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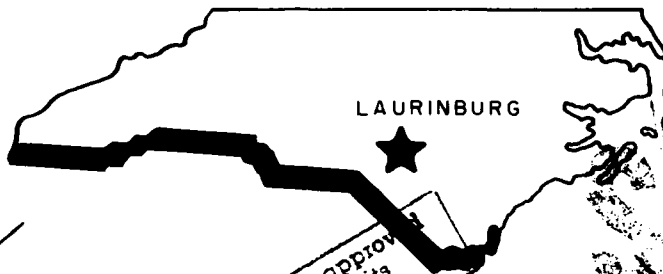
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# LEITH CREEK

Scotland County, N.C.

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## DETAILED PROJECT REPORT



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PREPARED BY

THE

CORPS OF ENGINEERS, U. S. ARMY

CHARLESTON, SOUTH CAROLINA, DISTRICT

SUBMITTED:

JANUARY 1977

REVISED:

JULY 1977



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DEPARTMENT OF THE ARMY

CHARLESTON DISTRICT, CORPS OF ENGINEERS

P O BOX 919

CHARLESTON, S.C. 29402

SACEN-PF

12 January 1977

SUBJECT: Leith Creek, Scotland County, North Carolina -  
Submission of Detailed Project Report and Negative Declaration  
of Environmental Effects

Division Engineer, South Atlantic  
ATTN: SADPD-P

1. References:

- a. ER 1105-2-50
- b. SADYR (11 Jul 72) 3d Ind dated 21 November 1972, subject "Reconnaissance Report, Leiths Creek, Scotland County, North Carolina."
- c. SADPD-P (26 Feb 76) 1st Ind dated 7 May 1976, subject "Leith Creek, Scotland County, North Carolina".
- d. SACEN-PF (26 Feb 76) 2nd Ind dated 14 December 1976, subject "Leith Creek, Scotland County, North Carolina".

2. In accordance with instructions contained in reference 1a, fifteen (15) copies of the Detailed Project Report and Negative Declaration of Environmental Effects for subject project are submitted for review and approval. All comments contained in reference 1c on the draft submittal of subject reports have been complied with in reference 1d. General authorization for this study is provided by Section 205 of the Flood Control Act of 1948, as amended. Specific authority is contained in reference 1b. Five copies of both documents have been sent to the State of North Carolina for comment by the Governor.

3. Leith Creek is located entirely within the limits of Scotland County, North Carolina. The creek flows through the City of Laurinburg and forms a political boundary between the Cities of Laurinburg and East Laurinburg. Flood waters from Leith Creek result in damages estimated to average \$26,550 annually. A combination of structural and non-structural flood control measures have been determined to be the best solution for the Leith Creek flood problem.



SACEN-PF

12 January 1977

SUBJECT: Leith Creek, Scotland County, North Carolina -  
Submission of Detailed Project Report and Negative Declaration  
of Environmental Effects

4. The best plan to provide a high degree of protection to the Leith Creek basin would involve construction of channel conveyance improvements at an estimated first cost of \$165,000 and an estimated average annual cost of \$12,800. Total average annual benefits from this plan are estimated at \$23,250. Adverse environmental effects are minimal due to the relatively small size of the project and environmental gains are produced by the recommendation of bridge modifications which in the past have reduced natural channel capacities.

5. Recreational facilities consisting of a greenway with bike trail, picnic facilities and park benches are also recommended as part of the proposed plan. The estimated additional first cost for providing these facilities is \$18,200 which would be apportioned on a 50/50 cost basis between Federal and non-Federal interests. Average annual cost of recreational facilities is estimated to be \$1,700. Total average annual recreational benefits are estimated at \$2,600.

6. Total first cost of the flood control/recreation plan is \$183,200, consisting of \$110,100 Federal cost and \$73,100 non-Federal cost. Average annual costs of \$14,500 when compared to annual benefits of \$25,850 yield a benefit-to-cost ratio of 1.78.

7. It is recommended that the Detailed Project Report and Negative Declaration of Environmental Effects be approved in order to facilitate preparation of Plans and Specifications and initiate project construction when funds are available.

2 Incl (15 cys)  
as

*for William C. Mattei*

HARRY S. WILSON, JR.  
Colonel, Corps of Engineers  
District Engineer

WILLIAM C. MATTEI  
Major, Corps of Engineers  
Deputy District Engineer

SADPD-P (12 Jan 77) 1st Ind

SUBJECT: Leith Creek, Scotland County, North Carolina - Submission  
of Detailed Project Report and Negative Declaration of  
Environmental Effects

DA, South Atlantic Division, Corps of Engineers, 510 Title Building,  
30 Pryor Street, S. W., Atlanta, Georgia 30303 18 March 1977

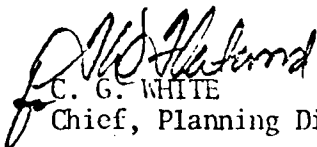
TO: District Engineer, Charleston, ATTN: SACEN-PF

1. After one review of draft DPR's, it is our objective to forward the finalized report to OCE for approval subject to minor comments. Because of the major omissions outlined in Inclosure 2, the Leith Creek DPR cannot be processed to OCE. The report must include reasonable cost data and detailed information on environmental aspects of any recommended plan. Additionally, all coordination must be included in the DPR if it is to be forwarded to OCE for approval.

2. Accordingly, the report and negative declaration are returned for revision in accordance with the attached comments.

FOR THE DIVISION ENGINEER:

3 Incl  
wd 1 cy ca Incl 1 & 2  
added 1 Incl  
3. SAD Comments, 18 Mar 77

  
C. G. WHITE  
Chief, Planning Division

3

A1 23  
GAD



SACEN-PS (12 Jan 77) 2nd Ind.

SUBJECT: Leith Creek, Scotland County, North Carolina.  
Submission of Detailed Project Report and Negative  
Declaration of Environmental Effects.

DA, Charleston District, Corps of Engineers, P. O. Box 919,  
Charleston, South Carolina 29402 28 March 1977

TO: Division Engineer, South Atlantic, ATTN: SADPD-P

1. The following is in response to Division Comments contained in Inclosure 2 of 1st indorsement to subject letter. Comments 1a-1c are based on comments to the original draft submittal while comments 2-6 represent new comments on the final report. District responses to subject comments are as follows:

a. Comment 1a: Comment 1a stated that SAD comment 2 to the draft report should be complied with by adding a table entitled, "Effect Assessment Summary", with each appropriate item as listed in Appendix C of ER 1105-2-240 shown on the table and discussed. Appendix C of ER 1105-2-240 lists specific items to be identified and evaluated. It further states that, even if the items are not significant, they should also be noted. However, paragraph 5 of ER 1105-2-921, dated 10 November 1975, specifically states that the System of Accounts satisfies the display requirement of Section 122 guidance (ER 1105-2-240). Therefore, in accordance with this regulation, a separate table for Section 122 items is not required. Paragraph 5 further states that only significant beneficial or adverse contributions will be displayed. Paragraph 24 of ER 1105-2-921 also states that the effects listed in Section 122 will be identified, assessed, and evaluated. If significant, they will be displayed in the System of Accounts and, when displayed, they will be asterisked. In response to comment 2 on the draft DPR, the Charleston District provided SAD with a list of Section 122 items and their locations in the System of Accounts. All significant Section 122 items were also identified with an asterisk in the S of A. Therefore, Charleston District is of the opinion that, in accordance with ER 1105-2-921, the requirements of Section 122 are sufficiently addressed to enable reviewers to make a decision on the project. However, in order to comply with Appendix C of ER 1105-2-240, it is recommended that the System of Accounts be footnoted to list the Section 122 items which have insignificant project effects. This requires revision of only one page.

b. Comment 1b: This comment states that the first paragraph on page 24 should be expanded to clearly explain the disposal plan and the use of Section 404 guidelines in the selection of disposal areas. This comment also questions ponding behind the mounds, open spaces in the mounds for drainage, and adverse effects of future flooding, including SPF on the disposal mound. This comment could be answered by indorsement to the subject report. Disposal mounds will be shaped to allow for drainage and to break the continuity of the proposed bike trail as mentioned in



SACEN-PS (12 Jan 77) 2nd Ind.

28 March 1977

SUBJECT: Leith Creek, Scotland County, North Carolina.  
Submission of Detailed Project Report and Negative  
Declaration of Environmental Effects.

the Negative Declaration. There are no tributaries to Leith Creek on banks where spoil disposal is recommended; therefore, no bridges will be required for the bike trail which is proposed for construction on the mound. Section 404 guidelines will be adhered to in the selection of final disposal areas and appropriate coordination will be made during the pre-construction planning phase.

c. Comment 1c: SAD Comment 11c to the draft DPR required an additional paragraph in the section of the main report concerning local cooperation requirements. This paragraph was unintentionally omitted in the final draft of the DPR. Compliance with this comment only requires revision of page 37 of the DPR.

d. Comment 2: Comment 2 states that the unit price estimates for excavation are too low and that E & D and S & A costs are excessive. The unit price for excavation (\$.85/cy) is based on September 1976 prices. This estimate is in line with actual bid estimates received in September 1976 for a similar project on Kingstree Branch, South Carolina, which is in the same geographic vicinity of Laurinburg. Excavation quantities are also very similar (33,500 cy for Kingstree Branch, as compared to 34,700 cy for Leith Creek). Unit bid prices received for Kingstree Branch excavation were \$.90, \$.85, \$.85 and \$1.25/cy. The Government estimate was \$.80/cy. The \$.85/cy for Leith Creek is well in line with the Kingstree Branch bid prices. Unit price estimates for excavation include mobilization and demobilization costs. Grading and compaction costs as included in the suggested \$1.25 unit price estimate for excavation are not included in the DPR cost estimates for excavation. Grading costs are reflected in shaping and seeding cost estimates. E & D and S & A cost estimates are based on estimates of work required to accomplish the desired results rather than simply applying the suggested 12% and 10% rates. The suggested rates, when applied to the relatively low contract price estimate of \$68,900, would not provide sufficient funds to accomplish the required work.

Compliance with comment 2 will require substantial report revision as all alternative plans considered are based on similar unit prices. The increased unit price for excavation would render Alternative Plan 2 as economically unfeasible which would affect the entire project formulation section. The Charleston District is of the opinion that cost estimates presented in the DPR are reasonable and sufficient for the decision-making process. Modification of these estimates as suggested in Comment 2 will require approximately two man weeks and result in needless delays. The suggested price modifications will have no effect on final project recommendations as each effected alternative will have proportionate increase in cost. Therefore, in view of the above, the District recommends that cost data presented in the DPR remain unchanged.

SACEN-PS (12 Jan 77) 2nd Ind.

28 March 1977

SUBJECT: Leith Creek, Scotland County, North Carolina.  
Submission of Detailed Project Report and Negative  
Declaration of Environmental Effects.

e. Comment 3: As stated in paragraph 2 of the basic letter, five copies of the DPR and Negative Declaration were sent to the State of North Carolina for comment by the Governor. These reports were mailed the same date as the final reports were sent for Division review. The District felt it was inappropriate to hold the report in the District until State review was complete. Therefore, the report was forwarded for review without formal state coordination. To date, no formal reply has been received endorsing subject report. However, verbal contact with representatives of the State of North Carolina indicates that subject documents have been reviewed and received favorable comment. State indorsement of the subject report is expected on or about 14 April 1977. Copies of the letter from the State of North Carolina will be forwarded for inclosure in the report upon receipt. Also, as stated in comment 3, correspondence from Fish and Wildlife is in draft form. A formal response was requested on two occasions but never received, therefore, the draft correspondence was included.

f. Comment 4: Proposed changes in the EIS procedures require that environmental assessments accompany the DPR's; they also make provisions for separate binding of the two documents for administrative purposes. The Leith Creek DPR and Negative Declaration were not bound together for two reasons: First, those in attendance at the public meeting only requested copies of the environmental assessments. These persons did not express any desire for copies of the DPR which has been made available to the public by the local sponsor. Secondly, due to the lack of significant impacts, the technical data and step by step analysis presented in the DPR was not required to understand the conclusions made leading to a negative declaration. Since binding of the two documents is optional, their separate bindings should not be considered a major omission.

Comment 4 also state that more discussion should be included concerning impact assessments of the disposal areas. Discussion of the disposal areas in the section entitled "Effect of the Plan on Environment" included loss of vegetation, temporary erosion and siltation, and better drained soils for a very narrow strip along the creek. These impacts are further detailed in the System of Accounts and the Negative Declaration. Location of disposal sites was discussed in the Design section of the DPR and shown on plate E-10. For the reach of the project between Gill Street and Church Street, no Section 404 coordination will be required except for a short reach where bank stabilization is recommended. In the reach below Church Street Section 404 coordination may be required, depending upon final selection for spoil disposal sites in this reach. If possible, wetlands disposal will be avoided. All formal Section 404 coordination will be made during pre-construction planning after final selection of disposal areas.

SACEN-PS (12 Jan 77) 2nd Ind.

28 March 1977

SUBJECT: Leith Creek, Scotland County, North Carolina.  
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g. Comment 5: Comment 5 suggests that views of Federal agencies be summarized with a few sentences of support or conflict and making reference to the detail in Appendix 2. This comment is in compliance with suggested report format and should be complied with in future reports. Inclosure or omission of the review summaries, however, is of minor consequence and should have little effect in determining adequacy of the report.

h. Comment 6: Comment 6 as was explained on page 5 of the Negative Declaration, the cost sharing for recreational features of the proposed plan would be borne by Scotland County rather than the City of Laurinburg, as the County is now the sole organization which funds recreation in the project area. Mr. Scott's letter of 29 October 1976, which appears in both the DPR and Negative Declaration, accurately reflects the current situation. The County and City have expressed their wish to cooperate with the Corps in developing a greenway in the floodplain, but pending the completion of a county-wide master plan, the County has not yet fully committed itself to 50 per cent of the recreation costs. A guarantee from the local sponsor is not required to include the recreational features as part of the plan. Both the County and the City are aware that such a commitment would have to be made before the project could proceed to construction. Requirements for cost sharing on recreation can be included as a local cooperation item as a revision to page 37 of the DPR.

2. Compliance with all comments contained in Inclosure 2 of the 1st Indorsement will require the expenditure of an additional \$3,750. To date, \$103,420 has been expended for preparation of the DPR in an effort to justify Federal expenditure of less than \$100,000 for project construction. The expenditure of an additional \$3,750 will have little effect on deciding whether or not a project is justified. The District recommends compliance with comments 1-a, 1-c and 6 through the submittal of revisions to pages 19 and 37 of the DPR. Other comments are of insignificant consequence and can be handled by indorsement if required. Revision of pages 19 and 37 should be adequate for submittal to OCE for project authorization at very little expense. However, should SAD require complete compliance with all comments, the District then recommends that an additional \$3,750 be allotted to Charleston District for Leith Creek.

wd all incl



HARRY S. WILSON, JR.  
Colonel, Corps of Engineers  
District Engineer

SADPD-P (12 Jan 77) 3d Ind

SUBJECT: Leith Creek, Scotland County, North Carolina,  
Submission of Detailed Project Report and Negative  
Declaration of Environmental Effects

DA, South Atlantic Division, Corps of Engineers, 510 Title Building,  
30 Pryor Street, S. W., Atlanta, Georgia 30303 25 April 1977

TO: District Engineer, Charleston

1. Your responses to SAO comments of 18 March 1977 have been considered and the following remarks on your responses are furnished:

a. Section 122 requires the evaluation of certain impact effects and a report summary included on their significance. This must be accomplished in narrative or tabular form as indicated by ER 1105-2-240. In order to minimize report preparation, it has been our suggestion to combine the Summary of Section 122 Effects in the System of Accounts Summary which is also required under Principles and Standards per instructions in ER 1105-2-941. For this reason, we do not feel there is a conflict between the two ER's. For this report, your suggested approach using footnotes to the System of Accounts to list the Section 122 items which have insignificant project effects is acceptable.

b. The requirements for Section 404 evaluation must be complied with by the District before approval will be granted by the Chief of Engineers. See EC 1165-2-125, dated 31 January 1977, particularly paragraph 7a(2) and paragraph 8. The evaluation must also be reflected in the assessment and Negative Declaration. A public notice should be prepared and released on the proposed actions before the report is resubmitted.

c. Concur with your proposed action.

d. We have reviewed the bids on Kingstree Branch, and your rationale for using one selected item from those bids is not acceptable. Contractors tend to unbalance their bids so as to go heavy on those items that will be completed early in the contract. Thus in the case of Kingstree Branch, the low bidder chose the clearing item to get working capital. The government estimate cannot be unbalanced. Therefore, realistic prices must be used no matter what and how contractors bid on one item of a multiple item bid. We still feel the estimated cost for the Leith Creek project is low. If the project is approved at the present cost, and if it were awarded today, we feel you would not get a bid under \$80,000 and a program problem would exist. There is still a need for better estimating at this stage of planning.

SADPD-P (12 Jan 77) 3d Ind

25 April 1977

SUBJECT: Leith Creek, Scotland County, North Carolina,  
Submission of Detailed Project Report and Negative  
Declaration of Environmental Effects

e. It is standard practice to have all coordination completed before the DPR is submitted. This should include a letter of intent from the local sponsor on cost sharing if recreation is a feature of the reconnaissance plan. The letter from the county is not considered sufficient to show intent of participation. The report should not be resubmitted until all coordination and State indorsement is received by the District.


f. We concur with your response to keep the environmental assessment separate from the DPR. However, you should be prepared to include the assessment in future reports as an appendix. As noted in paragraph 1.b. above, a Section 404 evaluation must be made now in the DPR stage.

g. Concur.

h. Concur.

2. The revised report incorporating the above comments should be submitted after all coordination is accomplished and the Section 404 public notice has been distributed for 30 days.

FOR THE DIVISION ENGINEER:

  
DANIEL D. HALL  
Colonel, Corps of Engineers  
Deputy Division Engineer

# LEITH CREEK SCOTLAND COUNTY, NORTH CAROLINA

A STUDY TO DETERMINE THE FEASIBILITY OF PROVIDING FLOOD  
CONTROL AND RELATED WATER RESOURCE IMPROVEMENTS ON LEITH  
CREEK IN THE VICINITY OF LAURINBURG, NORTH CAROLINA



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

**JANUARY 1977**

# Syllabus

The purpose of this study was to investigate flood problems associated with high flows from Leith Creek with a view to determining the need for and feasibility of improvements to solve the flood problems. Subject study was conducted in response to a request by the City of Laurinburg, North Carolina.

Leith Creek is located entirely within the limits of Scotland County, North Carolina. The creek flows through the City of Laurinburg and forms a political boundary between the Cities of Laurinburg and East Laurinburg. Flood waters from Leith Creek result in damages estimated to average \$26,550 annually. A combination of structural and non-structural flood control measures have been determined to be the best solution for the Leith Creek flood problem.

The best plan to provide a high degree of protection to the Leith Creek basin would involve construction of channel conveyance improvements at an estimated first cost of \$181,000 and an estimated average annual cost of \$13,900. Total average annual benefits from this plan are estimated at \$23,250. Adverse environmental effects are minimal due to the relatively small size of the project and environmental gains are produced by the recommendation of bridge modifications which in the past have reduced natural channel capacities.

Recreational facilities consisting of a greenway with bike trail, picnic facilities and park benches are also recommended as part of the proposed plan. The estimated additional first cost for providing these facilities is \$18,200 which would be apportioned on a 50/50 cost basis between Federal and non-Federal interests. Average annual cost of recreational facilities is estimated to be \$1,700. Total average annual recreational benefits are estimated at \$2,600.

Total first cost of the flood control/recreation plan is \$199,200. Average annual costs of \$15,600 when compared to annual benefits of \$25,850 yield a benefit-to-cost ratio of 1.66.

LEITH CREEK  
SCOTLAND COUNTY, NORTH CAROLINA

**DETAILED PROJECT REPORT**

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**LEITH CREEK  
SCOTLAND COUNTY, NORTH CAROLINA**

**DETAILED PROJECT REPORT**

**The Study and Report**

**PURPOSE AND AUTHORITY**

Due to frequent flood damages experienced by flood conditions on Leith Creek, the City of Laurinburg has requested a flood control study under authority contained in Section 205 of the Flood Control Act of 1948, as amended. The purpose of the study is to determine the need for and feasibility of improvements to reduce flood damages resulting from high flows on Leith Creek.

**SCOPE OF THE STUDY**

The studies in this report are for that portion of the Leith Creek Basin which affect the Cities of Laurinburg and East Laurinburg, North Carolina. Studies were concentrated on flood problems and potential solutions to these problems. Other water resource related problems were also investigated in connection with potential flood control alternatives. All reasonable alternative plans to solve the areas flood problems were considered in sufficient detail to determine their feasibility. The selection of the recommended plan was made after careful consideration of all factors, including environmental and social impacts and those expressed by concerned agencies and local interests.

## STUDY PARTICIPANTS AND COORIDNATION

The Charleston District, Corps of Engineers, had the principal responsibility for conducting and coordinating the subject study. The study was requested by the City of Laurinburg, North Carolina which cooperated throughout the entire study process. Coordination with various Federal, State and local agencies was made throughout the study and comments received are presented in Appendix 2. A public workshop was held on 20 November 1975, at which time all alternatives presented in this report were present for public review.

## THE REPORT

The results of studies for the Leith Creek Basin are presented in two parts; the main report and two appendixes.

The main report is a nontechnical presentation for both engineers and non-engineers that presents the results of the feasibility studies and a broad view of the overall study. It also contains a system of accounts (S of A) as required by Principles and Standards. The System of Accounts also satisfies the display requirements of Section 122 of the Rivers and Harbors Flood Control Act of 1970.

The first appendix is a technical report following essentially the same sequence as the main report and providing technical information required for an independent evaluation of the validity of the findings. Appendix 2 contains all pertinent correspondence in connection with the study and a transcript of the Public Workshop held 20 November 1975. Appendix 3 contains a reference list for coordination as required by Section 404 of Public Law 92-500.

## PRIOR STUDIES AND REPORTS

The Charleston District, Corps of Engineers, prepared a reconnaissance report on Leith Creek, dated 11 July 1972, which recommended that a detailed study be made under Section 205 of the Flood Control Act of 1948, as amended. No other reports have been prepared. The City of Laurinburg, however, has applied to the Flood Insurance Program and flood insurance is currently available. A flood insurance study is scheduled to begin during Fiscal Year 1977.

# Resources And Economy Of The Study Area

Leith Creek watershed is located in Scotland County in the upper coastal plains section of North Carolina. The watershed consists of a total area of 13.24 square miles above its confluence with Little Creek below the city limits. The Leith Creek flood plain passes through the City of Laurinburg and then forms the political boundary between the Cities of Laurinburg and East Laurinburg. The study scope has generally been limited to that portion of the flood plain located within the city limits of Laurinburg and East Laurinburg where flood damages are experienced. Development within this reach generally consists of low cost housing and several small commercial concerns.

## ENVIRONMENTAL SETTING AND NATURAL RESOURCES

An overall view of the entire watershed is useful in describing the study area. In general, lands in the upper portion of the watershed above the city limits of Laurinburg consist entirely of croplands and forest. The lower portion, generally located within the city limits of Laurinburg and East Laurinburg consist of urban type development, including residential, commercial and industrial development. Park areas and a school are also located in the lower portion of the watershed. Figures 1-5 show photographs of various reaches of Leith Creek within the study limits.

Climate in the area is characteristic of the warm temperate zone. In summer, the days are generally hot and the nights moderately warm. Subfreezing temperatures are experienced periodically during the winter months. Normal annual precipitation averages about 53 inches and is generally well distributed throughout the year.

There are no known places of significant historical or archeological value located within the Leith Creek flood plain. Therefore, construction of a flood control project on Leith Creek is not anticipated to have any adverse effects on historical or archeological values of the study area. An Archaeological Reconnaissance of the study area, prepared by an Archaeologist from nearby St. Andrews Presbyterian College, is included in Appendix 2 of this report.

Scotland County is mainly agricultural in nature. Cotton is the principal cash crop with other important farm crops consisting of corn, tobacco, soy beans and small grain. Beef cattle and poultry are also important farm enterprises.

Soils in Scotland County are acid, strongly leached and generally low in organic matter content. Soils under native forest are low in calcium, magnesium, and potassium because they have a low capacity to store these bases. Soils in the immediate vicinity of Leith Creek, however, are relatively high in organic matter content because water has retarded oxidation.

## HUMAN RESOURCES

The major centers of population, which affect future growth of the Leith Creek Basin, are the cities of Laurinburg and East Laurinburg, of which portions of both are located within the flood plain.

Detailed population information concerning the Leith Creek Basin is not available; however, data for Scotland County is considered to be indicative of the basin area. The population of Scotland County has increased from about 23,000 in 1940 to almost 27,000 in 1970 which represents a compound growth rate of 0.5 percent per year. The following tabulation shows 1970 population characteristics of Scotland County compared with the State of North Carolina.

<u>Item</u>	<u>Scotland County</u>	<u>North Carolina</u>
Population (1,000)	26.9	5,082
Median school years completed	9.6	10.6
Employment		
Non-worker/worker ratio	1.45	1.34
Percent in manufacturing industry	42.0	35.5
Percent in white collar occupation	34.2	38.6
Percent government workers	10.1	13.2
Median Income for families	\$7,030	\$7,774

Data on employed civilian workers by occupational group are available from the 1970 Census of Population. The largest group of workers in Scotland County were operatives, except transportation with about 2,700 or 26.6 percent of the total work force so classified. Craftsmen and foremen, and clerical workers were the second and third largest groups, each containing 13.4 and 11.8 percent respectively.

An indication of the projected future growth, employment, and per capita income for Scotland County is shown graphically on page 5.



A. Leith Creek between S.R. 1645 and U.S. 74 By-pass.



B. Leith Creek – Downstream from McKay Street.

FIGURE 1



C. Leith Creek – Just below McKay Street, looking upstream.



D. Downstream view from Commonwealth Street.

FIGURE 2



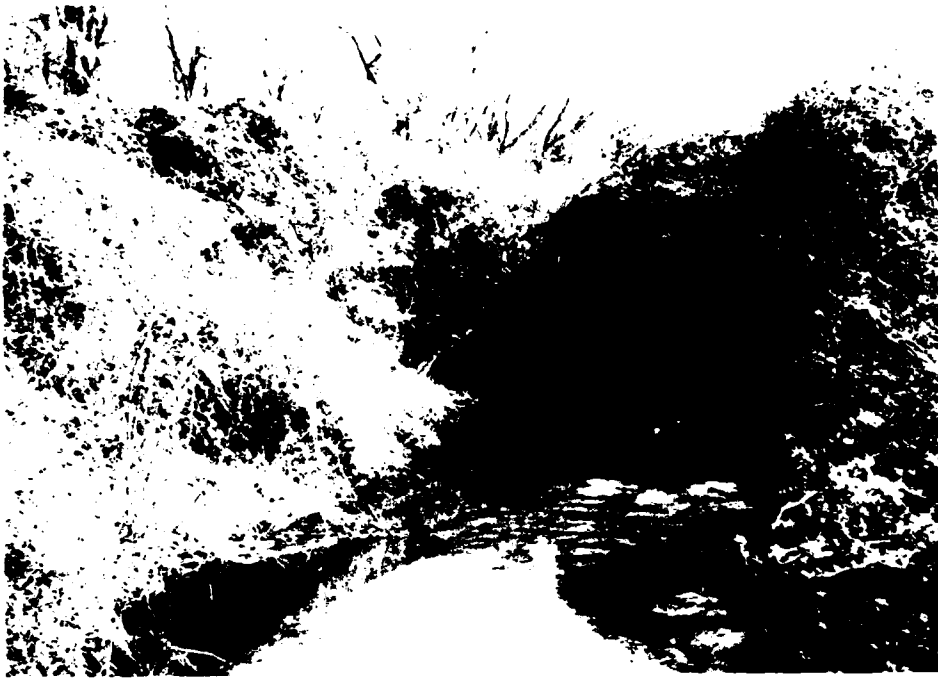


E. Leith Creek – Railroad crossing just above Commonwealth Street.



F. Leith Creek – View looking downstream at North Caledonia Road.

FIGURE 3



G. Leith Creek – View downstream from Carver Street. Note dense privet, honey suckle and blackberry covers which traps trash and debris.



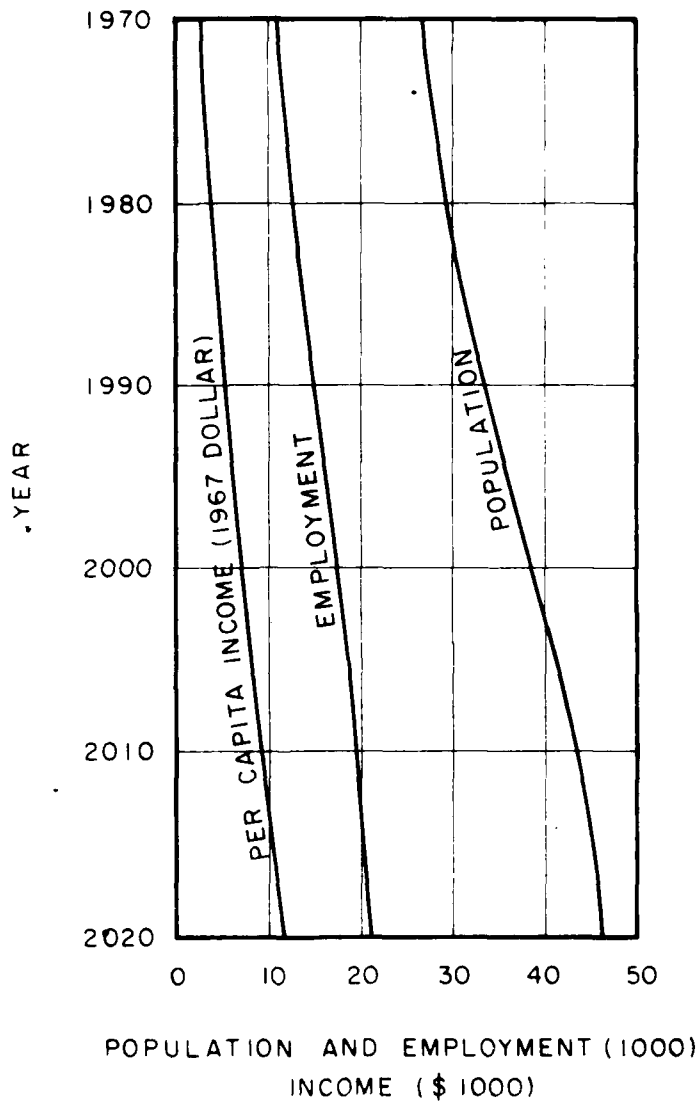
H. Leith Creek – View of debris downstream from McKay Street.

FIGURE 4



I. Leith Creek – View of reach between Gill and North Main Street.

FIGURE 5



HUMAN RESOURCE PROJECTIONS  
SCOTLAND COUNTY, N. C.

## DEVELOPMENT AND ECONOMY

The City of Laurinburg is the principal economic center of Scotland County and serves as the county seat and the major commercial retail center of the area. The City of East Laurinburg adjoins Laurinburg and is generally residential in nature. Although intensive urbanization of the area is not anticipated, significant increase in population can be anticipated as new industry moves into the area. Suburban development is expected to meet housing needs of the future working force.

Population of Scotland County is expected to increase from 26,929 in 1970 to 46,000 by the year 2020. This represents a compound growth rate of 1.06 percent per year as compared to a predicted compound growth rate of 1.25 percent per year for the State of North Carolina. Projected population figures through the year 2020 for Scotland County and North Carolina are shown below.

	<u>1970</u>	<u>1980</u>	<u>1990</u>	<u>2000</u>	<u>2010</u>	<u>2020</u>
Scotland County	26,929	29,500	33,500	38,500	42,500	46,000
North Carolina	5,082,059	5,703,900	6,419,300	7,302,800	8,333,200	9,535,800

The following tabulation shows projected civilian employment trends for Scotland County. This tabulation was formulated based on 1972 Series E, OBERS Projections for the Pee Dee Water Resource Subarea numbered 0304 which includes Scotland County.

	<u>1970</u>	<u>1980</u>	<u>1990</u>	<u>2000</u>	<u>2020</u>
Population	26,929	29,500	33,500	38,500	46,000
Participation Rate %	41	45	45	46	45
Projected Total Employment	10,947	13,275	15,075	17,710	20,700

Future income estimates for Scotland County are based on 1972 Series E, OBERS Projections for the Pee Dee Water Resource Subarea. The per capita personal income projections for 1970-2020 (in 1967 dollars) are shown in the following tabulation.

	<u>1970</u>	<u>1980</u>	<u>1990</u>	<u>2000</u>	<u>2020</u>
Scotland County	\$2,849	\$3,900	\$5,200	\$7,000	\$11,600
North Carolina	\$2,842	\$3,900	\$5,100	\$6,900	\$11,500

The primary development that will have an impact on the area's economy is increased industrial development which will result in the residential development in areas of the county which are currently predominantly agricultural. Also, improved farming techniques will undoubtedly be developed in future years that will increase per acre yields and help bolster the area's economy.

## Problems and Needs

The problems and needs of the Leith Creek Basin that are discussed in this report are concerned primarily with the flood damages that occur to the communities of Laurinburg and East Laurinburg, North Carolina. These are discussed in subsequent pages, along with a description of improvements desired by the local sponsoring organization.

### STATUS OF EXISTING PLANS AND IMPROVEMENTS

There are no existing or pending projects being considered on Leith Creek by city, county, state or other Federal agencies. The City of Laurinburg, however, has applied to the Flood Insurance Program and flood insurance is currently available. A flood insurance study is scheduled to begin during Fiscal Year 1977.

### FLOOD PROBLEMS

For the purposes of this study, study limits were established as U. S. Highway 74 (downstream) and U. S. Highway 15-401 Bypass (upstream). Within this reach, twelve highway crossings and four railroad crossings have been constructed across Leith Creek. In addition, ten utility crossings consisting of five water lines and five sewer mains also cross the creek.

The flood plain of Leith Creek passes through the City of Laurinburg and consists of residential, municipal, and business properties. Floods result from inadequate channel capacity to carry high discharges. Visual

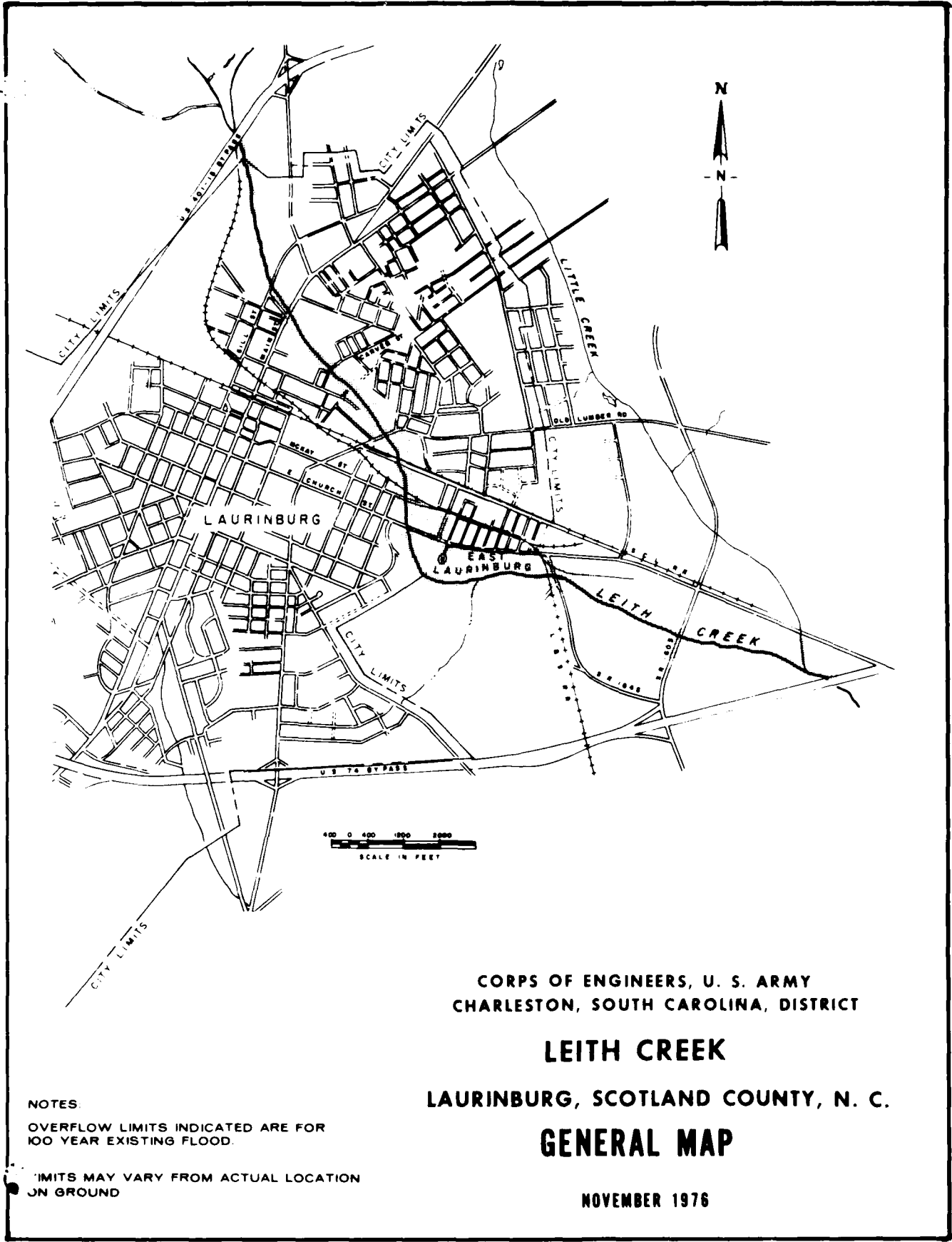
inspection of the creek indicates that little, if any effort has been made to maintain the channel. Evidence of debris and heavy siltation are evident throughout the entire study reach. With the exception of developed areas and park areas, considerable amounts of vegetation and debris restrict the effectiveness of the natural channel.

As shown on the general map, the major damage areas are located within the city limits of Laurinburg and East Laurinburg. Based upon flood elevations computed by backwater computer programs, there are an estimated 65 residential and 17 commercial structures located within the flood plain and susceptible to flood damages. In addition, a school, school lunch room, and gymnasium are also susceptible to damage.

Flood damages along Leith Creek 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 costs 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 appearance 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 located within the flood plain. Flood damage computations consisted of the creation of a logical relationship between flood frequencies, flood stages and flood damages. An economic index station was selected near Caledonia Road which was located in the high damage area and had stage fluctuations representative of the entire damage reach.

Average annual flood 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 by use of backwater computations and plotted to form a stage discharge relationship. Stage damage curves were established for three damage categories (residential, commercial, and public properties) based on field appraisal of individual structures and interviews with local people. 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 the average annual damages. The following tabulation summarizes existing damages.



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

**LEITH CREEK**

LAURINBURG, SCOTLAND COUNTY, N. C.

**GENERAL MAP**

NOTES  
 OVERFLOW LIMITS INDICATED ARE FOR  
 100 YEAR EXISTING FLOOD.

LIMITS MAY VARY FROM ACTUAL LOCATION  
 ON GROUND

NOVEMBER 1976



CATEGORY	AVERAGE ANNUAL DAMAGES
Residential	\$13,500
Commercial	11,500
<b>Public Properties</b>	<u>1,550</u>
Total Damages-Existing Conditions	\$26,550

## OTHER NEEDS

Other community needs associated with the potential development of a flood control project include the following:

- a) The City of Laurinburg has expressed a need to develop additional recreational facilities in the immediate vicinity of Leith Creek; and;
- b) The city has further indicated the need for a sewer line easement adjacent to Leith Creek. Sewer lines could be placed parallel to the creek and thus provide an additional use of land easements which would be required should a channel improvement project be approved.

## IMPROVEMENTS DESIRED

The city manager of Laurinburg submitted a letter requesting assistance to control flooding along Leith Creek. A copy of this letter is included in Appendix 2 of this report. Local people are willing to support a flood control project and have indicated that they will provide the necessary cooperation should a project be recommended and approved. A copy of a letter of intent to meet the requirement of local cooperation is included in Appendix 2.

A public workshop was held in Laurinburg on 20 November 1975. During this workshop, those in attendance had the opportunity to express their opinion on potential flood control alternatives and to make any additional proposals or recommendations concerning flood problems on Leith Creek. A transcript of the workshop has also been included in Appendix 2.

Local representatives have also expressed a desire to include recreational facilities as part of any recommended flood control project. Copies of correspondence from the local sponsors supporting the inclusion of recreation as part of a recommended project are included in Appendix 2 of this report.

# Formulating a Plan

Because of the frequent flooding being experienced in the Laurinburg and East Laurinburg area, and because of the monetary damage that would be incurred by local residents in the event of a major storm, or localized or high intensity, the need for flood control and improvement in the Leith Creek basin is of paramount importance. In order to formulate the best alternative plan of improvement, it is imperative to consider all appropriate alternative plans and to assess all project effects - tangible and intangible, favorable and unfavorable.

## FORMULATION AND EVALUATION CRITERIA

Formulation and evaluation of the plans of improvement for Leith Creek, including all possible alternatives, were based on technical, economic, and intangible criteria summarized in the following paragraphs. Such criteria permit the selection of the plan of improvement which represents the solution that best responds to the problems and needs of the area.

### Technical Criteria

Technical criteria used for the formulation and evaluation of alternative solutions to the flood problems on Leith Creek are consistent with established Corps of Engineers Regulations. These regulations provided guidance for carrying out the various task of multiobjective planning, consistent with the Water Resource Councils, Principles and Standards and related policies.

### Economic Criteria

The economic criteria which were applied in formulating a plan are those specified by the Principles and Standards. Economic benefits were developed in accordance with instructions contained in related Engineering Regulations. Additional economic criteria used to develop the recommended plan include the following:

- a. A National Economic Development (NED) Plan was formulated to maximize the net economic benefits while addressing project objectives.
- b. Tangible benefits exceeded cost for the NED Plan.
- c. All prices applied to estimated construction quantities are based on September 1976 estimates.
- d. A project life expectancy of 50 years and an interest rate of 6-3/8% were used in computing project costs.

e. Estimated construction time of the project was less than one year, therefore, no interest was included during construction.

#### Environmental and Other Criteria

The following environmental criteria and intangibles were considered in formulating a plan.

- a. An Environmental Quality (EQ) Plan was formulated with the goal of making the most significant contribution to preserving, maintaining, restoring, and/or enhancing the cultural and natural resources of the study area.
- b. All alternatives considered were compatible insofar as practical with the surrounding environment.
- c. All efforts were made to avoid detrimental environmental effects and whenever feasible, mitigating features were considered for such effects.
- d. Public health, safety and social well being were considered when formulating all alternatives.
- e. Public acceptance of various alternatives was considered in formulating each plan and feasible alternatives were coordinated with interested agencies and individuals through correspondence, public meetings and other procedures.

#### POSSIBLE SOLUTIONS

Several alternative measures to satisfy the problems and needs of the area are possible; however, some of these measures are not practical or economical. Possibilities include:

- a. Nonstructural measures such as zoning and building code regulations, flood proofing of both individual buildings or groups of buildings and permanent or temporary evacuation of flood plain areas.
- b. Structural measures such as reservoirs, levees and channel conveyance improvements.
- c. A combination of structural and nonstructural measures.

Zoning and building code regulations are legal measures that could be implemented and enforced by the regulating agency concerned to effectively reduce the flood damage potential of an area in accordance with a planned program of development and land use. Such action would be desirable in the Leith Creek problem area in order to preclude possible future development that would suffer large damages under flood conditions.

Flood proofing might include raising existing and future homes, protecting roads and utilities, and diking around individual buildings or areas to be protected. This type of flood protection may prove effective for commercial and public properties within the flood plain, however, residential structures consist generally of low cost frame housing which would be difficult to flood proof with cost being higher than the benefits will justify.

Permanent evacuation of the flood plain might involve removal of all buildings and personal property and converting the land to recreation or scenic areas which would not be seriously damaged by floodflows. Temporary evacuation would involve the establishment of an early warning system to predict flooding in sufficient time to conduct an orderly evacuation of the flood plain. However, due to the smallness of the watershed, a reliable flood forecasting system would be difficult to implement.

Flood insurance provides an additional nonstructural alternative to the flood problems of Laurinburg and East Laurinburg. This program is designed to provide flood insurance at rates made affordable through a Federal subsidy. Qualifying communities must adopt and administer local measures to protect lives and new construction from future flooding. The City of Laurinburg has applied for Flood Insurance and a Flood Insurance Study is scheduled for Fiscal Year 1977.

With an emphasis on nonstructural solutions a nonstructural alternative was formulated to protect all structures within the flood plain. The alternative consisted of flood proofing or relocating each individual structure. Structures which could not be flood proofed or physically relocated were assumed to be demolished and the occupants were relocated and provided with minimum standard housing. Estimated first cost of this alternative was \$770,200. Average annual costs of \$51,400 when compared with benefits of \$26,550 yielded an unfavorable benefit-to-cost ratio of 0.52.

Structural solutions offer a broad field of alternatives to alleviate flood damages. These alternatives include measures designed to modify floods by altering the natural environment. These modifications include efforts to divert floods; to change the timing and duration of floods, or; to restrict floods from portions of the flood plain.

Reservoirs provide a structural alternative to control flooding by storing runoff and thus reducing the peak flows downstream. However, investigations of the Leith Creek Basin revealed a lack of suitable sites for reservoir construction. No further study was made for this alternative.

Levees provide an alternative structural solution by restricting floods from portions of the flood plain highly susceptible to flood damage. The numerous road crossings over Leith Creek, however, render this type of improvement infeasible. An estimated nine road crossings would require substantial modification in order to implement an effective levee system. In addition, an interior drainage problem would be created by levee construction which would require a system of drainage ditches and pumps.

Channel Conveyance Improvement consists of various modifications to the existing channel which result in an increased flow capacity. These modifications include: cleaning; deepening; widening and/or channel re-alignment. Channel conveyance improvement is the most feasible structural alternative to flood problems associated with high water from Leith Creek.

Thus far, structural and nonstructural alternatives have been considered separately. However, a combination of structural and nonstructural alternatives may provide the best solution to the flood problems on Leith Creek. As previously discussed, nonstructural solutions are not sufficient to alleviate flood damages to existing structures. A structural alternative will be required to effectively reduce existing damages. Future development, however, is a different story. Without some type of flood plain regulation, future development can encroach the flood plain and thus reduce the effectiveness of a flood control project. In consideration of the above, any recommended structural solution to the flood problems on Leith Creek will be accompanied with a requirement that the local community establish and enforce flood plain regulations for the residual flood plain.

## ALTERNATIVES CONSIDERED FURTHER

As a result of reconnaissance studies and preliminary estimates, potential solutions to the flood problems which were clearly impractical or unfeasible were eliminated early in the course of study in order to concentrate on feasible alternatives. Reservoir and levee alternatives were not considered beyond the preliminary study phase which proved them to be infeasible.

Channel conveyance improvement in the form of cleaning and/or enlarging the existing channel offers the most practical method of reducing flood damages along Leith Creek. In order to formulate the most feasible channelization alternative, five basic channel plans were prepared and analyzed. All five plans are similar in that they begin at the L & S Railroad crossing immediately upstream of State Road 1645 and end at Gill Street (See Plate 1). Each plan also calls for the removal and/or replacement of the McKay and Carver Street Bridges. Plans 1 and 2 are designed with varying bottom slopes ranging from .0068 ft/ft to .00214 ft/ft. These plans also call for modification of the Laurinburg and Southern Railroad immediately upstream from McKay Street. Plans 3 and 4 are designed with varying bottom slopes ranging from .0015 ft/ft to .00086 ft/ft and do not recommend any railroad modifications. The fifth plan of improvement was designed to provide a 200 foot floodway for the entire project length without channel excavation. Each plan is discussed individually in the following paragraphs and a summary is presented on Plate 1.

Channel Conveyance Improvement Plan 1 begins at the Laurinburg and Southern Railroad and continues to Gill Street, a total project length of 1.97 miles. This plan calls for the deepening of the existing channel and widening. Design bottom widths vary from 35 feet in the reach between the L & S Railroad and Church Street; then 30 feet to the end of the project at Gill Street. Also included in the plan recommendation are the modification of two highway bridges and one railroad culvert as previously discussed. Plan 1 would reduce the maximum stage of the 100 year frequency flood by about 2.9 feet. The estimated first cost of the plan is \$318,700 and the annual charges \$23,100 including maintenance. Annual benefits of \$24,400 yield a benefit-to-cost ratio of 1.05.

Channel Conveyance Improvement Plan 2 is similar to Plan 1 in all respects except channel bottom widths. Design bottom widths for Plan 2 vary from 45 feet in the reach between the L & S Railroad and Church Street; thence, 40 feet to the end of the project at Gill Street. Plan 2 would reduce the maximum stage of the 100 year frequency flood by about 3.3 feet. The estimated first cost of this plan is \$365,000 and annual charges, \$27,000 including maintenance. Annual benefits of \$24,600 yield a benefit-to-cost ratio of 0.93.

Like Plans 1 and 2, Channel Conveyance Improvement Plan 3 begins at the Laurinburg and Southern Railroad and continues to Gill Street, a total project length of 1.97 miles. This plan avoids modification of the L & S Railroad crossing immediately upstream of McKay Street. Design bottom widths for Plan 3 vary from 35 feet between the lower project limits and North Main Street, to 30 feet in the short reach between North Main and Gill Streets. Plan 3 would reduce the maximum stage of the 100 year frequency flood by about 1.8 feet. The estimated first cost of this plan is \$181,000 and annual charges \$13,900. Annual benefits of \$23,250 yield a benefit-to-cost ratio 1.67.

Channel Conveyance Improvement Plan 4 is similar to Plan 3 in all respects except bottom widths. Design bottom widths for Plan 4 vary from 45 feet between the lower project limits and North Main Street, to 40 feet in the short reach between North Main Street and Gill Street. Plan 4 would reduce the maximum stage of the 100 year frequency flood by about 2.0 feet. The estimated first cost of this plan is \$203,400 and annual charges, \$15,400 including maintenance. Annual benefits of \$24,000 yield a benefit-to-cost ratio of 1.56.

Channel Improvement Plan 5 was designed to test the effect of providing a floodway for high flows and avoiding channel excavation. This plan recommends the construction of a 200 foot wide floodway in the reach between the L & S Railroad and Gill Street. The floodway would be grassed and mowed at frequent intervals to prevent obstructions to flow. Bridge modifications are the same as recommended for Plans 3 and 4. Plan 5 would reduce the maximum stage of the 100 year frequency flood by about 1.9 feet. The estimated first cost of the plan is \$161,200 and the annual charges, \$12,800 including maintenance. Annual benefits of \$16,700 yield a benefit-to-cost ratio of 1.30.

Plate 1 summarizes pertinent data relative to each of the alternatives discussed in the preceding paragraphs. Tables 1 and 2 summarize significant beneficial and adverse contributions of each alternative carried through the final planning stage.

## Selecting a Plan

The selection of the best plan of improvement for Leith Creek involved the comparison of the various alternatives which met the formulation and evaluation criteria outlined earlier. Consideration was given to environmental effects, social well-being, the regional development and the national economic development. During the selection process, all alternatives were presented to the public at a public workshop held at the Scotland County Courthouse on 20 November 1975. The transcript of the workshop and all subsequent correspondence is presented for review in Appendix 2.

### System of Accounts

The System of Accounts (S of A) is a display requirement of the Water Resource Council, "Principles and Standards" and is an integral part of the planning process. The System of Accounts displays all significant beneficial and adverse contributions of each alternative carried through the final planning stage and provides a useful tool to assist in the selection process. The S of A also satisfies the display requirements of Section 122, Public Law 91-611, River and Harbor and Flood Control Act of 1970. Table 1 displays the breadth and detail of the assessment and evaluation of all alternative plans. Table 2 summarizes Table 1 and presents the crucial planning consideration underlying each alternative. Table 2 is presented later in this report in the section entitled "Statement of Findings".

### The NED Plan

The Principles and Standards require the designation of 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. Basically, two structural types of channel improvement were considered. Plans 1 and 2 recommended deepening and widening while the remaining plans generally avoided deepening the existing channel. In consideration of the above, two plans emerged as candidates for the NED Plan. Of the deepening alternatives (Plan 1 and 2), Plan 1 resulted in the greatest amount of excess benefits over costs. Of the non-deepening alternatives (Plan 3-5), Plan 3 resulted in the greatest amount of excess benefits over costs. However, in consideration of the net amount of excess benefits, Plan 3 edged out Plan 1. Therefore, of all plans considered, Plan 3 is the plan which best addresses the planning objectives while maximizing net economic benefits. Plan 3 is the NED Plan.





Table 1  
(continued)  
SYSTEM OF ACCOUNTS

	Plan 1	Plan 2	Plan 3	Plan 4	Plan 5	Non-structural Plan 6	No Action Plan 7
Environmental quality degraded	(1) Selective clearing of vegetation (27.3 acres). Cleared area would be seeded with grass, and other vegetation could be re-established. 1.6, 9- (a) Small portion of habitat in immediate area for birds, squirrels & other small wildlife will be lost until vegetation is re-established. That portion lost is of marginal value. (b) Creek cover for fish habitat will be decreased on one side until vegetation is re-established. (2) Destruction of existing bottom flora and invertibrates. Some re-estabishment with time. 1.6, 9	(1) Loss of vegetation with same adverse impacts described for Plan 1, except that impacts with greater proportion to the amount of vegetation cleared (25.43 acres for Plan 2). 1.6, 9- (2) Same as Plan 1	(1) Plan 3 requires the least amount of clearing of all five structural plans. Impacts due to loss of vegetation for Plan 3 would be similar to Plan 1, but less severe, due to less amount of clearing required (12.97 acres). Plan 4 requires more cover loss than Plan 3, and a wider permanent creek bed clearing required (11.26 acres for Plan 3). 1.6, 9	(1) Impacts due to loss of vegetation with Plan 4 would be similar to Plan 1, but less severe, due to the lesser amount of clearing required (12.97 acres). Plan 4 requires more cover loss than Plan 3, and a wider permanent creek bed clearing required (11.26 acres for Plan 3). 1.6, 9	(1) Impacts due to loss of vegetation with Plan 5 are the most severe of all plans. More clearing is required (47.8 acres) than for all other plans. Vegetation could not be re-established as removal of the flood control benefits of this plan. 1.6, 9	(1) No clearing or cover loss. (a) No clearing or cover loss.	(1) Same as for Non-Structural Plan - No degradation.
Social well being	(1) Flood waters containing raw sewage would be more confined to creek channel. 1.4, 9	(1) Same as Plan 1, except that Plan 2 provides greater channel capacity. 1.4, 9	(1) Same as Plan 1, except that Plan 3 provides less channel capacity. 1.4, 9	(1) Same as Plan 1, except that Plan 4 provides slightly less channel capacity. 1.4, 9	(1) Same as Plan 1, except that Plan 5 provides no channel improvements, or the least control of the structural plans. 1.4, 9	(1) Removal of some homes from flooded area and health problems, removal of some open sewerage facilities. Flooding would continue to cause homes susceptible to sewage back problems, which were flood proofed would remain. 1.4, 9	(1) No change in water table.
Structural impacts	(1) Excavation proceeds deeper than the more recent sediment & silt deposits, draining of soils is possible. 1.4, 9	(1) Same as Plan 1, except that Plan 2 provides greater channel capacity. 1.4, 9	(1) Same as Plan 1, except that Plan 3 provides less channel capacity. 1.4, 9	(1) Same as Plan 1, except that Plan 4 provides slightly less channel capacity. 1.4, 9	(1) Same as Plan 1, except that Plan 5 provides no channel improvements, or the least control of the structural plans. 1.4, 9	(1) Removal of some homes from flooded area and health problems, removal of some open sewerage facilities. Flooding would continue to cause homes susceptible to sewage back problems, which were flood proofed would remain. 1.4, 9	(1) No change in turbidity or sediment load.



### The EQ Plan

The Principles and Standards also require the designation of an Environmental Quality Plan (EQ Plan). This plan is described as the plan which will make the most significant contribution to preserving, maintaining restoring, or enhancing cultural and natural resources. The existing conditions of the creek weighed heavily in selecting an EQ Plan. The existing channel bottom exhibits strong evidence of heavy siltation in the past. Therefore, the alternatives of deepening versus not deepening become a comparison of maintaining versus restoring natural resources. Of all alternatives considered, the nonstructural alternative was the best environmental alternative, but was not economically justified. Therefore, the major criteria in selecting an EQ Plan became the amount of natural cover disturbed during construction and subsequent maintenance. Plan 1 had the least disruptive effect of the deepening alternatives considered and Plan 3 had the least disruptive effects of the non-deepening alternatives. Plan 3 had slightly less disruptive effects than Plan 1. By placing more emphasis on maintaining rather than restoring cultural and natural resources, and in consideration of the structural alternative with the greatest amount of net Environmental benefits, Plan 3 edged Plan 1 and therefore, has been designated as the EQ Plan.

### SELECTING A PLAN

Plan selection is the designation of the most desirable alternative based on results of this detailed study. This selection is also influenced by the public response to the various plans of improvement. As discussed in the preceding paragraphs, Plan 3 is the NED and the EQ plan. Plan 1, however, had sufficient merits to be considered very strongly on both accounts. Therefore, selection of a recommended plan was narrowed to Plans 1 and 3.

After careful consideration of all data presented in the preceding pages and subsequent appendixes and after careful review of the public preferences expressed during the public workshop and subsequent correspondence, Plan 3, in combination with the regulation of the residual flood plain has been designated as the recommended plan.

## **The Selected Plan**

The preceding section summarized plan formulation and identified the plans with the best potential for resolving the problems and needs of the study area. The following pages present a description of the best plan, including its accomplishments and effects as well as its significant design, construction, operation and maintenance aspects.

## PLAN DESCRIPTION

The most appropriate plan of improvement in the Leith Creek Basin is a combination structural and nonstructural plan. The structural measures consist of the cleaning and widening of the existing channel for a total distance of 1.97 miles and replacing two highway bridges, and relocating two water mains and one sewer line. Nonstructural measures consist of passage, by the local sponsor, of regulatory measures to control the residual flood plain. The concept of designated floodways is recommended and designated floodways for both existing and improved conditions are presented in Section E of Appendix 1 for guidance.

The main features of the recommended plan are as follows:

Widen and clean the existing channel a total distance of 1.97 miles. Bottom widths vary from 35 feet to 30 feet with side slopes of 2 horizontal to 1 vertical.

Remove and replace the existing McKay Street bridge. Replacement structure should have a minimum low chord elevation of 196.4 feet msl and sufficient opening to pass a flow of 1640 cfs.

Remove and replace the existing Carver Street bridge. Replacement structure should have a minimum low member elevation of 201.0 feet msl and have sufficient opening to pass a flow of 1570 cfs.

Acquisition of 20.72 acres of permanent right-of-way will be required to implement the proposed plan.

Local sponsor is required to adopt and enforce land use measures to prevent the unwise and uneconomical development of the flood plain.

