STAGE 3	STAGE 1	STAGE 2	STAGE 3	STAGE 1	STAGE 2	STAGE 3	STAGE 1	STAGE 2	STAGE 3
NON-STRUCTURAL	Relocation of Structures	X	X	X	X	X	X	X	X		X	X		X	X		X	X	
	Evacuation Planning	X			X			X			X			X			X		
	Flood Insurance	X			X			X			X			X			X		
	Zoning & Mod. of Bldg. Codes	X			X			X			X			X			X		
	Regulation of Flood Plain	X			X			X			X			X			X		
	Floodproof Structures	X			X			X			X			X			X		
	Demolition	X	X	X	X	X	X	X	X		X	X		X	X		X	X	
	No Growth	X			X			X			X			X			X		
	Do Nothing (No Action)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
STRUCTURAL	Channel Modification	X	X		X	X	X				X	X		X	X				
	Bridge Modification				X	X	X				X	X		X	X				
	Levees																		
	Paved Channels				X	X	X												
	Covered Floodway				X	X													
	Reservoirs				X	X		X	X	X									
	Comb Reservoir/Chan. Imp.				X	X	X												

TABLE 2

SUMMARY OF ALTERNATIVES

	ALTERNATIVE	SUGAR/ IRWIN CREEK			STEWART CREEK			STEWART TRIB 1			STEWART TRIB 2			TAGGART CREEK					
		STAGE 1	STAGE 2	STAGE 3	STAGE 1	STAGE 2	STAGE 3	STAGE 1	STAGE 2	STAGE 3	STAGE 1	STAGE 2	STAGE 3	STAGE 1	STAGE 2	STAGE 3	STAGE 1	STAGE 2	STAGE 3
NON-STRUCTURAL	Relocation of Structures	X	X	X	X	X	X	X	X	X	X	X	X	X	X				
	Evacuation Planning	X			X			X			X			X					
	Flood Insurance	X			X			X			X			X					
	Zoning & Mod. of Bldg. Codes	X			X			X			X			X					
	Regulation of Flood Plain	X			X			X			X			X					
	Floodproof Structures	X			X			X			X			X					
	Demolition	X	X	X	X	X	X	X	X	X	X	X	X	X	X				
	No Growth	X			X			X			X			X					
	Do Nothing (No Action)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			
STRUCTURAL	Channel Modification	X			X	X		X			X	X							
	Bridge Modification				X	X		X											
	Levees	X	X	X															
	Paved Channels																		
	Covered Floodway																		
	Reservoirs																		
	Comb Reservoir/Chan. Imp.																		

McAlpine Creek

The McAlpine Creek sub-basin is located in the southeast portion of Sugar Creek Basin and has a drainage area of approximately 94.8 square miles. The creek flows in a southwestwardly direction to its confluence with Sugar Creek just south of the North Carolina-South Carolina state line. McMullen Creek, Campbell Creek, Irvins Creek and Fourmile Creek are major tributaries which contribute to the flow of McAlpine Creek.

Based on Stage 2 analyses, approximately 45 structures are located within the flood plain of McAlpine Creek, consisting mainly of single and multi-family residential structures. The equivalent average annual flood damages with affluence experienced by these structures and their contents was estimated to be approximately $141,700.

Preliminary structural alternatives formulated for McAlpine Creek included proposals for 3.2 miles of channel modification in the reach beginning downstream at the confluence with Rea Branch and extending upstream to Old Providence Road (ref. Alternatives, General Map, Page 34) and a proposed levee alternative to provide protection to residential structures located upstream from Providence Road (Alternative 2). Economic evaluation of these alternatives, however, indicated a lack of economic justification for further evaluation with respective benefit to cost ratios of 0.30 to 1 and 0.11 to 1.

Nonstructural alternatives were also formulated on McAlpine Creek for all stream reaches which experience flood damage. Only two of the seven reaches evaluated, however, showed economic justification for the removal of residential structures from the flood plain. Nonstructural alternatives showing economic justification as a result of the Stage 2 evaluation are summarized in Table 3.

Campbell Creek

The Campbell Creek sub-basin is located in the northeast portion of the Sugar Creek Basin and has a drainage area of approximately 7.2 square miles. The creek flows in a southerly direction to its confluence with McAlpine Creek near the U. S. Highway 74 road crossing.

Based on Stage 1 analyses, approximately 16 structures are located within the flood plain of Campbell Creek, consisting of 15 residential structures and 1 publicly owned structure. The equivalent average annual flood damages with affluences experienced by these structures and their contents was estimated to be approximately $3,800.

Structural and nonstructural measures considered for Campbell Creek in Stage 2 were evaluated and due to the relatively low monetary damages experienced, corrective measures were deemed economically unjustified.

McMullen Creek And Tributary

The McMullen Creek sub-basin is located in the east central portion of Sugar Creek Basin and has a drainage area of approximately 17.1 square miles. The creek flows in a southwestwardly direction to its confluence with McAlpine Creek several miles north of the North Carolina-South Carolina state line. One small tributary referred to as Tributary 1 is located in the upper portion of the sub-basin area and had sufficient damage to justify the evaluation of flood damage reduction measures.

Based on Stage 2 Analyses, approximately 40 structures are located within the flood plain limits of McMullen Creek and an additional 15 structures within the flood plain of Tributary 1. These structures were classified as single-family residential. The equivalent average annual flood damages with affluence experienced by the structures and their contents was estimated to be approximately $156,300, consisting of annual damages of $129,800 on McMullen Creek and $26,500 on Tributary 1.

Two levee alternatives (Alternatives 3 & 4) were formulated for McMullen Creek during Stage 2 evaluations. Levee alternative 3 provided flood protection to seven houses located on Johnny Cake Lane and was economically feasible, but was socially unacceptable to the affected residents.

Levee alternative 4 was formulated in an effort to provide flood protection to homes in the vicinity of Willhaven Drive. Preliminary evaluations, however, indicated that structural solutions for this area were not feasible and that the problem could be addressed more efficiently through nonstructural measures.

Channel modifications were also evaluated for McMullen Tributary 1. This alternative consisted of 3,550 feet of channel enlargement beginning at the confluence with McMullen Creek and extending upstream to Sharon Amity Road. Economic evaluation of this alternative, however, resulted in a benefit to cost ratio of 0.36 to 1.

Nonstructural alternatives were also formulated for McMullen Creek and Tributary 1 for all stream reaches which experience flood damages. Only four of the nine reaches evaluated, however, showed economic justification. Economic reaches 7, 8 and 9 on the main stem of McMullen Creek and economic reach 2 on Tributary 1 showed economic feasibility for the removal of residential structures from the flood plain.

Briar Creek And Tributaries

The Briar Creek sub-basin is located in the north central portion of Sugar Creek Basin and has a drainage area of approximately 23.4 square miles. The creek flows in a southwestwardly direction through the metropolitan area of Charlotte to its confluence with Little Sugar Creek near the geographical center of Sugar Creek Basin. Two tributaries, Edwards Branch and Tributary 2 contribute to the flood flows transported by Briar Creek.

Based on Stage 2 analyses, approximately 390 structures are located within the flood plain limits of Briar Creek and an additional 47 structures are in the Edwards Branch flood plain and 18 in the Briar Tributary 2 flood plain. The majority of these structures are residential structures with a scattering of commercial; industrial and publicly owned structures. The equivalent average annual flood damages with affluence experienced by these structures and their contents was estimated to be $1,803,400, consisting of annual damages of $1,543,000 on the main stem of Briar Creek, $212,000 on Edwards Branch and $48,400 on Tributary 2.

Five preliminary structural alternatives were formulated for Briar Creek and its tributaries during the Stage 2 phase of this investigation.

These alternatives included four channel modification proposals and one levee proposal. A comprehensive channel modification proposal, Alternative 8, consisted of 8.0 miles of channel enlargement on the main stem of Briar Creek. This alternative would begin 1,240 feet downstream from Colony Road and extend upstream to Plaza Road. Economic evaluation of this alternative indicated the proposal would be economically justified with a resultant benefit to cost ratio of 1.33 to 1.

A modified version of the above described alternative was also evaluated. This proposal, Alternative 8 (modified), was essentially the same as Alternative 8 with the deletion of the upper 3.6 miles of channel

enlargement which was found to be incrementally unjustified. The remaining 4.75 miles of channel improvement had a benefit to cost ratio of 1.47 to 1.

At the request of city officials, a third channel modification proposal was investigated. This proposal was designed to provide protection to homes located in the upper portion of the Briar Creek Basin in the vicinity of Shannonhouse Drive and Ruth Drive. The proposed 1.2 miles of channel enlargement, however, was not economically justified. The benefit to cost analysis for this alternative (Alternative 8A) resulted in a benefit to cost ratio of 0.30 to 1.

Two separate levee proposals were initially evaluated as independent systems but were later combined into one system due to their close proximity. The combined levee proposal (Alternative 9 & 10) was designed to provide protection to structures located on Hanson Drive and Scotland Avenue in the vicinity of the Providence Road crossing on Briar Creek. Economic analysis of the levee system, however, indicated the proposal was not justified as indicated by the resultant benefit to cost ratio of 0.65 to 1.

Channel modification proposals were also formulated to alleviate flood conditions on Briar Tributary 2. These proposals consisted of 0.6 miles of channel enlargement. Economic justification for continued evaluation during Stage 3 was lacking, however, as the benefit to cost analysis yielded as benefit to cost ratio of 0.87 to 1.

Nonstructural alternatives were also formulated for Briar Creek and it tributary areas. Only nine of the twenty-five reaches evaluated, however, showed economic justification for the modification of residential structures.

Little Sugar Creek And Derita Branch

The Little Sugar Creek sub-basin is located in the central portion of Sugar Creek Basin and has a drainage area of approximately 50.5 square miles. The creek flows in a southwestwardly direction through the metropolitan area of Charlotte to its confluence with Sugar Creek just south of the North Carolina-South Carolina state line. Derita Branch, Briar Creek and Little Hope Creeks form major tributaries to Little Sugar Creek.

Based on Stage 2 analyses, approximately 437 structures are located within the flood plain of Little Sugar Creek and its tributaries, excluding Briar Creek which was previously discussed. Approximately 75% of these structures were classified as single and multi-family residential structures and the remainder as commercial, industrial, and/or public buildings. The equivalent average annual flood damages projected for these structures and their contents, with affluence, was estimated to be approximately $5,215,500.

Six structural alternatives were formulated during Stage 2 to alleviate damages within the Little Sugar Creek Basin. A channel modification proposal (Alternative 11) was formulated to reduce flood stages in the reach of Little Sugar Creek beginning at the confluence with Briar Creek and extending upstream to Princeton Avenue. Economic analysis of this alternative, however, indicated the resultant benefit to cost ratio would be less than unity and therefore unworthy of further detailed evaluations.

A second channel modification proposal (Alternative 12) was formulated to provide protection to the middle reach of Little Sugar Creek beginning downstream from East Boulevard and extending approximately 5,700 feet (1.09 miles) upstream ending approximately 700 feet upstream from East Morehead Street. The benefit to cost ratio computed during Stage 2 for this alterntive was 1.24 to 1 which provided justification for continued evaluations in Stage 3.

Alternative 14 consisted of a proposal to provide conveyance improvements in a highly conjested area of Little Sugar Creek in the reach between Independence Boulevard and East 4th Street. Due to encroachment of development into the flood plain areas, less conventional means of channel modification were investigated. The proposals consisted of providing a rectangular shape concrete lined channel with a 30-foot bottom. The rectangular shape was adopted in order to provide maximum capacities and to reduce roughness coefficients in an effort to pass the greatest amount of flow. Stage 2 analyses of this alternative resulted in a benefit to cost ratio of 1.70 to 1.

Another proposal considered for Little Sugar Creek, Alternative 15, consisted of providing flood damage protection in the vicinity of Central Piedmont Community College by construction of a covered floodway. The covered floodway would consist of three 12 ft X 14 ft concrete box culverts which would tie into existing culvert systems. This alternative was marginally justified based on Stage 2 evaluations with a benefit to cost ratio of 1.0 to 1.

The fifth alternative formulated for Little Sugar Creek, Alternative 16, consisted of providing a ponding area (Dry Reservoir) on Derita Branch to control flow from Derita Branch in combination with approximately 2.0 miles of channel modification on Little Sugar Creek. Channel modifications would begin downstream in the vicinity of East 16th Street and extend upstream to the vicinity of Craghead Road. Benefit to cost analysis of this alternative yield a B/C ratio of 3.28 to 1.

The final alternative, Alternative 17, considered for Little Sugar Creek consisted of reservoir storage in the upper portion of Little Sugar Creek above North Tryon Road. The potential dam site, however, had significant residential development which would result in prohibitive cost for the purchase of lands and relocation of occupants. Further investigation of this alternative was terminated.

Nonstructural alternatives were also formulated to achieve residential damage reduction on Little Sugar Creek and its tributaries. Ten of the twenty-five reaches evaluated showed economic justification for modification of residential structures.

Little Hope Creek And Tributary

The Little Hope Creek sub-basin is located in the central portion of Sugar Creek Basin and has a drainage area of approximately 4.65 square miles. The creek flows in a southeastwardly direction to its confluence with Little Sugar Creek immediately downstream from the confluence of Little Sugar and Briar Creeks.

Based on Stage 2 analyses, approximately 68 residential structures are located within the flood plain limits of Little Hope Creek and its tributary. The equivalent average annual damages experienced by these structures and their contents, with affluence, was estimated to be approximately $53,500.

A channel enlargement alternative, Alternative 6, was formulated for Little Hope Creek and its tributary during Stage 2 as a potential method of alleviating flood damages. Total length of this alternative was approximately 6,000 feet including modification to both branches of the creek. Economic evaluation of this alternative, however, indicated a lack of economic justification based on a benefit to cost ratio of 0.47 to 1.

Nonstructural measures were also evaluated for Little Hope Basin and were found to lack economic justification.

Kings Branch

The Kings Branch sub-basin is located in the west central portion of the Sugar Creek Basin and has a drainage area of approximately 4.22 square miles. The creek flows in a southerly direction to its confluence with Sugar Creek.

Based on Stage 2 evaluations, approximately 11 residential structures are located within the flood plain of Kings Branch. The equivalent average annual damages projected for these structures and their contents, with affluence, was estimated to be approximately $6,600.

Structural and nonstructural measures considered for Kings Branch in Stage 2 were evaluated and due to the relatively low monetary damages experienced, corrective measures were deemed economically unjustified.

Sugar-Irwin & Stewart Creek

The Sugar-Irwin and Stewart Creek sub-basins are located in the northwest portion of Sugar Creek Basin and collectively have a drainage area of approximately 64.5 square miles. At N. C. Highway 51 major tributaries of this sub-basin include Stewart Creek, Irvin Creek, Taggart Creek, Coffee Creek and Kings Branch. These creeks merge at various locations to form Sugar Creek. For the purpose of this discussion only that portion of Sugar Creek Basin above the confluence of Sugar and Little Sugar Creeks is considered. Sugar and Little Sugar Creeks merge in the vicinity of the town of Pineville, North Carolina.

Based on Stage 2 evaluations, approximately 156 structures are located within the flood plain limits of Sugar-Irwin Creek and an additional 179 structures within the flood plain limits of Stewart Creek and its tributaries. The majority of these structures are residential with concentrated pockets of commercial and industrial development. The equivalent average annual flood damage projected for these structures and their contents, with affluence, was estimated to be $550,400, consisting of annual damages of $308,800 on Sugar-Irwin Creek and $241,600 on Stewart Creek and its tributaries.

Four structural measures were considered as flood damage reduction alternatives in the Sugar-Irwin Creek basin. Alternative 18 consisted of construction of a system of levees and floodwalls to protect commercial establishments located in the flood plain at the confluence of Stewart and Irwin Creeks. Total length of the system was approximately 3,900 feet and design criteria was established to provide standard project flood protection. Stage 2 economic analysis of this alternative resulted in a favorable benefit to cost ratio of 1.48 to 1.

An additional floodwall alternative (Alternative 19) was formulated to protect 22 residential rental structures located in the vicinity of Andrill Terrace. Economic analysis of this alternative also resulted in a favorable

benefit cost ratio of 1.94 to 1. The deteriorated condition of these structures, however, indicated that a nonstructural demolition alternative would be a better solution.

Two channel modification alternatives were also investigated for Stewart Creek and its tributary. Alternative 20 consisted of a proposal to construct 7,000 feet of channel modifications in the reach between Tuckaseegee Road and West Trade Street. A computed benefit to cost ratio of 0.22 to 1, however, indicated a lack of justification for continual evaluation.

The second channel modification proposal considered consisted of channel enlargements on Stewart Tributary 2. Evaluation of this alternative, Alternative 21, indicated that improvements on Tributary 2 would not be necessary if Alternative 20 were implemented, and would not be effective without it or some other action to reduce backwater effects from Stewart Creek. Therefore, no further structural evaluations of Tributary 2 were conducted.

Nonstructural alternatives were also formulated for residential damage reduction on Sugar-Irwin Creek and its tributaries. Seven of the twenty-one reaches evaluated showed economic justification for modification of residential structures.

Taggart Creek

The Taggart Creek sub-basin is located in the western portion of the Sugar Creek Basin and has a drainage area of approximately 6.8 square miles. The creek flows in a southeastwardly direction to its confluence with Sugar Creek.

Based on Stage 2 evaluations, approximately 10 residential and 3 commercial and industrial structures are located within the flood plain of Taggart Creek. The equivalent average annual damages, with affluence, projected for these structures and their contents was estimated to be $9,600.

Structural and nonstructural measures considered for Taggart Creek in Stage 2 were evaluated and due to the relatively low monetary damages experienced, corrective measures were deemed economically unjustified.

Pineville, North Carolina

The City of Pineville, North Carolina, is located south of Charlotte at the confluence of Little Sugar and Sugar Creeks. Mecklenburg County has previously constructed a dike with flapgated culverts for interior drainage to provide flood protection to residential and commercial structures located within flood plain areas. Hydraulic analysis of the dike indicated that the dike had sufficient height to provide protection in excess of the 50-year frequency flood. Additional structural improvements were evaluated during Stage 2 and found to be economically unjustified due to the relatively low amount of residual annual flood damages.

Nonstructural alternatives were also formulated for the Pineville area but were found to lack economic justification.

Comparative Assessment And Evaluation Of Plans

The preceding sections described all plans carried through Stage 2 of the plan formulation process. These alternatives were presented for public review and comment during the plan formulation public workshops which were held in Charlotte, North Carolina, on 18 and 19 April 1979. Transcripts of these workshop sessions are available upon request from the Charleston District office.

Following the workshop sessions with the general public, members of the Corps study team met and evaluated all available information pertaining to each formulated alternative. Each alternative was carefully evaluated from economic, environmental, and social acceptability viewpoints. The study team performed trade-off analyses and selected various structural and nonstructural plans of improvement for flood control on Sugar Creek Basin for recommendation to local government representatives. A Memorandum for Record covering the study team conference was prepared and sent to representatives of the city, county and state governments for their review and comment. A copy of the Memorandum for Record is contained in Appendix 7.

The final selection of plans for Stage 3 evaluation was performed by a working level task force consisting of representatives from city, county, state and Federal agencies. After reviewing transcripts of the public workshop sessions and the recommendations of the Corps study team, the task force met on 10 July 1979 and selected various plans of improvement for Stage 3 evaluation. Local acceptability was stressed as a critical factor for selection. A Memorandum for Record covering the 10 July 1979 meeting is also contained in Appendix 7.

Table 3 summarizes the results of the evaluation and selection process described in the preceding section. In summary, 21 nonstructural reaches and five structural alternatives were considered as viable alternatives worthy of Stage 3 evaluation. Structural alternatives selected included the following: channel modification on Briar Creek, Alternative 8 modified; channel modification and reservoir storage on Little Sugar Creek, Alternatives 12, 14 and 16; and levee protection at the confluence of Stewart and Irwin Creeks, Alternative 18.

Assessment And Evaluation Of Detailed Plans

During the final Stage 3 of the feasibility process, potential alternatives were further refined and reduced in number to obtain a reasonable array of fully implementable plans. Those refinements included a complete review of hydraulic conditions; the modification of some plans to provide more engineeringly and economically sound projects, and the addition of new alternatives, if warranted; and, a complete economic update of Stage 3 alternatives to reflect modification in hydraulic data, outputs, and current dollar values and interest rates. Nonstructural plans were also reanalyzed to update economic cost and benefits and to reflect flood insurance factors. A computer program for the economic analysis of flood control alternatives was utilized for reformulating Stage 3 nonstructural plans where changes were made in hydrologic computations. The logic of this program is discussed in Appendix 4 to this report. Nonstructural plans for smaller sub-basin areas were manually reanalyzed following essentially the same procedure utilized by the above referenced computer program.

The conceptual alternatives considered in Stage 2 were developed in Stage 3 into precise management programs composed of complete technical systems and institutional arrangements. As a general guide, each plan carried into Stage 3 possessed the following characteristics:

TABLE 3

STAGE 3 ALTERNATIVES
SUGAR CREEK BASIN NORTH AND SOUTH CAROLINA

ALTERNATIVE	LOCATION	TOTAL FIRST COST (1978 $)	ANNUAL COST (1978 $)	ANNUAL BENEFIT	BENEFIT COST RATIO
McALPINE CREEK					
Relocate [illegible] Houses	([illegible] Providence Rd. - Sardis Rd.)	$ 397,100	$ [illegible]	$ [illegible]	1.9[illegible]
Demolish [illegible] Houses	([illegible] Providence Rd. - Sardis Rd.)	241,000	[illegible]	[illegible]	[illegible]
Relocate 1 House	(Sharon Rd. - Monroe Rd.)	85,600	[illegible]	[illegible]	1.69
Demolish 1 House	(Sharon Rd. - Monroe Rd.)	49,900	[illegible]	[illegible]	1.69
Summary McAlpine Creek		$ 296,900	$ [illegible]	$ [illegible]	2.15
McMULLEN CREEK					
Relocate 3 House	(Mountain Brook Rd. - Sharon View Rd.)	$ 114,450	$ [illegible]	$ [illegible]	1.34
Demolish 3 House	(Mountain Brook Rd. - Sharon View Rd.)	[illegible]	[illegible]	[illegible]	[illegible]
Relocate [illegible] Houses	(Sharon View Rd. - Providence Rd.)	318,400	[illegible]	[illegible]	1.3[illegible]
Demolish [illegible] Houses	(Sharon View Rd. - Providence Rd.)	205,200	14,600	19,400	1.35
Relocate 5 Houses	(Providence Rd. - Randolph Rd.)	429,950	30,[illegible]	[illegible]	1.88
Demolish 5 Houses	(Providence Rd. - Randolph Rd.)	254,100	[illegible]	39,[illegible]	2.59
Summary McMullen Creek		$ 5[illegible],050	$ 38,5[illegible]	$ 63,6[illegible]	1.65
BRIAR CREEK					
Structural Alternative 8 (Modified)		$ 8,745,600	$ 6[illegible]	$ 1,195,[illegible]	1.77
Summary Briar Creek		$ 8,745,6[illegible]	$ 6[illegible]	$ 1,195,[illegible]	1.77
BRIAR TRIBUTARY 1					
Relocate 34 Houses	(Grafton Rd. - Calway Dr.)	$ 1,[illegible]	$ [illegible]	$ 96,[illegible]	1.26
Demolish 34 Houses	(Grafton Rd. - Calway Dr.)	573,400	[illegible]	[illegible]	1.04
Summary Briar Tributary 1		$ 571,400	$ 40,9[illegible]	$ 42,500	1.04
LITTLE SUGAR CREEK					
Demolish 54 Apartment Units	(Park Rd. - Woodlawn Rd.)	$ 866,600	$ 61,8[illegible]	$ 116,7[illegible]	1.89
Relocate 83 Houses	(Woodlawn Rd. - Hillside Ave.)	3,531,85[illegible]	251,9[illegible]	8[illegible]	3.35
Demolish 83 Houses	(Woodlawn Rd. - Hillside Ave.)	1,806,[illegible]	128,[illegible]	697,[illegible]	5.41
Relocate 58 Houses	(Hillside Dr. - Princeton Ave.)	4,008,5[illegible]	285,900	628,[illegible]	2.20
Demolish 58 Houses	(Hillside Dr. - Princeton Ave.)	2,258,[illegible]	161,100	436,[illegible]	2.71
Structural Alternatives 12 & 13		3,188,600	246,400	307,100	1.24
Structural Alternative 14		2,729,100	213,600	363,[illegible]	1.70
Demolish 5 Structures & 132 Apartments	(Northwest Freeway - SCLRR)	723,900	51,600	53,[illegible]	1.03
Relocate 76 Houses	(SCLRR - Parkwood Ave.)	2,224,600	158,700	250,2[illegible]	1.58
Demolish 76 Houses	(SCLRR - Parkwood Ave.)	777,900	55,500	192,[illegible]	3.47
Structural Alternative 2[illegible]		8,579,200	6[illegible]	2,245,[illegible]	3.28
Relocate 36 Houses & Demolish 40 Apts.	(N. Tyron St. - Kentbrook Dr.)	1,695,500	120,900	119,900	0.99
Demolish 36 Houses & 40 Apts., Reach 23	(N. Tyron St. - Kentbrook Dr.)	1,085,750	77,400	76,600	0.99
Relocate 7 Houses	(Kentbrook Dr. - Study Limit)	315,050	22,500	23,300	1.04
Demolish 7 Houses	(Kentbrook Dr. - Study Limit)	171,450	12,200	9,000	0.74
Summary, Little Sugar Creek		$22,869,150	$ 1,748,900	$ 4,498,9[illegible]	2.58
SUGAR-IRWIN CREEKS					
Relocate 26 Houses	(Yorkmont Rd. - Clanton Rd.)	$ 1,145,650	$ 85,300	$ 75,1[illegible]	0.88
Demolish 26 Houses	(Yorkmont Rd. - Clanton Rd.)	627,900	44,800	22,100	0.49
Relocate 20 Houses	(Remount Rd. - Independence Blvd.)	774,200	5[illegible],200	51,9[illegible]	0.94
Demolish 20 Houses	(Remount Rd. - Independence Blvd.)	325,200	23,70[illegible]	26,600	1.14
Structural Alternative 18		1,279,900	101,300	149,700	1.48
Relocate 22 Houses	(West Fifth St. - I-77)	448,950	32,000	102,100	3.19
Demolish 22 Houses	(West Fifth St. - I-77)	179,800	12,800	88,100	6.88
Relocate 9 Houses	(I-77 - I-85)	236,4[illegible]	16,900	23,100	1.36
Demolish 9 Houses	(I-77 - I-85)	$ 106,500	$ 7,200	$ 15,1[illegible]	2.10
Summary Sugar Irwin Creeks					
STEWART CREEK AND TRIBUTARIES					
Relocate 2 Houses	(State St. - Rozzelles Ferry Rd.)	$ 85,[illegible]	$ 6,[illegible]	$ 10,[illegible]	1.62
Demolish 2 Houses	(State St. - Rozzelles Ferry Rd.)	47,[illegible]	3,400	6,[illegible]	1.82
Demolish 3 Apts., Reach 1 (Trib. 1)		28,[illegible]	1,9[illegible]	2,0[illegible]	1.05
Relocate 12 Houses (Trib. 2)	(Confidence - Parkway Ave.)	4[illegible]	3[illegible]	41,[illegible]	1.16
Demolish 12 Houses (Trib. 2)	(Confidence - Parkway Ave.)	263,[illegible]	1[illegible]	15,2[illegible]	1.02
Relocate 2 Houses (Trib. 2)	(Parkway Ave. - Upstream Limit)	75,8[illegible]	5,6[illegible]	4,[illegible]	0.83
Demolish 2 Houses (Trib. 2)	(Parkway Ave. - Upstream Limit)	2[illegible],8[illegible]	[illegible]	[illegible]	1.0[illegible]
Summary Stewart Creek & Tributaries		$ 366,9[illegible]	$ 2[illegible]	$ 29,6[illegible]	1.13
BASIN TOTAL		$[illegible]	$ 2,691,8[illegible]	$ [illegible]	2.28

(1) Each plan provided an efficient and effective means for addressing the study objectives.

(2) Each detailed plan made unique contributions to the planning objectives not made by any of the other alternatives.

(3) Each plan carried into Stage 3 was justified in the sense that its total beneficial contributions (monetary and non-monetary) were equal to or exceeded its total adverse contributions.

Impacts of alternatives are summarized in the System of Accounts presented in Table 6 of this report. Stage 3 evaluations were initially evaluated in draft versions of this report, based on 1981 dollar values and an interest rate of 7-3/8 percent. These evaluations were updated to 1982 dollar values and an interest rate of 7-5/8% for this final report. More detailed information on evaluations may be found in supporting appendices. Individual structures considered for demolition in nonstructural plans, however, are not denoted to avoid adversely affecting market value. Information concerning specific structures may be obtained from the Charleston District Office. "The Provisions of Public Law 91-646, Uniform Relocation and Real Property Acquisition Policies Act of 1970" would be applicable for all structures acquired as part of a flood damage reduction plan.

For nonstructural plans there would be no mitigation requirements since implementation would not affect flood stages. The nonstructural concepts recommended would remove damageable properties from the flood plain and have no measurable effects downstream. Adverse impacts from implementation of structural measures are mitigated in the final recommended plans.

Cost apportionment of project first cost between Federal and non-Federal agencies is displayed in accordance with "traditional" laws and policies. Actual cost apportionment for implemented projects may vary, subject to cost-sharing and financing arrangements with the responsible non-Federal agency or agencies sponsoring the project, which are satisfactory to the President and the Congress.

In general, the traditional method of apportioning costs between Federal and non-Federal interests for structural flood control measures is based on standard requirements established as Federal policy for "local protection" works. Under this policy, non-Federal interests are required to furnish all lands, easements, and rights-of-way required for project construction and proper project maintenance. Non-Federal interests are also required to bear the costs of modifications to all utilities and highway crossings required for project construction. Cost associated with railroad modifications are Federal cost in accordance with existing law. The local sponsor must also operate and maintain the project after construction in accordance with Federal requirements. The Federal government would be responsible for all flood control construction cost, including cost incurred in performing feasibility investigations and preparing detail construction plans.

Apportionment of cost between Federal and non-Federal agencies for nonstructural alternatives is in general compliance with Section 78 of the Water Resources Development Act of 1974. Subject act provides that non-Federal participation in the cost of recommended nonstructural measures shall be comparable to the value of lands, easements, and rights-of-way which would have been required of non-Federal interests for structural local protection measures, but in no event shall exceed 20% of the project costs. Because of the difficulty in determining the appropriate

structural alternative and the fact that in some cases there may be no feasible structural alternative, it is impractical to specify on a case-by-case basis what the "Comparable" cost sharing would be for nonstructural measures. Accordingly, consistent with average cost sharing on traditional local protection projects, the non-Federal share of costs for recommended nonstructural measures has been recommended in all cases to be 20 percent of the first cost of such measures thereby assuring comparability to the average value of lands, easements, and rights-of-way required for Corps structural protection projects.

McALPINE CREEK

McAlpine Creek

Results of Stage 2 investigations on McAlpine Creek indicated that nonstructural flood control measures provided the only viable solution for alleviation of flood damages. Several variations of nonstructural alternatives were evaluated during Stage 3 in an effort to select the most feasible plan for recommendation. These variations were generally in the boundaries of the flood plain being treated. Subsequent sections describe the impacts of the plan considered most feasible for implementation. Selection of the plan was made only after full consideration of an array of alternatives.

Nonstructural Measures - McAlpine Creek

The best plan for addressing the flooding problems along McAlpine Creek would be to remove five residential structures in that reach beginning at Providence Road and extending upstream to Monroe Road. (See following map). The affected structures would be purchased at fair market value (including the purchase of related lands and improvements) and either relocated or demolished, depending on the type and condition of the structure and this availability of relocation sites; actual implementation of this nonstructural alternative would likely result in a combination of relocations and demolitions. For decision purposes, it is assumed that all affected structures would be demolished. Determinations to relocate or demolish a specific structure would be made during post-authorization investigations. Economic re-evaluation, during Stage 3, of the demolition alternative for McAlpine Creek yielded the following pertinent economic data.

Pertinent Economic Data
Nonstructural Measures -- McAlpine Creek

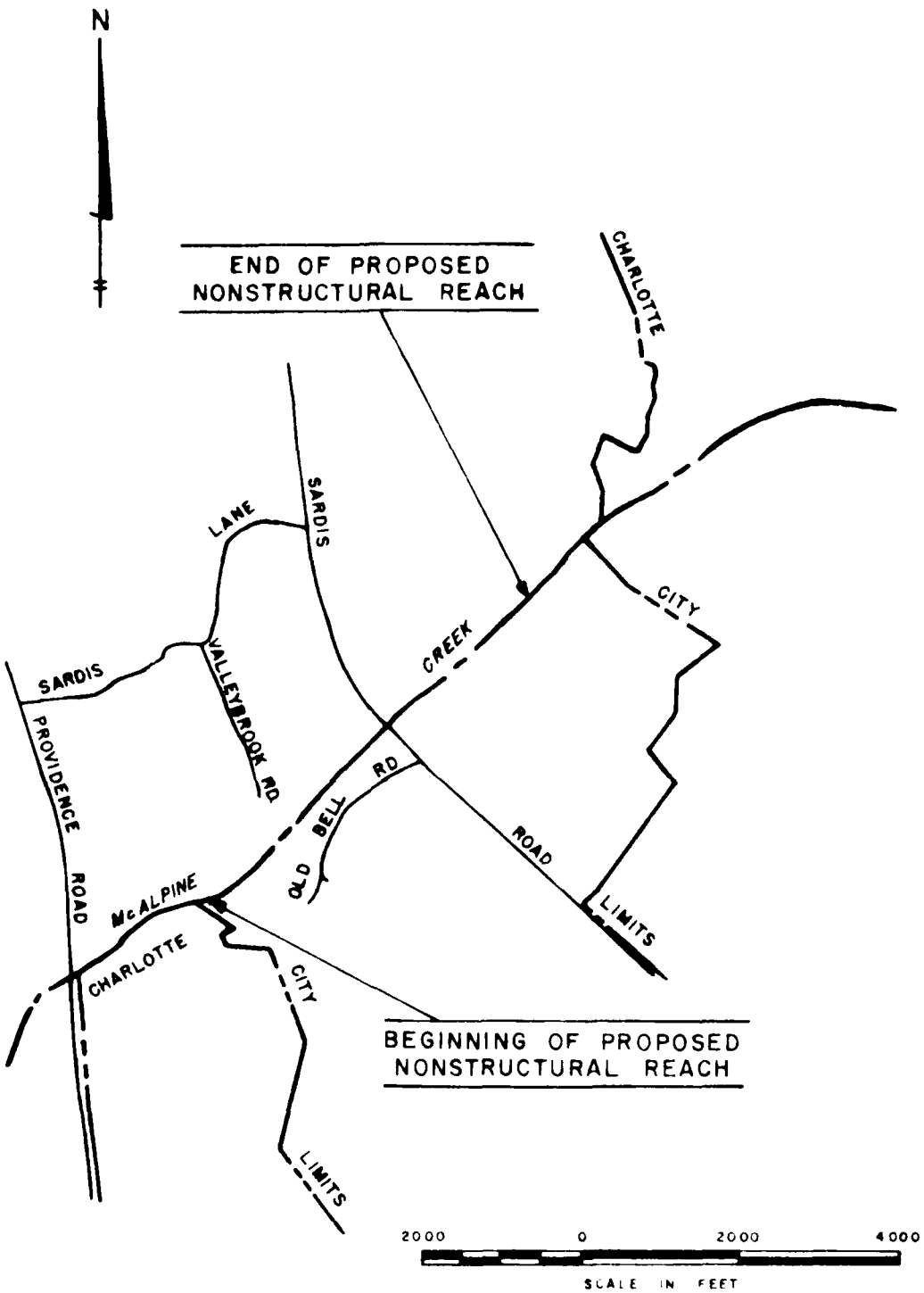
Alternative	First Cost 1982 $	Ann. Cost 7-5/8%	Ann. Benefits	B/C Ratio
Demolish 5 structures (Providence Rd. to Monroe Rd.)	$404,600	$31,700	$62,900	1.74 to 1

IMPACT ASSESSMENT

Implementation of nonstructural measures on McAlpine Creek would result in the displacement of approximately five families from the affected structures. Relocation activities may cause problems for these families. Efforts, however, would be made to reduce to a minimum the inconveniences and problems resulting from implementation.

Construction of this alternative could remove five structures from the housing market and place a temporary increase in the demand for housing. This would result in an increase in new housing construction in non-flood plain areas.

The estimated first cost of implementing nonstructural measures on McAlpine Creek is $404,600 (Demolition Alternative). This results in an annual cost of $31,700 and when compared to annual benefits of $62,900 yields a benefit-to-cost ratio of 1.74. An additional first cost of



CORPS OF ENGINEERS, U.S. ARMY
CHARLESTON, SOUTH CAROLINA DISTRICT

SUGAR CREEK BASIN

McALPINE CREEK SUBBASIN

PROPOSED NONSTRUCTURAL REACH
STAGE 3

approximately $25,000 will also be required to relocate affected families to non-flood plain sites. These costs are considered as financial costs to be shared by non-Federal interests, but not included in economic costs analysis.

Construction of nonstructural measures on McAlpine Creek would result in the fee purchase of approximately 9.18 acres of land which would be conveyed to the local project sponsors. Local project sponsors would be required to regulate future development of these lands in a manner compatible with flood plain usage.

Other tangible and intangible benefits resulting from the construction of this project include reduced evacuation cost during flood periods, reduction of health hazards resulting from the flooding of inhabited properties, the reduction of risk to human life and limb and the peace of mind that goes therewith, and improved aesthetic quality.

Evaluation and Trade-Off Analysis

No trade-offs were required in connection with the implementation of this alternative. Individual economic reaches evaluated in Stage 2, however, were combined in Stage 3 in the interest of continuity and providing a uniform level of protection.

Cost Apportionment

Apportionment of costs in accordance with current policy is as follows:

Cost Apportionment

Traditional Method

Nonstructural Measures -- McAlpine Creek
Demolish 5 Structures (Providence Road to Monroe Road)

Item	First Cost	Federal Cost	Local Cost
Construction Cost	$404,600	$323,700	$80,900
Associated Relocation Cost (P.L. 91-646)	25,000	20,000	5,000
TOTAL COST	$429,600	$343,700	$85,900

FEDERAL RESPONSIBILITIES

The presently estimated Federal share of the total first cost of nonstructural plans for McAlpine Creek is $343,700 consisting of a $323,700 share of construction cost and a $20,00 share of estimated personal relocation cost. The Federal Government is responsible for the preparation of plans and specifications and for construction of the project.

NON-FEDERAL RESPONSIBILITIES

The presently estimated non-Federal share of the total first cost of nonstructural plans for McAlpine Creek is $85,900 consisting of an $80,900 share of construction cost and a $5,000 share of personal relocation cost. These costs may be either a cash or in-kind contribution. The ABC's of sponsorship are spelled out in detail in the "SUMMARY -- ASSESSMENT AND EVALUATION OF DETAILED PLANS" section.

McMULLEN CREEK

McMullen Creek

Results of Stage 2 investigations on McMullen Creek indicated that nonstructural flood control measures provided the only viable solution for the alleviation of flood damages. Several variations of nonstructural alternatives were evaluated during Stage 3 in an effort to select the most feasible plan for recommendation. These variations were generally in the boundaries of the flood plain being treated. Subsequent sections describe the impacts of the plan considered most feasible for implementation. Selection for recommendation was made only after full consideration of an array of alternatives.

Nonstructural Measures - McMullen Creek

The best plan for addressing the flooding problems along McMullen Creek would be to remove eight residential structures in that reach beginning at Mountain Brook Road and extending upstream to Randolph Road. (See following map). The affected structures would be purchased at fair market value (including the purchase of related lands and improvements) and either relocated or demolished, depending on the type and condition of the structure and the availability of relocation sites. Actual implementation of nonstructural alternatives would likely result in a combination of relocations and demolitions. For decision purposes, it is assumed that all affected structures would be demolished. Determinations to relocate or demolish a specific structure would be made during post-authorization investigations. Economic re-evaluation, during Stage 3, of the demolition alternative for McMullen Creek yield the following pertinent economic data:

Pertinent Economic Data
Nonstructural Measures -- McMullen Creek

Alternative	First Cost 1982 $	Ann. Cost 7-5/8%	Ann. Benefits	B/C Ratio
Demolish 8 structures (Mountain Brook Rd. to Randolph Rd)	$745,000	$58,300	$101,100	1.73 to 1

IMPACT ASSESSMENT

Implementation of nonstructural measures on McMullen Creek would result in the displacement of approximately eight families from the affected structures. Relocation activities may cause problems for these families. Efforts, however, would be made to reduce to a minimum the inconveniences and problems resulting from implementation.

Construction of this alternative could remove eight structures from the housing market and place a temporary increase in the demand for housing. This would result in an increase in new housing construction in non-flood plain areas.

The estimated first cost of implementing nonstructural measures on McMullen Creek is $745,000 (Demolition Alternative). This results in an annual cost of $58,300 and when compared to benefits of $101,100 yields a benefit to cost ratio of 1.73 to 1. An additional first cost of approximately $40,000 will also be required to relocate affected families to non-flood

McMullen Creek

Results of Stage 2 investigations on McMullen Creek indicated that nonstructural flood control measures provided the only viable solution for the alleviation of flood damages. Several variations of nonstructural alternatives were evaluated during Stage 3 in an effort to select the most feasible plan for recommendation. These variations were generally in the boundaries of the flood plain being treated. Subsequent sections describe the impacts of the plan considered most feasible for implementation. Selection for recommendation was made only after full consideration of an array of alternatives.

Nonstructural Measures - McMullen Creek

The best plan for addressing the flooding problems along McMullen Creek would be to remove eight residential structures in that reach beginning at Mountain Brook Road and extending upstream to Randolph Road. (See following map). The affected structures would be purchased at fair market value (including the purchase of related lands and improvements) and either relocated or demolished, depending on the type and condition of the structure and the availability of relocation sites. Actual implementation of nonstructural alternatives would likely result in a combination of relocations and demolitions. For decision purposes, it is assumed that all affected structures would be demolished. Determinations to relocate or demolish a specific structure would be made during post-authorization investigations. Economic re-evaluation, during Stage 3, of the demolition alternative for McMullen Creek yield the following pertinent economic data:

Pertinent Economic Data

Nonstructural Measures -- McMullen Creek

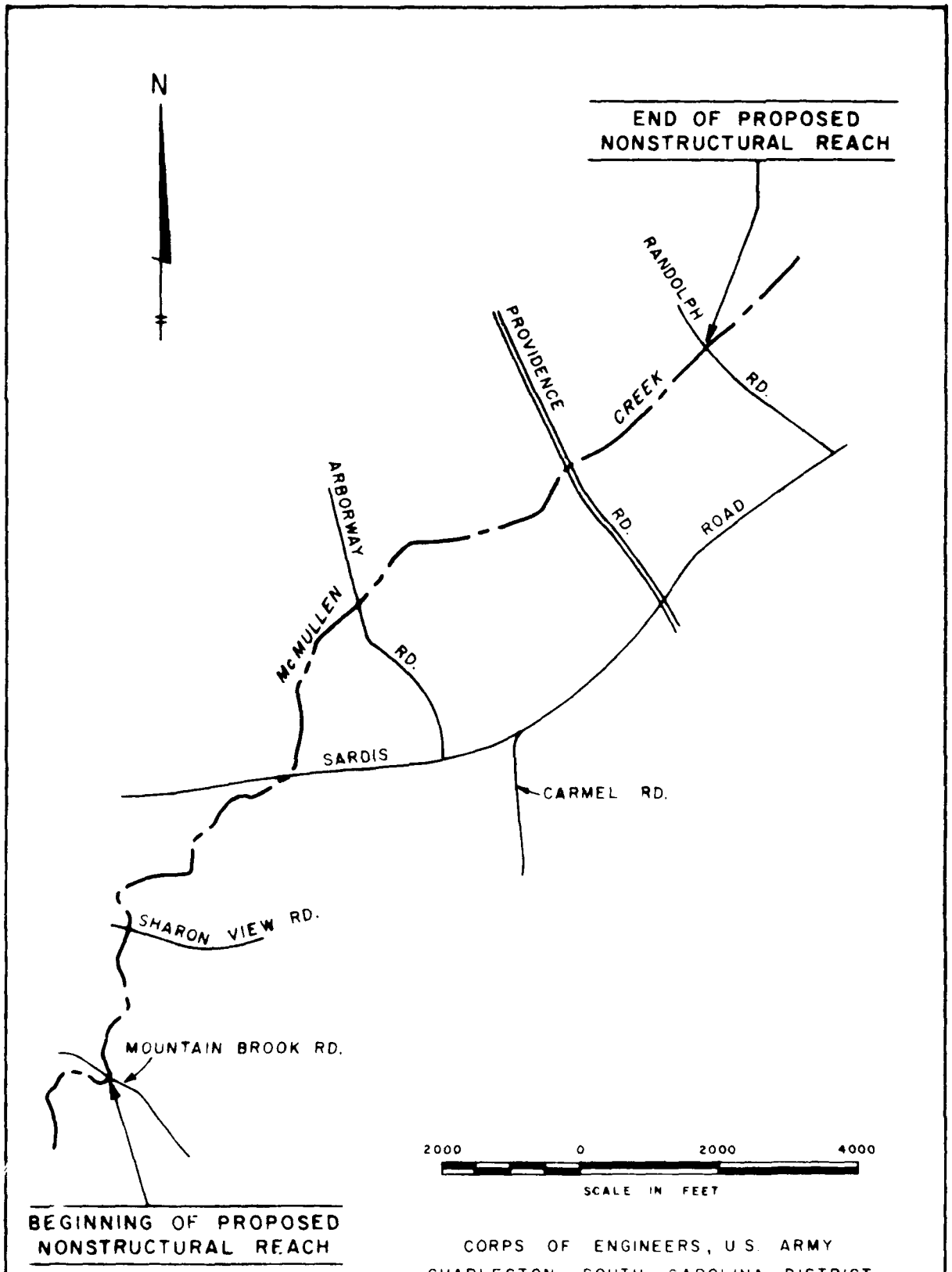
Alternative	First Cost 1982 $	Ann. Cost 7-5/8%	Ann. Benefits	B/C Ratio
Demolish 8 structures (Mountain Brook Rd. to Randolph Rd)	$745,000	$58,300	$101,100	1.73 to 1

Impact Assessment

Implementation of nonstructural measures on McMullen Creek would result in the displacement of approximately eight families from the affected structures. Relocation activities may cause problems for these families. Efforts, however, would be made to reduce to a minimum the inconveniences and problems resulting from implementation.

Construction of this alternative could remove eight structures from the housing market and place a temporary increase in the demand for housing. This would result in an increase in new housing construction in non-flood plain areas.

The estimated first cost of implementing nonstructural measures on McMullen Creek is $745,000 (Demolition Alternative). This results in an annual cost of $58,300 and when compared to benefits of $101,100 yields a benefit to cost ratio of 1.73 to 1. An additional first cost of approximately $40,000 will also be required to relocate affected families to non-flood



CORPS OF ENGINEERS, U.S. ARMY
CHARLESTON, SOUTH CAROLINA DISTRICT

SUGAR CREEK BASIN

McMULLEN CREEK SUBBASIN

PROPOSED NONSTRUCTURAL REACH
STAGE 3

plain sites. These costs are considered as financial costs to be shared by non-Federal interests, but not included in economic cost analyses.

Construction of nonstructural measures on McMullen Creek would result in the fee purchase of approximately 6.5 acres of land which would be conveyed to the local project sponsors. Local project sponsors would be required to regulate future development of these lands in a manner compatible with flood plain usage. Approximately 3.5 acres of the project lands in the vicinity of Willhaven Drive would be suitable for development as a neighborhood park and would be landscaped in a manner suitable for this type of development if desired by the local project sponsors.

Other tangible and intangible benefits resulting from the construction of this project includes reduced evacuation cost during flood periods, reduction of health hazards resulting from the flooding of inhabited properties; the reduction of risk to human life and limb and the peace of mind that goes therewith; and improved aesthetic quality.

Evaluation and Trade-Off Analysis

No trade-offs were required in connection with the implementation of the alternative. Individual economic reaches evaluated in Stage 2, however, were combined in Stage 3 in the interest of continuity and a uniform level of protection.

Cost Apportionment

Apportionment of costs in accordance with current policy is as follows:

Cost Apportionment

Traditional Method

Nonstructural Measures -- McMullen Creek
Demolish 8 Structures (Mountain Brook Road to Randolph Road)

Item	First Cost	Federal Cost	Local Cost
Construction Cost	$745,000	$596,000	$149,000
Associated Relocation Cost (P.L. 91-646)	40,000	32,000	8,000
TOTAL COST	$785,000	$628,000	$157,000

Federal Responsibilities

The presently estimated Federal share of the total first cost of nonstructural plans for McMullen Creek is $628,000 consisting of a $596,000 share of construction cost and an estimated $32,000 share of personal relocation cost. The Federal Government is responsible for the preparation of plans and specifications and for construction of the project.

Non-Federal Responsibilities

The presently estimated non-Federal share of the total first cost of nonstructural plans for McMullen Creek is $157,000 consisting of a $149,000 share of construction cost and an $8,000 share of personal relocation cost. These costs may be either a cash or in-kind contribution. The ABC's of sponsorship are spelled out in detail in the "SUMMARY -- ASSESSMENT AND EVALUATION OF DETAILED PLANS" section.

BRIAR CREEK

Briar Creek

During Stage 2 of the planning process, only one flood control alternative appeared feasible. This alternative consisted of 4.75 miles of channel modifications in the lower reaches of Briar Creek. However, in Stage 3 a complete review of the hyrdologic conditions and resultant economic impacts were performed. As a result of this re-evaluation, a slight modification of the plan appeared necessary. Also due to differences in predicted hydrologic conditions, a complete re-evaluation of nonstructural flood control measures was performed. This resulted in the identification of viable nonstructural alternatives which did not appear worthy during Stage 2 evaluations. Several structural and nonstructural flood control measures were evaluated in Stage 3 in order to select the best plan or plans for recommendation. The following sections describe the impacts of the plans considered most feasible for implementation. Selection of these plans was made after full consideration of an array of alternatives.

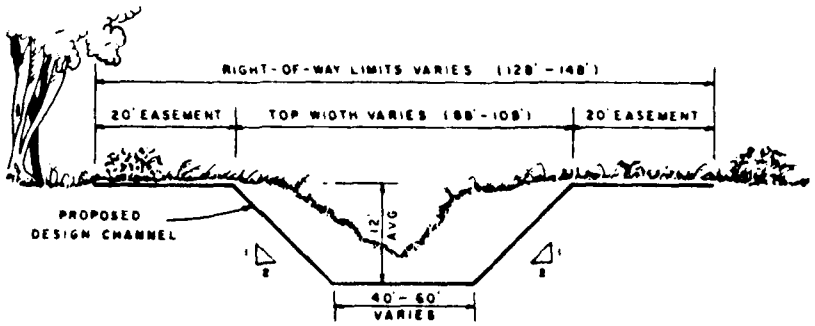
Channel Modifications — Briar Creek

Proposals for flood control improvement on Briar Creek consist of 4.75 miles of channel conveyance improvements beginning approximately 1,200 feet downstream from Colony Road and extending to the upstream limits approximately 1650 feet upstream from Central Avenue (See following map). The plan consists of widening the existing channel with design bottom widths varying from 60 feet to 40 feet with side slopes of 2 horizontal to 1 vertical. Riprap protection would be provided in areas where the potential for bank erosion exist. Estimated channel excavation yardage is 486,000 cubic yards. Bridge modifications would also be required as described below:

Colony Road	Replace bridge
Sharon Road	Add additional culvert
Providence Road	Add additional culvert
East 7th Street	Replace bridge
SCLRR	Add five additional culverts
Bramlet Street	Replace bridge

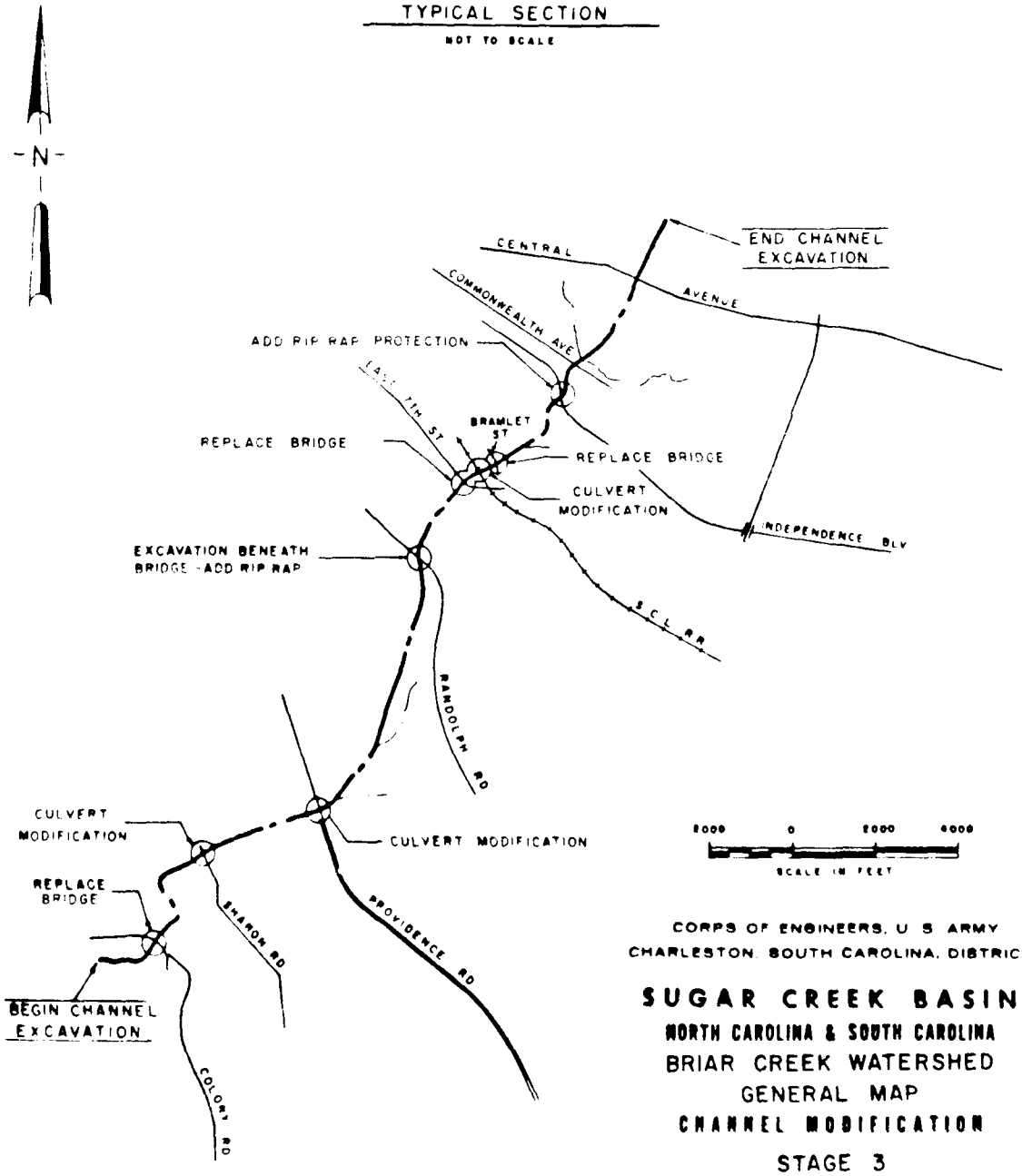
Land requirements for the plan would be 113.1 acres including 30.0 acres designated for the disposal of excavated materials. Excavated materials would be hauled to suitable disposal areas. These materials will not be placed in designated floodway areas. Detailed hydraulic designs for this alternative are presented in Appendix 3 to this report. Potential disposal areas include the Statesville landfill site, the undeveloped land on both banks between Central Avenue and Commonwealth Avenue, and the wooded land on the northwest bank between Sharon Road and Providence Road. The area between Central and Commonwealth Avenues would be suitable for recreational development desired by the Planning Commission. The area between Sharon Road and Providence Road could also be used as a small neighborhood park or could be connected to Eastover Park by means of a walking trail on the construction right-of-way. Both areas would be selectively cleared, leaving clumps of trees or large individual trees. Both disposal areas and the construction rights-of-way along the entire project would be planted with grasses, shrubs and trees to improve their appearance and to provide partial shading of the creek. No specific development plans, other than landscaping, are recommended for participation by the Corps. Project lands would be conveyed to the local project sponsor to be used for park or greenway development. Local sponsors would be required to provide assurances that these lands would not be used for other purposes which would detract from the recommended use.

Estimated construction costs for the channel modification plan were $11,820,100 (see Appendix 4 for detailed cost data). The unit price for excavation was based on unclassified yardage with an allowance for excavation of rock materials approximately equivalent to the percent of rock excavated during the construction of a small flood control project immediately down-



TYPICAL SECTION

NOT TO SCALE



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CHARLESTON, SOUTH CAROLINA, DISTRICT

SUGAR CREEK BASIN

NORTH CAROLINA & SOUTH CAROLINA

BRIAR CREEK WATERSHED

GENERAL MAP

CHANNEL MODIFICATION

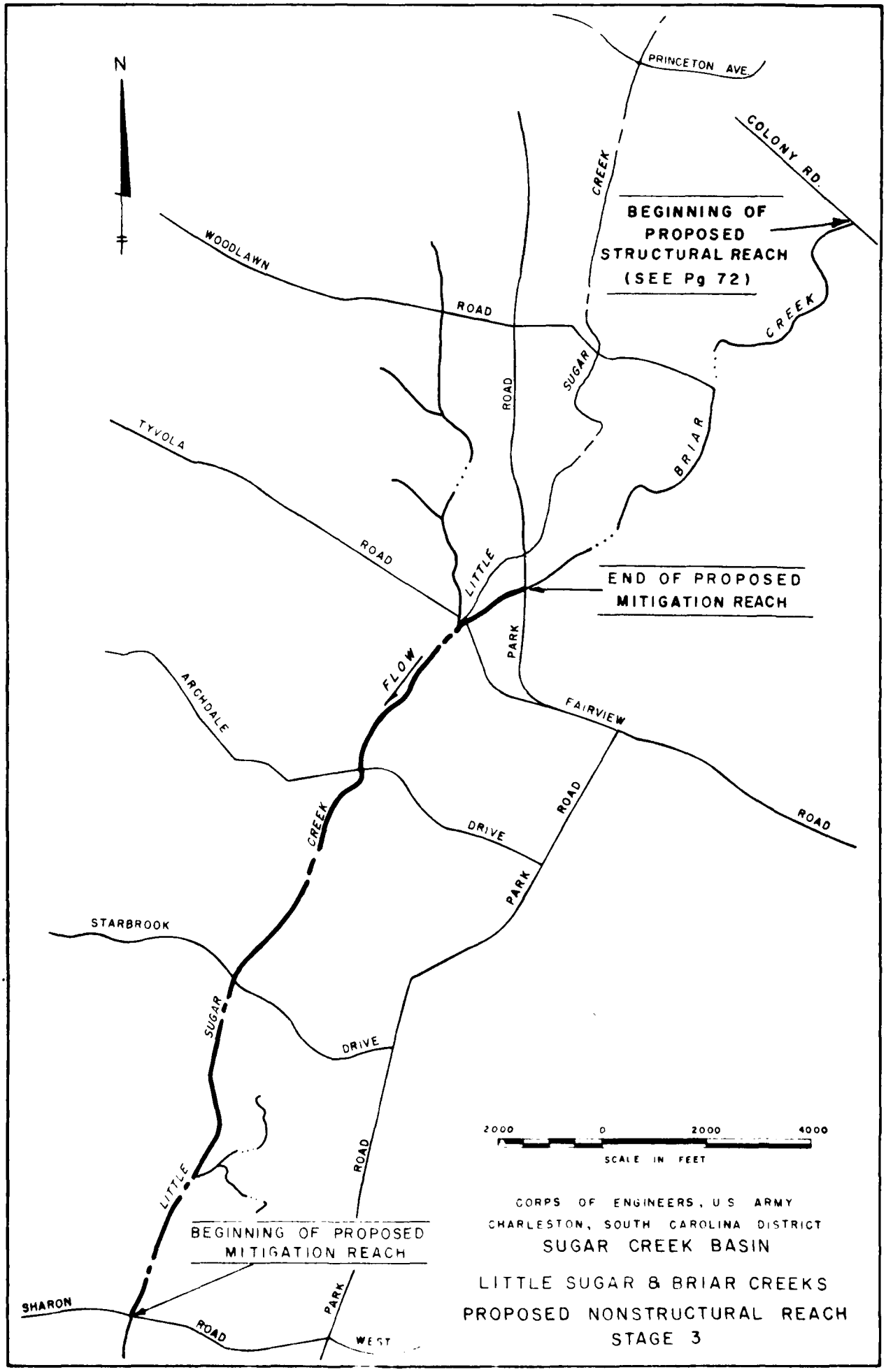
STAGE 3

stream on Little Sugar Creek. Real estate cost estimates were obtained from data compiled by the Savannah District Real Estate Office.

Implementation of the structural improvement on Briar Creek, however, would produce higher flood stages in downstream reaches and cause an estimated increase of $12,500 annually to structures located downstream from Colony Road. In order to mitigate these adverse effects, it is proposed that nonstructural measures consisting of the removal of six residential structures be implemented. These structures would be purchased and removed from the 10-year flood plain following the same procedures previously discussed for nonstructural plans. The structures considered for nonstructural modifications are located below the confluence of Little Sugar and Briar Creeks between the Sharon Road and Park Road crossings (See following map). Implmentation of nonstructural measures in downstream reaches would result in a net economic benefit when compared to existing conditions. Further information regarding mitigation proposals is contained in the section entitled "Mitigation Requirements".

Total project cost for flood control measures on this portion of Briar Creek, including mitigation cost, would be approximately $12,187,000 with a resultant annual cost of $1,022,400. Annual benefits of $1,467,200 would yield a benefit to cost ratio of 1.43 to 1.

The following tabulation summarizes economic data concerning this proposal. Detailed cost and benefit data is contained in Appendix 4 to this report.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PRINCETON AVE.
COLONY RD.
CREEK
BEGINNING OF PROPOSED STRUCTURAL REACH (SEE Pg 72)
WOODLAWN
ROAD
CREEK
SUGAR
ROAD
TYVOLA
BRIAR
ROAD
LITTLE
END OF PROPOSED MITIGATION REACH
PARK
FLOW
ARCHDALE
FAIRVIEW
ROAD
ROAD
CREEK
DRIVE
PARK
STARBROOK
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BEGINNING OF PROPOSED MITIGATION REACH
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CORPS OF ENGINEERS, U.S. ARMY
CHARLESTON, SOUTH CAROLINA DISTRICT
SUGAR CREEK BASIN
LITTLE SUGAR & BRIAR CREEKS
PROPOSED NONSTRUCTURAL REACH
STAGE 3

Summary - Pertinent Economic Data

Briar Creek Channel Modifications
(4.75 miles channel modification (vic. Colony Road to vic. Central Ave.)

A. First Cost

I. Channel Modifications	
Construction costs	$7,668,400
Land Cost	2,431,700
Bridge Modifications	
a. Highway	1,110,000
b. Railroad	610,000
Subtotal	$11,820,100
II. Mitigation Measures	
Purchase and Demolish 6 structures	$391,500
Salvage values	(-) 24,600
Subtotal	$366,900 1/
III. TOTAL PROJECT COST	$12,187,000

B. Annual Project Cost (i = 7 5/8%)

Item	Total First Cost	Annual Cost
Channel Construction	$ 11,820,100	$ 924,700
Annual O & M	-	69,000
Subtotal	$ 11,820,100	$ 993,700
Mitigation Measures	366,900	28,700
Total	$ 12,187,000	$1,022,400

C. Justification

Item	Base Year	Future	Total
Annual Project Benefits	$ 1,099,500	$ 367,700	$ 1,467,200
Annual Project Cost	$ 1,022,400	$ 0	$ 1,022,400
Benefit to Cost Ratio	1.07 to 1		1.43 to 1

1/ An additional first cost of approximately $30,000 will be required to relocate families to non-flood plain sites. These cost are considered financial cost to be shared by non-Federal interests, but, by policy, are not included in economic analyses.

Impact Assessment

The proposals for Briar Creek consist of widening the existing channel bottom to widths varying from 60 to 40 feet with minor deepening in isolated areas. The channel was designed to carry the existing 10-year flow in bank. Some minor out of bank flow during the 10-year flood conditions may occur in isolated low areas.

Adverse impacts of this plan are discussed by stream reach in the following paragraphs. The impacts include the removal of vegetation from one side of the creek and a temporary increase in turbidity and sediment load. Impacts on bottom flora and aquatic invertebrates are not significant when compared to the existing conditions. The scant flora and invertebrates in the present sand and silt bottom of Briar Creek would be removed, but recolonization should take place from upper stream reaches.

In the area below Colony Road, the creek passes through a narrow, low wooded area between a residential area and the Meyers Park school grounds. Trees adjacent to the creek in this reach are mostly tulip, poplar, sweet gum and sycamore, with some pines and oaks on the slopes. There is considerable undercover, but most of this reach is part of private yards or Meyers Park School and has limited value for wildlife. There is good shade over the creek, and a depth of 1 to 2 feet in places. However, the water quality is poor and the bottom is shifting sand and silt. Fish habitat is present, but limited, consisting mainly of bluegill, sunfish, catfish and various chubs, shiners, suckers, daces and darters.

Widening the channel and clearing rights-of-way would change the appearance of the area and further reduce its value for fish and small terrestrial animals by removing vegetation and spreading water over a wider, straighter, unshaded channel. Erosion would be increased, particularly during project construction, which could increase sedimentation further downstream. Disturbed areas would be landscaped and seeded to lessen the impact of stream bank erosion.

In the reach between Colony Road and Sharon Road, Briar Creek passes through the Meyers Park Country Club. Vegetation in this reach is limited to fairway grasses and a few trees. There is no significant wildlife habitat. Water quality is generally poor and the absence of shade or cover further reduces the stream value for fisheries. Nevertheless, there is limited habitat for the species listed for the reach below Colony Road.

Some of the trees on the creek bank would be lost if the creek were widened and straightened. Conditions for fish would be worsened by spreading the creek's flow over a wider, straightened channel. The landscaping required to restore the golf course would include the planting of selected hardwood trees immediately adjacent to the creek to lessen the impact of removing existing vegetation. Erosion and sedimentation downstream could detract from general appearances and the aquatic habitat in general.

The land adjacent to Briar Creek in the reach between Sharon Road and Randolph Road is predominantly residential. Just below Randolph Road, the creek passes through Eastover Park. The reach from Sharon Road to Randolph Road differs from other residential areas along many of the creeks in Charlotte in that the houses are generally not as closely spaced, and the maintained yards do not extend through the lowest portion of the flood plain to the edge of the creek. The absence of buildings close to the creek has resulted in wooded areas of widely varying widths (50 - 1,000 feet) along this reach; however, there are almost no trees or shrubs immediately adjacent to the creek, where powerline and sewage rights-of-way appear to be regularly mowed. There is limited habitat for the small animals that can exist in an urban area (songbirds, squirrels, and possibly rabbits, opossums, raccoons, etc.). The channel in this reach has already been drastically changed by straightening, clearing and, in places, concrete sides or riprap. Proceeding upstream from Sharon Road, the creek's width and depth

decreases, and the absence of stream meanders, shade or deep areas limit its value for fish. Water quality is poor.

Channel widening would remove the few trees adjacent to the creek in this reach, and clearing for construction and maintenance rights-of-way would, in many areas, extend beyond the already cleared utility rights-of-way into the wooded areas. A wider channel would spread the small amount of water over a wider area so that, under normal and low flow conditions, the creek's appearance, water quality and value for aquatic habitat would be worsened. Erosion would be increased as would sedimentation and the associated downstream impacts. Plans for revegetation include grassing and the planting of selected hardwood trees next to the creek. Clearing and placement of excavated material would be done in a manner that will not detract from the existing park on the west bank below Randolph Road, and that would leave these undeveloped areas even more suitable for "passive" recreation by local residents.

Above Randolph Road to a point just below Independence Boulevard the land use is predominantly residential: There are both single family houses and multi-family housing complexes, as well as several large areas of cleared and graded land adjacent to the creek. In the immediate area of Independence Boulevard land use is commercial. Much of the land next to the creek is paved, cleared or covered by structures. Vegetation is generally limited to grasses and a few trees characteristic of residential yards. There is very little habitat for wildlife of any type. However, a few small, widely spaced trees are located immediately adjacent to the creek. The channel has been modified by previous construction. Water quality is poor and a considerable amount of debris is present on the sand and silt bottom. There is little shade for the creek, and several pipes empty discharges from the commercial area and the parking lots of the housing complexes. Habitat is limited for fish in this reach.

Widening of this reach would further worsen the water quality and aquatic habitat by spreading the small volume of water over a wider, unshaded channel. The appearance of the banks would be improved by landscaping with hardwood trees and shrubs. Erosion due to construction activities would result in sedimentation and associated problems downstream.

In the vicinity of Independence Boulevard, land use is commercial. There is a large parking area on one bank and a maintained sewer line on the opposite bank. Between Commonwealth Avenue and Central Avenue, the creek passes through a predominantly residential area; however, the houses and yards do not extend all the way to the creek. Maintained rights-of-way for powerlines and sewer lines parallel both sides of the creek. Close to the creek there is a fringe of trees along one or both banks from Independence to Central, but generally these trees are scattered and do not provide thick cover or valuable habitat. Beyond this fringe (except near Independence Boulevard) there are cleared utility rights-of-way with grass or no vegetative cover at all. Farther back from these rights-of-way there are narrow wooded areas, but due to the surrounding urban development and their small size, they offer only limited habitat for songbirds, squirrels, and other small terrestrial animals that can exist in heavily populated urban areas. Above Central Avenue, there are more trees (river birch, sweet gum, sycamore, red maple, mulberry, and a few oaks) close to and shading the creek, but, like the area below Central Avenue, their value for wildlife is limited to species that can live in highly urbanized areas.

Next to Independence and Central Avenues there is concrete and riprap in the channel. A sand and silt bottom is present in the other portions of this reach. The entire reach appears to have been modified by previous channel work, but the portion above Central Avenue seems to have been the least damaged. In this portion, there is good shade from the overhanging trees and [illegible] habitat for bluegill, and various sunfish chubs, suckers, and [illegible]. [illegible] all specimens of large mouth bass have

AD-A153 981 SUGAR CREEK BASIN NORTH CAROLINA AND SOUTH CAROLINA FEASIBILITY REPORT AN..(U) CORPS OF ENGINEERS CHARLESTON SC CHARLESTON DISTRICT OCT 82 2/3

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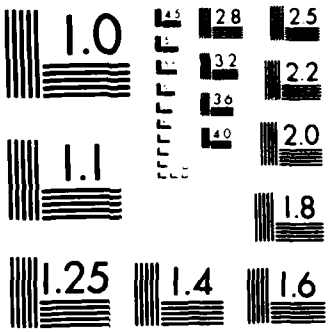


MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963-A

also been collected. The small shallow channel, poor water quality, the lack of holes or objects to provide shelter, and the shifting sand bottom are the principal limiting factors for fish.

Channel widening would probably take most of the few trees remaining below Central Avenue. The spreading of the water during normal and low flow conditions over a much wider, unshaded channel would further limit habitat for fish. The Charlotte-Mecklenburg Planning Commission has indicated a wish to acquire approximately eight acres in the vicinity of Central Avenue for parks. The undeveloped land above and below Central Avenue appears to be suitable for this purpose if properly landscaped. Structural changes in this reach include selective clearing and replanting of hardwood trees next to the creek. Placement of excavated material would not adversely affect drainage or use of the area as a park.

Erosion, turbidity and sedimentation would be increased during and after construction until vegetation is reestablished. Seeding with grass shall be done on all cleared areas. This plan requires 486,000 cubic yards of excavation and 113 acres of clearing. A small increase in sediment load may occur during periods of high flow due to a slight increase in channel velocities. Sediment impacts are not expected to occur downstream of the project in the more valuable habitat areas.

The recommended 4.75-mile project generally follows the existing invert elevations and avoids deepening. In areas where excavation proceeds deeper than more recently deposited sediment, a draining of wet soils is possible immediately adjacent to the creek. Elevated disposal areas and a slightly lower channel bottom could result in better drained soils and fewer lowland hardwoods in the reestablished cover.

The proposed plan can also be made compatible with local plans for recreational development as discussed in the plan description section. No specific development plans or facilities are recommended

for participation by the Corps. Project lands, however, would be landscaped in a manner compatible with recreational needs and conveyed to the local project sponsor to be used for park, greenway or other flood plain compatible development.

Temporary disruptions in the flow of traffic over road crossings within the project reach are expected to occur due to required construction of bridge modifications. These disruptions can be minimized, however, by the establishment of detour routes to route traffic around construction areas.

The major beneficial economic impact that would result from construction of the structural portion of the proposed plan is the reduction of existing and future damages to the urban area of Charlotte located adjacent to Briar Creek in the stream segment upstream from Colony Road. Implementation of the channel modifications would produce flood damage reduction benefits to over 200 structures located within the existing flood plain above Colony Road. Average annual benefits of $1,450,000 are estimated for the reduction of flood damages to those structures. No monetary benefits are claimed for reduction of damages to future development since the plan recommends regulation of the flood plain.

In the stream reach below Colony Road, however, upstream channel modifications would result in increased flood stage and increased flood damages. The estimated increase in economic flood losses is approximately $12,500 annually. To offset the induced damages, it is proposed that six residential structures be purchased and removed from the flood plain. Implementation of this mitigation measure would result in the realization of an additional $17,200 in annual project benefits when compared to existing conditions and thus increase total annual project benefits to $1,467,200.

Construction of the mitigation proposals below the channel modification project would result in the fee purchase of an additional 3.5 acres of land which would be conveyed to the local project sponsor for future regulation in a flood plain compatible manner.

Construction of a flood control project on Briar Creek would reduce health hazards, particularly those created by the overflow of low lying areas. Other intangible benefits include: the reduction of risk to human life and limb and the peace of mind that goes therewith; reduced number of traffic disruptions, and improved aesthetic quality.

Evaluation and Trade-Off Analysis

A comprehensive channel modification proposal consisting of 8 miles of channel enlargement was originally formulated for Briar Creek during Stage 2 of the planning process. More refined analysis of this alternative however, lead to the conclusion that the upper portion of this plan would not be economically justified. Based on this, the original plan was reduced in length to optimize the net return on investment.

Nonstructural proposals were also evaluated and in certain areas were found to be economically feasible. The structural solution was selected over the nonstructural on the basis of a small difference in excess benefits and in deference to city officials' desire to preserve residences to meet the need of a short supply market.

Mitigation Requirements

Implementation of the proposed alternative on Briar Creek would result in increased flood stage in adjacent downstream areas. The affected reach is generally defined by Colony Road as an upstream limit and extending down-

stream below the confluence of Little Sugar and Briar Creeks to the vicinity of Sharon Road. Increased flood stages in this area are displayed on flood profiles contained in Appendix 3 to this report. The estimated increase in economic damages in this stream segment resulting from upstream improvements is approximately $12,500 annually. Eighty-three percent of this monetary increase is concentrated below the confluence of Little Sugar and Briar Creeks.

As a mitigation measure designed to offset the increase in economic damages, it is recommended that six structures in the stream segment between Sharon Road and Park Road be purchased and removed from the 10-year flood plain. This damage reduction measures would be implemented following the same procedures previously discussed for proposed nonstructural plans at an estimated first cost of $366,900. The net result of this mitigation effort would reduce post project damages in downstream reaches below structural improvements by $29,700 annual, or a net damage reduction of $17,200 annually when compared to damage expectations based on existing conditions.

Inclusion of mitigation measures increases the total project cost for Briar Creek to $12,187,000. Annual project cost of $1,022,400 when compared to annual benefits of $1,467,200 yields a benefit to cost ratio of 1.43 to 1.

Cost Allocation

All project costs associated with the implementation of the proposed water resource alternative on Briar Creek have been allocated to flood control. No specific recreational facilities have been recommended

as part of this alternative. Landscaping of project-related lands will be conducted in a manner conducive to future recreational development by non-Federal interests. No significant increases in project cost are anticipated from these landscaping measures.

Cost Apportionment

The traditional method of apportioning structural costs between Federal and non-Federal interests is based on the standard requirements established as Federal policy for "local protection" works. Under this policy, non-Federal interests are required to furnish all lands, easements, and rights-of-way required for project construction and proper project maintenance. Non-Federal interests are also required to bear the costs of modifications to all utilities and highway crossings required for project construction. In addition, the local sponsor must operate and maintain the project after construction in accordance with Federal requirements. The Federal Government would be responsible for all flood control construction costs, including costs incurred in performing investigations and designs and costs incurred for the modifications to railroad crossings. Cost of mitigation measures would be apportioned using the same percentage ratio of apportioned Federal/non-Federal cost determined for the structural portion of the plan. Following this method, the apportionment of project cost for the Briar Creek project would be as follows:

Cost Apportionment

(Traditional Method)

Channel Modification - Briar Creek

Item	First Cost	Annual O&M Cost
A. Channel Construction Cost (Total = $11,820,100)		
I. Federal Cost		
Project Construction Cost	$7,668,400	$ 0
Railroad Modifications	610,000	0
Subtotal Federal Cost	$8,278,400 (70%)	$ 0
II. Non-Federal Cost		
Lands	$2,431,700	0
Highway Bridge Modifications	1,110,000	0
Subtotal Non-Federal Cost	$3,541,700 (30%)	0
III. Annual O & M Cost (Non-Federal)	$ 0	$ 69,000
B. Mitigation Cost (Total = $366,900)		
I. Federal Cost (70%)	$ 256,800	0
II. Non-Federal Cost (30%)	$ 110,100	0
C. Total Project Cost ($12,187,000)1/		
I. Federal Cost	$8,535,200	$ 0
II. Non-Federal Cost	$3,651,800	$ 69,000

1/ An additional $30,000 in first cost would be required to comply with requirements of P.L. 91-646. These cost are project related cost necessary to offset personal relocation expenses and would be cost shared on the same basis as mitigation costs. This would result in an additional $21,000 Federal expense and $9,000 additional local expense.

Federal Responsibilities

The presently estimated Federal share of the total first cost for channel modification on Briar Creek is $8,535,200, plus an additonal $21,000 necessary to comply with requirements of P.L. 91-646. The Federal Government is responsible for the preparation of detailed design memorandums, plans and specifications and for construction of the project.

Non-Federal Responsibilities

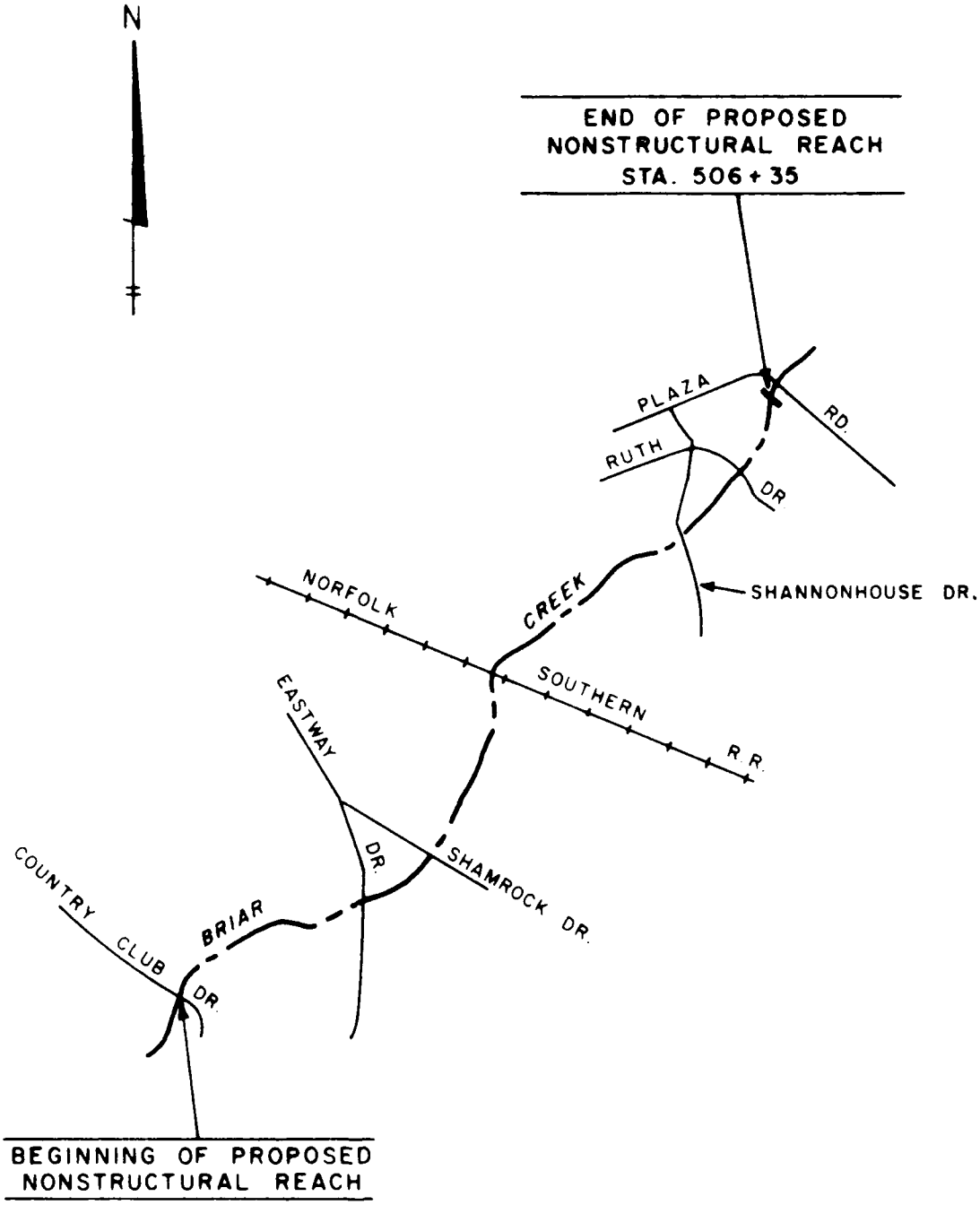
The presently estimated non-Federal share of the total first cost of project construction is $3,651,800. An additional $9,000 of local funds will also be required for the local share of personal relocation expenses (P.L. 91-646). Project maintenance, which is currently estimated to be $69,000 annually, is the sole responsibility of the local sponsor. The ABC's of sponsorship are spelled out in detail in the "SUMMARY -- ASSESSMENT AND EVALUATION OF DETAILED PLANS" section.