Development of a Greenway Park is also part of the recommended plan and will be discussed later in this report.

## PLAN ACCOMPLISHMENTS

The major benefits that will result from the selected plan are the reduction of existing and future damages to the urban areas of Laurinburg and East Laurinburg, North Carolina. Construction of the selected plan would produce flood damage reduction benefits for approximately 82 structures located within the existing flood plain. Average annual benefits of \$23,250 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. Plan and profile views for both existing conditions and improved conditions for various frequency floods are presented in Section E of Appendix 1 for comparison of pre-project and post project conditions.

## EFFECT OF THE PLAN ON ENVIRONMENT

The selected plan consists of widening the existing channel bottom to widths ranging from 30 to 35 feet and deepening as much as two feet. This plan would have beneficial environmental effects in that it recommends the removal of trash, debris and large discarded articles from the creek bottom and the removal of vegetation which, in places, clogs the channel and collects floating debris and scum.

Adverse effects of the selected plan include the destruction of existing bottom flora and invertebrates, loss of vegetation from one side of the creek, and a temporary increase in turbidity and sediment load. Construction of the proposed plan could also result in lowering of the surface water table immediately adjacent to the creek.

Right-of-way clearing would result in the loss of 20.72 acres of vegetation. This cover loss would include shrubs and thickets (black willow, privet, honeysuckle and greenbriar) and some trees (sweet gum, sycamore, black gum, and a few pines and small oaks). The project area is a narrow strip which is impinged upon from both sides by residential and commercial development, and provides only marginal to moderate habitat for birds, squirrels, rabbits and other small animals.

Studies by the North Carolina Wildlife Resources Commission show that the amount of stream cover is the greatest single factor affecting fish populations in streams disturbed by flood control measures. Fish resources in the project area are limited to darters, daces, a few sunfish of minimal size, and possibly small pickerel or largemouth bass at the lower project limit. Since this plan derives its flood control benefits by widening and deepening of the channel, cover could be reestablished along the edges of the creek without affecting channel flow.

Existing bottom flora and invertebrates will be removed as would be expected with any channel modification plan. The sand and silt bottom should gradually recolonize from flora and invertebrates above the project, but will probably result in a less diverse population.

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 34,700 cubic yards of excavation and 19.2 acres of clearing. A small increase in sediment load may occur during periods of high flows due to a slight increase in channel

velocities. Sediment impacts are not expected to occur downstream of the project in the more valuable habitat. Immediately below the lower project limit, the creek slows and widens to form a broad swamp with no defined channel. This area acts as a filter. On days of high volume flows and turbidity in the upper reaches of Leith Creek, clear water can be observed in the lower swampy area.

The selected plan calls for deepening as much as two feet in the extreme lower reach in order to obtain maximum capacity of the L & S Railroad culvert located at the downstream limit. The remaining reaches of the 1.97 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 fill areas and a slightly lower channel bottom could result in better drained soils and fewer low-land hardwoods in the reestablished cover.

The proposed plan can also be made compatible with local plans to construct a park on the western bank between Carver Street and Caledonia Road, by the construction of a greenway connecting existing park facilities with proposed park facilities. In accordance with established Corps' policy for recreation facilities at local flood protection projects, potential flood control alternatives were formulated without regard to recreation in order to avoid the influence of recreation on the formulation of a project which must attain a benefit/cost ratio greater than unity without regard to recreation. The inclusion of a greenway with a bike and walking trail and periodically spaced picnic tables and park benches is included as part of the recommended plan and will be discussed later.

## OTHER PLAN EFFECTS

Construction of a flood control project on Leith Creek will 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.

## DESIGN

The selected channel conveyance improvement plan for Leith Creek will pass an 8 year flood with zero damage to existing commercial and residential structures.

Material removed from the creek should be deposited parallel to the creek bank on one side only. Maximum height of fill shall be four feet. Disposal mounds shall be leveled, smoothed and seeded to grass.

Disposal materials shall be shaped to facilitate construction of a greenway and bike trail adjacent to Leith Creek. Construction of the greenway will begin at Church Street and extend to the upper project limits at Gill Street, a total distance of 6,350 feet. The greenway will include a four foot wide bituminous surfaced trail for biking and walking and will also include periodically spaced picnic tables and park benches. Two picnic sites have been located in the vicinity of Carver Street behind a complex of low rent apartments and in the vicinity of McKay Street near the elementary school and playground. Each picnic site will contain two tables and one trash receptacle. Park benches will be located at road crossings where picnic sites are not planned.

Beautification measures will receive full consideration during the preparation of plans and specifications. In general, visibly disturbed areas of all elements surrounding the project will be landscaped to restore the natural scenic beauty and to provide an attractive appearance. Ornamental shrubbery will be planted in appropriate locations to beautify the Greenway Park.

## CONSTRUCTION

Estimated time of construction for the selected plan of improvement is less than one year. During construction, only the areas required for construction and disposal of excavated materials shall be cleared. All efforts shall be made to disturb as little natural cover as possible. Where feasible, channel excavation shall be made from one bank only to avoid disruptive effects to the opposite bank.

In order to provide for abatement and control of any environmental pollution arising from construction activities, the contractor and his subcontractors shall comply with all applicable Federal, state and local laws and regulations concerning environmental pollution control and abatement.

## OPERATION AND MAINTENANCE

Operation and maintenance will be a non-Federal responsibility and will be accomplished in accordance with Federal regulations. No significant problems are anticipated in connection with the operation and maintenance of the selected plan.

## FLOODWAYS

The nonstructural portion of the selected plan of improvement requires regulation of uses made of the residual flood plain. The concept of designated floodways is recommended to allow optimum use of flood plains without significantly increasing flood hazards. Under natural conditions, a major flood would inundate the entire flood plain. The floodwater in the channel and areas immediately adjacent to the channel would normally be flowing swiftly, while the waters that cover the area adjacent to high ground would be ponded or moving very slowly. If obstructive development were placed in the area normally occupied by the swiftly flowing water, the obstruction would act as a dam, causing floodwater to back up and reach significantly higher elevations. Placement of development in the outer edges of the flood plain will cause displacement of stored waters, but obstruction to flow would be minimal. With the floodway concept an area, referred to as the "Floodway" is set aside for unobstructed passage of flood flow. The area between the floodway and the natural flood plain limits is referred to as the "Floodway Fringe". Complete filling of the floodway fringe will cause the design flood (usually a 100-year frequency flood) to rise about one foot higher than it would under present conditions. This possible future flood elevation is referred to as the "Flood Protection Elevation" which is designed to serve as a guide for development within the floodway fringe areas. Homes and other damageable facilities should be constructed above the flood protection elevation or provided equivalent protection by flood proofing. Plates showing floodway boundaries and floodway fringe areas (defined by the limits of the 100-year flood) for both pre-project and post-project conditions are contained in Appendix 1 of this report.

## Economics of Selected Plan

### METHODOLOGY

The tangible economic justifications of the selected plan can be ascertained by comparing average annual costs (including interests, amortization, operation and maintenance) with an equivalent average annual benefit which would be realized for the plan over a 50 year period of analysis. The average annual benefits should equal or exceed the annual cost if the Federal Government is to contribute toward the project. All costs and benefits presented in this section are based on September 1976 prices and the prevailing Federal interest rate of 6 3/8% was used to determine annual charges.



## COSTS

All cost estimates for the channel project include a 15 percent contingency factor, and costs for engineering and design and supervision based on cost experienced for similar projects. The following tabulation summarized total first costs for the Flood Control feature. Non-Federal cost estimates were obtained from the City of Laurinburg, local sponsor for the Leith Creek project.

### SUMMARY OF FIRST COSTS FLOOD CONTROL

#### FEDERAL

Channel Excavation	\$43,400
Riprap	11,000
Land Clearing	11,500
Shaping and Seeding	7,900
Contingencies	9,000
Engineering & Design	25,000
Supervision and Administration	<u>7,100</u>
TOTAL FEDERAL FIRST COST	\$117,000

#### NON-FEDERAL

Land Cost	1,800
Bridge Replacement	50,500
Water Line Relocations	8,500
Sewer Relocations	<u>3,200</u>
TOTAL NON-FEDERAL FIRST COSTS	\$ 64,000
TOTAL FLOOD CONTROL FIRST COST	\$181,000

Recreational cost reflect only those cost for recreational facilities over and above flood control costs. The local sponsors have indicated a willingness to cost share on a 50-50 basis, all recreational cost which fall within the cost limitations of Federal participation. Federal participation is limited to 10 percent of the Federal cost for flood control without approval of higher authority. Operation and maintenance of the facilities after completion will be a local responsibility. The following tabulation summarizes estimated first cost for recreation.

SUMMARY OF FIRST COST  
RECREATION

Bituminous Trail	\$11,400
Picnic Tables	3,200
Park Benches	800
Trash Receptacles	800
Ornamental Shrubbery	<u>2,000</u>
 TOTAL RECREATION FIRST COST	 \$18,200
 Federal Share	 \$ 9,100
Local Share	\$ 9,100

The following summarized total first cost for a flood control and recreation project on Leith Creek.

TOTAL FIRST COST-LEITH CREEK

Federal	
Flood Control	\$101,000
Recreation	<u>9,100</u>
TOTAL FEDERAL FIRST COST	\$110,100
 Non-Federal	
Flood Control	\$ 64,000
Recreation	<u>9,100</u>
TOTAL NON-FEDERAL FIRST COST	\$ 73,100
 TOTAL PROJECT FIRST COST	 \$183,200

Annual costs estimates are based on a 50 year period of analysis. Interest during construction is not included since the period of construction is estimated as being less than one year. Interest and amortization charges are based on an interest rate of 6 3/8% percent. The estimated cost of operation and maintenance is also included.

SUMMARY OF ANNUAL COSTS

Annual Federal Costs	
Flood Control	\$ 6,750
Recreation	<u>600</u>
TOTAL ANNUAL FEDERAL COSTS	\$ 7,350
 Annual Non-Federal Costs	
Flood Control	\$ 6,050
Recreation	<u>1,100</u>
TOTAL ANNUAL NON-FEDERAL COSTS	\$ 7,150
 TOTAL ANNUAL COST-ENTIRE PROJECT	 \$ 14,500

## BENEFITS

Estimates of monetary benefits are based on the September 1976 price level. The great majority of the area protected by the plan of improvement is currently developed in low cost housing with scattered commercial and public properties. Computed flood control benefits are based on existing development only. Benefits accrue due to the reduction of flood elevations to an estimated 65 residential and 17 commercial structures. Recreational benefits were determined by computing projected park usage based on projected visitation rates and assigning a visitation day value to determine benefits. An estimated visitation rate of 2,800 days annually and a visitation day value of \$0.93 were used in determining recreational benefits.

Average annual benefits are shown in the tabulation below for the plan of improvement. Although intangible benefits and possibly, tangible secondary benefits may accrue to the national economy, only tangible primary benefits are represented in the tabulation.

### SUMMARY OF ANNUAL BENEFITS

Residential	\$11,900
Commercial	10,000
Public Properties	<u>1,350</u>
TOTAL ANNUAL FLOOD CONTROL BENEFITS	\$23,250
Recreational Benefits	<u>2,600</u>
TOTAL ANNUAL BENEFITS	\$25,850

Average annual flood control benefits of \$23,250 when compared to annual flood control costs of \$12,800 yields a benefit-to-cost ratio of 1.81. Average annual recreational benefits of \$2,600 when compared to annual recreation costs of \$1,700 yields a benefit-to-cost ratio of 1.53. Total annual benefits of \$25,850 when compared to total annual costs of \$14,500 yields a project benefit-to-cost ratio of 1.78.

## Division of Plan Responsibilities

As previously discussed, the adoption and enforcement of land use measures to prevent the unwise and uneconomical development of the flood plain is a requirement of the selected plan of improvement. The

SUMMARY OF FIRST COST  
RECREATION

Bituminous Trail	\$11,400
Picnic Tables	3,200
Park Benches	800
Trash Receptacles	800
Ornamental Shrubbery	<u>2,000</u>
 TOTAL RECREATION FIRST COST	 \$18,200
 Federal Share	 \$ 9,100
Local Share	\$ 9,100

The following summarized total first cost for a flood control and recreation project on Leith Creek.

TOTAL FIRST COST-LEITH CREEK

Federal	
Flood Control	\$117,000
Recreation	<u>9,100</u>
TOTAL FEDERAL FIRST COST	\$126,100
 Non-Federal	
Flood Control	\$ 64,000
Recreation	<u>9,100</u>
TOTAL NON-FEDERAL FIRST COST	\$ 73,100
 TOTAL PROJECT FIRST COST	 \$199,200

Annual costs estimates are based on a 50 year period of analysis. Interest during construction is not included since the period of construction is estimated as being less than one year. Interest and amortization charges are based on an interest rate of 6 3/8% percent. The estimated cost of operation and maintenance is also included.

SUMMARY OF ANNUAL COSTS

Annual Federal Costs	
Flood Control	\$ 7,800
Recreation	<u>600</u>
TOTAL ANNUAL FEDERAL COSTS	\$ 8,400
 Annual Non-Federal Costs	
Flood Control	\$ 6,100
Recreation	<u>1,100</u>
TOTAL ANNUAL NON-FEDERAL COSTS	\$ 7,200
 TOTAL ANNUAL COST-ENTIRE PROJECT	 \$ 15,600

## BENEFITS

Estimates of monetary benefits are based on the September 1976 price level. The great majority of the area protected by the plan of improvement is currently developed in low cost housing with scattered commercial and public properties. Computed flood control benefits are based on existing development only. Benefits accrue due to the reduction of flood elevations to an estimated 65 residential and 17 commercial structures. Recreational benefits were determined by computing projected park usage based on projected visitation rates and assigning a visitation day value to determine benefits. An estimated visitation rate of 2,800 days annually and a visitation day value of \$0.93 were used in determining recreational benefits.

Average annual benefits are shown in the tabulation below for the plan of improvement. Although intangible benefits and possibly, tangible secondary benefits may accrue to the national economy, only tangible primary benefits are represented in the tabulation.

### SUMMARY OF ANNUAL BENEFITS

Residential	\$11,900
Commercial	10,000
Public Properties	<u>1,350</u>
TOTAL ANNUAL FLOOD CONTROL BENEFITS	\$23,250
Recreational Benefits	<u>2,600</u>
TOTAL ANNUAL BENEFITS	\$25,850

Average annual flood control benefits of \$23,250 when compared to annual flood control costs of \$13,900 yields a benefit-to-cost ratio of 1.61. Average annual recreational benefits of \$2,600 when compared to annual recreation costs of \$1,700 yields a benefit-to-cost ratio of 1.53. Total annual benefits of \$25,850 when compared to total annual costs of \$15,600 yields a project benefit-to-cost ratio of 1.66.

## Division of Plan Responsibilities

As previously discussed, the adoption and enforcement of land use measures to prevent the unwise and uneconomical development of the flood plain is a requirement of the selected plan of improvement. The

responsibility for such measures is non-Federal, although technical advice is available and shall be furnished to the local sponsor by the Charleston District. Designated floodways for both existing and improved conditions are presented in Appendix 1 of this report. The division of responsibilities for the Leith Creek Channel Conveyance Improvements is discussed in the following paragraphs.

Legislative and administrative policies have established the basis for Federal and non-Federal responsibilities in the construction and operation and maintenance of continuing authority flood control projects of this type. These responsibilities include both the sharing of costs for construction and operation and maintenance of the project. Other general non-Federal responsibilities, such as indemnifying the United States and preventing encroachments upon project channels, are not discussed but are set forth in the "Recommendations".

### COST APPORTIONMENT

Sharing of costs between Federal and non-Federal interests for the Leith Creek project 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 is responsible for all flood control construction costs including costs incurred in performing investigations and designs and costs incurred for modifications to railroad crossings. Under the study authorization, Federal costs are limited to \$2 million except in special cases concerning natural disasters. Non-Federal interests must pay all costs in excess of the Federal limitation. As discussed previously, recreational cost for recreational facilities on Leith Creek shall be apportioned on a 50-50 cost share basis between Federal and non-Federal interest.

The following tabulation shows the apportionment of first costs and annual operation and maintenance costs between Federal and non-Federal interests, in accordance with the policies outlined above.

## COST APPORTIONMENT

	ESTIMATED FIRST COST	ANNUAL O&M COSTS
FEDERAL		
Flood Control	\$117,000	0
Recreation	<u>9,100</u>	<u>0</u>
TOTAL FEDERAL	\$126,100	0
NON-FEDERAL		
Flood Control	\$ 64,000	\$1,800
Recreation	<u>9,100</u>	<u>500</u>
TOTAL NON-FEDERAL	\$ 73,100	\$2,300
TOTAL	\$199,200	\$2,300

### FEDERAL RESPONSIBILITIES

The presently estimated Federal share of the total first cost of the Leith Creek project is \$126,100. 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 the proposed project is \$73,100. In addition, the non-Federal interests must operate and maintain the project at an estimated annual cost of \$2,300. The local sponsor must also meet the local cooperation requirements as outlined in the section entitled "Recommendations".

# Plan Implementation

The following steps will be taken subsequent to the submission of this report:

Circulation of a Negative Declaration of Environmental Effects to all interested agencies and individuals. If comments on the Negative Declaration reveal significant adverse environmental effects or if sufficient public opposition is indicated an Environmental Impact Statement will be prepared and circulated.

Review of this report by the South Atlantic Division Office in Atlanta, Georgia, and the Office of the Chief of Engineers in Washington, D. C. The South Atlantic Division Engineer may delegate authority to the Charleston District Engineer to commence work on Plans and Specifications pending approval by the Chief of Engineers.

Formal review and comment by the Governor of North Carolina.

Authorization by the Chief of Engineers for project construction.

Notification of project authorization sent to Congressional delegation. (Effective date of project authorization is date Congressional delegation is notified.)

Funds for post authorization studies and construction requested from and allotted by the Chief of Engineers.

Preparation of plans and specifications including pre-construction surveys, materials investigations and detailed engineering cost estimates.

Local sponsor meets non-Federal requirements.

Agreement with sponsor processed and signed. (Agreement must be consistent with requirements of Section 221 of Public Law 91-611, Flood Control Act of 1970.)

Project advertised for bids.

Contract awarded.

Project construction completed and project turned over to local sponsors who assume responsibility for operation and maintenance.

It is not possible to accurately estimate a schedule for the above steps because of variables in the reviewing and funding process. However, the following time objectives have been established by the Chief



of Engineers following completion of the Feasibility Study by the Reporting Officer and preparation of this Detailed Project Report.

- a) Review of Detailed Project Report by Division Engineer 2 Months
- b) Review of Detailed Project Report by the Office, Chief of Engineers 2 Months
- c) Completion of Project Construction (Including Plans and Specifications After Project Approval) 18 Months

## Views of Non-Federal Interests

The considered plans of improvement were coordinated with various state, local and non-governmental interests. Coordination was also made in the form of a public workshop held in Laurinburg on 20 November 1975. Statements by those interests are contained in Appendix 2. In addition a complete transcript of the public workshop is also presented.

## Review by Other Federal Agencies

Letters and comments received from other Federal agencies are contained in Appendix 2.

# Summary

Leith Creek is located in Scotland County, in the upper coastal plains section of North Carolina. The watershed consists of a total area of 13.24 square miles above the confluence of Leith Creek and Little Creek immediately downstream of the city limits of Laurinburg.

The main flood problems associated with Leith Creek are located within the city limits of Laurinburg and East Laurinburg. An estimated 65 residential and commercial structures are located within the flood plain in addition to a school, school lunchroom, gymnasium and several public parks. Estimated annual flood damages for existing conditions are \$26,550.

Several techniques were considered for alleviating flood problems. A site was not available for reservoir construction and levees were determined to be ineffective due to numerous road crossings. Channel conveyance improvements were found to be the most feasible structural method of flood control on Leith Creek. Nonstructural measures were studied in depth but were found to be impractical for alleviating existing damages. Regulation of the flood plain, however, was determined to be an effective method of controlling future development damage.

The selected plan of improvement consists of a combination of structural and nonstructural alternatives. Structural measures recommended consist of 1.97 miles of channel conveyance improvement including replacement of two highway bridges, and relocation of three utility crossings. Nonstructural measures recommended include the adoption and enforcement by the local sponsor of regulatory measures to control future development of the flood plain.

Recreational facilities included as part of the recommended plan include a greenway park with bike and walking trail and picnic facilities. The greenway will connect existing and proposed parks.

The estimated first cost of the channel improvements and recreational facilities on Leith Creek is \$199,200 and the annual charges, \$15,600. Annual benefits are estimated to be \$25,850 yielding a benefit to cost ratio of 1.66.

Results of this detailed study indicate that Federal assistance is warranted to alleviate existing and potential flood hazards on Leith Creek. The proposed plan is economically justified and is the plan preferred by the majority of the local people.

# Statement Of Findings

The documents concerning the proposed action and the stated views of other interested agencies and concerned public have been reviewed and evaluated, in light of the overall public interest, relative to the various practicable alternatives in providing the needed flood control protection in the vicinity of Leith Creek. The possible consequences of these alternatives have been studied according to environmental, social well-being, and economic effects, including regional and national development and engineering feasibility. In evaluation, the following points were considered pertinent:

The project will provide an adequate degree of flood protection for the affected areas of the cities of Laurinburg and East Laurinburg.

The selected plan qualified as the EQ and NED plan and has strong local support.

Care was taken in the design of the project to minimize adverse environmental effects, and to mitigate, where possible, for those adverse environmental effects which could not be avoided. The selected project produces net environmental gains for the project area.

The project is sized at the optimum economic capacity, is functionally adequate and economically justified.

Recreational aspects of the project are economically justified and are desired by the local people. Local sponsors have indicated a willingness to cost share the recreational cost.

In addition to the above, the following table summarizes significant impacts of alternative plans and is considered pertinent to the selection and evaluation of the selected plan.

The proposed action, as developed in the "Formulating a Plan" and "The Selected Plan" sections, is based on thorough analysis and evaluation of various practicable alternative courses of action for achieving the stated objective. The selected plan is consonant with national policy, statutes, and administrative directives, and the total public interest should best be served by implementation of the selected plan.



TABLE 2  
(Continued)  
SUMMARY-SYSTEM OF ACCOUNTS

	PLAN 1	PLAN 2	PLAN 3	PLAN 4	PLAN 5	PLAN 6	PLAN 7	
(d) RD	Benefits are proportional to and roughly equal to net average RFD benefits.	Benefits are proportional to and roughly equal to net average RFD benefits.	Benefits are proportional to and roughly equal to net average RFD benefits.	Benefits are proportional to and roughly equal to net average RFD benefits.	Benefits are proportional to and roughly equal to net average RFD benefits.	Contributions to RD, like those for RFD, negative (-\$21,700).	No change.	
(b) Plan Response to Associated Evaluation Criteria								
(a) Acceptability	Well below Plan 2 in local preference.	Plan 2 was the plan preferred at 10-20-75 hearing in Laurinburg.*	Well below Plan 2 in local preference.	Well below Plan 2 in local preference.	Well below Plan 2 in local preference.	Plan 6 received no support from those at 10-20-75 hearing.	Plan 7 received no support from those at 10-20-75 hearing.	
(b) Completeness	All steps necessary to achieve stated outputs of Plan 1 are included as part of the plan.	All steps necessary to achieve stated outputs of Plan 2 are included as part of the plan.	All steps necessary to achieve stated outputs of Plan 3 are included as part of the plan.	All steps necessary to achieve stated outputs of Plan 4 are included as part of the plan.	All steps necessary to achieve stated outputs of Plan 5 are included as part of the plan.	All steps necessary to achieve stated outputs of Plan 6 are included as part of the plan.	All steps necessary to achieve stated outputs of Plan 7 are included as part of the plan.	
(c) Efficiency & Effectiveness	Ranks 3rd of 6 structural plans.	Ranks 5th of 6 structural plans.	Most efficient & effective of all 6 structural plans.	Ranks 2nd of 6 structural plans.	Ranks 4th of 6 structural plans.	Lowest of all plans in efficiency and effectiveness.	N/A	
(d) Uncertainty	Ranks 3rd of 4 channel modification plans.	Ranks 4th of 4 channel modification plans.	Less than 20%.	Less than 20%.	Less than 20%.	Less than 20%.	N/A	
(e) Geographical scope	Limited to study area. Areas above Gill St. & below Fertilizer Plant Rd. have been deleted from consideration.	Limited to study area. Areas above Gill St. & below Fertilizer Plant Rd. have been deleted from consideration.	Limited to study area. Areas above Gill St. & below Fertilizer Plant Rd. have been deleted from consideration.	Limited to study area. Areas above Gill St. & below Fertilizer Plant Rd. have been deleted from consideration.	Limited to study area. Areas above Gill St. & below Fertilizer Plant Rd. have been deleted from consideration.	Limited to study area. Areas above Gill St. & below Fertilizer Plant Rd. have been deleted from consideration.	No change.	
Flood Control	1.05	0.93	1.67	1.56	1.30	0.51	N/A	
Recreation	1.53	1.53	1.53	1.53	N/A	N/A	N/A	
Total Project	1.08	0.97	1.66	1.55	1.30	0.51	N/A	
Reversibility	All structural plans could be reversed in time necessary for vegetation to revert to original condition. Make structural changes for Plan 1 than for Plans 3, 4 or 5.	All structural plans could be reversed in time necessary for vegetation to revert to original condition. Make structural changes for Plan 2 than for Plans 3, 4 or 5.	All structural plans could be reversed in time necessary for vegetation to revert to original condition. Fewer structural changes than Plans 1, 2, 4 & 5.	All structural plans could be reversed in time necessary for vegetation to revert to original condition. Make structural changes for Plan 4 than for Plans 3 or 5.	All structural plans could be reversed in time necessary for vegetation to revert to original condition. No structural change.	All structural plans could be reversed in time necessary for vegetation to revert to original condition. Reverse undesirable.	Least easily reversed. Reverse undesirable.	N/A
Stability	Very stable.	Very stable.	Very stable.	Very stable.	Very stable.	Very stable.	N/A	

D IMPLEMENTATION RESPONSIBILITY

(1) Federal	Construction of all flood-control structures. Preparation of land. Railroad crossing modifications.	Construction of all flood-control structures. Preparation of land. Railroad crossing modifications.	Construction of all flood-control structures. Preparation of land. Railroad crossing modifications.	Construction of all flood-control structures. Preparation of land. Railroad crossing modifications.	Construction of all flood-control structures. Preparation of land. Railroad crossing modifications.	Clearing and other preparation of land.	N/A
(c) Non-Federal	50% of recreation cost. Lands, easements & rights-of-way. Utility modifications. Highway crossing modifications. Maintenance of project. Adopt Flood Management Plan.	50% of recreation cost. Lands, easements & rights-of-way. Utility modifications. Highway crossing modifications. Maintenance of project. Adopt Flood Management Plan.	50% of recreation cost. Lands, easements & rights-of-way. Utility modifications. Highway crossing modifications. Maintenance of project. Adopt Flood Management Plan.	50% of recreation cost. Lands, easements & rights-of-way. Utility modifications. Highway crossing modifications. Maintenance of project. Adopt Flood Management Plan.	50% of recreation cost. Lands, easements & rights-of-way. Utility modifications. Highway crossing modifications. Maintenance of project. Adopt Flood Management Plan.	Lands, easements & rights-of-way. Utility modifications. Highway crossing modifications. Maintenance of project. Adopt Flood Management Plan.	N/A

## Recommendations

It is recommended that a Federal project be approved under authority of Section 205 of the 1948 Flood Control Act, as amended, and as described in this report, with such modifications as in the discretion of the Chief of Engineers may be deemed advisable. Construction of the project is recommended provided local interests agree to the following:

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

b. Accomplish without cost to the United States all alterations and relocations of buildings, transportation facilities, storm drains, utilities, and other structures and improvements made necessary by the construction, excluding railroad bridges, approaches and facilities;

c. Hold and save the United States free from damages due to construction, operation and maintenance of the project, provided damages are not due to the fault or negligence of the United States or its contractors;

d. Maintain and operate the works after completion in accordance with regulations prescribed by the Secretary of the Army;

e. Prescribe and enforce regulations to prevent obstruction or encroachment on channels and other flood control works which would reduce their flood carrying capacity or hinder maintenance and operation, and control development in the project area to prevent an undue increase in flood damage potential;

f. At least annually; inform affected areas that the channel improvement will not provide complete flood protection;

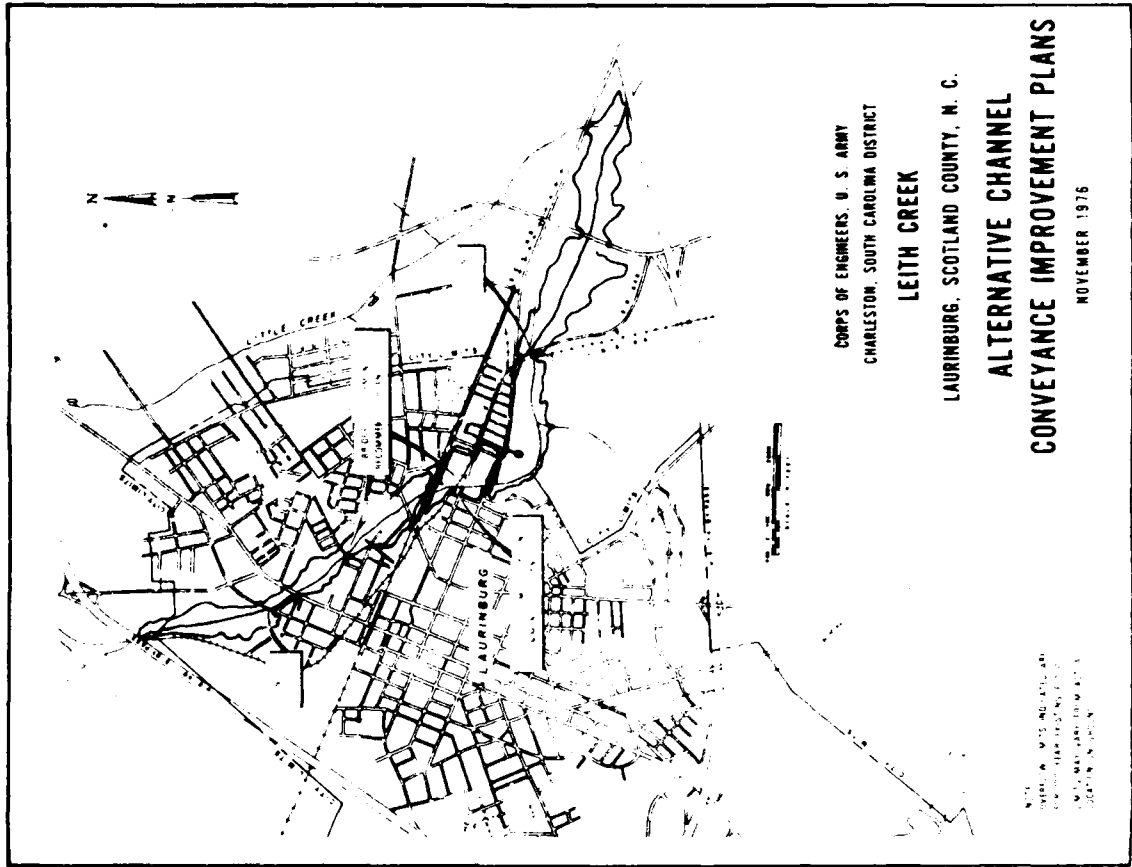
g. Publicize flood plain information in the areas concerned and provide this information to zoning and other regulatory agencies for their guidance and leadership in preventing unwise future development in the floodplain and in adopting such regulations as may be necessary to insure compatibility between future development and protection levels provided by the project; and

h. Provide 50% of project cost allocated to the recreation portion of the recommended project in accordance to established Federal policy.



HARRY S. WILSON, JR.  
Colonel, Corps of Engineers  
District Engineer

COMPARISON OF ALTERNATIVE CHANNEL CONVEYANCE IMPROVEMENT PLANS - LEITH CREEK, LAURINBURG, N. C.						
ALL MONETARY VALUES PRESENTED IN THIS TABLE ARE BASED ON SEPT 1976 ESTIMATES						
ITEM	UNIT	PLAN 1	PLAN 2	PLAN 3	PLAN 4	PLAN 5
BOTTOM WIDTH	FEET					
L & S RAILROAD TO CHURCH ST.		35	45	35	45	
CHURCH ST. TO CALEDONIA RD.		30	40	35	45	
CALEDONIA RD. TO W. MAIN ST.		30	40	35	45	
W. MAIN ST. TO GILL ST.		30	40	30	40	
R/W CLEARING	ACRES	30.04	35.43	19.32	23.84	47.8
CHANNEL EXCAVATION	CU YD.	74,250	98,500	34,700	44,250	
RIPRAP (SACKED SAND CEMENT)	CU YD.	110	133	122	145	
SHAPING AND SEEDING	ACRES	22.4	25.43	11.24	12.97	47.8
BRIDGE MODIFICATIONS	NO	3	3	2	2	2
PIPELINE MODIFICATIONS	NO	3	3	3	3	3
PERM R/W	ACRES	31.24	36.83	20.72	24.84	47.8
FEDERAL COST	\$	253,780	299,800	117,000	139,000	95,000
NON FEDERAL COST	\$	65,000	65,400	64,000	64,400	66,200
TOTAL PROJECT COST	\$	318,780	365,000	181,000	203,400	161,200
ANNUAL COST 6-3 8%	\$	21,300	24,400	12,100	13,600	10,800
MAINTENANCE COSTS	\$	1,800	1,800	1,800	1,800	2,000
TOTAL ANNUAL COSTS	\$	23,100	26,200	13,900	15,400	12,800
ANNUAL BENEFITS	\$	24,400	24,600	23,250	24,000	16,700
EXCESS BENEFITS OVER COSTS	\$	1,300	-1,600	9,350	8,600	3,900
B. C. RATIO		1.05	0.93	1.67	1.56	1.1



NOVEMBER 1976

**A**

**P**

**P**

**E**

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**D**

**I**

**X**

**E**

**S**



**Leith Creek**

Scotland County

North Carolina

**Detailed  
Project  
Report**



LEITH CREEK  
SCOTLAND COUNTY, NORTH CAROLINA  
DETAILED PROJECT REPORT

Technical Report

SECTION A	THE STUDY AND REPORT
SECTION B	RESOURCES AND ECONOMY OF THE STUDY AREA
SECTION C	PROBLEMS AND NEEDS
SECTION D	FORMULATING A PLAN
SECTION E	THE SELECTED PLAN
SECTION F	ECONOMICS OF THE SELECTED PLAN
SECTION G	DIVISION OF PLAN RESPONSIBILITIES

A  
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PREPARED BY THE  
CHARLESTON DISTRICT, CORPS OF ENGINEERS  
DEPARTMENT OF THE ARMY

# **SECTION A**

THE STUDY AND REPORT

# THE STUDY AND REPORT

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## SECTION A

# THE STUDY AND REPORT

1. Background information concerning the authorization of this study and a description of the nature of the study is presented here as a useful introduction to the contents and findings of this report.

## Purpose and Authority

2. The purpose of this study, the results of which are presented in this technical appendix, is to investigate problems in the Leith Creek Basin, and to develop the most suitable plan that would solve these problems. Principle and Standard for Planning Water and Related Land Resources as published in the Federal Register, Volume 38, Part III dated 10 September 1973 and as further explained subsequent Engineering Regulations were implemented during the course of the study. Consideration was also given to Section 73 of the Water Resources Development Act of 1974 (P.L. 93-251) in developing nonstructural alternatives to prevent or reduce flood damages.

3. The study and report are in compliance with Section 205 of the Flood Control Act of 1948 as amended by the Water Resources Development Acts of 1974 and 1976. The referenced act provide authority to the Chief of Engineers to construct small flood control projects that have not been specifically authorized by Congress. Each project must be complete within itself and economically justified. In addition, the project is limited to Federal cost of not more than \$2 million except for projects in areas which have been declared to be major disaster areas, pursuant to the Disaster Relief Act of 1966 or the Disaster Relief Act of 1970, in the 5 year period preceeding the date the Chief of Engineers deems such work advisable. In such cases, Section 61 of the Water Resources Development Act of 1974 (P.L. 93-251), as amended by Section 133, P.L. 94-587, amends the aforementioned authority in that Federal participation can be increased from \$2 million to \$3 million. Federal cost limitation includes all project costs for investigations, inspections, engineering, preparation of plans and specifications, supervision and administration and construction.

## Scope of the Study

4. A project planned and constructed under Section 205 is designed to provide the same complete project, the same adequate degree of protection and the same environmentally compatible project as would be provided under specific Congressional authorization. Flood control projects under Section 205 are not limited to any specific flood control alternative and the objective of reducing flood damage may be accomplished by either taking measures to modify the flood or modify human and property susceptibility to flood damages. Flood control projects under Section 205 may also include features for other water resources purposes, provided local interest indicate the need as well as their willingness and ability to contribute that portion of project cost related to purposes other than flood control.

5. The studies in this report are for that portion of the Leith Creek Basin which affect the cities of Laurinburg and East Laurinburg, North Carolina. Studies were concentrated on flood problems and the potential flood control alternatives, all reasonable alternative plans to solve the areas flood problems were considered and several plans were studied in some detail, including cost and benefit analysis and environmental impact. The selection of the most feasible plan was made after considering all factors, including those expressed by concerned agencies and local interests. The studies for various alternatives were made in sufficient detail to permit plan selection.

## Study Participants and Coordination

6. The Charleston District, Corps of Engineers had the principal responsibility for conducting and coordinating the study and the plan formulation, consolidating all available information and preparing the report and environmental assessments. The study was initiated at the request of the City of Laurinburg, North Carolina which cooperated throughout the entire study process.

7. The studies and investigations were coordinated with various Federal, state and local agencies. Comments received from these agencies are presented in Appendix 2. The recommended project was further coordinated pursuant to Section 404 of the Federal Water Pollution Control Act Amendments of 1972 (PL 92-500, 86 Stat. 816). A copy of the public notice is enclosed in Appendix 2.

8. A public workshop was held on 20 November 1975 to afford local interests the opportunity to express their ideas and to participate in the formulation of the best project alternate to meet national and community needs. The transcript of this workshop and subsequent correspondence is presented for review in Appendix 2 of this report.

## The Report

9. The organization and format of this report is in compliance with instructions contained in ER 1105-2-402 and ER 1105-2-403. This report has been arranged into a main report and two appendixes.

10. The main report is a nontechnical presentation of the feasibility studies for flood and associated water resources problems within the Leith Creek Basin. It is the basic document that presents a broad view of the overall study for the benefit of both general and technical readers. Included in the report are a description of the study area; the problems being experienced and the need for protective measures; formulation of the most suitable plan for meeting the need; a summary of the project economics indicating the benefits, costs and justification; the division of plan responsibilities; and recommendations for implementing the selected plan.

11. Appendix 1 is a technical report following the same general outline as the formulation and evaluation part of the main report, but in greater detail for the technical reviewer. Development of the problems and solutions are presented in the same order as the main report.

12. Appendix 2 contains all pertinent correspondence and a transcript of the Public Workshop held in the Scotland County Courthouse on 20 November 1975.

13. Appendix 3 contains a reference list for coordination as required by Section 404 of Public Law 92-500.

## Prior Studies and Reports

13. The Charleston District, Corps of Engineers, prepared a reconnaissance report on Leith Creek dated 11 July 1972 which recommended that a detailed study be made under Section 205 of the 1948 Flood Control Act, as amended. No other reports have been prepared. The City of Laurinburg, however, has applied to the flood insurance program and flood insurance is currently available. A flood insurance study is scheduled to commence during Fiscal Year 1977.

**SECTION B**

RESOURCES AND ECONOMY OF  
THE STUDY AREA



# RESOURCES AND ECONOMY OF THE STUDY AREA

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SECTION B

**RESOURCES AND ECONOMY  
OF THE STUDY AREA**

1. A general understanding of the resources, development, and economy of the study area is helpful in identifying the problems and needs of the area and in selecting the appropriate solutions. The following pages discuss the environmental, natural, and human resources of the area as well as its development and economy.

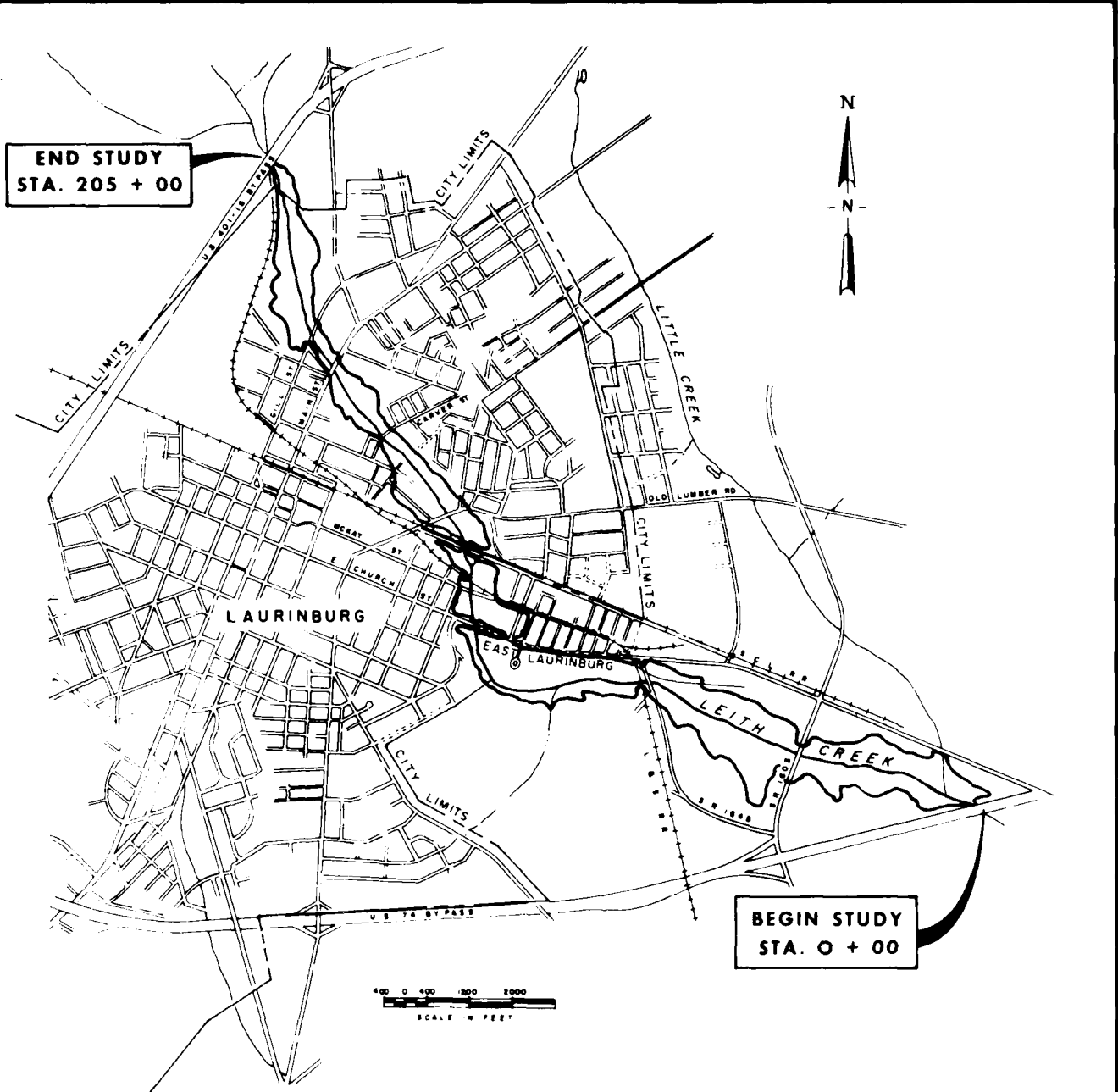
# Environmental Setting And Natural Resources

2. The Leith Creek watershed is located in Scotland County in the upper coastal plains section of North Carolina. The watershed consists of a total area of 13.24 square miles above its confluence with Little Creek below the city limits of Laurinburg. For the purpose of this study, the study reach limits were established as U. S. 74 Bypass, downstream and U. S. 15-401 Bypass upstream, a total reach length of 3.23 miles (see illustration). Portions of this reach lie within the city limits of Laurinburg and East Laurinburg, North Carolina.

3. The lower portion of the study area from U. S. 74 Bypass to the Laurinburg and Southern Railroad upstream from State Road 1645 is wooded swamp, characterized by backwater, poorly defined channels and lush vegetation. This low area provides excellent habitat for waterfowl, reptiles, amphibians and mammals common to swamps. Cypress, black gum and some tupelo gum are the dominant tree types. Redbreast sunfish, redbfin pickerel and largemouth bass are reported, in spite of residual pollution from Laurinburg. Wood ducks, woodcock, hawks, owls and various songbirds are seasonally present.

4. From State Road 1645 to E. Church Street, there is a change to a better defined channel. Tree types change from cypress and black gum to less water tolerant species of sweet gum, sycamore and a few pines. Black willow, privet, smilax and various shrubs and grasses grow to the waters edge and extend well over the creek. Aquatic vegetation is established on much of the creek's bottom.

5. From E. Church Street to Gill Street, the change to better drained soils and a more sharply defined channel continues. Above Gill Street more pines appear along with sweet gum, sycamore, tulip poplar, and some oak. Land adjacent to the creek is more characteristic of forests, numerous trees having diameters of 24 inches or greater. Habitat is suitable for beaver, squirrels, rabbits, racoons and other small mammals. The area provides habitat for wood ducks, woodcock, songbirds and screech owls. Fishery habitat supports darters, daces and possibly a few sunfish.



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

**LEITH CREEK**  
**LAURINBURG, SCOTLAND COUNTY, N. C.**  
**STUDY LIMITS**

NOTES  
 OVERFLOW LIMITS INDICATED ARE FOR  
 100 YEAR EXISTING FLOOD.  
 LIMITS MAY VARY FROM ACTUAL LOCATION  
 ON GROUND

NOVEMBER 1976

The reaches above Gill Street and below the L & S Railroad at SR1645 have the greatest ecological value but have the smallest potential for flood damages.

## TERRAIN AND LAND USE

Land use in the Leith Creek watershed is a combination of urban development and agriculture. The upper nine square miles of the watershed, generally above the study reach, is nearly 100 percent cropland and forest. Crops are generally row crops, however, no significant acreage is located on the flood plain. The lower four square miles are mostly urban communities of low cost residential and small business concerns. Portions of the flood plain in the vicinity of North Main and Gill Streets are occupied by parks areas which serve the entire community.

## CLIMATE

The climate of Laurinburg is typical of the warm temperature zone with an average annual temperature of 62° F. In summer, the days are generally hot and the nights moderately warm. Subfreezing temperatures are experienced occasionally during the winter, but generally the temperatures are mild, with occasional cold periods of short duration. Laurinburg has an average January temperature of 44° F and an average July temperature of 79° F. Normal annual precipitation is approximately 46 inches. This and other pertinent meteorological data is presented on Plate B-1.

## ARCHEOLOGICAL CONSIDERATIONS

The National Register of Historic Places lists only one structure of national significance in Scotland County. The Richmond Temperance and Manufacturing Hall located about one mile southwest of Wagram, North Carolina is the only historical place listed. This structure is located outside the Leith Creek watershed, therefore, any project on Leith Creek will not have any effect on the structure.

There are no known places of significant historical or archeological interest within the Leith Creek flood plain. Therefore, construction of a flood control project on Leith Creek is not anticipated to have any adverse effects on the historical or archeological values of the study area. An Archeological Reconnaissance of the study area, prepared by an Archeologist at the nearby St. Andrews Presbyterian College, is included in Appendix C of this report.

## NATURAL RESOURCES\*

11. Scotland County is mainly agricultural in nature with comparatively short, mild winters and long, hot summers which permit a wide range in types of farming and choice of crops. Cotton is the principal cash crop with other important farm crops consisting of corn, tobacco, soy beans, and small grain. Beef cattle and poultry are also important farm enterprises.

12. The soils of Scotland County are acid and strongly leached. Except for a few wet soils where water has retarded oxidation, their organic matter content is low. The soils under native forest are low in calcium, magnesium, and potassium because they have a low capacity to store these bases. Thirty-seven percent of the acreage is droughty sand, 10 percent somewhat droughty, loamy sand, 10 percent wet alluvial land and swamp, 10 percent wet soils in Carolina bays, 13 percent wet upland soils, 11 percent well-drained, sloping upland soils and 9 percent well-drained, nearly upland soils.

13. Soils within the flood plain of Leith Creek study reach are classified by the Soil Conservation Service as alluvial land, wet in the upper portion of the study area and as swamp in the lower portion.

14. Alluvial land, wet, as described by the Soil Conservation Service, consists of soils that are variable in texture and are poorly drained or very poorly drained. The surface layer is grayish or black sand, loamy sand, or silt. Characteristically, it is high in organic matter content. The texture of the underlying sediments ranges from coarse loamy to fine loamy, but is predominantly coarse loamy. In many places strata of coarse sand and gravel are within 40 inches of the surface. Generally, stream channels are not well defined and most of the areas are flooded frequently each year.

15. The second classification, swamp, is described as consisting of very poorly drained soils that are variable in texture. Stream channels are poorly defined in these areas and the soils are frequently flooded for long periods.

\*Source: Soil Survey, Scotland County, North Carolina, United States Department of Agriculture, Soil Conservation Service.

# Human Resources

16. Detailed information concerning human resources is very limited for solely that area within the drainage boundaries of Leith Creek. Information is even more limited for the valley floor area of Leith Creek; however, much information available for Scotland County, which includes the City of Laurinburg, the primary economic center of the study area. The entire watershed of Leith Creek is situated within the geographical limits of Scotland County, therefore, past, present and future trends for the county are considered indicative of the study area.

## POPULATION CHARACTERISTICS

17. Scotland County has for the past three decades realized a slow increase in total population. As the following tabulation shows, the county's population has increased from about 23,000 in 1940 to almost 27,000 in 1970, which represents a compound growth rate of 0.5 percent per year. During the same 30 year period, population in North Carolina grew from 3.6 million to 5.1 million persons, or at a compound growth rate of approximately 1.25 percent.

<u>Year</u>	<u>County Population</u>
1940	23,232
1950	26,336
1960	25,183
1970	26,929

Source of the above information is the U. S. Bureau of Census.

18. The historical population growth pattern in Scotland County, as it relates to the rural-to-urban movement, indicates a constant growth in urban population and an up and down pattern for non-urban population. All urban population is located within the city limits of Laurinburg. The accompanying tabulation, based on census information, illustrates that historical population growth in rural areas of Scotland County increased from 17,547 in 1940 to 18,070 in 1970 or 2.9 percent, while population in urban areas increased 55.8 percent during this period from 5,685 to 8,859.



<u>Area</u>	<u>1940</u>	<u>1950</u>	<u>1960</u>	<u>1970</u>
<u>Urban area</u>				
Laurinburg	5,685	7,134	8,242	8,859
<u>Rural area</u>	17,547	19,202	16,941	18,070
<u>Total</u>	23,232	26,336	25,183	26,929

19. Population in the flood plain of Leith Creek is mainly concentrated in the City of Laurinburg which constitutes approximately 32 percent of the county's population. The county population is anticipated to increase from 26,929 in 1970 to an estimated 46,000 in the year 2020 which represents an annual rate of increase of approximately 1.0625 percent.

20. Selected statistics on population characteristics of the City of Laurinburg and Scotland County are compared with those of the state as a whole in Table B-1. All data in this tabulation is based on 1970 census data.

Table B-1. Population Characteristics of  
Laurinburg, Scotland County and North Carolina

Characteristic	City of Laurinburg	Scotland County	No. Carolina
Population			
Number	8,859	26,929	5,082,059
Percent increase, 1960-70	7.5%	6.9%	11.5%
Age distribution			
Under 18	34.2%	38.3%	34.6%
18-64	57.6%	54.8%	57.2%
65 or older	8.2%	6.9%	8.1%
male, 18 yrs. & older	44.3%	46.1%	47.9%
Households			
Number	2,533	7,387	1,509,564
Percent increase, 1960-70	12.5%	22.6%	25.3%
Persons Per Household	3.20	3.53	3.24
Education (over 25)			
Median school yrs. completed	10.0	9.6	10.6
Percent completed 4 yrs. high school or greater	33.8%	32.6%	
Employment			
Non-worker - worker ratio	1.37	1.45	1.34
in mfg. industry	----	42.0%	35.5%
in white collar occupation	----	34.2%	38.6%
government workers	----	10.1%	13.2%
Income			
Median for families	\$6,993	\$7,030	\$7,774
families w/income over \$15,000	9.8%	8.6%	11.5%
families w/income poverty level	24.9%	23.8%	16.3%

21. The preceding table shows that the rate of population growth for the City of Laurinburg and Scotland County is below the state average. The table also shows that this medium family income for the city and county is well below the state average and the percent of families with income below poverty level is much higher than the state average.

## MAJOR SKILLS AND OCCUPATIONS

22. Data on employed civilian workers by occupational group are available from the 1970 Census of Population. Table B-2 is a summary tabulation of the detailed census breakdown of the employed labor force by occupational group for Scotland County. The table shows that the largest group of workers were operatives, except transportation; about 2700 or 26.6 percent out of a total of 10,243 were so classified in 1970. Craftsmen and firemen, and clerical workers were the second and third largest groups, each containing 13.4 and 11.8 percent respectively.

Table B-2. Distribution of Employed Persons by Occupational Group for Scotland County, 1970

<u>Occupation</u>	<u>Persons employed</u> <u>(16 yrs. &amp; older)</u> <u>(Thousands)</u>	<u>Distribution</u>
Professional, Technical	1.1	10.5
Non-farm Managers & Administrators	0.7	7.1
Sales Workers	0.5	4.9
Clerical Workers	1.2	11.8
Craftsmen, Foremen & Related	1.4	13.4
Operatives, Except Transportation	2.7	26.6
Transportation Equipment Operatives	.4	3.7
Non-farm Laborers	.5	4.6
Service Workers	.8	7.9
Private Household Workers	.5	4.8
Farm Workers	.5	4.7
Total Employed	10.2	100.0

Source: Adapted from 1970 Census of Population, General, Social and Economic Characteristics.

23. Of the total 10,243 workers accounted for in the 1970 census, 42.7% (42.7%) were female. The largest occupational group of female workers was operatives, except transportation which accounted for 24.5% of the total.

female workers. The second and third largest occupational categories for females were clerical workers and professional, technical workers which accounted for 20.5 and 14.0 percent, respectively.

24. During the period between 1960 and 1970, employment in Scotland County increased by 2,205 workers or 27.4 percent. There was a substantial decrease in agricultural related employment, but increases in manufacturing, communications and public utilities and service employment greatly offset the loss in agricultural employment. Approximately 42 percent of all persons employed in 1970 were employed by manufacturing concerns. Table B-3 shows a comparison between 1960 and 1970 employment trends.

Table B-3. Employment Trends in  
Scotland County, North Carolina 1960-1970

Industry Division	1960	1970	Numerical Change 1960-1970	Change 1960-1970
Agriculture, Forestry, & Fishing	1,172	534	(-)638	(-)54.4
Manufacturing	2,905	4,305	1,400	48.2
Construction	198	217	19	9.6
Communications & Public Utilities	125	323	198	158.4
Wholesale Trade	125	246	121	96.8
Retail Trade	1,140	1,277	137	12
Finance, Insurance and Real Estate	141	212	71	50.4
Government	1,656	2,508	852	51.4
Unemployed	147	221	74	50.3
Not Reported (1960 Only)	117		(-)117	(-)117
Total employed	8,038	10,243	2,205	27.4

## PERSONAL INCOME

25. During the calendar year 1969, one half of the families in Scotland County received an income of less than \$7,029 annually. Of the 6,379 families in the county, 1,515 or 23.8 percent received incomes below the poverty level compared to 549 families (8.6 percent) which received incomes in excess of \$15,000 annually. Table B-4 lists the number of families in various income brackets for calendar year 1969.

Table B-4. Income in 1969 of Families and  
Unrelated Individuals<sup>1/</sup> 14 Years Old and Over

Total Families	6,378
Less than \$2,000	720
\$2,000 to \$2,999	398
\$3,000 to \$3,999	578
\$4,000 to \$4,999	543
\$5,000 to \$5,999	469
\$6,000 to \$6,999	466
\$7,000 to \$7,999	501
\$8,000 to \$8,999	526
\$9,000 to \$9,999	369
\$10,000 to \$14,999	1,259
\$15,000 to \$24,999	424
\$25,000 and over	125
Median Family Income	\$7,029
Mean Family Income	\$7,881

<sup>1/</sup> Persons living alone or with non-relatives only

26. The per capita income of all persons in Scotland County for 1969 was \$2,033. The total number of persons in poverty was 7,793 (29.8 percent of all persons) and the "near poor" persons with income less than 125 percent of poverty totaled 9,519 (36.4 percent of all persons).

## Development and Economy

27. The following paragraphs discuss expected growth in Scotland County in relation to projected economic development of the Pee Dee Water resources Subarea. 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.

28. The principal economic center of Scotland County is the City of Laurinburg which serves as the county seat and as the major commercial retail center for the county. The City of East Laurinburg adjoins Laurinburg to form the urban center of Scotland County. Although intensive urbanization is not expected, significant increase in population can be anticipated as new industries move into the area. Sub-urban development is expected to fulfill housing needs of the future working force.

## PROJECTED POPULATION, EMPLOYMENT AND INCOME

29. As shown in the Region IV Population Projections published by the South Atlantic Division, U. S. Army Corps of Engineers, the population of Scotland County is expected to increase from 26,929 in 1970 to 46,000 by the year 2020. This represents a compound growth rate of 1.06 percent per year as compared to a predicted compound growth rate of 1.25 percent per year for the State of North Carolina. Historical population figures for the period between 1940 and 1970 indicated a compound growth rate of 0.5 percent for Scotland County. Population projections for Scotland County and the State of North Carolina are shown in the tabulation below and on Plate B-2.

### Population Trends

	<u>1970</u>	<u>1980</u>	<u>1990</u>	<u>2000</u>	<u>2010</u>	<u>2020</u>
Scotland County	26,929	29,500	33,500	38,500	42,500	46,000
North Carolina	5,082,059	5,703,900	6,419,300	7,302,800	8,333,200	9,535,800

30. The level of civilian employment depends upon the number of civilians in the labor force who are successful in finding work. Since employment projections for Scotland County are not available, employment projections presented in this report represent the employment/population ratio as projected in the 1972 Series E, OBERS Projections multiplied by projected county population. Scotland County forms a portion of the Pee Dee Water Resource Subarea numbered 0304 which was used in formulating employment projections. The following tabulation shows employment trends for Scotland County.

### Employment Trends

	<u>1970</u>	<u>1980</u>	<u>1990</u>	<u>2000</u>	<u>2020</u>
Population	26,929	29,500	33,500	38,500	46,000
Employment/population ratio	.41	.45	.45	.46	.45
Total Employment	10,947	13,275	15,075	17,710	20,700

31. Future income estimates for Scotland County are based on 1972 Series E, OBERS Projections. Since income projections are not available specifically for Scotland County, projections for the Pee Dee Water Resource Subarea numbered 0304 were used and are considered indicative of Scotland County. The following tabulation shows projected per capita income for Scotland County and for North Carolina. Information presented in the following tabulation is based on 1967 dollars.

		<u>Income Trends</u>				
		<u>1970</u>	<u>1980</u>	<u>1990</u>	<u>2000</u>	<u>2020</u>
Scotland County						
Per capita income (1967\$)		2,849	3,900	5,200	7,000	11,600
Per capita income relative (U.S.=1.00)		.82	.83	.85	.86	.88
North Carolina						
Per capita income (1967\$)		2,842	3,900	5,100	6,900	11,500
Per capita income relative (U.S.=1.00)		.82	.83	.84	.85	.87

## RECREATIONAL AREAS

32. A total of approximately 42 acres are currently available to the citizens of Laurinburg for recreational purposes. These facilities include several neighborhood parks, the American Legion and Little League Ball Parks and the Jaycee Community Park located in the upper portion of the Leith Creek study reach.

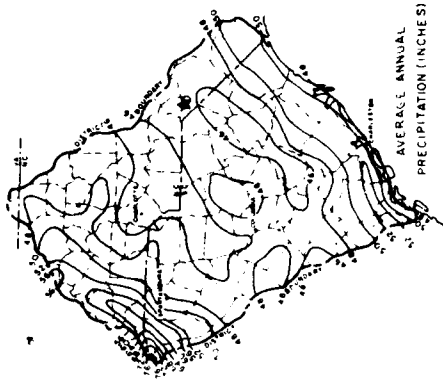
33. In addition to existing recreational facilities, the City of Laurinburg has proposed development of the "Lincoln Heights Neighborhood Development Program" on the left bank of Leith Creek (facing downstream) between the Carver Street and Caledonia Road crossings. Included in the master plan of development are four tennis courts, two baseball diamonds, two basketball courts, picnic areas and walking trails. Adequate parking would be provided for recreational users.

## DESCRIPTIVE PUBLICATIONS

34. The U. S. Geological Survey has mapped the Leith Creek Basin, and 7-1/2 minute quadrangle sheets are available with horizontal scale of 1:24,000. Contour intervals for these maps are 10 feet. A.S.C.S. aerial photographs with a scale of one inch equal to 400 feet were also used to study physical features and cultural development of the basin.

35. In addition to the above, field reconnaissances were used to acquaint the planner with the terrain, with changes in cultural development not shown on maps and photographs, with flooding problems and with detailed field study needs. Ensuing engineering surveys provided data on creek profiles, on channel obstruction, constructions and roughness, on stream and valley cross sections and on types of soils. Levels were run to damageable properties and appraisals of property values were made for use in calculating average annual damages.





AVERAGE ANNUAL  
PRECIPITATION (INCHES)

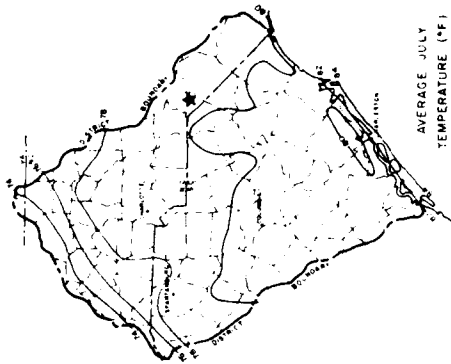


AVERAGE WARM SEASON  
PRECIPITATION (INCHES)  
APR. TO SEPT. 30)

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

LEITH CREEK  
LAURINBURG, SCOTLAND COUNTY  
NORTH CAROLINA  
CLIMATOLOGY  
NOVEMBER 1935

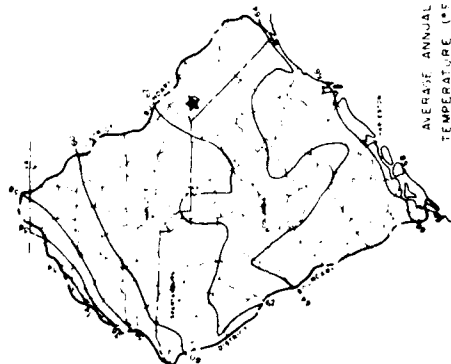
APPENDIX  
PLATE 81



AVERAGE JULY  
TEMPERATURE (°F.)



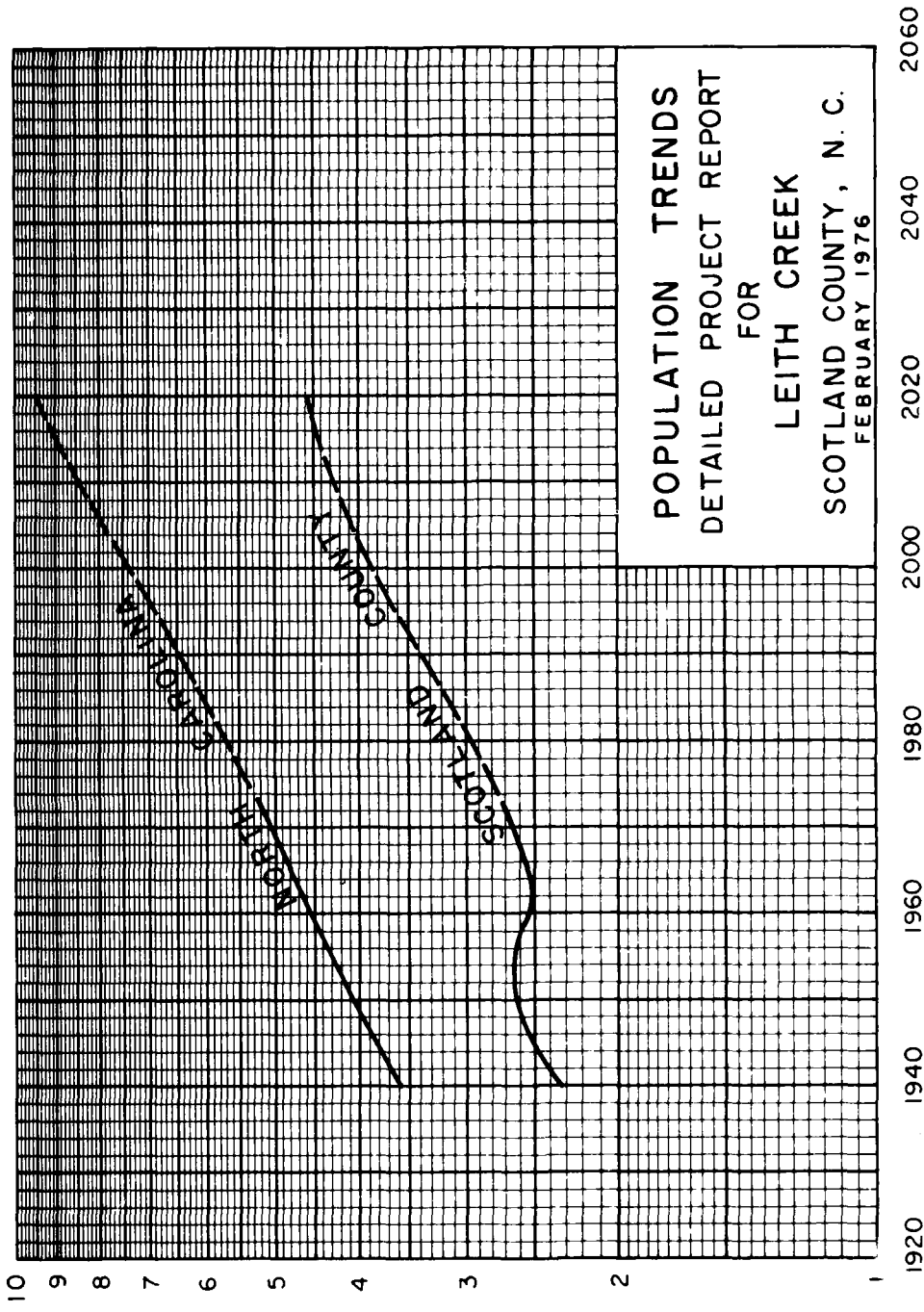
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TEMPERATURE (°F.)



AVERAGE ANNUAL  
TEMPERATURE (°F.)



AVERAGE DATE  
LAST FROST (Y.)



POPULATION TRENDS  
 DETAILED PROJECT REPORT  
 FOR  
 LEITH CREEK  
 SCOTLAND COUNTY, N. C.  
 FEBRUARY 1976

NORTH CAROLINA - POPULATION x 1,000,000  
 SCOTLAND COUNTY - POPULATION x 10,000

**SECTION C**

PROBLEMS AND NEEDS

# PROBLEMS AND NEEDS

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## SECTION C

# PROBLEMS AND NEEDS

1. This section discusses the problems and needs to which the study addresses itself. It discusses stream characteristics and flood problems including storm characteristics, streamflows, hydrologic analysis, areas subject to flooding, and historical and monetary damages as they relate to the Leith Creek Basin. Additional coverage, as related to specific areas where improvements are to be recommended, will be given in subsequent sections.

## Status of Existing Plans and Improvements

2. There are no existing or pending projects being considered on Leith Creek by city, county, state or other Federal agencies. The City of Laurinburg, however, has applied to the Flood Insurance program and flood insurance is currently available. A flood insurance study is scheduled to begin during Fiscal Year 1977.

# Flood Problems

## WATERSHED DESCRIPTION

3. The Leith Creek watershed is located entirely within the limits of Scotland County in the upper Coastal Plains region of North Carolina. The creek originates in an agricultural area northwest of the City of Laurinburg. From its source, the creek flows in a southeastwardly direction through the city to its confluence with Little Creek approximately 1.6 miles outside the city boundary. As it flows through Laurinburg, it forms a portion of the political boundary between the cities of Laurinburg and East Laurinburg. After its junction with Little Creek, flows from Leith Creek change to a southernly direction. They continue in this direction to Bridge Creek and then to the Little Pee Dee River just above McKays bridge, a distance of about 13 miles. This is approximately 4 miles above Little Rock, South Carolina. A map of the Leith Creek watershed is shown on Plate C-1.

4. Visual inspection of the creek indicates that little effort has been made to maintain the channel. With the exception of developed areas and park areas, considerable amounts of vegetation and debris restrict the effectiveness of the natural channel and overflow areas. In addition, several stream crossings have been constructed with culvert invert elevations above the natural stream gradient which has created a siltation problem and further reduced the effectiveness of the natural channel.

## TOPOGRAPHY

5. The topography of Leith Creek Basin is typical of the coastal plains of North and South Carolina which is gently sloping. Elevations in the upper watershed are 270 to 280 feet above mean sea level and gradually decrease to about 200 to 220 feet at its junction with Little Creek near the WEWO Radio Tower. Slopes of the natural stream bottom averages about six feet per mile.



# PRECIPITATION

6. A National Oceanic and Atmospheric Administration (NOAA) precipitation station is located in Laurinburg at latitude 34° 47', and longitude 78°. The elevation of the gage is 226 feet msl. Precipitation records for the gage have been obtained by NOAA intermittently since June 1946 and continuously since March 1951. The monthly and annual total precipitation amounts obtained at this station for the period of record are presented in Table C-1. Using values contained in this table, a plot of the monthly mean, daily, and minimum amounts of precipitation was prepared and is presented in Figure C-1. As shown there, the maximum recorded monthly precipitation was 14.82 inches and occurred in July 1965. The minimum recorded was 0.00 inches.

Table C-1

Precipitation Data  
Laurinburg, North Carolina<sup>1</sup>

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Total
1946	-	-	-	-	-	1.75	7.62	6.62	4.48	3.25	2.44	1.19	27.15
1947	4.04	3.37	4.43	6.39	2.42	1.68	13.79	4.32	6.40	3.36	8.95	2.72	67.95
1948	3.93	3.92	4.66	3.86	3.48	6.54	9.39	2.11	5.70	3.68	2.48	2.72	51.77
1949	2.27	4.96	2.71	2.15	4.60	4.66	3.56	6.50	3.68	3.20	3.17	2.72	47.54
1950	2.23	1.14	2.91	3.34	3.64	3.21	11.18	-	4.24	4.47	1.75	2.44	47.36
1951	2.08	-	3.93	4.09	1.03	2.85	4.00	1.54	3.93	.59	1.91	3.17	28.00
1952	2.65	5.34	5.17	2.08	2.03	6.01	1.71	7.90	2.29	.63	4.74	2.72	47.17
1953	2.14	3.29	4.22	1.79	6.18	10.01	2.70	3.48	5.48	.11	1.17	2.72	47.05
1954	3.74	2.98	4.43	2.43	2.96	1.79	2.61	2.23	.90	8.47	1.88	2.72	47.05
1955	3.34	2.24	2.46	5.26	4.82	3.95	3.31	10.18	4.04	1.42	2.72	2.72	51.77
1956	1.71	3.07	2.16	1.26	2.81	2.56	4.12	5.30	5.60	3.88	2.32	2.72	47.05
1957	3.10	2.09	4.09	2.46	4.73	7.34	2.72	5.79	6.32	2.32	8.33	2.72	51.77
1958	4.13	4.61	4.22	4.17	4.20	9.21	4.41	2.79	1.09	5.32	2.72	2.72	51.77
1959	2.51	4.76	5.47	6.52	2.96	3.66	8.48	5.03	6.55	10.29	2.72	2.72	67.95
1960	5.64	1.28	09.07	4.14	4.33	4.92	5.40	6.68	4.83	2.97	2.97	2.72	67.95
1961	2.61	6.16	3.68	6.95	3.57	8.14	5.44	6.40	1.59	2.72	2.72	2.72	67.95
1962	3.82	3.96	4.43	2.55	4.21	5.70	3.04	2.32	3.57	.54	1.32	2.72	47.05
1963	2.15	3.73	3.29	1.69	3.47	3.36	5.22	2.26	4.42	1.47	1.64	2.72	47.05
1964	5.19	6.36	5.01	3.49	1.30	4.93	9.00	6.56	5.01	5.78	1.32	2.72	67.95
1965	1.23	3.55	7.62	3.27	1.42	9.00	14.82	3.34	3.94	1.54	3.56	2.72	67.95
1966	5.12	4.73	2.38	3.39	7.50	5.04	3.32	7.06	3.86	2.46	1.47	2.72	67.95
1967	3.26	3.40	1.41	1.22	4.91	2.56	9.53	7.46	3.27	1.22	2.72	2.72	67.95
1968	4.74	2.33	2.42	1.25	1.16	2.94	3.77	2.84	1.63	2.15	2.72	2.72	47.05
1969	1.62	1.49	3.91	4.57	3.48	9.64	7.22	6.03	5.93	1.12	1.12	2.72	67.95
1970	3.39	2.17	3.19	1.34	1.49	5.24	9.11	7.67	2.45	3.34	2.72	2.72	67.95
1971	5.13	2.48	2.31	2.94	2.64	5.27	2.01	3.90	3.32	6.24	2.72	2.72	67.95
1972	4.37	3.85	3.22	1.34	6.25	2.27	5.95	2.75	4.52	2.22	2.72	2.72	67.95
1973	3.24	2.83	4.22	6.42	3.98	7.37	6.93	6.07	1.12	4.9	2.72	2.72	67.95
1974	3.29	4.43	2.22	2.45	6.33	2.22	7.60	6.86	2.11	2.72	2.72	2.72	67.95
1975	5.33	5.02	5.18	2.46	4.39	4.70	9.07	1.46	3.87	2.72	2.72	2.72	67.95
Average	3.63	3.19	4.17	3.49	3.63	5.06	6.50	4.76	4.20	3.96	3.17	2.72	47.05

1. Climatological Data for North Carolina, U. S. Department of Commerce (NOAA Station No. 4560).
2. 0 = Water equivalent of snow; 11 = wholly or partly estimated; 12 = partial; 13 = estimated equivalent to every 10 inches of snow; 14 =

STORM CHARACTERISTICS

7. Flood-producing rainfall in the Leith Creek Basin generally is a result of tropical storms and hurricanes or high intensity thunderstorms occurring mostly in the summer months. Hurricanes are storms of tropical origin which usually occur in late summer or autumn and generate extensive prolonged precipitation over a large area. During summer months, the most air masses which typically pass having lower temperatures and violent thunderstorms and intense precipitation. The most severe of these storms usually occur during the period of June through October.

8. A recording gaging was added by NOAA at the Laurinburg, N.C. in 1952. Hourly precipitation data for Laurinburg has been available since that date. All storms recorded having a total daily precipitation in excess of 3.00 inches are listed in order of severity in Table C-2. Precipitation for various durations are also shown. As shown, there is no record of a short duration storm that occurred during the period of record except the September 1974 storm where 3.40 inches fell in 3 hours. The October 1952 and 1958 storms contained the largest volume of rainfall.

Table C-2

Storm Having A Recorded Daily Precipitation  
In Excess Of 3.00 Inches  
Laurinburg, North Carolina<sup>1</sup>  
Period of Record 1952-1975

Date	Daily Rainfall In Inches	Max. Rainfall in Inches for Specified Duration						Total Daily Precipitation in Inches
		24-Hour	12-Hour	6-Hour	3-Hour	2-Hour	1-Hour	
10 Oct 1952	4.97	4.97 <sup>4</sup>	6.75 <sup>4</sup>	3.88	2.50	1.87	1.11	4.97
10 Oct 1958	4.96	4.96	4.80	4.71 <sup>4</sup>	2.83	2.44	2.55	4.96
27 Sep 1958	4.80	4.80	4.45	3.09	2.88	2.23	1.70	4.80
27 Sep 1973	4.60	4.60	4.50	3.90	2.70	2.00	1.11	4.60
28 Sep 1969	4.15	3.92	3.87	3.20	2.94	2.45	2.50	4.15
16 Sep 1962	4.15	-	-	-	-	-	-	4.15
17 Sep 1974	3.96	3.90	3.90	3.90	3.40 <sup>4</sup>	3.30 <sup>4</sup>	2.70 <sup>4</sup>	3.96
10 Oct 1973	3.88	-	-	-	-	-	-	3.88
10 Oct 1958	3.87	3.87	3.56	2.71	2.70	2.33	2.11	3.87
10 Oct 1962	3.71	3.71	3.71	3.04	2.90	2.67	2.11	3.71
10 Oct 1967	3.42	3.42	2.88	1.76	0.97	0.77	0.66	3.42
10 Oct 1972	3.30	3.30	3.25	3.01	1.60	1.40	1.22	3.30
10 Oct 1976	3.28	3.28	3.10	2.40	1.55	1.30	0.90	3.28
10 Oct 1969	3.21	-	-	-	-	-	-	3.21
10 Oct 1965	3.12	3.12	3.12	3.11	2.67	2.27	2.00	3.12
10 Oct 1966	3.01	3.01	2.91	1.98	1.27	1.06	0.77	3.01
10 Oct 1968	3.00	3.00	2.93	2.93	2.91	2.40	2.11	3.00

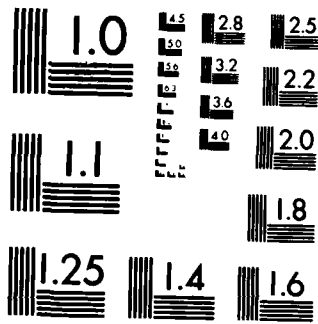
<sup>1</sup> Data for this table were obtained from the NOAA gaging station at Laurinburg, N.C. (1952-1975).

<sup>2</sup> The 1952 and 1958 storms were the most severe of the hurricanes which struck the Leith Creek Basin. The total rainfall for the 24-hour period for these storms was 4.97 inches and 4.96 inches, respectively.

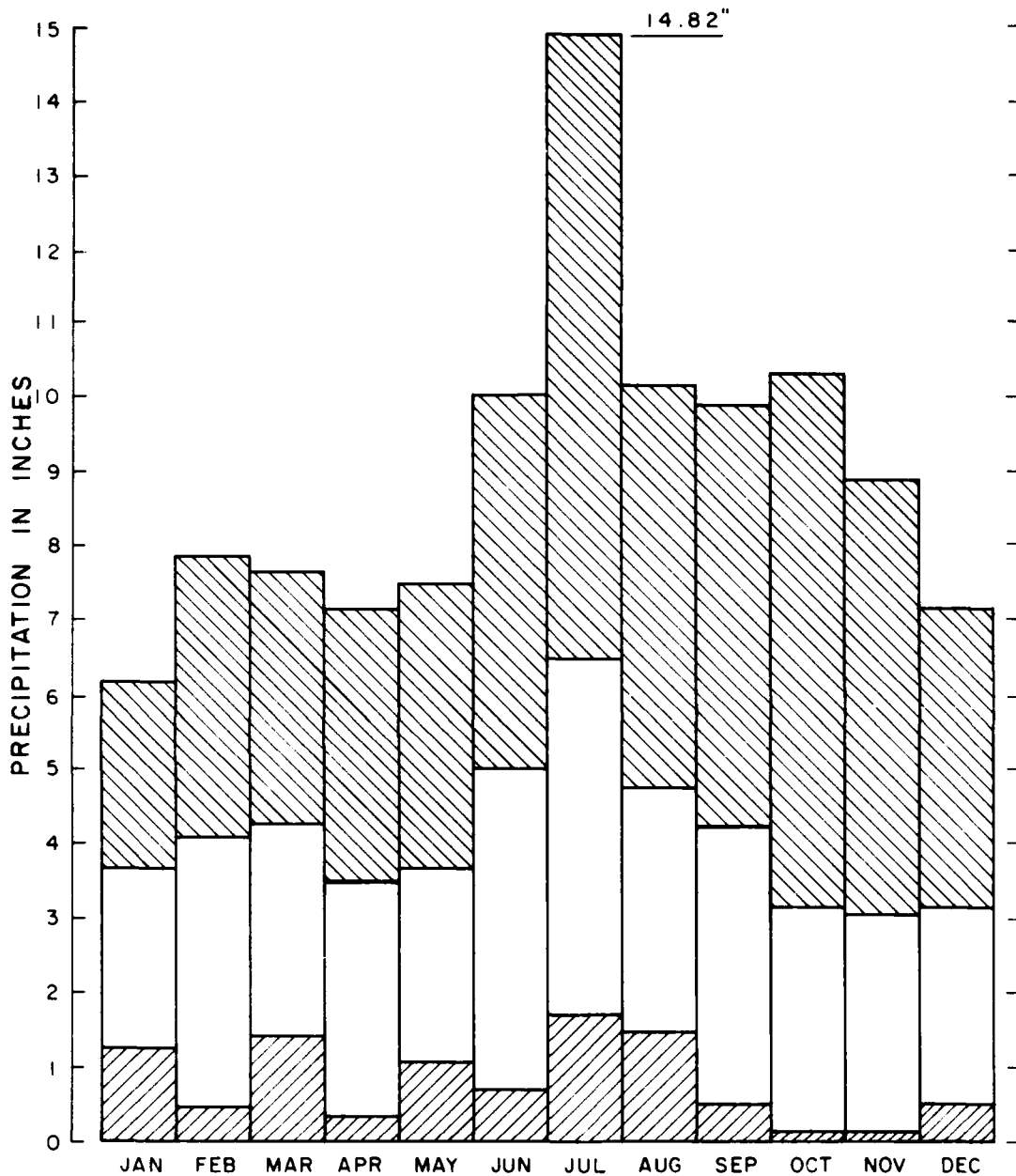
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Date: \_\_\_\_\_





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



 RECORD. MAX.    
  RECORD. MIN.    
  AVERAGE

**MONTHLY PRECIPITATION EXTREMES**  
**PERIOD OF RECORD, 1946 - 1975**  
**LAURINBURG, NORTH CAROLINA**

FIGURE C-1

9. A rainfall frequency atlas of the United States was prepared by the U.S. Weather Bureau (Now NOAA) in 1961. This data was published as Technical Paper No. 40. Rainfall-frequency data for the Laurinburg area for durations from 1 to 24 hours and frequencies from 2 to 100 years are shown in Table C-3.

Table C-3

Rainfall-Frequency-Duration

Frequency (Years)	Duration in Hours					
	1	2	3	6	12	24
2	1.8	2.1	2.4	2.8	3.3	3.8
5	2.3	2.7	3.1	3.6	4.3	4.9
10	2.7	3.2	3.5	4.2	5.0	5.7
25	3.1	3.6	4.1	4.4	5.6	6.5
50	3.4	4.1	4.5	5.3	6.3	7.4
100	3.7	4.6	5.0	6.1	7.2	8.2

Source: Weather Bureau (NOAA) Technical Paper No. 40, U.S. Department of Commerce, May 1961 entitled "Rainfall Frequency Atlas of the United States for Durations of 30 minutes to 24 hours and Return Periods from 1 to 100 years".

10. A brief description of a few of the more severe storms to have occurred in or near the Laurinburg area are discussed in the following paragraphs.

a. September 1928 Storm. The heavy rainfall associated with this storm was caused by a tropical hurricane which passed over central North Carolina on September 19th. The center of the storm occurred at Darlington, South Carolina where 12.5" of rain fell in about 60 hours. Locally, the storm dropped 8.5 inches of rainfall in Laurinburg over a 96 hour period. Maximum 24 hour precipitation at Laurinburg was approximately 7.1 inches. This is approximately equivalent to a 45 year 24 hour storm.

b. September 1945 Storm. This tropical storm extended from Florida to Pennsylvania and covered all of South Carolina and most of North Carolina. The major center of the storm occurred at Rockingham, North Carolina where 14.8 inches of rainfall was recorded in about 108 hours. Maximum 24 hour rainfall at Laurinburg was 6.0 inches. This is approximately equivalent to a 20 year 24 hour storm.

c. October 1954 Storm. Hurricane "Hazel" entered North Carolina at a point near the South Carolina line on 15 October and traveled generally northward over North Carolina and Virginia into the northeastern United States and Canada. Heavy rainfall totals accompanying the storm were in excess of six inches near the path of the storm with Carthage, North Carolina receiving 9.72 inches on the 15th and 16th. Twelve hour rainfall at Laurinburg was 6.75 inches. This is equivalent to approximately a 75 year 12 hour storm.

d. June 1958 Storm. A severe local storm struck Laurinburg on 27 June producing 4.80 inches of rain. This storm, while more widespread than the October 1959 storm, was most severe at Laurinburg. Maximum 12 hour rainfall was 4.45 inches at the Laurinburg station. This is equal to approximately a 6 year 12 hour storm.

e. October 1959 Storm. Laurinburg was the center of a localized storm which produced 4.96 inches of rain on the 11th. Maximum 6 hour rainfall was 4.71 inches. This is approximately equal to a 30 year 6 hour storm.

## STREAMFLOWS

11. There are no stream gaging records available for Leith Creek, however, the United States Geological Survey had a crest-stage partial record station located on a Bridge Creek tributary at Johns, North Carolina from 1953 to 1973. The watershed for this tributary is located adjacent to the lower portion of the Leith Creek watershed. The Bridge Creek tributary watershed is predominately rural and therefore is not directly applicable to Leith Creek but can be used as a guide. Because no flow records are available for Leith Creek, runoff estimates must be accomplished by synthetic methods. The methods used and results obtained are discussed in pertinent following paragraphs.

# Hydrology

## RUNOFF SYNTHESIS

12. As mentioned previously, there are no streamflow records for Leith Creek. To determine flow rates for project analysis and design, it was

necessary to use synthetic methods. Two independent methods were used. One employed frequency analysis, the other runoff from a hydrologic model developed for the Leith Creek watershed. Following initial independent studies using the two methods, the results of each were adjusted in order to reach common results. The following paragraphs discuss the two methods, their results, hydrologic criteria used, and adopted discharge frequency data.

## FLOOD FREQUENCY ANALYSIS

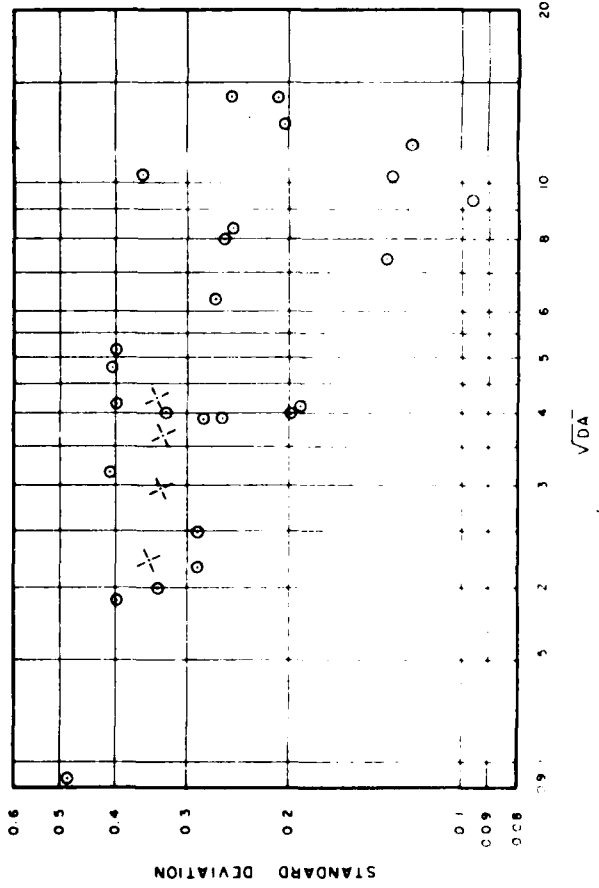
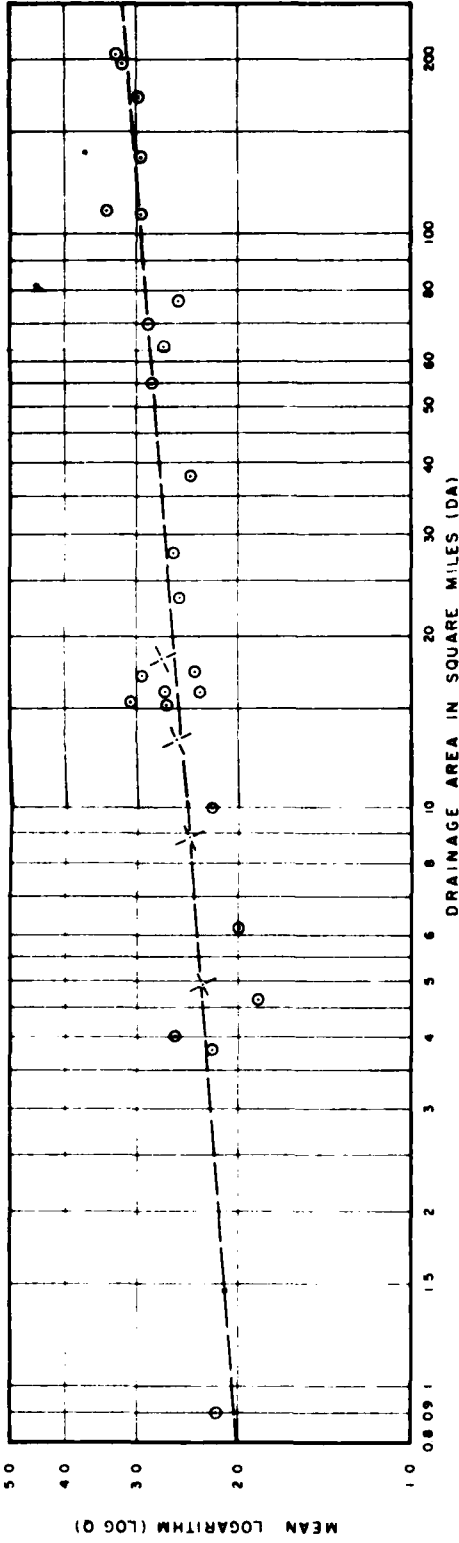
13. Statistical parameters (mean, standard deviation, and skew) have been derived for all stream gaging stations located within the Charleston District that record essentially unregulated flow and that have accumulated sufficient records to warrant their use. These parameters were derived using the Hydrologic Engineering Center's Computer Program No. 723-X6-L2350, Regional Frequency Computations. For the Leith Creek study, stations within the coastal section of the District and having watershed characteristics similar to Leith Creek were analyzed. The stations used, their drainage area and period of record, and the statistical parameters generated by the regional frequency program are presented in Table C-4. Using the data presented in the table, plots were made of mean discharge (Log Q) vs. drainage area (D.A.) and of Standard Deviations vs. square root of drainage area ( $\sqrt{DA}$ ). These plots are shown on Figures C-2. Using various values of mean, standard deviations, and skew, several frequency curves were generated. Discharge rates obtained from these curves for selected frequency floods were compared with those derived using the hydrologic watershed model discussed in paragraph 16. The values which gave the best correlation between methods are shown in Table C-5.



Table C-4

Statistical Data For Recorded And Reconstituted Flows

Station No.	Drainage Area (Mi <sup>2</sup> )		Period of Record (Yrs.)	Equivalent Record (Yrs.)		Mean	Standard Deviation	Skew
		$\sqrt{DA}$						
1089.6	15.3	3.9	19	22.2	2.652	.280	-0.607	
1096.4	16.0	4.0	18	21.7	2.665	.328	0.117	
1100.2	3.8	1.9	18	25.8	2.229	.399	-0.150	
1170.0	110.0	10.48	39	40.8	3.377	.357	0.527	
1173.9	0.9	.94	19	34.5	2.190	.481	-1.680	
1202.6	15.4	3.92	18	30.8	3.053	.261	1.184	
1294.4	17.0	4.12	18	27.7	2.939	.190	0.636	
1305.0	64.0	8.0	19	38.4	2.678	.259	1.749	
1306.0	55.0	7.4	4	38.9	2.821	.135	0.294	
1309.0	108.0	10.39	15	38.7	2.936	.131	-0.763	
1309.1	173.0	13.15	14	40.8	2.960	.202	0.601	
1311.5	28.0	5.29	8	36.4	2.586	.398	-0.548	
1322.3	6.2	2.49	21	28.4	1.996	.287	0.877	
1335.9	4.66	2.16	19	34.5	1.840	.288	-1.550	
1339.6	4.0	2.0	19	40.4	2.585	.337	-2.152	
1345.8	16.0	4.0	21	24.6	2.336	.198	-0.399	
1348.0	70.0	8.37	6	33.4	2.861	.250	-0.474	
1483.0	38.1	6.17	8	28.5	2.414	.269	0.628	
1695.5	136.0	11.66	15	27.4	2.938	.121	0.542	
1696.3	10.0	3.16	8	33.1	2.214	.406	0.817	
1716.8	17.4	4.17	8	28.0	2.362	.398	-0.277	
1725.0	198.0	14.07	30	34.9	3.183	.208	0.053	
1742.5	23.4	4.84	4	33.0	2.510	.401	0.448	
1765.0	20.3	4.51	24	30.0	3.226	.250	0.124	
1973	87	9.33	8	33.0	2.525	.096	0.843	



NOTES:  
 ○ VALUE FROM TABLE C-4  
 ✕ SELECTED VALUES (SEE TABLE C-5)

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

**LEITH CREEK**

LAURINBURG, NORTH CAROLINA

STATISTICAL PARAMETERS  
 FOR  
 FREQUENCY ANALYSIS

NOVEMBER 1976

Table C-5

Adopted Statistical Parameters

Location	Leith Creek Above U.S. 401 & Alt. 15	Leith Creek Above Confluence w/Little Creek	Little Creek At Mouth	Leith Creek Below Confluence w/Little Creek
Drainage Area (DA)-mi <sup>2</sup>	8.82	13.24	4.94	18.18
√DA	2.97	3.64	2.22	4.26
Mean Log of Peak Flow-cfs	2.45	2.56	2.30	2.70
Standard Deviation	0.33	0.33	0.35	0.34
Skew Coefficient	0	0	0	0

## UNIT HYDROGRAPH ANALYSIS

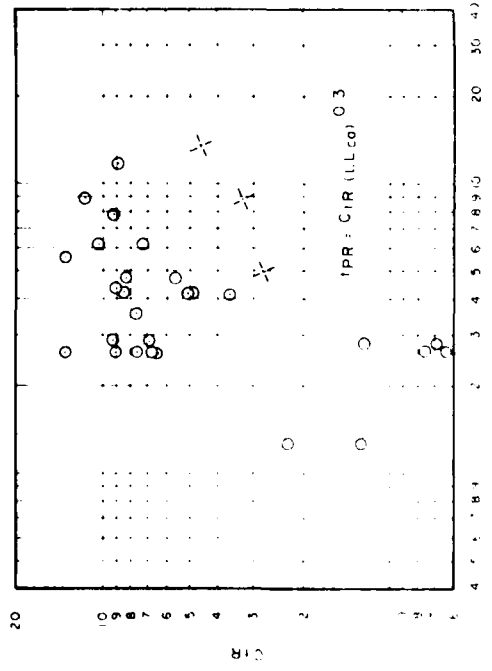
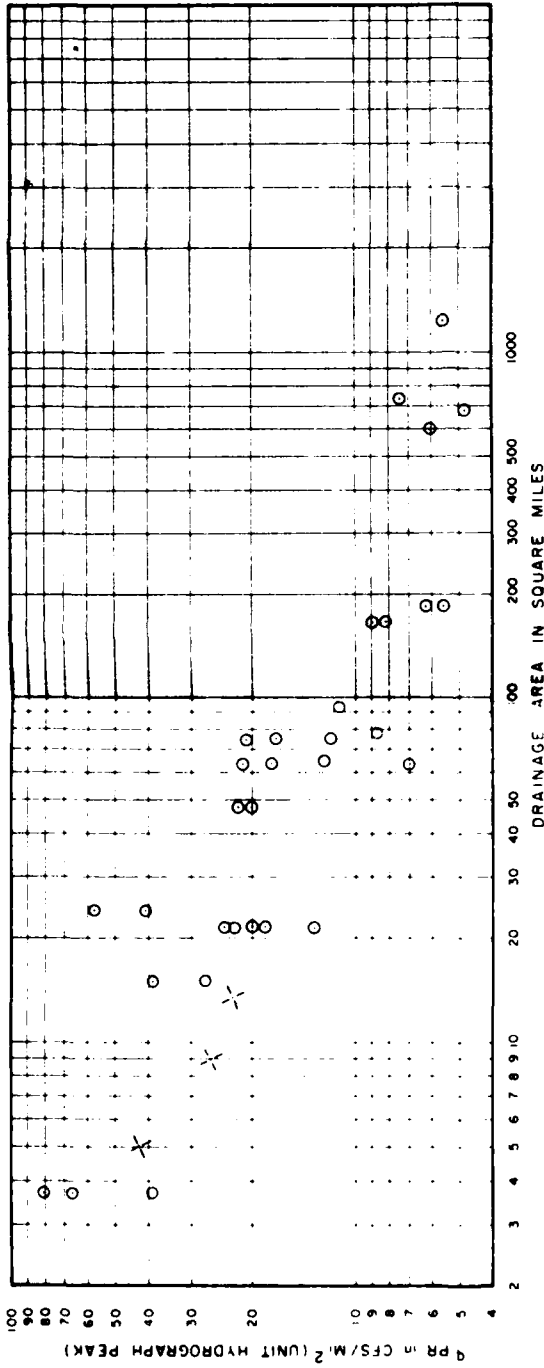
14. Synthetic unit hydrographs were computed at three locations in the Leith Creek watershed in accordance with criteria contained in EM 1110-2-1405. These locations were: Leith Creek at U. S. Alt. 15 and 401, Leith Creek upstream of confluence with Little Creek and at the mouth of Little Creek. The Unit Hydrographs for the final two locations were combined to obtain a Unit Hydrograph for Leith Creek just below the confluence with Little Creek. Since no flow data exists for Leith Creek, data from other studies were utilized to develop these hydrographs. Pertinent Unit Hydrograph data, watershed characteristics, and the utilized studies are presented in Table C-6. Using data contained in this table, plots were made of hydrograph Peaks ( $q_{pr}$ ) vs. drainage area and of Snyder's  $C_{tr}$  vs.  $(LL^{ca})^{0.3}$ . These plots are shown on Figure C-3. Using various combinations of Peak and lag ( $t_{pr}$ ) several unit hydrographs were developed and entered in the hydrologic model discussed in paragraph 16. The unit hydrographs which gave the best results in comparison with the frequency analysis (see paragraph 13) is presented in Table C-7. The table also contains other pertinent data associated with the unit hydrographs selected and the watersheds which they model.

Table C-6  
Unit Hydrograph Data From Areas Similar To Leith Creek

Watershed	D.A. (Square mi)	L (Miles)	L <sub>ca</sub> (Miles)	(LL <sub>ca</sub> ) <sup>0.3</sup>	t <sub>R</sub> (Hours)	q <sub>R</sub> (cfs/Mi <sup>2</sup> )	t <sub>pR</sub> (Hours)	C <sub>tR</sub>	640 C <sub>p</sub>
Ahoskie Creek Near Rich Square N. C. (1)	3.7	2.0	1.1	1.27	1.0	38.6	2.9	2.28	115
N.E. Cape Fear River Near Seven Springs, N. C. (1)	47.5	9.0	3.7	2.86	3.0	19.8	26.5	9.26	518
Rockfish Creek Near Wallace, N. C. (1)	63.8	14.25	8.4	4.2	6.0	17.4	20.2	4.81	352
Ahoskie Creek At Minton's Store, N. C. (1)	24.0	7.0	3.75	2.66	1.0	40.7	2.0	.75	76.8
Hood Creek Near Leland, N. C. (1)	21.6	7.0	3.5	2.61	1.0	53.6	1.7	.64	89.6
Herring Run Near Washington, N. C. (1)	15.0	7.0	4.4	2.80	1.0	38.8	1.9	.68	70
Lumber River At Boardman, N. C. (2)	1220	91.5	4.0	11.8	1.0	27.2	3.4	1.21	90
Black River Near Tomahawk, N. C. (2)	680	51.0	29.0	8.9	6.0	5.84	107.72	8.9	593
N.E. Cape Fear River Near Chinguapin, N. C. (2)	600	44.5	21.2	7.8	6.0	5.99	70.22	9.23	420
Trent River Near Trenton, N. C. (2)	168	28.5	15	6.18	6.0	8.93	44.45	7.28	396
Swift Creek Near Vanceboro, N. C. (2)	182	25.5	12.0	5.58	6.0	8.26	61.62	10.2	509
Little Contentnea Near Farmville, N. C. (2)	93.3	11.7	5.9	3.56	6.0	11.1	27.27	7.58	303
Nahunta Swamp Near Shine, N. C. (2)	77.6	19.5	8.9	4.7	6.0	11.8	27.28	5.57	321
New River Near Gum Branch, N. C. (2)	74.5	15.1	7.7	4.16	6.0	9.15	38.73	8.32	354
Conetoe Creek Near Bethel, N. C. (2)	78.1	16.2	8.4	4.36	6.0	17.1	20.45	5.05	350
					6.0	20.6	15.82	3.60	326
					6.0	8.65	38.72	8.95	336

NOTE:

1. Coastal Plain Unit Hydrograph Study, Charleston, S. C. District
2. General Flood Hydrology: North Carolina Coastal Region, Wilmington, N. C. District



**NOTES:**

- O VALUE FROM TABLE C-6
- X SELECTED VALUES (SEE TABLE C-7)

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

**LEITH CREEK**

**LAURINBURG, NORTH CAROLINA**

**UNIT HYDROGRAPH PARAMETERS**

NOVEMBER 1975

Table C-7  
Unit Hydrograph Data and Rainfall-Loss

Data	Basic Data			Hydrographs			Continuation of Hydrograph Ordinates			Rainfall Losses*								
	Area			End of Period Ordinates-cfs			Time in Hrs from Beginning of Rainfall			Area			Flood Frequency (Years)			Initial Infiltration For (In/hr)		
	I (1)	II (2)	III (3)	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III
D.A. (sq.mi.)	8.82	13.24	4.94	0	0	0	68	11	20	11	20	11	20	11	1.75	1.75	1.75	0.26
L (mi.)	6.0	8.8	5.5	2	24	33	70	10	18	10	18	10	18	10	1.65	1.65	1.65	0.25
L <sub>ca</sub> (mi.)	3.1	4.4	1.99	6	172	194	74	8	15	8	15	8	15	8	0.50	0.50	0.50	0.10
(LL <sub>ca</sub> ) <sup>0.3</sup>	2.4	2.18	2.05	8	226	203	76	7	14	7	14	7	14	7				
t <sub>R</sub> (hrs)	2.0	2.0	2.0	10	229	171	80	6	11	6	11	6	11	6				
R <sub>e</sub> (inches)	1.0	1.0	1.0	12	207	143	82	5	10	5	10	5	10	5				
Q <sub>pr</sub> (cfs)	234	305	210	14	186	310	84	4	8	4	8	4	8	4				
q <sub>p</sub> (cfs/sq.mi.)	26.5	23.0	42.7	16	168	294	86	4	8	4	8	4	8	4				
t <sub>pR</sub> (hrs)	8	13	6	18	151	265	88	4	7	4	7	4	7	4				
S <sub>st</sub> (ft/mi.)	9.3	8.4	14.2	20	137	240	90	3	6	3	6	3	6	3				
C <sub>tr</sub>	3.3	4.6	2.8	22	123	216	92	3	6	3	6	3	6	3				
C <sub>p</sub> 640	212	300	256	24	111	195	94	3	6	3	6	3	6	3				
				26	100	176	96	3	6	3	6	3	6	3				
				30	81	144	98	2	4	2	4	2	4	2				
				32	73	130	100	2	4	2	4	2	4	2				
				34	66	117	102	2	4	2	4	2	4	2				
				36	60	106	104	2	4	2	4	2	4	2				
				38	54	95	106	2	4	2	4	2	4	2				
				40	48	86	108	2	4	2	4	2	4	2				
				42	44	78	110	1	3	1	3	1	3	1				
				44	39	70	112	0	2	0	2	0	2	0				
				46	35	63												
				48	32	57												
				50	29	51												
				52	26	46												
				54	23	42												
				56	21	38												
				58	19	34												
				60	17	31												
				62	15	28												
				64	14	25												
				66	13	23												

\* Same loss rate used for each Sub Area (I, II, III)

## RAINFALL LOSSES

15. Rainfall losses were computed as an initial loss followed by a uniform infiltration rate. Initial loss rates varied between .5 and 1.75 inches while infiltration rates utilized varied from .10 to .26 inches per hour. Due to the relatively small amount of urban development in the watershed identical loss rates were used for all three sub-areas. The loss rates used for the SPF and 2, 10 and 100-year frequency floods are shown in Table C-7. These loss rates are similar in magnitude to those used in previous studies and for those derived from various storm studies.

## FLOOD FREQUENCIES USING A HYDROLOGIC WATERSHED MODEL

16. A hydrologic watershed model was developed for Leith Creek using the Hydrologic Engineering Centers HEC-1, "Flood Hydrograph Package". Runoff rates for the 2, 10 and 100 year frequency floods were derived using this model. Rainfall quantities used were the 24-hour values obtained from TP-40 subdivided into 2-hour values using an SPS distribution. Rainfall loss rates used were the same as those discussed in the previous paragraph. Several 2, 10 and 100 year floods were computed using different unit hydrographs and loss rates. Each was correlated with the various discharge frequency curves obtained from the frequency analysis until a suitable correlation between all factors was obtained. Values produced from the adopted unit hydrographs are presented in Table C-8. To show the correlation obtained, they are also plotted on the adopted discharge frequency curves shown on Figures C-6 through C-9.

Table C-8

### Flood Peaks Using Hydrologic Watershed Model

<u>Location</u>	<u>Peak Discharges - cfs</u>		
	<u>2-Year Flood</u>	<u>10-Year Flood</u>	<u>100-Year Flood</u>
Leith Creek at U.S. Alt Highways 15 & 401	330	730	1470
Leith Creek Above Confluence with Little Creek	450	990	2000
Little Creek at Mouth	290	630	1260
Leith Creek Below Confluence with Little Creek	630	1390	2830

## HISTORICAL FLOOD SYNTHESIZED

17. Since the flood of February 1973 was the only historical flood on which high water marks could be obtained, it was chosen to verify synthesized hydrologic and hydraulic data. Rainfall for the storm was obtained from the NOAA hourly rainfall gage located in Laurinburg. A hyetograph showing the rainfall that occurred and the losses and rainfall excess computed is shown on Figure C-4. Runoff for the storm was determined by applying the computed rainfall excess to the Unit Hydrographs derived for Leith Creek. The peak discharge rate obtained for Leith Creek below the confluence with Little Creek was 546 cfs. The computed hydrograph at this location is shown on Figure C-4. This rate of flow is approximately equal to a 3 year frequency flood. A comparison of the 24 hour rainfall values with those presented in Table C-3 indicates a storm return frequency of about 4 years. The details of the correlation with the observed high water marks is discussed later in paragraph 29 through 32.

## STANDARD PROJECT FLOOD

18. A standard project storm was developed for the Leith Creek watershed using the procedure described in Civil Engineer Bulletin No. 52-8, EM 1110-2-1411, entitled, "Standard Project Flood Determinations". The computed storm has a duration of 96 hours and a total storm precipitation of 18.43 inches. The critical 24 hour period has a total rainfall of 15.19 inches. Following an initial loss of 0.50 inches and an infiltration rate of 0.10 inches per hour, a total rainfall excess of 13.70 inches is obtained. This is 74 percent of the total storm rainfall. To determine the standard project flood, the computed rainfall excess was applied to the unit hydrographs determined for Leith Creek. The SPS hyetograph and the SPF hydrographs are shown on Figure C-5.

## ADOPTED DISCHARGE FREQUENCY DATA

19. The adopted discharge frequency curves are shown on Figures C-6 through C-9. Discharges used for design and project formulation studies for various frequency floods for selected locations are presented in Table C-9. Discharges at locations other than those where frequency curves were computed, were obtained by proportional analysis using square root of the drainage area. Since there are no measured stream-flow records available, and it is not possible to perform a direct analysis, the methods used and the correlation obtained between them represent a sound solution to the problem.



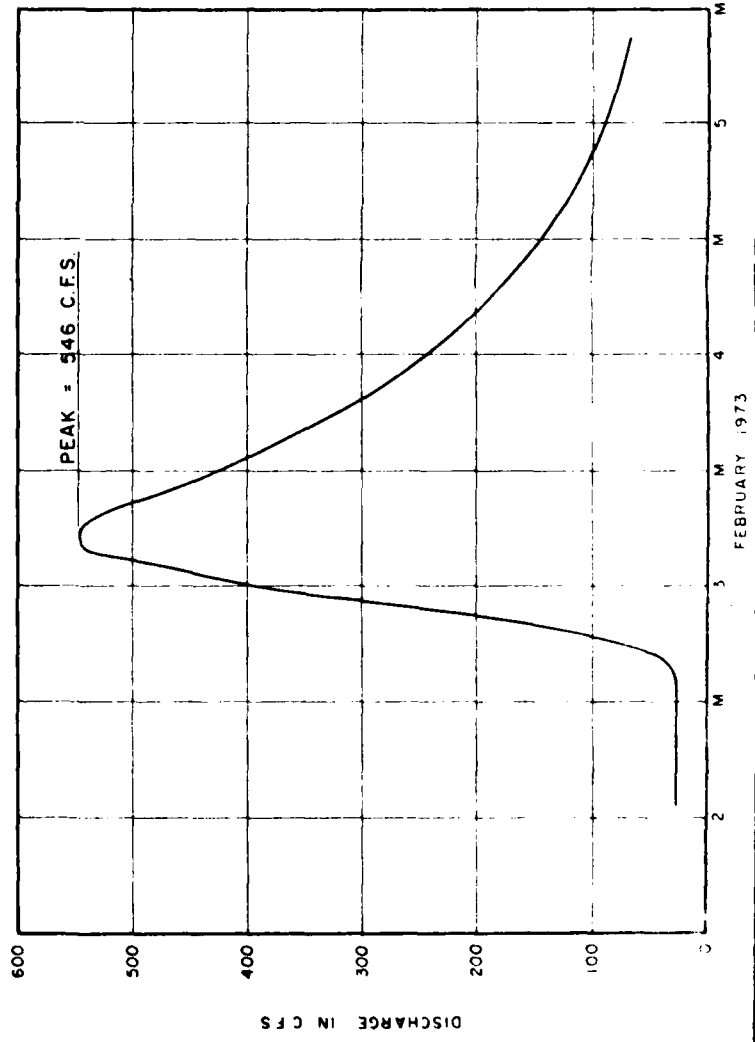
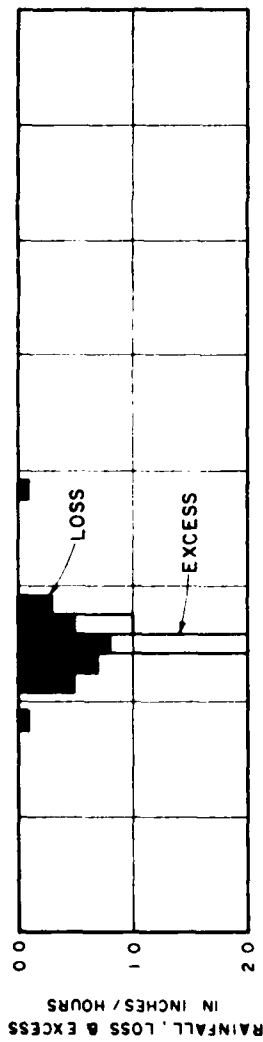
Table C-9

## Discharge-Frequency Data At Various Locations

Location	Station (feet)	Drainage Area (sq. mi.)	Recurrence Interval In Years						Standard Project Flood
			2	5	10	20	50	100	
			Peak Discharge In CFS						
Leith Creek at U.S. Hwy. 15 & 401	205+00	7.93	310	520	690	920	1260	1380	2550
Leith Creek at U.S. Alt. Hwy. 15 & 401	168+00	8.82	330	550	730	980	1340	1470	2760
Leith Creek 2200' Above U.S. Hwy 74 Crossing	131+00	11.11	410	630	910	1150	1570	1840	3430
Leith Creek at Laurin- burg & Southern R.R. South of E. Laurinburg	69+00	12.19	430	660	950	1210	1640	1920	3600
Leith Creek Above Confluence with Little Creek	27+00	13.24	450	690	990	1260	1710	2000	3750
Leith Creek at Mouth	9+25	4.94	290	390	630	740	1020	1260	2290
Leith Creek Below Confluence with Little Cr. Near U.S. Hwy. 74	9+00	18.18	630	960	1390	1810	2500	2830	5380

## EFFECT OF FUTURE URBANIZATION ON RUNOFF

20. As previously discussed, the City of Laurinburg has experienced a 56% increase in population from 1940 to 1970. This growth is expected to continue although possibly at a slower rate. A significant percentage of any future urbanization is expected to occur east of Laurinburg and East Laurinburg in the Little Creek watershed. Some additional development will probably occur within the lower limits of the study area in the Leith Creek watershed. The upper and middle portions of the Leith Creek watershed are not expected to experience any significant development.