Nonstructural Measures - Briar Creek

Nonstructural alternatives evaluated in Stage 3 indicated that reaches of Briar Creek above proposed channel improvement were justified for nonstructural measures. The best plan would remove twenty-nine residential structures from the reach beginning at Country Club Drive and extending to the upstream study limits (See following map). The affected structures would be purchased at fair market value (including the purchase of related lands and improvements) and either relocated or demolished, depending on the type and condition of the structure and the availability of relocation sites. Actual implementation of nonstructural alternatives would likely result in a combination of relocations and demolitions. For decision purposes it is assumed that all affected structures would be demolished. Determinations to relocate or demolish a specific structure would be made during post-authorization investigations. Economic evaluation of the demolition alternative for this portion of Briar Creek yielded the following pertinent economic data.

Pertinent Economic Data
Nonstructural Measures -- Briar Creek
(Country Club Drive to Upstream Limit)

Alternative	First Cost 1982 $	Annual Cost 7-5/8%	Annual Benefits	B/C Ratio
Demolish 29 Structures (Country Club Drive to Upstream Limit)	$1,259,900	$ 98,600	$173,300	1.76 to 1



CORPS OF ENGINEERS, U.S. ARMY
CHARLESTON, SOUTH CAROLINA DISTRICT

SUGAR CREEK BASIN

BRIAR CREEK SUBBASIN

PROPOSED NONSTRUCTURAL REACH
STAGE 3

Impact Assessment

Implementation of nonstructural measures on this portion of Briar Creek would result in the displacement of approximately twenty-nine families from the affected structures.

Relocation activities may cause problems for these families. Efforts, however, would be made to reduce to a minimum the inconveniences and problems resulting from implementation.

Construction of this alternative could remove twenty-nine structures from the housing market and place a temporary increase in the demand for housing. This would result in an increase in new housing construction in non-flood plain areas.

The estimated first cost of implementing nonstructural measures on this reach of Briar Creek is $1,259,900. This results in an annual costs of $98,600 and when compared to annual benefits of $173,300 yields a benefit to cost ratio of 1.76 to 1. An additional first cost of approximately $145,000 would be required to relocate affected families to non-flood plain sites. These costs are considered as financial costs to be shared by non-Federal interests, but not included in economic costs analysis.

Construction of nonstructural measures on Briar Creek would result in the fee purchase of approximately 9.8 acres of land which would be conveyed to the local project sponsors. Local project sponsors would be required to regulate future development of these lands in a manner compatible with flood plain usage.

Other tangible and intangible benefits resulting from the construction of this project include reduced evacuation cost during flood periods, reduction of health hazards resulting from the flooding of inhabited properties, the reduction of risk to human life and limb and the peace of mind that goes therewith, and improved aesthetic quality.

Evaluation and Trade-Off Analysis

No trade-offs were required in connection with the implementation of this alternative. Individual economic reaches evaluated in Stage 2, however, were combined in Stage 3 in the interest of continuity and providing a uniform level of protection.

Cost Apportionment

Apportionment of costs in accordance with current policy is as follows:

Cost Apportionment

Nonstructural Measures -- Briar Creek
Demolish 29 Structures (Country Club Drive to Upstream Limit)

Item	First Cost	Federal Cost	Local Cost
Construction Cost	$1,259,900	$1,007,900	$252,000
Associated Relocation Cost (P.L. 91-646)	145,000	116,000	29,000
TOTAL COST	$1,404,900	$1,123,900	$281,000

Federal Responsibilities

The presently estimated Federal share of project cost for this portion of Briar Creek based on current policy is $1,123,900, consisting of a $1,007,900

share of construction cost and a $116,000 share of personal relocation cost. The Federal Government is responsible for the preparation of plans and specifications and for construction of the project.

NON-FEDERAL RESPONSIBILITIES

The presently estimated non-Federal share of the total cost of this nonstructural plan for Briar Creek is $281,000 consisting of a $252,000 share of construction cost and a $29,000 share of personal relocation cost. These costs may be either a cash or in-kind contribution. The ABC's of sponsorship are spelled out in detail in the "SUMMARY -- ASSESSMENT AND EVALUATION OF DETAILED PLANS" section.

BRIAR TRIBUTARY 2

Briar Tributary 2

Results of Stage 2 investigations on Briar Tributary 2 indicated that nonstructural flood control measures provided the only viable solution for the alleviation of flood damages. Several variations of nonstructural alternatives were evaluated during Stage 3 in an effort to select the most feasible plan for recommendation. These variations were generally in the boundaries of the flood plain being treated. Subsequent sections describe the impacts of the plan considered most feasible for implementation. Selection of the plan was made after full consideration of an array of alternatives.

Nonstructural Measures — Briar Tributary 2

The best plan for addressing the flooding problems along Briar Tributary 2 would be to remove thirteen residential structures in that reach beginning at Grafton Road and extending upstream to Galway Drive (See following map). The affected structures would be purchased at fair market value (including the purchase of related lands and improvements) and either relocated or demolished, depending on the type and condition of the structure and the availability of relocation sites. Actual implementation of nonstructural alternatives, if authorized would likely result in a combination of relocations and demolitions. For decision purposes it is assumed that all affected structures would be demolished. Determinations to relocate or demolish a specific structure would be made during post-authorization investigations. Economic re-evaluation, during Stage 3, of the demolition alternative for Briar Tributary 2 yielded the following pertinent economic data.

Pertinent Economic Data
Nonstructural Measures -- Briar Tributary 2

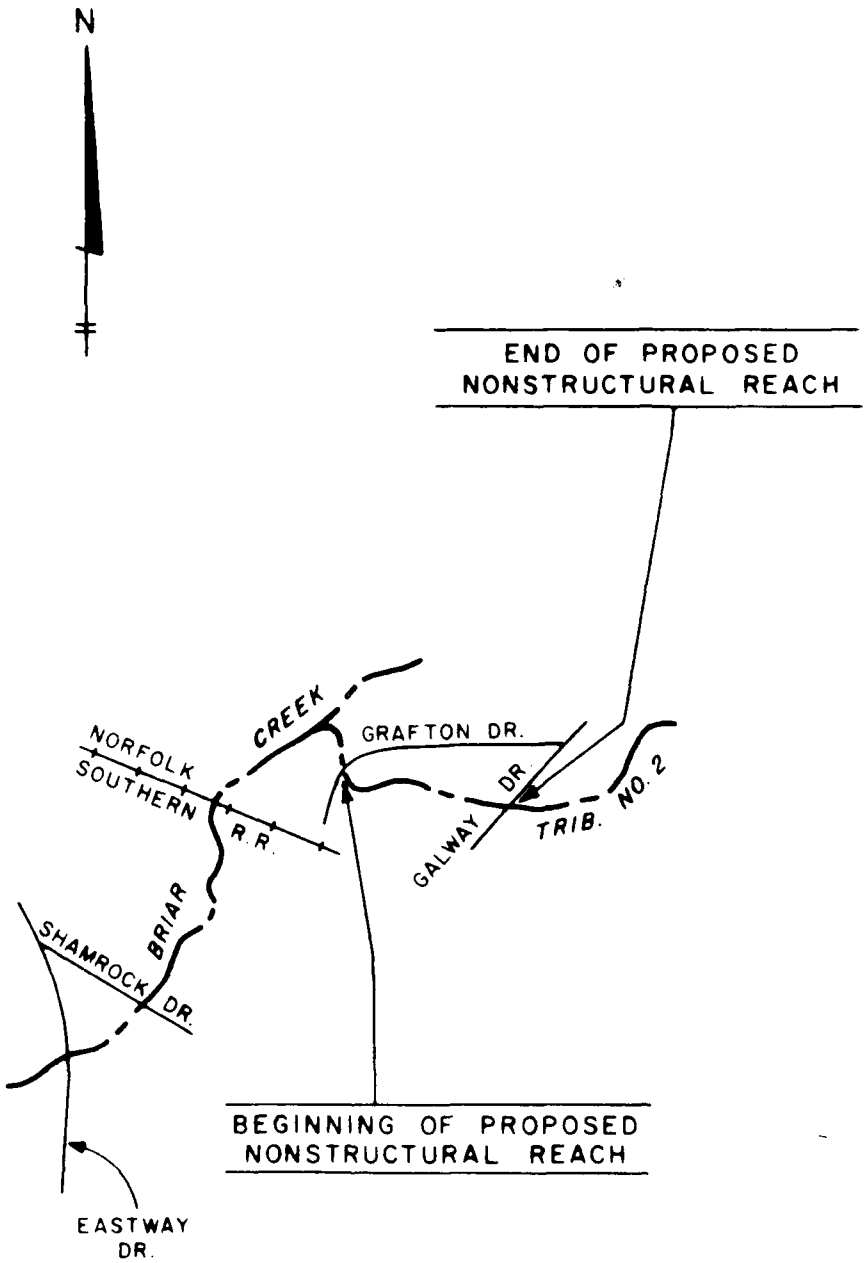
Alternative	First Cost 1982 $	Annual Cost 7-5/8%	Annual Benefits	B/C Ratio
Demolish 13 structures (Grafton Road to Galway Drive)	$737,300	$57,700	$61,700	1.07 to 1

Impact Assessment

Implementation of nonstructural measures on Briar Tributary 2 would result in the displacement of approximately thirteen families from the affected structures. Relocation activities may cause problems for these families. Efforts, however, would be made to reduce to a minmum the inconveniences and problems resulting from implementation.

Construction of this alternative could remove thirteen structures from the housing market and create a temporary increase in the demand for housing. This would result in an increase in new housing construction in non-flood plain areas.

The estimated first cost of implementing nonstructural measures for Briar Tributary 2 is $737,300 (Demolition Alternative). This results in an annual cost of $57,700 and when compared to benefits of $61,700 yields a benefit to cost ratio of 1.07. An additional first cost of approximately



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SCALE IN FEET

CORPS OF ENGINEERS, U.S. ARMY

CHARLESTON, SOUTH CAROLINA DISTRICT

SUGAR CREEK BASIN

BRIAR CREEK SUBBASIN

TRIB. NO. 2

PROPOSED NONSTRUCTURAL REACH

STAGE 3

$65,000 will also be required to relocate affected families to non-flood plain sites. These costs are considered as financial costs to be shared by non-Federal interests, but not included in economic cost analyses.

Construction of nonstructural measures on Briar Tributary 2 would result in the fee purchase of approximately 3.7 acres of land which would be landscaped and conveyed to the local project sponsors for incorporation into a proposed park. Local project sponsors would be required to regulate future development of these lands in a manner compatible with the flood hazard.

Land acquired as part of this plan may be suitable as part of future park development desired by the Planning Commission in this general vicinity. Selective clearing and landscaping would be the same as described for Briar Creek.

Other tangible and intangible benefits resulting from the construction of this project includes reduced evacuation cost during flood periods, reduction of health hazards resulting from the flooding of inhabited properties; the reduction of risk to human life and limb and the peace of mind that goes therewith; and improved aesthetic quality.

Evaluation and Trade-Off Analysis

No trade-offs were required in connection with the implementation of this alternative. Individual economic reaches evaluated in Stage 2, however, were combined in Stage 3 in the interest of continuity and a uniform level of protection.

Cost Apportionment

Apportionment of project cost in accordance with current policy is as follows:

Cost Apportionment

Nonstructural Measures -- Briar Tributary 2
Demolish 13 Structures (Grafton Road to Galway Drive)

Item	First Cost	Federal Cost	Local Cost
Construction Cost	$737,300	$589,800	$147,500
Associated Relocation Cost (P.L. 91-646)	65,000	52,000	13,000
TOTAL COST	$802,300	$641,800	$160,500

FEDERAL RESPONSIBILITIES

The presently estimated Federal share of the total first cost of nonstructural plans for Briary Tributary 2 is $641,800 consisting of a $589,800 share of construction cost and an estimated $52,000 share of relocation cost. The Federal Government is responsible for the preparation of plans and specifications and for construction of the project.

NON-FEDERAL RESPONSIBILITIES

The presently estimated non-Federal share of the total first cost of nonstructural plans for Briar Tributary 2 is $160,500 consisting of a $147,500 share of construction cost and a $13,000 share of relocation cost. These costs may be either a cash or in-kind contribution. The ABC's of local sponsorship are spelled out in detail in the "SUMMARY -- ASSESSMENT AND EVALUATION OF DETAILED PLANS" section.

LITTLE SUGAR CREEK

Little Sugar Creek

Results of Stage 2 evaluations on Little Sugar Creek indicated that three structural alternatives were economically justified and worthy of Stage 3 investigations. These alternatives included 1.09 miles of channel modifications in the vicinity of East Boulevard and East Morehead Street, a channel modification/paved channel proposal in the channel reach between Independence Boulevard and East 4th Street; and a third alternative consisting of reservoir storage on Derita Branch in combination with approximately 2.0 miles of channel modifications in the vicinity of East 16th Street and Craighead Road. In addition, nonstructural proposals were justified for several economic reaches, which would not be protected by structural solutions.

A complete review of hydrologic/hydraulic computatons for Little Sugar Creek was performed during Stage 3. Changes in computed flood stages necessitated re-evaluation of damages and re-formulation of alternative plans. Further evaluation of the downstream channel enlargement plan indicated a lack of economic justification.

Increased cost and reduced benefits were encountered in the reach previously considered for channel modification with some paving (Independence Boulevard to East 4th Street) and resulted in a loss of economic viability.

In the upper reaches, reformulation resulted in the elimination of the dry reservoir on Derita Branch. Control of flooding was achieved by extending channel work further downstream through a railroad embankment constriction. Other downstream constrictions (Northwest Freeway Culverts) cause ponding which prevents increases in floodstages downstream of the freeway.

Nonstructural proposals were also reformulated as described in subsequent sections describing the Stage 3 evaluations of potential alternatives.

The following sections describe the impacts of plans considered most feasible for implementation. Selection of these plans was made after full consideration of the impacts of all plans considered in Stage 3.

Nonstructural Measures Lower Little Sugar Creek

Proposals for flood control improvements on the lower portion of Little Sugar Creek above its junction with Briar Creek were reevaluated during Stage 3. The draft version of this report recommended construction of a combination structural/nonstructural plan consisting of approximately 1.08 miles of channel conveyance improvements beginning approximately 1,350 feet downstream from East Boulevard and extending approximately 700 feet upstream from East Morehead Street in conjunction with the evacuation and demolition of 89 residential structures from the 10-year flood plain in the stream reach between Sharon Road and Princeton Avenue. Eighty-one of these structures were located within the existing 10-year flood plain and the remaining eight structures were located in the post-project 10-year flood plain due to increased flood stages resulting from upstream channel modifications.

Careful review of this draft plan, however, indicated a lack of incremental justification for the structural portion of the proposed plan. Therefore, during the late stages of feasibility investigations, the structural improvement was deleted and the scope of the proposed nonstructural improvement was reduced to a plan for the purchase and demolition of 77 flood plain structures located in the 10-year flood plain between Park Road and Princeton Avenue. Structures located in the 10-year flood plain of the deleted nonstructural reach between Sharon Road and Park Road would remain subject to induced flood damages resulting of channel modifications proposed for adjacent Briar Creek. Therefore, proposals for removal of these flood plain structures were included as a mitigation measure as part of the proposed structural plan for Briar Creek discussed in previous sections of this report.

The modified plan for addressing flooding problems in the lower reach of Little Sugar Creek consists of the removal of 77 residential structures from the flood plain in the stream segment beginning at Park Road and extending upstream to Princeton Avenue. (See following map). The affected structures would be purchased at fair market values (including the purchase of related lands and improvements) and either relocated or demolished, depending on the type and condition of the structure and the availability of relocation sites. Actual implementation of nonstructural alternatives, if authorized would likely result in a combination of relocations and demolitions. For decision purposes it is assumed that all affected structures would be demolished. Determinations to relocate or demolish a specific structure would be made during post-authorization investigations. Pertinent economic data concerning this proposal is contained in the following tabulation. Further detailed data is presented in Appendix 4.

PERTINENT ECONOMIC DATA

Nonstructural Measures - Lower Little Sugar Creek

Alternative	First Cost 1982 $	Annual Cost 7 5/8%	Annual Benefits	B/C Ratio
Demolish 77 structures (Park Road to Princeton Ave.)	$2,971,300	$232,500	$309,100	1.33 to 1

IMPACT ASSESSMENT

Implementation of nonstructural measures on this portion of Little Sugar Creek would result in the displacement of approximately 77 families from the affected structures. Relocation activities may cause problems for these families. Efforts, however, would be made to reduce to a minimum the inconveniences and problems resulting from implementation.

Construction of this alternative could remove 77 structures from the housing market and create a temporary increase in the demand for housing. This would result in an increase in new housing construction in non-flood plain areas.

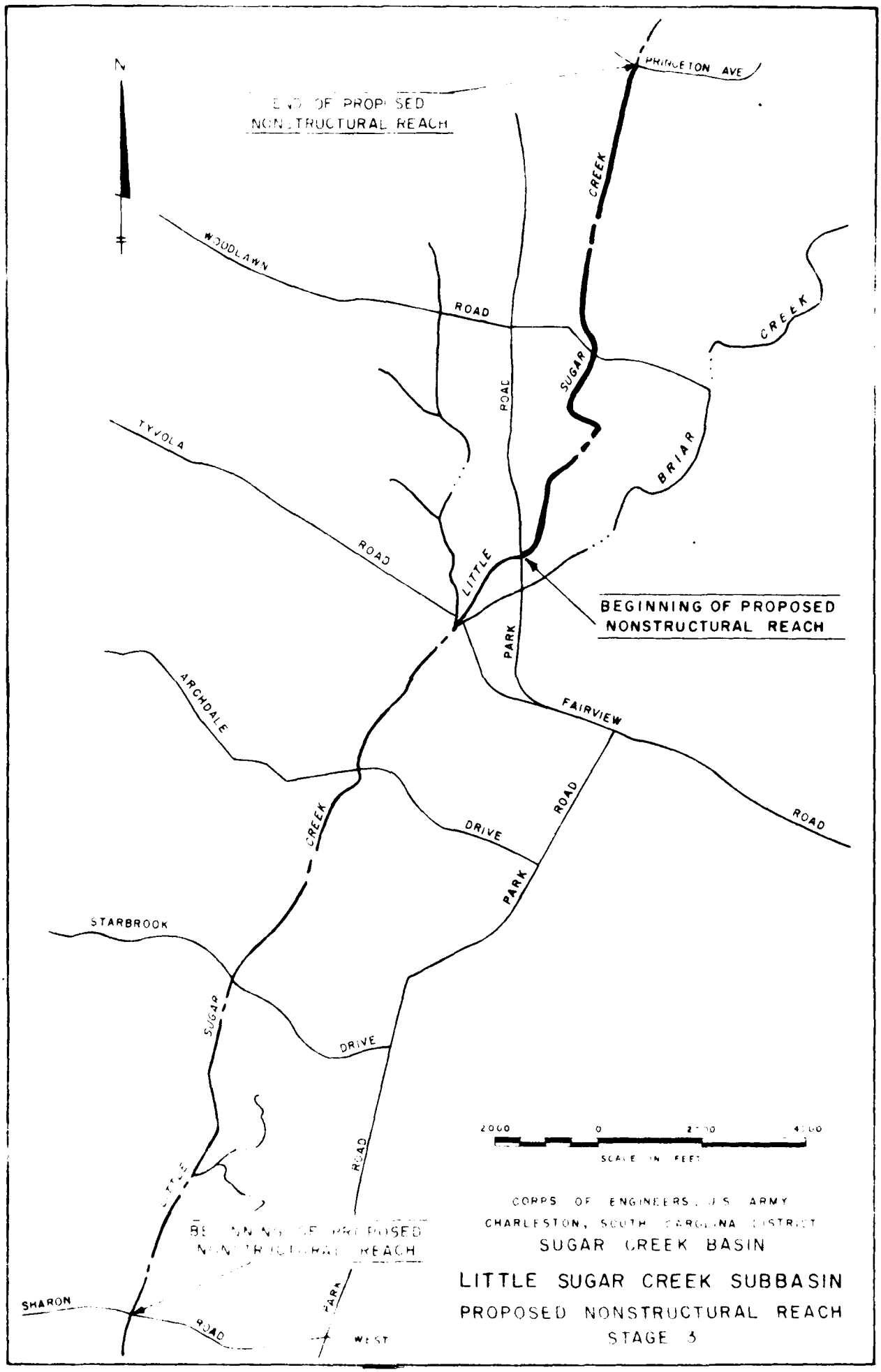
The estimated first cost of implementing nonstructural measures for this portion of Little Sugar Creek is $2,971,300 (Demolition Alternative). This results in an annual cost of $232,500 and when compared to benefits of $309,100 yields a benefit to cost ratio of 1.33 to 1. An additional first cost of approximately $385,000 will also be required to relocate families to non-flood plain sites. These costs are considered as financial costs to be share by non-Federal interests, but not included in economic cost analyses.

Constructon of nonstructural measures on the lower portion of Little Sugar Creek would result in the fee purchase of approximately 46.5 acres of land which would be landscaped and conveyed to the local project sponsors for regulation in a flood plain compatible manner, in accordance with guidance furnished by the Secretary of Army acting through the Chief of Engineers.

Other tangible and intangible benefits resulting from the construction of this project includes reduced evacuation costs during flood periods, reduction of health hazards caused by the flooding of inhabited properties; the reduction of risk to life and limb and the peace of mind that gives therewith; and improved aesthetic quality.

Evaluation and Trade-Off Analysis

No trade-offs were required in connection with the implementation of this alternative. The combination structural/nonstructural alternative as proposed in the draft report provided protection to commercial concerns in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END OF PROPOSED
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CORPS OF ENGINEERS, U.S. ARMY
CHARLESTON, SOUTH CAROLINA DISTRICT
SUGAR CREEK BASIN
LITTLE SUGAR CREEK SUBBASIN
PROPOSED NONSTRUCTURAL REACH
STAGE 3

the proposed channel modification reach at the expense of induced damages to downstream residential structures. Since the structural improvements were deleted due to the lack of incremental economic justification, there would be no trade-offs involved as a result of plan implementation.

Cost Apportionment

Apportionment of project cost in accordance with current policy is as follows:

Cost Apportionment

Nonstructural Measures -- Lower Little Sugar Creek
Demolish 77 Structures (Park Road to Princeton Avenue)

Item	First Cost	Federal Cost	Local Cost
Construction Cost	$2,971,300	$2,377,000	$594,300
Associated Relocation Cost (P.L. 91-646)	385,000	308,000	77,000
TOTAL	$3,356,300	$2,685,000	$671,300

Federal Responsibilities

The presently estimated Federal share of project cost for the nonstructural plan on lower Little Sugar Creek based on current policy is $2,685,000, consisting of a $2,377,000 share of construction cost and a $308,000 share of personal relocation cost. The Federal Government is responsible for the preparation of plans and specifications and for construction for the project.

NON-FEDERAL RESPONSIBILITIES

The presently estimated non-Federal share of the total project cost is $671,300 consisting of a $594,300 share of construction cost and a $77,000 share of personal relocation costs. The ABC's of sponsorship are spelled out in detail in the "SUMMARY -- ASSESSMENT AND EVALUATION OF DETAILED PLANS" section.

Channel Modification – Upper Little Sugar Creek

Proposals for flood control improvements on the upper portion of Little Sugar Creek above the Northwest Freeway consist of approximately 2.56 miles of channel conveyance improvements beginning approximately 600 feet upstream from the Northwest Freeway and extending approximately 540 feet upstream from East 36th Street (See following map). The plan consists of widening the existing channel bottom to a width of 30 feet and shaping banks to a slope of 2 horizontal to 1 vertical. Extimated construction yardage is 100,500 cubic yards. Riprap would be placed in areas where velocities would create a potential for bank erosion. Four bridge replacements (East 18th Street, North Davidson Street, North Brevard Street and East 36th Street) would be required in addition to additional culvert capacities at the SCL Railroad, Parkwood Avenue, and 2 Norfolk and Southern Railroad Crossings.

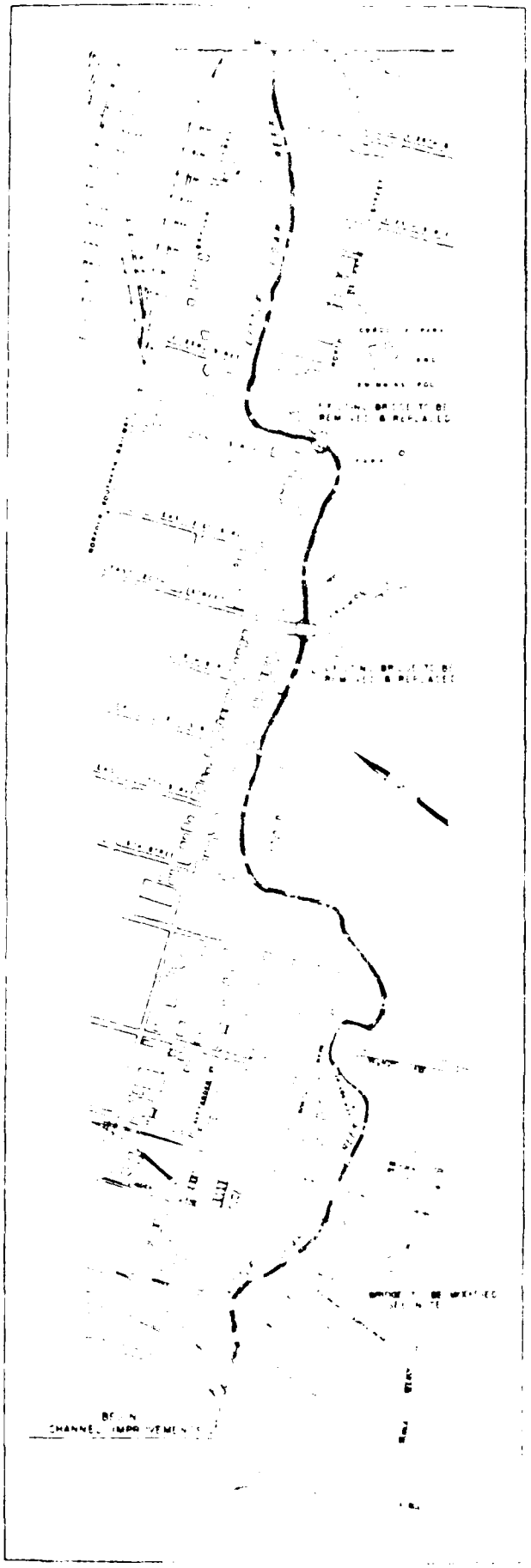
Total land requirements for channel plan would be 52.6 acres including 12.6 acres remote to the work site for disposal purposes. This estimate is based on an average right-of-way width of 110 feet. Detailed hydraulic design for this alternative is presented in Appendix 3 to this report.

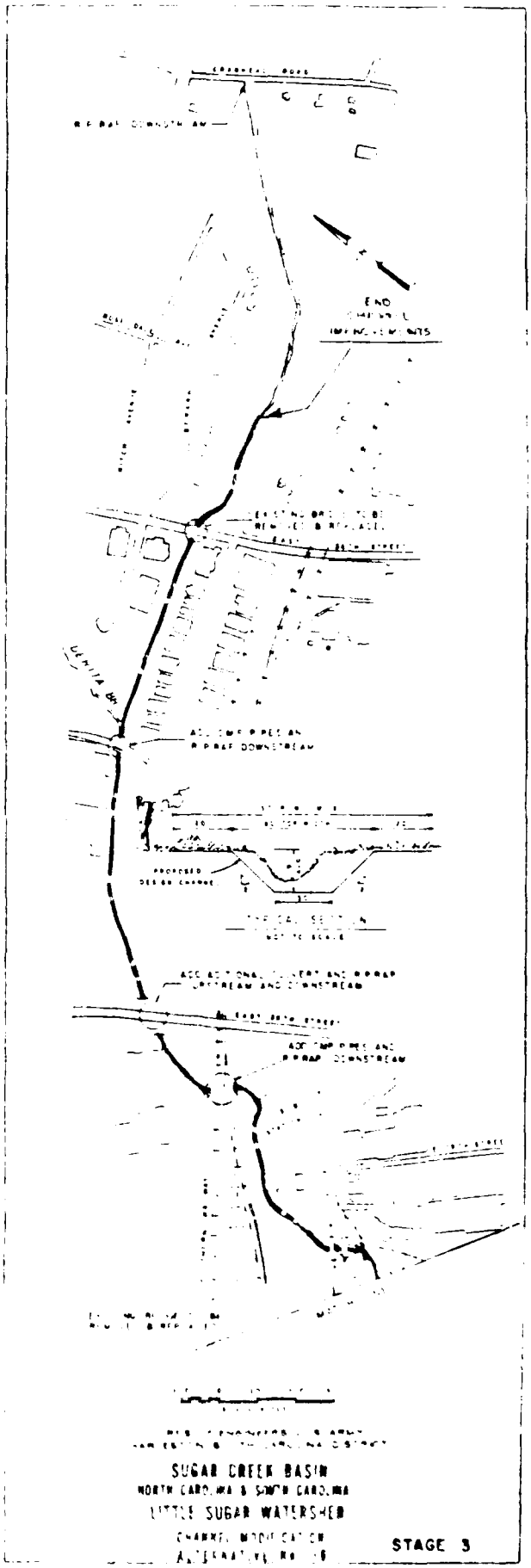
Land would be purchased in fee and would be placed under the control of the local sponsor in a condition that would be suitable for use as a conservation area or passive recreation area such as a walking trail. This possibly could be made an extension of the existing Cordelia Park and greenway trails. The Corps would grade, grass and plant trees in all portions of the rights-of-way disturbed by construction, but would not participate in the building of any specific recreation structures.

First cost of the channel plan would be about $5,781,300 (See Appendix [illegible] for detailed breakdown of cost data) and annual costs would be $[illegible], [illegible] for annual project maintenance. When compared to annual benefits of $[illegible]36,300, the resultant benefit to cost ratio is 1.[illegible]:1.

IMPACT ASSESSMENT

The reach of Lajar Creek, proposed for channel modification, passes through an area which is predominantly industrial and commercial, with some residential development. About 1/3 of the reach passes through a large railroad yard. From Davidson Street to Parkwood Street, the creek passes through a small park (Cordelia Park). In the area just below Craighead Road there are small trees and undercover on both banks except for two strips about [illegible] feet in width immediately adjacent to the creek which are cleared for sewer rights-of-way. The tree mixture includes poplar, sweet gum, sycamore, oaks, pines and hickories. Because of the small area and the close proximity of commercial and residential development on all sides, the wildlife habitat is limited for songbirds, squirrels and other small animals that can live in an urban environment. From East 26th Street to the lower limit of the project, vegetation is limited to grass, [illegible] scattered shrubs and trees. The project area below East [illegible] is [illegible] more commercial and industrial


BEGIN
CHANNEL IMPROVEMENTS


END
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ADD CMP PIPES AND
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UPSTREAM AND DOWNSTREAM
ADD CMP PIPES AND
RIPRAP DOWNSTREAM
SUGAR CREEK BASIN
NORTH CAROLINA & SOUTH CAROLINA
LITTLE SUGAR WATERSHED
CHANNEL MODIFICATION
STAGE 3

development and has [illegible] less value for wildlife than the reach above. The channel has already been modified along most of the reach as it passes through the commercial or industrial properties. The creek is very shallow, the bottom is covered with sand and silt; and there is little or no shade for most of the day. Water quality and fish habitat are poor.

Because of the absence of valuable habitat and the previous changes to the channel, further modification would not result in significant losses. Stable, grassed side slopes and planting of hardwood trees close to the [illegible] would improve the fish habitat, but widening and straightening would have adverse effects. There would be no substantial overall losses or gains.

Existing bottom flora and invertebrates will be removed in the channel improvement reach. The sand and silt bottom should gradually recolonize from flora and invertebrates above the project.

Erosion, turbidity, and sedimentation would be increased during and after construction of channel modifications until vegetation is reestablished. Seeding with grasses would be done in all cleared areas. This plan requires 190,000 cubic yards of channel excavation. A small increase in sediment load may occur during periods of high flows due to a possible increase in channel velocities. Sediment impacts are not expected to occur downstream of the project.

Temporary disruption in the flow of traffic over road crossings within the project reach are expected to occur due to required construction of bridge modifications. These disruptions can be minimized by the establishment of detour routes to route traffic away from construction areas.

The major economic impact that will result from construction of the proposed project is the reduction of existing and future damages to the urban area of Charlotte, North Carolina. Implementation of the plan would produce flood damage reduction benefits to approximately 58 structures located within the existing flood plain. Average annual benefits of $836,300 are estimated for the reduction of flood damages to existing structures. No monetary benefits are claimed for reduction of damages to future development since the plan recommends regulation of the flood plain.

Construction of the proposed project would also reduce health hazards, particularly those created by the overflow of low lying areas. Other intangible benefits include: the reduction of risk to human life and limb and the peace of mind that goes therewith; reduced number of traffic disruptions, and improved aesthetic quality.

Evaluation and Trade-Off Analysis

Flood control alternatives formulated during stage 2 for this portion of Little Sugar Creek included nonstructural measures and a combination structural alternative consisting of channel enlargement and reservoir storage on Derita Branch, a tributary to Little Sugar Creek. Both alternatives were found to be economically justified. The majority of structures considered for nonstructural modification, however, were commercial concerns which located in this area for location advantages and for access to rail and highway transportation systems. The relocation of these establishments could result in substantial business losses. For this reason, nonstructural measures were deemed undesirable as a means of reducing flood damages.

Stage 3 evaluation of structural alternatives indicated that the need for reservoir storage could be eliminated by extending channel modi-

fications further downstream through a manmade construction created by the Seaboard Coastline Railroad embankment. By increasing culvert capacity through this embankment, floodflows could pass into a reach of Little Sugar Creek which has sufficient storage and conveyance capacity to pass the increased flow with an insignificant adverse affect downstream. The Northwest Freeway culvert system, located downstream from the SCL Railroad causes ponding of runoff and would thereby eliminate any adverse effects downstream.

Mitigation Measures

Construction of the plan described would not create any adverse conditions in stream reaches below the Northwest Freeway. Mitigation measures, therefore, were not required to offset induced downstream damages. The insignificant adverse impact on the area's environment would not warrant mitigation efforts.

Cost Allocation

All project costs associated with construction of the proposed water resource alternative on Little Sugar Creek have been allocated to flood control. No specific recreational facilities have been recommended as part of this alternative. Landscaping of project-related lands will be conducted in a manner conducive to future recreational development by non-Federal interests. No significant increases in project costs are anticipated from these landscaping measures.

Cost Apportionment

The traditional method of apportioning structural costs between Federal and non-Federal interests is based on the standard requirement established as Federal policy for "local protection" works. Under this policy, non-Federal interests are required to furnish all lands, easements and right-of-way required for project construction and proper project maintenance. Non-Federal interests are also required to bear the costs of modifications to all utilities and highway crossings required for project construction. In addition, the local sponsor must operate and maintain the project after construction in accordance with Federal requirements. The Federal Government would be responsible for all flood control construction costs including costs incurred in performing investigations and designs and costs incurred for the modifications to railroad crossings. Following the traditional method of apportionment of project cost would be as follows:

Cost Apportionment (Traditional Method)
Channel Modifications - Upper Reach
Little Sugar Creek

	Estimated First Cost	Annual O&M Cost
Federal		
Construction Cost - Channel Modification	$2,136,300	0
Railroad Modifications	$1,369,900	0
Total Federal Cost	$3,506,200	0
Non-Federal		
Land Cost - Channel Modifications	$ 925,000	0
Highway Bridge Modifications	$1,350,100	0
Annual Maintenance - Channel Modification	0	$45,000
Total Non-Federal Cost	$2,275,100	$45,000

FEDERAL RESPONSIBILITIES

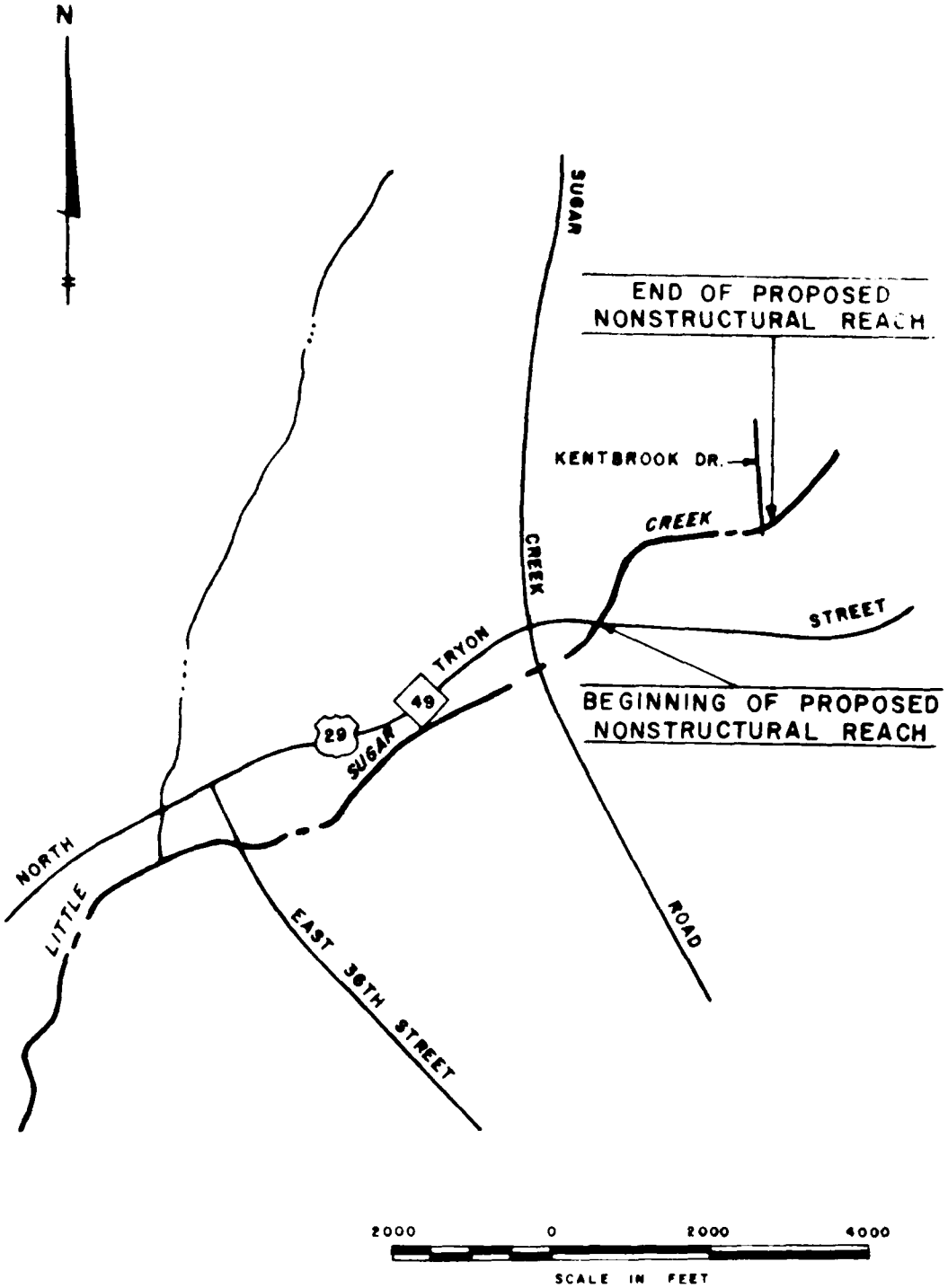
The presently estimated Federal share of the total first cost of the channel modification alternative for Little Sugar Creek is $3,506,200. The Federal Government is responsible for the preparation of detailed design memorandums, plans and specifications and for construction of the project.

NON-FEDERAL RESPONSIBILITIES

The presently estimated non-Federal share of the total first cost of project construction is $2,275,100. The local project sponsor is responsible for proper project maintenance which is currently estimated to be $45,000 annually. The ABC's of sponsorship are spelled out in detail in the "SUMMARY -- ASSESSMENT AND EVALUATION OF DETAILED PLANS" section.

Nonstructural Measures Upper Little Sugar Creek

At the conclusion of stage 2 investigations, two viable nonstructural flood control alternatives remained in consideration for the portion of Little Sugar Creek [illegible] North Tryon Street (See following map). These alternatives [illegible] nonstructural protection via removing residential [illegible] existing flood plain. The number of affected structures [illegible] during stage 3 due to hydraulic refinements. Stage [illegible] removal of 16 residential structures in the [illegible] above North Tryon Street. The affected structures [illegible] fair market value (including the purchase



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SUGAR CREEK BASIN

LITTLE SUGAR CREEK SUBBASIN

PROPOSED NONSTRUCTURAL REACH

STAGE 3

of related lands and improvements) and either relocated or demolished, depending on the type and condition of the structure and the availability of relocation sites. Actual implementation of nonstructural alternatives would likely result in a combination of relocating some structures and demolishing others. For the purpose of the feasibility study, however, the assumption was made that all affected structures would be demolished. The decision to relocate or demolish a specific structure would be made during post-authorization investigations. Economic evaluation during Stage [illegible] the demolition alternative for the portion of Little Sugar Creek [illegible] the following pertinent economic data.

Pertinent Economic Data

Nonstructural Measures - Little Sugar Creek
(with Trygon Street to Upstream Study Limits)

Alternative	First Cost 1982 $	Annual Cost 7-5/8%	Annual Benefits	B/C Ratio
Demolition [illegible]		$34,200	$67,800	1.98 to 1

IMPACT ASSESSMENT

Implementation of nonstructural measures on this portion of Little Sugar Creek would [illegible] the displacement of approximately sixteen families from the affected structures. Relocation activities may cause problems for these families, Efforts, however, would be made to reduce to a minimum the inconveniences and problems resulting from implementation.

Construction of this alternative could remove sixteen structures from the housing market and place a temporary increase in the demand for housing. This would result in an increase in new housing construction in non-flood plain areas.

The estimated first cost of implementing nonstructural measures in the channel reach upstream from North Tryon Street is $437,000. This results in an annual cost of $34,200, and when compared to benefits of $67,800 yields a benefit to cost ratio of 1.98 to 1. An additional first cost of approximately $80,000 would also be required to relocate affected families to non flood plain sites. These costs are considered as financial costs, to be shared by non-Federal interest, but not included in the economic cost analysis.

Construction of nonstructural measures on this reach of Little Sugar Creek would result in the fee purchase of approximately 3.3 acres of land which would be conveyed to the local project sponsors. Local project sponsors would be required to regulate future development of these lands in a manner compatible with flood plain usage.

Other tangible and intangible benefits resulting from the construction of this project include reduced evacuation cost during flood periods, reduction of health hazards resulting from the flooding of inhabited properties, and reduction of risk to human life and limb and the peace of mind that goes therewith, and improved aesthetic quality.

Evaluation and Trade-Off Analysis

Nonstructural alternatives present the only economically feasible measures of reducing flood damages to this reach of Little Sugar Creek. A structural alternative of enlarging the culvert capacity of North Tryon

Street would alleviate damages experienced in this reach but would also result in higher flood damages downstream. Individual economic reaches evaluated in Stage 1 for nonstructural measures were combined in Stage 3 in the interest of continuity and providing a uniform level of protection.

Cost Apportionment

Apportionment of costs in accordance with current policy is as follows:

Cost Apportionment

Nonstructural Measures - Upper Little Sugar Creek
Demolish 16 Structures (North Tryon Street to Upstream Limit)

Item	First Cost	Federal Cost	Local Cost
Construction Cost	$437,000	$349,600	$87,400
Associated Relocation Cost (P.L. 91-646)	80,000	64,000	16,000
Total Cost	$517,000	$413,600	$103,400

Federal Responsibilities

The presently estimated Federal share of the total first cost of nonstructural plans for this reach of Little Sugar Creek is $413,600 consisting of a $349,600 share of construction cost and a $64,000 share of associated personal relocation costs. The Federal Government is responsible for the preparation of plans and specifications and for construction of the project.

Non-Fed[illegible]

The [illegible] non-Federal share of the total first cost for non-[illegible] [illegible] of Little Sugar Creek is $103,400 [illegible] construction cost and a $16,000 share of relocat[illegible] [illegible] be either a cash or in-kind contribution. The [illegible] [illegible] out in detail in the "SUMMARY -- [illegible] PLANS" section.

SUGAR – IRWIN CREEKS

Sugar-Irwin Creek

Results of Stage 2 evaluations on Sugar-Irwin Creeks indicated that four economic reaches were justified for nonstructural flood control measures in addition to a levee/floodwall alternative at the confluence of Irwin Creek and Stewart Creek. Refinement of hydrologic and hydraulic computations in Stage 3, however, indicated that the levee height and alignment proposed in Stage 2 was insufficient to satisfy Corps criteria for implementation of projects of this type. Redesign of the proposed levee and floodwall proposal raised the first cost of this alternative resulting in a loss of economic justification.

Nonstructural alternative, however, in various reaches of the creek remained economically feasible. Several variations of nonstructural alternatives were evaluated in Stage 3 in an effort to select the most feasible plan for recommendation. These variations were generally in the boundaries of the flood plain being treated. Subsequent sections describe the impacts of plans considered most feasible for implementation. The selection of these plans was made only after full consideration of an array of alternatives.

Nonstructural Measures - Lower Reach Sugar-Irwin Creek

The best plan for addressing the flooding problems along the lower reach of Sugar-Irwin Creek would be to remove 24 residential structures in that reach beginning at Yorkmont Road and extending upstream to Clanton Road (See following map). The affected structures would be purchased at fair market value (including the purchase of related lands and improvements) and either relocated or demolished, depending on the

type and condition of the structure and the availability of relocation sites. Actual implementation of nonstructural alternatives would likely result in a combination of relocations and demolitions. For decision purposes, it is assumed that all affected structures would be demolished. Determinations to relocate or demolish a specific structure would be made during post-authorization investigations. Economic evaluation of the demolition alternative for this portion of Sugar-Irwin Creek yielded the following pertinent economic data.

Pertinent Economic Data

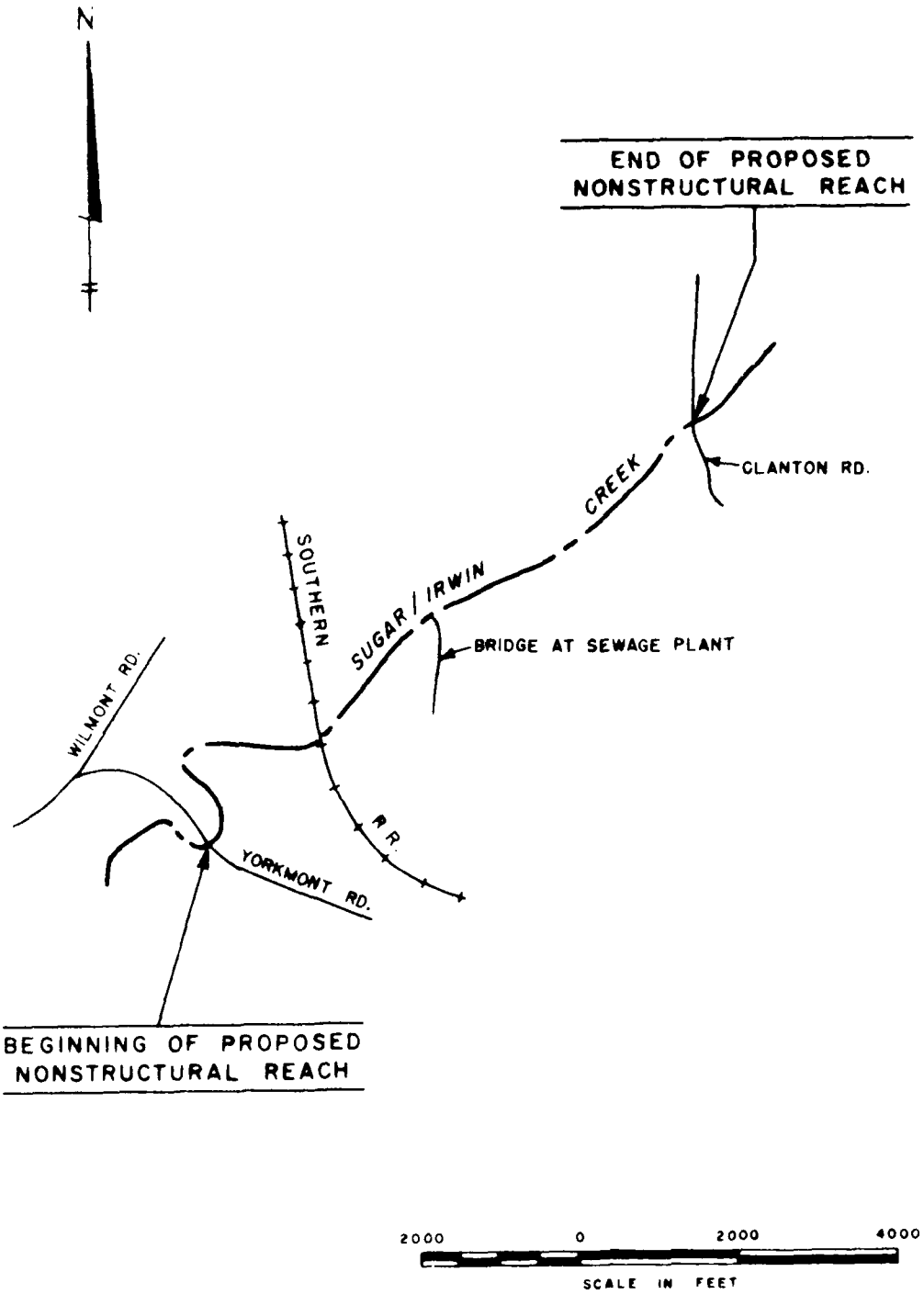
Nonstructural Measures - Lower Reach - Sugar-Irwin Creek

Alternative	First Cost 1982 $	Annual Cost 7-5/8%	Annual Benefits	B/C Ratio
Demolish 24 Structures (Yorkmont Road to Clanton Road)	$858,300	$67,100	$111,600	1.66 to 1

Impact Assessment

Implementation of nonstructural measures on this portion of Sugar-Irwin Creek would result in the displacement of approximately 24 families from the affected structures. Relocation activities may cause problems for these families. Efforts, however, would be made to reduce to a minimum the inconveniences and problems resulting from implementation.

Construction of this alternative could remove 24 structures from the housing market and place a temporary increase in the demand for housing. This would result in an increase in new housing construction in non-flood plain areas.



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SUGAR CREEK BASIN

SUGAR / IRWIN CREEK SUBBASIN

PROPOSED NONSTRUCTURAL REACH

STAGE 3

The estimated first cost of implementing nonstructural measures on this portion of Sugar-Irwin Creek is $858,300 (Demolition Alternative). This results in an annual cost of $67,100 and when compared to annual benefits of $111,600 yields a benefit to cost ratio of 1.66 to 1. An additional first cost of approximately $120,000 will also be required to relocate affected families to non-flood plain sites. These costs are considered as financial costs to be shared by non-Federal interests, but not included in economic costs analysis.

Construction of nonstructural measures on this portion of Sugar-Irwin Creek would result in the fee purchase of approximately 8.2 acres of land which would be conveyed to the local project sponsors. Local project sponsors would be required to regulate future development of these lands in a manner compatible with flood plain usage.

Other tangible and intangible benefits resulting from the construction of this project include reduced evacuation cost during flood periods, reduction of health hazards resulting from the flooding of inhabited properties, the reduction of risk to human life and limb and the peace of mind that goes therewith, and improved aesthetic quality.

Evaluation and Trade-Off Analysis

No trade-offs were required in connection with the implementation of this alternative. Individual economic reaches evaluated in Stage 2, however, were combined in Stage 3 in the interest of continuity and providing a uniform level of protection.

Cost Apportionment

Apportionment of costs in accordance with current policy is as follows:

Cost Apportionment

Lower Reach - Sugar-Irwin Creek
Demolish 24 Structures (Yorkmont Road to Clanton Road)

Item	First Cost	Federal Cost	Local Cost
Construction Cost	$858,300	$686,600	$171,700
Associated Relocation Cost (P.L. 91-646)	120,000	96,000	24,000
Total Cost	$978,300	$782,600	$195,700

FEDERAL RESPONSIBILITIES

The presently estimated Federal share of the total first cost of non-structural plans for the lower reach of Sugar-Irwin Creek is $782,600, consisting of a $686,600 share of construction cost and a $96,000 share of associated relocation cost. The Federal Government is responsible for the preparation of plans and specifications and for construction of the project.

NON-FEDERAL RESPONSIBILITIES

The presently estimated non-Federal share of the total first cost of this alternative is $195,700, consisting of a $171,700 share of construction cost and a $24,000 share of associated relocation cost. These costs may be either a cash or in-kind contribution. The ABC's of sponsorship are spelled out in detail in the "SUMMARY -- ASSESSMENT AND EVALUATION OF DETAILED PLANS" section.

Nonstructural Measures - Upper Reach Sugar-Irwin Creek

The best plan for addressing the flooding problems along the upper reach Sugar-Irwin Creek would be to remove four residential structures in that reach beginning at Interstate Highway 77 and extending upstream to Interstate Highway 95 (See following map). The affected structures would be purchased at fair market value (including the purchase of related lands and improvements) and either relocated or demolished, depending on the type and condition of the structure and the availability of relocation sites. Actual implementation of this nonstructural alternative would likely result in a combination of relocations and demolitions. For decision purposes it is assumed that all affected structures would be demolished. Determinations to relocate or demolish a specific structure would be made during post-authorization investigations. Economic evaluation of the demolition alternative for this portion of Sugar-Irwin Creek yielded the following pertinent economic data.

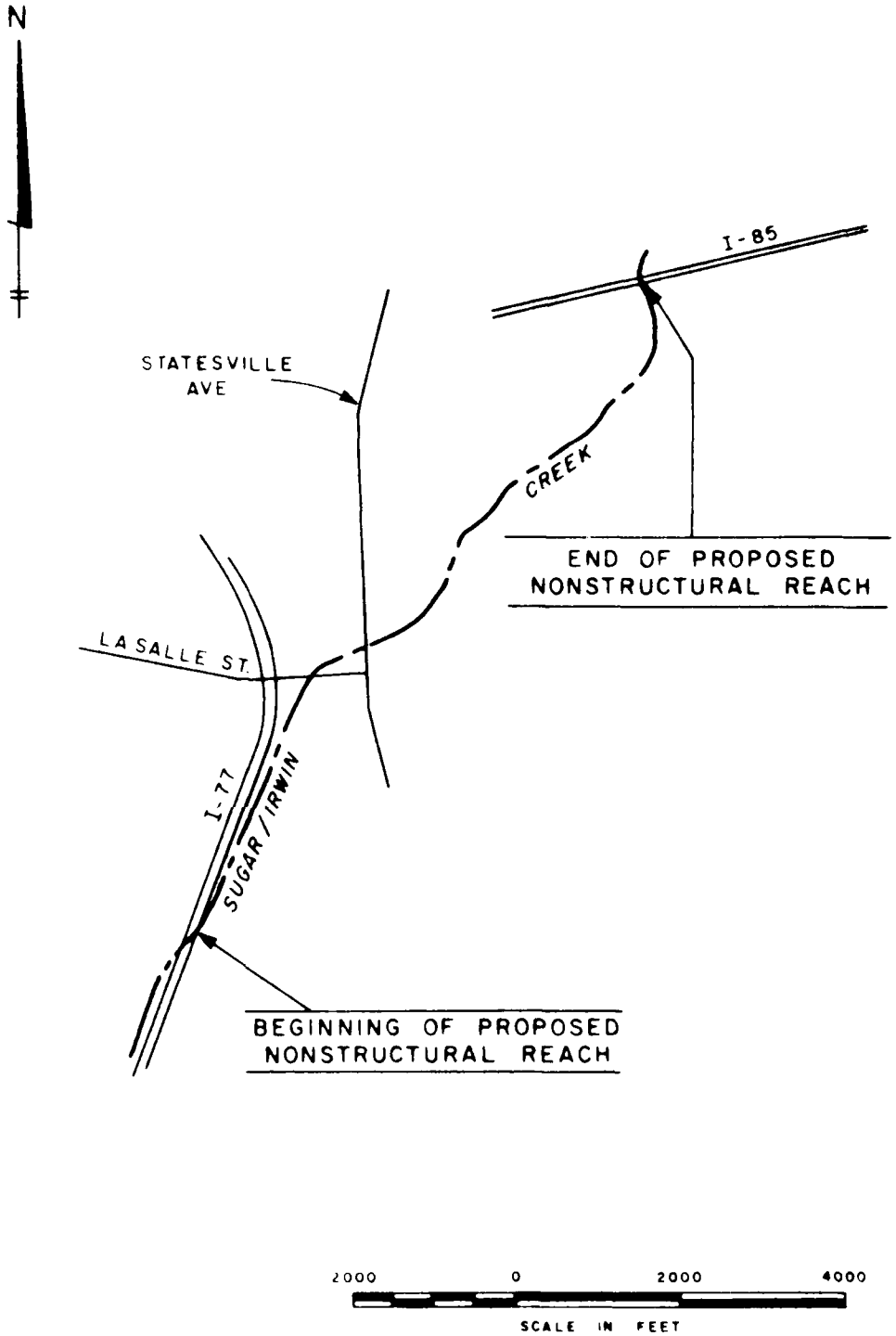
Pertinent Economic Data

Nonstructural Measures - Upper Reach - Sugar-Irwin Creek

Alternative	First Cost 1982 $	Annual Cost 7-5/8%	Annual Benefits	B/C Ratio
Demolish 4 structures (I-77 to I-95)	$72,400	$5,700	$19,300	3.41 to 1

Impact Assessment

Implementation of nonstructural measures on this reach of Sugar-Irwin Creek would result in the displacement of approximately five families from



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SUGAR CREEK BASIN

SUGAR/IRWIN CREEK SUBBASIN

PROPOSED NONSTRUCTURAL REACH

STAGE 3

the affected structures. Relocation activities may cause problems for these families. Efforts, however, would be made to reduce to a minimum the inconveniences and problems resulting from implementation.

Construction of this alternative could remove 4 structures from the housing market and place a temporary increase in the demand for housing. This would result in an increase in new housing construction in non-flood plain areas.

The estimated first cost of implementing nonstructural measures on this portion of Sugar-Irwin Creek is $72,400 (Demolition Alternative). This results in an annual cost of $5,700 and when compared to annual benefits of $19,300 yields a benefit to cost ratio of 3.41 to 1. An additional first cost of approximately $20,000 will also be required to relocate affected families to non-flood plain sites. These costs are considered as financial costs to be shared by non-Federal interests, but not included in economic costs analysis.

Construction of nonstructural measures on this portion of Sugar-Irwin Creek would result in the fee purchase of approximately 1.5 acres of land which would be conveyed to the local project sponsors. Local project sponsors would be required to regulate future development of these lands in a manner compatible with flood plain usage.

Other tangible and intangible benefits resulting from the construction of this project include reduced evacuation cost during flood periods, reduction of health hazards resulting from the flooding of inhabited properties, the reduction of risk to human life and limb and the peace of mind that goes therewith, and improved aesthetic quality.

Evaluation and Trade-Off Analysis

No trade-offs were required in connection with the implementation of this alternative. Individual economic reaches evaluated in Stage 2, however, were combined in Stage 3 in the interest of continuity and providing a uniform level of protection.

Cost Apportionment

Apportionment of costs in accordance with current policy is as follows:

Cost Apportionment
Upper Reach - Sugar-Irwin Creek
Demolish 4 Structures (I-77 to I-95)

Item	First Cost	Federal Cost	Local Cost
Construction Cost	$72,400	$57,900	$14,500
Associated Relocation Cost (P.L. 91-646)	$20,000	$16,000	$ 4,000
Total Cost	$92,400	$73,900	$18,500

Federal Responsibilities

The presently estimated Federal share of the total first cost of nonstructural plans for the upper reach of Sugar-Irwin Creek is $73,900

consisting of a $57,900 share of construction cost and a $16,000 share of personal relocation cost. The Federal Government is responsible for the preparation of plans and specifications and for construction of the project.

NON-FEDERAL RESPONSIBILITIES

The presently estimated non-Federal share of the total first cost of this alternative is $18,500 consisting of a $14,500 share of construction cost and a $4,000 share of personal relocation cost. These costs may be either a cash or in-kind contribution. The ABC's of sponsorship are spelled out in detail in the "SUMMARY -- ASSESSMENT AND EVALUATION OF DETAILED PLANS" section.

STEWART CREEK & TRIBUTARIES

Stewart Creek And Tributaries

Results of Stage 2 investigations on Stewart Creek and its tributaries indicated that nonstructural flood control measures provided the only viable solution for the alleviation of flood damages. Several variations of nonstructural alternatives were evaluated during Stage 3 in an effort to select the most feasible plan for recommendation. These variations were generally in the boundaries of the flood plain being treated. Subsequent sections describe the impacts of plans considered most feasible for implementation. Selection of these plans was made only after full consideration of an array of alternatives.

Nonstructural Measures - Stewart Creek

The best plan for flood protection on Stewart Creek consist of removing three residential structures from that reach beginning at LaSalle Street and extending upstream to Southwest Boulevard (See following map). The affected structures would be purchased at fair market values (including the purchase of related lands and improvements) and either relocated or demolished, depending on the type and condition of the structure and the availability of relocation sites. Actual implementation of nonstructural alternatives would likely result in a combination of relocations and demolitions. For decision purposes it is assumed that all affected structures would be demolished. Determinations to relocate or demolish a specific structure would be made during post-authorization investigations. Economic evaluation of the demolition alternative for this portion of Stewart Creek yielded the following pertinent economic data.

Pertinent Economic Data

Nonstructural Measures - Stewart Creek

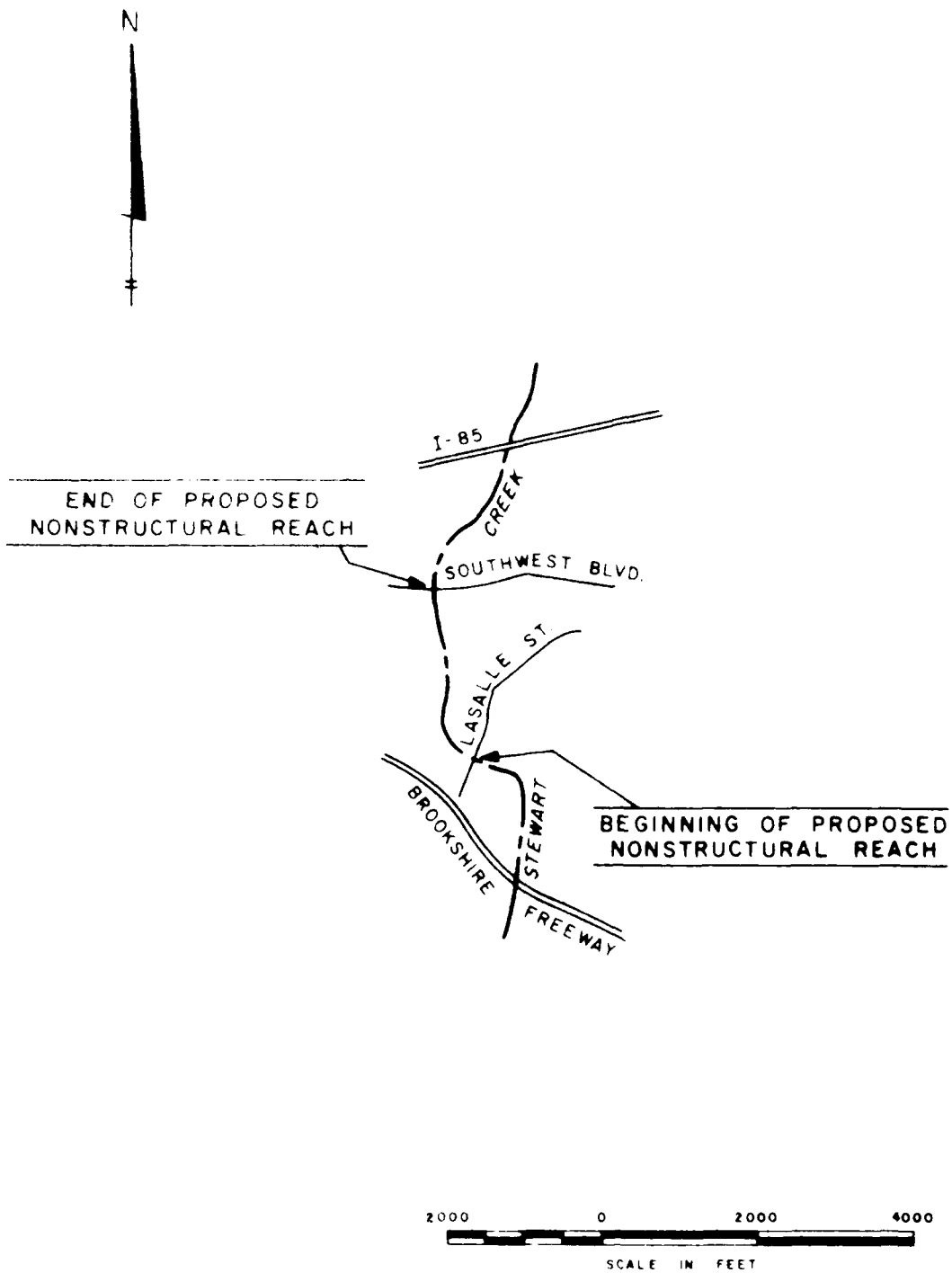
Alternative	First Cost 1982 $	Annual Cost 7-5/8%	Annual Benefits	B/C Ratio
Demolish Structures (LaSalle Street to Southwest Boulevard)	[illegible]	$4,[illegible]	$5,300	1.23 to 1

Impact Assessment

Implementation of nonstructural measures on Stewart Creek would result in the displacement of approximately three families from the affected structures. Relocation activities may cause problems for the families. Efforts, however, would be made to reduce to a minimum the inconveniences and problems resulting from implementation.

Construction of this alternative could remove 3 structures from the housing market and place a temporary increase in the demand for housing. This would result in an increase in new housing construction in non-flood plain areas.

The estimated first cost of implementing nonstructural measures on this portion of Stewart Creek is $35,[illegible] (Demolition Alternative). This results in an annual [illegible] and when compared to annual benefits of $5,300 yields a benefit to cost ratio of 1.23 to 1. An additional first cost of approximately [illegible] also be required to relocate affected



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SUGAR CREEK BASIN

STEWART CREEK SUBBASIN

PROPOSED NONSTRUCTURAL REACH

STAGE 3

families to non-flood plain sites. These costs are considered as financial costs to be shared by non-Federal interests, but not included in economic costs analysis.

Construction of nonstructural measures on this portion of Stewart Creek would result in the fee purchase of approximately 1.0 acres of land which would be conveyed to the local project sponsors. Local project sponsors would be required to regulate future development of these lands in a manner compatible with flood plain usage.

Other tangible and intangible benefits resulting from the construction of this project include reduced evacuation cost during flood periods, reduction of health hazards resulting from the flooding of inhabited properties, the reduction of risk to human life and limb and the peace of mind that goes therewith, and improved aesthetic quality.

Evaluation and Trade-Off Analysis

No trade-offs were required in connection with the implementation of this alternative. Individual economic reaches evaluated in Stage 2, however, were combined in Stage 3 in the interest of continuity and providing a uniform level of protection.

Cost Apportionment

Apportionment of costs in accordance with current policy is as follows:

Cost Apportionment

Nonstructural Measures - Stewart Creek
Demolish 5 Structures (LaSalle Street to Southwest Blvd.)

Item	First Cost	Federal Cost	Local Cost
Construction Cost	$55,200	$44,200	$11,000
Associated Relocation Cost (P.L. 91-646)	$15,000	$12,000	$ 3,000
Total Cost	$70,200	$56,200	$14,000

FEDERAL RESPONSIBILITIES

The presently estimated Federal share of the total first cost of non-structural plans for the Stewart Creek is $56,200 consisting of a $44,200 share of construction cost and a $12,000 share of personal relocation expenses. The Federal Government is responsible for the preparation of plans and specifications and for construction of the project.

NON-FEDERAL RESPONSIBILITIES

The presently estimated non-Federal share of the total first cost of this alternative is $14,000 consisting of an $11,000 share of construction cost and a $3,000 share of personal relocation cost. These costs may be either a cash or in-kind contribution. The ABC's of sponsorship are spelled out in detail in the "SUMMARY -- ASSESSMENT AND EVALUATION OF DETAILED PLANS" section.

Nonstructural Measures - Stewart Creek Tributaries

The best plan flood protection along the two tributary areas of Stewart Creek consist of removing 14 residential structures scattered along these streams (see following maps). The affected structures would be purchased at fair market value (including the purchase of related lands and improvements) and either relocated or demolished, depending on the type and condition of the structure and the availability of relocation sites. Actual implementation of nonstructural alternatives would likely result in a combination of relocations and demolitions. For decision purposes, it is assumed that all affected structures would be demolished. Determinations to relocate or demolish a specific structure would be made during post-authorization investigations. Economic evaluation of the demolition alternative for Stewart Creek tributaries yielded the following pertinent economic data.

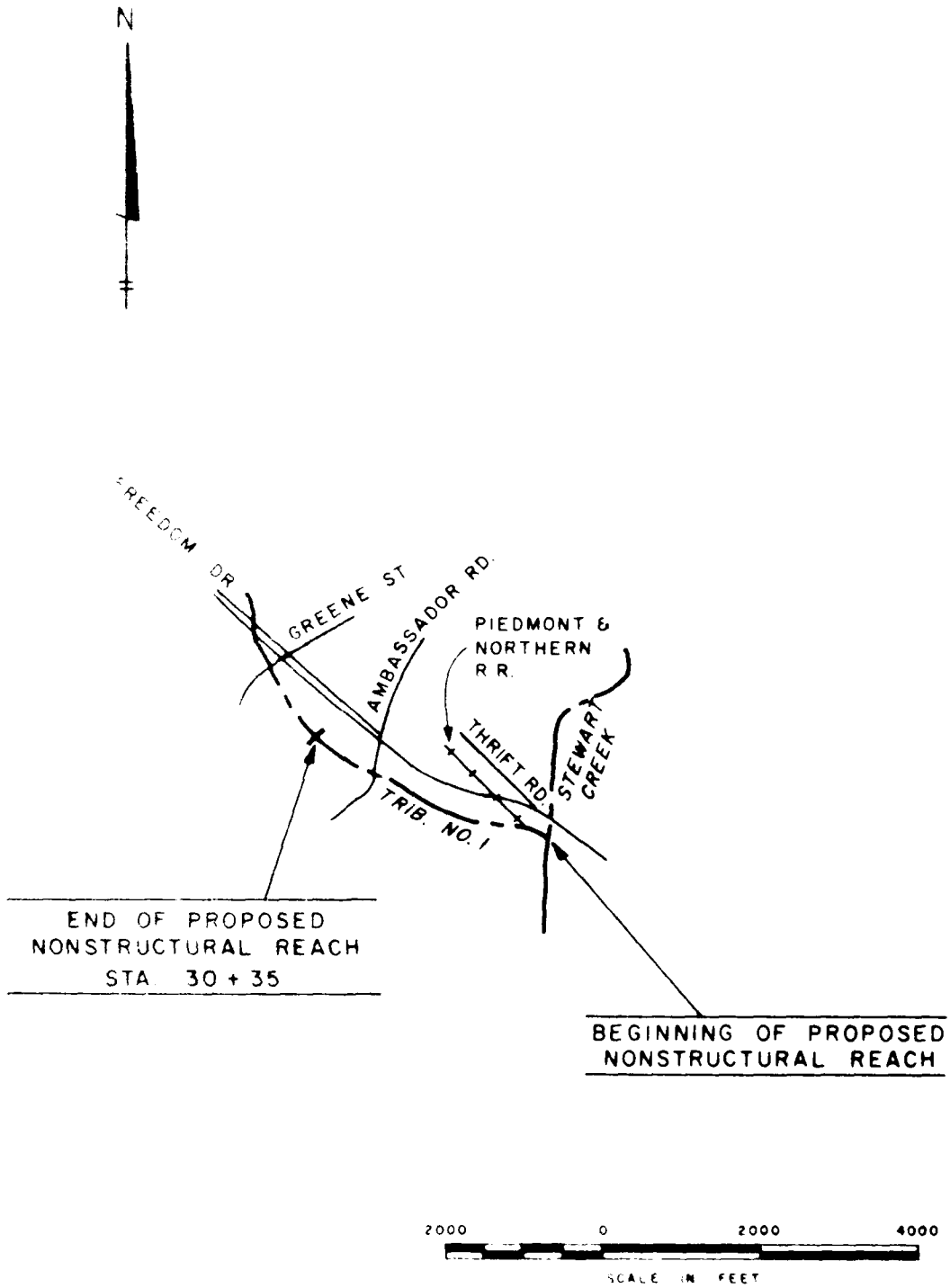
Pertinent Economic Data

Nonstructural Measures - Stewart Creek Tributaries

Alternative	First Cost 1982 $	Annual Cost 7-5/8%	Annual Benefits	B/C Ratio
Demolish 14 structures Stewart Creek Tributaries	$448,900	$35,100	$37,000	1.05 to 1

Impact Assessment

Implementation of nonstructural measures on the tributary areas of Stewart Creek would result in the displacement of approximately 14 families



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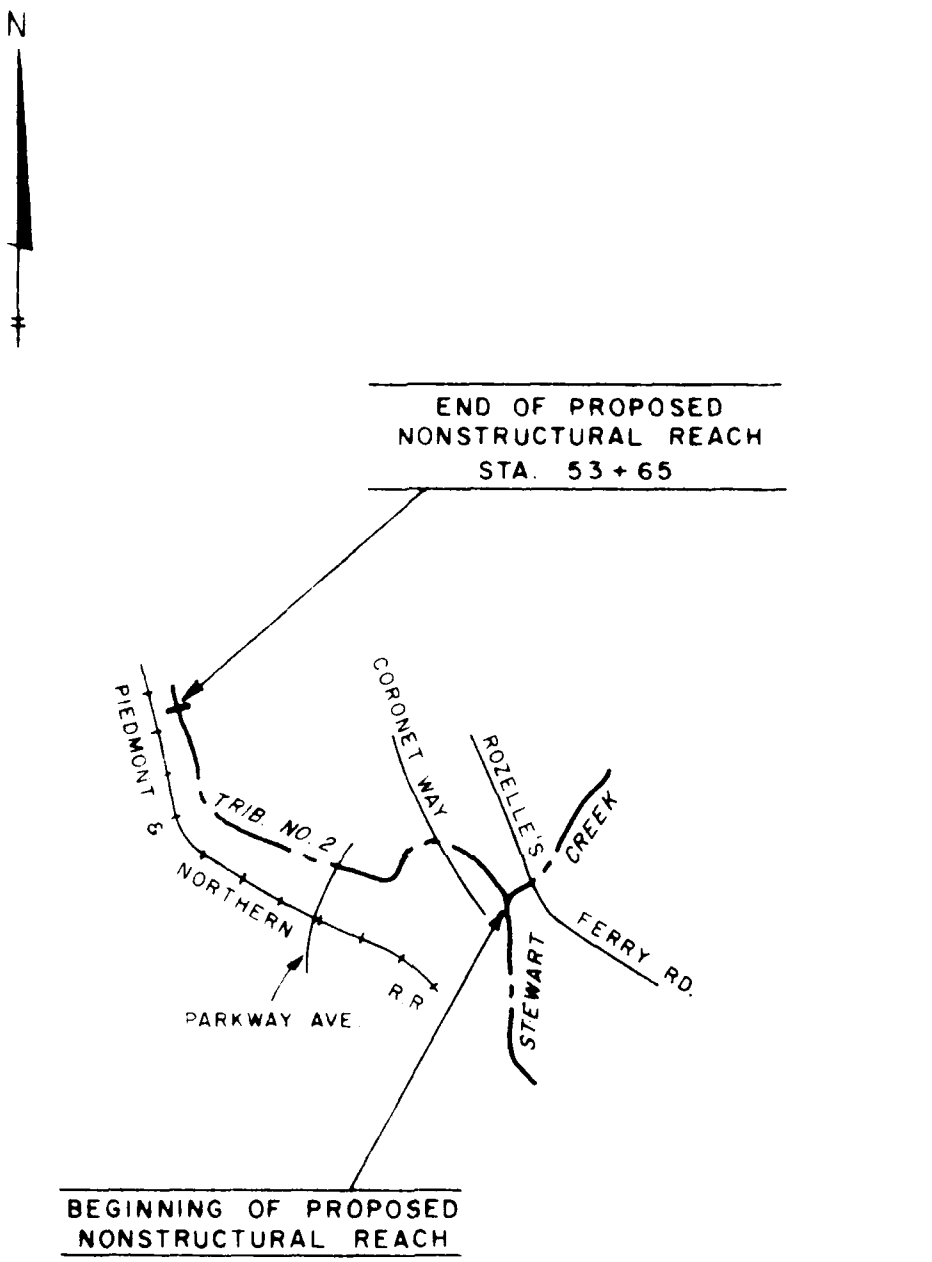
SUGAR CREEK BASIN
STEWART CREEK SUBBASIN
TRIB. NO. 1
PROPOSED NONSTRUCTURAL REACH
STAGE 3



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SCALE IN FEET

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SUGAR CREEK BASIN
STEWART CREEK SUBBASIN
TRIB. NO. 2
PROPOSED NONSTRUCTURAL REACH
STAGE 3

[illegible] tures. Relocation activities may cause problems for these [illegible] efforts, however, would be made to reduce to a minimum [illegible] iences and problems resulting from implementation.

Construction of this alternative could remove 14 structures from the housing market and place a temporary increase in the demand for housing. This would result in an increase in new housing construction in non-flood plain areas.

The estimated first cost of implementing nonstructural measures on the tributary [illegible] of Stewart Creek is $448,900 (Demolition Alternative). This results in an annual cost of $35,100 and when compared to annual benefits of $37,000 yields a benefit to cost ratio of 1.05 to 1. An additional first cost of approximately $70,000 will also be required to relocate affected families to non-flood plain sites. These costs are considered as financial costs to be shared by non-Federal interests, but not included in economic costs analysis.

Construction of nonstructural measures on Stewart Creek Tributaries result in the fee purchase of approximately 14.1 acres of land which would be conveyed to the local project sponsors. Local project sponsors would be required to regulate future development of these lands in a manner compatible with flood plain usage.

Other tangible and intangible benefits resulting from the construction of this project include reduced evacuation cost during flood periods, reduction of health hazards resulting from the flooding of inhabited properties, the reduction of risk to human life and limb and the peace of mind that goes therewith and improved aesthetic quality.

EVALUATION AND TRADE-OFF ANALYSIS

No trade-offs were required in connection with the implementation of this alternative. Individual economic reaches evaluated in Stage 2, however, were combined in Stage 3 in the interest of continuity and providing a uniform level of protection.

COST APPORTIONMENT

Apportionment of costs in accordance with current policy is as follows:

Cost Apportionment

Nonstructural Measures - Stewart Creek Tributaries
Demolish 14 Structures (Tributary Areas)

Item	First Cost	Federal Cost	Local Cost
Construction Cost	$448,900	$359,100	$89,800
Associated Relocation Cost (P.L. 91-646)	70,000	56,000	14,000
Total Cost	$518,900	$415,100	$103,800

FEDERAL RESPONSIBILITIES

The presently estimated Federal share of the total first cost of nonstructural plans for the Stewart Creek tributaries is $415,100 consisting of a $359,100 share of construction cost and a $56,000 share of personal reloca-

cost. The Federal Government is responsible for the preparation of plans and specifications and for construction of the project.