TOTAL RAINFALL - INCHES 4.71  
 TOTAL LOSSES - INCHES 3.01  
 TOTAL EXCESS - INCHES 1.70  
 INITIAL LOSS - INCHES 1.70  
 INFILTRATION - IN/HOUR .25

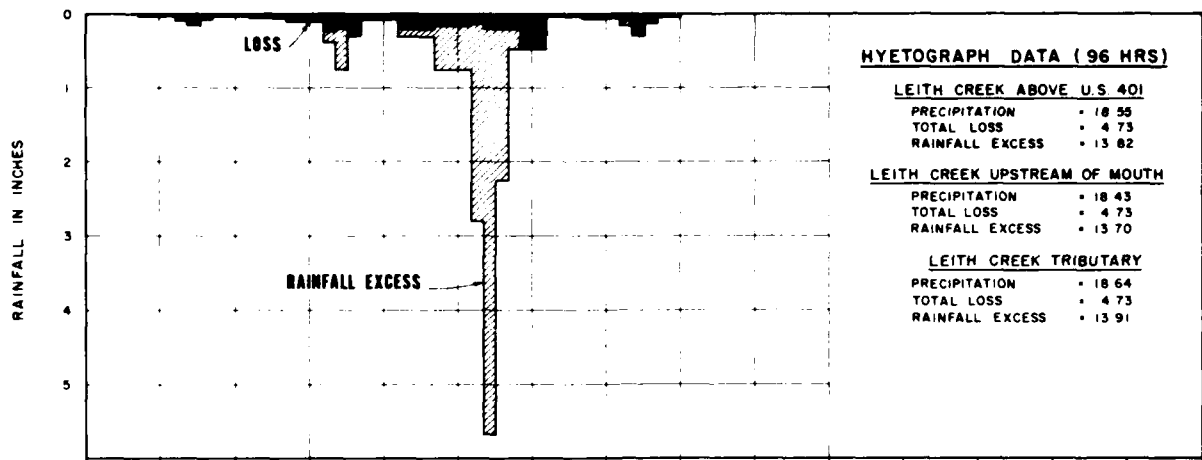
CORPS OF ENGINEERS, U S ARMY  
 CHARLESTON, SOUTH CAROLINA, DISTRICT

**LEITH CREEK, LAURINBURG, N. C.**  
 BELOW CONFLUENCE WITH LITTLE CREEK

( D A 13 24 Sq Mi )

**FEBRUARY 1973 FLOOD**

FEBRUARY 1976



**HYETOGRAPH DATA (96 HRS)**

**LEITH CREEK ABOVE U.S. 401**

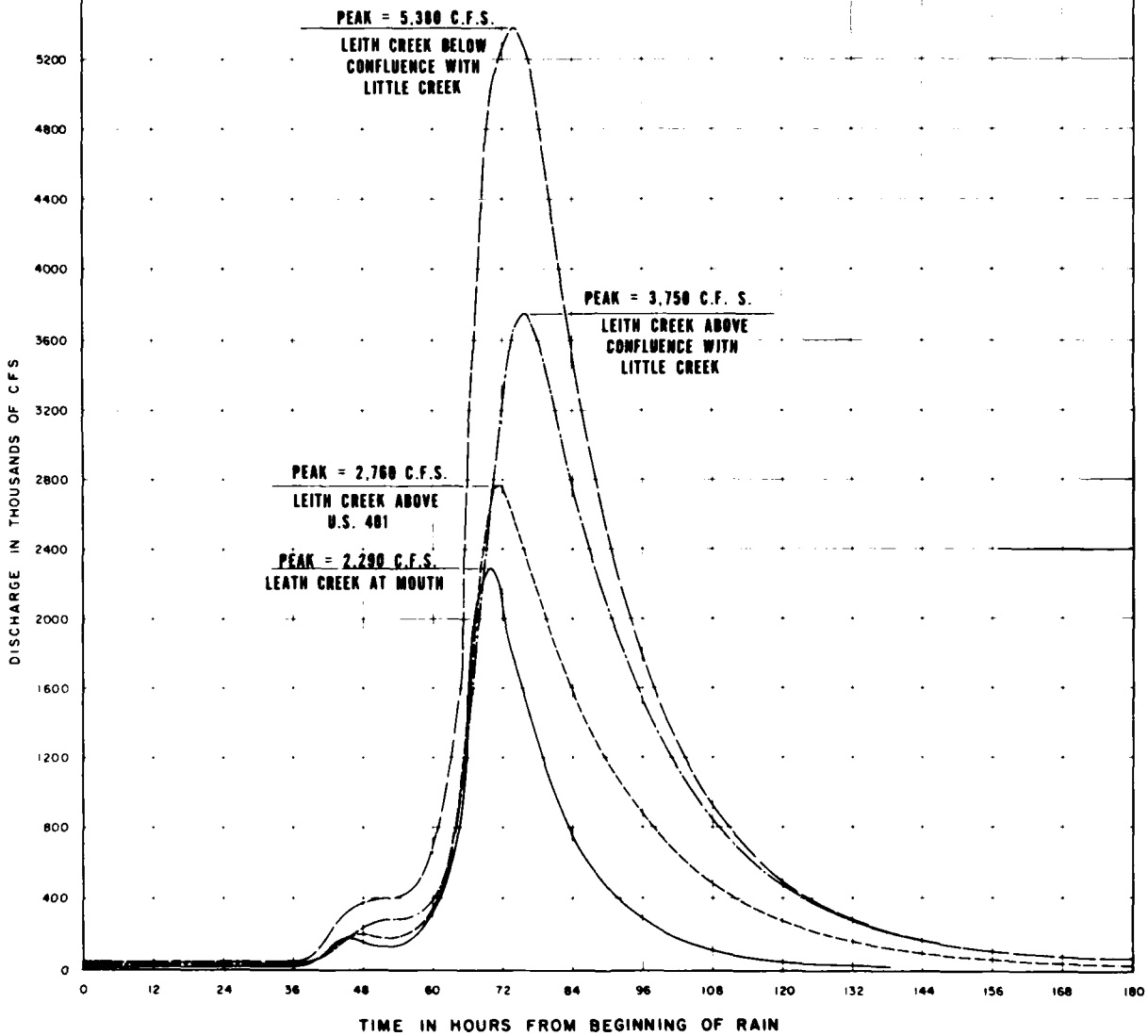
PRECIPITATION	• 18.55
TOTAL LOSS	• 4.73
RAINFALL EXCESS	• 13.82

**LEITH CREEK UPSTREAM OF MOUTH**

PRECIPITATION	• 18.43
TOTAL LOSS	• 4.73
RAINFALL EXCESS	• 13.70

**LEITH CREEK TRIBUTARY**

PRECIPITATION	• 18.64
TOTAL LOSS	• 4.73
RAINFALL EXCESS	• 13.91



**LEITH CREEK**  
 LAURINBURG, NORTH CAROLINA  
 STANDARD PROJECT FLOOD  
 HYDROGRAPH & HYETOGRAPH

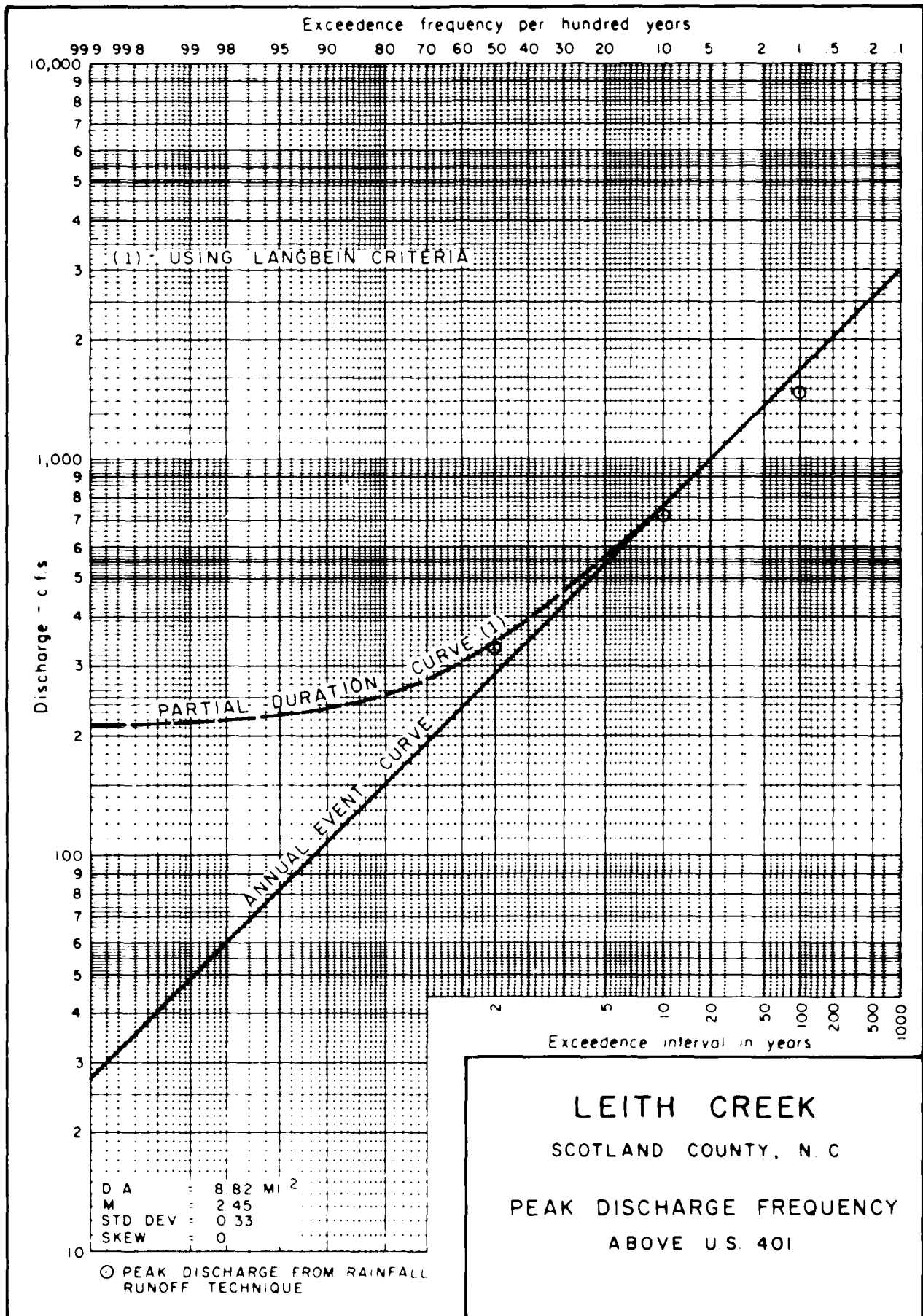


FIGURE C-6

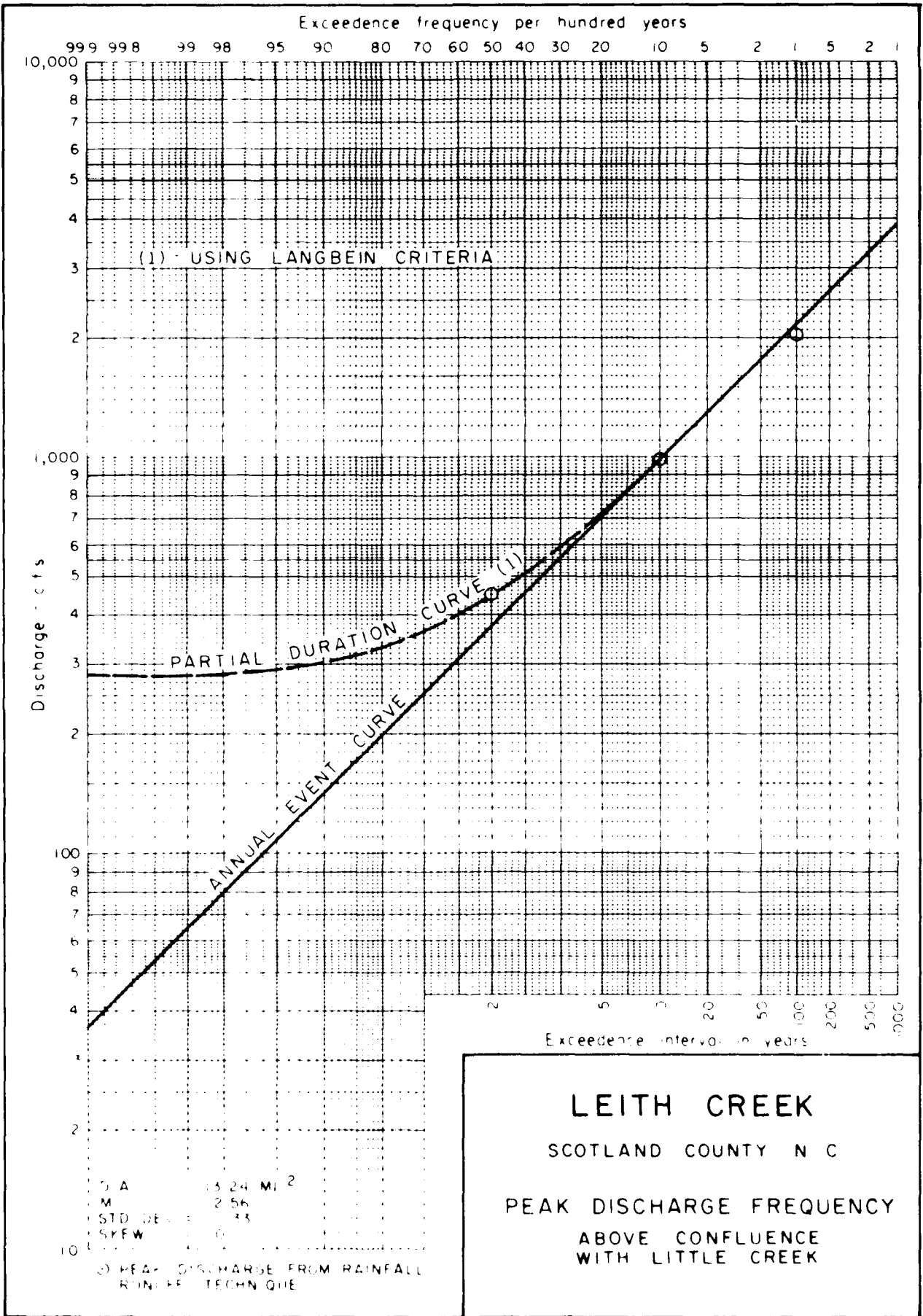


FIGURE C-7

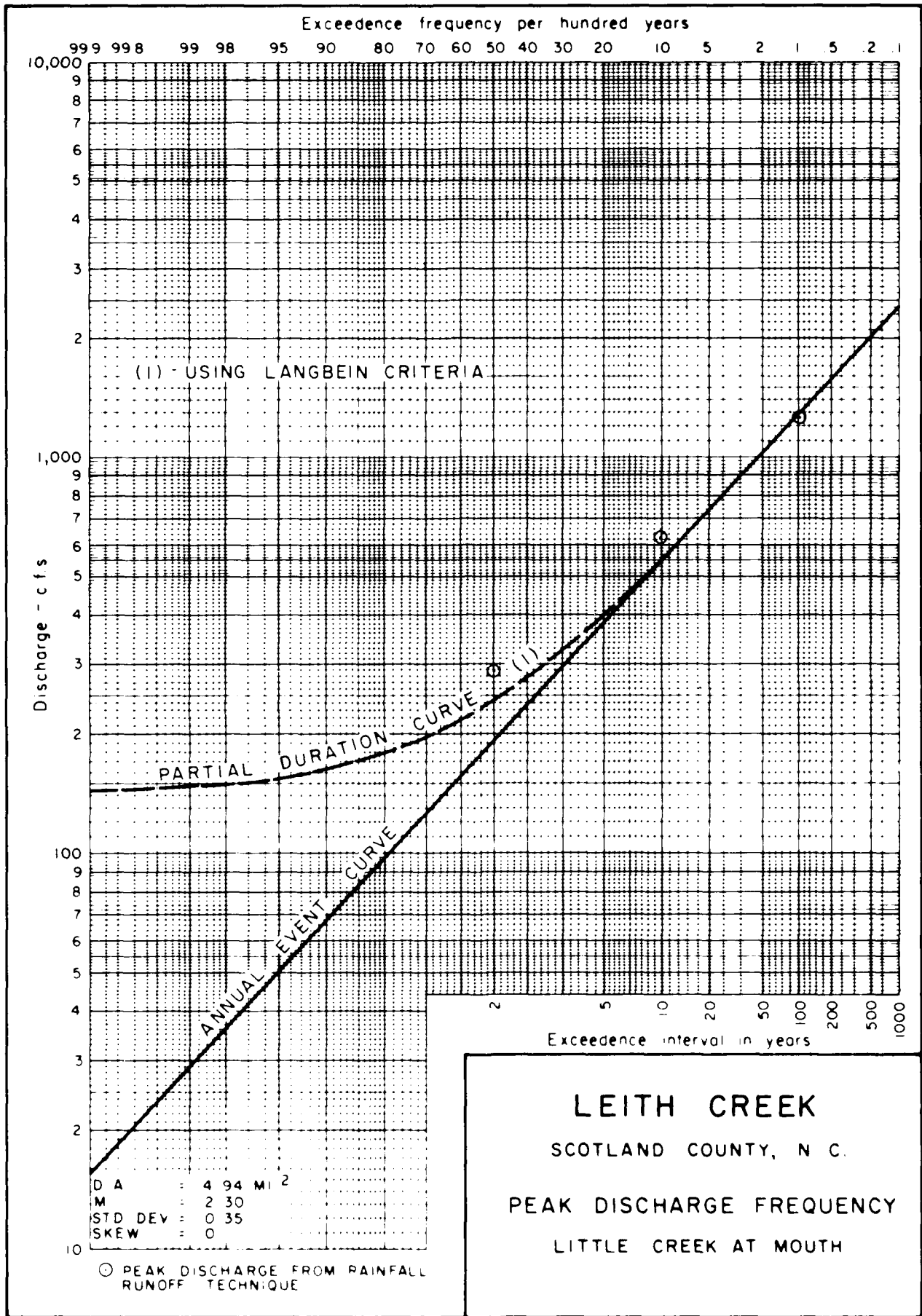


FIGURE C 8

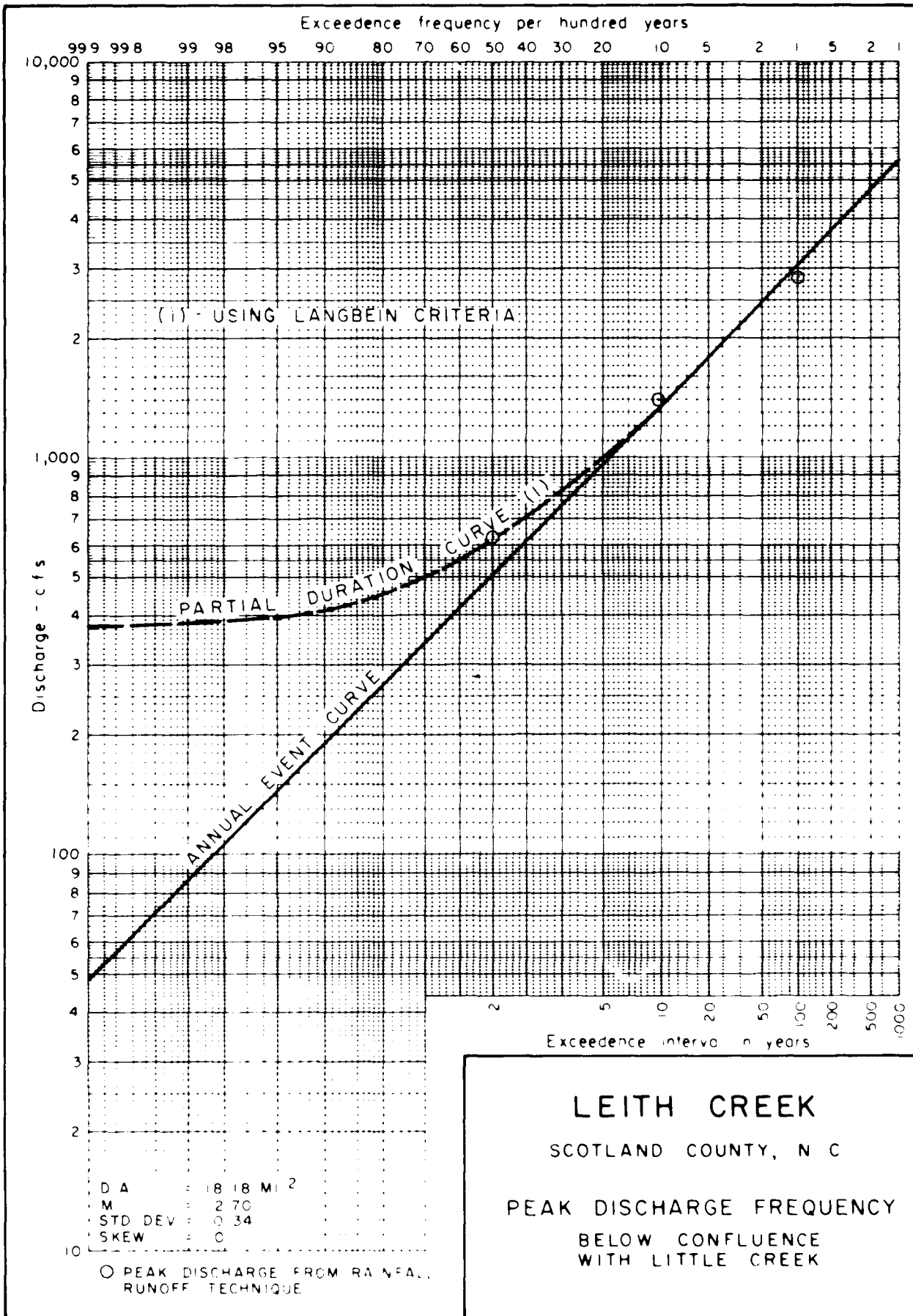


FIGURE C 9

Due to the expected locations of this future growth, future urbanization effects are not expected to alter runoff characteristics sufficiently to be considered in project formulation or design studies.

## Hydraulics

### ROADS AND BRIDGES

21. Twelve highway crossings, including two dual bridges at U.S. Highway 74 (start of study), and four railroad crossings have been constructed across Leith Creek. Three of the railroad crossings are owned and maintained by the Laurinburg and Southern (L&S) Railroad. The fourth crossing is maintained by the Seaboard Coastline (SCL) Railroad. Drawings of all highway and railroad crossings are shown on Plates E-7 and E-8 in Section E of this appendix.

### UTILITIES

22. The following represents a complete listing, including location and description of all known utility crossings located within the study reach of Leith Creek. The location of each utility line is also shown graphically on the channel profiles (See Plates E-2 through E-3).

a. Station 63+60 A 12-inch water main supported by a horizontal I beam is located approximately twenty feet downstream from Fertilizer Plant Road. Top elevation of the 12-inch cast iron pipe is 187.32 feet msl and the invert elevation of the supporting beam is 185.25 feet msl.

b. Station 105+50 A six inch force sewer main is located at the Church Street crossing. The main serves the City of East Laurinburg and is located in a portion which does not obstruct stream flow.



c. Station 111+90 An 8-inch water pipe is located at the McKay Street bridge. Elevations were not obtained because the pipe will be relocated with any structural plan considered.

d. Station 122+50 A 21-inch gravity flow sewer line is located approximately 170 feet upstream from the Seaboard Coast Line crossing. Top elevation of the pipe is 195.7 feet msl.

e. Station 128+20 An 8-inch water main crosses Leith Creek at the Caledonia Road crossing. The pipe is located in such a position that it offers no obstruction to stream flow.

f. Station 128+70 A 8-inch gravity flow sewer pipe is located 40 feet upstream from the Caledonia Road bridge. The cast iron pipe is supported on creosote piles and has a top elevation of 194.9 feet msl.

g. Station 147+00 A 21-inch gravity flow sewer line is located approximately 10 feet downstream from the Carver Street bridge. Top elevation of the cast iron pipe is 198.84 feet msl.

h. Station 147+25 A 6-inch water main is located beneath the Carver Street bridge. Top elevation of the water main is 196.50 feet msl.

i. Station 162+30 An 18-inch gravity flow sewer pipe is located on the downstream side of the North Main Street crossing. The pipe is supported by creosote piling and has a top elevation of 203.5 feet msl.

j. Station 162+60 A 6-inch water main is located at the Main Street crossing. The pipe is located so as to offer no obstruction to stream flow.

## EXISTING WATER SURFACE PROFILES

23. Hydraulic studies for Leith Creek were accomplished in accordance with criteria contained in applicable Engineering Manuals and with design practices previously approved on similar projects. Water surface profiles for existing conditions were computed using the Hydrologic Engineering Center's HEC-2 Computer Program "Water Surface Profiles." Hydraulic criteria used are discussed in the following paragraphs.

## STARTING CONDITIONS

24. Water surface profile computations were started below the U.S. Bypass 74 crossing and below the junction of Leith Creek and Little Creek.

within a long reach which has a fairly uniform cross section. Starting elevations were computed by the slope area method assuming a frictional slope of .001 for all discharges. A slope of .001 is approximately equal to the slope of the channel invert in this reach. To insure that the validity of the water surface profiles for the various plans would not be effected by starting conditions, backwater computations were started a sufficient distance below the alternative projects so that channel control was established before reaching the lower limits of the project.

## MANNING'S ROUGHNESS COEFFICIENT "N"

25. Initial values of Manning's "n" were selected after careful review of various references including U.S.G.S. Water Supply Paper 1249, "Roughness Characteristics of Natural Channels" and Dr. Ven Te Chow's text entitled, "Open Channel Hydraulics". Field observations and past experience with similar type streams also played a major role in the selection of "n" values. The initially selected values of Manning's "n" were then adjusted as a result of a high water correlation analysis which is discussed later in the paragraph 30. Overbank "n" values varied from .06 in park areas to .16 in undeveloped reaches. Existing channel "n" values ranged from .06 to .10 depending upon the condition of the channel at each respective reach.

## MINOR LOSSES

26. Minor loss coefficients used in computing water surface profiles included contraction and expansion losses and losses at bridges. Cross sections for all bridges crossing within the study reach are shown on Plates E-7 and E-8 of Section E.

27. Contraction loss coefficients used in backwater computations for existing conditions varied from 0.2 for long gradual transitions to 0.6 for abrupt transitions such as those occurring at bridge openings. Expansion coefficient used for these same transitions varied from 0.5 to 0.8.

28. Pier shape coefficient "k", for use in Yarnell's energy equation varied from 0.90 to 1.25 for Class A flow. For submerged bridge conditions, the loss coefficient, "k", as used in the orifice flow equation  $Q = A(2gh/k)$  varied from 1.3 to 1.5. These values were computed in accordance with procedures outlined in Exhibit 2 of the users manual for the HEC-2 computer program. The coefficient of discharge "c", used in the weir flow equation, varied from 2.5 to 2.7.

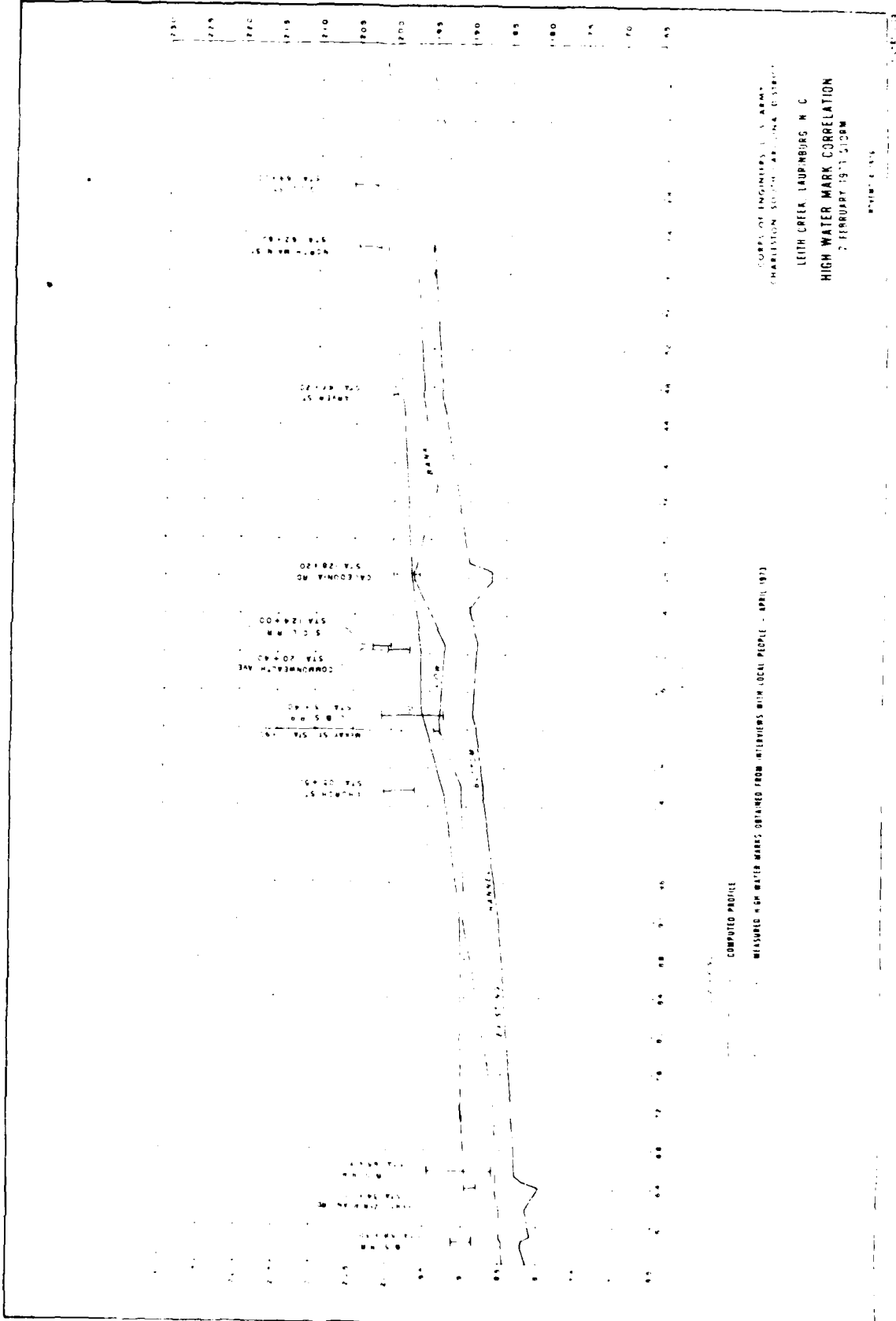
## HIGH WATER MARK CORRELATION

29. District personnel visited Laurinburg on the third and fourth of April 1973 in an effort to obtain high water mark data. The flood of 2 February 1973 was the only flood for which high water information could be obtained. Since physical evidence was no longer present along Leith Creek, District personnel questioned residents of the area. This produced only a limited number of high water marks with questionable accuracy. This is because the individuals questioned had to rely on memory since approximately three months had elapsed since the flood event had occurred. Also, the flood event was not large enough to induce residents to make marks indicating the maximum flood levels attained. The high water marks obtained from this investigation are plotted on Figure C-10. There were no discharge measurements made on Leith Creek for this flood.

30. The high water mark correlation analysis was a trial and error procedure where a water surface profile was computed with a given set of hydraulic criteria and then compared with the high water marks. Several profiles were computed and compared with the high water marks using different sets of hydraulic criteria. Mannings "n" values were increased in magnitude in several reaches from those initially selected. Values of the minor loss coefficients were also reviewed and in some cases increased; however, because of the small channel velocities this had only a relatively minor effect on the water surface profiles. The backwater profile resulting from this analysis using the most reasonable set of hydraulic criteria is shown on Figure C-10. Based on the judgment of those conducting the study a better correlation would have required unreasonably high "n" values. Flows derived for the February storm (see paragraph 17) were used for all the water surface profiles computed in this analysis.

31. The field trip in search of high water data, revealed that some reaches of the channel were clogged with trash or debris, old tires, refrigerators and discarded junk. This debris could have caused higher stages than predicted in the backwater analysis, particularly if some of it had collected during the flood at or near the upstream openings of culverts or bridges.

32. Additional studies could have been made to improve the correlation presented on Figure C-10, such as estimating blockages at the bridges or increasing flow rates by reducing rainfall losses. These additional studies were not considered warranted because the studies would represent a measure of refinement not shared by the accuracy of the high water data. Also, estimates of blockage at bridges or culverts would be strictly speculative and not supportable by observed fact. In view of the poor correlation, values used in design studies for Mannings "n" and other pertinent hydraulic design criteria were judgementally selected using experience gained from previous studies and from streams having similar characteristics to those of Leith Creek.



CORPS OF ENGINEERS, U. S. ARMY  
 CHARLOTTE SOUTH CAROLINA DISTRICT  
 LEITH CREEK LAURINBURG N. C.  
 HIGH WATER MARK CORRELATION  
 2 FEBRUARY 1933 SLOAN

COMPUTED PROFILE

MEASURED H. BY WATER MARKS OBTAINED FROM INTERVIEWS WITH LOCAL PEOPLE - APRIL 1933

ENGINEERS

## COMPUTED PROFILES

33. Water surface profiles for existing conditions were computed using the above hydraulic criteria for the Standard Project Flood and floods having recurrence intervals of 2, 5, 10, 20, 50 and 100 years. Plates E-2 and E-3 of Section E show plan and profile views of the 100 year frequency flood. Profiles for the 10, 20, and 50 year floods and the standard project flood are shown on Plates E-5 and E-6.

## Flood Damages

34. The flood plain of Leith Creek passes through the City of Laurinburg and consists of residential, commercial and public properties. Overflow from the creek often occurs and results in monetary damage to these properties. Based upon flood elevations computed by backwater computations, there are an estimated 65 residential and 17 commercial buildings susceptible to flood damage. In addition, a school, school lunch room and gymnasium are also susceptible to damage.

35. Flood damages along Leith Creek 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 costs for flood damage prevention; and business, financial, and wage losses in and adjacent to the flooded 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 appearance and aesthetic quality of the flood plain such as deposition of debris, etc.

## Flood Damage Computations

36. Flood damage computations consisted of detailed field surveys and office studies in order to create a logical relationship between flood frequencies, flood stages and flood damages. Field surveys were conducted in order to obtain property elevations and to make appraisals of property value. An economic index station was selected at Station 129+60 which was located in the high damage area and had stage fluctuations representative of the entire damage reach.

37. Average annual flood damages for natural conditions were computed by first computing discharges for selected frequency storms and formulating the discharge frequency relationship shown in Figure C-11. Discharges were then converted into stage by use of backwater computations. These stages were plotted to establish the stage-discharge relationship as shown on Figure C-12. Stage damage curves (Figure C-13) were constructed for each category of damage based on a field appraisal of individual structures and improvements. 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 the average annual damages. Average annual damage computations for existing conditions are presented in Figures C-14 through C-16 and are summarized in the following tabulation.

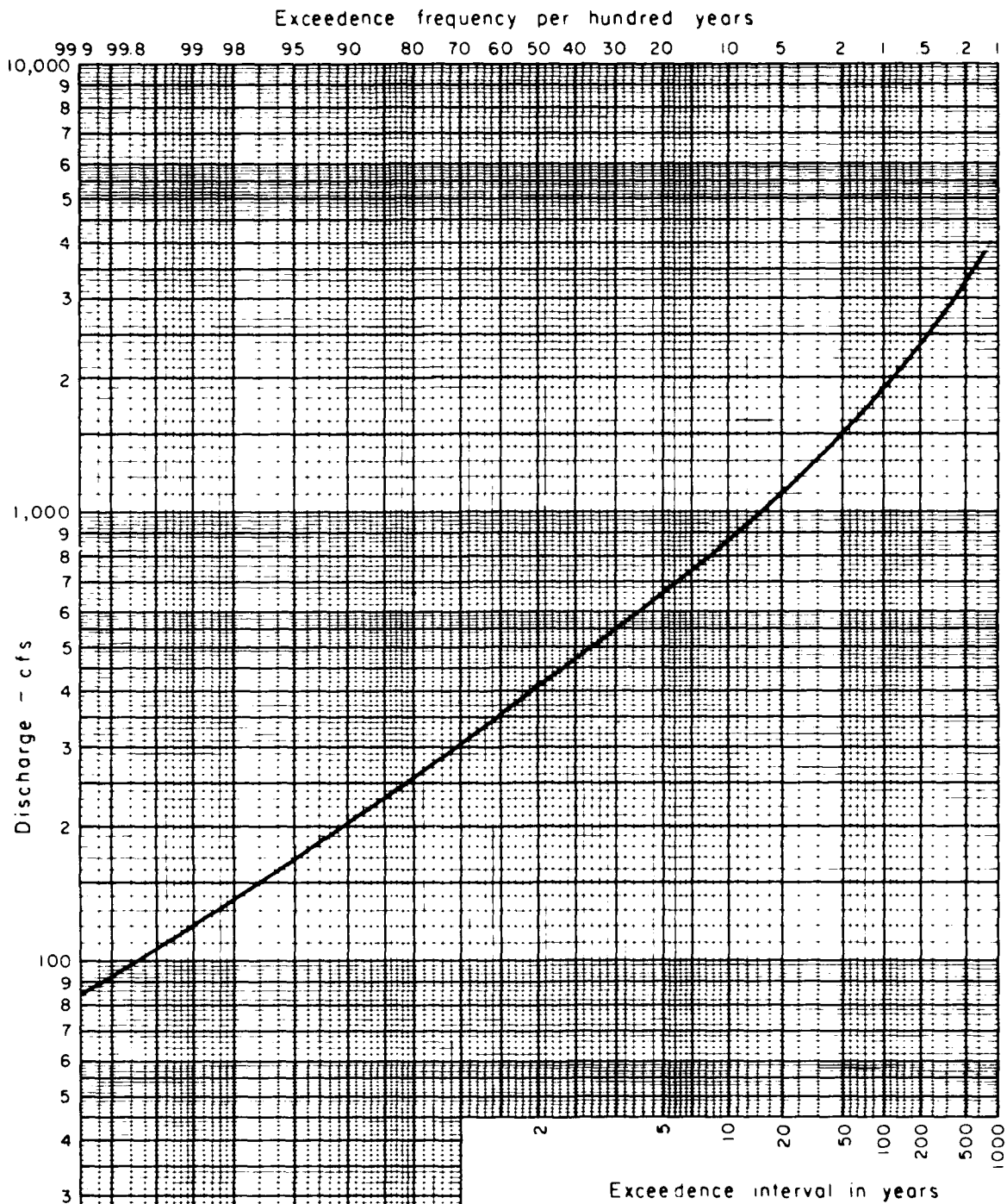
Average Annual Damages-Existing Conditions  
Leith Creek at Laurinburg, North Carolina

<u>Category</u>	<u>Average Annual Damages (\$)</u>
Residential	\$13,500
Commercial	11,500
Public Properties	<u>1,550</u>
Total	\$26,550

## Other Needs

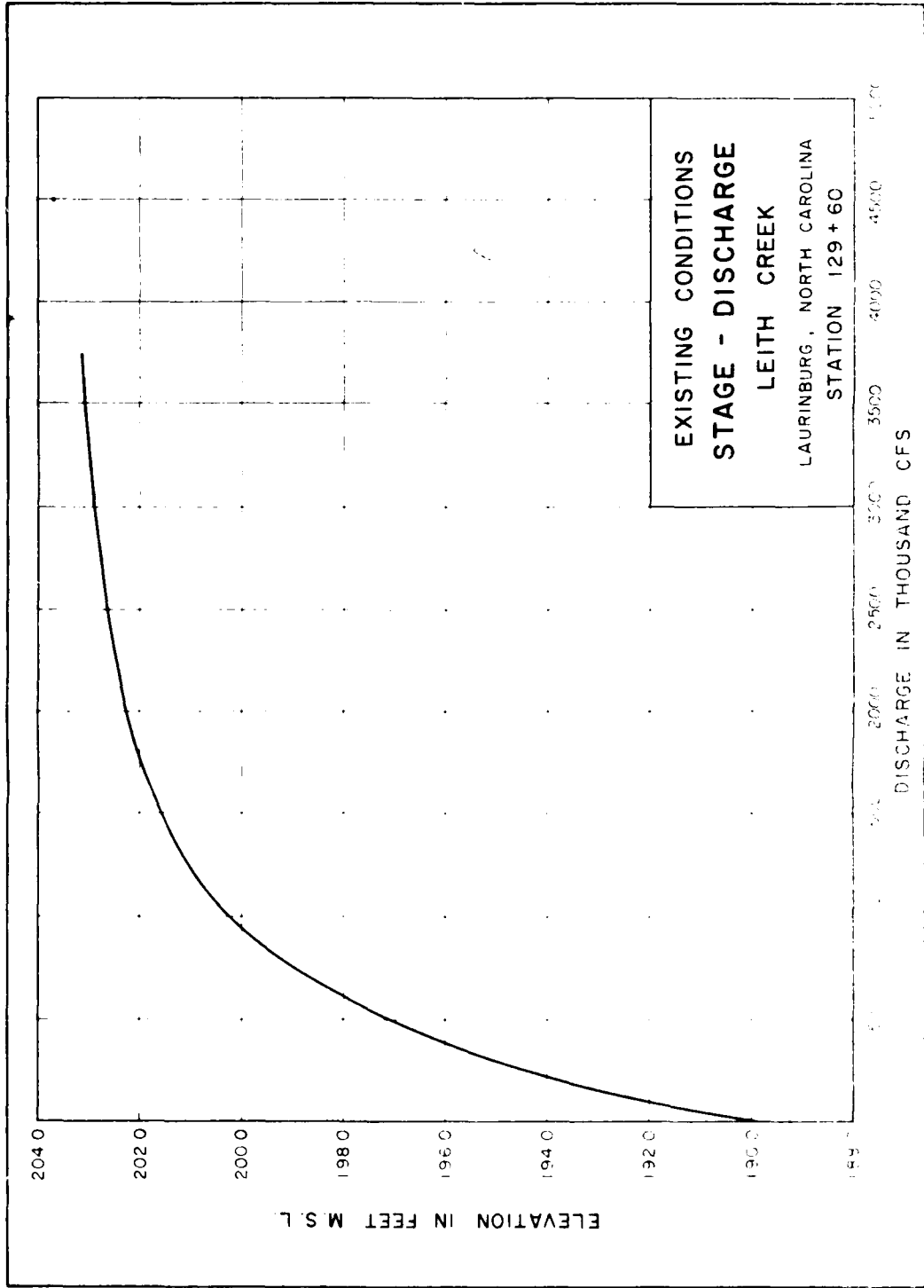
38. The land development plan for the City of Laurinburg discusses future needs of the community and proposes various alternatives to meet these needs. This plan was compiled by the State of North Carolina, Department of Conservation and Development, Division of Community Planning and was published in December 1968. The following is an extract from the referenced publication which proposes an alternative to assist in meeting the recreational needs of the community. The report proposes the acquisition of "a strip about 300 feet wide along the Leith Creek flood plain extending from the present Jaycee Park site to the southeast where the creek flows under Church Street".

39. The report further states that, "This park would serve several functions:

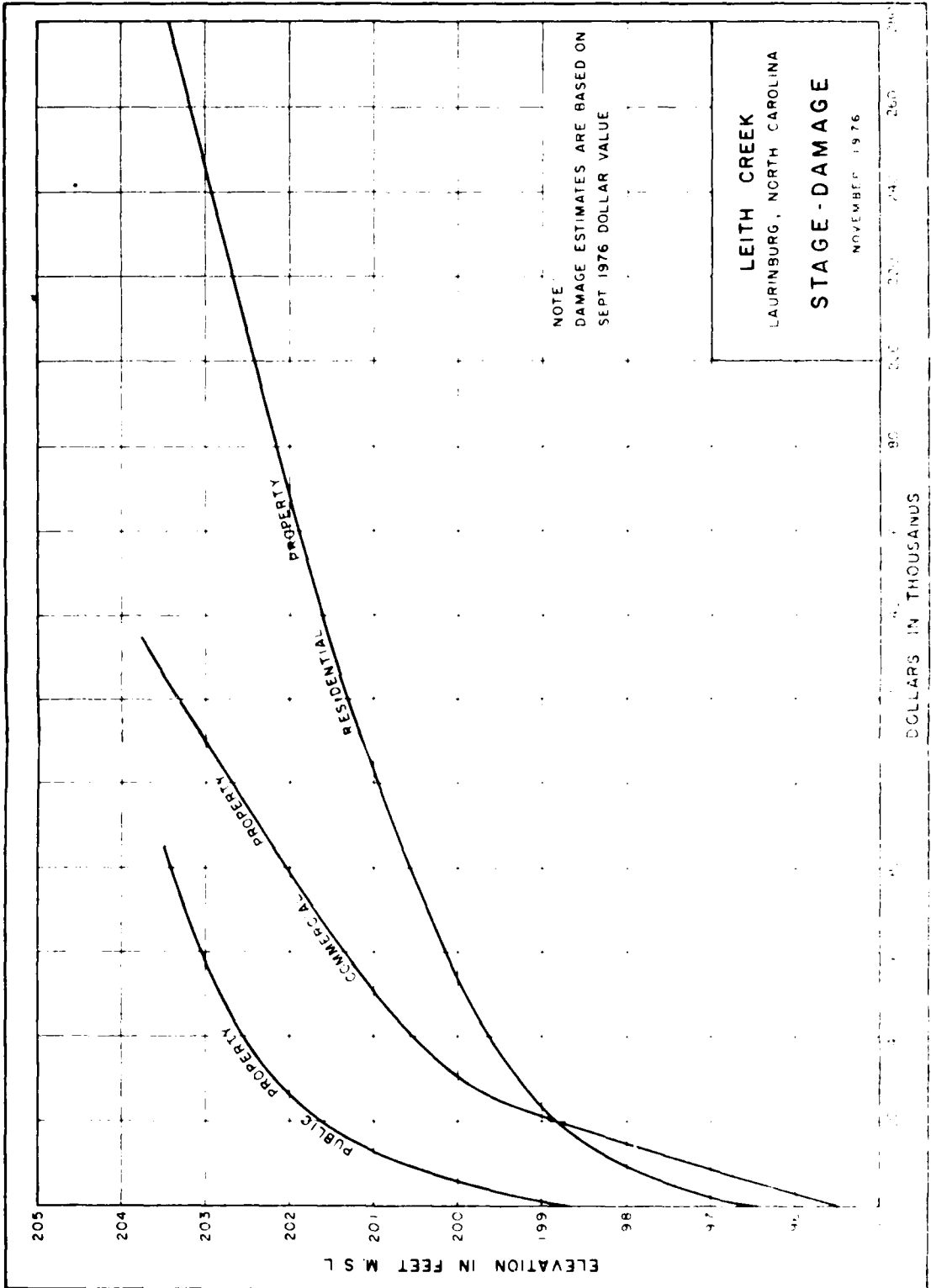


**DISCHARGE - FREQUENCY**  
**LEITH CREEK**  
**AT LAURINBURG, NORTH CAROLINA**  
**INDEX STATION 129 + 60**  
**NOVEMBER 1976**

FIGURE C-II







DOLLARS IN THOUSANDS

80 100 120 140 160 180 200 220 240 260

100

AVERAGE ANNUAL DAMAGE COMPUTATION

Type of Damage Residential Damage Stage 196.0

Reach Number Leith Creek Gage Location 129+60

Condition Existing

Frequency in years	Probable Occurrence	Incremental Probability	Elevation of WS (msl)	Damages in <sup>1/</sup> \$1,000 - Average	Damage Increment
		.005		\$240	\$1200
200	.0050	.0050	202.6	\$240	\$1100
		.0025		\$188	\$ 470
100	.0100	.0042	202.1	\$200	\$ 705
		.0083		\$168	\$1203
80	.0125	.0083	201.8	\$176	\$ 954
		.0167		\$145	\$1570
60	.0167	.0167	201.6	\$160	\$1220
		.0333		\$115	\$1630
40	.0250	.0333	201.2	\$130	\$2600
		.0667		\$ 94	\$ 800
30	.0333	.1000	200.8	\$100	
		.1667		\$ 73	
20	.0500	.1667	200.6	\$ 88	
		.3333		\$ 58	
15	.0667	.3333	200.0	\$ 58	
		.5000		\$ 49	
10	.1000	.5000	199.5	\$ 40	
		1.0000		\$ 26	
5	.2000	1.0000	198.3	\$ 12	
				\$ 6	
3	.3333		196.7	0	
2	.5000				
1	1.0000				
.5	2.0000				

TOTAL \$13,452

SAN 120, 4/26/65

SAY \$13,500

1/ Based on September 1976 Prices

Figure C-14

AVERAGE ANNUAL DAMAGE COMPUTATION

Type of Damage Commercial Damage Stage 195.5

Reach Number Leith Creek Gage Location 129+60

Condition Existing

Frequency in years	Probable Occurrence	Incremental Probability	Elevation of WS (msl) <sup>1/</sup>	Damages in <sup>1/</sup> \$1,000 - Average	Damage Increment
		.005		\$107	\$ 535
200	.0050		202.6	\$107	
		.0050		\$ 98.5	\$ 493
100	.0100		202.1	\$ 90	
		.0025		\$ 85	\$ 213
80	.0125		201.8	\$ 80	
		.0042		\$ 77	\$ 323
60	.0167		201.6	\$ 74	
		.0083		\$ 69	\$ 573
40	.0250		201.2	\$ 64	
		.0083		\$ 59	\$ 490
30	.0333		200.8	\$ 54	
		.0167		\$ 51	\$ 852
20	.0500		200.6	\$ 48	
		.0167		\$ 42	\$ 701
15	.0667		200.0	\$ 36	
		.0333		\$ 33	\$1099
10	.1000		199.5	\$ 30	
		.1000		\$ 24.5	\$2450
5	.2000		198.3	\$ 19	
		.1333		\$ 13.5	\$1800
3	.3333		196.7	\$ 8	
		.1667		\$ 6	\$1000
2	.5000		196.1	\$ 4	
		.5000		\$ 2	\$1000
1	1.0000		191.6	0	
		1.0000		0	
.5	2.0000				

TOTAL \$11,529

SAN 120, 4/26/65

SAY \$11,500

<sup>1/</sup> Based on September 1976 Prices

Figure C-15

AVERAGE ANNUAL DAMAGE COMPUTATION

Type of Damage Public Properties Damage Stage 198.7

Reach Number Leith Creek Gage Location 129+60

Condition Existing

Frequency in years	Probable Occurrence	Incremental Probability	Elevation of WS (msl)	Damages in <sup>1/</sup> \$1,000 - Average	Damage Increment \$
		.005		\$48	\$240
200	.0050		202.6	\$48	
		.0050		\$40	\$200
100	.0100		202.1	\$32	
		.0025		\$28	\$ 70
80	.0125		201.8	\$26	
		.0042		\$24	\$101
60	.0167		201.6	\$22	
		.0083		\$19.5	\$162
40	.0250		201.2	\$17	
		.0083		\$14.5	\$120
30	.0333		200.8	\$12	
		.0167		\$11.5	\$192
20	.0500		200.6	\$11	
		.0167		\$ 9	\$150
15	.0667		200.0	\$ 7	
		.0333		\$ 5	\$166
10	.1000		199.5	\$ 3	
		.1000		\$ 1.5	\$150
5	.2000		198.3	0	
		.1333			
3	.3333				
		.1667			
2	.5000				
		.5000			
1	1.0000				
		1.0000			
.5	2.0000				

TOTAL \$1,551

SAN 120, 4/26/65

SAY \$1,550

<sup>1/</sup> Based on September 1976 Prices

Figure C-16

- (1) linking public parks (with bike and walking trails),
- (2) provide a drainage easement to carry peak flow of water runoff, and
- (3) provide a sewer line easement for future use.

The above park should be mowed and developed with picnic facilities."<sup>1/</sup>

40. The above extract indicates three community needs which could be met by construction of a flood control project on Leith Creek. The need for flood control has already been discussed previously in this section. Other cited needs are discussed in the following paragraphs:

## RECREATIONAL NEEDS

41. In order to establish recreational needs of an area, it is necessary to determine the recreational demand of the area and how much of this demand is satisfied by existing recreational facilities. The "North Carolina Statewide Comprehensive Outdoor Recreation Plan" (SCORP Report) published by the North Carolina Department of Natural and Economic Resources defines the term "need" as, "the lack or insufficiency of existing recreation opportunities relative to the amount of such opportunities desired by a population under given conditions. Such needs are a measure of what should be supplied in addition to what already exists to satisfy the population under given conditions."

42. The North Carolina SCORP Report establishes the 1986 net outdoor recreation needs for the three county area of Scotland, Hoke and Robeson Counties as 169 acres of parks with community emphasis, 119 acres of parks with neighborhood emphasis and 364 acres of city parks. The Greenway concept proposed in the previously referenced land development plan for the City of Laurinburg can primarily be considered as a community park. Its strategic location with reference to the city results in the greenway meeting many of the established criteria for neighborhood and city parks.

43. The land development plan for the City of Laurinburg proposes the acquisition of a 300 foot wide strip along Leith Creek to assist in meeting the recreational needs of the community. The plan further states that at least 100 additional acres of parks will be needed by 1987, based on standards of the National Recreation Association of 10 acres/1,000 persons.

<sup>1/</sup> Source: Land Development Plan-Laurinburg, North Carolina, North Carolina Department of Conservation and Development, Division of Community Planning, December 1968.

## RECREATIONAL DEMAND

44. The preceding paragraphs establish the need for additional park acreage. The following paragraphs discuss computations made to obtain user day and activity day values used to compute recreational demand for activities associated with the potential development of a greenway on Leith Creek. Informal discussions with local representatives revealed a desire to establish a combination walking and bike trail adjacent to Leith Creek with periodically spaced picnic tables and park benches. Therefore, recreational activities investigated included picnicking, nature trails, bird watching and biking.

45. The North Carolina SCORP report discussed recreational demands based on units designated as activity days/household. The report establishes a need of 5.98 days/household for picnicking; 4.26 days/household for nature walks; 3.4 days/household for bird watching and 1.66 days/household for biking. Based on 1970 Census data, there are an estimated 3,282 households within the Laurinburg-East Laurinburg area which would be served by construction of a greenway along Leith Creek. Therefore, the 1970 recreational demand for selected activities has been established as follows:

1970 Recreational Demand for Selected Activities  
LAURINBURG & EAST LAURINBURG, NO. CAROLINA

<u>Activity</u>	<u>Adult Activity Day/Household</u>	<u>Households</u>	<u>Adult Activity Days</u>
Picnicking	5.98	3282	19,626
Nature Walks	4.26	3282	13,981
Bird Watching	3.40	3282	11,159
Biking	1.66	3282	5,448

46. The 1970 Recreational demand for selected activities in the Laurinburg-East Laurinburg area was projected to the year 1986 based on the ratio of statewide demand for each activity in 1986 as compared to the 1970 statewide demand. Statewide demands for 1970 and 1986 were obtained from the North Carolina SCORP Report and reflect changes in population and recreation preference. The 1986 demand for selected recreational activities was obtained by multiplying the 1970 demand by the 1970/1986 statewide ratio. The following tabulation presents the 1986 demand.

1986 Recreational Demand for Selected Activities  
LAURINBURG & EAST LAURINBURG, NO. CAROLINA

Activity	1970 Demand (Adult Activity Days)	Statewide Demand 1986/1970	1986 Demand (Adult Activity Days)
Picnicking	19,626	11,863,800/9,024,000	25,802
Nature Walks	13,981	7,603,600/6,428,000	16,538
Bird Watching	11,159	5,123,000/5,131,000	11,142
Biking	5,448	4,673,600/2,505,000	10,164

47. To meet the recreational needs of the community, the City of Laurinburg has developed several neighborhood parks within the city and has plans for additional park development. These parks include a park area near the upper end of the study reach between North Main Street and Gill Street (Jaycee Park) and a school playground and ball field near the lower reach. Plans have also been developed for a Neighborhood Development Park adjacent to the middle of the study reach. The proposal of a linear park adjacent to Leith Creek could become a reality by proper utilization of lands required for construction of a potential flood control project and could provide a vital link connecting the above mentioned park and playground development.

#### OTHER NEEDS

48. The third need, as described in the land use plan, is the need for a sewer easement. Fulfillment of this need would be an added benefit realized by the city in that additional easements for sewer construction would not be required. Sewer lines could be placed parallel to the creek and thus provide an additional use of land easements.

## Improvements Desired

49. The city manager of Laurinburg submitted a letter requesting assistance to control flooding along Leith Creek. A copy of this letter is included in Appendix 2 of this report. Local people are willing to support a flood control project and have indicated that they will provide the necessary cooperation should a project be recommended and approved. A copy of a letter of intent to meet the requirement of local cooperation is included in Appendix 2.

50. A public workshop was held in Laurinburg on 20 November 1975. During this workshop, those in attendance had the opportunity to express their opinion on potential flood control alternatives and to make any additional proposals or recommendations concerning flood problems on Leith Creek. A transcript of the workshop has also been included in Appendix 2.

51. Local representatives have also expressed a desire to include recreational facilities as a part of any recommended flood control project. Copies of correspondence from the City of Laurinburg and Scotland County supporting the inclusion of recreation as part of a recommended project are included in Appendix 2.

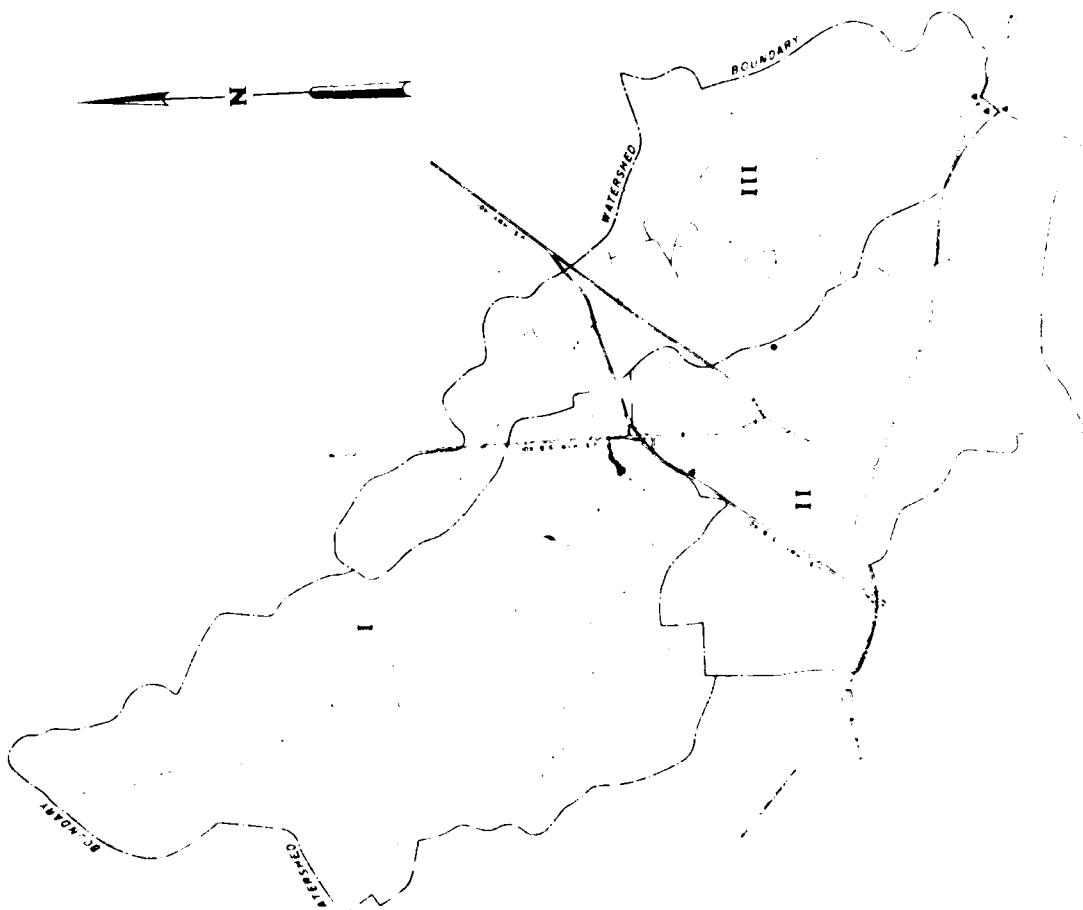
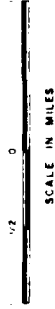


DRAINAGE AREA

AREA	NAME	DRAINAGE AREA
I	LEITH CREEK ABOVE U.S. HWY 15 S. 401	6 82 SQ MI
I & II	LEITH CREEK ABOVE MOUTH	13 24 SQ MI
III	LITTLE CREEK	4 94 SQ MI
	TOTAL DRAINAGE AREA I, II & III	18 16 SQ MI

LEGEND

- USWSO RECORDING PRECIPITATION STATION
- ▲ DISCHARGE FREQUENCY STATION LOCATION
- DRAINAGE DIVIDES



CORPS OF ENGINEERS, U.S. ARMY  
CHARLESTON, SOUTH CAROLINA DISTRICT  
LEITH CREEK  
LAURINBURG, NORTH CAROLINA  
WATERSHED MAP  
NOVEMBER 1976

# **SECTION D**

FORMULATING A PLAN

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# FORMULATING A PLAN

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## SECTION D

# FORMULATING A PLAN

1. The primary objective in project formulation is to provide the best use, or combination of uses, of water and related land resources to meet all foreseeable short and long-term needs of the local area. Consideration must also be given to all project effects--tangible and intangible, favorable and unfavorable. In order to meet the requirements of project formulation in this report and in order to comply with the requirements of the Principles and Standards, project alternatives were planned with the achievement of National Economic Development (NED) and Environmental Quality (EQ) as co-equal objectives.

2. During the course of project formulation, an NED plan and an EQ plan were developed as potential project alternatives. The NED plan was formulated to maximize the net economic benefits while addressing the project objectives. The EQ plan was formulated with the goals of making the most significant contribution to preserving, maintaining restoring, and/or enhancing the cultural and natural resources of the study area and of creating the least adverse environmental impact while addressing the project objectives. In addition to the NED and EQ plans, all possible alternatives were considered without regard to implementing authority.

## Formulation and Evaluation Criteria

3. The formulation and evaluation of the various plans of improvement for the study area, including all possible alternatives, were based on technical, economic, and intangible criteria, including beneficial and detrimental effects on the area's environment. Such criteria permit the selection of the plan of improvement which represents the solution that best responds to the problems and needs of the area and is justifiable.

## TECHNICAL CRITERIA

4. Technical criteria used for the formulation and evaluation of alternative solutions to the flood problems on Leith Creek are consistent with instructions contained in the 1105-2-XXX series of Engineering Regulations. The referenced regulations provided guidance for carrying out the various task of multiobjective planning, consistent with the WRC Principles and Standards and related policies. In addition the following hydrologic and hydraulic criteria were also used:

a. Discharge data used in evaluating various alternatives are the same as those contained in Section C.

b. The performance of each channel conveyance improvement plan was evaluated using their respective water surface profiles. Profiles for the Standard Project Flood and for the 5, 10, 50 and 100 year recurrence floods were computed for each alternative. Hydraulic criteria used in determining these profiles were the same as those discussed in Section C.