NON-FEDERAL RESPONSIBILITIES

The presently estimated non-Federal share of the total first cost of this alternative is $103,800 consisting of an $89,800 share of construction cost and a $14,000 share of personal relocation costs. These costs may be either a cash or in-kind contribution. The ABC's of sponsorship are spelled out in detail in the "SUMMARY -- ASSESSMENT AND EVALUATION OF DETAILED PLANS" section.

Summary - Assessment And Evaluation Of Detailed Plans - Sugar Creek Basin

PLAN DESCRIPTION

The preceding sections of this report have described the various plans proposed for implementation on the individual streams of the Sugar Creek Basin and the impacts of implementing these individual plans. The purpose of this section is to summarize these alternatives and to assess the overall impacts if all alternatives were to be implemented. This section also details the impacts on relocated persons and the assistance which is available to minimize the economic impacts on affected individuals.

Table 4 summarizes all proposed alternatives and presents pertinent economic data concerning estimated project first cost and estimated annual costs and benefits (See Plate 1 for Project Locations). In summary non-structural alternatives are proposed for 10 separate areas within the Sugar Creek Basin and include the evacuation of 193 residential structures. In addition, two channel reaches are proposed for channel enlargement totalling approximately 7.3 miles. Nonstructural modifications to six additional structures are proposed as a mitigation measure in connection with channel modifications on Briar Creek. Inclusion of these structures increases the total number of structures proposed for removal from the flood plain to 199. Further detailed information describing these alternatives is contained in supporting appendixes to this report.

Table 4

Pertinent Economic Data
Proposed Plan of Improvement

Sugar Creek Basin

Alternative	First Cost[1/]	Annual Cost	Annual Benefits	B/C Ratio
		McAlpine Creek		
Demolish 5 structures (Providence Road to Monroe Road)	$404,600	$31,700	$62,900	1.98 to 1
		McMullen Creek		
Demolish 8 structures (Mountain Brook Road to Randolph Road)	$745,000	$58,300	$101,100	1.73 to 1
		Briar Creek		
4.75 miles channel modifications (vic. of Colony Rd. to vic. of Central Ave.)	$12,187,000	$1,022,400	$1,467,200	1.43 to 1
Demolish 29 structures (Country Club Dr. to Upstream Study Limit)	$1,259,900	$98,600	$173,300	1.76 to 1
		Briar Tributary 2		
Demolish 13 structures (Grafton Road to Galway Drive)	$737,300	$57,700	$61,700	1.07 to 1
		Little Sugar Creek		
Demolish 77 structures (Park Road to Princeton Ave.)	$2,971,300	$232,500	$309,100	1.33 to 1
2.56 miles channel modifications (vic. N.W. Freeway to vic. E. 36th Street)	$5,781,300	$497,300	$843,100	1.70 to 1

Table 4 (continued)

Pertinent Economic Data
Proposed Plan of Improvement

Sugar Creek Basin

Alternative	First Cost 1/	Annual Cost	Annual Benefits	B/C Ratio
	Little Sugar Creek - cont'd			
Demolish 16 structures vic. N. Tryon St. to Upstream Study Limit	$437,000	$34,200	$67,800	1.98 to 1
	Sugar-Irwin Creek			
Demolish 24 structures (Yorkmont Road to Clanton Road)	$858,300	$67,100	$111,600	1.66 to 1
Demolish 4 structures (I-77 to I-95)	$72,400	$ 5,700	$19,300	3.41 to 1
	Stewart Creek and Tributaries			
Demolish 3 structures (LaSalle St. to Southwest Blvd.)	$55,200	$ 4,300	$5,300	1.23 to 1
Demolish 14 structures (Stewart Creek Tributaries)	$448,900	$35,100	$37,000	1.05 to 1
	TOTAL BASIN			
All of Above	$25,958,200	$2,144,900	$3,259,400	1.51 to 1

1/ The cost estimates contained in this tabulation represent 1982 $ values for project related properties and 1982 $ estimates for construction items. An estimated additional $995,000 would be required to cover personal relocation expenses incurred in compliance with provisions of P. L. 91-646. These personal relocation expenses were not included in the economic analyses determining project feasibility in compliance with current water resource policy.

[illegible]

[illegible] of all proposed nonstructural reaches in the Sugar Creek Basin [illegible] result in the displacement of approximately 199 families from structures currently located in the flood plains of the various [illegible] stigated. Stream reaches considered for nonstructural improvements [illegible] in Appendix 3. Individual structures considered f[illegible] [illegible], however, have not been denoted due to possible adverse affect [illegible]. Information concerning specific structures may be obtained from the responsible Corps District office.

[illegible] activities may cause problems to the people directly affected. Efforts, however, would be made to reduce to a minimum the inconveniences and problems resulting from such actions. The provisions of [illegible] Law 91-646, "The Uniform Relocation Assistance and Real Property [illegible] Act of 1970" would be applicable to protect dislocated flood plain occupants and to assist in paying personal relocation expenses. Brochures describing the provisions of this act have been made available to affected persons.

Construction of all recommended nonstructural measures simultaneously would remove 199 housing units from the housing market and would result in a substantial increase in the demand for housing. To alleviate this impact, it is proposed that each individual area recommended for nonstructural measures be implemented in accordance with a predetermined schedule. This, if spread out over a reasonable period, would avoid overstressing the housing market. The Corps would work with local officials during post-authorization studies to formulate a workable schedule for implementation of nonstructural plans. Based on review of market listings in the Charlotte area, a sufficient number of existing homes are available for purchase to replace [illegible] structures. The total number of structures proposed for [illegible] than 0.2% of the available housing in the Charlotte area. [illegible] may arise, however, on an individual basis in [illegible] (in reference to location, style, size, and price) [illegible] references of dislocated persons.

[illegible] channel plans would result in the construc[illegible] enlargement. These would create a slight [illegible] Little Sugar Creek downstream of construc[illegible] stages are shown on flood profiles displayed [illegible] measures consisting of the purchase and dem[illegible] have been incorporated in the plan [illegible] induced hazard.

[illegible] of each proposed plan are discussed in [illegible] preceding plan descriptions. Local project sponsors [illegible] that the areas proposed for conservation or [illegible] but to uses considered incompatible with their [illegible] hazards.

The est[illegible] implementing flood control measures in Sugar Creek [illegible] plus an additional estimated $995,000 for associated [illegible] results in an annual cost of $2,144,900 which includes [illegible] operation and maintenance costs. Annual benefits of $[illegible] to estimated annual costs yields a benefit to cost ratio of [illegible]

Construction [illegible] flood control measures in Sugar Creek Basin would result [illegible] purchase of approximately 261 acres of land which would be [illegible] local project sponsors. A total of approximately 95 acres would be [illegible] for constructural measures and approximately 166 acres for [illegible]. Local project sponsors would be required to regulate [illegible] of these lands in a manner compatible with flood pla[illegible] determination would lie with the Secretary [illegible] the Chief of Engineers.

EVALUATION AND [illegible]

[illegible] descriptions of individual plans.

MITIGATION REQUIREMENTS

These [illegible] discussed in the detailed descriptions of individual plans.

COST ALLOCATION

All costs associated with the implementation of proposed plans have [illegible] control. Recreation is a stated project purpose and specific areas have been designated for future development as discussed in the Recreational Appendix. Since no specific recreational facilities have been proposed, however, there are no costs allocated to this purpose.

COST APPORTIONMENT

Apportionment of project first cost between Federal and non-Federal agencies has been displayed in preceeding sections using "Traditional" procedures. These procedures generally consist of apportioning land and highway bridge and utility modification costs of structural plans to non-Federal sources, and actual construction cost plus railroad modification cost to the Federal government. All operation and maintenance costs are considered a local responsibility. Cost apportionment for nonstructural plans has been displayed on an 80/20 cost sharing basis.

The [illegible] administration, however, is reviewing project cost sharing and financing [illegible] the entire spectrum of water resource development functions [illegible] proposed legislation to Congress for navigation projects. [illegible] governing the development of specific costs sharing [illegible] possible the cost of services [illegible] water [illegible] for by direct beneficiaries. It is also

recognized that [illegible] government can no longer bear the major portion of the [illegible] water projects. New sources of project financing, both [illegible] private, will have to be found.

While specific [illegible] applicable for specific flood control projects have not yet been established, non-Federal interest can expect that, under the Administration's financing and cost sharing principles, the level of [illegible] participation could be significantly greater than in the past. Accordingly, actual apportionment of project costs [illegible] be subject to modified cost-sharing and financing arrangements which are satisfactory to the President and to Congress.

If the traditional methods of apportioning project cost were followed, however, apportionment of project first cost would be as shown in Table [illegible]

Table 5[1/]

Cost Apportionment - First Cost
(Traditional Method)

Summary - Proposed Plans of Improvement

Sugar Creek Basin

Item	Project First Cost			Annual O & M Cost
	Total Cost	Federal Share	Local Share	(100% Local Share)
McAlpine Creek - Demolish 5 Structures (Providence Road to Monroe Road				
Construction Cost	$ 404,600	$ 323,700	$ 80,900	
Associated Relocation Cost	25,000	20,000	5,000	
Annual O & M				$ 0
Subtotal	$ 429,000	$ 343,700	$ 85,900	$ 0
McMullen Creek - Demolish 8 Structures (Mountain Brook Road to Randolph Road				
Construction Cost	$ 745,000	$ 596,000	$ 149,000	
Associated Relocation Cost	40,000	32,000	8,000	
Annual O & M				$ 0
Subtotal	$ 785,000	$ 628,000	$ 157,000	$ 0
Briar Creek - 4.75 Miles Channel Modifications				
Construction Cost	$12,187,000	$ 8,535,200	$ 3,651,800	
Associated Relocation Cost	30,000	21,000	9,000	
Annual O & M				$ 69,000
Subtotal	$12,217,000	$ 8,556,200	$ 3,660,800	$ 69,000
Briar Creek - Demolish 29 Structures (Country Club Drive to Upstream Limit)				
Construction Cost	$ 1,259,900	$ 1,007,900	$ 252,000	
Associated Relocation Cost	145,000	116,000	29,000	
Annual O & M				$ 0
Subtotal	$ 1,404,900	$ 1,123,900	$ 281,000	$ 0
Briar Trib. 2 - Demolish 13 Structures (Grafton Road to Galway Drive)				
Construction Cost	$ 737,300	$ 589,800	$ 147,500	
Associated Relocation Cost	65,000	52,000	13,000	
Annual O & M				$
Subtotal	$ 802,300	$ 641,800	$ 160,500	$

Table E-1/ (con't)

Item	Project First Cost: Total Cost	Project First Cost: Federal Share	Project First Cost: Local Share	Annual O & M Cost (100% Local Expense)
Little Sugar Creek - Demolish [illegible] Structures (Park Road to Princeton Avenue)				
Construction Cost	$ [illegible]	$ 2,377,000	$ 594,300	
Associated Relocation Cost	[illegible]	308,000	77,000	
Annual O & M				$ [illegible]
Subtotal	$ [illegible]	$ 2,685,000	$ 671,300	$ [illegible]
Little Sugar Creek - [illegible].56 Miles Channel Modifications				
Construction Cost	$ 5,[illegible]	$ 3,506,200	$ 2,275,100	
Associated Relocation Cost	0	0	0	
Annual O & M				$ 45,000
Subtotal	$ 5,[illegible]	$ 3,506,200	$ 2,275,100	$ 45,000
Little Sugar Creek - Demolish [illegible]9 Structures (N. Tryon St. to Upstream Limits)				
Construction Cost	$ [illegible]	$ 349,600	$ 87,400	
Associated Relocation Cost	[illegible]	64,000	16,000	
Annual O & M				$ [illegible]
Subtotal	$ 517,[illegible]	$ 413,600	$ 103,400	$ 0
Sugar-Irwin Creeks - Demolish [illegible]4 Structures (Yorkmont Rd. to Clanton Road)				
Construction Cost	$ [illegible]	$ 686,600	$ 171,700	
Associated Relocation Cost	[illegible]	96,000	24,000	
Annual O & M				$ [illegible]
Subtotal	$ [illegible]	$ 782,600	$ 195,700	$ 0
Sugar-Irwin Creeks - Demolish 4 Structures (I-77 to I-95)				
Construction Cost	$ [illegible]	$ 67,200	$ 14,800	
Associated Relocation Cost	[illegible]	[illegible]	4,000	
Annual O & M				$ [illegible]
Subtotal	$ [illegible]	[illegible]	$ 18,800	$ [illegible]
Stewart Creek - [illegible] (LaCalle Street to Southwest Blvd.				
Construction Cost	[illegible]	[illegible]	$ 11,[illegible]	
Associated Relocation Cost	[illegible]	[illegible]	[illegible]	
Annual O & M				
Subtotal	[illegible]	[illegible]	$ [illegible]	

Table 5[1/] (con't)

Item	Project First Cost			Annual O & M Cost (100% Local Expense)
	Total Cost	Federal Share	Local Share	
[illegible] Tributaries - Demolish 14 Structures				
Construction Cost	$ [illegible],900	$ 359,100	$ 89,800	
Associated Relocation Cost	[illegible],000	56,000	14,000	
Annual O & M				$ [illegible]
Basin Total	$ [illegible],900	$ 415,100	$ 103,800	$ [illegible]
[illegible] Creek Basin - All Projects				
Construction Cost	$25,958,200	$18,433,200	$ 7,525,000	
Associated Relocation Cost	995,000	793,000	202,000	
Annual O & M				$ 114,000
Basin Total	$26,953,200	$19,226,200	$ 7,727,000	$ 114,000

1/ Actual cost apportionment of implemented project may vary based on modified cost-sharing and financing arrangements deemed appropriate to the President and to Congress.

FEDERAL RESPONSIBILITIES

Based on tradition cost sharing policies, the estimated Federal share of the total first cost would be $19,226,200 including an estimated $793,000 share of personal relocation cost. The Federal Government would be responsible for the preparation of post-authorization studies, plans and specifications and for construction of the flood control measures, including necessary railroad modifications.

NON-FEDERAL RESPONSIBILITIES

Again based on traditional policy the estimated non-Federal share of total first cost would be $7,727,000 consisting of a $7,525,000 share of construction cost and a $202,000 share of personal relocation cost, as required in compliance with the "Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970." (PL 91-646). Non-Federal contributions may be either a cash or in-kind contribution. Local sponsoring agencies must also agree to provide the following items of local cooperation:

a. Provide without cost to the United States, all lands, easements and rights-of-way including disposal areas as determined necessary by the Chief of Engineers, for construction of structural channel modification projects;

b. Accomplish without cost to the United States, all alterations and relocation of buildings, transportation facilities, storm drains, utilities, and other structures made necessary by construction of structural channel modification projects;

[illegible] cash or in-kind contribution equal to 20 percent of the project [illegible] assigned nonstructural flood control improvements, [illegible] percent contribution toward cost incurred in the compliance with [illegible] of P.L. 91-646 and amendments thereto;

[illegible] Hold and save the United States free from damages due to construction, operation and maintenance of the various projects; provided damages are [illegible] the fault or negligence of the United States or [illegible]

[illegible] Maintain and operate the projects after completion in accordance with regulations provided by the Secretary of the Army;

[illegible] Prescribe and enforce regulations to prevent distruction or [illegible] on channels or other flood control works which would reduce their [illegible] capacity or hinder maintenance and operation;

7. Adopt and enforce regulatory measures to assure that project lands will be used for project compatible purposes; such compatibility determination shall lie with the Secretary of the Army acting through the Chief of Engineers;

8. Publicize flood plain information in the areas concerned and provide this information to zoning and other regulatory agencies for their guidance and leadership in preventing unwise future development in the flood plain and in adopting such regulations as may be necessary to insure compatibility, between future development and prescribed levels of protection [illegible] as projects or other Federal legislation.

[illegible] that cost sharing procedures are being reviewed [illegible] administration in an effort to require direct beneficiaries [illegible] larger share of project cost for water resource development [illegible] apportionment of project cost may be modified [illegible] in accordance with cost-sharing and financing arrangement [illegible] President and the Congress.

Public Views

[illegible] ment have been displayed to various [illegible] state, and local agencies, and other inter[illegible] individu[illegible] Coordination has been conducted [illegible] procedures. The procedures [illegible] three [illegible] informal meetings with state and [illegible] feasibility report were mailed [illegible] Septemb[illegible] day review period to pertinent agencies [illegible] interest in the study results, and not[illegible] Environmental Impact Statement (EIS) was published [illegible] dated October 9, 1981. Comments concerning [illegible] in the following paragraphs and pertinent [illegible] contained in Appendix 7 to this report. The [illegible] Report, as required by law, is included as Exhibit [illegible] Appendix 5.

Views of Public [illegible]

a. Soil Conservation Service: The State Conservationist agreed that flood protection is needed in the area covered by the proposed project and offered assistance in reviewing or developing plans for erosion control during and after construction.

b. National Oceanic and Atmospheric Administration offered no comment concerning study [illegible] recommended funding for the relocation of any disturbed [illegible]

c. Environmental [illegible] EPA commented that the overall plan was well [illegible] agreement with the selected alternative to [illegible]

d. U. S. Fish and Wildlife Service, Raleigh, North Carolina: This agency, after review of the draft report and EIS, concurred with recommendations [illegible] in the U. S. Fish and Wildlife Coordination Act [illegible] Charleston Field Office. (See Exhibit 5-1, Appendix [illegible]).

e. State Clearinghouse, North Carolina Office of State Budget and Management: [illegible] various state agencies were consolidated in a [illegible] State Clearinghouse. The State Department of Administration [illegible] that relocation of 184 structures in Charlotte may be difficult and should be given more consideration. The North Carolina Department of Natural Resources and Community Development stated the requirement of erosion and sediment control plans in areas where more than one acre of land is disturbed and strongly endorsed recreational/greenway proposals, and the Department of Cultural Resources commented that a summary of the documentary cultural research report should be contained in the final report.

f. Centralina Council of Governments: This agency did not recommend the project stating that removal of 205 residential structures impacts the community [illegible] and that required local funds are considered too expensive.

g. City of Charlotte: The city has indicated their willingness to continue local project sponsorship with the following qualifications:

1. Upon implementation of any of the alternatives presented, that further study be made to minimize the purchase of homes within the project area;

2. That the benefit-cost ratio be given further study to reflect current market values of all property at the time of implementation; and

3. That the final plans for implementation of any alternative be subject to approval by the City Council of the City of Charlotte.

Views of Other Interested Agencies and Individuals

Potential alternatives considered during Stage 2 Evaluations were presented for general review at Plan Formulation Conferences held on 18 and 19 April 1979. At that time, those in attendance indicated general support of proposed flood control measures.

A late stage public meeting was held on 24 November 1981 at which time, proposed recommendations were displayed for public review. The general public was aware of their susceptibility to flood damage, but expressed general concern and opposition in several instance to non-structural proposals. Transcript of these public meetings are available upon request from the Charleston District Office.

Comparison Of Detailed Plans

The purpose of this portion of the feasibility report is to identify and compare significant impacts of each plan carried into the final phase of the plan formulation process. Preceding sections discussing Stage 3 alternatives have been generally limited to discussion of alternatives which appeared most feasible for recommendation. This was done in order to produce a more concise report which emphasized the impacts of potential recommended plans. Additional plans, however, were evaluated in the late planning stages and the impacts of all Stage 3 alternatives were carefully evaluated and compared prior to the selection of a recommended plan. Evaluations included an assessment of each plan's contribution to the NED, EQ,

RED and OSE accounts as established by Federal planning plicies. All beneficial and adverse impacts were identified, quantitatively and/or qualitatively, including an assessment of who gains or loses, locational incidence, and time of occurrence. Specified critera, including those specifically denoted by Section 122 of P.L. 91-611, were applied to the various plans to test their responsiveness. Evaluation criteria included: acceptability, completeness, effectiveness, and efficiency; plus certainty, geographic scope, NED benefit-to-cost ratio, reversibility and stability.

The System of Accounts provides a useful tool for the comparison of alternative plans. It displays various plans carried through the final iteration and the beneficial and adverse contributions to the planning objectives made by each alternative. Contributions are indicated in physical terms wherever practicable with considerable flexibility to allow the indisciplinary planning team to choose appropriate descriptive units. Table 6, the System of Accounts, has been designed to meet display requirements as outlined in Engineering Regulation (ER) 1105-2-60 dated 25 January 1982. This table is organized by stream sub-basin in order to allow the reviewer to compare impacts of various alternatives on individual streams. The NED, recommended, and EQ plans are designated for each stream reach evaluated.

TABLE 6 - SYSTEM OF ACCOUNTS
(FOR EXPLANATION OF TERMS SEE FOOTNOTES)

ACCOUNTS AND EFFECTS	RECOMMENDED PLAN NONSTRUCTURAL DEMOLITION ALT.						EQ PLAN NONSTRUCTURAL DEMOLITION ALT.						NED PLAN NONSTRUCTURAL DEMOLITION ALT.						NO ACTION					
	LOCATION OF IMPACT						LOCATION OF IMPACT						LOCATION OF IMPACT						LOCATION OF IMPACT					
	WITHIN THE STUDY AREA	WITHIN REST OF THE NATION	TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	WITHIN THE STUDY AREA	WITHIN REST OF THE NATION	TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	WITHIN THE STUDY AREA	WITHIN REST OF THE NATION	TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	WITHIN THE STUDY AREA	WITHIN REST OF THE NATION	TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY
	McALPINE CREEK																							
PLAN DESCRIPTION See Note A	Demolish 9 residential structures (Providence Road to Monroe Road)						SAME AS RECOMMENDED PLAN						SAME AS RECOMMENDED PLAN						Do Nothing					
I. Planning Objectives																								
A. Flood Damage Reduction	Provides 100 yr protection to single family structures in affected stream reach																		Does not meet flood control objective.					
B. Recreation and Conservation Enhancement	Provides 2.25 acres of land for potential recreation/conservation use.																		Does not meet recreation and conservation objective.					
II. National Economic Development (NED)																								
A. Beneficial Impacts																								
1. Ann. Flood Control Benefit	$ 65,200		3	5	7	9																		
2. Residual Land Values	$ 2,400		3	5	7	9																		
3. Flood Ins. Adjustment	$- 7,700		3	5	7	9																		
4. Net Annual Benefits	$ 62,900		3	5	7	9														$0				
B. Adverse Impacts																								
1. Project First Cost	$404,600		1	5	7	9														$0				
2. Moving & Reloc. Expense	$ 25,000		1	5	7	9																		
3. Annual Project Cost	$ 31,700		3	5	7	9																		
4. Annual O&M Cost	0		3	5	7	9																		
5. Total Annual Costs	$ 31,700		3	5	7	9														$0				
a. Local	$ 6,300		3	5	7	9																		
b. Federal		$ 25,400	3	5	7	9																		
6. Residual Damages	$ 11,600		3	5	7	9													$ 79,800		3	5	7	
C. Excess Benefits Over Cost (Annual)	$ 31,200		3	5	7															$0				
D. Benefit to Cost Ratio	1.98 to 1		3	5	7																			

TABLE 6 - SYSTEM OF ACCOUNTS
(FOR EXPLANATION OF TERMS SEE FOOTNOTES)

ACCOUNTS AND ITEMS	RECOMMENDED PLAN NONSTRUCTURAL DEMOLITION ALT.					EQ PLAN NONSTRUCTURAL DEMOLITION ALT.					NED PLAN NONSTRUCTURAL DEMOLITION ALT.					NO ACTION				
	LOCATION OF IMPACT					LOCATION OF IMPACT					LOCATION OF IMPACT					LOCATION OF IMPACT				
	WITHIN THE STUDY AREA	WITHIN REST OF THE NATION	TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	WITHIN THE STUDY AREA	WITHIN REST OF THE NATION	TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	WITHIN THE STUDY AREA	WITHIN REST OF THE NATION	TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	WITHIN THE STUDY AREA	WITHIN REST OF THE NATION	TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY
	McALPINE CREEK																							
III. Environmental Quality (EQ)																								
A. EQ Enhanced																								
1. Esthetics*	Landscaped lands restore natural appearance.	Negligible	1	5	8	9	SAME AS RECOMMENDED PLAN						SAME AS RECOMMENDED PLAN						Negligible	Negligible				
2. Man Made Resources*	Flood damage potential reduced.	Negligible	1	5	8	10													Negligible	Negligible				
3. Natural Resources*	Selective planting restores natural setting.	Negligible	1	6	8	9													Negligible	Negligible				
4. Air Quality*	No significant enhancement.	Negligible	1	6	8	9													Negligible	Negligible				
5. Noise*	No significant enhancement.	Negligible	1	6	8	9													Negligible	Negligible				
B. EQ Degraded																								
1. Esthetics*	No significant adverse impact.	Negligible	1	6	8	9													Continued change of undeveloped areas to urban areas.	Negligible	3	5		9
2. Man Made Resources*	Demolition of flood prone structures.	Negligible	1	6	8	9													Continued damage due to flooding.	Negligible	3	5		9
3. Natural Resources*	No significant adverse impact	Negligible	1	6	8	9													Change in natural cover due to development.	Negligible	3	5		9
4. Water Quality*	Potential increase in sediment load during construction	Negligible	1	5	8	9													Probable increase in pollutants	Negligible	3	5		9

TABLE 6 - SYSTEM OF ACCOUNTS
FOR EXPLANATION OF TERMS SEE FOOTNOTE 7

A. [illegible]	RECOMMENDED PLAN NONSTRUCTURAL DEMOLITION ALT.						EQ PLAN NONSTRUCTURAL DEMOLITION ALT.						NEG PLAN NONSTRUCTURAL DEMOLITION ALT.						NO ACTION					
	LOCATION OF IMPACT						LOCATION OF IMPACT						LOCATION OF IMPACT						LOCATION OF IMPACT					
	WITHIN THE STUDY AREA	WITHIN REST OF THE NATION	TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	WITHIN THE STUDY AREA	WITHIN REST OF THE NATION	TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	WITHIN THE STUDY AREA	WITHIN REST OF THE NATION	TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	WITHIN THE STUDY AREA	WITHIN REST OF THE NATION	TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY
	COALPINE CREEK																							
[illegible] Air Quality*	Negligible	Negligible	1	6	8	9													Probable increase in air pollutants	Negligible	[illegible]			9
[illegible] Noise*	Increase in noise level during construction	Negligible	1	6	8	9													Gradual increase with urban development	Negligible	[illegible]			
IV. Other Social Effects (OSE)																								
A. Beneficial Impacts																								
1. Community Cohesion*	Unites community for common cause.	Negligible	1	6		9													Negligible	Negligible				
2. Community Growth*	Encourages nonflood plain growth.	Negligible	1	6		9													Negligible	Negligible				
3. Recreational Opportunities	Potential for recreation development of project lands.		1	5	8	10													Negligible	Negligible				
B. Adverse Impacts																								
1. Community Cohesion*	Disrupts cohesion thru relocation activities.	Negligible	1	6		9													Con't community complaints about flood problems.	Negligible	3	5		
2. Community Growth*	Prevents future flood plain growth.	Negligible	1	5		9													Negligible	Negligible				
3. Recreational Opportunity*	No adverse impact.	Negligible																	Negligible	Negligible				
4. Displacement of People	Affected people relocated to flood free sites.	Negligible	1	6		9													Possible forced displacement during flood periods.	Negligible	3	5		
V. Regional Economic Development (RED)																								
A. Beneficial Impacts																								

SAME AS RECOMMENDED PLAN

SAME AS RECOMMENDED PLAN

TABLE 6 - SYSTEM OF ACCOUNTS
(FOR EXPLANATION OF TERMS SEE FOOTNOTES)

[illegible]	RECOMMENDED PLAN [illegible]						E2 PLAN NONSTRUCTURAL DEMOLITION ALT						NED PLAN NONSTRUCTURAL DEMOLITION ALT						NO ACTION					
	[illegible]						[illegible]						[illegible]						[illegible]					
	[illegible]	[illegible]					WITHIN THE SITE AREA	WITHIN REST OF THE NATION					WITHIN THE SITE AREA	WITHIN REST OF THE NATION					[illegible]	[illegible]				
	McALPINE CREEK																							
[illegible]	Increased revenues from non flood plain development	Negligible	2			9	SAME AS RECOMMENDED PLAN						SAME AS RECOMMENDED PLAN						Negligible	Negligible				
[illegible] Values*	Negligible	Negligible																	Negligible	Negligible				
[illegible] Facilities*	Negligible	Negligible																	Negligible	Negligible				
Public Services*	Reduced emergency cost	Negligible	2	5		9													Negligible	Negligible				
Regional Growth	Encourages non flood plain growth	Negligible	2	6		9													Negligible	Negligible				
Employment Labor Force	Increased employment during construction.	Negligible	1	6		9													Negligible	Negligible				
Business and Industrial	Increased demand for new housing.	Negligible	2	5		9													Negligible	Negligible				
B. Adverse Impacts																								
Tax Revenues*	Loss of revenue from demolished structures	Negligible	1	[illegible]		9													Negligible	Negligible				
[illegible] Values*	Monetary flood plain value decreases	Negligible	1	[illegible]		9													Decreased value due to flood damage.	Negligible	3	5		
[illegible] Facilities*	Negligible	Negligible																	Negligible	Negligible				
[illegible] Services*	Negligible	Negligible																	Con't need for emergency services.	Negligible	3	5		
[illegible]	[illegible] flood plain development	Negligible	3	[illegible]		[illegible]													Negligible	Negligible				
[illegible]	[illegible]	Negligible																	Negligible	Negligible				

NOTE A:

Plans for demolition of residential structures and no action were the only alternatives carried through Stage 3. Structural alternatives were not feasible for McAlpine Creek.

TABLE [illegible] - SYSTEM OF ACCOUNTS
(FOR EXPLANATION OF TERMS SEE FOOTNOTES)

[illegible]	RECOMMENDED PLAN NONSTRUCTURAL DEMOLITION ALT.						EQ PLAN NONSTRUCTURAL DEMOLITION ALT.						NED PLAN NONSTRUCTURAL DEMOLITION ALT.						NO ACTION					
	LOCATION OF IMPACT						LOCATION OF IMPACT						LOCATION OF IMPACT						LOCATION OF IMPACT					
	WITHIN THE [illegible] AREA	WITHIN REST OF THE NATION	[illegible]	[illegible]	[illegible]	[illegible]	WITHIN THE [illegible] AREA	WITHIN REST OF THE NATION	[illegible]	[illegible]	[illegible]	[illegible]	WITHIN THE [illegible] AREA	WITHIN REST OF THE NATION	[illegible]	[illegible]	[illegible]	[illegible]	WITHIN THE [illegible] AREA	WITHIN REST OF THE NATION	[illegible]	[illegible]	[illegible]	[illegible]
	MONTHLEN CREEK																							
[illegible] See [illegible]	Demolish 4 residential structures (Mountain Brook Road to Randolph Road)						SAME AS RECOMMENDED PLAN						SAME AS RECOMMENDED PLAN						Do Nothing					
I. Planning Objectives																								
A. Flood Damage Reduction	Provides 100 yr. protection to single family structures in affected stream branch.																		Does not meet flood control objective					
B. Recreation and Conservation Enhancement	Provides 1.79 acres of land for potential recreation/conservation use.																		Does not meet recreation and conservation objective.					
II. National Economic Development (NED)																								
A. Beneficial Impacts																								
1. Ann. Flood Control Benefit	$100,100		3	5	7	9													$0					
2. Residual Land Value	$ 7,600		3	5	7	9																		
3. Flood Ins. Adjustment	$- 6,600		3	5	7	9																		
4. Net Annual Benefits	$100,100		3	5	7	9													$0					
B. Adverse Impacts																								
1. Project First Cost	$745,000		1	5	7	9																		
2. Moving & Relocation Expense	$ 40,000		1	5	7	9																		
3. Annual Project Cost	$ 58,300		3	5	7	9																		
4. Annual O&M Cost	0		3	5	7	9																		
5. Total Annual Costs	$ 58,300		3	5	7	9													$0					
a. Local	$ 11,700		3	5	7	9																		
b. Federal		$ 46,600	3	5	7	9																		
6. Residual Damages	0		3	5	7	9													$100,100		3	5	7	
7. Excess Benefits Over Cost (Annual)	$ 41,800		3	5	7														$0					
8. Benefit to Cost Ratio	1.73 to 1		3	5	7																			

TABLE 6 - SYSTEM OF ACCOUNTS
(FOR EXPLANATION OF TERMS SEE FOOTNOTES)

ACCOUNTS AND EFFECTS	RECOMMENDED PLAN NONSTRUCTURAL DEMOLITION ALT.					EQ PLAN NONSTRUCTURAL DEMOLITION ALT.					NED PLAN NONSTRUCTURAL DEMOLITION ALT					NO ACTION				
	LOCATION OF IMPACT		TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	LOCATION OF IMPACT		TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	LOCATION OF IMPACT		TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	LOCATION OF IMPACT		TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY
	WITHIN THE STUDY AREA	WITHIN REST OF THE NATION					WITHIN THE STUDY AREA	WITHIN REST OF THE NATION					WITHIN THE STUDY AREA	WITHIN REST OF THE NATION					WITHIN THE STUDY AREA	WITHIN REST OF THE NATION				
	McMULLEN CREEK																							
III. Environmental Quality	EQ impacts for Nonstructural and No Action Alternatives on McMullen Creek are the same as shown previously for similar alternatives on McAlpine Creek.																							
IV. Other Social Effects	OSE impacts for Nonstructural and No Action Alternatives on McMullen Creek are the same as shown previously for similar alternatives on McAlpine Creek.																							
V. Regional Economic	RED impacts for Nonstructural and No Action Alternatives on McMullen Creek are the same as shown previously for similar alternatives on McAlpine Creek.																							

FOOTNOTES

TIMING

1. Impact is reported to occur prior to or during implementation of the plan.

2. Impact is reported within 10 years following plan implementation.

3. Impact is reported within a longer time frame (10 or more years following implementation).

UNCERTAINTY

4. The uncertainty associated with the impact is 50% or more.

5. The uncertainty is between 10 and 50%.

6. The uncertainty is less than 10%.

EXCLUSIVITY

7. Overlapping entry fully monetized in NED account.

8. Overlapping entry not fully monetized in NED account.

ACTUALITY

9. Impact will occur with implementation.

10. Impact will occur only when specific additional actions are carried out during implementation.

11. Impact will not occur because necessary additional actions are lacking.

*ASTERISK denotes items specifically mentioned in Section 122 of Public Law 91-611 for evaluation.

NOTE B:

Plans for demolition of residential structures and no action were the only alternatives carried through Stage 3. Structural alternatives were not feasible for McMullen Creek.

TABLE [illegible] SYSTEM OF ACCOUNTS
(FOR EXPLANATION OF TERMS SEE FOOTNOTES)

[illegible]	NED PLAN [illegible]						NONSTRUCTURAL DEMOLITION ALT. 12 [illegible] YEAR PROTECTION						EQ PLAN NONSTRUCTURAL DEMOLITION ALT. 12 SPF PROTECTION						NO ACTION					
	[illegible]						[illegible]						LOCATION OF IMPACT						[illegible]					
	[illegible]	[illegible]					[illegible]	[illegible]					WITHIN THE STUDY AREA	WITHIN RE OF THE NATION					WITHIN THE STUDY AREA	WITHIN RE OF THE NATION				
	PLAN [illegible] CONFLUENCE TO VICINITY CENTRAL AVENUE																							
[illegible]	[illegible] miles [illegible] to vicinity Central Ave. Bottom width varies 60 ft to 40 ft side slope 2V 1H						[illegible] confluence [illegible] Central Avenue						Demolish 176 residential structures (confluence to vicinity Central Avenue)						Do Nothing					
Planning Objectives	Demolish 6 structures to mitigate adverse downstream effects																							
A. Flood Damage Reduction	Provides 10 year Infank protection, eliminates 98% of existing damages.						[illegible] year protection to residential structures in affected stream reach.						Provides SPF protection to residential structures in affected stream reach.						Does not meet flood control objective.					
B. Recreation and Conservation Enhancement	Provides in excess of 100 acres for potential recreation/conservation use						Project lands would provide potential for recreation/conservation use						Project lands would provide potential for recreation/conservation use.						Does not meet recreation and conservation objective.					
II National Economic Development (NED)																								
A. Beneficial Impacts																								
1. Ann. Flood Control Benefit	$ 1,467,200		3	5	7	9	$ 1,175,970		3	5	7	9	$ 1,231,680		3	5	7	9						
2. Residual Land Values	-						$ 46,160		3	5	7	9	$ 89,150		3	5	7	9						
3. Flood Insurance Adjustment	-						$- 174,000		3	5	7	9	$- 189,860		3	5	7	9						
4. Net Annual Benefits	$ 1,467,200		3	5	7	9	$ 1,048,130		3	5	7	9	$ 1,130,970		3	5	7	9		$0				
B. Adverse Impacts																								
1. Project First Cost	$12,187,000		1	5	7	9	$ 8,502,680		1	5	7	9	$12,961,480		1	5	7	9		$0				
2. Moving & Reloc. Expenses	30,000						$ 210,000		1	5	7	9	$ 528,000		1	5	7	9						
3. Annual Project Cost	$ 953,400		3	5	7	9	$ 645,480		3	5	7	9	$ 1,229,940		3	5	7	9						
4. Annual O&M Cost	$ 69,000		3	5	7	9	0		3	5	7	9	0		3	5	7	9						
5. Total Annual Costs	$ 1,022,400		3	5	7	9	$ 645,480		3	5	7	9	$ 1,229,940		3	5	7	9		$0				
a. Local	$ 354,700		3	5	7	9	$ 129,100		3	5	7	9	$ 245,990		3	5	7	9						
b. Federal		$ 667,760	3	5	7	9		$ 516,380	3	5	7	9		$ 983,950	3	5	7	9						
6. Residual Damages	$ 27,600		3	5	7	9	$ 231,590		3	5	7	9	$ 176,240		3	5	7	9	$ 1,494,800		3	5	7	
C. Excess Benefits Over Cost (Annual)	$ 444,800		3	5	7		$ 402,650		3	5	7		$- 98,970		3	5	7			$0				
D. Benefit to Cost Ratio	1.43 to 1		3	5	7		1.62 to 1		3	5	7		0.92 to 1		3	5	7			-				

TABLE 6 - SYSTEM OF ACCOUNTS
(FOR EXPLANATION OF TERMS SEE FOOTNOTES)

ACCOUNTS AND EFFECTS	NED PLAN RECOMMENDED PLAN CHANNEL MODIFICATION ALT.					NONSTRUCTURAL DEMOLITION ALT. 10 YEAR PROTECTION[12]					EQ PLAN NONSTRUCTURAL DEMOLITION ALT. SPF PROTECTION[12]					NO ACTION				
	LOCATION OF IMPACT		TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	LOCATION OF IMPACT		TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	LOCATION OF IMPACT		TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	LOCATION OF IMPACT		TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY
	WITHIN THE STUDY AREA	WITHIN REST OF THE NATION					WITHIN THE STUDY AREA	WITHIN REST OF THE NATION					WITHIN THE STUDY AREA	WITHIN REST OF THE NATION					WITHIN THE STUDY AREA	WITHIN REST OF THE NATION				
	BRIAR CREEK - CONFLUENCE TO VICINITY CENTRAL AVENUE																							
III. Environmental Quality (EQ)																								
A. EQ Enhanced																								
1. Esthetics*	Project R/w landscaped for potential greenway park.		1	6	8	9	Landscaped lands restore natural appearance.	Negligible	1	5	8	9	SAME IMPACTS AS 10 YEAR NONSTRUCTURAL PLAN BUT SLIGHTLY GREATER DUE TO EVACUATION OF 106 ADDITIONAL STRUCTURES.						Negligible	Negligible				
2. Man-Made Resources*	Reduced damages. Improved park access.		1	6	8	10	Flood damage potential reduced.	Negligible	1	5	8	10							Negligible	Negligible				
3. Natural Resources*	Selective planting restores natural setting.		1	6	8	9	Selective planting restores natural setting.	Negligible	1	6	8	9							Negligible	Negligible				
4. Air Quality*	No significant enhancement.		1	6	8	9	No significant enhancement.	Negligible	1	6	8	9							Negligible	Negligible				
5. Noise*	No significant enhancement.		1	6	8	9	No significant enhancement.		1	6	9	8							Negligible	Negligible				
B. EQ Degraded																								
1. Esthetics*	Loss of large trees in R/w area.		1	6	8	9	No significant adverse impact.	Negligible	1	6	8	9							Continued change of undeveloped areas to urban areas.	Negligible	3	5		9
2. Man-Made Resources*	No significant adverse effect.		1	6	8	9	Demolition of flood prone structures.		1	6	8	9							Continued damage due to flooding.	Negligible	3	5		9
3. Natural Resources*	Wider channel could adversely affect aquatic habitat.		1	6	8	9	No significant adverse impact.	Negligible	1	6	8	9							Change in natural cover due to development.	Negligible	3	5		9
4. Water Quality*	Temp. increase in turbidity.		1	5	8	9	Potential increase in sediment load during construction.	Negligible	1	5	8	9							Probable increase in pollutants.	Negligible	3	5		9