## ECONOMIC CRITERIA

5. The economic criteria which were applied in formulating a plan are those specified by the Principles and Standards. Economic benefits were developed in accordance with instructions contained in related Engineering Regulations. Additional economics criteria used to develop the recommended plan include the following:

a. Tangible benefits exceed project costs for the NED plan.

b. All prices applied to estimated construction quantities are based on September 1976 prices.

c. A project life expectancy of 50 years and an interest rate of  $6\frac{3}{8}\%$  were used in computing project costs.

d. Estimated construction time of the project was less than one year, therefore, no interest was included during construction.

6. Annual project costs were computed on a fifty year life basis and interest rate of  $6\frac{3}{8}$  percent. Annual cost include both Federal and non-Federal expenditures and operation and maintenance cost.

## ENVIRONMENTAL AND OTHER CRITERIA

7. The following environmental criteria and intangibles were considered in formulating a plan.

a. All alternatives considered should be compatible insofar as practical with the surrounding environment.

b. Efforts were made, where possible, to avoid detrimental environmental effects and whenever feasible mitigating features were considered for such effects.

c. Public health, safety and social well being, including possible loss of life were considered in formulating all alternatives.

d. Public acceptance of various alternatives was considered in formulating each plan and feasible alternatives were coordinated with interested agencies and individuals through correspondence, public meetings and other procedures.

## Possible Solutions

8. Several alternative measures to satisfy the problems and needs of the area are possible; however, some of these measures are not practical or economical. The possible solutions may be divided into two broad categories of structural and nonstructural. Structural measures are designed to modify floods by altering the natural environment. These measures include alternatives which reduce flood elevations, divert floods, change the timing and duration of floods or restrict floods from portions of the flood plain. Nonstructural measures, on the other hand, are designed to modify flood damage susceptibility and include modification to the cultural environment by adjustment in the pattern and mode of land use, by development policies and by assistance to affected individuals. Also, a combination of structural and nonstructural measures is possible.

## NONSTRUCTURAL MEASURES

9. Nonstructural measures do not attempt to reduce or eliminate flooding, but are to regulate the use and development of the flood plain, thus lessening damaging effects of large floods. Several non-structural measures considered in formulating a recommended plan for flood damage reduction in the flood plain of Leith Creek are discussed briefly in the following paragraphs.

### Zoning

10. Zoning is a legal measure which could be implemented by the City of Laurinburg which, if enforced, would prove effective in reducing the flood damage potential of the area. Zoning ordinances could be developed in accordance with a planned program of development and land use. The ordinances could also be used to establish limiting elevations below which no development would be permitted. Zoning measures insure the safekeeping of property for the health, welfare and safety of the general public.

### Subdivision Regulations

11. Subdivision regulations, like zoning, could be implemented by the local government as a effective means of regulating the damage potential of the area. Regulations could be adopted that could state requirements for street widths and minimum elevations, drainage structures, minimum building elevations, and restrictions on location to provide floodways and minimize flood damages.

### Building Codes

12. Local governmental agencies could adopt building code regulations that would assist in reducing future flood damages. These codes would set forth standards for the construction of buildings that could prescribe the type of materials that would not be easily damaged by water, establish floor elevations and prohibit any equipment or material in the flood plain which would be hazardous to life or substantially susceptible to flood damage.

### Flood Proofing

13. Flood proofing is a method of flood damage reduction designed to protect individual structure or small groups of structures from flood damage. Alternative flood proofing techniques could include waterproofing the existing structure; raising the structure; establishing a dike and pump system; or providing temporary water tight coverings at all openings.

### Evacuation

14. Permanent evacuation of flood plain areas could also be used to reduce the flood damage potential. Evacuation would involve the relocation of



persons adversely affected by flood conditions. In turn, evacuated lands could be used for park development and other purposes which could withstand flood conditions without substantial damage.

15. Temporary evacuation is still another alternative which could be utilized provided a reliable flood forecasting procedure were available. However, due to the smallness of the watershed and to the nature of flooding, a reliable flood forecasting system would be difficult to implement.

#### Open Space Development

16. Open space development consists of developing the flood plain as an open area to be utilized as parks, playgrounds or recreational areas. Portions of the existing flood plain of Leith Creek above North Main Street have already been developed as a park area. In addition to creating recreational facilities, extension of the park area downstream could alleviate the existing flood problem by providing a cleared floodway and could also reduce the future flood damage potential by controlling future land use.

#### Other Measures

17. Other preventive measures could be provided in the flood plain such as warning signs, tax adjustments, restrictions on building financing, flood insurance, urban redevelopment, and reconstruction or removal of bridges which restrict flow. These measures could effectively reduce or eliminate future damage in the flood plain.

#### Nonstructural Measures Summary

18. In order to evaluate the various nonstructural alternatives, each of the following parameters was analyzed: a) achievement of desired project objectives; b) cost of implementation, and; c) intangible advantages and disadvantages. The following description of flood plain development should be considered when evaluating nonstructural alternatives.

19. The major portion of the Leith Creek flood plain within the study reach is located within the city limits of Laurinburg and East Laurinburg. Development within the existing 100 year flood plain consists of an estimated 61 structures which would be flooded above floor elevations during the 100 year event. The total estimated value of the structures is \$681,000. Residential structures within the flood plain are low cost frame type dwellings which account for the relatively low total value of flood plain structures.

20. Zoning, subdivision regulations and building codes could be developed on the basis of flooded areas. These ordinances if adopted could regulate development of the flood plain by restricting the type of future development and the location. Park development and other types of development which will not impede flow or be easily damaged may be permitted. Residential, commercial and industrial development could be permitted in areas subject

to inundation but not required for flowage provided that improvements were constructed or flood proofed to provide protection to the level specified by the regulating agency involved. This type of nonstructural measure is effective in reducing damages to future development but will not improve the flood problems for existing development.

21. Flood proofing of existing structures is primarily the responsibility of individuals who, knowing their property is in a potential flood zone, would take steps to provide adequate protection against possible damage. This type of flood protection may prove effective for commercial and public properties within the flood plain, however, residential structures consist generally of low cost frame housing which would be difficult to flood proof and often more expensive than the owner can afford. In many cases the cost of flood proofing dwellings would exceed the benefits received. Flood proofing future development would be feasible and such measures would be the responsibility of the local interests.

22. Flood plain evacuation can be temporary or permanent. Permanent evacuation offers the more feasible alternative of the two due to the relatively small size of the watershed and to problems encountered in developing a reliable flood forecasting system. Permanent evacuation would include the relocation of families from their homes and in doing so, could create adverse social conditions. Relocation could result in a disservice to those affected by increasing the cost of living.

23. During the course of project formulation, a nonstructural alternative consisting of flood proofing or relocating all structures subject to flood damage was formulated. Structures which could not be flood proofed or physically relocated were assumed to be demolished and occupants relocated to minimum standard housing. Estimated first cost of this nonstructural alternative was \$770,200. Average annual costs of \$51,400 when compared with benefits of \$26,550 yielded an unfavorable benefit-to-cost ratio of 0.52.

## STRUCTURAL MEASURES

### Reservoirs

24. Reservoirs provide a structural alternative to control flooding by storing runoff and thus reducing the peak flows downstream. However, investigations of the Leith Creek basin revealed a lack of sites suitable for reservoir construction. No further study was made for this alternative.

### Levees

25. Levees provide an alternative structural solution by restricting floods from portions of the flood plain highly susceptible to flood damage.

The numerous road crossings over Leith Creek render this type of improvement an effective levee system. In addition, an interior drainage problem would be created by construction which would require a system of drainage ditches and pumps.

#### Channel Conveyance Improvement

26. Channel conveyance improvements consist of various modifications to the existing channel which result in an increased flow capacity. These modifications include: cleaning; deepening; widening and/or channel realignment. Channel conveyance improvement is the most feasible structural alternative to flood problems associated with high water from Leith Creek.

### NONSTRUCTURAL AND STRUCTURAL COMBINATION

27. As indicated previously, the City of Laurinburg has applied for Flood Insurance and a Flood Insurance Study is scheduled for Fiscal Year 1977. The flood insurance program was established by Congress in the National Flood Insurance Act of 1968 and expanded in the Flood Disaster Protection Act of 1973. The program is designed to provide flood insurance at rates made affordable through a Federal subsidy. Qualifying communities must adopt and administer local measures to protect lives and new construction from future flooding.

28. In view of the availability of flood insurance, structural alternatives considered were designed to reduce damages to existing development only. No benefits were claimed for damage reduction to future development. Benefits would accrue to local property owners, however, in the form of reduced flood insurance rates resulting from lower flood elevations. Any recommended structural solution to flood problems on Leith Creek will be accompanied with a recommendation that the local community establish and enforce flood plain regulations for the residual flood plain.

## Alternatives Considered Further

29. As a result of reconnaissance studies and preliminary estimates, potential solutions to the flood problems which were clearly impractical

or unfeasible were eliminated early in the course of study in order to enable the planner to concentrate on feasible alternatives. Reservoir and levee alternatives were not considered beyond the preliminary study phase which indicated them to be unfeasible alternatives.

## CHANNEL CONVEYANCE IMPROVEMENT

30. Channel conveyance improvement in the form of cleaning and/or enlarging the existing channel offers the most practical method of reducing flood damages along Leith Creek. Detail study of existing conditions indicated insufficient openings at several stream crossings which aggravate flood conditions. Detailed sketches of each stream crossing are presented on Plates E-7 and E-8 of Section E. Surveyed cross-sections for the project reach are shown on Plate E-4.

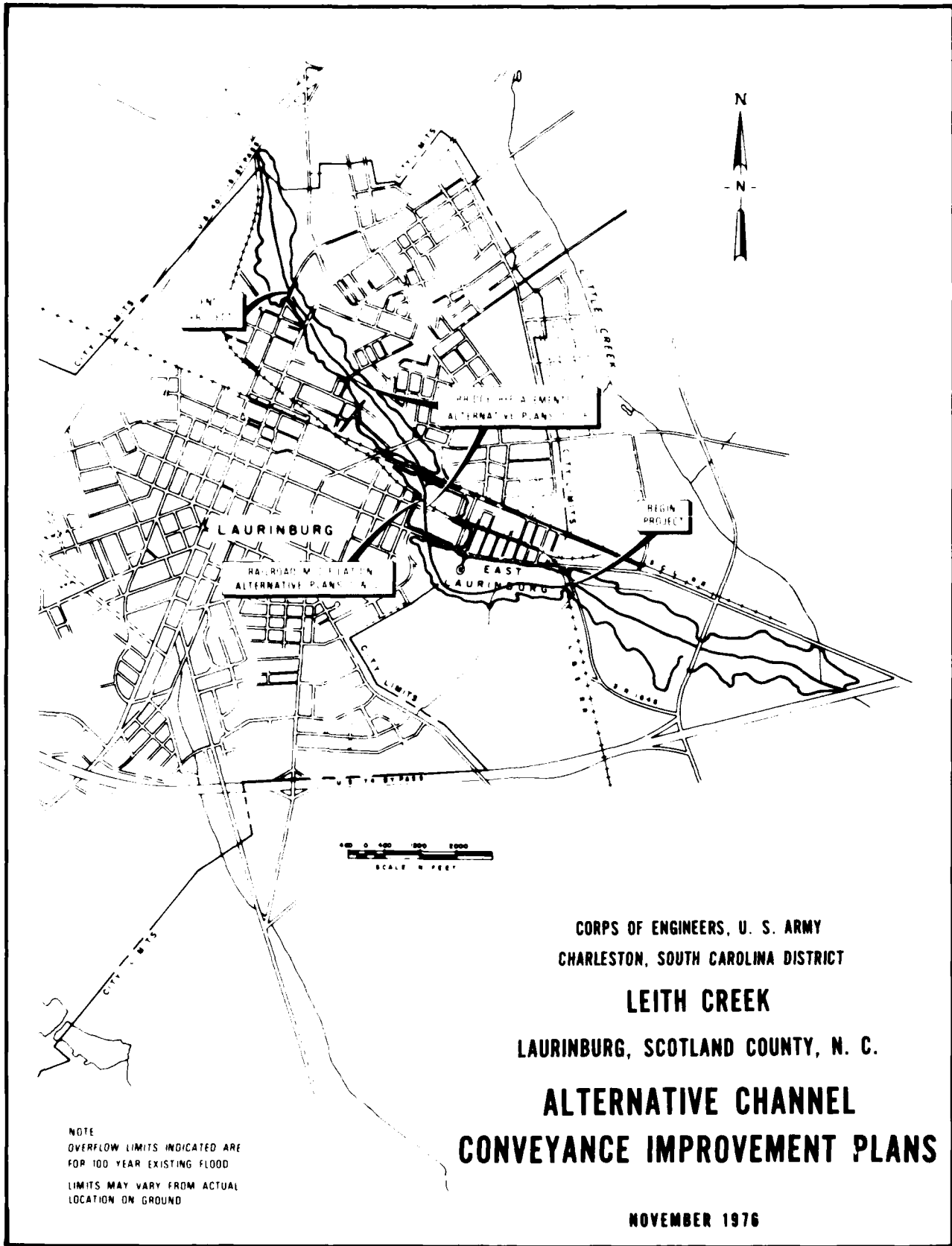
31. In order to formulate the most feasible channel improvement alternative, five basic channel improvement plans were prepared and analyzed. All five plans are similar in that each plan calls for the removal and/or replacement of the McKay and Carver Street bridges (See General Map). Plans 1 or 2 are designed with varying bottom slopes ranging from .00068 ft/ft to .00214 ft/ft and call for widening and deepening the existing channel. These plans also call for modification of the Laurinburg and Southern Railroad Crossing at station 113 + 40 in addition to highway bridge modifications. Plans 3 and 4 are designed with bottom slopes ranging from .00086 ft/ft to .0015 ft/ft and call for widening the existing channel without excessive deepening. These plans do not recommend modification of the railroad culvert at station 113 + 40. The fifth plan of improvement was designed to provide a 200 foot floodway for the entire project length without any channel excavation. Each plan is discussed individually in the following paragraphs.

### Plan 1

32. Channel Conveyance Improvement Plan 1 begins at station 65 + 70 (L & S Railroad) and continues to station 169 + 00 (Gill Street), a total project length of 1.97 miles. The following tabulation shows pertinent design data relative to Plan 1:

Channel Dimensions - Plan 1

Reach (Sta. to Sta.)	Bottom Width (feet)	Side Slope (horz:vert)	Bottom Slope (feet/foot)
65 + 70 to 105 + 50	35	2:1	.00106
105 + 50 to 128 + 70	30	2:1	.00068
128 + 70 to 162 + 65	30	2:1	.00214
162 + 65 to 169 + 00	30	2:1	.000893



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

LEITH CREEK  
 LAURINBURG, SCOTLAND COUNTY, N. C.

**ALTERNATIVE CHANNEL  
 CONVEYANCE IMPROVEMENT PLANS**

NOVEMBER 1976

NOTE  
 OVERFLOW LIMITS INDICATED ARE  
 FOR 100 YEAR EXISTING FLOOD  
 LIMITS MAY VARY FROM ACTUAL  
 LOCATION ON GROUND

33. Plan 1 calls for the following modifications to stream crossings:

1) McKay Street (Station 111 + 90). Remove and replace existing bridge. Replacement structure should have minimum low chord elevation of 195.7 feet msl and sufficient opening to pass a flow of 1641 cfs (50 year flow).

2) Laurinburg and Southern Railroad (Station 113 + 40). Lower existing invert elevation of two center box culverts from elevation 188.78 feet msl to elevation 185.5 feet msl.

3) Carver Street (Station 147 + 20). Remove and replace existing bridge. Replacement structure should have minimum low chord elevation of 199.94 feet msl and have sufficient opening to pass a flow of 1570 cfs (50 year flow).

34. Plan 1 also calls for the following utility relocations:

<u>Station</u>	<u>Type of Utility</u>
111 + 90	8 inch water main
128 + 70	8 inch sewer main
147 + 25	6 inch water main

35. Plan 1 would reduce the maximum stage of the 100 year frequency flood by about 2.9 feet. The estimated first cost of the plan is \$318,700 and the annual charges \$23,100 including maintenance. Annual benefits of \$24,400 yield a benefit-to-cost ratio of 1.05. Other pertinent data related to Plan 1 are summarized in Table D-1 for comparison with alternative plans.

Plan 2

36. Channel Conveyance Improvement Plan 2 is similar to Plan 1 in all respects except channel bottom widths. The following tabulation shows the bottom widths used when formulating Plan 2.

Channel Dimensions - Plan 2

<u>Reach (Sta. to Sta.)</u>	<u>Bottom Width (feet)</u>	<u>Side Slope (horz:vert)</u>	<u>Bottom Slope (feet/foot)</u>
65 + 70 to 105 + 50	45	2:1	.00106
105 + 50 to 128 + 70	40	2:1	.00068
128 + 70 to 162 + 65	40	2:1	.00214
162 + 65 to 169 + 00	40	2:1	.000893

37. Bridge and utility modifications called for in Plan 2 are the same as in Plan 1.

38. Plan 2 would reduce the maximum stage of the 100-year frequency flood by about 3.3 feet. The estimated first cost of the plan is \$365,000 and annual charges, \$26,200 including maintenance. Annual benefits of \$24,600 yield a benefit-to-cost ratio of 0.93. Other pertinent data related to Plan 2 are summarized in Table D-1 for comparison with alternative plans.

### Plan 3

39. Channel improvement Plan 3 begins at station 65 + 70 (Laurinburg and Southern Railroad) and continues to station 169 + 00 (Gill Street), a total project length of 1.97 miles. This plan was designed to avoid modification to the main line crossing of the Laurinburg and Southern Railroad at station 113 + 40. The following tabulation shows pertinent design data relative to Plan 3.

Channel Dimensions - Plan 3

Reach (Sta. to Sta)	Bottom Width (feet)	Side Slopes (horz:vert)	Bottom Slope (feet/foot)
65 + 70 to 133 + 00	35	2:1	.0015
133 + 00 to 163 + 00	35	2:1	.00086
163 + 00 to 169 + 00	30	2:1	.00086

40. Plan 3 calls for the following modifications to stream crossings:

1) McKay Street (Station 111 + 90). Remove and replace existing bridge. Replacement structure should have minimum low chord elevation of 196.4 feet msl and sufficient opening to pass a flow of 1640 cfs (50 year flow).

2) Carver Street (Station 147 + 20). Remove and replace existing bridge. Replacement structure should have minimum low chord elevation of 201.0 feet msl and sufficient opening to pass a flow of 1570 cfs (50 year flow).

41. Plan 3 also includes the same utility modifications as described for Plan 1. Plan 3 would reduce the maximum stage of the 100 year frequency flood by about 1.8 feet. The estimated first cost of the plan is \$181,000 and the annual charges \$13,900. Annual benefits of \$23,250 yield a benefit-to-cost ratio of 1.67. Other pertinent data related to Plan 3 are summarized in Table 1-D for comparison with alternative plans.

#### Plan 4

42. Channel Conveyance Improvement Plan 4 is similar to Plan 3 in all respects except channel bottom widths. The following tabulation shows the bottom widths used when formulating Plan 4.

Channel Dimensions - Plan 4

Reach (Sta. to Sta.)	Bottom Width (feet)	Side Slopes (horz:vert)	Bottom Slope (feet/foot)
65 + 70 to 133 + 00	45	2:1	.0015
133 + 00 to 163 + 00	45	2:1	.00086
163 + 00 to 169 + 00	40	2:1	.00086

43. Bridge and utility modifications called for in Plan 4 are the same as Plan 3.

44. Plan 4 would reduce the maximum stage of the 100 year frequency flood by about 2.0 feet. The estimated first cost of the plan is \$203,400 and the annual charges, \$15,400 including maintenance. Annual benefits of \$24,000 yield a benefit-to-cost ratio of 1.56. Other pertinent data related to Plan 4 are summarized in Table D-1 for comparison with alternative plans.

#### Plan 5

45. Channel Improvement Plan 5 was designed to test the effect of providing a floodway for high flows and avoiding channel excavation. The plan considers the construction of a 200 foot wide floodway beginning at station 65 + 70 (L & S Railroad) and ending at Gill Street (Station 169 + 00). The floodway would be grassed and mowed at frequent intervals to prevent obstructions to flow.

46. This plan also includes the removal and replacement of bridges at McKay and Carver Streets as considered in Plans 3 and 4, however, no railroad modifications are included. Utility modifications are the same as recommended in all previously described plans.

47. Plan 5 would reduce the maximum stage of the 100 year frequency flood by about 1.0 feet. The estimated first cost of the plan is \$161,200 and the annual charges, \$12,800 including maintenance. Annual benefits of \$16,700 yield a benefit-to-cost ratio of 1.30. Other pertinent data related to Plan 5 are summarized in Table D-1 for comparison with alternative plans.

#### Summary - Channel Conveyance Improvement Alternatives

48. Table D-1 summarizes pertinent data relative to each of the alternatives discussed in the preceding paragraphs. Stage-Discharge relationships for existing conditions and alternative solutions are presented for comparison in Plate D-1. The Stage-Discharge curves present the comparative reduction in flood stage for each alternative at station 129 + 60, the

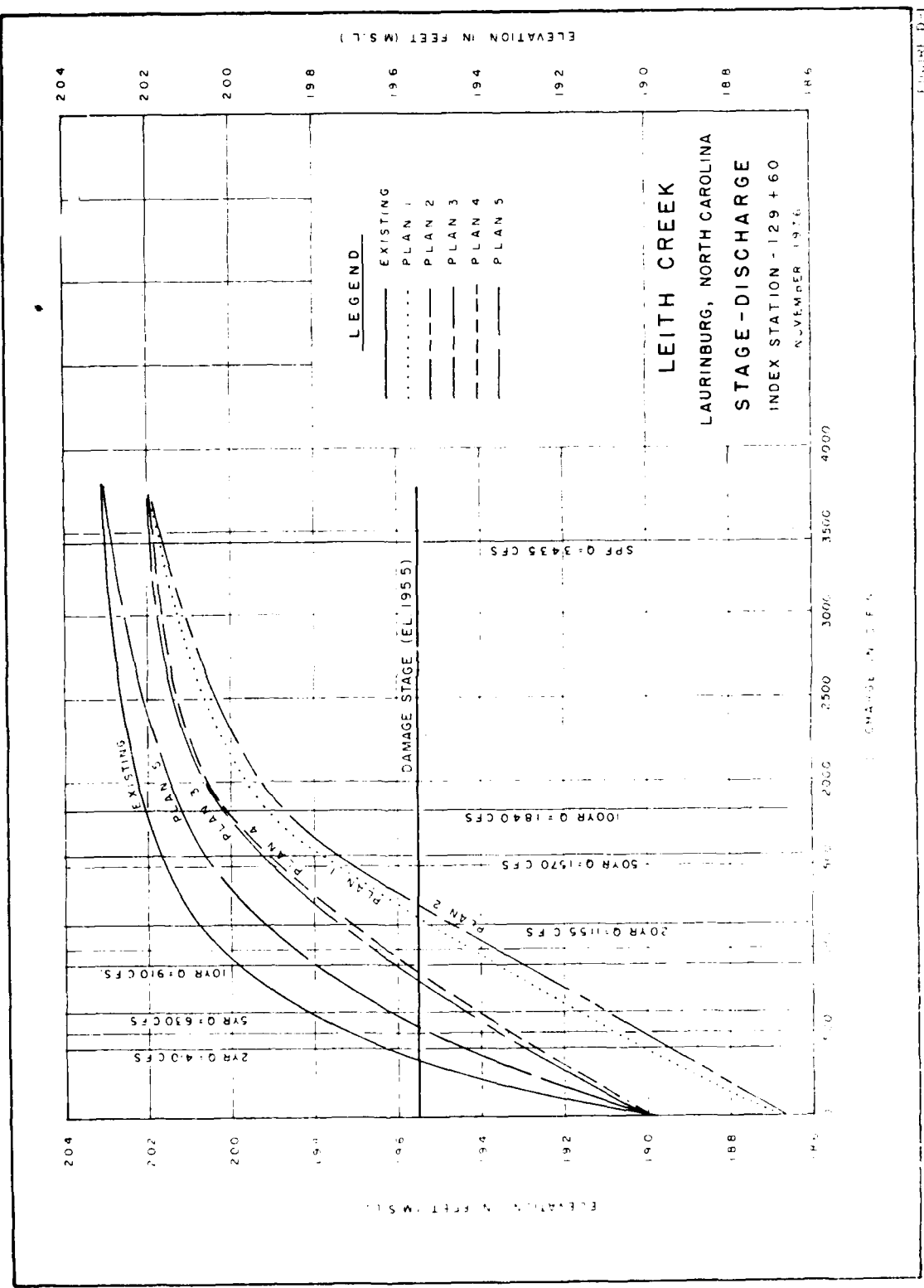


economic index station. The damage stage (Elevation 195.5 feet msl) is also indicated on Figure D-1 to assist in evaluating the various alternatives.

Table D-1<sup>1/</sup>  
 Comparison of Alternative Channel Conveyance  
 Improvement Plans - Leith Creek, Laurinburg, North Carolina

Item	Unit	Plan 1	Plan 2	Plan 3	Plan 4	Plan 5
Bottom width	Ft.					
Sta. 69+70 to 105+50		35	45	35	45	
Sta. 105+50 to 128+70		30	40	35	45	
Sta. 128+70 to 162+25		30	40	35	45	
Sta. 162+25 to 169+00		30	40	30	40	
R/W Clearing	Ac.	30.04	35.43	19.52	23.64	42.1
Channel Excavation	C.Y.	74,250	98,500	34,700	44,250	
Riprap (Sacked Cement)	C.Y.	110	133	122	145	
Shaping and Seeding	Ac.	22.4	25.43	11.24	12.97	41.8
Bridge Modification	No.	3	3	2	2	2
Pipeline Modifications	No.	3	3	3	3	3
Perm. R/W	Ac.	31.24	36.63	20.72	24.84	42.8
Federal Cost	\$	253,700	299,600	117,000	139,000	25,000
Non-Federal Cost	\$	65,000	65,400	64,000	64,400	66,200
Total Project Cost	\$	318,700	365,000	181,000	203,400	161,200
Annual Costs (6-3/8 )	\$	21,300	24,400	12,100	13,600	10,800
Maintenance Costs	\$	1,800	1,800	1,800	1,800	2,000
Total Annual Costs	\$	23,100	26,200	13,900	15,400	12,800
Annual Benefits	\$	24,400	24,600	23,250	24,000	16,700
Excess Benefits Over Costs	\$	1,300	(-1,600)	9,350	8,600	3,900
B/C Ratio		1.05	0.93	1.67	1.56	1.30

<sup>1/</sup> All monetary values presented in this table are based on September 1970 estimates.



# Selecting A Plan

49. The selection of the best plan of improvement for the study area involved the comparison of the various alternatives which satisfy the formulation and evaluation criteria outlined earlier. Consideration was given to environmental effects; social well-being, the regional development and the national economic development. During the selection process, all alternatives were presented to the public at a public workshop held at the Scotland County Courthouse on 20 November 1975. The transcript of the workshop and all subsequent correspondence is presented for review in Appendix 2.

50. A System of Accounts, as required by Principles and Standards, is presented in the main report. The System of Accounts displays each planning objective carried through the final iteration and the beneficial and adverse contributions thereto by each alternative considered.

## The NED Plan

51. As described in ER 1105-2-230 dated 10 November 1975, the NED Plan is the plan which best addresses the planning objectives in a way which maximizes net economic benefits. In consideration of the different types of structural alternatives considered (deepening versus not deepening), two plans emerged as candidates for the NED Plan. Of the deepening alternatives (Plans 1 and 2), Plan 1 resulted in the greatest amount of excess benefits over costs. Of the non-deepening alternatives (Plans 3-5), Plan 3 resulted in the greatest amount of excess benefits over costs. However, in consideration of the net amount of excess benefits, Plan 3 edged out Plan 1. Therefore, of all plans considered, Plan 3 is the plan which best addresses the planning objectives while maximizing net economic benefits. Plan 3 is the NED Plan.

## The EQ Plan

52. The EQ Plan is described as the plan which will make the most significant contribution to preserving, maintaining, restoring, or enhancing cultural and natural resources. The existing conditions of the creek

weighed heavily in selecting an EQ Plan. The existing channel bottom exhibits strong evidence of heavy siltation in the past. Therefore, the alternatives of deepening versus not deepening become a comparison of maintaining versus restoring natural resources. Of all alternatives considered, the non-structural alternative was the best environmental alternative, but was not economically justified. Therefore, the major criteria in selecting an EQ Plan became the amount of natural cover disturbed during construction and subsequent maintenance. Plan 1 had the least disruptive effects of the deepening alternatives considered and Plan 3 had the least disruptive effects of the non-deepening alternatives. Plan 3 had slightly less disruptive effects than Plan 1. By placing slightly more emphasis on maintaining rather than restoring cultural and natural resources, and in consideration of the structural alternative with the greatest amount of net environmental benefits, Plan 3 edged Plan 1 and therefore has been designated as the EQ Plan.

#### The Selected Plan

53. As described in ER 1105-2-200 dated 10 November 1975, plan selection and the designation of that alternative considered to be the most desirable, based on results of the study. This selection is based upon the public response to the detailed plans carried through the final stage including the views of those who participated in the study both formally and informally.

54. As discussed in the preceding paragraphs, Plan 3 is the NED and the EQ Plan. Plan 1, however, had sufficient merits to be considered very strongly on both accounts. Therefore, selection of a recommended plan was narrowed to Plans 1 and 3.

55. After careful consideration of all data presented in the preceding pages and after careful review of public preferences expressed during the public workshop and subsequent correspondence and informal coordination, Plan 3, in combination with the regulation of the residual flood plain has been designated as the recommended plan.

**SECTION E**

THE SELECTED PLAN

# THE SEI ECTED PLAN

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## SECTION E

# THE SELECTED PLAN

1. This section of Appendix 1 is concerned with describing the plan selected in the previous section. All meaningful effects of the plan, both favorable and unfavorable, are presented. Information presented in this section and the remainder of the Detailed Project Report serves a dual purpose: the report serves as the basis for approval of the project for construction by the Chief of Engineers; and it serves as a basis for preparation of plans and specifications. Therefore, the level of detail and extent of engineering work reflected in this appendix must be sufficient to proceed directly to plans and specifications.

## Plan Description

2. The most appropriate plan of improvement for flood control in the Leith Creek Basin is a combination structural and nonstructural plan. The structural measures consist of cleaning and widening the existing channel for a total distance of 1.97 miles, replacing two highway bridges, and relocating two water mains and one sewer line. Nonstructural measures consist of passage, by the local sponsor, of regulatory measures to control the residual flood plain. The concept of designated floodways is recommended and discussed later in this section. A general map of the project area is presented as Plate E-1 at the end of this section. Detailed project information concerning pertinent aspects of the selected project is presented in Plates E-2 through E-12.

3. The main features of the recommended plan are as follows:

Widen and clean the existing channel a total distance of 1.97 miles. Bottom widths vary from 35 feet in the reach between the Laurinburg and Southern Railroad (Station 65 + 70) and N. Main Street (Station 162+60) to 30 feet between N. Main Street and the end of the project at Gill Street (Station 169 + 00). Channel side slopes are designated as 2 horizontal to 1 vertical.

Bottom slopes range from .0015 ft/ft to .00086 ft/ft.

Remove and replace the existing McKay Street Bridge (Station 111 + 90). Replacement structure will have a minimum low member elevation of 196.4 feet msl and sufficient opening to pass a flow of 1640 cfs with a head loss of no more than 0.2 feet.

Remove and replace the existing Carver Street Bridge (Station 147 + 20). Replacement structure will have a low member elevation of 201.0 feet msl and have sufficient opening to pass a flow of 1570 cfs with a head loss of no more than 0.2 feet.

Relocate the following utility crossings:

Station 111 + 90 --- 8 inch water main  
Station 128 + 70 --- 8 inch sewer main  
Station 147 + 25 --- 6 inch water main

Acquisition of 20.72 acres of permanent right-of-way will be required to implement the proposed plan.

Local sponsor is required to adopt and enforce land use measures to prevent the unwise and uneconomical development of the flood plain.

## Plan Accomplishments

4. The major benefits that will result from the selected plan are the reduction of existing and future damages to the urban areas of Laurinburg and East Laurinburg, North Carolina. Construction of the selected plan

would produce flood damage reduction benefits for approximately 82 structures located within the existing flood plain. Average annual benefits of \$23,250 are estimated for the reduction of flood damages to existing structures. No monetary benefits are claimed to future development since the plan recommends regulation of the residual flood plain. Plates E-2 and E-3 illustrate existing and improved plan and profile views for the 100 year frequency flood; Plates E-5 and E-6 illustrate stage reductions for the 10, 20, 50 year and standard project floods.

## Effect of the Plan on Environment

5. The selected plan consists of widening the existing channel bottom to widths ranging from 30 to 35 feet and deepening as much as two feet. This plan would have environmental effects in that it recommends the removal of trash, debris and large discarded articles from the creek bottom and the removal of vegetation which, in places, clogs the channel and collects floating debris and scum.

6. Adverse effects of the selected plan include the destruction of existing bottom flora and invertebrates, loss of vegetation from one side of the creek, and a temporary increase in turbidity and sediment load. Construction of the proposed plan could also result in lowering of the surface water table immediately adjacent to the improved channel.

7. Right-of-way clearing would result in the loss of 20.72 acres of vegetation. This cover loss would include shrubs and thickets (black willow, privet, honeysuckle and greenbriar) and some trees (sweet gum, sycamore, black gum, and a few pines and small oaks). The project area is a narrow strip which is impinged upon from both sides by residential and commercial development, and provides only marginal to moderate habitat for birds, squirrels, rabbits and other small animals.

8. Studies by the North Carolina Wildlife Resources Commission show that the amount of stream cover is the greatest single factor affecting fish population in streams disturbed by flood control measures. Fish resources in the project area are limited to darters, daces, a few sunfish of minimal size, and possibly small pickereel or largemouth bass at the lower project limit. Since this plan derives its flood control benefits by widening and deepening of the channel, cover could be reestablished along the edges of the creek without affecting channel flow.

9. Existing bottom flora and invertebrates will be removed as would be expected with any channel modification plan. The sand and silt bottom should gradually recolonize from flora and invertebrates above the project, but will probably result in a less diverse population.

10. 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 34,700 cubic yards of excavation and 19.2 acres of clearing. A small increase in sediment load may occur during periods of high flows due to a slight increase in channel velocities. Sediment impacts are not expected to occur downstream of the project in the more valuable habitat. Immediately below the lower project limit, the creek slows and widens to form a broad swamp with no defined channel. This area acts as a filter. On days of high volume flow and turbidity in the upper reaches of Leith Creek, clear water can be observed in the lower swampy area.

11. The selected plan calls for deepening as much as two feet in the extreme lower reach in order to obtain maximum capacity of the L & S Railroad culvert located at the downstream limit. The remaining reaches of the 1.97 mile project generally follows the existing invert elevations and avoids deepening. In areas where excavation proceeds deeper than more recently deposited sediment a silt, a draining of wet soils is possible immediately adjacent to the creek. Elevated fill areas and a slightly lower channel bottom could result in better drained soils and fewer lowland hardwoods in the reestablished cover.

12. The proposed plan can also be made compatible with local plans to construct a park on the western bank between Carver Street and Caledonia Road, by the construction of a greenway connecting existing park facilities with proposed park facilities. In accordance with established Corps policy for recreation facilities at local flood protection projects, potential flood control alternatives were formulated without regard to recreation in order to avoid the influence of recreation on the formulation of a project which must attain a benefit/cost ratio greater than unity without regard to recreation. The inclusion of a greenway with a bike and walking trail and periodically spaced picnic tables and park benches is included as part of the recommended plan and will be discussed later in this section.

## Other Plan Effects

13. Construction of a flood control project on Leith Creek will 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.

# DESIGN

The hydraulic analysis conducted for Leith Creek is discussed in Section C of this Appendix. It is pertinent to the selected plan and those that may be considered as a result of the selected plan are discussed in the following paragraphs. The data prepared to begin and evaluate the selected plan are presented in Table C-9, Section C, of this Appendix.

## EFFECT OF CHANNEL IMPROVEMENT ON DISCHARGE RATES

In order to evaluate the relative magnitude the proposed channel improvement will have on peak discharge rates, a modified puls routing was performed using SPF flows. For this test, Plan 1 was used. Storage-discharge curves for a reach to be improved were computed for existing and improved conditions using the Hydrologic Engineering Center's HEC-2 Backwater Program. Routing coefficients, values, etc., used were the same as those used for existing and improved channel conditions presented in Section C and later paragraphs of this section. The derived storage-discharge curves are shown on Figure E-1. Although the outflow hydrograph for a reach is composed of the routed inflow hydrograph and the local inflow hydrograph, an indication as to the amount and relative significance of the change in discharge rates that might accompany an improved channel can be obtained by analyzing only the routed inflow hydrograph. If the change in the routed hydrograph using natural vs improved channel conditions is insignificant, then additional studies to more accurately define this change would be warranted. Using this as the initial study objective, the inflow hydrograph of the SPF was routed for both existing and improved channel conditions using the storage-discharge curves and routing procedures described above. The difference obtained between the existing and improved conditions was only 6 cfs, a 2 percent increase in the peak discharge rate. The inflow and outflow hydrographs for the natural condition are shown on Figure E-2. Based on the results of this investigation, it is concluded that the improved channel does not significantly increase discharge rates. Plan 3, the recommended plan, would have even less effect on discharge rates since much less excavation is involved (See Table D-1). Therefore, based on the findings of these findings, it is concluded that the possible increase in discharge rates due to recommend channel improvement, need not be considered in the project analysis or design. It is further concluded, that had the recommended plan been considered, the conclusion reached would have been the same, namely, the contribution from local inflow to the peak of the outflow hydrograph would be under improved conditions than under existing conditions.

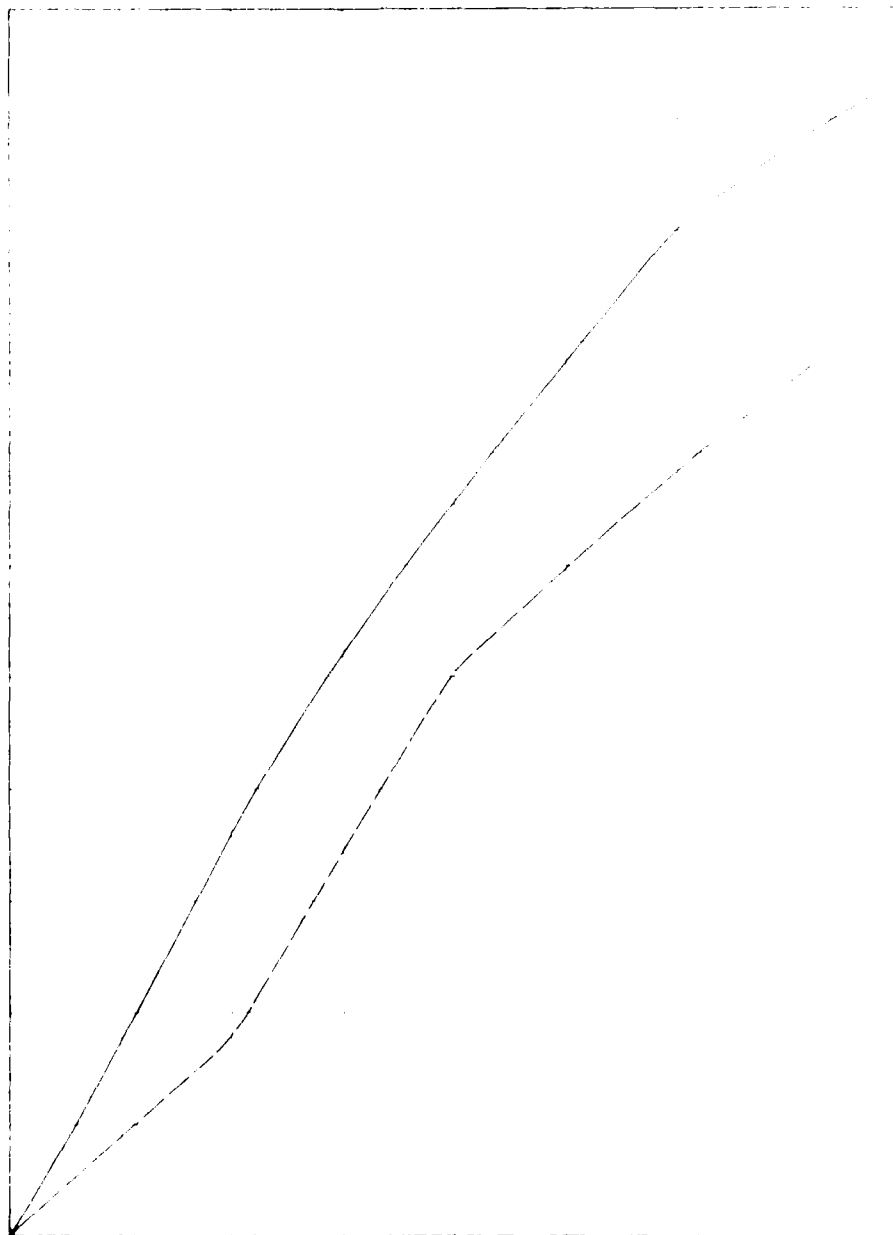
## HYDRAULIC DESIGN

Hydraulic studies for Leith Creek were accomplished in accordance with methods contained in applicable Engineering Manuals and with design practices commonly employed on similar projects. For project formulation and design, hydraulic analyses were made for Leith Creek from U.S. Highway 74 (Station 2 + 00) to U.S. 15-401 Bypass (Station 205 + 00). The proposed project, as presented in this report, consists of channel enlargement from the Louisiana and Southern Railroad (Station 65 + 70) to Gill (Station 163 + 00). Design parameters used in computations and hydraulic criteria for the recommended project are discussed and presented in the following paragraphs.

## IMPROVED WATER SURFACE PROFILES

Water surface profiles for improved conditions were computed using the Improvement Option (CI card) of the Hydraulic Engineering Center's computer program, "Water Surface Profiles". Improved profiles were computed for the Standard Project Flood and floods having recurrence intervals of 10, 20, 50 and 100 years. Plates E-2 and E-3 compare the existing channel plan and profile views for the 100 year frequency flood; plates E-4 and E-5 compare existing and improved flood profiles for the 10, 20 year and standard project floods. Hydraulic criteria used for computing improved conditions are the same as those presented in Section C for existing conditions, except as noted in the following paragraphs.

STORAGE IN HUNDREDS OF A.C.F.



DISCHARGE IN THOUSANDS OF C.F.S.  
STA 65+45 TO STA 169+25

LEGEND

- — — — — EXISTING CHANNEL
- - - - - IMPROVED CHANNEL PLAN

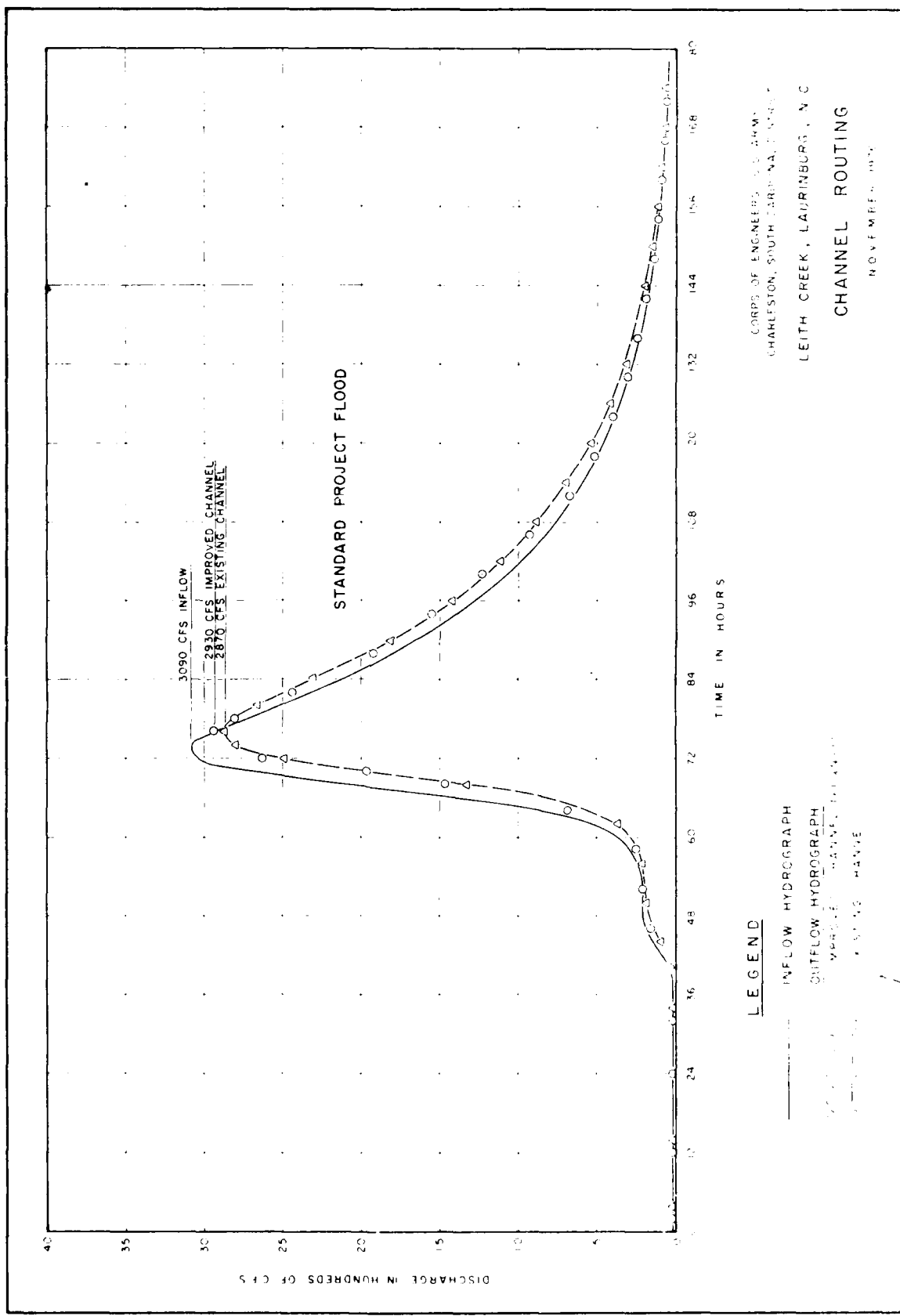
U.S. ARMY CORPS OF ENGINEERS  
CHARLESTON DISTRICT OFFICE

LEITH CREEK, LA. RAINBOWS DIV.

STORAGE - DISCHARGE  
CURVES

NOVEMBER 1954





CORPS OF ENGINEERS, DISTRICT  
 CHARLESTON, SOUTH CAROLINA DISTRICT  
 LEITH CREEK, LAURINBURG, N.C.  
**CHANNEL ROUTING**  
 NOVEMBER 1957

**LEGEND**  
 INFLOW HYDROGRAPH  
 OUTFLOW HYDROGRAPH  
 IMPROVED CHANNEL  
 EXISTING CHANNEL

## STARTING CONDITIONS

18. Starting values were the same as those for existing conditions. Back-water computations were started sufficiently below the project limits to ensure that any errors introduced by faulty starting assumptions would be corrected by channel control before reaching the start of the project.

## MANNING'S ROUGHNESS COEFFICIENT

19. When computing improved water surface profiles, the values of Manning's "n" above and below project limits were unchanged from those used in computing the existing profiles. For the project reach limits, a channel "n" value of 0.035 was used to reflect improved channel conditions.

## MINOR LOSSES

20. In general, all minor loss coefficients used were the same as used for existing profiles, with the exception of expansion and contraction coefficients within the project limits. Contraction and expansion coefficients within the project limits were reduced to reflect improved conditions.

## PERTINENT HYDRAULIC DATA

21. Pertinent hydraulic design criteria, such as bottom widths, side slopes and limits of improvement are shown in Table E-1. The table also presents the 100 year design discharges and the average channel velocity and water surface elevations for both existing and improved conditions.

Table E-1

PERTINENT HYDRAULIC DATA  
LEITH CREEK, SCOTLAND COUNTY

100 Year Flood-Existing and Improved Conditions

Station	Hydraulic Elements		Discharge (cfs)	Average Channel Velocity		Water Surface Elevation	
	Bottom (Ft)	Slope (ft/vert)		Existing	Improved	Existing	Improved
C/D - S. N. Bypass							
1000	Natural	Natural	2830	1.30		182.24	
1000	Natural	Natural	2000	7.73		186.73	
1000	Natural	Natural	2000	2.58		189.75	
C/D - S. 1903							
1000	Natural	Natural	2000	2.74		189.80	
1000	Natural	Natural	2000	2.33		189.90	
1000	Natural	Natural	2000	2.08		190.78	
1000	Natural	Natural	2000	.49		191.06	
1000	Natural	Natural	2000	.78		191.10	
C/D - S. R.R.							
1000	Natural	Natural	2000	.77		191.17	
1000	Natural	Natural	2000	.59		191.18	
1000	Natural	Natural	2000	.69		191.21	
1000	Natural	Natural	2000	1.73		191.26	
C/D - R.R. 1940							
1000	Natural	Natural	2000	1.66		191.39	
1000	Natural	Natural	2000	1.64		191.41	
1000	Natural	Natural	1920	6.23		191.21	
C/D - S.S.R.R. - Beginning of Project							
1000		2.0	1920	4.62	3.06	193.78	193.97
1000		1.6	1920	.66	1.44	194.34	194.35
1000		2.0	1920	1.27	1.99	194.34	194.27
1000		0	1920	4.77	5.26	194.91	194.42
C/D - Channel Street							
1000		0	1920	5.69	6.54	196.29	194.42
1000		1.0	1920	2.06	3.61	198.67	195.43
1000		2.0	1920	2.49	3.99	198.67	195.75
C/D - May Street <sup>1/2</sup>							
1000		0	1920	.97	3.07	198.17	194.75

Table E-1 (Continued)

Centerline Station (feet)	Bottom Width (feet)	Elements Side Slope (hor/vert)	Discharge (cfs)	Average Channel Velocity		Elevation Existing (Ft. msl)	Elevation Proposed (Ft. msl)
				Existing	Improved		
113+00	35	0	1920	.75	1.45	200.18	199.8
114+00	35	2.0	1920	.62	1.40	200.19	199.8
115+00	20	1.0	1920	6.66	5.23	200.13	199.8
116+00	20	1.0	1920	.76	6.40	200.81	199.8
117+00	35	1.5	1920	2.74	2.85	201.32	199.8
118+00	35	2.0	1920	1.19	2.70	201.68	199.8
119+00	35	0	1840	1.24	2.54	201.77	199.8
120+00	35	0	1840	1.22	2.60	201.85	199.8
121+00	35	2.0	1840	1.09	2.68	201.84	199.8
122+00	35	2.0	1840	1.23	2.21	202.19	199.8
123+00	35	2.0	1840	1.58	3.36	202.00	199.8
124+00	35	2.0	1840	2.08	3.56	202.00	199.8
125+00	35	2.0	1840	1.69	3.64	202.58	199.8
126+00	35	2.0	1840	2.53	4.15	202.18	199.8
127+00	35	0	1840	10.99	5.45	202.03	199.8
128+00	35	0	1840	10.99	6.22	202.03	199.8
129+00	35	2.0	1470	1.55	3.93	202.03	199.8
130+00	35	2.0	1470	1.77	3.50	202.03	199.8
131+00	35	2.0	1470	1.52	4.37	202.03	199.8
132+00	35	2.0	1470	1.54	6.04	202.03	199.8
133+00	35	2.0	1470	1.16	4.37	202.03	199.8
134+00	35	2.0	1470	1.37	4.37	202.03	199.8

End of Project

1/ Recommended plan of improvement includes the replacement of the McKay Street Bridge. Channel widths in this table represent improved conditions.

2/ Reach between 120 + 12.5 and 121 + 07.5 requires slope protection for bank stabilization. See Plate E-9 for details.

3/ Recommended plan of improvement includes the replacement of the Carver Street Bridge. Channel widths in this table represent improved conditions.

# Channel Design

22. The selected channel conveyance improvement plan for Leith Creek will pass an 8-year flood with zero damage to existing commercial and residential structures. The following tabulation shows pertinent design data relative to the selected plan.

Reach (Sta. to Sta.)	Bottom Width (feet)	Side Slope (horz:vert)	Bottom Slope (feet/foot)
65+70 to 133+00	35	2:1	.00150
133+00 to 163+00	35	2:1	.00086
163+00 to 169+00	30	2:1	.00036

23. Design bottom and other data are shown on Plates E-2 and E-3 of this section and in Table E-1.

## SLOPE PROTECTION

24. Results of hydraulic computations and investigations indicated that slope protection would not be required for hydraulic purposes. Representatives of the Foundation and Materials Section of Charleston District performed a site reconnaissance of the project area in November 1976. Results of this visit indicated that the soils were very sandy with some silt content. No rock was observed along the areas inspected. The existing side slopes are 1V and 1H and steeper with adequate vegetive cover. Slope heights vary but do not exceed 3 feet. The normal groundwater table appeared to be between 0.5 to 1.0 feet above the creek bottom. There were no significant erosion which was apparently due to adequate vegetation.

25. The channel design requires a 35-foot bottom with 1V and 2H side slopes for most of the project reach. However, channel transition will be required in the vicinity of Commonwealth Avenue (Station 120+40) and the SCL Railroad (Station 120+80). In this reach the design channel must transition from a 35-foot bottom with 2:1 side slopes to a 20-foot bottom with 1:1 side slopes. Bank stabilization will be required in this reach as shown on Plate E-9. The maximum height of cut slope in this reach would be approximately 9 feet; but, the average height of cut slope would be about 6 feet.

26. Stability analyses were conducted for the steady seepage and drawdown cases using assumed soil properties typical for the soil types found on the project. Both cases examined showed the sections to be stable for IV on 2H side slopes (See Figures E-3 and E-4). Existing wood retaining structures at Commonwealth Avenue may be extended as necessary to provide stability behind the IV and IH cut slopes for the waterway opening beneath the bridge. The structure extensions would be short and would consist of wood soldier piles and wood lagging, the same type construction as the existing structures.

27. The use of sacked sand-cement riprap protection is also recommended for this transition reach. This type of protection consists of the placement of cloth cement sacks filled and securely tied with a mixture of one part Portland Cement (ASTM C150, Type 1) and 5 parts sand. Sacks should contain one to one and one-half cubic feet of sand-cement mix when two-thirds filled. Each sack shall be hand placed and pushed in to firm contact with adjacent sacks. The riprap shall be thoroughly wetted as work progresses in order to form a bond between adjacent sacks.

## BRIDGES

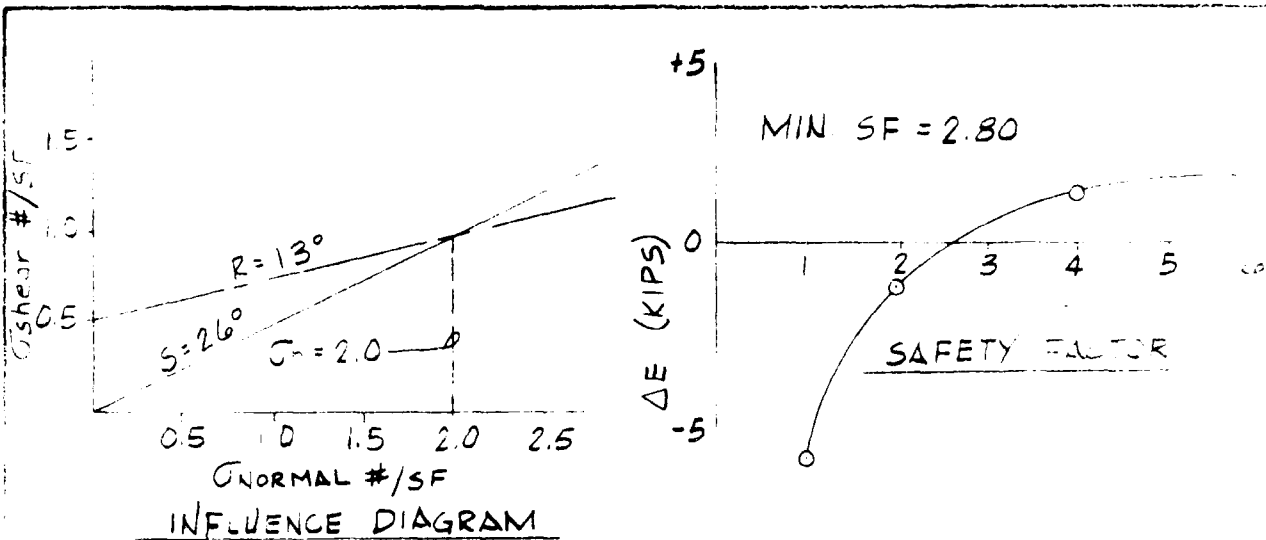
28. All bridge crossings within the study reach are illustrated on Plates E-7 and E-8. Proposed improvements at each crossing are shown in red. Two bridge replacements are recommended at the McKay and Carver Street crossings. Recommended minimum low member elevations at each are 196.4 and 201.0 ft. msl, respectively. The replacement bridges should pass a fifty-year flow with a head loss of no more than 0.2 feet. Recommended low member elevations allow a one-foot freeboard for the 50-year flood. Cost estimates for bridge replacements represent the cost of removing the existing structure and replacing with four fifteen-foot precast spans, 26 feet wide with a H-10 loading. Actual replacement structures will be a local responsibility and will be coordinated with the Charleston District.

29. No structural modifications to the remaining bridges are recommended. Remaining bridges have sufficient openings or adequate wingwall protection to allow passage of high flows without significant damage to the structure.