TABLE 6 - SYSTEM OF ACCOUNTS
(FOR EXPLANATION OF TERMS SEE FOOTNOTES)

[illegible]	NED PLAN RECOMMENDED PLAN (CHANNEL MODIFICATION ALT.)						NONSTRUCTURAL DEMOLITION ALT. 10 YEAR PROTECTION						EQ PLAN NONSTRUCTURAL [illegible] 100 YEAR PROTECTION						NO ACTION					
[illegible]	[illegible] IMPACT						[illegible] IMPACT						[illegible]						[illegible] IMPACT					
	[illegible]	[illegible]					[illegible]	[illegible]					[illegible]	[illegible]					[illegible]	[illegible]				
	BRIAR CREEK - CONFLUENCE TO VICINITY CENTRAL AVENUE																							
[illegible]*	No significant adverse impact.		1	6	6	9	Negligible	Negligible	1	6	[illegible]								Probable increase in pollutants	Negligible				
Noise*	Temporary increase during construction		1	6	8	9	Increase in noise level during construction	Negligible	1	6	[illegible]	[illegible]							Gradual increase with urban development.	Negligible				
[illegible] Other Social Effects (OSE)																								
A. Beneficial Impacts																								
1. Community Cohesion*	Unites community for common cause.		1	6		9	Unites community for common cause.	Negligible	1	6		9							Negligible	Negligible				
2. Community Growth*	Reduces flood hazard in existing flood plain		1	6		9	Encourages non-flood plain growth.		1	6		9							Negligible	Negligible				
3. Recreational Opportunities	Land made available for greenway park.		1	5	8	10	Potential for recreation development of project lands.	Negligible	1	5	8	10							Negligible	Negligible				
B. Adverse Impacts																								
1. Community Cohesion*	Negligible	Negligible	1	6		9	Disrupts cohesion thru relocation activities.	Negligible	1	6		9	SAME IMPACTS AS 10 YEAR NONSTRUCTURAL PLAN BUT SLIGHTLY GREATER DUE TO EVACUATION OF 106 ADDITIONAL STRUCTURES		1	6		9	Con't. community complaints about flood problems.	Negligible	3	5		
2. Community Growth*	Negligible	Negligible	1	5		9	Prevents future flood plain growth	Negligible	1	[illegible]		10							Negligible	Negligible				
3. Recreational Opportunity	No adverse impacts.	Negligible					No adverse impacts.	Negligible											Negligible	Negligible				
4. Displacement of People	No persons relocated	Negligible	1	6		9	Affected people relocated to flood plain sites.	Negligible	1	6		9			1	6		9	Possible forced displacement during floods	Negligible	3	5		

TABLE 6 SYSTEM OF ACCOUNTS
(FOR EXPLANATION OF TERMS [illegible])

[illegible]	NED PLAN RECOMMENDED PLAN CHANNEL MODIFICATION ALT. — LOCATION OF IMPACT: WITHIN THE STUDY AREA	WITHIN REST OF THE NATION	TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	NONSTRUCTURAL DEMOLITION [illegible] 10 YEAR PROTECTION — LOCATION OF IMPACT: WITHIN THE STUDY AREA	WITHIN REST OF THE NATION	[illegible]	[illegible]	[illegible]	[illegible] — WITHIN THE STUDY AREA	WITHIN REST OF THE NATION	TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	NO ACTION — LOCATION OF IMPACT: WITHIN THE STUDY AREA	WITHIN REST OF THE NATION	TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY
	BRIAR CREEK - CONFLUENCE [illegible] AVENUE																						
Regional Economic Development (RED)																							
A. Beneficial Impacts																							
1. Tax Revenues*	Increased revenue due to increased values.	Negligible	2	5		9	Increased revenue from nonflood plain development.	Negligible	2	5		9	SAME IMPACTS AS 10 YEAR NONSTRUCTURAL PLAN BUT SLIGHTLY GREATER DUE TO EVACUATION OF 106 ADDITIONAL STRUCTURES.	2	5		9	Negligible	Negligible				
2. Property Values*	Increased value due to reduced hazard.	Negligible	2	5		9	Negligible	Negligible										Negligible	Negligible				
3. Public Facilities*	Reduced emergency cost.	Negligible	2	5		9	Negligible	Negligible										Negligible	Negligible				
4. Public Service*	Reduced emergency cost.	Negligible	2	5		9	Reduced emergency cost.	Negligible	2	5		9		2	5		9	Negligible	Negligible				
5. Regional Growth*	Negligible	Negligible	2	6		9	Encourages nonflood plain growth.	Negligible	2	6		9		2	6		9	Negligible	Negligible				
6. Employment/Labor Force	Increased employment during construction.	Negligible	1	6		9	Increased employment during construction.	Negligible	1	6		9		1	6		9	Negligible	Negligible				
7. Business and Industrial	Fewer business losses.	Negligible	2	5		9	Increased demand for new business.	Negligible	2	5		9		2	5		9	Negligible	Negligible				
B. Adverse Impacts																							
1. Tax Revenues*	Negligible	Negligible	1	5		9	Loss of revenue from demolished structures.	Negligible	1	5		9		1	5		9	Negligible	Negligible				
2. Property Values*	No significant adverse effect.	Negligible	1	5		9	Monetary flood plain value decreases.	Negligible	1	5		9		1	5		9	Decreased value due to flood damage.	Negligible	3	5		
3. Public Facilities*	Need for annual maintenance.	Negligible					Negligible	Negligible										Negligible	Negligible				

TABLE 6 - SYSTEM OF ACCOUNTS
(FOR EXPLANATION OF TERMS SEE FOOTNOTES)

ACCOUNTS AND EFFECTS	NED PLAN RECOMMENDED PLAN CHANNEL MODIFICATION ALT.						NONSTRUCTURAL DEMOLITION ALT. 10 YEAR PROTECTION 12/						EQ PLAN NONSTRUCTURAL DEMOLITION ALT. SPF PROTECTION 12/						NO ACTION					
V B. (Continued)	LOCATION OF IMPACT		TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	LOCATION OF IMPACT		TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	LOCATION OF IMPACT		TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	LOCATION OF IMPACT		TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY
	WITHIN THE STUDY AREA	WITHIN REST OF THE NATION					WITHIN THE STUDY AREA	WITHIN REST OF THE NATION					WITHIN THE STUDY AREA	WITHIN REST OF THE NATION					WITHIN THE STUDY AREA	WITHIN REST OF THE NATION				
	BRIAR CREEK - CONFLUENCE TO VICINITY CENTRAL AVENUE																							
4. Public Service*	Negligible	Negligible					Negligible	Negligible					Negligible	Negligible					Continued need for emergency service.	Negligible	3	5		
5. Regional Growth	Negligible	Negligible					Negligible	Negligible					Negligible	Negligible					Negligible	Negligible				
6. Employment/Labor Force	Negligible	Negligible					Negligible	Negligible					Negligible	Negligible					Negligible	Negligible				
7 Business and Industrial	Negligible	Negligible					Negligible	Negligible					Negligible	Negligible					Negligible	Negligible				
8. Farm Displacement	None	None					None	None					None	None					None	None				

FOOTNOTES

TIMING

1. Impact is expected to occur prior to or during implementation of the plan.

2. Impact is expected within 1[illegible] years following plan implementation.

3. Impact is expected wit in a longer time frame (15 or more years following implementation).

UNCERTAINTY

4. The uncertainty associated with the impact is 50% or more.

5. The uncertainty is between 10 and 50%.

6. The uncertainty is less than 10%.

EXCLUSIVITY

7. Overlapping entry, fully monetized in NED account.

8. Overlapping entry not fully monetized in NED account.

ACTUALITY

9. Impact will occur with implementation.

10. Impact will occur only when specific additional actions are carried out during implementation.

11. Impact will not occur because necessary additional actions are lacking.

*ASTERISK denotes items specifically mentioned in Section 122 of Public Law 91-611 for evaluation.

12. **Economic data for Non-structural Plans is based on 1981 $ and 6 7/8% interest rate.**

TABLE 6 - SYSTEM OF ACCOUNTS
(FOR EXPLANATION OF TERMS SEE FOOTNOTES)

ACCOUNTS AND EFFECTS	RECOMMENDED PLAN NONSTRUCTURAL DEMOLITION ALT. 10 YEAR PROTECTION		TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	EQ PLAN NONSTRUCTURAL DEMOLITION ALT. 100 YEAR PROTECTION		TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	NED PLAN NONSTRUCTURAL DEMOLITION ALT. 10 YEAR PROTECTION		TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	NO ACTION		TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY
	LOCATION OF IMPACT						LOCATION OF IMPACT						LOCATION OF IMPACT						LOCATION OF IMPACT					
	WITHIN THE STUDY AREA	WITHIN REST OF THE NATION					WITHIN THE STUDY AREA	WITHIN REST OF THE NATION					WITHIN THE STUDY AREA	WITHIN REST OF THE NATION					WITHIN THE STUDY AREA	WITHIN REST OF THE NATION				
	BRIAR CREEK - COUNTRY CLUB DRIVE TO ONE SQUARE MILE DRAINAGE AREA																							
PLAN DESCRIPTION (See Note C)	Demolish 29 residential structures (Country Club Drive to upstream limits).						Demolish 61 residential structures (Country Club Drive to upstream limits)						SAME AS RECOMMENDED PLAN						Do Nothing					
I. Planning Objectives																								
A. Flood Damage Reduction	Provides 10 year protection to single family structures in affected stream reach.						Provides SPF protection to single family structures in affected stream reach.												Does not meet flood control objective.					
B. Recreation and Conservation Enhancement	Provides 9.8 acres of land for potential recreation/ conservation use						Provides 20.1 acres of land for potential recreation/ conservation use.												Does not meet recreation and conservation objective.					
II. National Economic Development (NED)																								
A. Beneficial Impacts																								
1. Ann. Flood Control Benefit	$ 198,800		3	5	7	9	$ 229,400		3	5	7	9												
2. Residual Land Values	$ 1,800		3	5	7	9	$ 4,500		3	5	7	9												
3. Flood Ins. Adjustment	$- 27,300		3	5	7	9	$- 35,600		3	5	7	9												
4. Net Annual Benefits	$ 173,300		3	5	7	9	$ 198,300		3	5	7	9							$0					
B. Adverse Impacts																								
1. Project First Cost	$ 1,259,900		1	5	7	9	$ 2,815,700		1	5	7	9							$0					
2. Moving & Relocation Expense	$ 145,000		1	5	7	9	$ 305,000		1	5	7	9												
3. Annual Project Cost	$ 98,600		3	5	7	9	$ 220,300		3	5	7	9												
4. Annual O&M Cost	0		3	5	7	9	0		3	5	7	9												
5. Total Annual Cost	$ 98,600		3	5	7	9	$ 220,300		3	5	7	9							$0					
a. Local	$ 19,700		3	5	7	9	$ 44,100		3	5	7	9												
b. Federal		$ 78,900	3	5	7	9		$ 176,200	3	5	7	9												
6. Residual Damages	$ 54,100		3	5	7	9	$ 33,500		3	5	7	9							$ 262,900		3	5	7	
Excess Benefits Over Cost (Annual)	$ 74,700		3	5	7		$- 22,000		3	5	7								$0					
7. Benefit to Cost	1.76 to 1		3	5	7		0.90 to 1		3	5	7													
III. Environmental Quality	EQ, OSE and NED impacts for nonstructural and no action alternatives on this reach of Briar Creek are the same as shown previously for similar alternatives on McAlpine Creek. Impacts for 100 year protection plan will be greater than the 10 year plan due to demolition of 32 additional structures.																							

TABLE 6 - SYSTEM OF ACCOUNTS
(FOR EXPLANATION OF TERMS SEE FOOTNOTES)

ACCOUNT AND EFFECT	RECOMMENDED PLAN NONSTRUCTURAL DEMOLITION ALT. 10 YEAR PROTECTION					EQ PLAN NONSTRUCTURAL DEMOLITION ALT. 100 YEAR PROTECTION					NED PLAN NONSTRUCTURAL DEMOLITION ALT. 10 YEAR PROTECTION					NO CHANGE				
	LOCATION OF IMPACT		TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	LOCATION OF IMPACT		TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	LOCATION OF IMPACT		TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	LOCATION OF IMPACT		TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY
	WITHIN THE STUDY AREA	WITHIN REST OF THE NATION					WITHIN THE STUDY AREA	WITHIN REST OF THE NATION					WITHIN THE STUDY AREA	WITHIN REST OF THE NATION					WITHIN THE STUDY AREA	WITHIN REST OF THE NATION				
	BRIAR CREEK - COUNTRY CLUB DRIVE TO ONE SQUARE MILE DRAINAGE AREA																							
[illegible] Other Social Effects (OSE) V Regional Economic Development (RED)	EQ, OSE, and RED impacts for nonstructural and no action alternatives on this reach of Briar Creek are the same as shown previously for similar alternatives on McAlpine Creek. Impacts for 100 year protection plan will be greater than the 10 year plan due to demolition of 32 additional structures.																							
FOOTNOTES [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]	UNCERTAINTY [illegible] The uncertainty associated with the impact is 50% or more. [illegible] The uncertainty is between 10 and 50% [illegible] The uncertainty is less than 10%					EXCLUSIVITY [illegible] Overlapping entry, fully monetized in NED account 8. Overlapping entry, not fully monetized in NED account						ACTUALITY 9. Impact will occur with implementation. 10. Impact will occur only when specific additional actions are carried out during implementation. 11. Impact will not occur because necessary additional actions are lacking						*ASTERISK denotes items specifically mentioned in Section 122 of Public Law 91-611 for evaluation. NOTE C: Plans for demolition of residential structures and no action were the only alternatives carried through Stage 3. Structural alternatives were not feasible for this reach of Briar Creek				

TABLE 6 - SYSTEM OF ACCOUNTS
(FOR EXPLANATION OF TERMS SEE FOOTNOTES)

ACCOUNTS AND EFFECTS	RECOMMENDED PLAN NONSTRUCTURAL DEMOLITION ALT.					EQ PLAN NONSTRUCTURAL DEMOLITION ALT					NED PLAN NONSTRUCTURAL DEMOLITION ALT					NO ACTION				
	LOCATION OF IMPACT		TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	LOCATION OF IMPACT		TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	LOCATION OF IMPACT		TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	LOCATION OF IMPACT		TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY
	WITHIN THE STUDY AREA	WITHIN REST OF THE NATION					WITHIN THE STUDY AREA	WITHIN REST OF THE NATION					WITHIN THE STUDY AREA	WITHIN REST OF THE NATION					WITHIN THE STUDY AREA	WITHIN REST OF THE NATION				
	BRIAR TRIBUTARY 2																							
PLAN DESCRIPTION (See Note D)	Demolish 13 residential structures (Grafton Road to Galway Drive).						SAME AS RECOMMENDED PLAN						SAME AS RECOMMENDED PLAN						Do Nothing					
I. Planning Objectives																								
A. Flood Damage Reduction	Provides 100 year protection to single family structures in affected stream reach.																		Does not meet flood control objectives					
B. Recreation and Conservation Enhancement	Provides 37 acres of land for potential recreation/ conservation use.																		Does not meet recreation and conservation objective.					
II. National Economic Development (NED)																								
A. Beneficial Impacts																								
1. Ann. Flood Control Benefit	$ 60,000		3	5	7	9																		
2. Residual Land Value	$ 7,700		3	5	7	9																		
3. Flood Ins. Adjustment	$- 6,000		3	5	7	9																		
4. Net Annual Benefits	$ 61,700		3	5	7	9													$0					
B. Adverse Impacts																								
1. Project First Cost	$ 737,300		1	5	7	9													$0					
2. Moving & Reloc. Expenses	$ 65,000		1	5	7	9																		
3. Annual Project Cost	$ 57,700		3	5	7	9																		
4. Annual O&M Cost	0		3	5	7	9																		
5. Total Annual Costs	$ 57,700		3	5	7	9													$0					
a. Local	$ 11,500		3	5	7	9																		
b. Federal		$ 46,200	3	5	7	9																		
6. Residual Damages	0																		$ 60,000		3	5	7	
Excess Benefits	$ 4,000		3	5	7														$0					
B. Benefit to Cost Ratio	1.37 to 1		3	5	7																			
III. Environmental Quality	EQ Impacts for Nonstructural and No Action Alternatives on Briar Tributary 2 are the same as shown previously for similar alternatives on McAlpine Creek.																							

TABLE 6 - SYSTEM OF ACCOUNTS
(FOR EXPLANATION OF TERMS SEE FOOTNOTES)

[illegible]	RECOMMENDED PLAN [illegible]				NO PLAN NONSTRUCTURAL DEMOLITION ALT.				NED PLAN [illegible]				NO ACTION			
	LOCATION OF IMPACT		TIMING	UNCERTAINTY	LOCATION OF IMPACT		TIMING	UNCERTAINTY	LOCATION OF IMPACT		TIMING	UNCERTAINTY	LOCATION OF IMPACT		TIMING	UNCERTAINTY
	WITHIN THE [illegible]	WITHIN REST OF NATION			WITHIN [illegible] AREA	WITHIN REST OF NATION			WITHIN THE [illegible] AREA	WITHIN REST OF THE NATION			WITHIN [illegible]	WITHIN REST OF NATION		
	[illegible]															
[illegible]	[illegible] for Nonstructural and No Action Alternatives [illegible] are the same as shown previously for similar alternatives on McAlpine Creek.															
[illegible] Development (RED)	[illegible] for Nonstructural and No Action Alternatives [illegible] are the same as shown previously for similar alternatives on McAlpine Creek.															
	[illegible]				FLEXIBILITY [illegible]				ACTUALITY [illegible] implementation [illegible] impact will [illegible] where [illegible] actions are [illegible] during implementation [illegible]				ASTERISK denotes items specifically mentioned in [illegible] of Public [illegible] for evaluation NOTED: Plans for demolition of residential structures and no action were the only alternatives carried through [illegible]. Structural alternatives were not feasible for Briar Tributary 2			

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TABLE 6 - SYSTEM OF ACCOUNTS
(FOR EXPLANATION OF TERMS SEE FOOTNOTES)

ACCOUNTS AND ELEMENTS	COMBINATION CHANNEL MODIFICATIONS NONSTRUCTURAL ALT. LOCATION OF IMPACT: WITHIN THE STUDY AREA	WITHIN REST OF THE NATION	TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	EQ, NED & RECOMMENDED PLAN NONSTRUCTURAL DEMOLITION ALT. 10 YEAR PROTECTION LOCATION OF IMPACT: WITHIN THE STUDY AREA	WITHIN REST OF THE NATION	TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	CHANNEL MODIFICATION ALT. LOCATION OF IMPACT: WITHIN THE STUDY AREA	WITHIN REST OF THE NATION	TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	NO ACTION LOCATION OF IMPACT: WITHIN THE STUDY AREA	WITHIN REST OF THE NATION	TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY
	LITTLE SUGAR CREEK (PARK ROAD TO VICINITY E. MOREHEAD STREET)																							
PLAN DESCRIPTION	1.08 miles channel mod. (vic. E. Blvd. to vic. E. Morehead St.) in combination with demolition of 83 residential structures (Park Rd. to Princeton Ave.)						Demolish 77 residential structures (Park Rd. to E. Morehead St.)						1.08 miles of channel modification (vic. East Blvd. to E. Morehead St.)						[illegible]					
I. Planning Objectives																								
A. Flood Damage Reduction	Alleviates residential and commercial flood damages.						Ineffective in protecting commercial concerns in stream reach						Provides protection to commercial concerns, increases residential damage.						Does not meet flood control					
B. Recreation and Conservation Enhancement	Provides 80.4 acres of land for potential recreation/conservation use						Provides 41.5 acres of land for potential reacreation/conservation use.						Provides 34.4 acres of land for potential recreation/conservation use						Does not meet recreation and conservation objective.					
II. National Economic Development (NED)																								
A. Beneficial Impacts																								
1. Ann. Flood Control Benefit	$ 658,270		3	5	7	9	$ 336,600		3	5	7	9	$ 279,100		3	5	7	9	$0					
2. Residual Land Values	$ 18,260		3	5	7	9	$ 40,400		3	5	7	9	$ 0		3	5	7	9						
3. Flood Ins. Adjustment	$- 48,080		3	5	7	9	$- 43,800		3	5	7	9	$ 0		3	5	7	9						
4. Net Annual Benefits	$ 628,450		3	5	7	9	$ 309,100		3	5	7	9	$ 279,100		3	5	7	9	$0					
B. Adverse Impacts																								
1. Project First	$ 3,098,400		1	5	7	9	$ 2,971,300		1	5	7	9	$ 3,800,800		1	5	7	9	$0					
2. Moving & Reloc. Expense	$ 415,000		1	5	7	9	$ 385,000		1	5	7	9	$ 0		1	5	7	9						
3. Annual Project Cost	$ 551,000		3	5	7	9	$ 232,500		3	5	7	9	$ 279,350		3	5	7	9						
4. Annual O&M Cost	$ 25,000		3	5	7	9			3	5	7	9	$ 25,000		3	5	7	9						
5. Total Annual Cost	$ 576,000		3	5	7	9	$ 232,500		3	5	7	9	$ 322,350		3	5	7	9	$0					
a. Local			3	5	7	9	$ 46,500		3	5	7	9	$ 210,100		3	5	7	9						
b. Federal			3	5	7	9		$ 186,000	3	5	7	9		$ 112,300	3	5	7	9						
6. Residual Damages	$ 79,200		3	5	7	9	$ 40,400		3	5	7	9	$ 450,500		3	5	7	9	$ 737,500		3	5	7	
7. Excess Benefits Over Cost (Annual)	$ [illegible]		3	5	7		$ 76,600		3	5	7		$- 43,250		3	5	7		$0					
D. Benefit to Cost Ratio	[illegible] to 1		3	5	7		1.33 to 1		3	5	7		0.86 to 1		3	5	7							

TABLE [illegible] SELECTION OF ACTIONS
(FOR EXPLANATION OF TERMS SEE [illegible])

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TABLE 6 - SYSTEM OF ACCOUNTS
(FOR EXPLANATION OF TERMS SEE FOOTNOTES)

[illegible]	MINIMUM CHANNEL MODIFICATIONS NONSTRUCTURAL ALT.						EQ. NED & RECOMMENDED PLAN NONSTRUCTURAL DEMOLITION ALT. 10 YEAR PROTECTION						CHANNEL MODIFICATION ALT.						NO ACTION					
	LOCATION OF IMPACT						LOCATION OF IMPACT						LOCATION OF IMPACT						LOCATION OF IMPACT					
	WITHIN THE STUDY AREA	WITHIN REST OF THE NATION	[illegible]	IMPORTANCE	[illegible]	ACTUALITY	WITHIN THE STUDY AREA	WITHIN REST OF THE NATION	[illegible]	[illegible]	[illegible]	[illegible]	WITHIN THE STUDY AREA	WITHIN REST OF THE NATION	[illegible]	IMPORTANCE	[illegible]	ACTUALITY	WITHIN THE STUDY AREA	WITHIN REST OF THE NATION	[illegible]	IMPORTANCE	[illegible]	ACTUALITY
	LITTLE SUGAR CREEK - PARK ROAD (VICINITY OF NORTHEAST STREET)																							
[illegible]*	Increase in noise level during construction	Negligible	1	6	8	9	Increase in noise level during construction	Negligible	1	6	8	9	Increase in noise level during construction	Negligible	1	6	8	9	Gradual increase with development	Negligible	3	5		
[illegible]																								
A. Beneficial Impacts																								
1. Community Cohesion*	Unites community for common cause	Negligible	1	6		9	Unites community for common cause	Negligible	1	6		9	Unites community for common cause.	Negligible	1	6		9	Negligible	Negligible				
2. Community Growth*	Encourages nonflood plain growth.	Negligible	1	6		9	Encourages nonflood plain growth	Negligible	1	6		9	Encourages nonflood plain growth	Negligible	1	6		9	Negligible	Negligible				
3. Recreational	Potential for recreational development of project lands	Negligible	1	5	8	10	Potential for recreational development of project lands.	Negligible	1	5	8	10	Potential for recreational development of project lands	Negligible	1	5	8	10	Negligible	Negligible				
B. Adverse Impacts																								
1. Community Cohesion*	Disrupts cohesion thru relocation activities	Negligible	1	6		9	Disrupts cohesion thru relocation activities.	Negligible	1	6		9	Negligible	Negligible	1	6		9	Con't community complaints about flood problems.	Negligible	3	5		
2. Community Growth*	Prevents future flood plain growth	Negligible	1	5		9	Prevents future flood plain growth.	Negligible	1	5		9	Prevents future flood plain growth.	Negligible	1	5		9	Negligible	Negligible				
3. Recreational Opportunity	No adverse impact.	Negligible					No adverse impact.	Negligible					No adverse impact.	Negligible					Negligible	Negligible				
4. Displacement of People	Affected people relocated to flood free sites	Negligible	1	6		9	Affected people relocated to flood free sites.	Negligible	1	6		9	Negligible	Negligible					Possible forced relocation during flood periods	Negligible	3	5		
2. Regional Economic Development (RED)																								
A. Beneficial Impacts																								
1. Tax Revenues*	Loss of revenue from demolished structures	Negligible	1	5		9	Loss of revenue from demolished structures	Negligible	1	[illegible]		9	Loss of revenue from demolished structures	Negligible	1	5		9	Negligible	Negligible				

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FEASIBILITY REPORT AN..(U) CORPS OF ENGINEERS
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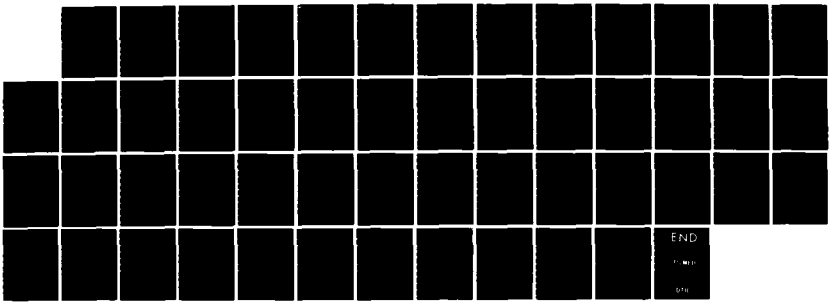

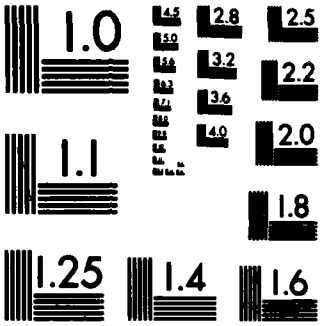

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

TABLE 6 - SYSTEM OF ACCOUNTS
(FOR EXPLANATION OF TERMS SEE FOOTNOTES)

ACCOUNTS AND EFFECTS	COMBINATION CHANNEL MODIFICATIONS NONSTRUCTURAL ALT.						EQ, NED & RECOMMENDED PLAN NONSTRUCTURAL DEMOLITION ALT. 10 YEAR PROTECTION						CHANNEL MODIFICATION ALT.						NO ACTION					
V.A. (Continued)	LOCATION OF IMPACT		TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	LOCATION OF IMPACT		TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	LOCATION OF IMPACT		TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	LOCATION OF IMPACT		TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY
	WITHIN THE STUDY AREA	WITHIN REST OF THE NATION					WITHIN THE STUDY AREA	WITHIN REST OF THE NATION					WITHIN THE STUDY AREA	WITHIN REST OF THE NATION					WITHIN THE STUDY AREA	WITHIN REST OF THE NATION				
	LITTLE SUGAR CREEK (PARK ROAD TO VICINITY E. MOREHEAD STREET)																							
2. Property Values*	Monetary flood plain value decreases.	Negligible	1	5		9	Monetary flood plain value decreases.	Negligible	1	5		9	Monetary flood plain value decreases.	Negligible	1	5		9	Decrease in value due to flood damage.	Negligible				
3. Public Facilities*	Negligible	Negligible					Negligible						Negligible	Negligible					Negligible	Negligible				
4. Public Service*	Requires annual project maintenance.	Negligible	3	5	7	9	Negligible	Negligible					Requires annual project maintenance.	Negligible	3	5	9	7	Con't need for emergency service.	Negligible	3	5		
5. Regional Growth	Deters flood plain development.	Negligible	3	5		9	Deters flood plain development.	Negligible	3	5		9	Deters flood plain development.	Negligible	3	5		9	Negligible	Negligible				
6. Employment/Labor Force	Negligible	Negligible					Negligible	Negligible					Negligible	Negligible					Negligible	Negligible				
7. Business and Industrial	Negligible	Negligible					Con't. business disruptions during floods.	Negligible	3	6			Negligible	Negligible					Con't. business disruptions during floods.	Negligible	3	6		
8. Farm Displacement	None	None					None	None					None	None					None	None				

FOOTNOTES:

TIMING

1. Impact is expected to occur prior to or during implementation of the plan.
2. Impact is expected within 15 years following plan implementation.
3. Impact is expected within a longer time frame (15 or more years following implementation).

UNCERTAINTY

4. The uncertainty associated with the impact is 50% or more.
5. The uncertainty is between 10 and 50%.
6. The uncertainty is less than 10%.

EXCLUSIVITY

7. Overlapping entry; fully monetized in NED account.
8. Overlapping entry; not fully monetized in NED account.

ACTUALITY

9. Impact will occur with implementation.
10. Impact will occur only when specific additional actions are carried out during implementation.
11. Impact will not occur because necessary additional actions are lacking.

*ASTERISK denotes items specifically mentioned in Section 122 of Public Law 91-611 for evaluation.

TABLE 6 - SYSTEM OF ACCOUNTS
(FOR EXPLANATION OF TERMS SEE FOOTNOTES)

ACCOUNTS AND EFFECTS	NED PLAN RECOMMENDED PLAN CHANNEL MODIFICATION ALT.						NONSTRUCTURAL DEMOLITION ALT. 10 YEAR PROTECTION 12/						EQ PLAN 12/ NONSTRUCTURAL DEMOLITION ALT. SPF PROTECTION						NO ACTION					
	LOCATION OF IMPACT						LOCATION OF IMPACT						LOCATION OF IMPACT						LOCATION OF IMPACT					
	WITHIN THE STUDY AREA	WITHIN REST OF THE NATION	TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	WITHIN THE STUDY AREA	WITHIN REST OF THE NATION	TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	WITHIN THE STUDY AREA	WITHIN REST OF THE NATION	TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	WITHIN THE STUDY AREA	WITHIN REST OF THE NATION	TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY
	LITTLE SUGAR CREEK (VICINITY NORTHWEST FREEWAY TO VICINITY EAST 36TH STREET)																							
PLAN DESCRIPTION	2.56 miles channel modification (vic. Northwest Freeway to vic. East 36th Street). Bottom width = 30 feet, side slopes 2V:1H.						Demolish 7 residential structures (Northwest Freeway to Craighead Road).						Demolish 97 residential structures (Northwest Freeway to Craighead Road).						Do Nothing					
I. Planning Objectives																								
A. Flood Damage Reduction	Provides 10 year inbank protection; eliminates 92% of existing flood damages.						Provides 10 year protection to residential structures, but is ineffective in reducing commercial and industrial damages.						Provides SPF protection to residential structures, but is ineffective in reducing commercial and industrial damages.						Does not meet flood control objective.					
B. Recreation and Conservation Enhancement	Provides in excess of 50 acres for potential recreation/conservation use.						Provides approximately 3.0 acres for potential recreation/conservation use.						Provides approximately 30 acres for potential recreation conservation use.						Does not meet recreation and conservation objectives.					
II. National Economic Development (NED)																								
A. Beneficial Impacts																								
1. Ann. Flood Control Benefit	$ 843,100		3	5	7	9	$ 25,200		3	5	7	9	$ 52,180		3	5	7	9						
2. Residual Land Values	-						$ 2,260		3	5	7	9	$ 10,830		3	5	7	9						
3. Flood Ins. Adjustment	-						$- 8,300		3	5	7	9	$- 13,580		3	5	7	9						
4. Net Annual Benefits	$ 843,100		3	5	7	9	$ 19,160		3	5	7	9	$ 49,430		3	5	7	9		$0				
B. Adverse Impacts																								
1. Project First Cost	$5,781,300		1	5	7	9	$ 324,100		1	5	7	9	$1,928,970		1	5	7	9		$0				
2. Moving & Reloc. Expense	-						$ 21,000		1	5	7	9	$ 291,000		1	5	7	9						
3. Annual Project Cost	$ 452,300		3	5	7	9	$ 24,600		3	5	7	9	$ 146,430		3	5	7	9						
4. Annual O&M Cost	$ 45,000		3	5	7	9	0		3	5	7	9	0		3	5	7	9						
5. Total Annual Costs	$ 497,300		3	5	7	9	$ 24,600		3	5	7	9	$ 146,430		3	5	7	9		$0				
a. Local	$ 223,000		3	5	7	9	$ 4,920		3	5	7	9	$ 29,280		3	5	7	9						
b. Federal		$ 274,300	3	5	7	9		$ 19,680	3	5	7	9		$ 117,150	3	5	7	9						
6. Residual Damages	$ 101,100		3	5	7	9	$ 869,680		3	5	7	9	$ 842,700		3	5	7	9	$ 944,200		3	5	7	
C. Excess Benefits Over Cost (Annual)	$ 345,800		3	5	7		$- 5,440		3	5	7		$- 97,000		3	5	7			$0				
D. Benefit to Cost	1.70 to 1		3	5	7		0.77 to 1		3	5	7		0.33 to 1		3	5	7							

TABLE 6 - SYSTEM OF ACCOUNTS
(FOR EXPLANATION OF TERMS SEE FOOTNOTES)

ACCOUNTS AND EFFECTS	NED PLAN RECOMMENDED PLAN CHANNEL MODIFICATION ALT.					NONSTRUCTURAL DEMOLITION ALT.[12] 10 YEAR PROTECTION					EQ PLAN[12] NONSTRUCTURAL DEMOLITION ALT. SPF PROTECTION					NO ACTION				
	LOCATION OF IMPACT		TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	LOCATION OF IMPACT		TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	LOCATION OF IMPACT		TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	LOCATION OF IMPACT		TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY
	WITHIN THE STUDY AREA	WITHIN REST OF THE NATION					WITHIN THE STUDY AREA	WITHIN REST OF THE NATION					WITHIN THE STUDY AREA	WITHIN REST OF THE NATION					WITHIN THE STUDY AREA	WITHIN REST OF THE NATION				
	LITTLE SUGAR CREEK (VICINITY NORTHWEST FREEWAY TO VICINITY EAST 36TH STREET)																							
III. Environmental Quality (EQ) IV. Other Social Effects (OSE) V. Regional Economic Development (RED)	EQ, OSE and RED impacts for structural, nonstructural, and no action alternatives for this portion of Little Sugar Creek are the same as shown previously for similar alternatives for the reach of Briar Creek between its confluence with Little Sugar Creek upstream to the vicinity of Central Avenue.																							

FOOTNOTES:

TIMING

1. Impact is expected to occur prior to or during implementation of the plan.

2. Impact is expected within 10 years following plan implementation.

3. Impact is expected within a longer time frame (15 or more years following implementation).

UNCERTAINTY

4. The uncertainty associated with the impact is 50% or more.

5. The uncertainty is between 10 and 50%.

6. The uncertainty is less than 10%.

EXCLUSIVITY

7. Overlapping entry; full monetized in NED account.

8. Overlapping entry; not fully monetized in NED account.

ACTUALITY

9. Impact will occur with implementation.

10. Impact will occur only when specific additional actions are carried out during implementation.

11. Impact will not occur because necessary additional actions are lacking.

*ASTERISK denotes items specifically mentioned in Section 122 of Public Law 91-611 for evaluation.

12. **Economic Analysis of Nonstructural Plans based on 1981 $ and 6 7/8% interest rate.**

TABLE 6 - SYSTEM OF ACCOUNTS
(FOR EXPLANATION OF TERMS SEE FOOTNOTES)

ACCOUNTS AND EFFECTS	RECOMMENDED PLAN 10 YEAR PROTECTION ALT.						EQ PLAN NONSTRUCTURAL DEMOLITION ALT. 100 YEAR PROTECTION						NED PLAN NONSTRUCTURAL DEMOLITION ALT. - 10 YEAR PROTECTION						NO ACTION					
	LOCATION OF IMPACT						LOCATION OF IMPACT						LOCATION OF IMPACT						LOCATION OF IMPACT					
	WITHIN THE STUDY AREA	WITHIN REST OF THE NATION	TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	WITHIN THE STUDY AREA	WITHIN REST OF THE NATION	TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	WITHIN THE STUDY AREA	WITHIN REST OF THE NATION	TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	WITHIN THE STUDY AREA	WITHIN REST OF THE NATION	TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY
LITTLE SUGAR CREEK (NORTH TRYON STREET TO ONE SQUARE MILE DRAINAGE AREA)																								
PLAN DESCRIPTION	Demolish 16 residential structures (N. Tryon St. to upstream study limits).						Demolish 33 residential structures (N. Tryon St. to upstream study limits).						SAME AS RECOMMENDED PLAN						Do Nothing					
I. Planning Objectives																								
A. Flood Damage Reduction	Provides 10 year protection to single family residential structures in affected stream reach.						Provides 100 year protection to single family residential structures in affected stream reach.												Does not meet flood control objective.					
B. Recreation and Conservation Enhancement	Provides 3.3 acres of land for potential recreation/ conservation use.						Provides 6.2 acres of land for potential recreation/ conservation use.												Does not meet recreation/ conservation objective.					
II. National Economic Development (NED)																								
A. Beneficial Impacts																								
1. Ann. Flood Control Benefit	$ 76,300		3	5	7	9	$ 87,900		3	5	7	9												
2. Residual Land Value	$ 1,800		3	5	7	9	$ 9,400		3	5	7	9												
3. Flood Ins. Adjustment	$- 10,300		3	5	7	9	$- 13,400		3	5	7	9												
4. Net Annual Benefits	$ 67,800		3	5	7	9	$ 83,900		3	5	7	9							$0					
B. Adverse Impacts																								
1. Project First Cost	$ 437,000		1	5	7	9	$1,368,500		1	5	7	9							$0					
2. Moving & Reloc. Expense	$ 80,000		1	5	7	9	$ 165,000		1	5	7	9												
3. Annual Project Cost	$ 34,200		3	5	7	9	$ 107,100		3	5	7	9												
4. Annual O&M Cost	0		3	5	7	9	0		3	5	7	9												
5. Total Annual Costs	$ 34,200		3	5	7	9	$ 107,100		3	5	7	9							$0					
a. Local	$ 6,800		3	5	7	9	$ 21,400		3	5	7	9												
b. Federal		$ 27,400	3	5	7	9		$ 86,700	3	5	7	9												
6. Residual Damages	$ 16,000		3	5	7	9	$ 4,400		3	5	7	9							$ 92,300		3	5	7	
C. Excess Benefits Over Cost (Annual)	$ 33,600		3	5	7		$ - 23,200		3	5	7													
D. Benefit to Cost Ratio	1.98 to 1		3	5	7		0.78 to 1		3	5	7													

TABLE 6 - SYSTEM OF ACCOUNTS
(FOR EXPLANATION OF TERMS SEE FOOTNOTES)

ACCOUNTS AND EFFECTS	RECOMMENDED PLAN 10 YEAR PROTECTION ALT.					EQ PLAN NONSTRUCTURAL DEMOLITION ALT. 100 YEAR PROTECTION					NED PLAN NONSTRUCTURAL DEMOLITION ALT. 10 YEAR PROTECTION					NO ACTION				
	LOCATION OF IMPACT		TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	LOCATION OF IMPACT		TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	LOCATION OF IMPACT		TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	LOCATION OF IMPACT		TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY
	WITHIN THE STUDY AREA	WITHIN REST OF THE NATION					WITHIN THE STUDY AREA	WITHIN REST OF THE NATION					WITHIN THE STUDY AREA	WITHIN REST OF THE NATION					WITHIN THE STUDY AREA	WITHIN REST OF THE NATION				
	LITTLE SUGAR CREEK (NORTH TRYON STREET TO ONE SQUARE MILE DRAINAGE AREA)																							
III. Environmental Quality (EQ) IV. Other Social Effects (OSE) V. Regional Economic Development (RED)	EQ, OSE, and RED impacts for nonstructural and no action alternatives on this reach of Little Sugar Creek are the same as shown previously for similar alternatives on McAlpine Creek. Impacts for 100 year protection plan will be greater than the 10 year plan due to the demolition of 17 additional structures.																							