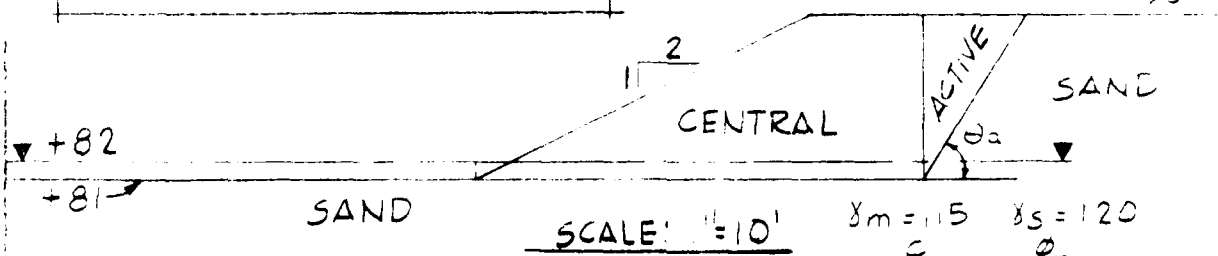
## UTILITIES

30. The selected plan of improvement calls for the relocation of the following utilities:

Station 111 + 90 --- 8 inch water main  
Station 128 + 70 --- 8 inch sewer main  
Station 147 + 25 --- 6 inch water main

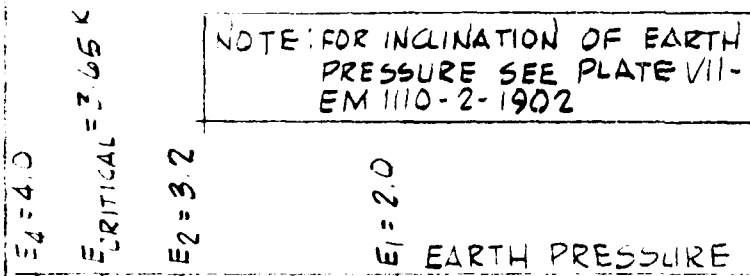


MIN. SAFETY FACTOR = 2.80

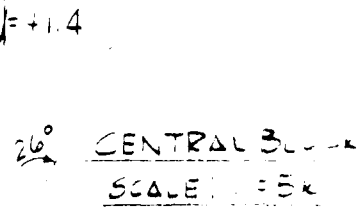
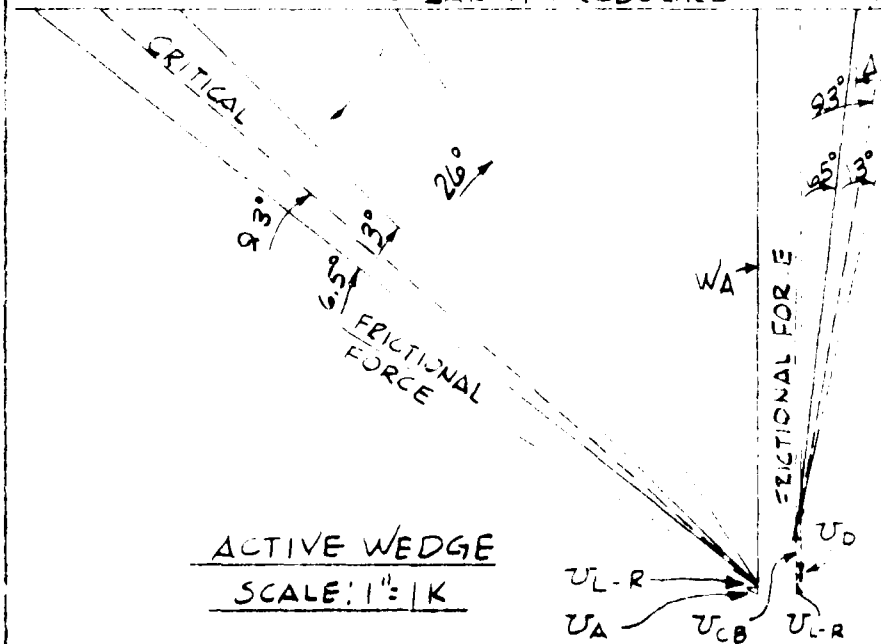


NOTE: FOR INCLINATION OF EARTH PRESSURE SEE PLATE VII-2, EM 1110-2-1902

$\gamma_m = 115$     $\gamma_s = 120$   
 $Q = 0.5$     $\phi = 0^\circ$   
 $R = 0.5$     $13^\circ$   
 $S = 0$     $26^\circ$



$\Delta E = -6.0$   
 $\Delta E = -1.2$



LEITH OR LAURINBURG  
 FLOOD CONTROL PROJ.  
 STABILITY ANALYSIS  
 STEADY SEEPAGE CASE  
 SCALE: AS SHOWN  
 NOV 1971





31. Replacement of the water mains may be best accomplished simultaneously with the replacement of the McKay and Carver Street bridges, as one main is located beneath each bridge.

32. Two additional sewer crossings were considered for relocation. These mains are the 21 inch sewer at Station 122 + 50 and the 18 inch sewer at Station 147 + 00. Cost estimates for relocation of these sewers using inverted siphons are \$35,750 and \$25,300 respectively. Ensuing engineering and economic studies indicated that the relocation of these pipes was not feasible and would place an unjustified burden on the local sponsor. After consultation with higher authority, it was decided not to recommend relocation of these pipes as part of the selected plan of improvement.

### RIGHTS-OF-WAY

33. Right-of-way acquisitions for projects authorized by this study authorization are a non-Federal responsibility. An estimated 20.72 acres of permanent right-of-way will be required in order to construct the selected plan of improvement. Cost estimates for right-of-way acquisition were obtained from the local sponsor. A typical right-of-way section is presented on Plate E-10.

### RECREATION

34. Recreational facilities included as part of the recommended plan include the construction of a greenway adjacent to Leith Creek beginning at the Church Street Crossing (Station 105+50) and extending to the upper project limits at Gill Street (Station 169+00), a total distance of 6,350 feet. The greenway will be constructed on one bank only (see plate E-10 for location of proposed greenway) and will include a four-foot wide bituminous surfaced trail for biking and walking and will also include periodically spaced picnic tables and park benches. Two picnic sites have been located in the vicinity of Carver Street behind a complex of low rent apartments and in the vicinity of McKay Street near the elementary school and playground. Each picnic site will contain two tables and one trash receptacle. Park benches will be located at road crossings where picnic sites are not planned in order to serve pedestrian traffic from the trail and from each respective road. Ornamental shrubbery will be planted in appropriate locations to beautify the greenway parks.

## BEAUTIFICATION

35. In order to provide a more environmentally compatible and aesthetically acceptable project, all attempts shall be made to excavate from one bank only to avoid disruptive effects to the opposite bank. Materials excavated shall be deposited in disposal areas adjacent to the creek and to a maximum depth of four feet. All disturbed areas shall be smoothed and seeded.

36. Additional beautification measures would receive full consideration during the preparation of plans and specifications. In general, all disturbed areas of all elements surrounding the project would be landscaped to restore the natural scenic beauty and to provide an attractive appearance. A greenway park will be constructed adjacent to Leith Creek and ornamental shrubbery planted to assist in beautifying the area.

## Construction

37. Assuming authorization and funds availability, it is estimated that the project could be designed and constructed in less than two years. The time estimated for construction is less than one year. The major construction material items required for the project include 34,700 cubic yards of channel excavation; 19.2 acres of right-of-way clearing and 11.24 acres of shaping and seeding. During construction, only the areas required for construction and disposal of excavated materials shall be cleared. All efforts shall be made to disturb as little natural cover as possible.

38. In order to provide for abatement and control of any environmental pollution arising from construction activities, the contractor and his subcontractors shall comply with all applicable Federal, state and local laws and regulations concerning environmental pollution control and abatement.

## Operation and Maintenance

39. Normal operation and maintenance costs would be expected for the channel works and recreational facilities. Operation and maintenance would be a non-Federal responsibility and would be accomplished in accordance with Federal regulations. No significant problems are anticipated in connection with operation and maintenance of the selected plan.

# Floodways

40. The nonstructural portion of the selected plan of improvement requires regulation of the residual flood plain. The concept of designated floodways is described and discussed in the following paragraphs. Designated floodways for both existing and improved conditions are presented in Plate E-10 and E-12.

## FLOODWAY CONCEPT

41. The objective of the floodway concept is to allow optimum use of flood plain areas without significantly increasing flood hazards. Under natural conditions, a major flood would inundate the entire flood plain. The floodwater in the channel and areas immediately adjacent to the channel would normally be flowing swiftly, while water that covers the area adjacent to high ground would be ponded or moving very slowly. If obstructive development were placed in the area normally occupied by the swiftly flowing water, the obstruction would act as a dam, causing floodwater to back up and reach significantly higher elevations. Placement of development in the outer areas of the flood plain will cause displacement of stored floodwater, but obstruction to flow will be slight. Reduction of floodwater storage areas will cause some increase in flood elevations, but the amount of elevation increase can be controlled by altering the width of the area set aside for passage of flood flow. The elevation that will be reached by the design flood after development of fringe areas is used to regulate the floor elevations of buildings to be constructed within the fringe areas. The area set aside for unobstructed passage of flood flow is referred to as the "Floodway".

## FLOODWAY FRINGE

42. The area between the floodway and the natural flood plain limits is designated as the "Floodway Fringe". In this report, the floodways are designed to convey the 100-year frequency flood discharge with a one-foot increase in flood elevation. The floodway fringe is the area located between the floodway boundary and the limits of the 100-year floodplain.

## FLOOD PROTECTION ELEVATION

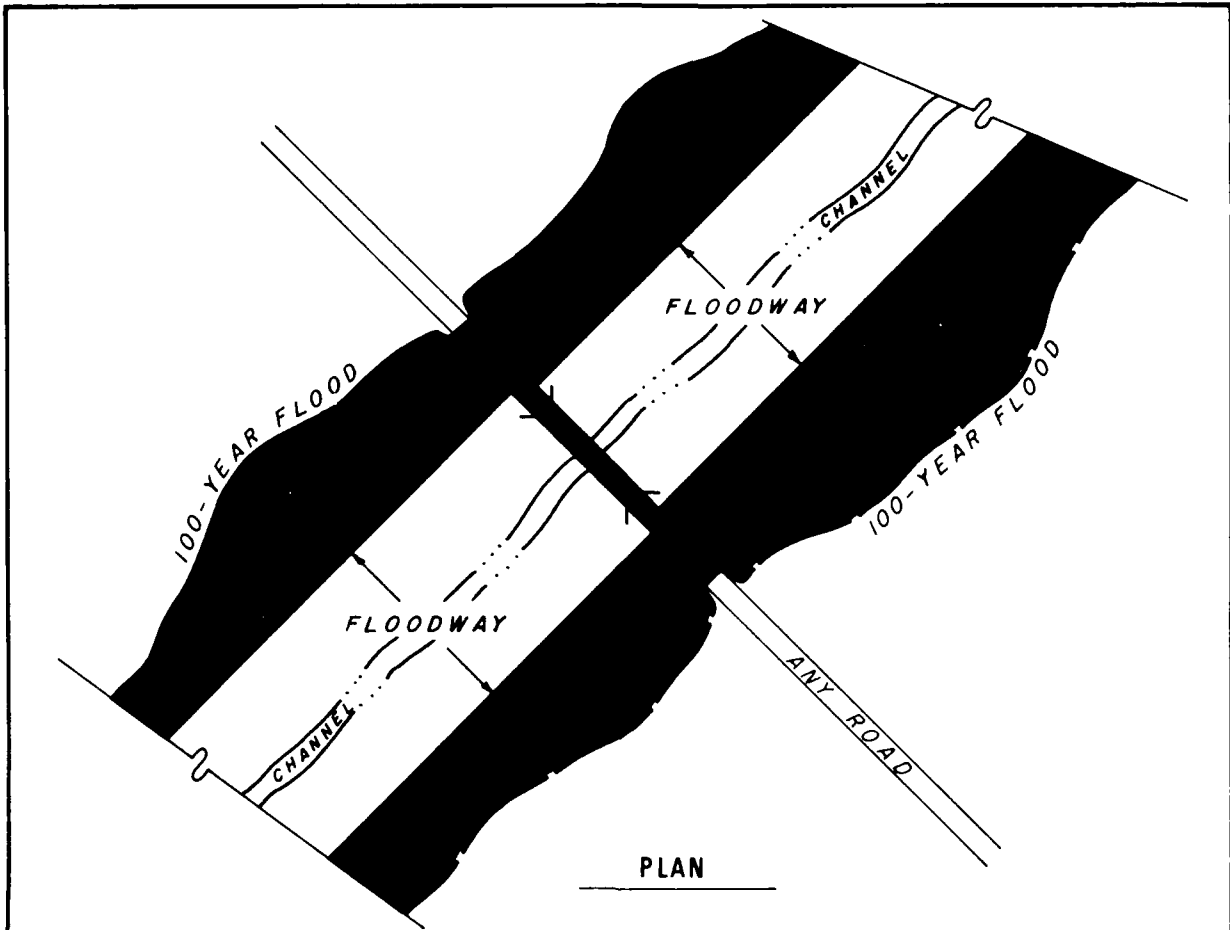
43. Complete filling of the floodway fringe area will cause the 100-year flood to rise about one foot higher than it would under present conditions. This possible future 100-year flood elevation is referred to as the "Flood Protection Elevation" which is designed to serve as a guide for development within the floodway fringe areas. Homes and other damageable facilities should be constructed above the flood protection elevation or provided equivalent protection by flood proofing. Exhibit E-1 illustrates the terms described in the preceding paragraphs.

## FLOODED AREA MAPS

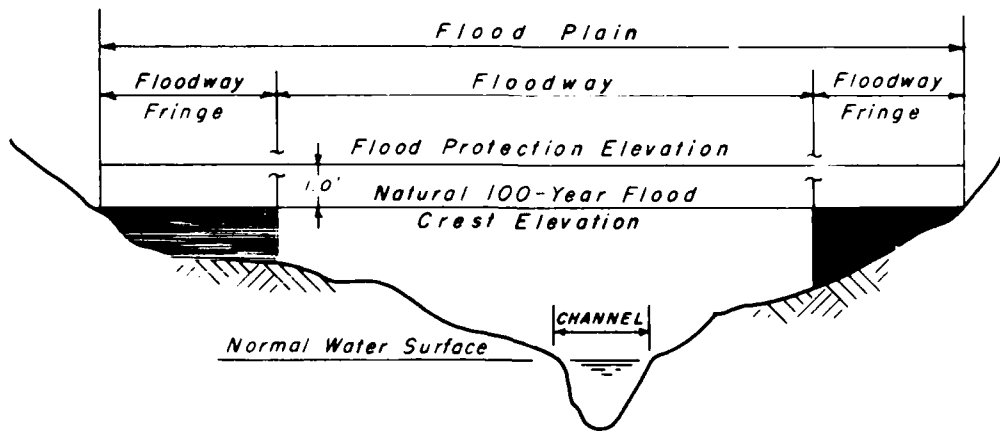
44. Plates E-11 and E-12 show floodway boundaries and floodway fringe areas (defined by the limits of the 100-year flood) for both pre-project and post project conditions. Also shown on the Flooded Area maps are locations and numbers of surveyed cross sections and computed flood protection elevations. The floodway and floodway fringe boundaries were located by scaling computed distances right and left of stream centerline. In order to locate the floodway and floodway fringe boundaries on land, it will be necessary to scale distances from boundary line to identifiable reference marks (streets, buildings, etc.) on the maps, then measure the same distances in the field. The actual limits of the 100-year flood may vary somewhat from that shown on the map because in using aerial photographs as based maps, the flood plain limits must be interpolated between surveyed cross sections.

45. The floodway was calculated based on existing and improved hydraulic conditions. The method of calculating the floodway removes an equal amount of conveyance from each side of the channel. Therefore, from a hydraulic standpoint, the floodway area on either side of the stream will be proportionate to the flooding potential that now exists on its respective side of the stream.

46. The floodway location and floodway may have to be shifted from one side to the other, depending upon political, policy, or other decisions. Also, public and private plans for development and conservation may influence the desirability of the floodway location. If such policies and plans indicate a shifting of the floodway, it will be necessary to recompute the floodway based on these decisions together with the hydraulic conditions.



PLAN



CROSS SECTION

**NOTE.**

Placement of landfill in floodway fringe areas will confine 100-Year Flood to floodway and raise Natural 100-Year Flood Crest Elevation one foot to Flood Protection Elevation.

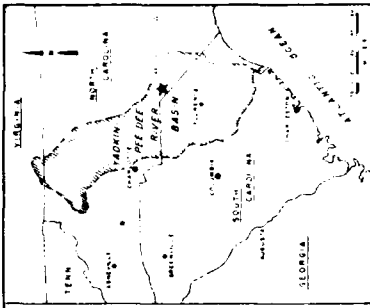
Development located in Floodway Fringe areas should be elevated above Flood Protection Elevation.

**TYPICAL FLOODWAY  
PLAN & CROSS SECTION**

Not to Scale

## PROFILES

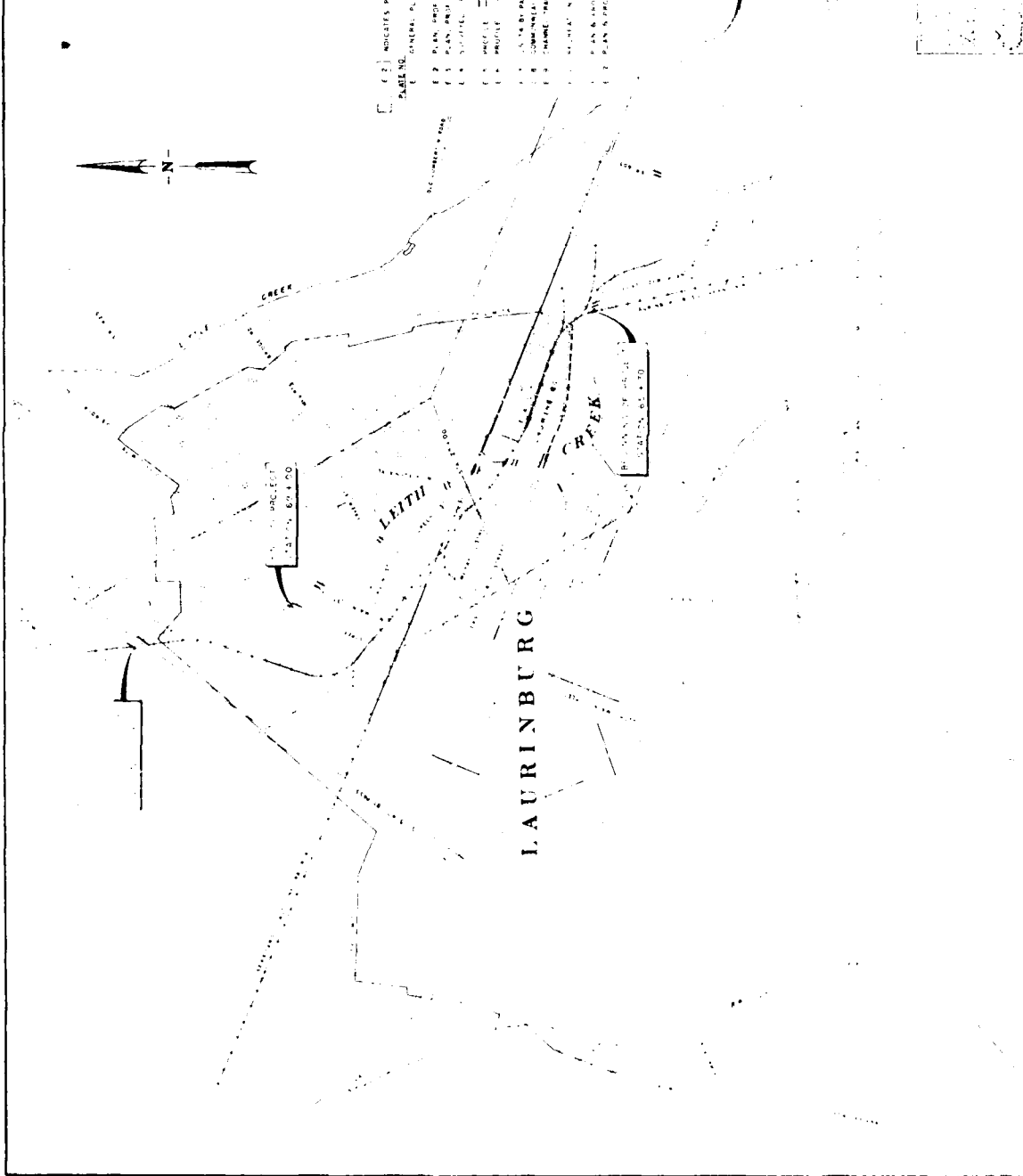
47. As mentioned in the previous paragraph, the limits of the 100 year flood, which delineate the floodway fringe area, are shown on the Flooded Area Maps (Plates E-11 and E-12). High water profiles for various frequency floods under existing and improved conditions are shown on Plates E-5 and E-6. Floodway Profiles, showing the flood protection elevation profiles for existing and improved conditions are shown on the same plates as the flooded area maps.



NEIGHBORHOOD MAP

LEGEND  
 INDICATES PLACE NUMBER AND AREA COVERED BY MAP

PLACE	INDICATES PLACE NUMBER AND AREA COVERED BY MAP
1	LAURINBURG, N.C.
2	LAURINBURG, N.C. (SOUTH SIDE)
3	LAURINBURG, N.C. (NORTH SIDE)
4	LAURINBURG, N.C. (WEST SIDE)
5	LAURINBURG, N.C. (EAST SIDE)
6	LAURINBURG, N.C. (CENTRAL)
7	LAURINBURG, N.C. (SOUTHWEST)
8	LAURINBURG, N.C. (NORTHEAST)
9	LAURINBURG, N.C. (SOUTHEAST)
10	LAURINBURG, N.C. (NORTHWEST)
11	LAURINBURG, N.C. (SOUTHWEST)
12	LAURINBURG, N.C. (NORTHEAST)
13	LAURINBURG, N.C. (SOUTHEAST)
14	LAURINBURG, N.C. (NORTHWEST)
15	LAURINBURG, N.C. (SOUTHWEST)
16	LAURINBURG, N.C. (NORTHEAST)
17	LAURINBURG, N.C. (SOUTHEAST)
18	LAURINBURG, N.C. (NORTHWEST)
19	LAURINBURG, N.C. (SOUTHWEST)
20	LAURINBURG, N.C. (NORTHEAST)
21	LAURINBURG, N.C. (SOUTHEAST)
22	LAURINBURG, N.C. (NORTHWEST)
23	LAURINBURG, N.C. (SOUTHWEST)
24	LAURINBURG, N.C. (NORTHEAST)
25	LAURINBURG, N.C. (SOUTHEAST)
26	LAURINBURG, N.C. (NORTHWEST)
27	LAURINBURG, N.C. (SOUTHWEST)
28	LAURINBURG, N.C. (NORTHEAST)
29	LAURINBURG, N.C. (SOUTHEAST)
30	LAURINBURG, N.C. (NORTHWEST)
31	LAURINBURG, N.C. (SOUTHWEST)
32	LAURINBURG, N.C. (NORTHEAST)
33	LAURINBURG, N.C. (SOUTHEAST)
34	LAURINBURG, N.C. (NORTHWEST)
35	LAURINBURG, N.C. (SOUTHWEST)
36	LAURINBURG, N.C. (NORTHEAST)
37	LAURINBURG, N.C. (SOUTHEAST)
38	LAURINBURG, N.C. (NORTHWEST)
39	LAURINBURG, N.C. (SOUTHWEST)
40	LAURINBURG, N.C. (NORTHEAST)
41	LAURINBURG, N.C. (SOUTHEAST)
42	LAURINBURG, N.C. (NORTHWEST)
43	LAURINBURG, N.C. (SOUTHWEST)
44	LAURINBURG, N.C. (NORTHEAST)
45	LAURINBURG, N.C. (SOUTHEAST)
46	LAURINBURG, N.C. (NORTHWEST)
47	LAURINBURG, N.C. (SOUTHWEST)
48	LAURINBURG, N.C. (NORTHEAST)
49	LAURINBURG, N.C. (SOUTHEAST)
50	LAURINBURG, N.C. (NORTHWEST)



LEITH CREEK

LEGEND

INDICATES PLACE NUMBER AND AREA COVERED BY MAP

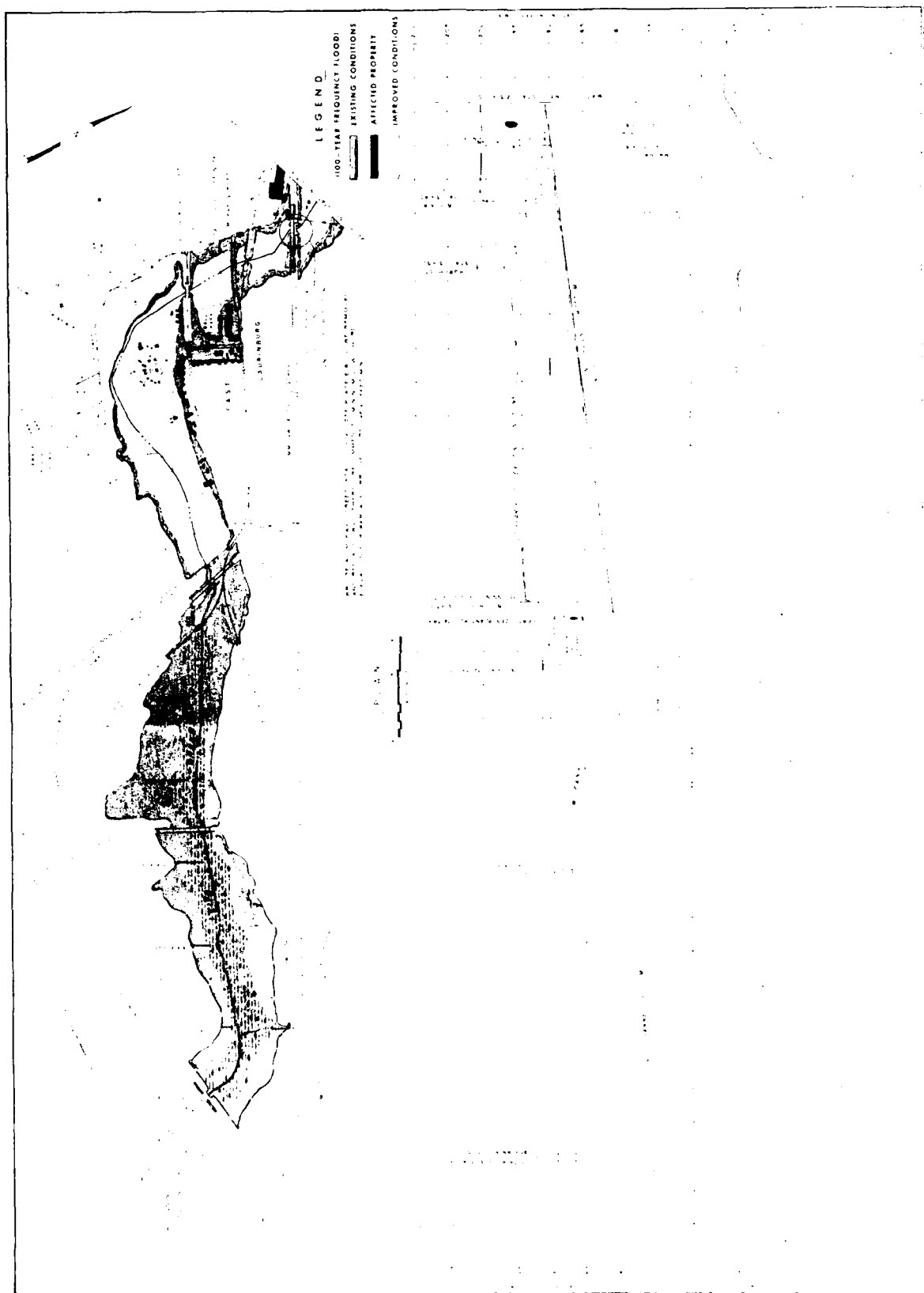
LAURINBURG

LEITH CREEK

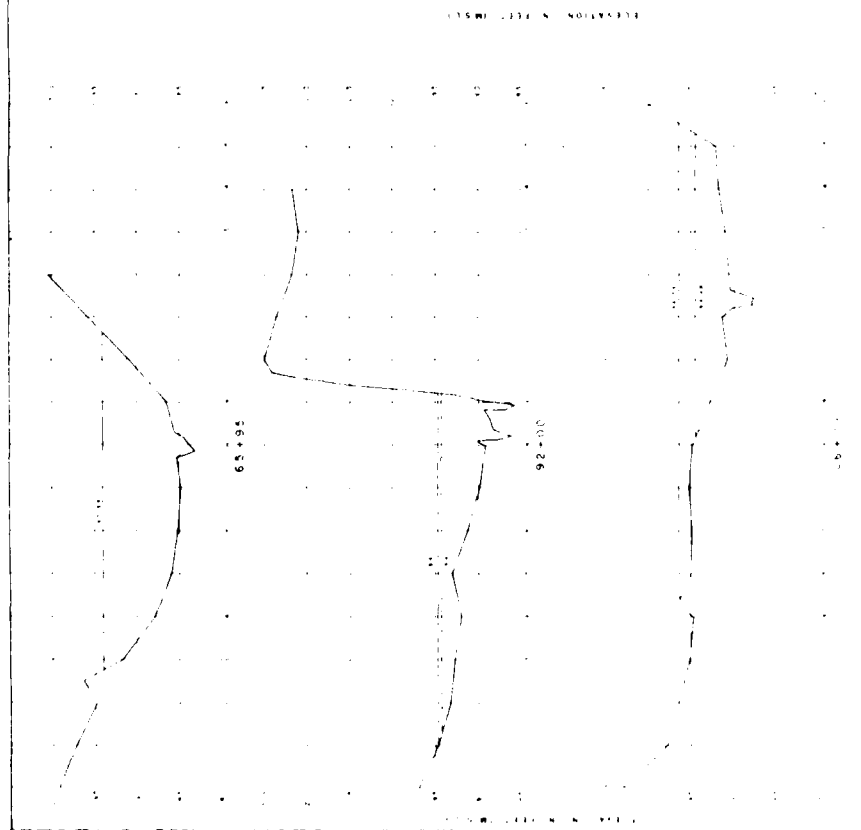
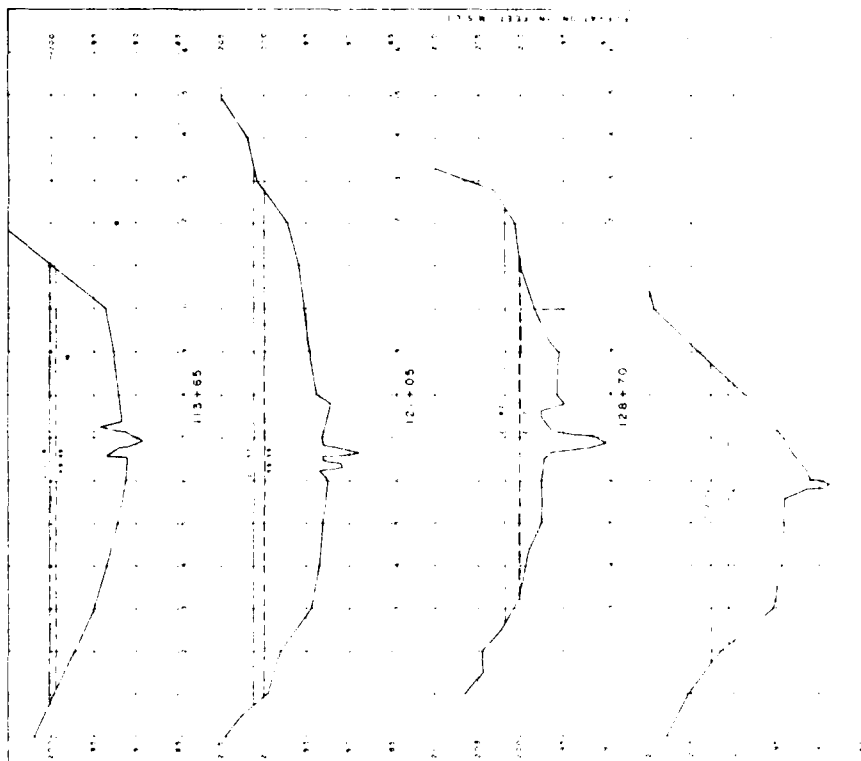
INDICATES PLACE NUMBER AND AREA COVERED BY MAP

INDICATES PLACE NUMBER AND AREA COVERED BY MAP

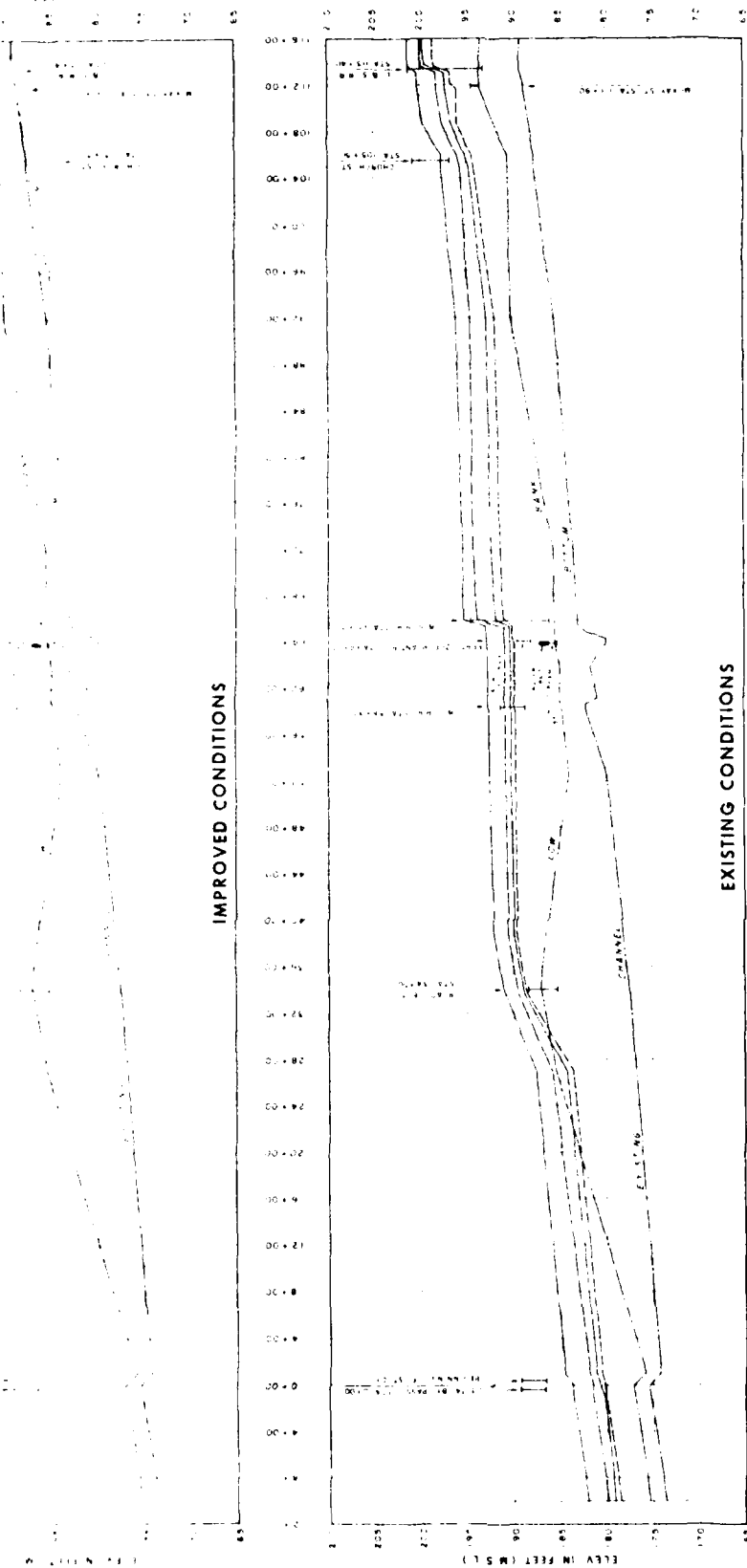








PROJECT NO. 100-1000  
 SHEET NO. 100-1000  
 DATE: 10/1/50  
 DRAWN BY: J. H. BROWN  
 CHECKED BY: J. H. BROWN  
 SURVEYED CROSS SECTIONS  
 100-1000

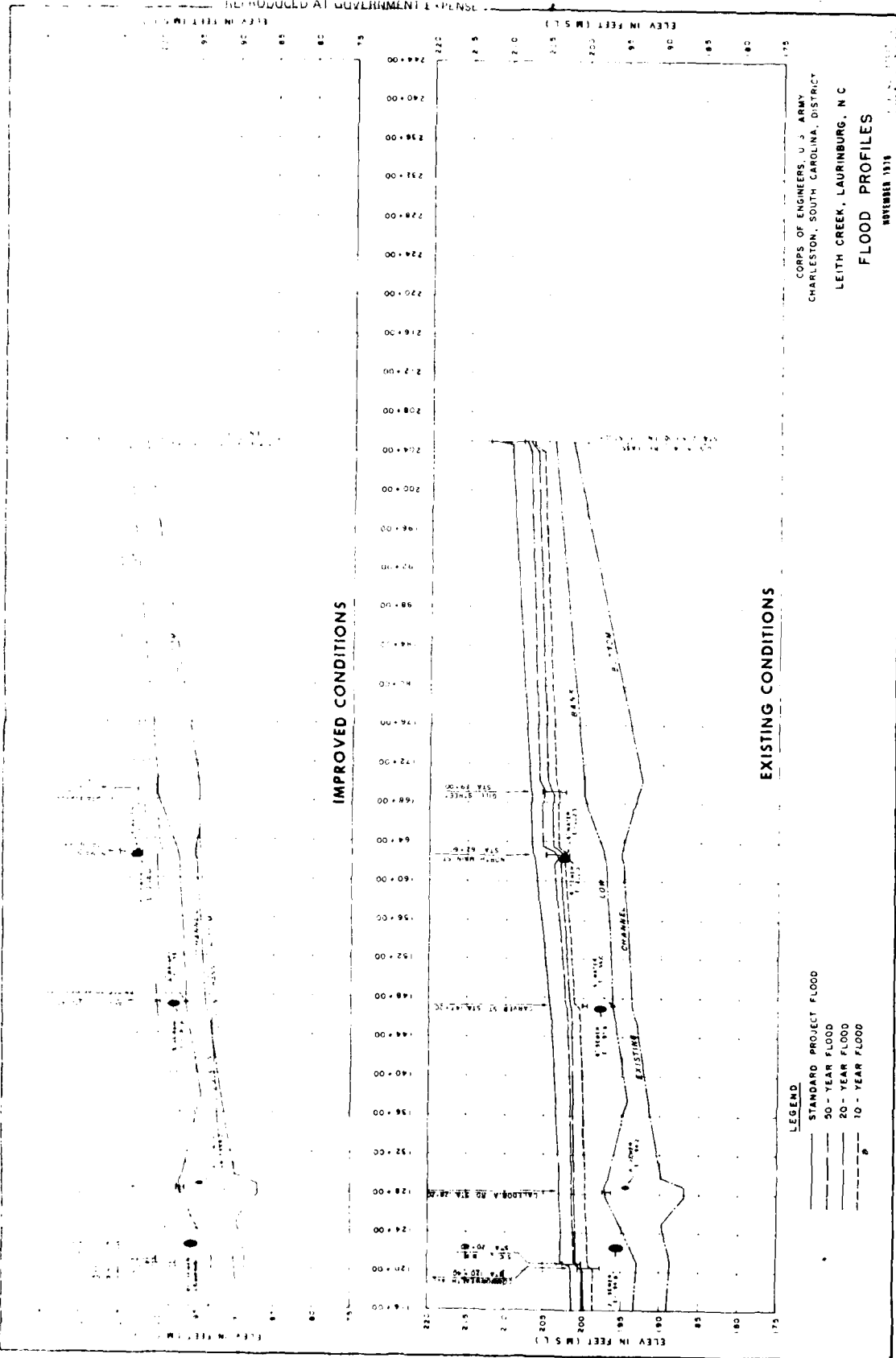


CORPS OF ENGINEERS, U. S. ARMY  
 HARLESTON, SOUTH CAROLINA, DISTRICT  
 LEITH CREEK, LAURINBURG, N. C.

FLOOD PROFILES

NOVEMBER 1970

PLATE 13



CORPS OF ENGINEERS, U. S. ARMY  
 CHARLESTON, SOUTH CAROLINA, DISTRICT  
 LEITH CREEK, LAURINBURG, N. C.  
**FLOOD PROFILES**  
 NOVEMBER 1918

PLATE 1

2

U.S. 74 BYPASS  
STATION 0+00  
BEGINNING OF STUDY

U.S. 74 BYPASS  
STATION 1+44+00

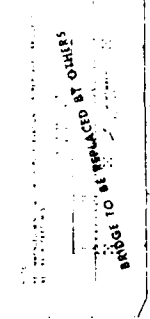
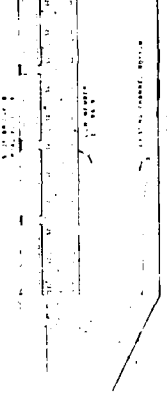


LAURINBURG SOUTHERN RAILROAD  
STATION 58+30

FERTILIZER CANAL ROAD  
STATION 64+25

U.S. 74 SOUTHERN RAILROAD  
STATION 61+45

BEGINNING OF PROJECT



BRIDGE TO BE REPLACED BY OTHERS

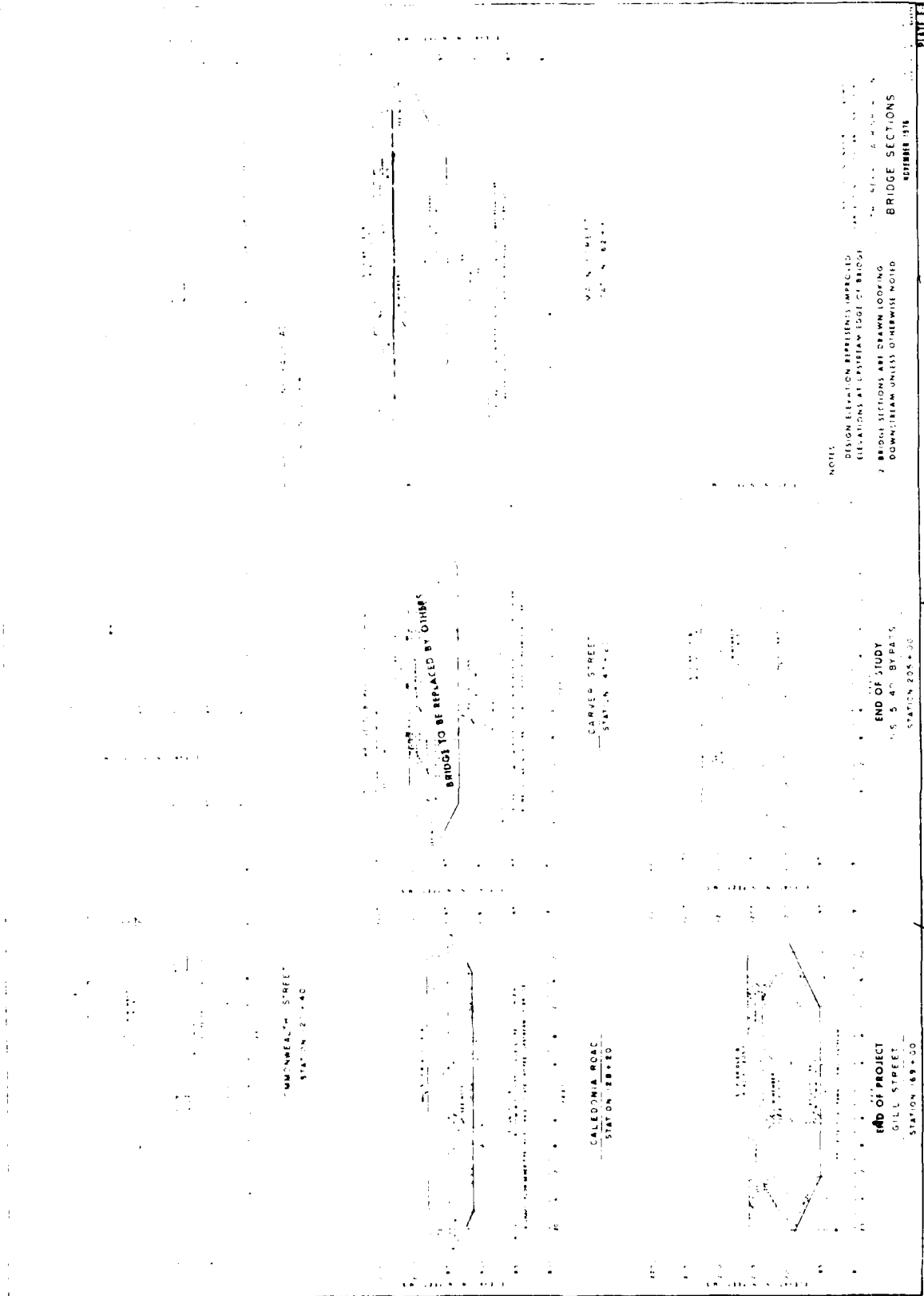
CHURCH STREET - U.S. HWY. 74  
STATION 105+50

MEKAT STREET  
STATION 111+50

NOTES

- 1. DESIGN ELEVATION DIFFERENCES IMPROVED
- 2. ELEVATIONS AT DOWNSTREAM EDGE OF BRIDGE
- 3. BRIDGE SECTIONS ARE DRAWN LOOKING DOWNSTREAM UNLESS OTHERWISE NOTED

BRIDGE 107



NOTES:  
 DESIGN ELEVATION REPRESENTS IMPROVED  
 ELEVATIONS AT UPSTREAM EDGE OF BRIDGE  
 BRIDGE SECTIONS ARE DRAWN LOOKING  
 DOWNSTREAM UNLESS OTHERWISE NOTED

BRIDGE SECTIONS  
 SHEET 511

PLATE 1

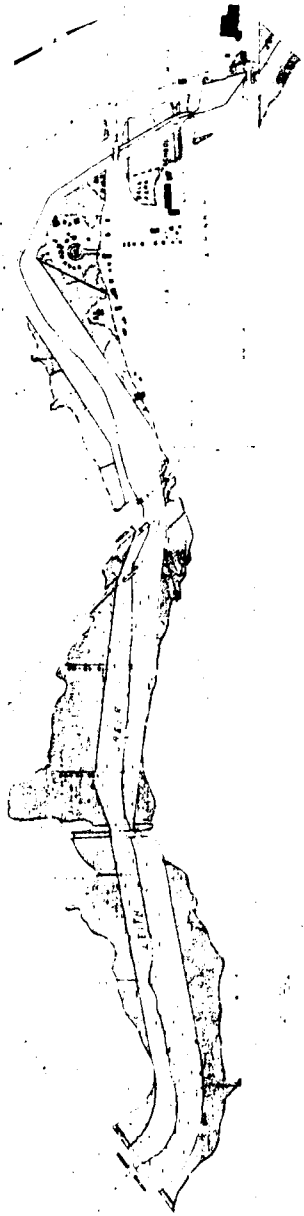








EXISTING CONDITIONS



IMPROVED CONDITIONS

LEGEND

- 95 YEAR FLOOD
- FLOODWAY BOUNDARY
- CHANNEL
- FLOOD PREVENTION ELEVATION IN FEET ABOVE MEAN SEA LEVEL
- 78-33-31-10N

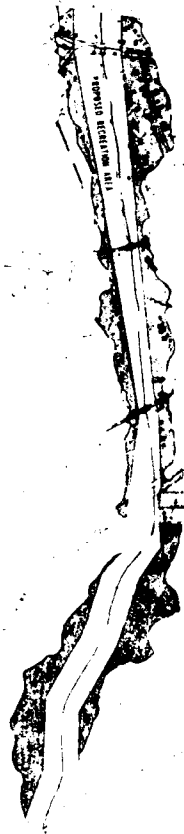
ENGINEERS U.S. ARMY  
 CHARLESTON SOUTH CAROLINA 29701  
 LEITH CREEK LAURINBURG N.C.  
 FLOODWAY BOUNDARIES

SCHEMATIC

IMPROVED CONDITIONS



EXISTING CONDITIONS



NOTES

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5. THE U.S. ARMY CORPS OF ENGINEERS IS NOT RESPONSIBLE FOR ANY DAMAGE TO PROPERTY OR PERSONS ARISING FROM THE USE OF THIS DRAWING.

LEGEND

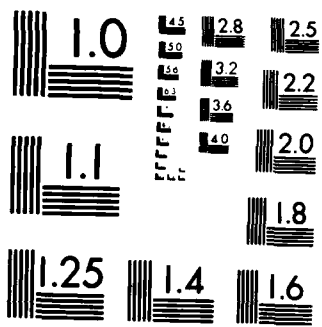
- 10' HIGH DAM
- 10' HIGH LOCK
- 10' HIGH BARRAGE
- 10' HIGH WEIR
- 10' HIGH GATE
- 10' HIGH SLUICE
- 10' HIGH TUNNEL
- 10' HIGH PIERS
- 10' HIGH BULKHEADS
- 10' HIGH DAMS
- 10' HIGH LOCKS
- 10' HIGH BARRAGES
- 10' HIGH WEIRS
- 10' HIGH GATES
- 10' HIGH SLUICES
- 10' HIGH TUNNELS
- 10' HIGH PIERS
- 10' HIGH BULKHEADS

U.S. ARMY CORPS OF ENGINEERS  
 DISTRICT OFFICE  
 FLOODWAY BOUNDARIES  
 1954

# SECTION F

ECONOMICS OF SELECTED PLAN





MICROCOPY RESOLUTION TEST CHART  
NATIONAL BUREAU OF STANDARDS-1963 A

# ECONOMICS OF SELECTED PLAN

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## SECTION F

# ECONOMICS OF SELECTED PLAN

1. The purpose of this section is to centralize economic material, both cost and benefit data. The material presented in the following pages concerns only those facets of the proposed improvement which can be readily quantified in dollar values. Data related to the computation of monetary damages without project construction is presented in Section C.

## Methodology

2. The tangible economic justification of the proposed improvement can be ascertained by comparing the equivalent average annual charges (i.e., interest, amortization, operation and maintenance and major replacement costs, etc.) with an estimate of the equivalent average annual benefits which probably would be realized over the 50 year period of analysis selected. The average annual benefits should equal or exceed the annual cost if the Federal Government is to contribute toward the project.

3. In order to evaluate economic benefits and damages, field investigations were conducted to determine property elevations within the flood plain of Leith Creek and to make appraisals of property value within the damage area. Data was also obtained in interviews with various city officials, merchants, and individual property owners. Flood damages within the flood plain do not vary significantly with the season of the year.

4. All estimates presented in this section are based on September 1976 prices and the prevailing Federal interest rate of 6-3/8% was used to determine annual charges.

## Costs

### FIRST COSTS

5. The estimates of first costs presented in this section are for providing the channel conveyance improvement project and recreational facilities described in Section E. In accordance to established policy, recreation and flood control costs have been separated in order to establish justification of a flood control project on Leith Creek without regard to recreation. Recreation cost represent the estimated cost over and above the estimated cost of the flood control project, for providing a Greenway adjacent to Leith Creek.

### FLOOD CONTROL COST

6. Federal costs for flood control include all Corps of Engineers costs for investigations, design, and construction (including costs of supervision and administration) which are anticipated to be incurred following the transmittal of this report to the Office, Chief of Engineers for approval. All costs incurred prior to the transmittal are considered "preauthorization study costs" and are excluded from economic analysis. Federal construction costs were obtained by applying unit cost to estimated construction quantities. An allowance of 15 percent of the estimated construction costs was added for contingencies. Engineering and design costs was estimated at 15 percent of the construction cost and supervision and administration was estimated to be 7.5 percent.

7. Non-Federal costs for flood control include all anticipated cost which will be incurred by the local sponsor in fulfilling the requirements of local cooperation and any Federal cost in excess of the Federal limitation. Non-Federal costs were obtained from the City of Laurinburg, the local sponsor. Table F-1 summarizes the estimated cost for the plan of improvement for flood control. Details of this estimate, including a breakdown of Federal and non-Federal costs, are included in Table F-1.

Table F-1. Detailed Estimate of First Costs<sup>1/</sup>  
FOR FLOOD CONTROL

Description	Estimated Quantity	Unit	Unit Cost	Total Cost
<u>FEDERAL COST</u>				
Channel Excavation	34,700	C.Y.	\$1.25	\$43,400
Riprap	122	C.Y.	90.00	11,000
Land Clearing	19.2	Ac.	600.00	11,500
Shaping & Seeding	11.24	Ac.	700.00	7,900
Subtotal				\$73,800
Contingencies				11,100
Subtotal				<u>\$84,900</u>
Engineering & Design				25,000
Supervision & Administration				7,100
Total Federal Cost				<u>\$117,000</u>
<u>NON-FEDERAL<sup>2/</sup></u>				
Land Cost		L.S.	\$1,800	\$1,800
Bridge Replacement	2	Job	25,250	50,500
Water Line Relocations	1	Job	8,500	8,500
Sewer Relocations	1	Job	3,200	3,200
Total Non-Federal				\$64,000
Total Federal				<u>117,000</u>
Total Project				<u>\$181,000</u>

<sup>1/</sup>All cost based on September 1976 prices.

<sup>2/</sup>Non-Federal cost are actual cost estimates obtained from the City of Laurinburg, North Carolina, the local project sponsor.

## RECREATION COSTS

8. Only those costs expended on recreation over and above flood control costs are apportioned to recreation. For the limited development proposed on Leith Creek, these costs would be restricted to cost incurred in the development of a bike and walking trail, four picnic tables, four park benches, trash receptacles and ornamental shrubbery. The local sponsor has indicated a willingness to cost share on a 50-50 basis, all recreational expenses which fall within the cost limitations of Federal participation. Federal participation is limited to 10 percent of the Federal cost for flood control, without approval of higher authority. (The current estimate of the Federal share for a flood control project is \$101,000.) Operation and maintenance of the facilities after completion will be a local responsibility. Table F-2 summarizes estimated recreational costs. A contingency factor of 20% was included in the costs to cover such items as road crossing markings and special earthwork which may prove necessary after detailed survey of the area.

Table F-2. Detailed Estimate of First Costs  
for Recreation

Description	Estimated Quantity	Unit	Unit Cost	Total Cost
Bituminous Trail				
a) Soil Compaction	6,350	L.F.	\$ .30	\$1,900
b) Bituminous Surface	6,350	L.F.	1.50	9,500
Picnic Tables	4	ea	800.00	3,200
Park Benches	4	ea	200.00	800
Trash Receptacles	8	ea	100.00	800
Ornamental Shrubby	1	L.S.		<u>2,000</u>
Total cost				\$18,200
Federal share 50% (not to exceed \$10,100)				\$ 9,100
Local share 50%				\$ 9,100

## TOTAL FIRST COSTS

9. Table F-3 summarizes total first cost for a flood control and recreation project on Leith Creek. Details of the cost estimates are presented in Tables F-1 and F-2.

Table F-3  
Total First Cost - Leith Creek

<u>Federal Cost</u>	
Flood Control	\$117,000
Recreation	9,100
Total Federal	<u>\$126,100</u>
<u>Non-Federal Cost</u>	
Flood Control	\$ 64,000
Recreation	9,100
Total Non-federal	<u>\$ 73,100</u>
<u>Total Project Cost</u>	
Flood Control	\$181,000
Recreation	18,200
Total Project	<u>\$199,200</u>

## ANNUAL COSTS

10. Estimates of annual costs are based on a 50 year period of analysis. Interest during construction is not included since the construction period is estimated as being less than one year. The investment cost thus equals the first cost. Interest and amortization charges are based on an interest rate of 6-3/8 percent. The estimated cost of operation and maintenance is also included. Table F-4 summarizes the annual costs for flood control, Table F-5 summarizes annual cost for recreation and Table F-6 summarizes total project annual cost.

Table F-4. Average Annual Costs - Flood Control

Items	Cost
<b>FEDERAL COSTS</b>	
Investment = \$117,000	
*Amortized at 6-3/8% for 50 years equals average annual charges	\$7,800
<b>NON-FEDERAL COSTS</b>	
Investment = \$64,000	
*Amortized at 6-3/8% for 50 years equals average annual charges	\$4,300
Maintenance (2.0 miles @ \$900)	<u>\$1,800</u>
Subtotal - Non-Federal	\$6,100
Total Annual Charges - Flood Control	\$13,900

\*Factor - .066789

Table F-5. Average Annual Cost - Recreation

Items	Cost
<b>FEDERAL COSTS</b>	
Investment = \$9,100	
*Amortized at 6-3/8% for 50 years equals average annual charges	\$600
<b>NON-FEDERAL COSTS</b>	
Investment = \$9,100	
*Amortized at 6-3/8% for 50 years equals average annual charges	\$600
Maintenance	<u>\$500</u>
Subtotal - Non-Federal	\$1,100
Total Annual Charges - Recreation	\$1,700

\*Factor - .066789

Table F-6. Average Annual Cost - Total Project

Items	Cost
<b>FEDERAL COSTS</b>	
Average Annual Flood Control	\$7,800
Average Annual Recreation	<u>600</u>
Total Federal	\$8,400
<b>NON-FEDERAL COSTS</b>	
Average Annual Flood Control	\$4,300
Flood Control Maintenance	<u>1,800</u>
Subtotal - Non-Federal Flood Control	\$6,100
Average Annual Recreation	\$ 600
Recreation Maintenance	<u>500</u>
Subtotal Non-Federal Recreation	\$1,100
Total Non-Federal	\$7,200
Total Annual Cost - Entire Project	\$15,600

# Benefits

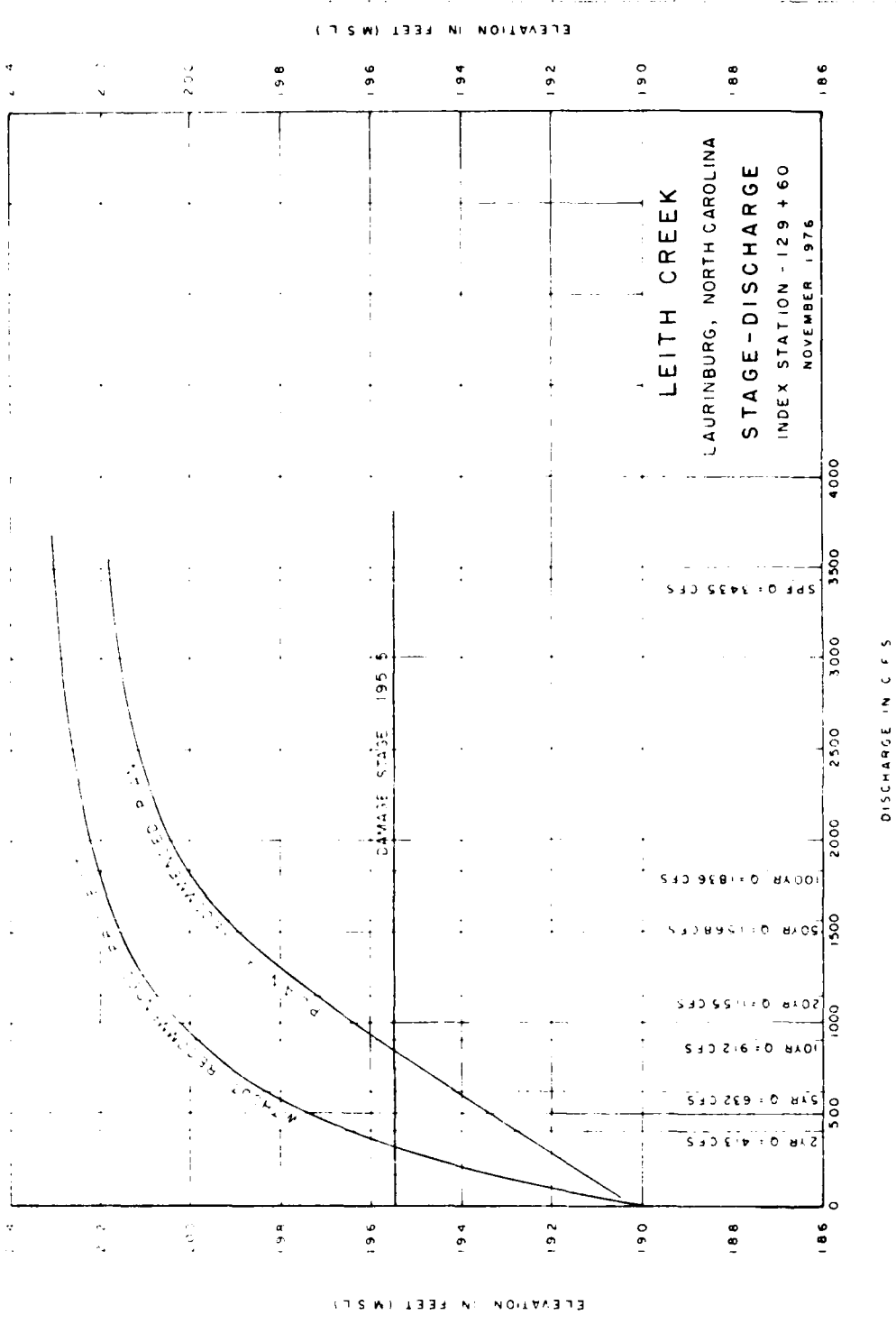
## FLOOD CONTROL BENEFITS

11. Estimates of monetary benefits for flood control are based on the September 1976 price level. The great majority of the area protected by the plan of improvement is currently developed in low cost housing. Computed flood benefits are based on existing development only. Benefits accrue due to the reduction of flood elevations to an estimated 65 residential and 17 commercial structures.