FOOTNOTES:

TIMING

1. Impact is expected to occur prior to or during implementation of the plan.
2. Impact is expected within [illegible] years following plan implementation.
3. Impact is expected within a longer time frame (15 or more years following implementation).

UNCERTAINTY

4. The uncertainty associated with the impact is 50% or more.
5. The uncertainty is between 10 and 50%.
6. The uncertainty is less than 10%.

EXCLUSIVITY

7. Overlapping entry; fully monetized in NED account.
8. Overlapping entry; not fully monetized in NED account.

ACTUALITY

9. Impact will occur with implementation.
10. Impact will occur only when specific additional actions are carried out during implementation.
11. Impact will not occur because necessary additional actions are lacking.

*ASTERISK denotes items specifically mentioned in Section 122 of Public Law 91-611 for evaluation.

TABLE 6 - SYSTEM OF ACCOUNTS
(FOR EXPLANATION OF TERMS SEE FOOTNOTES)

ACCOUNTS AND EFFECTS	RECOMMENDED PLAN NONSTRUCTURAL DEMOLITION ALT. 10 YEAR PLAN						EQ PLAN NONSTRUCTURAL DEMOLITION ALT. 100 YEAR PLAN						NED PLAN NONSTRUCTURAL DEMOLITION ALT. 10 YEAR PLAN						NO ACTION					
	LOCATION OF IMPACT						LOCATION OF IMPACT						LOCATION OF IMPACT						LOCATION OF IMPACT					
	WITHIN THE STUDY AREA	WITHIN REST OF THE NATION	TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	WITHIN THE STUDY AREA	WITHIN REST OF THE NATION	TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	WITHIN THE STUDY AREA	WITHIN REST OF THE NATION	TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	WITHIN THE STUDY AREA	WITHIN REST OF THE NATION	TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY
	SUGAR/IRWIN CREEK (YORKMONT ROAD TO CLANTON ROAD)																							
PLAN DESCRIPTION (See Note E)	Demolish 24 residential structures (Yorkmont Rd. to Clanton Rd.)						Demolish 26 residential structures (Yorkmont Rd. to Clanton Rod.)												Do Nothing					
I. Planning Objectives																								
A. Flood Damage Reduction	Provides 8.2 acres of land for potential recreation/ conservation use.						Provides 8.9 acres of land for potential recreation/ conservation use.												Does not meet flood control objectives.					
B. Recreation and Conservation Enhancement																			Does not meet recreation/ conservation objectives.					
II. National Economic Development (NED)																								
A. Beneficial Impacts																								
1. Ann. Flood Control Benefit	$ 120,700		3	5	7	9	$ 121,500		3	5	7	9	SAME AS RECOMMENDED PLAN						$0					
2. Residual Land Values	$ 4,400		3	5	7	9	$ 4,800		3	5	7	9												
3. Flood Ins. Adjustment	$- 13,500		3	5	7	9	$- 13,600		3	5	7	9												
4. Net Annual Benefits	$ 111,600		3	5	7	9	$ 112,600		3	5	7	9							$0					
B. Adverse Impacts																								
1. Project First Cost	$ 858,300		1	5	7	9	$ 928,300		1	5	7	9							$0					
2. Moving & Reloc. Expense	$ 120,000		1	5	7	9	$ 130,000		1	5	7	9												
3. Annual Project Cost	$ 67,100		3	5	7	9	$ 72,600		3	5	7	9												
4. Annual O&M Cost	0		3	5	7	9	0		3	5	7	9												
5. Total Annual Costs	$ 67,100		3	5	7	9	$ 72,600		3	5	7	9							$0					
a. Local	$ 13,400		3	5	7	9	$ 14,500		3	5	7	9												
b. Federal		$ 63,700	3	5	7	9		$ 58,100	3	5	7	9												
6. Residual Damages	$ 800		3	5	7	9	$ 50		3	5	7	9							$ 121,500		3	5	7	
C. Excess Benefits Over Cost (Annual)	$ 44,500		3	5	7		$ 40,000		3	5	7								$0					
D. Benefit to Cost Ratio	1.66 to 1		3	5	7		1.55 to 1		3	5	7													

TABLE 6 - SYSTEM OF ACCOUNTS
(FOR EXPLANATION OF TERMS SEE FOOTNOTES)

ACCOUNTS AND EFFECTS	RECOMMENDED PLAN NONSTRUCTURAL DEMOLITION ALT. 10 YEAR PLAN					EQ PLAN NONSTRUCTURAL DEMOLITION ALT. 100 YEAR PLAN					NED PLAN NONSTRUCTURAL DEMOLITION ALT. 10 YEAR PLAN					NO ACTION				
	LOCATION OF IMPACT		TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	LOCATION OF IMPACT		TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	LOCATION OF IMPACT		TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	LOCATION OF IMPACT		TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY
	WITHIN THE STUDY AREA	WITHIN REST OF THE NATION					WITHIN THE STUDY AREA	WITHIN REST OF THE NATION					WITHIN THE STUDY AREA	WITHIN REST OF THE NATION					WITHIN THE STUDY AREA	WITHIN REST OF THE NATION				
	SUGAR/IRWIN CREEK (YORKMONT ROAD TO CLANTON ROAD)																							
III. Environmental Quality (EQ) IV. Other Social Effects (OSE) V. Regional Economic Development (RED)	EQ, OSE, and RED impacts for nonstructural and no action alternatives on this portion of Sugar/Irwin Creek are the same as shown previously for similar alternatives on McAlpine Creek. Impacts for 100 year protection plan will be slightly greater than the 10 year plan due to the demolition of 2 additional structures.																							

FOOTNOTES

TIMING

1. Impact is expected to occur prior to or during implementation of the plan.

2. Impact is expected within [illegible] years following plan implementation.

3. Impact is expected within a longer time frame (15 or more years following implementation).

UNCERTAINTY

4. The uncertainty associated with the impact is 50% or more.

5. The uncertainty is between 10 and 50%.

6. The uncertainty is less than 10%.

EXCLUSIVITY

7. Overlapping entry; fully monetized in NED account.

8. Overlapping entry; not fully monetized in NED account.

ACTUALITY

9. Impact will occur with implementation.

10. Impact will occur only when specific additional actions are carried out during implementation.

11. Impact will not occur because necessary additional actions are lacking.

*ASTERISK denotes items specifically mentioned in Section 122 of Public Law 91-611 for evaluation.

NOTE E:

Plans for demolition of residential structures and no action were the only alternatives carried through Stage 3. Structural alternatives were not feasible for Sugar/Irwin Creek.

TABLE 6 - SYSTEM OF ACCOUNTS
(FOR EXPLANATION OF TERMS SEE FOOTNOTES)

ACCOUNTS AND EFFECTS	RECOMMENDED PLAN NONSTRUCTURAL DEMOLITION ALT. 10 YEAR PLAN						EQ PLAN NONSTRUCTURAL DEMOLITION ALT. 100 YEAR PLAN						NED PLAN NONSTRUCTURAL DEMOLITION ALT. 10 YEAR PLAN						NO ACTION					
	LOCATION OF IMPACT						LOCATION OF IMPACT						LOCATION OF IMPACT						LOCATION OF IMPACT					
	WITHIN THE STUDY AREA	WITHIN REST OF THE NATION	TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	WITHIN THE STUDY AREA	WITHIN REST OF THE NATION	TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	WITHIN THE STUDY AREA	WITHIN REST OF THE NATION	TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	WITHIN THE STUDY AREA	WITHIN REST OF THE NATION	TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY
	SUGAR IRWIN CREEKS (I-77 TO I-85)																							
PLAN DESCRIPTION (See Note F.)	Demolish 4 residential strucures (I-77 to I-95).						Demolish 5 residential structures (I-77 to I-95).						SAME AS RECOMMENDED PLAN.						Do Nothing					
I. Planning Objectives																								
A. Flood Damage Reduction	Provides 10 year protection to residential structures in affected stream reach.						Provides 100 year protection to residential structures in affected stream reach.												Does not meet flood control objective.					
B. Recreation and Conservation Enhancement	Provides 1.5 acres of land for potential recreation/ conservation use.						Provides 1.8 acres of land for potential recreation/ conservation use.												Does not meet recreation/ conservation objective.					
II. National Economic Development (NED)																								
A. Beneficial Impacts																								
1. Ann. Flood Control Benefit	$ 23,100		3	5	7	9	$ 23,300		3	5	7	9							$0					
2. Residual Land Values	$ 400		3	5	7	9	$ 400		3	5	7	9												
3. Flood Ins. Adjustment	$- 4,200		3	5	7	9	$- 4,200		3	5	7	9												
4. Net Annual Benefits	$ 19,300		3	5	7	9	$ 19,500		3	5	7	9							$0					
B. Adverse Impacts																								
1. Project First Cost	$ 72,400		1	5	7	9	$ 92,900		1	5	7	9							$0					
2. Moving & Reloc. Expenses	$ 20,000		1	5	7	9	$ 25,000		1	5	7	0												
3. Annual Project Cost	$ 5,700		3	5	7	9	$ 7,300																	
4. Annual O&M Cost	0		3	5	7	9	0		3	5	7	9												
5. Total Annual Costs	$ 5.700		3	5	7	9	$ 7,300		3	5	7	9							$0					
a. Local	$ 1,100		3	5	7	9	$ 1,500		3	5	7	9												
b. Federal		$ 4,600	3	5	7	9		$ 5,800	3	5	7	9												
6. Residual Damages	$ 400		3	5	7	9	$ 200		3	5	7	9							$ 23,500					
C. Excess Benefits Over Cost (Annual)	$ 13,600		3	5	7		$ 12,200		3	5	7								$0					
D. Benefit to Cost Ratio	3.41 to 1		3	5	7		2.69 to 1		3	5	7													

TABLE 6 - SYSTEM OF ACCOUNTS
(FOR EXPLANATION OF TERMS SEE FOOTNOTES)

ACCOUNTS AND EFFECTS	RECOMMENDED PLAN NONSTRUCTURAL DEMOLITION ALT. 10 YEAR PLAN					EQ PLAN NONSTRUCTURAL DEMOLITION ALT. 100 YEAR PLAN					NED PLAN NONSTRUCTURAL DEMOLITION ALT. 10 YEAR PLAN					NO CHANGE				
	LOCATION OF IMPACT		TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	LOCATION OF IMPACT		TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	LOCATION OF IMPACT		TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	LOCATION OF IMPACT		TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY
	WITHIN THE STUDY AREA	WITHIN REST OF THE NATION					WITHIN THE STUDY AREA	WITHIN REST OF THE NATION					WITHIN THE STUDY AREA	WITHIN REST OF THE NATION					WITHIN THE STUDY AREA	WITHIN REST OF THE NATION				
	SUGAR IRWIN CREEKS (I-77 TO I-85)																							
III. Environmental Quality (EQ) IV. Other Social Effects (OSE) V. Regional Economic Development	EQ, OSE, and RED impacts for nonstructural and no action alternatives on this portion of Sugar/Irwin Creek are the same as shown previously for similar alternatives on McAlpine Creek. Impacts for 100 year protection plan will be slightly greater than for 10 year plan due to the demolition of 1 additional structure.																							

FOOTNOTES

TIMING

1. Impact is expected to occur prior to or during implementation of the plan.

2. Impact is expected within 15 years following plan implementation.

3. Impact is expected within a longer time frame (15 or more years following implementation).

UNCERTAINTY

4. The uncertainty associated with the impact is 50% or more.

5. The uncertainty is between 10 and 50%.

6. The uncertainty is less than 10%.

EXCLUSIVITY

7. Overlapping entry; fully monetized in NED account.

8. Overlapping entry, not fully monetized in NED account.

ACTUALITY

9. Impact will occur with implementation.

10. Impact will occur only when specific additional actions are carried out during implementation.

11. Impact will not occur because necessary additional actions are lacking.

*ASTERISK denotes items specifically mentioned in Section 122 of Public Law 91-611 for evaluation.

NOTE F:

Plans for demolition of residential structures and no action were the only alternatives carried through Stage 3. Structural alternatives were not feasible for Sugar/Irwin Creek.

TABLE 6 - SYSTEM OF ACCOUNTS
(FOR EXPLANATION OF TERMS SEE FOOTNOTES)

ACCOUNTS AND EFFECTS	RECOMMENDED PLAN NONSTRUCTURAL DEMOLITION ALT. 10 YEAR PROTECTION						EQ PLAN NONSTRUCTURAL DEMOLITION ALT. 100 YEAR PROTECTION						NED PLAN NONSTRUCTURAL DEMOLITION ALT. 10 YEAR PROTECTION						NO ACTION					
	LOCATION OF IMPACT		TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	LOCATION OF IMPACT		TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	LOCATION OF IMPACT		TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	LOCATION OF IMPACT		TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY
	WITHIN THE STUDY AREA	WITHIN REST OF THE NATION					WITHIN THE STUDY AREA	WITHIN REST OF THE NATION					WITHIN THE STUDY AREA	WITHIN REST OF THE NATION					WITHIN THE STUDY AREA	WITHIN REST OF THE NATION				
	STEWART CREEK (LaSALLE STREET TO SOUTWEST BLVD.)																							
PLAN DESCRIPTION	Demolish 3 residential structures (LaSalle St. to Soutwest Blvd.).						Demolish 4 residential structures (LaSalle St. to Southwest Blvd.).						SAME AS RECOMMENDED PLAN.						Do Nothing					
I. Planning Objectives																								
A. Flood Damage Reduction	Provides 10 year protection to residential structures in affected stream reach.						Provides 100 year protection to residential structures in affected stream reach.												Does not address flood control objective.					
B. Recreation and Conservation Enhancement	Provides 1.0 acres of land for potential recreation/ conservation use.						Provides 1.3 acres of land for potential recreation/ conservation use.												Does not address recreation/ conservation objective.					
II. National Economic Development (NED)																								
A. Beneficial Impacts																								
1. Ann. Flood Control Benefit	$ 7,300		3	5	7	9	$ 7,400		3	5	7	9							$0					
2. Residual Land Value	$ 100		3	5	7	9	$ 200		3	5	7	9												
3. Flood Ins. Adjustment	$- 2,100		3	5	7	9	$- 2,200		3	5	7	9												
4. Net Annual Benefits	$ 5,300		3	5	7	9	$ 5,400		3	5	7	9							$0					
B. Adverse Impacts																								
1. Project First Cost	$ 55,200		1	5	7	9	$ 73,600		1	5	7	9							$0					
2. Moving & Reloc. Expense	$ 15,000		1	5	7	9	$ 20,000		1	5	7	9												
3. Annual Project Cost	$ 4,300		3	5	7	9	$ 5,700		3	5	7	9												
4. Annual O&M Cost	0		3	5	7	9	0		3	5	7	9												
5. Total Annual Costs	$ 4,300		3	5	7	9	$ 5,700		3	5	7	9							$0					
a. Local	$ 900		3	5	7	9	$ 1,100		3	5	7	9												
b. Federal		$ 3,400	3	5	7	9		$ 4,600	3	5	7	9												
6. Residual Damages	$ 1,400		3	5	7	9	$ 1,200		3	5	7	9							$ 8,700		3	5	7	
C. Excess Benefits Over Cost (Annual)	$ 1,000		3	5	7		$- 300		3	5	7													
D. Benefit to Cost Ratio	1.23 to 1		3	5	7		0 94 to 1		3	5	7													

TABLE 6 - SYSTEM OF ACCOUNTS
(FOR EXPLANATION OF TERMS SEE FOOTNOTES)

ACCOUNTS AND EFFECTS	RECOMMENDED PLAN NONSTRUCTURAL DEMOLITION ALT. 10 YEAR PROTECTION						EQ PLAN NONSTRUCTURAL DEMOLITION ALT. 100 YEAR PROTECTION						NED PLAN NONSTRUCTURAL DEMOLITION ALT. 10 YEAR PROTECTION						NO ACTION					
	LOCATION OF IMPACT		TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	LOCATION OF IMPACT		TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	LOCATION OF IMPACT		TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	LOCATION OF IMPACT		TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY
	WITHIN THE STUDY AREA	WITHIN REST OF THE NATION					WITHIN THE STUDY AREA	WITHIN REST OF THE NATION					WITHIN THE STUDY AREA	WITHIN REST OF THE NATION					WITHIN THE STUDY AREA	WITHIN REST OF THE NATION				
	STEWART CREEK (LaSALLE STREET TO SOUTHWEST BLVD.)																							
III. Environmental Quality (EQ) IV. Other Social Effects (OSE) V. Regional Economic Development	EQ, OSE, and RED impacts for nonstructural and no action alternatives on this portion of Stewart Creek are the same as shown previously for similar alternatives on McAlpine Creek. Impacts for 100 year protection plan will be slightly greater than for the 10 year plan due to the demolition of 1 additional structure.																							

FOOTNOTES

TIMING

1. Impact is expected to occur prior to or during implementation of the plan.

2. Impact is expected within 10 years following plan implementation.

3. Impact is expected within a longer time frame (10 or more years following implementation).

UNCERTAINTY

4. The uncertainty associated with the impact is 50% or more.

5. The uncertainty is between 10 and 50%.

6. The uncertainty is less than 10%.

EXCLUSIVITY

7. Overlapping entry; fully monetized in NED account.

8. Overlapping entry; not fully monetized in NED account.

ACTUALITY

9. Impact will occur with implementation.

10. Impact will occur only when specific additional actions are carried out during implementation.

11. Impact will not occur because necessary additional actions are lacking.

*ASTERISK denotes items specifically mentioned in Section 122 of Public Law 91-611 for evaluation.

TABLE 6 - SYSTEMS OF ACCOUNTS
(FOR EXPLANATION OF TERMS SEE FOOTNOTES)

ACCOUNTS AND EFFECTS	RECOMMENDED PLAN NONSTRUCTURAL DEMOLITION ALT. 100 YEAR PROTECTION						EQ PLAN NONSTRUCTURAL DEMOLITION ALT. 100 YEAR PROTECTION						NED PLAN NONSTRUCTURAL DEMOLITION ALT. 100 YEAR PLAN						NO ACTION					
	LOCATION OF IMPACT		TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	LOCATION OF IMPACT		TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	LOCATION OF IMPACT		TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	LOCATION OF IMPACT		TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY
	WITHIN THE STUDY AREA	WITHIN REST OF THE NATION					WITHIN THE STUDY AREA	WITHIN REST OF THE NATION					WITHIN THE STUDY AREA	WITHIN REST OF THE NATION					WITHIN THE STUDY AREA	WITHIN REST OF THE NATION				
	STEWART CREEK TRIBUTARIES																							
PLAN DESCRIPTION	Demolish 14 residential structures on affected stream reach.						SAME AS RECOMMENDED PLAN.						SAME AS RECOMMENDED PLAN.						Do Nothing					
I. Planning Objectives																								
A. Flood Damage Reduction	Provides 100 year protection to residential structures on affected stream reach.																		Does not meet flood control objective.					
B. Recreation and Conservation Enhancement	Provides 6.56 acres of land for potential recreation/conservation use.																		Does not meet recreation/ conservation objective.					
II. National Economic Development (NED)																								
A. Beneficial Impacts																								
1. Ann. Flood Control Benefit	$ 39,500		3	5	7	9													$0					
2. Residual Land Values	$ 4,100		3	5	7	9																		
3. Flood Ins. Adjustment	$- 6,600		3	5	7	9																		
4. Net Annual Benefits	$ 37,000		3	5	7	9													$0					
B. Adverse Impacts																								
1. Project First Cost	$ 448,900		1	5	7	9													$0					
2. Moving & Reloc. Expense	$ 70,000		1	5	7	9																		
3. Annual Project Cost	$ 35,100		3	5	7	9													$0					
4. Annual O&M Cost	0		3	5	7	9																		
5. Total Annual Costs	$ 35,100		3	5	7	9													$0					
a. Local	$ 7,000		3	5	7	9																		
b. Federal		$ 28,100	3	5	7	9																		
6. Residual Damages	$ 23,400		3	5	7	9													$ 62,900		3	5	7	
C. Excess Benefits Over Cost (Annual)	$ 1,900		3	5	7														0					
D. Benefit to Cost Ratio	1.05 to 1		3	5	7														-					

TABLE 6 - SYSTEMS OF ACCOUNTS
(FOR EXPLANATION OF TERMS SEE FOOTNOTES)

ACCOUNTS AND EFFECTS	RECOMMENDED PLAN NONSTRUCTURAL DEMOLITION ALT. 100 YEAR PROTECTION					EQ PLAN NONSTRUCTURAL DEMOLITION ALT. 100 YEAR PROTECTION					NED PLAN NONSTRUCTURAL DEMOLITION ALT. 100 YEAR PLAN					NO ACTION				
	LOCATION OF IMPACT		TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	LOCATION OF IMPACT		TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	LOCATION OF IMPACT		TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY	LOCATION OF IMPACT		TIMING	UNCERTAINTY	EXCLUSIVITY	ACTUALITY
	WITHIN THE STUDY AREA	WITHIN REST OF THE NATION					WITHIN THE STUDY AREA	WITHIN REST OF THE NATION					WITHIN THE STUDY AREA	WITHIN REST OF THE NATION					WITHIN THE STUDY AREA	WITHIN REST OF THE NATION				
	STEWART CREEK TRIBUTARIES																							
III. Environmental Quality (EQ) IV. Other Social Effects (OSE) V. Regional Economic Development	EQ, OSE, and RED impacts for nonstructural and no action alternatives on Stewart Creek Tributaries are the same as shown previously for similar alternatives on McAlpine Creek.																							

FOOTNOTES:

TIMING:

1. Impact is expected to occur prior to or during implementation of the plan.

2. Impact is expected within 15 years following plan implementation.

3. Impact is expected within a longer time frame (15 or more years following implementation).

UNCERTAINTY

4. The uncertainty associated with the impact is 50% or more.

5. The uncertainty is between 10 and 50%.

6. The uncertainty is less than 10%.

EXCLUSIVITY

7. Overlapping entry; fully monetized in NED account.

8. Overlapping entry; not fully monetized in NED account.

ACTUALITY

9. Impact will occur with implementation.

10. Impact will occur only when specific additional actions are carried out during implementation.

11. Impact will not occur because necessary additional actions are lacking.

*ASTERISK denotes items specifically mentioned in Section 122 of Public Law 91-611 for evaluation.

Rationale For Designation Of NED Plan

Planning Policy requires the designation of a National Economic Development (NED) Plan. This plan is described as the plan which best addresses the planning objectives in a way which maximizes net economic benefits. The NED plan must have net economic benefits. Alternative measures considered in the formulation of a NED plan are evaluated according to economic criteria. However, the design of physical structures is done according to engineering criteria. As is true for all alternatives, sound design based upon the interdisciplinary inputs of the planning team is required for a NED plan. Because a NED plan includes all measures to address planning objectives whose incremental dollar benefits exceed dollar costs; mitigation, preservation, or enhancement measures are included when they are economically justified. The NED plans for the various basin streams are designated and evaluated in Table 6 on the Systems of Accounts and are further summarized in the following Table 7.

Rationale For Designation Of EQ Plan

Recognizing that the environmental quality has both natural and human manifestations, an EQ plan addresses the planning objectives in a way which emphasizes aesthetic, ecological, and cultural contributions. Beneficial EQ contributions are made by preserving, maintaining, restoring or enhancing the significant cultural and natural environmental attributes of the study area. Determination of EQ benefits involves subjective analysis, underscoring the need for interdisciplinary planning with extensive public input, to place values on the environmental contributions of plans. Designation of EQ plans involves measuring the environmental changes related to different plans and selecting those which, based on public input, contribute to or are most harmonious with environmental objectives. This means that EQ plans are those which make the "best" contribution to one or more components of the EQ account. The EQ plans for the various basin streams are designated and evaluated in Table 6 on the Systems of Accounts and are further summarized in Table 8.

Table 7

NED Plans - Sugar Creek Basin
North and South Carolina

Description	First Cost	Annual Cost	Annual Benefits	B/C Ratio	Net NED Benefits
McAlpine Creek					
Demolish 5 Residential structures 1/ 2/ (Providence Road to Monroe Road)	$ 404,600	$ 31,700	$ 62,900	1.98 to 1	$ 31,200
McMullen Creek					
Demolish 8 Residential structures 1/ 2/ (Mountain Brook Rd. to Randolph Rd.)	$ 745,000	$ 58,300	$ 101,100	1.73 to 1	$ 42,800
Briar Creek					
4.75 miles channel modification 1/ (vic. Colony Rd. to vic. Central Ave)	$12,187,000	$1,022,400	$1,467,200	1.43 to 1	$ 444,800
Demolish 29 Residential structures 1/ (Grafton Road to Galway Drive)	$ 1,259,900	$ 98,600	$ 173,300	1.76 to 1	$ 74,700
Briar Tributary 2					
Demolish 13 Residential structures 1/ 2/ (Grafton Road to Galway Drive)	$ 737,300	$ 57,700	$ 61,700	1.07 to 1	$ 4,000
Little Sugar Creek					
Demolish 77 Residential structures 1/ 2/ (Park Road to Princeton Ave.)	$ 2,971,300	$ 232,500	$ 309,100	1.33 to 1	$ 76,600
2.56 miles channel modifications 1/ (vic. N.W. Freeway to E. 36th St.)	$ 5,781,300	$ 497,000	$ 843,100	1.70 to 1	$ 346,100
Demolish 16 Residential structures 1/ (N. Tryon St. to Upstream limits)	$ 437,000	$ 34,200	$ 67,800	1.98 to 1	$ 33,600
Sugar-Irwin Creek					
Demolish 24 Residential structures 1/ (Yorkmont Road to Clanton Road)	$ 858,300	$ 67,100	$ 111,600	1.66 to 1	$ 44,500
Demolish 4 Residential structures 1/ (I-77 to I-85)	$ 72,400	$ 5,700	$ 19,300	3.41 to 1	$ 13,600
Stewart Creek					
Demolish 3 Residential structures 1/ (LaSalle St. to Southwest Blvd.)	$ 55,200	$ 4,300	$ 5,300	1.23 to 1	$ 1,000
Stewart Creek Tributaries					
Demolish 14 Residential structures 1/ 2/	$ 448,900	$ 35,100	$ 37,000	1.05 to 1	$ 1,900

1/ NED plan recommended for implementation

2/ NED plan also designated as EQ plan

Table 8

EQ Plans - Sugar Creek Basin
North and South Carolina

Description	First Cost	Annual Cost	Annual Benefits	B/C Ratio	Net NED Benefits
McAlpine Creek					
Demolish 5 Residential structures 1/ 2/ (Providence Road to Monroe Road)	$ 404,600	$ 31,700	$ 62,900	1.98 to 1	$ 31,200
McMullen Creek					
Demolish 8 Residential structures 1/ 2/ (Mountain Brook Rd. to Randolph Rd.)	$ 745,000	$ 58,300	$ 101,100	1.73 to 1	$ 42,800
Briar Creek					
Demolish 176 Residential structures 3/ (confluence to vic. Central Ave.)	$12,961,480	$1,229,940	$1,130,970	0.92 to 1	(-)$98,940
Demolish 61 Residential structures (Country Club Dr. to upstream study limit)	$ 2,815,700	$ 220,300	$ 198,300	0.90 to 1	(-)$22,000
Briar Tributary 2					
Demolish 13 Residential structures 1/ 2/ (Grafton Road to Galway Drive)	$ 737,300	$ 57,700	$ 61,700	1.07 to 1	$ 4,000
Little Sugar Creek					
Demolish 77 Residential structures 1/ 2/ (Park Road to Princeton Ave.)	$ 2,971,300	$ 232,500	$ 309,100	1.33 to 1	$ 76,600
Demolish 97 Residential structures 3/ (Northwest Freeway to Craighead Rd.)	$ 1,928,970	$ 146,430	$ 49,430	0.33 to 1	(-)$97,000
Demolish 16 Residential structures (N. Tryon St. to Upstream limits)	$ 1,368,500	$ 107,100	$ 83,900	0.78 to 1	(-)$23,200
Sugar-Irwin Creek					
Demolish 26 Residential structures (Yorkmont Road to Clanton Road)	$ 928,300	$ 72,600	$ 112,600	1.55 to 1	$ 40,000
Demolish 5 Residential structures (I-77 to I-95)	$ 92,900	$ 7,300	$ 19,500	2.69 to 1	$ 12,200
Stewart Creek					
Demolish 4 Residential structures (LaSalle St. to Southwest Blvd.)	$ 73,600	$ 5,700	$ 5,400	0.94 to 1	$ - 300
Stewart Creek Tributaries					
Demolish 14 Residential structures 1/2/	$ 448,900	$ 35,100	$ 37,000	1.05 to 1	$ 1,900

1/ EQ plan recommended for implementation

2/ EQ plan also designated as NED plan

3/ Economic Data for designated alternatives is based on 1981 $ and 6 7/8% interest rate. All other plans were evaluated based on 1982 $ and 7 5/8% interest rates.

Rationale For Selected Plans

The process of selecting plans for authorization consisted of careful evaluation of the contributions of each plan to the four accounts (NED, EQ, RED and OSE) and evaluating the acceptability of each plan to the general public and philanthropic and other special interest groups and organizations. The selection process was performed using input from all levels of government, including those of the city, county, state and Federal governments.

All evaluated plans with the exception of the do-nothing alternatives adquately addressed the stated planning objectives of flood damage reduction and enhancement of recreation and conservation opportunities. Each plan considered is fully implementable from an engineering viewpoint. Social evaluations, however, indicated a preference for structural solutions over those classified as nonstructural where there is a real choice. In areas which are not suited for structural solutions or in which the advantages of nonstructural solutions greatly exceeded those of the structural plan(s), the nonstructural plan calling for the removal of flood plain structures received general support. For the purpose of this study, alternatives recommending removal of flood plain structures are based on the assumption that affected structures would be demolished. Actual implementation of nonstructural alternatives, if authorized, would likely result in the demolition of some structures and the physical relocation of others, depending on the type and condition of each individual structure and the availability of relocation sites. The decision to relocate or demolish a specific structure would be made during post-authorization investigations.

Separable plans are not dependent upon other works to be fully effective. Separable plans selected for recommendation in the Sugar Creek Basin are summarized in Table 9.

TABLE 9

SUMMARY OF RECOMMENDED PLANS
SUGAR CREEK BASIN, NORTH & SOUTH CAROLINA

Selected Plan	First Cost (1982 $)	Annual Cost (7 5/8%)	Annual O & M Costs	Total Annual Costs	Total Damages w/o Proj	Residual Damages w/Proj	Avg. Ann. Equivalent Benefits	Benefit[1/] to Cost Ratio	Cost Apportionment First Cost Federal	Cost Apportionment First Cost Local	Cost Apportionment Ann. O & M Local
McALPINE CREEK											
Demolish 5 Residential Structures (Providence Rd to Monroe Rd)											
a. Construction Cost	$ 404,600	$ 31,700	0	$ 31,700	-	-	-	-	$ 323,700	$ 80,900	$ 0
b. Associated PL 91-646 Cost	$ 25,000	$ 2,000	0	$ 2,000	-	-	-	-	$ 20,000	$ 5,000	$ 0
c. Totals	$ 429,600	$ 33,700	0	$ 33,700	$ 79,800	$ 11,600	$ 62,900	1.98 to 1	$ 343,700	$ 85,900	$ 0
McMULLEN CREEK											
Demolish 8 Residential Structures (Mountain Brook Rd to Randolph Rd)											
a. Construction Cost	$ 745,000	$ 58,300	0	$ 58,300	-	-	-	-	$ 596,000	$ 149,000	$ 0
b. Associated PL 91-646 Cost	$ 40,000	$ 3,100	0	$ 3,100	-	-	-	-	$ 32,000	$ 8,000	$ 0
c. Totals	$ 785,000	$ 61,400	0	$ 61,400	$ 100,100	$ 0	$ 101,100	1.73 to 1	$ 628,000	$ 157,000	$ 0
BRIAR CREEK											
4.75 Miles Channel Modifications (vic Colony Rd to vic Central Ave)											
a. Construction Cost	$12,187,000	$ 953,400	$ 69,000	$1,022,400	-	-	-	-	$8,535,200	$3,651,800	$ 69,000
b. Associated PL 91-646 Cost	$ 30,000	$ 2,300	$ 0	$ 2,300	-	-	-	-	$ 21,000	$ 9,000	$ 0
c. Totals	$12,217,000	$ 955,700	$ 69,000	$1,024,700	$1,494,800	$ 27,600	$1,467,200	1.43 to 1	$8,556,200	$3,660,800	$ 69,000
Demolish 29 Residential Structures (Country Club Dr to Upstream Study Limit)											
a. Construction	$ 1,259,900	$ 98,600	0	$ 98,600	-	-	-	-	$1,007,900	$ 252,000	$ 0
b. Associated PL 91-646 Cost	$ 145,000	$ 11,300	0	$ 11,300	-	-	-	-	$ 116,000	$ 29,000	$ 0
c. Totals	$ 1,404,900	$ 109,900	0	$ 109,900	$ 262,900	$ 64,100	$ 173,300	1.76 to 1	$1,123,900	$ 281,000	$ 0
BRIAR TRIBUTARY 2											
Demolish 13 Residential Structures (Grafton Rd to Galway Dr)											
a. Construction Cost	$ 737,300	$ 57,700	0	$ 57,700	-	-	-	-	$ 589,800	$ 147,500	$ 0
b. Associated PL 91-646 Cost	$ 65,000	$ 5,100	0	$ 5,100	-	-	-	-	$ 52,000	$ 13,000	$ 0
c. Totals	$ 802,300	$ 62,800	0	$ 62,800	$ 60,000	$ 0	$ 61,700	1.07 to 1	$ 641,800	$ 160,500	$ 0
LITTLE SUGAR CREEK											
Demolish 77 Residential Structures (Park Rd to Princeton Ave)											
a. Construction Cost	$ 2,971,300	$ 232,500	0	$ 232,500	-	-	-	-	$2,377,000	$ 594,300	$ 0
b. Associated PL 91-646 Cost	$ 385,000	$ 30,100	0	$ 30,100	-	-	-	-	$ 308,000	$ 77,000	$ 0
c. Totals	$ 3,356,300	$ 262,600	0	$ 262,600	$ 377,000	$ 40,400	$ 309,100	1.33 to 1	$2,685,000	$ 671,300	$ 0

TABLE 9 (Con't)

SUMMARY OF RECOMMENDED PLANS
SUGAR CREEK BASIN, NORTH & SOUTH CAROLINA

Selected Plan	First Cost (1982 $)	Annual Cost (7 5/8%)	Annual O & M Costs	Total Annual Costs	Total Damages w/o Proj	Residual Damages w/Proj	Avg. Ann. Equivalent Benefits	Benefit[1/] to Cost Ratio	Cost Apportionment First Cost Federal	Cost Apportionment First Cost Local	Cost Apportionment Ann. O & M Local
LITTLE SUGAR CREEK (Con't)											
2.56 Miles Channel Modification (vic NW Freeway to vic E 36th St)											
a. Construction Cost	$ 5,781,300	$ 452,300	$ 45,000	$ 497,300	-	-	-	-	$3,506,200	$2,275,100	$ 45,000
b. Associated PL 91-646 Cost	$ 0	$ 0	$ 0	$ 0	-	-	-	-	$ 0	$ 0	$ 0
c. Totals	$ 5,781,300	$ 452,300	$ 45,000	$ 497,300	$944,200	$107,100	$843,100	1.70 to 1	$3,506,200	$2,275,100	$ 45,000
Demolish 16 Residential Structures (N Tryon St to Upstream Study Limit)											
a. Construction Cost	$ 437,000	$ 34,200	$ 0	$ 34,200	-	-	-	-	$ 349,600	$ 87,400	$ 0
b. Associated PL 91-646 Cost	$ 80,000	$ 6,300	0	$ 6,300	-	-	-	-	$ 64,000	$ 16,000	$ 0
c. Totals	$ 517,000	$ 40,500	$ 0	$ 40,500	$ 92,300	$ 16,000	$ 67,800	1.98 to 1	$ 413,600	$ 103,400	$ 0
SUGAR/IRWIN CREEKS											
Demolish 24 Residential Structures (Yorkmont Rd to Clanton Ave)											
a. Construction Cost	$ 858,300	$ 67,100	$ 0	$ 67,100	-	-	-	-	$ 686,600	$ 171,700	$ 0
b Associated PL 91-646 Cost	$ 120,000	$ 9,400	$ 0	$ 9,400	-	-	-	-	$ 96,000	$ 24,000	$ 0
c. Totals	$ 978,300	$ 76,500	$ 0	$ 76,500	$121,500	$ 800	$111,600	1.66 to 1	$ 782,600	$ 195,700	$ 0
Demolish 4 Residential Structures (I-77 to I-95)											
a. Construction Cost	$ 72,400	$ 5,700	$ 0	$ 5,700	-	-	-	-	$ 57,900	$ 14,500	$ 0
b. Associated PL 91-646 Cost	$ 20,000	$ 1,600	0	$ 1,600	-	-	-	-	$ 16,000	$ 4,000	$ 0
c. Totals	$ 92,400	$ 7,300	$ 0	$ 7,300	$ 23,500	$ 400	$ 19,300	3.41 to 1	$ 73,900	$ 18,500	$ 0
STEWART CREEK & TRIBUTARIES											
Demolish 3 Residential Structures (LaSalle St to Southwest Blvd)											
a. Construction Cost	$ 55,200	$ 4,300	$ 0	$ 4,300	-	-	-	-	$ 44,200	$ 11,000	$ 0
b. Associated PL 91-646 Cost	$ 15,000	$ 1,200	0	$ 1,200	-	-	-	-	$ 12,000	$ 3,000	$ 0
c. Totals	$ 70,200	$ 5,500	$ 0	$ 5,500	$ 8,700	$ 1,400	$ 5,300	1.23 to 1	$ 56,200	$ 14,000	$ 0
Demolish 14 Residential Structures (Tributary Areas)											
a. Construction Cost	$ 448,900	$ 35,100	$ 0	$ 35,100	-	-	-	-	$ 359,100	$ 89,800	$ 0
b. Associated PL 91-646 Cost	$ 70,000	$ 5,500	0	$ 5,500	-	-	-	-	$ 56,000	$ 14,000	$ 0
c. Totals	$ 518,900	$ 40,600	$ 0	$ 40,600	$ 62,900	$ 23,400	$ 37,000	1.05 to 1	$ 415,100	$ 103,800	$ 0
BASIN SUMMARY											
7.31 Miles Channel Modifications & Demolition of 199 Residential Structures											
a. Construction Cost	$25,958,200	$2,030,900	$ 114,000	$2,144,900	-	-	-	-	$18,433,200	$7,525,000	$114,000
b. Associated PL 91-646 Cost	$ 995,000	$ 77,800	$ 0	$ 77,800	-	-	-	-	$ 793,000	$ 202,000	$ 0
c. Totals	$26,953,200	$2,108,700	$ 114,000	$2,222,700	$3,627,700	$292,800	$3,259,400	1.51 to 1	$19,226,200	$7,727,000	$114,000

1/ The benefit-to-cost Ratio is a comparison of Annual Construction and O & M Cost verses Annual Project Benefits. Cost of complying with provisions of PL 91-646 are not considered in this analysis.

FINAL ENVIRONMENTAL IMPACT STATEMENT

PROPOSED PLAN FOR FLOOD CONTROL AND CONSERVATION OF OPEN FLOOD PLAIN AREAS, SUGAR CREEK DRAINAGE BASIN, MECKLENBURG COUNTY, NORTH CAROLINA

The responsible lead agency is the U. S. Army Engineer District, Charleston.

The responsible cooperating agencies are the U. S. Fish and Wildlife Service and the U. S. Environmental Protection Agency.

Abstract. The Sugar Creek Basin drains surface waters from the City of Charlotte and other parts of southern Mecklenburg County in North Carolina, as well as small portions of York and Lancaster Counties in South Carolina. The Charleston District has been authorized to conduct a study and to recommend plans for "flood control and allied purposes." A wide variety of structural and nonstructural plans have been examined for the entire drainage basin; however, the major problems and the most cost-effective solutions are located in the Charlotte area. Each stream is different from all others in terms of resources, problems and potential for improvement; therefore, plans have been formulated, evaluated and selected on a stream-by-stream basis. The many unique alternatives for each stream and the large number of streams involved make a quick summary of all plans impossible. In general, the alternatives considered for each stream included an array of structural and nonstructural flood control measures. Nonstructural measures included relocation or demolition of floodprone structures. Structural alternatives considered included channel modifications and, where appropriate, alternatives such as levees, floodwalls and dry flood retention reservoirs. Plans selected for recommendation call

for removal of floodprone residential structures in specified reaches of various basin streams, and channel enlargement in other reaches. Landscaping and conservation of project lands for future passive enjoyment and recreation is also recommended. The Environmental Quality plan for areas considered for flood control measures consisted of demolition of floodplain structures and designation of project acquired land for recreation and conservation use. Four of twelve areas proposed for flood control improvements recommend implementation of the EQ designated plan.