12. For estimating purposes, flood losses were grouped into three major categories: residential, business and public properties. Physical damage to the property was estimated by evaluating the cost of replacing, repairing, or rehabilitating affected property.

13. Average annual flood damages were computed for both with and without conditions. Discharges for selected frequency storms were determined from discharge-frequency relationships and converted into stage by computer back-water computations. For comparison purposes, stage discharge curves under existing conditions and improved conditions are presented on Figure F-1. Stage damage curves were constructed for each category of damage based on a field appraisal of individual structures and improvements. (See Figure C-13, Section C). 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. Average annual damage computations for existing conditions are presented in Section C. Average remaining damage computations for the proposed plan of improvement are presented in Figures F-2 through F-4. Average annual damages prevented represents the difference in the average annual damages without a project and with the proposed plan of improvement and are summarized in Table F-7.





APPENDIX I, FIGURE F-1







Table F-7. Average Annual Benefits - Flood Control

Proposed Plan of Improvement

Category of Damages	Annual Damages Without Project	Annual Damages With Project	Annual Benefit
Residential	\$13,500	\$1,600	\$11,900
Commercial	11,500	1,500	10,000
Public Properties	<u>1,550</u>	<u>200</u>	<u>1,350</u>
Totals	\$26,550	\$3,300	\$23,250

RECREATIONAL BENEFITS

RECREATIONAL DEMAND

14. Recreational benefits were computed based on guidance established by SAOPD-R letter dated 2 February 1976, subject, "Recreation Resources Planning", and OCE memorandum dated 2 June 1976, subject, "Policy for Recreation Facilities at Local Flood Protection Projects". The 1970 and 1986 recreational demands for the Laurinburg area have been established in Section C of this appendix. The purpose of this section is to determine what portion of the recreational demand will be satisfied by utilization of the greenway facilities, to establish a recreational day value for use of these facilities and to compute corresponding benefits. The 1986 recreational demand for the selected activities in the Laurinburg area has been established as follows:

Activity	1986 Demand (Adult Activity Days)
Picnicking	25,802
Nature walks	16,538
Bird watching	11,142
Fishing	10,164

15. In order to adjust the 1986 activity day demand to account for use in other recreational areas, it was assumed that one half of the picnicking, nature walking and bird watching activities could take place in other areas outside of the Laurinburg area, such as state or county parks. Therefore, the 1986 demand for picnicking was reduced to 12,900 activity days; for nature walks - 8,250 activity days; and for bird watching 5,570 activity days.

16. Recreational demands were further reduced to account for other recreational areas within the city which include facilities for each respective activity. This reduction was made based on the ratio of acreage in the proposed greenway (12 acres) to the total acreage of other existing and proposed parks offering the same activity. Investigations revealed a total of 96 acres of existing and proposed which offer picnicking facilities, 85 acres which offer nature walk facilities and 85 acres with bird watch facilities. Therefore, assuming equitable usage of all park facilities, including the greenway, the estimated use of the greenway has been established as follows:

Activity	Activity Day Demand		Acreage Ratio	=	Activity Day Usage for Proposed Greenway
Picnicking	12,900	X	12/96	=	1613
Nature Walking	8,250	X	12/85	=	1167
Bird Watching	5,570	X	12/85	=	786

17. No other park areas in the vicinity of Laurenburg offer bike trails. However, assuming that four times as much adult biking would take place on city streets as in the proposed greenway, the activity day usage for biking in the greenway can be established as one fifth (1/5) of the total activity day demand or 2,033 activity days (10,164 X 1/5). The following tabulation summarizes total activity day demands for proposed greenway on Leith Creek.

Activity	Adult Activity Day Demand
Picnicking	1613
Nature Walking	1167
Bird Watching	786
Biking	<u>2033</u>
<b>TOTAL</b>	<b>5599</b>

18. Assuming each visitor can take part in two activities per visit, the estimated visitation rate to the greenway is established as one half (1/2) of the adult activity day demand established in the preceding tabulation. Therefore, annual visitation days to the greenway is estimated as 1/2 X 5,599 or 2,800 visitation days.

## VISITATION DAY VALUE

19. Visitation day values were determined based on criteria established by SADPD-R letter dated 2 February 1966, subject, "Recreation Resources Planning". Exhibits E-1 and E-2 are the basis of the rationale used to establish visitation day values. Each criteria presented on Exhibit E-1 was evaluated and assigned a point value based on the rating system shown. Point values for the six criteria were then summed and used to determine the visitation day value from the graph point verses values. Rationale for assignment of point values for each criteria are shown in the following tabulation.

Criteria	Point Value	Rationale
a	7	The project will access several areas, but development is low.
b	5	No water contract; limited land development.
c	4	Aesthetic values of local significance if developed. No major disturbances.
d	2	Several competitive areas.
e	2	75% of use from within 15 miles.
f	<u>7</u>	No drawdown problems, but flooding will limit some recreation.
Total points (a-f)	27	

20. Based on the graphical presentation in Exhibit F-2 a value of 27 points indicates that each visitation day is worth \$0.93. This value is within the lower range of values suggested by Principles and Standard Guidelines.

## RECREATION BENEFITS

21. Based on a computed visitation rate of 2,800 days annually and a visitation value of \$0.93 per day, annual recreational benefits are estimated to be \$2,600.

## BENEFIT-COST RATIO

22. In order to justify construction of the proposed project from an economic viewpoint, the average annual benefits for the basic flood control project should equal or exceed the average annual project cost, without regards to recreation. In this section all benefits and cost for flood control and recreation have been computed separately in order to demonstrate the feasibility of the basic flood control project and recreation facilities independently. All monetary values are based on September 1976 values and are expressed in comparable terms to the fullest extent possible. Table F-8 presents a benefit-cost comparison of the basic flood control project; the recreational facilities and the total recommended project.

Table F-8. Benefit-Cost Ratio

Proposed Plan of Improvement

FLOOD CONTROL

Total Annual Benefits	\$23,250
Total Annual Costs	\$13,900
Benefit-To-Cost Ratio	1.67

RECREATION

Total Annual Benefits	\$2,600
Total Annual Cost	\$1,700
Benefit-To-Cost Ratio	1.53

TOTAL RECOMMENDED PROJECT

Total Annual Benefits	\$25,850
Total Annual Cost	\$15,600
Benefit-To-Cost Ratio	1.66



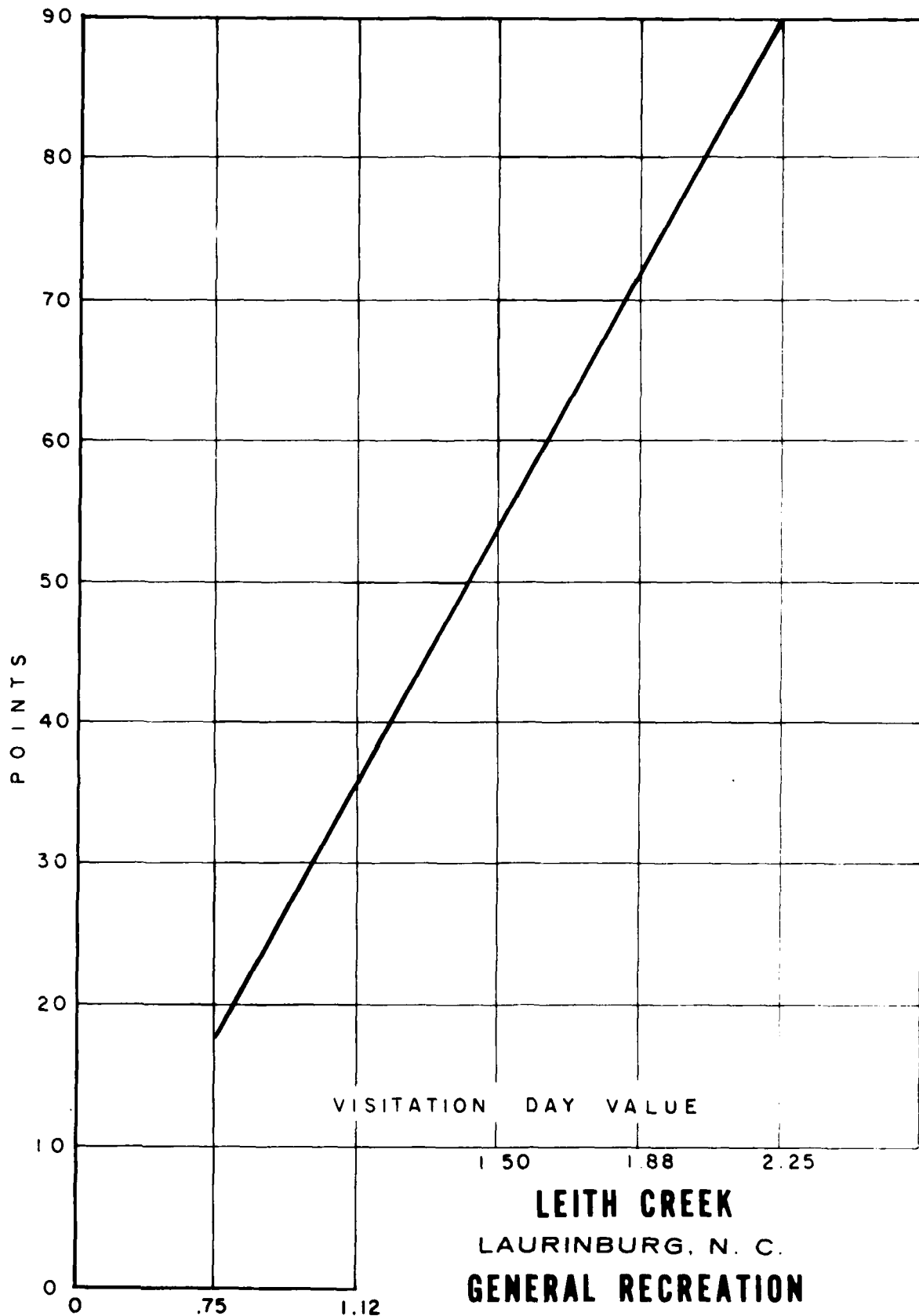
**DETERMINATION OF UNIT VALUE FOR GENERAL RECREATION**

**CRITERIA**

**JUDGMENT FACTORS**

CRITERIA	JUDGMENT FACTORS
a. Quantity and quality of project access & recreational facilities provided.	Access to several areas w/high quality fac.dev. (flush toilets, landscaping; stove tables, multilane ramps, & campground).
b. Number of project recreational opportunities available.	Project conditions highly conducive to multiple activities
c. Aesthetic, scientific and educational values of project.	Highly attractive; aesthetically rewarding. Unique or outstanding archeological, ecological, geological, historical, or historical values.
d. Competitive water-oriented recreation areas within market area.	No competitive water areas within 50 miles of the project.
e. Relationship of project to market area population.	75% of recreational use from over 50 miles of the project.
f. Project Conditions	Stable water surface at or near normal pool. Reservoir for recreation as primary purpose.

Exhibit  
1



**LEITH CREEK**  
 LAURINBURG, N. C.  
**GENERAL RECREATION**  
 POINTS vs VALUE

**EXHIBIT F-2**

# SECTION G

DIVISION OF PLAN RESPONSIBILITIES

# DIVISION OF PLAN RESPONSIBILITIES

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<u>NO.</u>	<u>TITLE</u>	<u>PAGE</u>
G-1	COST APPORTIONMENT	G-2

# SECTION G

## DIVISION OF PLAN RESPONSIBILITIES

1. The major purpose of this section is to present information regarding cost apportionment between Federal and non-Federal interests for the proposed plan and to delegate various responsibilities for implementation of the recommended plan. Cost apportionment is based on Federal legislation and administrative policies governing flood control channel projects and cost apportionment policies for recreation facilities at local flood protection projects. As previously discussed, nonstructural measures such as building codes and flood proofing individual structures are not requirements of the recommended plan, however, the adoption of flood plain ordinances is a part of the recommended plan and a requirement of the study authorization. The responsibility for such measures is non-Federal. Technical advice in the form of designated floodways for both existing and improved conditions has been presented in this report. Additional technical advice can be furnished upon request to the local sponsoring agencies. The basis for apportioning the costs of the structural portion of the recommended project is described in the following paragraphs.

### Cost Apportionment

#### FLOOD CONTROL COST

2. Sharing of costs between Federal and non-Federal interests for the Leith Creek flood control project is based on the standard requirements established as Federal policy for "local protection" improvements. 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 bear the expense of operating and maintaining project features after construction in accordance with Federal requirements. The Federal Government is responsible for all flood control construction costs including costs incurred in performing investigations and designs and costs incurred for modifications to railroad crossings. The Leith Creek project is authorized under the continuing authorities program, specifically by Section 205 of the 1948 Flood Control Act, as amended. Under this authority, Federal participation is limited to \$2,000,000, except for projects in areas which have been declared to be major disaster areas, pursuant to the Disaster Relief Act of 1966 or the Disaster Relief Act of 1970, in the five year period preceding the date the Chief of Engineers deems such work advisable. In such cases, Federal participation may be increased to \$3,000,000. The non-Federal interests must pay all expense in excess of the Federal limitation. As stated in ER 1105-2-50, contributions of other Federal agencies may not be accepted by the local interests to satisfy local cooperation requirements once local interests have furnished a letter of intent to the reporting officer. Table G-1 shows the apportionment of the first costs and annual operation and maintenance costs for flood control between Federal and non-Federal interests, in accordance with the policies outlined above.

Table G-1. Cost Apportionment-Flood Control

	Estimated First Cost	Annual Maintenance and Operation Costs
Federal	\$117,000	0
Non-Federal	<u>\$64,000</u>	<u>\$1800</u>
Total	\$181,000	\$1800

## RECREATION COST

3. Cost apportionment policies for recreation facilities recommended as part of the Leith Creek flood control project are based on instruction contained in the Chief of Engineers Memorandum dated 2 June 1976, subject, "Policy for Recreation Facilities at Local Flood Protection Projects".

4. The level of financial participation in recreation development by the Corps for projects of this type will not result in an increase of more than 10 percent in the estimated Federal cost of a flood control plan without approval of higher authority. The estimated additional Federal share of recreational cost for Leith Creek is within the 10 percent limitation.

5. The local sponsor is required to acquire in its name and dedicate to public outdoor recreation use for the economic life of the basic flood control improvement (50 years) all lands required for recreation development and needed to insure public control of the development, with credit as stated below.

6. Where the appraised value of the land so provided amounts to less than 50 percent of the total first cost of the recreation development, the local sponsor must make additional contribution sufficient to raise the non-Federal share to at least that level; such additional contribution may consist of the actual cost of carrying out an agreed upon portion of the development, a cash contribution, or a combination of the above.

7. The local sponsor must also operate, maintain, and replace, without expense to the Federal Government, the recreation areas and all facilities installed pursuant to the agreement.

8. In the case of Leith Creek, all recreational developments are planned within the land easements required for flood control, no additional lands are required for recreation. Therefore, additional project cost required to provide recreation facilities are apportioned on a 50-50 basis between Federal and non-Federal agencies. For cost apportionment purposes, the non-Federal share is assumed to be a cash contribution. The local sponsor, however, may elect at a later date to provide their portion of the recreation expense in a different manner, as described in paragraph 6 above. Table G-2 shows the apportionment of the first costs and the annual operation and maintenance costs for recreation between Federal and non-Federal interests, in accordance with the policies outlined above.

Table G-2. Cost Apportionment-Recreation

	Estimated First Cost	Annual Maintenance and Operation Costs
Federal	\$9,100	0
Non-Federal	<u>\$9,100</u>	<u>\$500</u>
Total	\$18,200	\$500

TOTAL PROJECT COST

9. Table G-3 summarizes the apportionment of the entire project first cost and annual operation and maintenance costs between Federal and non-Federal agencies.

Table G-3 Cost Apportionment-Entire Project

Estimated First Cost	Annual Maintenance and Operation Costs
<u>Federal</u>	
Flood Control \$117,000	\$ 0
Recreation \$ 9,100	\$ 0
Subtotal \$126,100	\$ 0
<u>Non-Federal</u>	
Flood Control \$64,000	\$1,800
Recreation \$ 9,100	\$ 500
Subtotal \$73,100	\$2,300
<u>Total Project</u>	
Flood Control \$181,000	\$1,800
Recreation \$ 18,200	\$ 500
Total \$199,200	\$2,300



## Federal Responsibilities

10. As indicated in Table G-3, the presently estimated Federal share of the total project first cost for Leith Creek is \$126,100, consisting of \$117,000 allocated to flood control and \$9,100 allocated to recreation. The estimated Government cost includes estimates for the preparation of plans and specifications and for actual construction of the phases of the recommended project allowed under Federal legislation.

11. Upon transmittal of this report by the Division Engineer to the Office, Chief of Engineers, the Division Engineer may delegate authority to the District Engineer to commence work on plans and specifications pending approval of the project by the Chief of Engineers. Such work may be stopped, however, if review of this report by the Chief of Engineers reveals a policy problem affecting the project or the report recommendations. This initial work on the plans and specifications generally will utilize all remaining funds from allocations for the feasibility study. Following receipt of approval by the Office, Chief of Engineers, the reporting officers may submit a request for funds to complete plans and specifications and to construct the project.

## Non-Federal Responsibilities

12. The presently estimated non-Federal share of the total first cost of the proposed project is \$73,100, consisting of \$64,000 allocated for flood control and \$9,100 allocated for recreation. In addition, the non-Federal interests must provide an estimated \$1,800 annually for maintenance of the basic flood control project and \$500 annually for maintenance of recreation facilities.

13. The City Of Laurinburg, local sponsor for Leith Creek project has provided a letter of intent to provide the following assurances of local cooperation as required by Federal legislation. The letter of intent is presented in Appendix 2. Required assurances are as follows:

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

b. Accomplish without cost to the United States all alterations and relocations of buildings, transportation facilities, storm drains, utilities, and other structures and improvements made necessary by the construction; excluding railroad bridges, approaches and facilities.

c. Hold and save the United States free from damages due to construction, operation and maintenance of the project, provided damages are not due to the fault or negligence of the United States or its contractors;

d. Maintain and operate the works after completion in accordance with regulations prescribed by the Secretary of the Army;

e. Prescribe and enforce regulations to prevent obstruction or encroachment on channels and other flood control works which would reduce their flood carrying capacity or hinder maintenance and operation; and control development in the project area to prevent an undue increase in flood damage potential;

f. At least annually; inform affected areas that the channel improvement will not provide complete flood protection;

g. Publicize flood plain information in the areas concerned and provide this information to 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 protection levels provided by the project; and

h. Provide 50% of project cost allocated to the recreation portion of the recommended project in accordance to established Federal policy.

In carrying out the specified non-Federal responsibilities the local sponsor is required to comply with provisions of the "Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970", Public Law 91-646, approved 2 January 1971; and Section 221, Public Law 91-611 approved 31 December 1970, as amended.

LEITH CREEK  
SCOTLAND COUNTY, NORTH CAROLINA

**Technical Report**

**SECTION A**            PERTINENT CORRESPONDENCE

**SECTION B**            PUBLIC WORKSHOP

A  
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PREPARED BY THE  
CHARLESTON DISTRICT, CORPS OF ENGINEERS  
DEPARTMENT OF THE ARMY

**SECTION A**  
PERTINENT CORRESPONDENCE

## PERTINENT CORRESPONDENCE

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# CITY OF LAURINBURG

P. O. BOX 786

LAURINBURG, NORTH CAROLINA 28352

November 11, 1969



Colonel Burke W. Lee  
District Engineer  
U. S. Army Engineer District, Charleston  
P. O. Box 919  
Charleston, South Carolina 29402

Dear Colonel Lee:


We appreciate the visit by Mr. John Murphree and Mr. James Joslin on November 7, 1969 at which time we discussed a flooding condition along Leith's Creek - both within the City and outside the City Limits.

Leith's Creek runs through the northern part of the City and overflows several times each year due to the channel having been clogged as a result of storms over the years. Fallen trees and limbs have contributed to the silting of the channel.

The City Council requests that a study be made of the Leith's Creek watershed to determine whether a flood control project under the authority of Section 208 of the 1948 Flood Control Act is feasible and economically justified.

The City of Laurinburg will furnish whatever is necessary or required as the local sponsoring agency for this proposed project.

Respectfully yours,

  
J. Guy Smith  
City Manager

JGS/wjw

Appendix 2

A-1

# City of Laurinburg



October 27, 1975

Mr. Bob Sanders  
U. S. Army Corp of Engineers  
Box 919  
Charleston, South Carolina 29403

Dear Mr. Sanders:

Mr. David Harris and Mr. Steve Morrision of your office met with us here in Laurinburg on October 9th, to discuss the alternatives for improvement to Leith's Creek. At that time, Mr. Harris asked that we secure certain information for him. I am enclosing that information with this letter.

Enclosed you will find a list of individuals who should be invited to the Public Hearing which we have arranged for November 20th, 1975, at 7: 30 p.m. at the Scotland County Courthouse, here in Laurinburg. The list includes: property owners along Leith's Creek, City and County officials, communications individuals, and interested citizens.

Also enclosed, is a cost estimate for obtaining the right-of-way for each of the five alternatives. These values are based on property taxes, which was secured from the Scotland County tax office and consultation with two local appraisers.

The City of Laurinburg owns property along Leith's Creek and is presently engaged in Community Development Activities in areas adjacent to the creek. David asked that we send him a copy of the Lincoln Heights Neighborhood Development Plan which proposes a park along Leith's Creek. That map is enclosed also.

The Public Works Director, the City Engineer, and myself have consulted outside engineers in obtaining cost for physical improvements which would be required under each plan. A summation of these costs is also enclosed.

This is the information which we understood you needed from us. If you do need further information, please let us know and we will be glad to get it to you well in advance of the November 20th Public Hearing. Please know that the Mayor and City Council are enthused with the dedicated work that your office has undertaken in the past few months and we are looking forward to meeting with you on November 20th.

Sincerely yours,

Peter G. Vandenberg, City Manager

Appendix 2  
A-2

303 WEST CHURCH STREET • P. O. BOX 786 • LAURINBURG, N. C. • 919 276-8257

Estimated Cost for Water Line Relocations  
Along Leith's Creek

<u>Location</u>	<u>Materials</u>	<u>Cost</u>
Fertilizer Plant Road Sta. 34+00	200' of 12" C.I.M.J. pipe two 12" valve and box two 12" Dresser coupling Style 138	\$5,000.00 900.00 141.88 <u>\$6,041.88</u>
McKay Street Sta. 111+90	100' of 8" C.I.M.J. pipe two 8" valve and box two 8" Dresser coupling Style 138	\$1,950.00 700.00 78.66 <u>\$2,728.66</u>
N. Caledonia Road Sta. 128+20	100' of 8" C.I.M.J. pipe two 8" valve and box two 8" Dresser coupling Style 138	\$1,950.00 700.00 78.66 <u>\$2,728.66</u>
Carver Street Sta. 147+20	100' of 6" C.I.M.J. pipe two 6" valve and box two 6" Dresser coupling Style 138	\$1,750.00 450.00 61.96 <u>\$2,261.96</u>
Total Cost of Water Line Relocations		<u>\$13,761.16</u>

---

Cost of R.G. clamps, lateral rods and hangers, and labor are included in the above estimates.



Estimated Cost of Sanitary Sewer Relocations  
Along Leith's Creek

<u>Location</u>	<u>Materials</u>	<u>Cost</u>
Commonwealth Ave. Sta. 120+40		
Alternative #1:	100' Double Barrell Inverted Siphon @\$225.00/Ft.	\$22,500.00
	2 Junction Chambers @ \$5,000.00 ea.	<u>10,000.00</u>
	Total	<u>\$32,500.00</u>
Alternative #2:	1 Lift Station	\$65,000.00
	2 Manholes @ \$475.00 ea.	<u>950.00</u>
	Total	<u>\$65,950.00</u>
Caledonia Road Sta. 128+20		
	230' 8" C.I. pipe @ \$9.50/Ft.	\$ 2,185.00
	2 Manholes (6-8") @ \$350.00 ea.	<u>700.00</u>
	Total	<u>\$ 2,885.00</u>
Carver Street Sta. 147+20		
Alternative #1:	100' Double Barrell Inverted Siphon @\$150.00/Ft.	\$15,000.00
	2 Junction Chambers @ \$4,000.00 ea.	<u>8,000.00</u>
	Total	<u>\$23,000.00</u>
Alternative #2:	1 Lift Station	\$35,000.00
	100' 18 C.I. pipe @\$35.00/Ft.	3,500.00
	2 Manholes (8-10') @\$475.00 ea.	<u>9,950.00</u>
	Total	<u>\$39,450.00</u>

Fair Market Value Estimate  
for Right-of-Way Along Leith's Creek

	<u>Plan 1</u>	<u>Plan 2</u>	<u>Plan 3</u>	<u>Plan 4</u>	<u>Plan 5</u>
Permanent Right-of-Way Required	46.53 acres	54.62 acres	34.48 acres	41.57 acres	78.50 acres
Estimated Value of Land	\$3,489,75	\$4,096.50	\$2,586.00	\$3,117.75	\$5,887.50

Property Owners Adjoining Leith's Creek

Mariah McClelland, Est.  
Box 101  
Laurinburg, NC 28352

Joe L. Lee  
Rt. 5, Box 22  
Laurinburg, NC 28352

G. Y. Jones, Est.  
Box 904  
Laurinburg, NC 28352

John Russell  
2304 Montrose Avenue  
Winston Salem, NC

Westminster Presbyterian Church  
McGirts Bridge Road  
Laurinburg, NC 28352

Mrs. Victor Caldwell, Heir of Dr. W. C.  
329 M. Oak Street  
Statesville, NC 28677

Charles H. Allen  
No Address

Silas Fields & Marsha Wooten  
Rt. 2, Box 352  
Laurinburg, NC 28352

Hattie Florence Jones  
336 Dickson Street  
Laurinburg, NC 28352

Floyd W. Nichols  
P. O. Box 783  
Laurinburg, NC 28352

J. Kelly Pearson  
P. O. Box 87  
Laurinburg, NC 28352

Mary A. Campbell  
603 Midland Way  
Laurinburg, NC 28352

Magaline Thompson  
710 S. Pine Street  
Laurinburg, NC 28352

C. D. Morris-Lizzie Williams  
241 McCallum Street  
Laurinburg, NC 28352

Ruth Jones  
235 Alcott Street  
Locka, NJ 14218

Frank McQuaige  
Rt. 4, Box 9  
Laurinburg, NC 28352

Roland C. Bowyer & Franklin C. Bowyer  
211 Bowyer Dr. Rt. 5, Box 18-A  
Laurinburg, NC Laurinburg, NC 28352

John S. Rorie, Jr.  
1665 S. Main Street  
Laurinburg, NC 28352

James B. Jackson  
Box K-3 Kiser Road  
Laurinburg, NC 28352

James Franklin Smith  
307 Emory Street  
East Laurinburg, NC 28352

North American Acceptance Corp.  
1720 Peachtree Street  
Atlanta, Ga. 30309

Sadie Jane Faulk  
303 Emory Street  
Laurinburg, NC 28352

Robert Scott  
301 Emory Street  
East Laurinburg 28352

Louis P. English  
Drawer 1508  
Laurinburg, NC 28352

Beulah Adams  
612 E. Covington Street  
Laurinburg, NC 28352

Eugene K. Ritch  
Rt. 1  
Laurinburg, NC 28352

Clarence McPherson  
Rt. 3, Old Maxton Road  
Laurinburg, NC 28352

J. C. Pate  
General Delivery  
East Laurinburg, NC 28352

Luther J. Faulk  
General Delivery  
Laurinburg, East NC 28352

Donald Clear  
Box 1303  
Laurinburg, NC 28352

Walter Cooper  
Rt. 1  
McCall, SC 29570

Ishmael Maddox  
East Laurinburg, NC 28352

Z.V. Hern  
409 Fairly Street  
Laurinburg, NC 28352

Carolina Domestic Gas Co.  
Box 949  
Laurinburg, NC 28352

Dixie Guano Co.\*  
Box 152  
Laurinburg, NC 28352

L. T. Walters  
239 Aberdeen Road  
Laurinburg, NC 28352

J.E. King  
Rt. 4, Box 15  
Laurinburg, NC 28352

Mrs. Doris Lawrence  
1804 Horseback Trail  
Vienne, Va.

Samuel Ray McCormick  
Box 1926  
Laurinburg, NC 28352

James T. Campbell  
45 Phillips Drive  
Laurinburg, NC 28352

Jessie Strickland Locklear  
% Elvie S. Troublefield  
East Laurinburg, NC 28352

Ruth Scott  
East Laurinburg, NC 28352

Henry Martin  
Rt. 1 Indian Trail  
Killeen, Texas 76541

Atlantic Acceptance Corp.  
523 S. Main Street  
Salisbury, NC

Z.V. Pate, Inc.  
127 Fairly Street  
Laurinburg, NC 28352

McNair Investment Co.  
127 Fairly Street  
Laurinburg, NC 28352

Ned V. McRae-Mattie McRae  
Rt. 4 Aberdeen Road  
Laurinburg, NC 28352

Woodrow Peele  
% Mrs. Richard Brock  
Rt. 4, Box 29A  
Laurinburg, NC 28352

Austin Hatcher  
119 Gretchen Lane  
Greensboro, NC 27410

James H. Peden  
Box 25  
Wagram, NC 28369

\* Leases to Lumbee Timber Co.  
Box 747  
Laurinburg, NC 28352

SCOTLAND COUNTY COMMISSIONERS

William (Bill) Morgan  
Blue's Farm Road  
Laurinburg, NC 28352

Daniel Shaw  
Rt. 1, Box 265  
Wagram, NC 28396

Dr. James Mitchener  
P. O. Box 1599  
Laurinburg, NC 28352

C. Harold Morris, Jr.  
Morris Funeral Home  
122 McKay Street  
Laurinburg, NC 28352

Albert McMillan, Jr., Chairman  
Rt. 2, Box 253  
Laurinburg, NC 28352

Dr. Tom G. Gibson, Jr.  
Gibson, NC 28343

Floyd Nichols  
705 Park Circle  
Laurinburg, NC 28352

LAURINBURG CITY COUNCIL

Samuel G. Littlejohn  
218 Center Street  
Laurinburg, NC 28352

Donald W. Barrett  
817 W. Church Street  
Laurinburg, NC 28352

Mayor Charles Barrett  
739 Richmond Street  
Laurinburg, NC 28352

Ernest Daniels  
330 E. Covington Street  
Laurinburg, NC 28352

R. F. McCoy  
502 W. Church Street  
Laurinburg, NC 28352

J. E. Mitchell (John)  
715 Atkinson Street  
Laurinburg, NC 28352

EAST LAURINBURG CITY COUNCIL

Mayor William C. Clarke  
438th Street  
East Laurinburg, NC 28352

Ralph L. Wagner  
8th Street  
East Laurinburg, NC 28352

Wiley B. Haire  
2nd Street  
East Laurinburg, NC 28352

J. A. Hardwick, Jr.  
58 9th Street  
East Laurinburg, NC 28352

LAURINBURG MAYOR'S CITIZENS ADVISORY COMMITTEE

Dr. Lamar Brooks  
829 Gilchrist Street  
Laurinburg, NC 28352

Mr. Craig Ellis  
Dunbar Drive  
Laurinburg, NC 28352

Mrs. James Hogue  
210 Dixon Street  
Laurinburg, NC 28352

Mr. James E. Gales  
308 Douglas Street  
Laurinburg, NC 28352

Mr. Joe T. Jordan  
Feden Street  
Laurinburg, NC 28352

Mr. James A. Pierce  
Aberdeen Road  
Laurinburg, NC 28352

Mr. Sam Snowdon  
721 King Street  
Laurinburg, NC 28352

Mr. Joe Wampler  
Woodburn Drive  
Laurinburg, NC 28352

Mrs. James David  
317 Welch Street  
Laurinburg, NC 28352

Mr. Lacy M. Gay  
Stewartville Road  
Laurinburg, NC 28352

Mr. George Jacobs  
332 Perk Street  
Laurinburg, NC 28352

Mr. Sam McInnis  
James Street  
Laurinburg, NC 28352

Mrs. Magellan Robinson  
Roseville Street  
Laurinburg, NC 28352

Mr. Wade Terry  
120 Caledonia Road  
Laurinburg, NC 28352

Mrs. Gladys Roberts  
208 Maple Street  
Laurinburg, NC 28352

COMMUNICATIONS

Ronald W. Curtis  
Waco Maxton Highway  
Laurinburg, NC 28352

James Milligan  
Laurinburg Exchange  
211 Cronly Street  
Laurinburg, NC 28352

George Phillips  
WLNC-Moody Lane Hill  
Laurinburg, NC 28352

Dick Brown  
Fayetteville  
Wachovia Building  
Laurinburg, NC 28352

OTHERS

Mr. J. Robert Gordon, President Laurinburg Scotland County Area Board  
P. O. Box 1296  
Laurinburg, NC 28352

Mr. A. S. Hafer, Chairman (Planning Board)  
P. O. Box 655  
Laurinburg, NC 28352

Mr. Terry Markham, Chairman  
County Planning Board  
Fredrick Avenue  
Laurinburg, NC 28352

# City of Laurinburg



December 16, 1979

Colonel Harry S. Wilson, Jr.  
District Engineer  
US Army Engineer District  
P.O. Box 819  
Charleston, S. C. 29402

Dear Colonel Wilson:

The City of Laurinburg hereby gives the US Army Corps of Engineers notice of intent to provide the following assistance and cooperation for the execution of the Lorton Creek Flood Control Project, Laurinburg, North Carolina, as authorized by Section 205 of the 1941 Flood Control Act, as amended:

a. Provide without cost to the United States all easements, easements, and rights-of-way necessary for project construction and operation;

b. Provide without cost to the United States, all bridge, highway bridge and utility alterations necessary for project construction;

c. Hold and Save the United States free from damages due to construction, operation and maintenance of the project, provided damages are not due to the fault or negligence of the United States or its contractors;

d. Maintain and operate the works after completion in accordance to regulations prescribed by the Secretary of the Army;

e. Protect the channel and other flood control works from future encroachment or obstruction that would reduce their flood-carrying capacity or otherwise affect their efficiency;

f. Adopt and enforce land use measures to prevent unwise and un economical development in the flood plain;

P.O. BOX 819 • LORNTON CREEK PROJECT • CHARLESTON, S.C. 29402

Colonel Harry S. Wilson, Jr.  
Page 2  
December 16, 1975

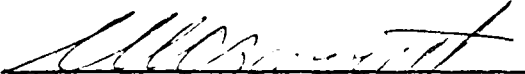
g. At least annually; inform affected interests that the channel improvement will not provide complete flood protection; and

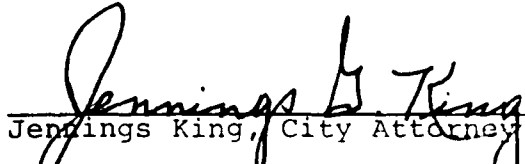
h. Take action to place in effect necessary statutes and/or regulations which will protect the water quality for the authorized uses of the project. Their regulations shall be in accordance with applicable laws and regulations of state and local authorities responsible for water quality control.

In carrying out the specified non-Federal responsibilities for the Leiths Creek Flood Control Project, The City of Laurinburg agrees to comply with the provisions of the "Uniform Relocation Assistance and Real Property Acquisitions Policies Act of 1970", Public Law 91-646, approved 2 January 1971; and Section 221, Public Law 91-611 approved 31 December 1970, as amended.

Very truly yours,

CITY OF LAURINBURG

  
W. Charles Barrett, Mayor

  
Jennings King, City Attorney



railed w/cards 12/11/75

PROPOSED LETTER

District Engineer  
U.S. Army Corps of Engineers  
P.O. Box 919  
Charleston, South Carolina 29402

Dear Sir:

The Fish and Wildlife Service has made a preliminary review of the Leith Creek, Scotland County, North Carolina, 205 project. We hope our comments and recommendations can be helpful to you in deciding on a final alternative for this project.

Leiths Creek is a slow moving Piedmont stream characterized by poorly defined channels and minimal flow. The largest portion of this project lies within the city limits of Laurinburg, North Carolina. There is excellent wildlife habitat in 2 sections of the proposed project area. These are from the 401-15 bypass to Gill Street and from SR 1645 to the U.S. 74 bypass. The upper location contains a good stand of hardwoods such as tulip poplar, sycamore, sweet gum, black gum and white oak on the better drained soils. Numerous trees have diameters of 24 inches or greater. The understory contains a prolific growth of greenbriar and honeysuckle. The land adjacent to the creek is a low lying, swampy area that provides excellent habitat for wood ducks, woodcock, various species of songbirds and screech owls. In addition, beaver, squirrels, rabbits, raccoons, and other small mammals are found here. Fishery habitat is limited to darters, daces and possibly a few sunfish of minimal size. The

Appendix 2  
A-12

lower portion of the project area contains an excellent wooded swamp that consists primarily of cypress and black gum. This area supports a good wildlife population. Wood ducks, woodcock, hawks, owls, and various songbirds are seasonally present. It is also excellent habitat for mammals and reptiles and amphibians. Aquatic habitat at the U.S. 74 bypass favors such fish species as red-breast sunfish, pickerel, and largemouth bass.

Both of these portions of the stream are unique in that they occur so close to a metropolitan area. In a relatively short distance the habitat types vary considerably. The upper part of Leiths Creek is more characteristic of upland habitat and the lower portion is composed of wooded swamp and associated biota.

At numerous points along the creek, septic tank overflow empties directly into the water. This is easily seen on the east side of Church Street bridge, where a gray, foul-smelling effluent enters the stream. This adds to the degraded water quality and marginal stream habitat in this portion of the creek. The wooded swamp below S.R. 1645 acts as an effective biological filter in controlling pollutants in the stream and when the water reaches the U.S. 74 bypass the quality has improved to the point that aquatic life is apparent. Water quality tests would be needed to determine how widespread the water pollution is and to what extent the cypress swamp filters the water.

Fish and wildlife habitat between Gill Street bridge and S.R. 1645 is marginal at best. A heavy growth of honeysuckle and greenbriar

cover the ground and trees adjacent to the creek. Garbage and trash is scattered throughout this portion of the stream and on the stream-banks. Flooding potential appears to be greatest at this location.

Since flood damage would appear to be minimal and fish and wildlife habitat is very good to excellent above Gills Street bridge and below S.R. 1645, we recommend that all flood plans be revised so these areas may be omitted in the final plan. If they are omitted, any of the 5 alternatives are acceptable to the Service at this time; however, Plan 5 appears preferable.

We look forward to providing you with a Fish and Wildlife Coordination Report when a final plan is adopted. Please keep us informed of progress in this matter.

Sincerely yours,

Regional Director

Cernohous:Pobinson:pm

ARCHAEOLOGICAL RECONNAISSANCE OF  
LEITH CREEK FLOOD CONTROL  
PROJECT AREA

APPLICANT: U.S. Army Engineer District, Charleston Corps  
of Engineers

PROJECT NAME: Alternative Channel Conveyance Improvement Plan  
Leith Creek, Laurinburg, N.C.

LOCATION: The area of Leith Creek under consideration, begins  
at the bridge over Leith Creek on Gill St. Laurinburg  
N.C. and continues to the L & S Railroad near State  
Road 1645, also within City Limits of Laurinburg.

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

Dates OF INSPECTION: March 19, 23 and 24, 1976

SURVEY MADE BY: Dr. David A. McLean, Archaeologist, and crew.  
St. Andrews Presbyterian College  
Laurinburg, N.C. 28352

AGREEMENT BETWEEN: St. Andrews Presbyterian College, Dr. David A.  
McLean and U.S. Army Engineer District, Charleston  
Corps of Engineers, Charleston, S.C.

CONTRACT PROPOSAL NO: 118

\*\*\*\*\*

P R O C E D U R E

1.

Survey began at the Bridge on Gill St. and followed the  
Northern bank of Leith Creek covering 100 feet from said  
Creek to the L & S Railroad near State Road 1645. Wherever  
land appeared above water samples of soil (50' x 50') sifted  
and inspected. No evidence of prehistoric or historic occupation  
was found.

Beginning at L & S Railroad near State Road 1645 and returning  
up Leith Creek on the Southern side to Bridge on Gill St.  
Samples were taken (50' x 50') wherever possible. No evidence  
of prehistoric or historic occupation was found. Approximately  
350 tests were made. (See Glossary).

Most of the terrain was muddy, swampy, and where you could walk  
on dry land, congested with briars and privet bushes.

2.

Latest edition of the National Register of Historic Places  
(Federal Register, Vol. 40 No. 24, Tuesday, February 14, 1975)

Appendix  
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ARCHAEOLOGICAL RECONNAISSANCE OF LEITH CREEK

Page 2

and all monthly supplements were consulted to ascertain if any of the property located within 100 feet on either side of Leith Creek, Laurinburg, N.C. from Gill St. to the L & S Railroad near State Road 1645 contained areas nominated to the Register.. NONE WERE FOUND

3.

Dr. Pat Garrou of the North Carolina Bureau of Archives and History, Archaeology Section, was consulted. He researched the project under investigation and reported that as far as he could ascertain, the property was clear of any site, either prehistoric or historic as recorded in the National Registry or nominated to same.

President of the Local Historical Society was consulted and he stated that there were no sites on the above property that had ever been, or now being recommended to the National Registry of Historic Places.

4.

Research into literature and documentary papers revealed no evidence of either historic or prehistoric sites.

5.

On the-ground (and water) reconnaissance was conducted as previously mentioned in Section # 1 of this report. No evidence of sites either prehistoric or historic were found.

AS FAR AS I AM ABLE TO ASCERTAIN, THERE ARE NO PREHISTORIC OR HISTORIC SITES OF ANY SORT ON THE PROPERTY 100' ON EITHER SIDE OF LEITH CREEK FROM GILL ST. TO THE L & S RAILROAD NEAR STATE ROAD # 1645.

March 25, 1976

*David A. McLean, Ph.D.*  
Archaeologist,  
St. Andrews College  
Laurinburg, N.C. 28352

## GLOSSARY OF TERMS USED

\*\*\*\*\*

### Diagnostic Sites

Site: Where one or more artifacts are found

Insignificant Site: Where surface collection is adequate to document previous occupation or activities. No reason to impede construction or destruction of site.

Important Site: Where surface collection is inadequate to document previous occupation and indicate that there is more to be found underground, not enough to be nominated to the National Registry, but enough to recommend salvage archaeology.

Significant Site: Site or sites with important artifacts that would indicate the need for careful excavation and preservation. Such a site would be recommended for nomination to the National Registry.

### Methods of Surface Examination

Dogleash Technique: Where one end of a ten metre string is tied to the searcher and the other to a post in the center of the site. The searcher rotates in the site until string is wound up. This insures careful survey of site.

50' by 50' Technique: Where visibility of the ground is poor and recovery of artifacts by the walkover technique is poor or impossible, then samples of earth (12 qts.) are removed at 50 sq. intervals, sifted to recover artifacts.

Walkover reconnaissance technique: Where visibility of the ground or earth is good and artifact recovery is good, searcher covers the ground in approximately 10 ft. intervals collecting artifacts lying on top of ground.

\*\*\*\*\*

Salvage Archaeology: When survey indicates that mitigating action is necessary and a delay in construction is requested while rapid excavation is made to ascertain and recover as much information as possible before site is destroyed.



STATE OF NORTH CAROLINA  
Department of Cultural Resources  
Raleigh 27611

James E. Holshouser, Jr.  
Governor

April 6, 1976

Division of Archives and History  
Larry E. Tise, Director  
State Historic Preservation Officer

Grace J. Rohrer  
Secretary

Colonel Harry S. Wilson, Jr.  
US Army Corps of Engineers  
Post Office Box 919  
Charleston, South Carolina 29402

Dear Colonel Wilson:

Archaeology Section staff have reviewed a report from Dr. David McClean of St. Andrews College concerning an archaeological survey that he conducted on Leith Creek, Laurinburg, North Carolina. This survey was conducted under contract with your office in connection with the Leith Creek Alternative Channel Conveyance Plan Project for Laurinburg.

Dr. McClean reported that his archaeological survey revealed no sites of any kind were present in the project area. The Archaeology Section concurs with Dr. McClean's report, and recommends that immediate archaeological clearance be granted for this project.

In view of Dr. McClean's report, we remove our objection of November 24, 1975. Thank you for your cooperation in this matter. Please call upon us if we can be of further service.

Sincerely yours,

Larry E. Tise

LET:e

cc: Dr. David McClean

The foregoing comments are rendered as a free service of the State Historic Preservation Officer and the staff of the Division of Archives and History, Department of Cultural Resources to assist applicants, governmental agencies, and other institutions in complying with the requirements of one or more of the following laws, orders, or statutes: P.L. 59-209, 74-292, 85-31, 89-605, 91-190, 93-291, 93-383; Executive Order 11593; 36 CFR 800; G. S. 70, 113-279, 113A, 121-4, 121-6, 121-12, 121-22, 136-42.1. Further information on the review process and legal requirements regarding historical and archaeological resources may be found in "Environmental Assessments of Historical Archaeological Resources: Policies and Procedures of the North Carolina State Historic Preservation Officer and the Department of Cultural Resources," a copy of which will be sent to interested citizens upon written request.



North Carolina Department of  
Natural & Economic Resources

JAMES E. HOLSHOUSER, JR., GOVERNOR • George W. Little, SECRETARY

June 14, 1976

Mr. Jack Lesemann, Chief  
Engineering Division  
Charleston District Corps of Engineers  
P. O. Box 919  
Charleston, South Carolina 29402

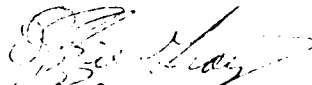
Dear Mr. Lesemann:

In response to your letter of 25 May 1976, personnel from this office conducted an on-site investigation of Leith's Creek keeping in mind your agency's proposed flood control project on that creek for the City of Laurinburg.

We found your proposal to be completely acceptable and concur with that proposal. At this time, no State funds are available for the non-federal share of the project nor has any request been received for such funds. Therefore, we must assume the non-federal share of project costs will be paid entirely by the City of Laurinburg.

Should you have any questions concerning our investigation, please contact Steve Reed of the Water Planning Section or give me a call.

Sincerely,

  
Uzzie Gray

cc: Steve Reed

Appendix  
A-1



# City of Laurinburg



October 8, 1976

Mr. Steve Morrison  
U. S. Army Corps of Engineers  
P.O. Box 919  
Charleston, SC 29402

Dear Mr. Morrison:

We enjoyed your visit on September 22 and were especially glad to hear of the possibility of developing the Leith Creek Flood Control Project as a recreation area.

Over the past several years, I have heard many people talk of developing Leith Creek as a recreational greenbelt and we view the Corps's efforts with the Leith Creek Project as the key to this hope.

We appreciate your sharing this information with us and look forward to working with you and your office in making Leith Creek a lasting benefit to the Laurinburg community.

Sincerely yours,

A handwritten signature in cursive script that reads "Stephen C. Floyd".

Stephen C. Floyd  
Acting City Manager

SCF/brc

303 WEST CHURCH STREET • P.O. BOX 786<sup>312</sup> • LAURINBURG, N. C. • 919 276-8324

# Scotland County Parks and Recreation Commission

HENRY McLEOD, JR. CHAIRMAN  
SAMUEL SNEAD, VICE CHAIRMAN  
H. REGINALD POSEAT  
W. L. BAKER  
J. ROBERT GORDON  
JAMES E. MULLIGAN  
WYATHAN McLEAN  
TOM WHITLOCK  
DUNCAN McRAY  
NANCY SHELLEY  
HARLEE JOHNSTON  
ELUISE JACKSON

WILLIAM J. SCOTT,  
EXECUTIVE DIRECTOR SECRETARY

P. O. Box 1910 -- 1835 South Main Street -- Phone 919-276-0412  
LAURINBURG, NORTH CAROLINA 28352



October 29, 1976

Mr. Steve Morrison  
Corp. of Engineers  
Charleston District  
P.O. Box 919  
Charleston, SC 29401

Dear Mr. Morrison:

I enjoyed your recent visit to Laurinburg and a chance to learn of your interest in providing park facilities in your projects. I have discussed the Loch Creek Project at length with my Parks & Recreation Commission and we feel this is a worthwhile and lasting project for our county. However, we have had so many requests for parks in other parts of our county, that our Commission has agreed not to acquire additional park lands until a county-wide master plan can be completed.

I feel that the project can be incorporated into this master plan hopefully in time to jointly develop this area with the Corp and the City of Laurinburg. Please keep me informed on the time frame of the projects and any changes on any matters related to park development.

Sincerely,  
*William J. Scott*  
William J. Scott  
Executive Director

RIS:lp

cc: Steve Morrison  
Laurinburg

Appendix 2  
A-21



North Carolina Department of  
Natural & Economic Resources

JAMES B. HUNT, JR., GOVERNOR

HOWARD N. LEE, SECRETARY

P. O. BOX 27687  
RALEIGH 27611

TELEPHONE 919 733 4481

April 21, 1977

Colonel Harry S. Wilson, Jr.  
District Engineer  
Charleston District, Corps of Engineers  
P. O. Box 519  
Charleston, South Carolina 29401

Dear Colonel Wilson:

This letter is to inform you of the State's position on the proposed Leith Creek Flood Control Project (Sec. 205) in Laurinburg, Scotland County, North Carolina.

On April 14, 1977, the Environmental Management Commission, upon receiving a favorable recommendation from the staff of this Department, unconditionally approved the Detailed Project Report. The Commission has the statutory responsibility to review projects of this type. Their action, therefore, is the State's final approval for the Leith Creek project.

With kindest regards and best wishes, I am

Respectfully yours,

A handwritten signature in dark ink, appearing to read 'Howard N. Lee', written over a faint printed name.

Howard N. Lee



North Carolina Department of  
Natural & Economic Resources

JAMES B. HUNT, JR., GOVERNOR

HOWARD N. LEE, SECRETARY

PO BOX 265  
RALEIGH, NC  
TELEPHONE 361-4740

April 21, 1977

Colonel Harry S. Wilson, Jr.  
District Engineer  
Charleston District, Corps of Engineers  
P. O. Box 919  
Charleston, South Carolina 29401

Dear Colonel Wilson:

A staff review of the Leith Creek Project (Sec. 205) was conducted to prepare recommendations to the Environmental Management Commission. Follow-up on the comments indicated that some of them were over-stated. For example, an elaborate sediment monitoring plan does not seem to be justified in this case. We do urge you to use sediment basins or other means to keep the downstream sediment load to a minimum during and after construction.

I have attached copies of some of the substantive comments on the project. These are provided for your information and consideration in carrying out this and other projects. The comments are not requirements or conditions on project approval. As Secretary Lee stated in his letter to you, the Environmental Management Commission has approved the project unconditionally.

Please let me know if I can be of assistance with this project or with other activities of your District.

Sincerely yours,

John Morris  
Water Resources Development

Attachments

Appendix 1  
A-23

January 20, 1977

MEMORANDUM

TO:            Tom Ehnestock

FROM:          W. L. Knight

SUBJECT:       Leith Creek Flood Control Detailed Project Report

We have completed our review of the small flood control project which the U. S. Army Corps of Engineers proposes to construct on Leith Creek in Scotland County.

While not crucial to the analysis of the project, there are some inaccuracies in the socio-economic description of the county. The projected population for 2020 shown in paragraph 23, page B-12, appendix I is based on the "C" rather than Series "E". The April 1976 projections for North Carolina based on disaggregated OBERS "E" for North Carolina give 31,900 for 2020. However, projections by the North Carolina Department of Natural and Economic Resources are considerably higher than disaggregated OBERS. Our projections for Scotland County for 2020 are 57,200 Series C; and 43,400 Series E. On July 1, 1975 Scotland was estimated to have a population of 32,700. This was an increase of 11.3 percent from 1970, and far exceeded the average increase for the State of 7.2 percent. This is a departure from past trends; if it continues the population will greatly exceed projections which indicate the county will grow less rapidly than the state.

The April 1976 BEA disaggregations of North Carolina published by the South Atlantic Division of the Corps projects per capita income in the county in 2020 at \$9,906 in 1967 dollars. This is considerably less than the projection in paragraph 31, and reflects the fact that per capita income in the county is less than that for the Yadkin-Pee Dee Basin.

We have no objections to the plan recommended by the District Engineer. The benefit-cost ratio is favorable and there appears to be a minimal amount of environmental disruption. The recommended plan will certainly require some re-orienting structures. The Cities of Laurinburg and East Laurinburg will be required to pass flood plain ordinances to insure that there is no development on lands protected by the channel improvements. The development of a parkway and associated recreation seems a most progressive idea and we encourage it. The recreation benefits seem to be calculated very conservatively during this phase of the project even better than shown.

W. L. Knight  
Appendix I  
A-24



# State of North Carolina

## Wildlife Resources Commission

RALEIGH, N. C. 27611

January 26, 1977

ROBERT B. HAZEL, Raleigh  
Executive Director  
HENRY E. MOORE, JR., Cary  
ROSCOE C. SANDLIN, Jarratt  
DEWEY W. WELLS, Concord  
V. E. WILSON, III, Raleigh

MEMORANDUM FOR THE COMMISSION  
SUBJECT: *Wetland*  
FROM: Frank B. Barick *FBB*  
TITLE: Little Creek Flood Control Project

The subject document has been reviewed and we concur in the relatively minor adverse impacts to fish and wildlife resources which will result from the proposed plan.

The mitigation of losses has been effected by reducing the length of channel excavation from that which was originally proposed.

We feel that the Principles and Standards evaluation procedure which was followed by the Corps has resulted in a more cost effective and less environmentally damaging project.

We feel constrained to point out, however, that widening the channel from 20 feet to 35-40 feet will reduce the depth of water to one-fourth of its present depth. Considering the fact that the stream is described as having a "small" volume, it follows that during non-flood, low flow conditions, there will be very little water in the new channel. During much of the time it could be a 20 to 30 foot wide mud strip through the city with the primary source of water being from residential sewer drain fields. It seems to us that this would be a far cry from a high use recreational park situation. The channel could be much improved by shaping the new channel so as to maintain one side of it considerably lower than the other and encouraging a grass growth well into the channel on the tapered shallow side. The grass, of course, be on the far side where the trees and other vegetation are not as completely removed. This would provide for a natural stream flow and preservation of fish habitat whereas a 35 foot wide channel would result in no livable habitat for fish except at normal or low flow.

Appendix 2  
A-25

January 26, 1977

Another way to accomplish this objective would be to install one or two low dams to maintain a ribbon of water 35 feet wide and two or three feet deep through the park. This might be aesthetically more pleasing than the design described above. It would, however, require periodic removal of accumulated sediment. One way to reduce clogging the 1.97 miles with sediment would be to install two or three sediment traps at points of easy access and dip them out as needed.

TSC:en

DIVISION OF ENVIRONMENTAL MANAGEMENT

AIR QUALITY SECTION

January 19, 1977

M E M O R A N D U M

TO: Lafayette Jones, Field Office Manager

FROM: Alan P. Grainger, Engineering Technician III *APG*  
Air Quality Section

SUBJECT: Leith Creek Flood Control Project  
Scotland County, North Carolina

The document listed above has been reviewed, and the following comments are provided:

Any open burning conducted for this project must be in compliance with the North Carolina Open Burning Regulation (No.1.)

Proper steps should be taken to minimize dust created by this project.

APG/gc

cc: Central File

Appendix 2  
A-27



February 17, 1977

MEMORANDUM TO: Lafayette N. Jones, Field Office Manager  
South Central Field Office

FROM: Floyd R. Williams, Land Quality Section *fw*

SUBJECT: Leith Creek Flood Control Project

If greater than one acre of land is to be disturbed, an erosion control plan will be required. This plan should be submitted to the Land Quality Section, D-NER, at least 30 days prior to commencement of the land-disturbing activity. The plan must be reviewed before construction can begin.

FRW/fbc

Appendix 2  
A-28

## WATER QUALITY COMMENTS ON THE DETAILED PROJECT REPORT

### Leith's Creek Channelization Project

The major adverse impact on surface water quality resulting from the project will be an increased sediment load to Leith Creek (Class C Swamp, 7Q10-0.04 cfs). The methods by which the levels of sediment loading are predicted contain assumptions and arbitrarily fixed parameters which may produce considerable error in the results. Thus, it is not possible to accurately predict the occurrence of water quality standard contraventions due to increased levels of turbidity. However, based on the experience of Division of Environmental Management personnel with similar Corps of Engineers projects in other regions, turbidity standard contraventions are anticipated in the 1.97 miles to be channelized by the project and in a two mile segment immediately downstream from the project reach. This is approximately the same segment of stream which assimilates the effluents from a number of treatment plants in the area. The bottom of the dissolved oxygen sag curve resulting from the effluents discharged by the Laurinburg Industrial (0.024 MGD) and Eaton Corporation (0.005 MGD) wastewater treatment plants is predicted to occur 75 feet upstream from the upper end of the proposed channel. A similar type of sag point due to the discharge from the City of Laurinburg's Leith Creek Wastewater Treatment Plant (2.0 MGD) occurs two miles below the confluence of Leith Creek and Little Creek. This location is approximately one mile downstream from the furthest point expected to experience turbidity violations. The stream bottom in the section proposed for channelization is expected to have considerable amounts of oxygen demanding compounds in it, some from natural conditions and some as a result of the treatment plant effluents. These materials will be re-suspended by the project and may exert oxygen demand in a stream segment already in continual danger of dissolved oxygen standard contraventions (several are noted in the basin plan). None of the mentioned treatment facilities are currently producing an effluent of sufficient quality ( $\text{BOD}_5=5\text{mg/l}$ ;  $\text{NH}_3=2\text{mg/l}$ ) to maintain the stream for its assigned best use, fish propagation. The 0.005 MGD discharged by Eaton Corporation must comply with final effluent limits before July 1, 1977, but the others are scheduled to be upgraded according to the Laurinburg-Maxton 201 Facilities Plan (currently in State review), which probably will not reach the construction phase until after the completion of the proposed channelization and following the time of the major adverse impact (six months to a year following the project).