The National Economic Development Plan was selected for all twelve stream reaches for which detailed proposals were made. Four of the recommended NED plans, however, were also designated as EQ plans.

Nonstructural recommendations were evaluated based on the assumption that all affected structures would be demolished. Actual implementation of such measures would likely include a combination of demolition and relocation, dependent on the type, location, and condition of affected structures and the availability of relocation sites.

SEND YOUR COMMENTS TO THE DISTRICT ENGINEER BY

If you would like further information of this statement, please contact:

Mr. John Carothers
U. S. Army Engineer District, Charleston
P. O. Box 919
Charleston, S. C. 29402
Commercial Telephone (803) 724-4258
FTS Telephone: 677-4258

NOTE: Information, displays, maps, etc. discussed in the Sugar Creek Basin Feasibility Report are incorporated by reference in the EIS.

SUMMARY

1. Major Conclusions and Findings. In general, there are few important natural resources in the areas of Charlotte for which plans are proposed. The projected increase in population and construction activities over the next twenty years indicate that urban growth and its associated impacts will further reduce existing resources. Under the current Congressional authorization, there are few opportunities for environmental enhancement in the center of the city where most of the implementable solutions are proposed. Similarly, there are few significant adverse impacts which would result from the proposed plans when compared to the existing and future "without project" conditions. In formulating and selecting plans, the Charleston District attempted to avoid unnecessary impacts and, within the limits of the study authorization, to enhance the few and diminishing natural resources still present. The proposed discharge sites for dredged or fill material have been specified through the application of the Section 404(b)(1) Guidelines, for submittal to Congress under the provisions of Section 404(r), PL 92-500, as amended.

2. A large number of plans have been evaluated due to the many different streams and the many potential solutions. Nonstructural alternatives consisting of the removal of development from flood plain areas and designation of acquired lands for recreation or conservation use have been designated as Environmental Quality (EQ) plans based on their beneficial contribution to the EQ account. This approach would remove many existing sources of sediment and pollution from the flood plain; would revegetate a large expanse of urban land; and would designate future use of these lands for more environmentally oriented purposes. The plans which maximized the net economic benefits have been designated as National Economic Development (NED) plans. Selected NED plans varied with each creek, depending upon stream and development characteristics which would affect economic outputs. The System of Accounts, Table 6 displays the economic costs and benefits for each alternative by stream location and designates which plan was selected as the NED plan. It also denotes the recommended plan and the

various factors which went into the decision making process. The type of plan selected differed from stream to stream, depending on local conditions and preferences, and the overall recommendations included two structural plans and ten nonstructural solutions.

3. Areas of Controversy. No areas of controversy or major disagreement among public interests surfaced during the study. Although there was some stated opposition to removal or demolition of structures, voiced during the study, the City of Charlotte has indicated their continued willingness for project sponsorship.

4. Unresolved Issues. There are no unresolved major disagreements among study interests. The City of Charlotte, North Carolina, has submitted a letter indicating their intent to implement all of the local aspects of the flood control and conservation measures recommended, subject to final review and approval of City Council prior to implementation.

RELATIONSHIP OF PLANS TO ENVIRONMENTAL PROTECTION STATUTES
AND OTHER ENVIRONMENTAL REQUIREMENTS
SUGAR CREEK BASIN WATER RESOURCES DEVELOPMENT

	Plan Considered	
Federal Statutes	Structural	Non-Structural
Archeological and Historic Preservation Act, as amended	Full	Full
Clean Air Act, as amended	Full	Full
Clean Water Act (Federal Water Pollution Control Act), as amended	Full	Full
Coastal Zone Management Act of 1972, as amended	NA	NA
Endangered Species Act of 1973, as amended	Full	Full
Estuary Protection Act	NA	NA
Federal Water Project Recreation Act, as amended	Full	Full
Fish and Wildlife Coordination Act, as amended	Full	Full
Land and Water Conservation Fund Act of 1965, as amended	NA	NA
Marine Protection, Research, and Sanctuaries Act of 1969, as amended	NA	NA
National Environmental Policy Act of 1969, as amended	Full	Full
National Historic Preservation Act of 1966, as amended	Full	Full
Rivers and Harbors Appropriation Act of 1899, as amended	NA	NA
Watershed Protection and Flood Prevention Act, as amended	NA	NA
Wild and Scenic River Act, as amended	Full	Full
Executive Orders, Memoranda, etc.		
Floodplain Management (E.O. 11988)	Full	Full
Protection of Wetlands (E.O. 11990)	Full	Full
Environmental Effects Abroad of Major Federal Actions (E.O. 12114)	NA	NA
Analysis of Impacts on Prime and Unique Farmlands (CEQ Memorandum, 11 Aug 80)	Full	Full
Land Use Plans		
Mecklenburg County, North Carolina	Full	Full

ENVIRONMENTAL IMPACT STATEMENT

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Need For and Objectives of Action.

5. Study Authority. The Sugar Creek Basin Study was initiated as a result of the following resolution adopted 4 November 1971 by the Committee on Public Works of the United States Senate:

> RESOLVED BY THE COMMITTEE ON PUBLIC WORKS OF THE UNITED STATES SENATE, that the Board of Engineers for Rivers and Harbors, created under the Provisions of Section 3 of the Rivers and Harbors Act approved June 13, 1902, be, and is hereby, requested to review the report of the Chief of Engineers on the Santee River System, North Carolina and South Carolina, Published as Senate Document Number 189, Seventy-eighth 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 Sugar Creek Basin, North Carolina and South Carolina, in the interest of flood control and allied purposes.

6. Public Concerns. The major problems and needs identified in the early parts of the study were flooding, poor water quality, rapid urban growth, and the continued decrease of open, undeveloped spaces in the Charlotte-Mecklenburg area suitable for passive enjoyment, wildlife, and recreation. These problems are summarized in the sections of this EIS entitled "Without Conditions" and "Affected Environment". Detailed discussions are found in the main report and appendixes.

7. Planning Objectives. The planning objectives established for the study are as follows:

a. Reduction of flood damages to structures located within the various flood plains of Sugar Creek Basin;

b. Establishment and conservation of undeveloped areas adjacent to basin streams; and,

c. Enhancement of recreational opportunities to residents of the area through the development of greenway parks and improvements or additions to established park facilities.

8. Translation of Natural Resource and Recreation Needs Into Project Plans. Within the urban portion of Sugar Creek Basin where flood problems can be addressed under the current study resolution, the water quality is poor and there is only poor to fair habitat for fish or wildlife. These conditions may improve, but not within the time of project construction. As discussed elsewhere in the EIS and main report, there will be a great increase in population and construction activity in the next twenty years, and there will also be an increase in pollutants associated with area sources.

9. Specific measures, such as structures to improve fish habitat, numbers of fish food organisms, or general aquatic diversity, would not be effective as long as heavy siltation persists, water quality remains poor, and heavy construction further reduces the vegetation on adjacent lands. Control of pollution sources and land use planning have been cited as study area needs, but actual regulation by permit conditions and zoning will have to be carried out by the local, state and other Federal agencies with legislated authority in these areas.

10. With a marked increase in construction, there would be a corresponding decrease in the number of undeveloped, vegetated tracts of land in the Charlotte area suitable for small wildlife and public enjoyment, although there will be a significant increase in the number of persons seeking these types of areas. Given the present condition of the streams, the widely changing desires of the urban population with time, and the success of the local park programs in planning for short-term needs, the major environmental

objective which evolved from the early stages of the Sugar Creek Basin study was the conservation of flood plain lands within the city to statisfy long-term environmental needs. Over a long period, water quality and creek bottoms will hopefully return to conditions that will once again allow the establishment of a healthy ecosystem and good sport fishing within easy access of the majority of persons in the metropolitan area. If, at that time, there are sufficiently long stretches of creek bank where the existing vegetation is undisturbed or has been specially planted, and if adjacent land use is suitable, recovery of even the more severely degraded streams is possible.

11. Lands in the Sugar Creek Basin acquired during the implementation of nonstructural flood control measures, project rights-of-way associated with structural measures, and disposal areas have been recommended for conservation or recreation use in areas where there is a demonstrated or predicted need. Existing vegetation on these lands would be selectively cleared, and attractive or useful specimens would be retained. The areas would be grassed to prevent erosion and landscaped with selected trees and shrubs in a manner compatible with park use. See the preliminary landscaping plan in Appendix 5. This approach to environmental issues provides for the most suitable present use of project lands (as parks) and conserves undeveloped lands for the best future uses.

ALTERNATIVES

12. Plans Considered in Preliminary Studies. During the preliminary phases of this investigation, each component stream of the Sugar Creek Basin drainage system was evaluated to determine the potential for flood damage and the need for water resources improvements. Individual streams were further broken down into a number of segments or reaches in order to identify problem areas and to designate areas with high flood damage potential.

13. Following the process of identifying problem areas, a wide variety of technical and institutional means for managing water resources of the basin were evaluated. Both structural and nonstructural means were given equal consideration, and the range of management measures were not constrained to those traditionally used by the Corps. Management measures considered as part of the Sugar Creek investigations included the following:

Nonstructural Measures	Structural Measures
Relocation of Structures	Channel Modifications
Evacuation Planning	Bridge Modifications
Flood Insurance	Levees/Floodwalls
Zoning and Modification of Building Codes	Paved Channels
Floodplain Regulation	Covered Floodways
Floodproof Structures	Reservoirs
Demolition	Combination Reservoirs and Channel Improvements
No Growth	
Do Nothing (No Action)	

14. Alternatives evaluated in preliminary stages of this study are discussed by sub-basin area in the section of the main report entitled "Analysis of Plans Considered in Preliminary Planning (Stages 1 & 2)" and are discussed

in greater detail in Appendix 2. Due to the large number of study streams and potential alternatives, it is impractical to discuss the advantages and drawbacks of each alternative in this impact statement. Such impacts are discussed, however, in the main report and supporting appendixes. Table 2 of the main report shows the stage of planning through which each potential alternative was carried.

15. As studies progressed, potential alternatives were refined and reduced in number to obtain a reasonable array of fully implementable plans. In general, if a plan was dropped from further consideration, it was dropped due to a lack of economic justification or to adverse environmental or social impacts. All potential alternatives that were economically justified and which had no unacceptable environmental or social impacts were carried into the final stage of evaluation. These alternatives are summarized in Table 3 of the main body of this report.

16. Without Conditions (No Action). If no corrective actions are taken, the flooding in Sugar Creek Basin will continue. In the Charlotte-Mecklenburg area where most of the damages now occur, floodway regulations have been enacted, and these regulations should retard the future construction of flood-prone buildings. A tremendous increase in construction activities is predicted for the Charlotte-Mecklenburg area by the end of the century. As more and more of the open, vegetated areas are converted into buildings, roads, parking lots and other impervious surfaces, the amount of rapid water runoff is expected to increase, and the frequency of flooding will also increase. There are certain construction measures which, if implemented, could slow some of the runoff into the streams. At present, however, these measures are not required by local building codes or regulations administered at higher levels, and, short of legislative action, implementation of runoff reduction measures on a large scale appears unlikely. The Table which follows is a summary of Table 1 in the main report. It shows the equivalent average annual damages (also in 1982 dollars) for the 50-year period of 1990-2040.

TOTAL FLOOD DAMAGES, EXISTING AND FUTURE CONDITIONS

Creek	Equivalent Average Annual Damages (1990-2040) (1982$ X 1,000)
Briar Creek	$1,733.03
Briar Tributary 2	63.52
Edwards Branch	296.23
Campbell Creek	4.68
Kings Creek	8.35
Little Hope Creek	27.71
Little Hope Tributary	40.89
Little Sugar Creek	1,846.25
Derita Branch	82.73
McAlpine Creek	189.71
McMullen Creek	170.21
McMullen Tributary	34.58
Steele Creek	0.04
Stewart Creek	99.55
Stewart Tributary 1	28.03
Stewart Tributary 2	34.90
Sugar/Irwin Creeks	215.47
Taggart Creek	13.18
Basin Total	$4,889.06

17. As the already large Charlotte-Mecklenburg metropolitan area continues to grow, there will be fewer tracts of land which are suitable for wildlife and passive recreational uses. The City of Charlotte, Mecklenburg County, and the Charlotte-Mecklenburg Planning Commission are acquiring lands for park use, but the total acreage of private and public undeveloped areas will decrease. The planning commission has identified a definite, long-term need for the conservation of undeveloped areas that are available for public use. (See Appendix 5 to the main report).

18. With an increase in population and construction, there will also be an increase in the amount of wastes generated in the project area. Some wastes such as sewage and effluents from industry might be controlled if stricter controls and new treatment technologies are applied. Non-point sources, however, will in all probability continue to increase. At present, there is no effective means to locate and measure all of the pollutants which runoff parking lots, industrial holding areas, streets and small, illegal dumps or seepages. Nor are there existing regulatory programs to effectively control all of these "areas sources". Streams in the Charlotte area now have the lowest state water quality classification (Class "C"), even though the State of North Carolina has issued standards designed to prevent further deterioration and to permit the most suitable uses of these streams (See Appendix 5). Even if the State and local agencies are successful in controlling most of the major point sources of pollution, a realistic outlook would predict continued poor water quality in the urban areas -- at least for those parameters that are affected by non-point sources (i.e., dissolved oxygen, pH, oil and grease, turbidity, etc.). Aquatic habitat, which is also a function of bottom type, water quality and land use, is also expected to remain poor in the Charlotte area in the foreseeable future.

19. Plans Considered in Detail. All plans considered through the final stage of planning are described and evaluated in the System of Accounts (Table 6 of the Main Report). More in-depth descriptions of plans are given in the section of the Main Report entitled "Assessment and Evaluation of Detailed Plans". Detailed economic and design data for these alternatives is contained in Appendixes 3 and 4. Detailed evaluations were conducted for the following alternatives identified by stream or stream subreach. Footnotes designate the alternatives selected for recommendation and identifies EQ and NED plans.

a. McAlpine Creek (Providence Road to Monroe Road)
   -Demolish 5 residential structures[1/ 2/ 3/]
   -No Action

b. McMullen Creek (Mountain Brook Road to Randolph Road)
   -Demolish 8 residential structures[1/ 2/ 3/]

c. Briar Creek (Confluence to vic. Central Avenue)
   -Channel modifications - 4.75 miles[1/ 3/]
   -Demolish 70 residential structures
   -Demolish 176 residential structures[2/]
   -No Action

d. Briar Creek (Country Club Drive to upstream study Limits)
   -Demolish 29 residential structures[1/ 3/]
   -Demolish 61 residential structures[2/]
   -No Action

e. Briar Tributary 2
   -Demolish 13 residential structures[1/ 2/ 3/]
   -No Action

f. Little Sugar Creek (Park Road to vic. East Morehead Street)
   -Channel Modification - 1.08 miles, demolish 83 residential structures
   -Demolish 77 residential structures[1/ 2/ 3/]
   -Channel Modification - 1.08 miles
   -No Action

g. Little Sugar Creek (vic. Northwest Freeway to vic. E. 36th Street)
-Channel Modification - 2.56 miles 1/ 3/
-Demolish 7 Residential Structures
-Demolish 97 Residential Structures 2/
-No Action

h. Little Sugar Creek (N. Tryon Street to upstream study Limits)
-Demolish 16 Residential Structures 1/ 3/
-Demolish 33 Residential Structures 2/
-No Action

i. Sugar/Irwin Creeks (Yorkmont Road to Clanton Road)
-Demolish 24 Residential Structures 1/ 3/
-Demolish 26 Residential Structures 2/
-No Action

j. Sugar/Irwin Creek (I-77 to I-95)
-Demolish 4 Residential Structures 1/ 3/
-Demolish 5 Residential Structures 2/
-No Action

k. Stewart Creek (LaSalle Street to Southwest Blvd.)
-Demolish 3 Residential Structures 1/ 3/
-Demolish 4 Residential Structures 2/
-No Action

l. Stewart Creek Tributaries
-Demolish 14 Residential Structures 1/ 2/ 3/
-No Action

1/ Recommended Plan
2/ EQ Plan
3/ NED Plan

20. Implementation of nonstructural measures would likely result in the relocation of some structures and demolition of others, depending on the type, location and condition of the affected structure and the availability

of relocation sites. Decisions to demolish or relocate individual structures would be made during post authorization investigations. Where tracts of lands acquired as part of the nonstructural plans are suitable for conversion into small parks or incorporation into existing parks, these lands would be landscaped and conveyed to the local sponsor for such purposes.

21. Details concerning structural plans recommended for flood control in the Sugar Creek Basin are given in the paragraphs which follow. Maps and more data on these alternatives is contained in the main report and supporting appendixes.

a. Briar Creek - Channel Modifications

The plan calls for 4.75 miles of channel modifications beginning about 1200 feet downstream of Colony Road and extending approximately 1650 feet upstream from Central Avenue. The channel would be widened to bottom widths varying from 60 feet to 40 feet, and channel side slopes of 2 horizontal to 1 vertical would be established. About 486,000 cubic yards of materials would be excavated, and eight bridges would have to be modified. Rights-of-way varying from 138 feet to 148 feet would be grassed and landscaped for erosion control and for use as a greenway park. The preferred disposal area is the Statesville Landfill which would benefit from the earth fill. Other alternate disposal sites were located below Providence Road and between Central and Commonwealth Avenues. Total land requirements available for park or greenway use after landscaping (see preliminary landscaping plan in Appendix 5) would be 113 acres.

b. Little Sugar Creek (Upper Reach) - Channel Modification

The plan for the upper reaches of Little Sugar Creek consist of 2.56 miles of channel modifications beginning approximately 600 feet upstream from the Northwest Freeway and extending approximately 540 feet upstream from East 36th Street. The channel would be widened to a bottom width of 30 feet with channel side slopes of two horizontal to one vertical. Total excavation is approximately 100,500 cubic yards. Eight bridge modifications

would be required. Total land requirements for channel modifications are 52.6 acres including 12.6 acres for disposal of excavated materials. This is based on an average right-of-way width of 130 feet.

Disturbed areas would be revegetated as shown in the landscaping plan in Appendix 5. The land would be turned over to the city in a condition that would allow the city to manage it as a conservation area or to add simple, "passive" recreation items such as a walking trail, benches, etc., at a later date. The local sponsor would have to provide assurances that the land would not be altered or put to uses that would detract from its use as a flood storage and conservation area.

Federal and Non-Federal Responsibilities

22. Cost apportionment of project first cost for recommended plans between Federal and non-Federal agencies is proposed in accordance with traditional laws and policies. Actual cost apportionment for implemented projects may vary, subject to cost-sharing and financing arrangements with the responsible non-Federal agency or agencies sponsoring the project, which are satisfactory to the President and the Congress.

23. In general, the traditional method of apportioning costs between Federal and non-Federal interests for structural flood control measures is based on standard requirements established as Federal policy for "local protection" works. Under this policy, non-Federal interests are required to furnish all lands, easements, and rights-of-way required for project construction and proper project maintenance. Non-Federal interests are also required to bear the costs of modifications to all utilities and highway crossings required for project construction. Cost associated with railroad modifications are Federal costs in accordance with existing law. The local sponsor must also operate and maintain the project after construction in accordance with Federal requirements. The Federal government would be responsible for all flood control construction cost, including cost incurred in performing feasibility investigations and preparing detail construction plans.

24. Proposed apportionment of cost between Federal and non-Federal agencies for nonstructural alternatives is in general compliance with Section 78 of the Water Resources Development Act of 1974. Subject act provides that non-Federal participation in the cost of recommended nonstructural measures shall be comparable to the value of lands, easements, and rights-of-way which would have been required of non-Federal interests for structural local protection measures, but in no event shall exceed 20% of the project costs. Because of the difficulty in determining the appropriate structural alternative and the fact that in some cases there may be no feasible structural alternative, it is impractical to specify on a case-by-case basis what the "Comparable" cost sharing would be for nonstructural measures. Accordingly, consistent with average cost sharing on traditional local protection projects, the non-Federal share of costs for recommended nonstructural measures has been recommended in all cases to be 20 percent of the first cost of such measures thereby assuring comparability to the average value of lands, easements and rights-of-way required for Corps structural protection projects.

25. Local sponsoring agencies must also agree to provide the following items of local cooperation:

a. Provide without cost to the United States, all lands, easements, and rights-of-way including disposal areas as determined necessary by the Chief of Engineers, for construction of structural channel modification project;

b. Accomplish without cost to the United States, all alterations and relocation of buildings, transportation facilities, storm drains, utilities, and other structures made necessary by construction of structural channel modification projects;

c. Provide a cash or in-kind contribution equal to 20 percent of the project first cost assigned nonstructural flood control improvements, including a 20 percent contribution toward cost incurred in the compliance with provisions of P. L. 91-646 and amendments thereto;

d. Hold and save the United States free from damages due to construction, operation and maintenance of the various projects; provided damages are not due to the fault or negligence of the United States or its contractor;

e. Maintain and operate the projects after completion in accordance with regulations provided by the Secretary of the Army;

f. Prescribe and enforce regulations to prevent destruction or encroachment on channels or other flood control works which would reduce their flood carrying capacity or hinder maintenance and operation;

g. Adopt and enforce regulatory measures to assure that project lands will be used for project compatible purposes; such compatibility determination shall lie with the Secretary of the Army acting through the Chief of Engineers;

h. Publicize flood plain information in the areas concerned and provide this information to zoning and other regulatory agencies for their guidance and leadership in preventing unwise future development in the flood plain and in adopting such regulations as may be necessary to insure compatibility between future development and prescribed levels of protection provided by various projects or other Federal legislation.

26. Comparative Impacts of Alternatives. The impacts of the detailed plans on the environment, economic costs and benefits, and on social conditions are displayed in the System of Accounts in Table 6 of the main report. Statements in the System of Accounts pertaining to impacts (beneficial and

adverse) on aesthetics, man-made resources, natural resources, water quality, aquatic habitat and recreation are only valid if the features of the plans dealing with landscaping, conservation and park use are actually carried out. The feasibility report established the requirements of local sponsorship necessary to assure that these features will be carried through the construction and maintenance phases on lands designated for recreation and conservation. Before this can be realized, recreation and conservation lands must be clearly delineated and a clear and positive commitment received from the local sponsor.

Affected Environment

27. Environmental Conditions. The Charlotte-Mecklenburg area, where the plans are proposed, is a metropolitan area with a 1980 population of approximately 404,000. In the nineteen-seventies, the City of Charlotte alone grew from 241,000 to 314,500, and Mecklenburg County grew from 354,700 to 404,300. Income, employment and construction are projected to continue rising at a fast rate for the next twenty years, as Charlotte expands its role as the economic center for a much larger region. As expected in a rapidly growing area, the demand for housing has, at least temporarily, exceeded the amount available, and the new apartments, suburbs, roads and urban revitalization are rapidly changing the distribution of persons and the appearance of the Charlotte-Mecklenburg area.

28. Most of the streams in the city have been severely altered from natural conditions by past actions, including channel straightening, back-filling, paved bottoms and sides. The typically urban uses of lands adjacent to the streams have resulted in the removal of vegetation, rapid water runoff, erosion, and the discharge of wastes into most of the streams. The general absence of shade, the poor water quality, and the shifting sand and silt bottoms sharply limit the aquatic habitat. High densities of structures, persons, and domestic animals reduce the value of the city's flood plains for wildlife, even in the few reaches where some vegetation remains.

29. Significant Resources. Archeological and historic resources are present in the general project area, but a reconnaissance failed to locate any sites immediately adjacent to the streams for which structural or demolition measures are recommended. The severely altered condition of the reduced project area limits wildlife to songbirds, squirrels, rabbits, oppossums, mice, rats and other small animals that can exist in heavily populated areas. There is no hunting in the areas for which plans have been proposed. Fisheries resources are very limited in the Charlotte area, even for the more tolerant fish such as bluegill, redbreast and catfish (see Appendix 5). Federal, state and local (UNCC) biologists were consulted, and none knew of any species in the basin listed as threatened or endangered by the U. S. Department of the Interior. The Natural Heritage Section of the Division of State Parks knew of no ecologically fragile areas.

30. The only resources of concern are those which deserve attention because of their scarcity in the local environment. Existing parks and other open areas suitable for passive outdoor enjoyment are important, then, not only for their active recreational opportunities, but also because they offer some potential for conservation of the few remaining natural resources that are otherwise not readily available to many Charlotte residents. The City of Charlotte, Mecklenburg County, and the Charlotte-Mecklenburg Planning Commission cooperate in a very active parks and recreation program. The existing parks and the need for more undeveloped public areas are summarized in Appendix 5.

Environmental Effects

31. Environmental effects are summarized for each plan in the Systems of Accounts (Tables 6 of the Main Report). Because of the number of streams and the difference in reaches on each stream, a detailed description of all the effects is not possible in this section. A brief summary of impacts follows.

32. Nonstructural Alternatives. The main effect of the nonstructural plans is the removal of persons and structures from the flood plain. As shown in the Systems of Accounts, this action results in both economic and environmental benefits. Evacuation removes sources of pollution from the flood plain and reduces many of the activities that result in erosion, heavy sediment loads in streams, loss of vegetation, and poor aquatic and terrestrial habitat. Removal of structures from the flood plain and regulation of flood plain uses is most effective in providing the above environmental benefits when large continuous reaches of streams are evacuated. Where the lands acquired as part of the demolition or relocation plans are suitably located, they will be landscaped and made into neighborhood parks or incorporated into larger existing parks (see the recommendations for individual areas in Appendix 5).

33. The major adverse environmental effects of relocation or demolition plans are the hardships created for the property owners. An individual homeowner who may have lived in one place for many years would be required to move, even if he preferred to stay and suffer the flood damages. Particularly for persons who have strong ties to a house, piece of property or neighborhood, the economic reimbursement for property and moving expenses would not completely compensate for the inconvenience and, in some cases, the trauma of moving to a new location. The removal of a large number of structures could have a disruptive effect on the neighborhood as well as the individual. Short-term problems are the noise, erosion and unattractive appearance of properties during demolition or relocation of structures.

34. Structural Alternatives. The major benefit due to structural measures is the reduction of flooding, economic damages, inconvenience and safety problems. In several instances, the improved channel side slopes, grassing of project lands and planting of shrubs and trees would greatly improve the appearance and would enhance the recreation potential or urban

areas that are now unattractive and of little environmental importance. The environmental impacts of structural plans in the individual reaches of streams are discussed under the headings "Impact Assessment" in the detailed description of each plan in the main report.

35. Major adverse impacts associated with the channel widening alternatives are the removal of the remaining shade trees and the spreading of the small streams over a wider, straighter channel, further reducing its value for fish and other aquatic life. Disturbed areas would be grassed and landscaped to lessen erosion, improve appearance and to provide food for the limited wildlife present. It would be 20-30 years, however, before the hardwood trees reached maturity. Erosion and stream sediment loads would be increased, at least during construction and before vegetation is established. This could increase the sedimentation downstream. There could be some hardships experienced by property owners whose land is needed for project rights-of-way. Because structural measures attempt to protect structures, reduce flooding and maintain the existing uses, there would not be nearly the inconvenience or hardship experienced with the demolition or removal alternatives. No historic or archeological resources were located by the reconnaissance in the narrow strips adjacent to project areas. The already severely altered channels and banks make further disturbance of valuable, unknown archeological resources unlikely.

36. The major beneficial effects would be the landscaping or urban lands and their conservation for recreation and passive enjoyment. Long strips of channel modification rights-of-way along Briar and Little Sugar Creeks would not only protect these lands from industrial commercial and residential development, but would also connect several of the existing parks.

Public Involvement

37. An initial televised public meeting was held on 13 April 1972 with an estimated attendance of 90 persons. The purpose of that meeting was

to inform all concerned of the initiation of the study and allow them an opportunity to express their views. Individuals offered comments and statements calling attention to the flooding and drainage problems in the basin and offered statements in support of the study effort.

38. During the stages of the study when problems and needs were being assessed and plans were being drawn up, numerous contacts were made with local officials, state and Federal agencies and the public through meetings, correspondence and telephone calls. Two series of letters, one in 1977 and another in 1978 went out from the Charleston District requesting information and input into the formulation of plans. On 26 and 27 April 1978 a two-day meeting was held in Charlotte, with representatives from EPA, the U. S. Fish and Wildlife Service, the Sierra Club, the N. C. Wildlife Commission, The Environmental Health Department of the N. C. Department of Natural Resources and Community Development and the Charlotte-Mecklenburg planning Council present. The group was taken by van to the potential project locations, briefed on the latest developments and asked for suggestions, in accordance with draft regulations on the "scoping process".

39. On 18 and 19 April 1979, Plan Formulation Public Conferences were held to allow all concerned to express their views regarding the alternatives and plan components under consideration. Approximately 50 individuals attended the conferences which consisted of a formal presentation followed by workshop sessions designed to establish two-way communication with the interested public.

40. After the Plan Formulation Public Conferences, project team members met to analyze and select various plans of improvement to recommend to local government (local sponsor) representatives. Charleston District study personnel then met with representatives of the city, county, and state governments to make final selection of recommended plans and to establish a priority for implementing these plans.

41. A late stage public meeting was held in Charlotte on 24 November 1981 at which time proposed recommendations were displayed for public review. Public notices were mailed to all addresses directly affected by nonstructural proposals and to all parties, public and private, which had indicated an interest in the study. This meeting was attended by approximately 200 persons who were afforded an opportunity to express their thoughts concerning study proposals.

42. In addition to the formal coordination discussed above, numerous informal contacts were made with persons and agencies through meetings, correspondence and telephone calls. Two briefings with the Charlotte City Council were held to update local officials.

43. Direct public input was also obtained through the use of questionnaires distributed to the general public. This procedure was used on two occasions. The first questionnaire was left with individual property owners to obtain information concerning the magnitude and type of flood damages experienced. A second questionnaire was distributed during the public workshop sessions previously discussed. This questionnaire was designed to obtain public input concerning the willingness of local residents to obligate local tax revenues for water resource improvements.

43. Public notices concerning the proposed improvements were mailed in September 1981 in compliance with Executive Order 11988 and Section 404(b)(1) of Public Law 92-500. Notice of availability of the Environmental Impact Statement (EIS) was published in the Federal Register dated October 9, 1981. In addition, draft copies of the feasibility report and EIS were mailed on 18 September 1981 for a designated review period to pertinent agencies and individuals. Comments received have been summarized in the main body of the feasibility report and pertinent correspondence has been included in Appendix 7 of the final version of this report.

LIST OF PREPARERS
SUGAR CREEK BASIN FEASIBILITY REPORT AND EIS

Name	Expertise	Experience	Professional Discipline
Mr. Robert Billue	Civil Engineering	3 years, Hydraulic Engineer, Vicksburg District 8 years, Hydraulic Engineer, Charleston District	Hydraulic Engineer
Mr. John Carothers EIS Coordinator	Botany Fishery Management Wildlife Management	3 years, fisheries biologist, Alabama Conservation Department. 3 years, fisheries biologist, U. S. Fish and Wildlife Service. 5 years, biologist, New Orleans District. 11 years, environmental studies, Charleston District.	Fish and Wildlife Biologist
Mr. David Harris Study Manager	Civil Engineering	13 years, study management of Water Resource Investigations, Charleston District.	Civil Engineer
Mr. David McLean Consultant	Archeology	17 years, instructor, Zaire, Africa. 7 years, professor, St. Andrews College, Laurinburg, N. C.	Archeologist
Mr. Gerald Melton	Economics	8 years, water resources planning economist, USDA, SCS. 8 years water resources planning economist, Charleston District	Economist

Mr. Stephen Morrison	Environmental Analysis	1 year, marine biologist, NSF grant, Honolulu, Hawaii. 1 year, physical scientist, EPA, Atlanta, Georgia. 7 years, environmental studies, Charleston District.	Biologist/ Engineer
Mr. Joseph Paxton	Biology	1 year, Fishery Biologist, San Francisco District, 5 years, environmental studies, Kansas City District 2 year, environmental studies, Charleston District	Ecologist
Mr. James Preacher	Biology/Agronomy	5 years, soil conservationist, USDA, SCS. 4 years, biologist/agronomist, SCS, Columbia, S. C. 4 years, environmental studies Charleston District.	Biologist/ Agronomist

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RECOMMENDATIONS

It is recommended that the water resources plans listed in Table 9 and discussed in detail in this report and supporting appendices be authorized for construction (See Plate 1 for project locations). These plans would alleviate flood problems and enhance recreation and conservation opportunities in the Sugar Creek Basin. Estimated first cost for construction of these alternatives is $25,958,200. An additional $995,000 would also be required for compliance with personal relocation benefits allowable under provisions of P. L. 91-646.

Construction of the recommended water resource project would be contingent upon the willingness of local interest to provide the following designated items of local cooperation. Cost apportionment procedures listed in the following local cooperation requirements are based on traditional policies. The current administration, however, is reviewing cost sharing and financing across the entire spectrum of water resource development functions. The basic principle governing the development of specific cost sharing policies is that whenever possible the cost of services produced by a water resource project should be paid for by direct beneficiaries. It is also recognized that the Federal government can no longer bear the major portion of financing water resource projects. New sources of project financing, both public and private, will have to be found.

While specific policies applicable to flood control projects have not yet been established, non-Federal interests can expect that the level of financial participation could be significantly greater than in the past. Accordingly, actual apportionment of project cost will be subject to modified cost-sharing and financial arrangements which are satisfactory to the President and to Congress, and thus, may vary from the apportionment procedures listed in the following local cooperation requirements:

a. Provide without cost to the United States, all lands, easements, and rights-of-way including disposal areas as determined necessary by the

Chief of Engineers, for construction of structural channel modification project;

b. Accomplish without cost to the United States, all alterations and relocation of buildings, transportation facilities, storm drains, utilities, and other structures made necessary by construction of structural channel modification projects;

c. Provide a cash or in-kind contribution equal to 20 percent of the project first cost assigned nonstructural flood control improvements, including a 20 percent contribution toward cost incurred in the compliance with provisions of P. L. 91-646 and amendments thereto;

d. Hold and save the United States free from damages due to construction, operation and maintenance of the various projects; provided damages are not due to the fault or negligence of the United States or its contractor;

e. Maintain and operate the projects after completion in accordance with regulations provided by the Secretary of the Army;

f. Prescribe and enforce regulations to prevent destruction or encroachment on channels or other flood control works which would reduce their flood carrying capacity or hinder maintenance and operation;

g. Adopt and enforce regulatory measures to assure that project lands will be used for project compatible purposes; such compatibility determination shall lie with the Secretary of the Army acting through the Chief of Engineers;

h. Publicize flood plain information in the areas concerned and provide this information to zoning and other regulatory agencies for their guidance and leadership in preventing unwise future development in the flood

plain and in adopting such regulations as may be necessary to insure compatibility between future development and prescribed levels of protection provided by various projects or other Federal legislation.

B.E. Stalmann

BERNARD E. STALMANN
LTC, Corps of Engineers
Commanding

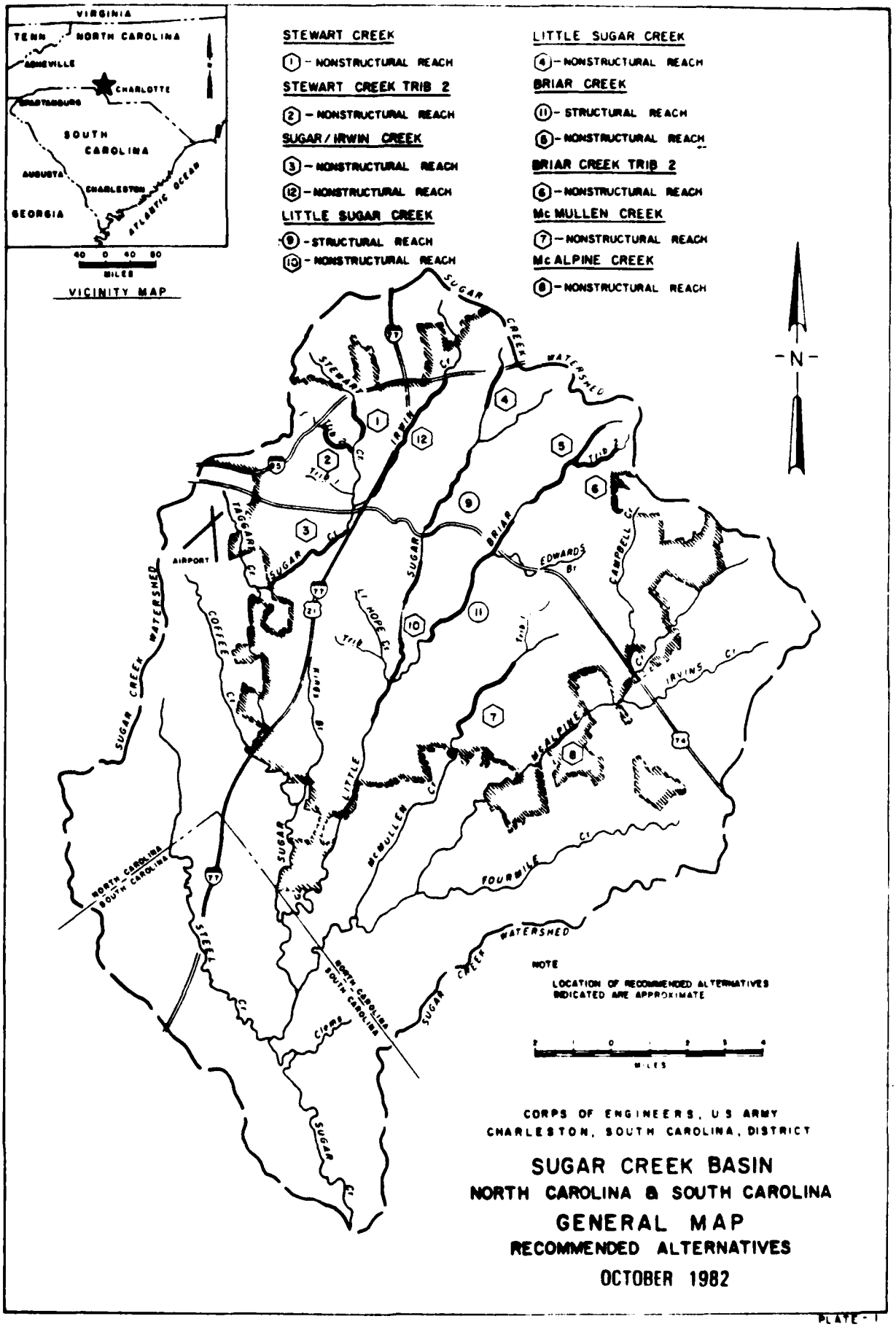
VIRGINIA
TENN
NORTH CAROLINA
ASHEVILLE
CHARLOTTE
SPARTANBURG
SOUTH CAROLINA
AUGUSTA
CHARLESTON
ATLANTIC OCEAN
GEORGIA
40 0 40 80
MILES
VICINITY MAP
STEWART CREEK
1 - NONSTRUCTURAL REACH
STEWART CREEK TRIB 2
2 - NONSTRUCTURAL REACH
SUGAR/IRWIN CREEK
3 - NONSTRUCTURAL REACH
12 - NONSTRUCTURAL REACH
LITTLE SUGAR CREEK
9 - STRUCTURAL REACH
10 - NONSTRUCTURAL REACH
LITTLE SUGAR CREEK
4 - NONSTRUCTURAL REACH
BRIAR CREEK
11 - STRUCTURAL REACH
5 - NONSTRUCTURAL REACH
BRIAR CREEK TRIB 2
6 - NONSTRUCTURAL REACH
McMULLEN CREEK
7 - NONSTRUCTURAL REACH
McALPINE CREEK
8 - NONSTRUCTURAL REACH
N
SUGAR CREEK WATERSHED
STEWART
IRWIN
SUGAR
BRIAR
EDWARDS Br
CAMPBELL Cr
IRVINS Cr
TAGGART Cr
AIRPORT
COFFEE Cr
LI HOPE Cr
LITTLE
McMULLEN Cr
McALPINE
FOURMILE Cr
STEEL Cr
Clems
NORTH CAROLINA
SOUTH CAROLINA
NOTE
LOCATION OF RECOMMENDED ALTERNATIVES INDICATED ARE APPROXIMATE
MILES
CORPS OF ENGINEERS, U S ARMY
CHARLESTON, SOUTH CAROLINA, DISTRICT
SUGAR CREEK BASIN
NORTH CAROLINA & SOUTH CAROLINA
GENERAL MAP
RECOMMENDED ALTERNATIVES
OCTOBER 1982

PLATE - 1

END

FILMED

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