It is recommended that the proposed project be amended to include in-stream sediment basins to reduce downstream sedimentation and a turbidity and suspended solids monitoring program to establish the magnitude of the impact due to sediment transport.

One basin should be located at the downstream end of the proposed channel, and three more basins should be placed at appropriate sites at one half mile intervals upstream from the first basin. These basins should be maintained throughout the construction phase of the project. The basins may have the additional benefit of providing sanctuaries for fish during low flow periods, although by virtue of their intended purpose, they will not be permanent.

The turbidity and suspended solids monitoring program should include the following sampling stations:

1. Leith Creek at the L & S Railroad culvert or the bridge on SR 1645, the downstream end of the proposed channel.
2. Leith Creek at the Gill Street bridge, the upstream end of the proposed channel.
3. Leith Creek at the SR 1603 bridge, approximately 0.6 mile below the downstream end of the proposed channel.
4. Little Creek at the U.S. 74 (Business) bridge.
5. Leith Creek at the U.S. 74 (Bypass) bridge, approximately 0.8 mile below the downstream end of the proposed channel.
6. Leith Creek at the SR 1609 bridge, approximately 1.5 miles below the downstream end of the proposed channel.
7. Leith Creek at the SR 1619 bridge, approximately 3.9 miles below the downstream end of the proposed channel.

Sampling frequencies should vary depending on when and where they are taken, with the following suggested schedule:

1. Pre-project grab samples should be obtained from all stations and analyzed for three non rainfall days and three rainfall days.
2. During the project, all stations should be monitored daily by grab samples.
3. For the first six month period following the completion of the project, all stations should be monitored weekly by grab samples.
4. Following the first six month period after construction, sampling frequency will depend on the results obtained from the previous analysis. At a minimum, this sampling should be bimonthly by grab sample and should last until five years following the completion of construction.

# Scotland County Parks and Recreation Commission

HENRY MCLEOD, Chairman  
DUNCAN MCKAY, Vice-Chairman  
J ROBERT GORDON  
O M GRAHAM  
ELOUISE JACKSON  
MARLEE JOHNSTON  
DAVID McNAIR  
JAMES E MILLIGAN  
H REGINALD POTEAT  
NANCY SHELLEY  
SAMUEL SNEAD  
ALLAN THAMES  
DR DAVID WILLIAMS

WILLIAM J SCOTT, Secretary  
*Executive Director*

P O. Box 1910 — 1835 South Main Street  
Laurinburg, North Carolina 28352  
Telephone (919) 276-0412

July 20, 1977

Mr. David Harris  
Corps of Engineers Office  
P.O. Box 919  
Charleston, SC 29402

Dear Mr. Harris:

The Scotland County Parks & Recreation Commission met July 12 and officially endorsed the Leith Creek Project in Laurinburg. The Parks & Recreation Commission voted unanimously to support the project which includes the strip park along the creek.

This project will benefit Laurinburg and Scotland County for many years and will provide a better quality of life for the citizens.

Please keep us informed on your plans and thank you for the opportunity to express our interest in this development.

Sincerely,



William J. Scott  
Executive Director

WJS/dmc

Appendix 2  
A-31

PUBLIC NOTICE

DEPARTMENT OF THE ARMY  
Charleston District, Corps of Engineers  
P. O. Box 919  
Charleston, South Carolina 29402

SACCO-P

16 June 1977

Refer to: P/N 77-5A-217  
(Leith Creek Flood Control Project, Laurinburg, North Carolina)

TO WHOM IT MAY CONCERN:

The Charleston District, Corps of Engineers, Charleston, South Carolina, proposes to perform the work described herein with due consideration and review being given to the relevant provisions of the following laws:

1. Federal Water Pollution Control Act Amendments of 1972 (PL 92-500).
2. The National Environmental Policy Act of 1969 (42 U.S.C. 4321-4347).
3. The Fish and Wildlife Act of 1956 (16 U.S.C. 472a et seq), the Migratory Marine Game - Fish Act (16 U.S.C. 760c - 760g) and the Fish and Wildlife Coordination Act (16 U.S.C. 661-666c).
4. The National Historic Preservation Act of 1966 (80 Stat. 915, 16 U.S.C. 470).
5. The Coastal Zone Management Act of 1972 (16 U.S.C. 1456 (c)(1) and (2), 86 Stat. 1280).
6. The Marine Protection, Research and Sanctuaries Act of 1972 (PL 92-532).
7. The Endangered Species Act of 1973 (PL 73-205).
8. Section 205 of the 1948 Flood Control Act, as amended.

PROJECT DESCRIPTION:

General. The proposed plan of improvement for flood control in the Leith Creek Basin is a combination structural and nonstructural plan. The structural measures consist of cleaning and widening the existing channel for a total distance of 1.97 miles and replacing two highway bridges, and relocating two water mains and one sewer line. Nonstructural measures consist of passage of regulatory measures, by the local sponsor, to control the residual flood plain. The proposed plan also includes a greenway park with a bike and walking trail. Details of each facet of the project are included hereafter.

Channel Modification. Channel modifications would consist of widening and cleaning the existing channel a distance of 1.97 miles. (see Plate 1.) Bottom widths would vary from 35 feet in the reach between the Laurinburg and Southern Railroad (Station 65+70) and N. Main Street (Station 162+60) to 30 feet between N. Main Street and the end of the project at Gill Street (Station 169+00). Channel side slopes are designated as 2 horizontal to 1 vertical.

Appendix 2  
A-32

Bridge and Utility Modifications. Bridge modifications consist of removal and/or replacement of the McKay and Carver Street bridges. Utility modifications include replacement of two water mains and one sewer main. Bridge and utility modifications are the responsibility of the local project sponsor.

Disposal Areas. Materials excavated would be deposited in areas adjacent to the creek and to a maximum height of four-feet. All disturbed areas would be smoothed and seeded with grass. Visibly disturbed areas of all elements surrounding the project would be landscaped to provide an attractive appearance. A greenway park, consisting of a bike trail and picnic facilities, would be constructed adjacent to the creek in the reach between Church Street and Gill Street, on areas other than wetlands.

Approximately 12,500 cubic yards of materials excavated in the lower reach of the project below Church Street would be deposited in permanently or periodically inundated wetlands on one side of the creek (See Plate 2 for details.) This would be accomplished by forming disposal mounds with adequate breaks to allow local drainage. The wetland area which would receive fill material now receives pollutant discharges from several sources. As a result of these discharges, the normally small discharge of the creek and the frequent disposal of trash and garbage from impinging developments, the water quality in this reach is poor. Fish and wildlife habitat in this reach has been described as "marginal at best" by the U. S. Fish and Wildlife Service. Final selection of disposal sites in this area would depend on ability of local sponsor to acquire rights-of-way.

Alternate methods of disposal have been considered. Hauling of excavated material by truck to nearby highland disposal areas would require access roads, the construction of which would involve more fill and more filled area than the 12,500 cubic yards to be removed from the creek. Pumping to upland sites would be the most environmentally acceptable alternative, but would require special equipment just for this purpose. The relatively small amount of material (12,500 cubic yards) is insufficient to justify the additional expense for the protection of a poor to marginal area.

Slope Protection. Channel transition would be required in the vicinity of Commonwealth Avenue and the SCL Railroad. In this reach, the design channel must transition from 35-foot bottom with 2:1 side slopes, to a 20-foot bottom with 1:1 side slopes in order to utilize the existing Commonwealth Avenue Bridge. Sacked sand-cement riprap would be used in this reach for slope protection. This type of protection consists of the placement of cloth sacks filled with a cement mixture and securely tied. Each sack would be hand placed and pushed into firm contact with adjacent sacks. The riprap would be thoroughly wetted as work progresses in order to form a bond between adjacent sacks. See Plate 3 for details of riprap placement.

Recreation Facilities. Recreational facilities included as part of the recommended plan include the construction of a greenway adjacent to Leith Creek beginning at the Church Street Crossing (Station 105+50) and extending to the upper project limits of Gill Street (Station 169+00), a total distance of 6,350 feet. The greenway would be constructed on one bank only and would include a four-foot wide bituminous surfaced trail for biking and walking and would also include periodically spaced picnic tables and  
Two picnic sites have been located in the vicinity of

SACCO-P

16 June 1977

Refer to: P/N 77-5A-217

(Leith Creek Flood Control Project, Laurinburg, North Carolina)

Carver Street behind a complex of low rent apartments and in the vicinity of McKay Street near the elementary school and playground. Each picnic site would contain two tables and one trash receptacle. Park benches would be located at road crossings where picnic sites are not planned in order to serve pedestrian traffic from the trail and from each respective road. Ornamental shrubbery would be planted in appropriate locations to beautify the greenway parks.

The purpose of the Leith Creek flood control project is to provide flood protection for existing structures located within the floodplain of Leith Creek in the vicinity of Laurinburg and East Laurinburg, North Carolina. Primary benefits resulting from project construction result from the reduction of flood damages in residential areas. Additional recreation benefits would accrue from development of the Greenway Park.

Large scale drawings of the proposed project are available for review in the Charleston District Office, Charleston, South Carolina. Disposal areas are located adjacent to the creek and would be shaped and landscaped to blend with the natural setting. Disposal areas would be on one bank only. Total excavated material for the entire project is estimated to be 34,700 cubic yards. Disposal sites have not previously been designated by the Administrator, Environmental Protection Agency (EPA).

Preliminary review of this application indicates that an Environmental Impact Statement (EIS) will not be required. An environmental assessment and negative declaration can be obtained from the Charleston District upon request.

Review of the latest published version of the National Register of Historic Places indicates that no registered properties or properties listed as eligible for inclusion therein are located at the site of the proposed work. An archaeological reconnaissance of the area was also conducted and no sites of any significant archaeological value were found.

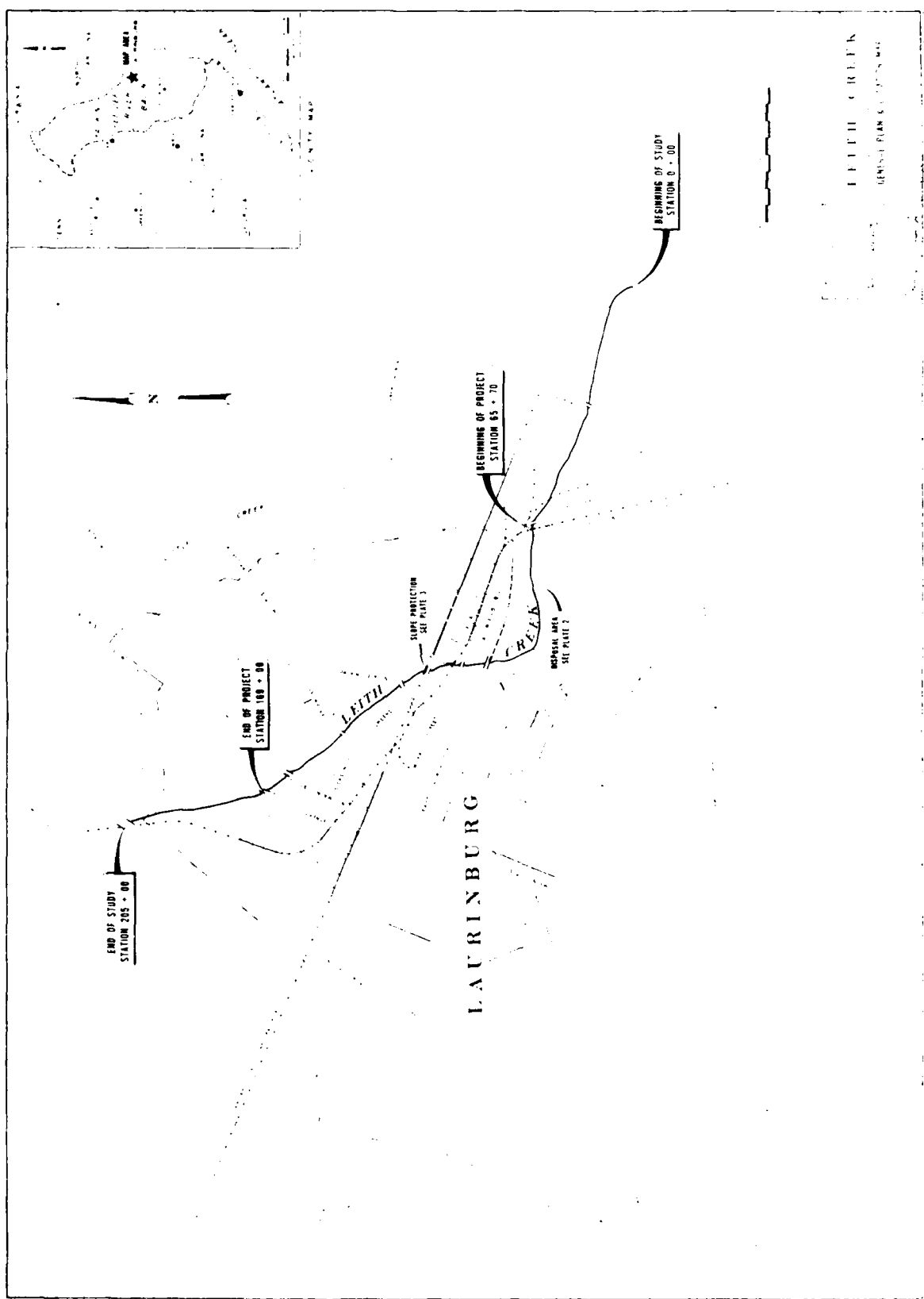
This public notice is being distributed to all known interested parties in order to assist in developing facts on which a decision may be made by the Corps of Engineers with respect to the disposal of dredged material in navigable waters. For accuracy and completeness of record, all data in support of or in opposition to the proposed work should be submitted in writing to the District Engineer setting forth sufficient detail to support convictions. Any person who has an interest which may be affected by the disposal of dredged material may request a public hearing. The request must be submitted in writing to the District Engineer within thirty (30) days of the date of this notice and must clearly set forth the interest which may be affected and the manner in which the interest may be affected by the activity. All submissions should be made to the U. S. Army Engineer District, Charleston, P. O. Box 919, Charleston, South Carolina 29402, in time to be received on or before

12 O'CLOCK NOON, MONDAY, 18 JULY 1977

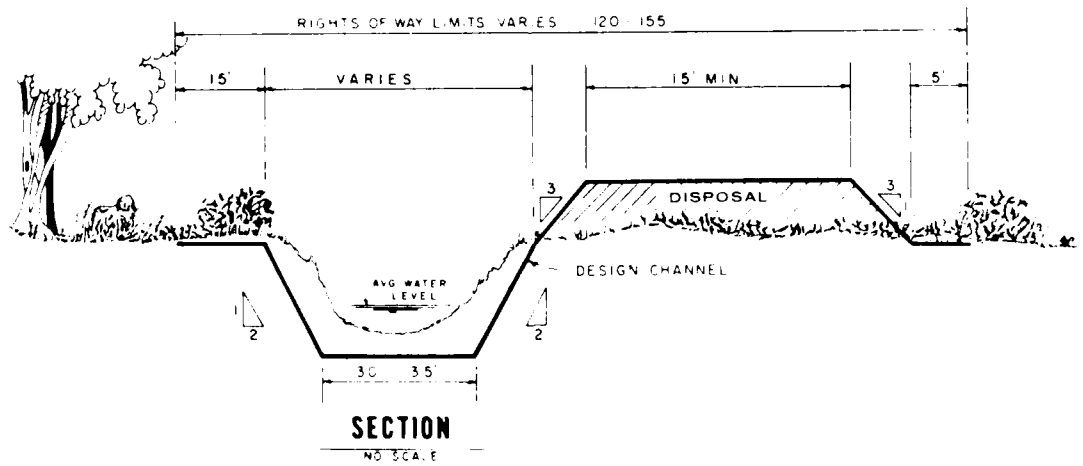
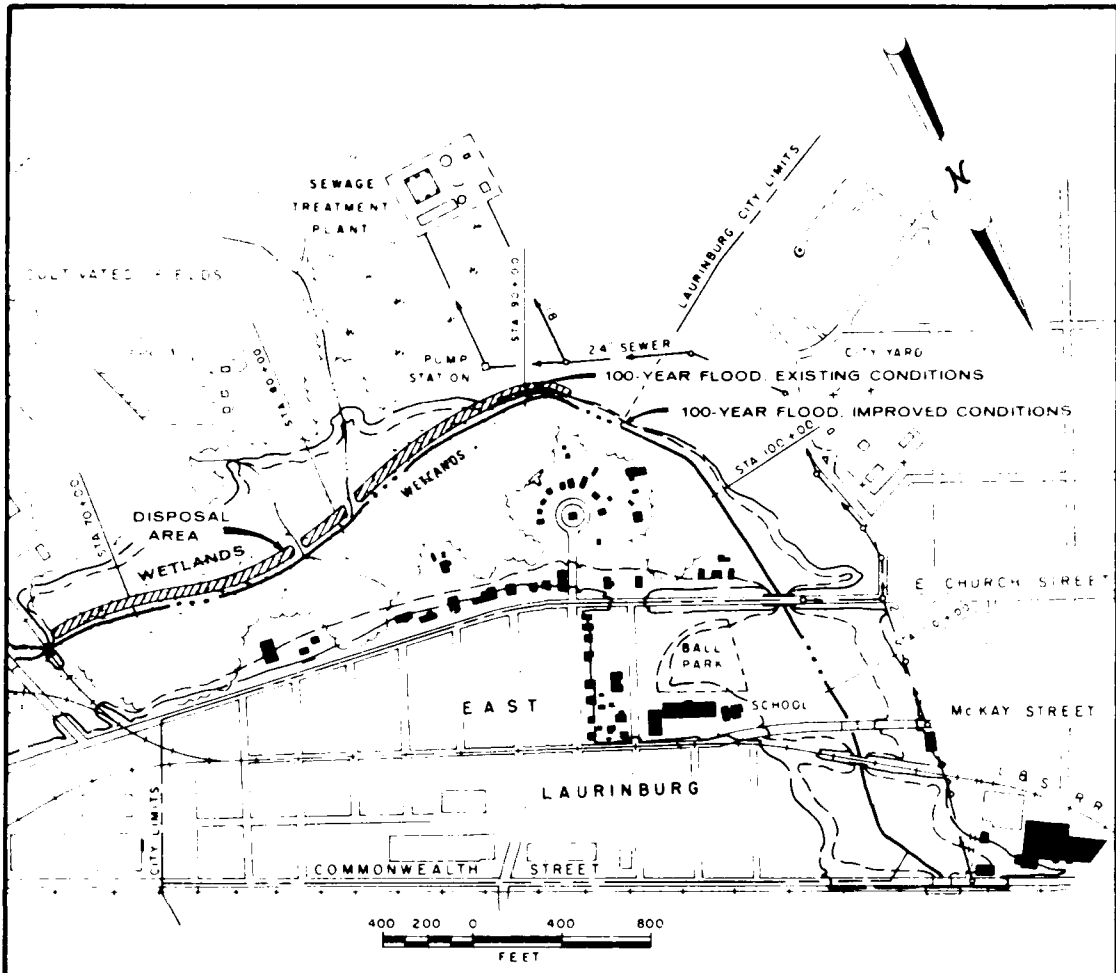


HARRY S. WILSON, JR.  
Colonel, Corps of Engineers  
District Engineer

Appendix 2  
A-34







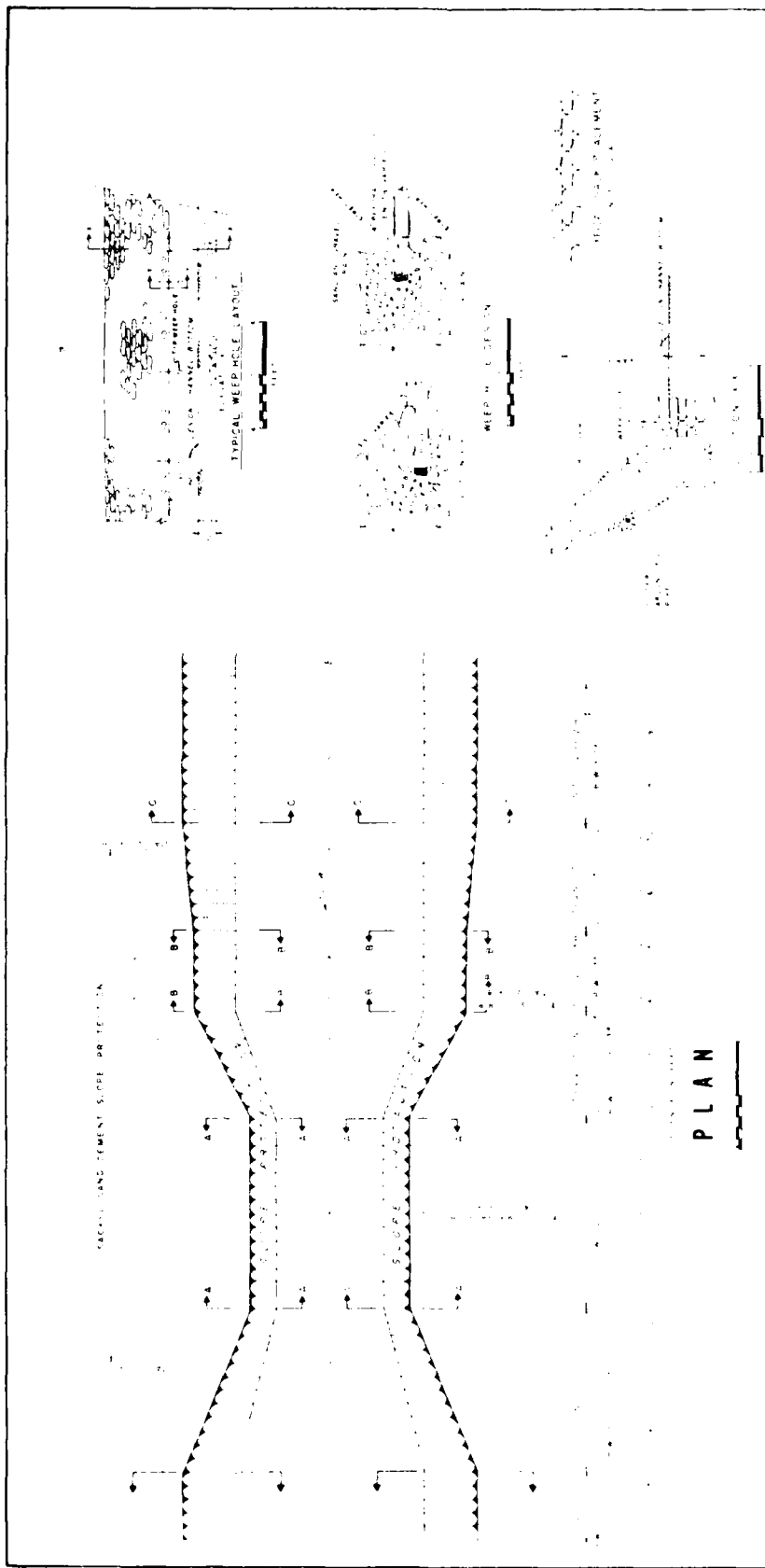
**NOTE**

BELOW CHURCH STREET APPROX 12,500 cu yds OF EXCAVATED MATERIAL WILL BE PLACED IN WETLANDS ADJACENT TO THE CREEK FROM THE LOWER PROJECT LIMITS STA 85 + 95 TO STA 92 + 00 FINAL SELECTION OF DISPOSAL SITES WILL DEPEND ON ABILITY OF LOCAL SPONSOR TO ACQUIRE RIGHTS OF WAYS. EXCAVATED MATERIAL WILL BE DEPOSITED IN SUCH A MANNER NOT TO INTERFERE WITH NATURAL DRAINAGE OF ADJACENT AREAS

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

**TYPICAL SECTION**  
STA. 65+95 to STA. 92+00

SHEET 2 OF 3 SHEETS



**PLAN**

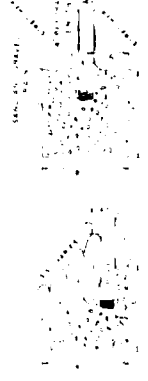
TYPICAL SECTIONS AND DETAILS OF SACKED SAND-CEMENT SLOPE PROTECTION  
SCALE AS SHOWN

CORPS OF ENGINEERS U. S. ARMY  
 CHARLESTON SOUTH CAROLINA DISTRICT  
 LEITH CREEK LAURINBURG N. C.  
 CHANNEL TRANSITION  
 COMMONWEALTH AVENUE

SLOPE PROTECTION

WEED HOLE DESIGN

TYPICAL WEED HOLE LAYOUT



**SECTION B**

PUBLIC WORKSHOP

PUBLIC WORKSHOP

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LIST OF EXHIBITS

<u>NO.</u>	<u>TITLE</u>	<u>FOLLOWING PAGE</u>
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## PUBLIC WORKSHOP

1. This section presents a transcript of the public workshop held at the Scotland County Courthouse in Laurinburg, North Carolina, on 20 November 1975. Approximately 60 persons attended including local property owners, local business representatives, county and municipal government officials and representatives of various state agencies.

2. The workshop consisted of an introductory session to inform the public of the purpose of the workshop and to briefly describe the flood problems on Leith Creek and possible solutions. Following this session, the people attending were divided into four smaller groups. Each group selected a moderator to report their groups findings and conclusions. The small groups provided individuals the opportunity to make any statement they desired and to openly discuss any questions they had concerning the study, including technical, economic, ecological and environmental matters. Following the allotted period for group discussion, the people were reassembled to hear reports of the group moderators.

3. In order to provide a complete documentation of the workshop the following items have been included in the order listed:

- a. Announcement of Public Workshop
- b. Mailing List
- c. List of Attendees
- d. Transcript of Workshop
- e. Subsequent Correspondence



**DEPARTMENT OF THE ARMY**

CHARLESTON DISTRICT, CORPS OF ENGINEERS  
P O BOX 919  
CHARLESTON, S.C. 29402

SANGP-F

6 November 1975

The City of Laurinburg, North Carolina, and the U. S. Army Corps of Engineers request your presence at a public workshop concerning possible flood control alternatives for Leith Creek, Scotland County, North Carolina. The workshop will be held on 20 November 1975 at 7:30 P.M. in the Scotland County Courthouse.

Under the provisions of Section 205 of the 1948 Flood Control Act, as amended, the Corps of Engineers has initiated a detailed study of the flooding problems on Leith Creek in response to a request for such a study from the City of Laurinburg. The detailed study has progressed to the point that a public workshop is required to discuss problems concerning flood control alternatives in the study area.

The purpose of the workshop is as follows:

- a. Inform the interested public of the current status of the detailed study on Leith Creek.
- b. Discuss the existing flood problem and potential alternatives to alleviate flood damages.
- c. Provide an opportunity for local officials to express their views on the problems and possible alternative solutions; and
- d. Provide the general public an opportunity to openly voice their views and to assist in formulating the best flood control project to meet national and community needs.



SANGP-F

6 November 1975

You are urged to attend this workshop and contribute to the planning of a possible Leith Creek Flood Control Project.

Sincerely,



HARRY S. WILSON, JR.  
Colonel, Corps of Engineers  
District Engineer

Appendix 2  
B-3

MAILING LIST  
FOR  
NOTICE OF PUBLIC WORKSHOP  
LEITH CREEK FLOOD CONTROL PROJECT,  
SCOTLAND COUNTY, NORTH CAROLINA  
NOVEMBER 1975

CONGRESSIONAL

U. S. Senate (North Carolina)

#Honorable Jesse Helms  
United States Senator  
Washington, D. C. 20510

#Honorable Jesse Helms  
United States Senator  
1513 Caswell Street  
Raleigh, N. C. 27602

#Honorable Robert Morgan  
United States Senator  
Washington, D. C. 20510

#Honorable Robert Morgan  
United States Senator  
P. O. Drawer 2719  
Raleigh, N. C. 27602

U. S. House of Representatives (N.C.)

#Honorable W. G. Hefner  
House of Representatives  
Washington, D. C. 20515

#Honorable W. G. Hefner  
Box 698  
Kannapolis, N. C. 28081

FEDERAL AGENCIES

Water Resources Council

Director  
Water Resources Council  
Suite 800  
2120 "L" Street, N. W.  
Washington, D. C. 20037 (2)

Environmental Protection Agency

Regional Administrator  
Environmental Protection Agency  
Suite 300  
1421 Peachtree Street, N. E.  
Atlanta, Georgia 30309 (12)

Environmental Protection Agency  
Suite DD-509  
Merchandise Mart  
2500 East Independence Boulevard  
Charlotte, North Carolina 28205

Department of Agriculture

The Administrator  
Soil Conservation Service  
U. S. Dept. of Agriculture  
Washington, D. C. 20250 (7)

State Conservationist  
Soil Conservation Service  
Raleigh, N. C. 27602 (5)

District Conservationist  
Soil Conservation Service  
P. O. Box 247  
Laurinburg, N. C. 28352

# - Copy of Mailing List Furnished

( ) - Copies of Notice Furnished



Department of the Army

#Chief of Engineers  
Department of the Army  
Washington, D. C. 20314 (5)

#Board of Engineers for Rivers and Harbors  
Tempo C Building  
2nd & Q Streets, S. W.  
Washington, D. C. 20315

Director  
Coastal Engineering Research Center  
5201 Little Falls Road, N. W.  
Washington, D. C. 20016

#Division Engineer  
U. S. Army Engineer Division  
South Atlantic  
510 Title Building  
30 Prvor Street, S. W.  
Atlanta, Georgia 30303 (2)

Department of Commerce

Water Resources Coordinator  
Department of Commerce  
6010 Executive Boulevard  
Rockville, Maryland 20852

Regional Director  
National Marine Fisheries Service  
U. S. Department of Commerce  
144 First Avenue South  
St. Petersburg, Florida 33701

Area Supervisor  
Water Resources Division  
National Marine Fisheries Service  
Beaufort, North Carolina 28516

Maritime Administration & Chairman  
U. S. Department of Commerce  
Room 3059  
General Accounting Office Building  
5th & G Streets, N. W.  
Washington, D. C. 20548

Department of Commerce (Cont'd)

Assistant Secretary for Economic Development  
Department of Commerce  
Washington, D. C. 20230

Regional Director for Economic Development  
Southeastern Regional Office  
904 Bob Wallace Avenue, S. W.  
Huntsville, Alabama 35801

The Director  
National Ocean Survey  
National Oceanic & Atmospheric Administration  
U. S. Dept. of Commerce  
Rockville, Maryland 20852

Atlantic Marine Center  
National Ocean Survey  
439 West York Street  
Norfolk, Virginia 23510

Dept. of Health, Education & Welfare

The Surgeon General  
USPHS/DHEW  
230 Independence Ave., S. W.  
Washington, D. C. 20201

Regional Director  
PHS Region IV, DHEW  
50 Seventh Street, N. E.  
Atlanta, Georgia 30322 (4)

Department of the Interior

Regional Director  
National Park Service  
U. S. Dept. of the Interior  
3401 Whipple Street  
Atlanta, Georgia 30344

Regional Director  
Bureau of Outdoor Recreation  
Department of the Interior  
810 New Walton Building  
Atlanta, Georgia 30303

Dept. of the Interior (Cont'd)

Regional Director  
Bureau of Sport Fisheries & Wildlife  
USDI  
17 Executive Park Drive, N. E.  
Atlanta, Georgia 30329

Field Supervisor  
Bureau of Sport Fisheries and  
Wildlife  
U. S. Fish & Wildlife Service  
310 New Bern  
Raleigh, North Carolina 27601

Department of Transportation

Administrator  
Federal Highway Administration  
U. S. Dept. of Transportation  
400 Seventh Street, S. E.  
Washington, D. C. 20591

Postmasters

Postmaster  
Laurinburg, N. C. 28352

NORTH CAROLINA STATE GOVERNMENT

Honorable James E. Holshouser, Jr.  
Governor of North Carolina  
Administration Building  
Raleigh, N. C. 27611

Honorable James B. Hunt, Jr.  
Lieutenant Governor of North Carolina  
Administration Building  
Raleigh, N. C. 27611

The Honorable James B. Garrison  
Albermarle, North Carolina 28001

The Honorable Joy J. Johnson  
Fairmont, North Carolina 28340

The Honorable David Parnell  
Parkton, North Carolina 28371

The Honorable Mary H. Odom  
Wagram, North Carolina 28396

The Honorable Henry W. Oxendine  
Pembroke, North Carolina 28372

The Honorable Luther J. Britt, Jr.  
603 W. 25th Street  
Lumberton, N. C. 28358

STATE OFFICES NORTH CAROLINA

Mr. James L. Harrington, Jr.  
Secretary  
Department of Natural & Economic  
Resources  
P. O. Box 27687  
Raleigh, N. C. 27611

Mr. Dan Blue  
Water Resources Planning  
Department of Natural & Economic  
Resources  
P. O. Box 27687  
Raleigh, N. C. 27611

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N. C. Department of Cultural  
Resources  
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Mr. Bruce L. Lentz, Secretary  
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Morris Funeral Home  
122 McKay Street  
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Mr. Tom G. Gibson, Jr.  
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Mayor City of Laurinburg  
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#Mr. F. G. Vandenburg  
City Manager  
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Laurinburg, N. C. 28352

R. F. McCoy  
502 W. Church Street  
Laurinburg, N. C. 28352

Donald W. Barrett  
817 W. Church Street  
Laurinburg, N. C. 28352

Ernest Daniels  
330 E. Covington Street  
Laurinburg, N. C. 28352

J. E. Mitchell (John)  
715 Atkinson Street  
Laurinburg, N. C. 28352

LAURINBURG MAYOR'S CITIZENS  
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Mr. Craig Ellis  
Dunbar Drive  
Laurinburg, N. C. 28352

Mrs. James Hogue  
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Laurinburg, N. C. 28352

Mr. Joe T. Jordan  
Pelen Street  
Laurinburg, N. C. 28352

Mr. James A. Pierce  
Aberdeen Road  
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Mr. Sam Snowden  
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Mr. Ed Wampler  
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Mr. Roy M. Gay  
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Mr. George Jacobs  
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Mr. Sam McInnis  
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Mrs. Magellan Robinson  
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Mr. Wade Terry  
119 Calodonia Road  
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Mrs. Gladys Roberts  
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Laurinburg, N. C. 28352

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Wiley B. Haire  
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Ralph L. Wagner  
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Laurinburg, N. C. 28352

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Laurinburg Exchange  
211 Cronly Street  
Laurinburg, N. C. 28352

George Phillips  
WENC-Moody Grass Hill  
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Fayetteville Observer  
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G. Y. Jones, Est.  
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Westminister Presbyterian Church  
McGirts Bridge Road  
Laurinburg, N. C. 28352

Charles H. Allen  
No Address

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Raleigh, N. C. 27607

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Laurinburg & Southern Railroad  
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Laurinburg, North Carolina 28352

Mr. John V. Highfill, Executive  
Lumber River Council of Government  
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Charleston, South Carolina
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District Assistant  
U. S. Army Engineer District, Charleston  
Charleston, South Carolina
- Paul H. Mansfield  
District Planning Branch  
U. S. Army Engineer District, Charleston  
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- Walter W. Hensley  
District  
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- William H. Murel  
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U. S. Army Engineer District, Charleston  
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District  
U. S. Army Engineer District, Charleston  
Charleston, South Carolina
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District  
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1. The first part of the document discusses the importance of maintaining accurate records of all transactions. It emphasizes that proper record-keeping is essential for the integrity of the financial system and for the ability to detect and prevent fraud.

2. The second part of the document outlines the various methods used to collect and analyze data. It describes the use of statistical techniques to identify trends and anomalies in the data, and the importance of using reliable sources of information.

3. The third part of the document discusses the role of the auditor in the process. It highlights the need for the auditor to maintain independence and objectivity, and to follow established procedures to ensure the accuracy and reliability of the audit results.

4. The fourth part of the document discusses the importance of communication in the audit process. It emphasizes the need for the auditor to communicate clearly and effectively with the client, and to provide timely and accurate information to the relevant stakeholders.

5. The fifth part of the document discusses the importance of documentation in the audit process. It highlights the need for the auditor to maintain accurate and complete records of all audit activities, and to ensure that these records are accessible and understandable to the relevant stakeholders.

6. The sixth part of the document discusses the importance of ethics in the audit process. It emphasizes the need for the auditor to adhere to the highest standards of ethical conduct, and to act in the best interests of the public and the financial system.

7. The seventh part of the document discusses the importance of continuous improvement in the audit process. It highlights the need for the auditor to regularly review and update their procedures and methods, and to seek out new and innovative ways to improve the quality and efficiency of the audit process.

8. The eighth part of the document discusses the importance of transparency in the audit process. It emphasizes the need for the auditor to provide clear and accessible information about the audit process and the results of the audit, and to engage with the relevant stakeholders in a transparent and open manner.

9. The ninth part of the document discusses the importance of accountability in the audit process. It highlights the need for the auditor to be held accountable for their actions and decisions, and to provide a clear and transparent explanation of the reasons for their findings and conclusions.

10. The tenth part of the document discusses the importance of collaboration in the audit process. It emphasizes the need for the auditor to work closely with the client and other relevant stakeholders, and to share information and expertise to ensure the most effective and efficient audit process possible.

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Henry F. Milaurin	Box 152 Laurinburg, North Carolina
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Wade P. Terry	P. O. Box 1174 Laurinburg, North Carolina
Barbara Winn	605 Peden Street Laurinburg, North Carolina

TRANSCRIPT OF PUBLIC WORKSHOP  
HELD  
SCOTLAND COUNTY COURTHOUSE  
LAURINBURG, NORTH CAROLINA

20 November 1975

In accordance with authority contained under Section 205 of the 1948 Flood Control Act, as amended, and as authorized by SADYR 3rd Indorsement dated 21 November 1972 to a letter from this office dated 11 July 1972, subject: Reconnaissance Report, Leith Creek, Scotland County, North Carolina, the District Engineer has been directed to conduct a detailed investigation of Leith Creek in order to determine the feasibility of flood control techniques.

The meeting was called to order by Charles Barrett, Mayor of the City of Laurinburg. Mayor Barrett presented Colonel Harry S. Wilson, Jr., District Engineer of the U. S. Army Engineer District, Charleston, to preside over the workshop.

COLONEL WILSON: Ladies and gentlemen, I would like to welcome each of you to the workshop on Leith Creek. The purpose of this workshop is to present to you various alternative plans for reducing flood damages on Leith Creek, and to elicit your assistance in evaluating and selecting the most desirable plan to meet national and local needs. (SLIDE 1). I am Colonel Harry Wilson, District Engineer, Charleston District, U. S. Army Corps of Engineers. At this time I would like to express my appreciation to the City of Laurinburg for making arrangements for this meeting and to Scotland County for allowing us to use these facilities. Now I would like you to meet other members of the Corps of Engineers team participating with me in the workshop. These members are: Mrs. Charlotte Murray, my secretary; Mr. Bob Barnard, Public Affairs Officer; Mr. Ed Meredith, Chief of the Project Planning Branch; Mr. Steve Morrison, Biologist in the Environmental Branch and Mr. David Harris, an engineer in the Small Flood Control Section.

In order that we may have a complete list of those participating in this meeting, will you please fill out the attendance card handed you at the door, if you have not done so already. If you did not get a card, please raise your hand and one will be given to you.

As I mentioned earlier, the purpose of this meeting is to discuss solutions to the flooding of Leith Creek. A reconnaissance study was then made which affirmed that flood control measures were needed and

NOTE: Slide descriptions contained in Exhibit 1

appeared to be qualified for Federal subsidy. Based on the findings of the reconnaissance study, a detailed project study was authorized and is now being accomplished under authority contained in Section 205 of the amended Flood Control Act of 1948. This authorization enables the Chief of Engineers to construct small flood control type projects which must be complete within itself, economically justified and cannot exceed a Federal subsidy of more than one million dollars.

Initiation by a local sponsoring organization is a necessary ingredient to federal participation in a local flood control project of this type. The local sponsor, which in this case is you, the City of Laurinburg, must furnish all lands, easements and rights-of-way required for project construction. In addition you are responsible for the relocation or modification of all utilities and highway bridges necessary for the project. Once construction is complete the project is turned over to you the local sponsor who assumes responsibility for its maintenance.

Let's take a look, now, at Leith Creek (SLIDE 2). As may be seen on the slide, portions of the flood plain are located within the city limits of Laurinburg and East Laurinburg. Development within the flood plain is generally residential with scattered commercial and public properties. An estimated 65 residential and 17 commercial buildings are located within the flood plain. In addition a school and playground are also subject to flood damages.

Average annual flood damages associated with high waters from Leith Creek are estimated to be \$23,500. These damages include an estimated \$12,200 residential, \$9,900 commercial and \$1,400 public

properties. These figures are discussed in the brochure handed to you as you entered tonight (SLIDES 3, 4 and 5). Each of these pictures illustrate previous flood conditions on Leith Creek and resulting flood damage.

I am sure that you are aware that there are numerous ways to reduce flood damages along a stream. Possible solutions, however, may be divided into two broad categories - structural and non-structural solutions. Structural measures are designed to modify floods by altering the natural environment and include alternatives which reduce flood elevations, divert floods, change the timing and duration of floods or restrict floods from portions of the flood plain. Non-structural measures, on the other hand, are designed to modify flood damage susceptibility by adjustment in the pattern and mode of land use, by development policies and by assistance to affected individuals. Also combinations of structural and non-structural measures are possible.

First, let's look at non-structural alternative zoning, subdivision regulations and building codes could be developed on the basis of flooded areas. These ordinances, if adopted, would regulate development of the flood plain by restricting the type and location of future development. Parks and other types of development which would not impede flow nor be easily damaged may be permitted. Residential, commercial, and industrial development could be permitted in areas subject to flooding if they did not seriously impede flowage and if constructed or flood proofed to provide protection to the level specified by the regulating agency involved. This type of non-structural measure is effective in reducing damages to future development but will not improve the flood problems for existing development.

Another non-structural alternative would involve the flood proofing of existing structures. Flood proofing is primarily the responsibility of the individual property owner. In the case of Leith Creek, however, the cost of flood proofing in many cases could exceed the value of the structure. If this happens, then the alternative of relocating the structure may prove more beneficial. If not, then the relocation of the occupants and the demolition of the structure would be the only remaining alternative.

During our study, a non-structural alternative consisting of a combination of flood proofing and relocation of structures subject to flood damage was studied in detail. Structures which could not be flood proofed or physically relocated were to be demolished with the owner being reimbursed for his property or given comparable property elsewhere. Estimated first cost of this alternative was \$700,200. Translated into economic language this means the average annual costs of \$45,200 exceeds the annual benefits of \$23,500 and yields an unfavorable benefit-cost ratio of 0.52. Therefore, this alternative could not be recommended for Federal support due to the lack of economic justification.

Having reviewed the non-structural alternatives we then considered the structural solution in which three alternatives were examined.

First, there's the structural alternative of constructing a flood control reservoir (SLIDE 6). Reservoirs temporarily store storm runoff until the water can be safely released thereby reducing the peak stages downstream. There are, however, no suitable sites in the Leith Creek basin which could be developed for this purpose. Therefore, no further study was made of this alternative.



Next, there's the alternative of preventing the overflow of creek banks through the use of dikes or levees. Problems associated with the numerous road crossings and with interior drainage makes this type of improvement economically infeasible.

Finally, there's the alternative of (SLIDE 7) channel conveyance improvements. This alternative consists of various modifications to the existing channel which basically improve the capability to carry the flow. Such modifications include: cleaning, deepening, widening, and/or channel realignment. Channel conveyance improvement appears to be the only feasible solution to the flooding problem along Leith Creek.

Please refer to your handouts as I briefly describe each channel conveyance improvement studied (Appendix 2).

In our efforts to identify the most feasible channel improvement alternative, five plans were considered. All five plans are similar in that each calls for the removal and/or replacement of the McKay and Carver Street bridges. Each plan also recommends that improvement begin at the Laurinburg and Southern Railroad immediately upstream of the fertilizer plant road and extend upstream a distance of 1.97 miles to the Gill Street crossing. Longer reaches of channel improvement were considered but were not economically or environmentally justified.

Plan I calls for widening, deepening and cleaning of the existing channel. Deepening would be as much as 4.0 feet. Width of the channel bottom would be 35 feet in that reach between SR 1645 crossing and Church Street and 30 feet above this to the upper project limit at Gill Street. Plan I also recommends modification of the L&S railroad culvert immediately upstream of McKay Street (railroad modifications

are a Federal cost). This alternative, if constructed, would reduce the maximum stage of the 100 year flood by about 2.9 feet. As shown on the table in your handout, the estimated first cost of this plan is \$289,600 of which \$114,600 is a non Federal cost which must be borne by the local sponsor. Annual charges including maintenance are estimated at \$20,300 while annual benefits are \$22,200. These values yield a benefit to cost ratio of 1.09.

Plan II is similar to Plan I in all respects except for the width of channel excavation. Widths for this plan range from 45 feet in the lower reach to 40 feet in the upper reach. Utility and bridge modifications are the same as called for in Plan I. If constructed, Plan II would reduce the maximum stage of the 100 year frequency flood by about 3.3 feet. Estimated first cost of this alternative is \$321,900 of which \$114,900 is a local cost. Benefits and annual charges, including maintenance, are each to be about \$22,400. This yields a benefit-cost ratio of 1.0.

Plans III and IV vary from Plans I and II respectively, in that they do not recommend any significant deepening or modification to the L&S Railroad culvert. Plans III and IV generally follow the existing channel bottom and recommend only cleaning and widening. Highway bridge modifications and utility modifications called for are the same as in the previously discussed plans.

Plan III recommends bottom widths of 35 feet in that reach between the downstream project limits and N. Main Street and 30 feet from that point upstream. This plan would reduce the 100 year flood elevation by approximately 1.8 feet. Estimated first cost of the plan is \$175,700 of which \$113,700 is a local cost. Annual charges are

estimated at \$12,900, including maintenance and benefits at \$19,200.

This yields a benefit to cost ratio of 1.54.

Plan IV is similar in all respects to Plan III with the exception of the bottom widths. Plan IV recommends bottom widths ranging from 45 to 40 feet. This plan would reduce the 100 year flood elevation by approximately 2.0 feet. Estimated first cost of Plan IV is \$127,000 of which \$114,000 is a local cost. Annual charges are estimated to be \$19,300, including maintenance and benefits at \$20,600. This yields a benefit to cost ratio of 1.40.

The final plan evaluated (Plan V) was designed to test the effect of providing a floodway for high flows and avoiding channel excavation. The plan recommends construction of a 200 foot cleared floodway the entire project length. The floodway would be grassed and mowed at frequent intervals to prevent obstruction to flow.

This plan also recommends the removal and replacement of bridges at McKay and Carver Streets, however, no railroad modifications are recommended. Utility modifications are the same as recommended in all previously discussed plans.

Plan V would reduce the maximum stage of the 100 year flood by about 1.0 feet. The estimated first cost of the plan is \$211,700 of which \$115,700 is a local cost. Annual charges of \$15,700, including maintenance, when compared to annual benefits of \$15,200 yield a benefit to cost ratio of 0.96.

At this time, I would like to emphasize that any structural plan recommended would be accompanied by a requirement that the local authority regulate development in the residual flood plain. This is a prerequisite

for all projects of this type in order to prevent damage to future development. Also in this vein I would like to commend the City of Lumburg for applying for flood insurance and providing leadership in regulating flood plain development.

In a few minutes we are going to divide those assembled here into working groups. This gives each of you an opportunity to discuss the plans presented and express your own ideas. Corps representatives will be available to answer any questions which you may have. We particularly encourage you to assess all project effects including environmental and social. Each group is requested to select a moderator who will report their groups findings and conclusions. Minority viewpoints may also be reported. What we have done is broken the cards into four groups. I'll read the names and you will be dismissed to the various rooms with Corps representatives to discuss your plans. (Names are alphabetized in groups in List of Attendees. Groups were in conference for approximately 45 minutes.)

Ladies and gentlemen, Group III is still coming up with a majority vote. I told them we would go ahead and start and they can join us when they get their decision made.

Group I - the spokesman or moderator. You not only can give your group opinion or if you have any other comments or questions, please be sure and bring them up.

I. G. STEARNS, JR: I was very surprised, actually. We had a most interesting discussion. We had a good group. The discussion I think could have lasted many hours on into the night. There are so many ramifications on this thing that really all of us I think need to be better

informed. We had a very diverse and well informed group, I thought. We had good representation from the city which of course is very interested in this. We had a good representation from the environmental people, I think which is a good sign and others in this group were outspoken and had definite ideas and opinions which I thought were good and taken well. We considered all these plans thoroughly I think and the majority of us felt that the Plan II was the best plan. Even though there are some factors against it we felt that the overriding factor which sold us on Plan II is the efficiency standpoint. We felt that it was a more efficient plan than were the others. Those that were opposed to it were in favor of Plan IV from a strictly environmental standpoint. That was the findings of this group. As I said, all of us enjoyed it and we could spend a whole lot more time on it. Thank you.

COLONEL WILSON: Thanks very much sir. Any comments from minorities in the first group? (No response)

How about Group II.

CRAIG E. ELLIS: I'm not sure why they selected me to be the head of this group since I knew the least about what was going on back there, maybe that's why they chose me. I was impressed by the discussion which we also had of the people who were there knowing what they were talking about - how little I did know. I think the majority of them were probably like me who did not know enough to come right out and make a definite statement as to which one of these plans was the best. Plan I received 4 votes in our group and Plan V received 3 votes. This is

several people in our group who were concerned about the ecology; about what would happen if we cut down a lot of trees; what it would do to the animal and plant life in the area and felt that an environmental impact study should be made. There was a suggestion which all of us would like to see investigated further of not proposing a new plan but the investigation of a possible alternative and that would be to begin widening the creek from just south or just east of State Road 1603 and widening it from that point back to McKay Street. Then, from McKay Street to Gill Street and snagging the river, snagging meaning removing debris, stumps, limbs and anything that happened to be there with the thought being that it would make way downstream for the water within the city to move on faster and possibly not cause the flooding. Again, that was just a recommendation we had. Anybody in our group have anything to add that I have omitted? (No response)

COLONEL WILSON: Thanks very much sir.

Well, I thought we had a hung jury back there with Group III for a while. Group III you are up if you have your thoughts organized or otherwise we can go to Group IV and come back to you sir.

WILLIAM WINN: When we finally voted on the various plans we had 6 people to vote for Plan I and 4 people to vote for Plan III.

COLONEL WILSON: Thank you. Did you have any questions that we didn't answer in the room there? (No response)

How about Group IV?

LEWIS CHAMBERS: Our group had mainly a lot of questions. We discussed

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LEITH CREEK SCOTLAND COUNTY NORTH CAROLINA DETAILED  
PROJECT REPORT REVISED(U) CORPS OF ENGINEERS CHARLESTON  
SC CHARLESTON DISTRICT JUL 77

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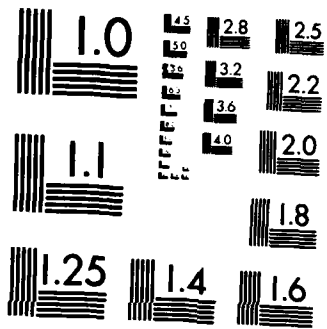
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mainly general questions concerning all five alternatives. I think one of the major questions that was expressed by the group was why the improvements would not continue along the SR 1645 in the lower reaches. I think some of the people in the group have experienced flooding in that area and have seen the road overflowed and be flooded and they had questions concerning this. If these improvements were stopped as planned at the fertilizer road that there was a fear that the waters once reaching this outlet would have nowhere to go, would back up and just compound the problem upstream. This was one of the major problems expressed. Another question that was raised that I can remember is how the decision would be reached as to which side of the bank of the river the spoil would be placed on and would there be any ecological considerations or would there just be a decision that would be reached by some members of the city government and perhaps the Corps of Engineers without any real concern for ecology so far as would there or would there not be a best side for placing this spoil. One final question, I think a very practical question, is where would the funds come from that the city would have to put forth? I think from what was said just a few minutes ago, our group concurred mostly with the second plan with the suggestion that there be snagging done beyond the fertilizer road down to 74 By-Pass and that this would help alleviate the fears and problems with just simply stopping the improvements at the fertilizer road. Did anyone else have any questions or comments from the group? (A statement was made from the audience that the group did not vote on any specific plan.) No, we did not vote. I thought the gentleman that told me it was the consensus of the group that we did accept Plan II. We did not actually put it to a vote. I was not aware that we were supposed to do

this.

COLONEL WILSON: If your group is back there maybe you could get a consensus. I'm going to be saying a few words while you are doing that.

I just want to clarify one point that came up during some of the discussions. As far as the environmental impact statements - what we generally do on these projects is make an environmental assessment. By that assessment we put the project into perspective as to its impact on the environment and determine whether it has a major significant impact on the human or the wildlife environment. Also, we get feedback from you in this meeting. It helps us in that assessment. If we determine that the project does not have a major adverse significant impact then we don't make an environmental impact statement. So, again, what helps in that decision is any comments we get from you, any comments we get from other organizations and also our own in-house assessment of the project as we see it.

Those points that were raised as to the downstream end of the channel, we'll look at again. As we discussed in group discussion, down at that end is sort of a swamp area. There would be nothing damaged if we had some local flooding down there except that the road might get under water. However, we will look at it again and see if it is possible under certain project conditions to do something about it. For that matter, we will re-examine everything that is brought up tonight.

Were you able to get a quick vote back there? (Mr. Chalmers responded yes.)

As to that point raised on the real estate, we have estimated for each of the plans, the approximate amount of real estate which would be needed for the placement of material. The areas have not been delineated

and it is the responsibility of the city to obtain the necessary easements. Of course we would work together with them but I assure you there has been no decision yet as to specific areas for the placement of the material.

LOUIS CHALMERS: After a quick vote, the majority of the group did vote for Plan II as I stated earlier. There was one more point I failed to make that someone reminded me of - there was a question about all five plans as to whether or not any of them would be feasible. The question was, the fact that all the plans shown have an average annual benefit of around from \$15,000 to \$22,000 - \$22,400 being the maximum benefit realized and the annual damages estimated existing being a total of \$23,500. So the question was raised, that would give a difference of about \$1,100 actually you would gain in benefits leaving a deficit of \$1,100 in actual damages and then spending, as is shown, an annual cost of \$22,400 - that question was asked and I'll pass that on.

COLONEL WILSON: On these costs, and maybe most of you know this already, this is a fifty year project and we discount our money over the life of the project - fifty years. We take the cost to build the project and cost of maintaining the project and discount that amount over a fifty year period at a certain interest rate. This gives you an average annual cost for that project. Now on the benefits we do the same thing. If your annual benefits exceed your cost then you have a project that can be considered. The interest rate we use now is six and one eighth.

Are there any other questions or comments?

DAVID HARRIS: I would like to comment that the address of the District is on the back of this brochure and if you should have any further comments you can send them to us by mail.

COLONEL WILSON: Or if a question occurs to you later that you wished you had asked, give us a call.

QUESTION: What is the procedure after this workshop?

COLONEL WILSON: We will go back and look at what you all have input and then put the detail project report into final form. This, we anticipate, will take two to three months.

QUESTION: Are you going to come up with one alternative or are you going to have all these alternatives?

COLONEL WILSON: All these alternatives will be in the report. Alternative five's benefit-cost ratio is a little bit below one but, as I see it, this alternative will still be in the final report.

QUESTION: I have a question about Plan V - that would, I think allow some of the area to become a green belt through the City of Laurinburg, is there somewhere in your specifications and plans whereby you could realize some recreational or aesthetic benefits that would perhaps bring that benefit cost funds?

COLONEL WILSON: Some activities are allowed on a flood plain if they are compatible and if they will not obstruct the flow under flood conditions. Such things as parks may be a possibility but certainly not houses or commercial buildings. This is a possibility that you have with alternative V that you may not have with the others.

QUESTION: Colonel, I believe you just stated that Plan V was so cheap the government wouldn't fool with it. Is that right?

COLONEL WILSON: No, Alternative V is marginal on the benefit-cost ratio and, hence, it is going to be looked at real closely. However, it may have the least environmental impact and, therefore, is important.

DAVID HARRIS: If we have a plan which has a favorable B-C ratio, then there is a possibility according to our regulations that we could possibly recommend a plan with a B-C ratio less than one if it had a lot of environmental assets which the plan with the B-C ratio greater than one didn't have. So, environmentally can have a little weight to carry a project like that over the hill.

COLONEL WILSON: This is a fairly new possibility now available to us. Before, the B-C ratio had to be above one or it wouldn't be considered. Now under the concept of Principles and Standards we also take a look at the best environmental plan that might solve the problem and even if the B-C ratio is less than one it might still be chosen because the environmental pluses may carry it. That's the reason alternative V is still being considered.

QUESTION: In the environmental assessment, do you look at each alternate by itself or the whole project?

COLONEL WILSON: We have to assess each alternative. They are all kind of similar except five, five stands off by itself.

QUESTION: Am I correct in saying that recreational benefits are not looked into for the cost benefit ratio in a project such as this?

COLONEL WILSON: Recreational benefits can only be a 50-50 proposition and can be supported only if the recreational benefits stem directly from the project, as could be the case in number V.

QUESTION: Will there be a public hearing in which everyone is invited before a final decision is made?

COLONEL WILSON: We put the detail project report in final form and it will go up to the Division Office in Atlanta. They will give it a wringing out and see if it is engineeringly sound and environmentally

correct. If they agree with what is being recommended in the report, it will go to Washington for approval. At any point along the way, if you as the sponsor do not like the way the project is going, you as the sponsor can say stop. We do not plan to have another public hearing before we forward the report although the report is public information and can be made available to you.

QUESTION: Well, what I had in mind, is that, as I understand other than a brief announcement in the newspaper a few weeks ago, the people who have property along the creek - there was no attempt to make a personal announcement.

COLONEL WILSON: We tried to - we mailed out many public notices.

STATEMENT: I don't believe there was any other than the report several days ago that there would be a meeting - I don't believe they even gave a date and time for the meeting. Was that correct?

DAVID HARRIS: I would like to give you a copy of the mailing list of everyone that was invited.

STATEMENT: I know that but I'm thinking of the fact they might think this is a project that does effect the whole community and saying that there would be some value if publicity was made in such a way that anyone might be able to come and participate.

DAVID HARRIS: We intended it to be so. Newspapers were notified, television stations were notified and radio stations were notified. Congressional representatives were notified; government notified and state agencies notified. Local sponsors, all of county council and all these people received invitations. (See Appendix 3)

STATEMENT: I believe there has been a slip then because it wasn't

run in the newspapers last night or even this week.

DAVID HARRIS: We notified the newspapers and that's about as far as we can go. I would like to give you a copy of the mailing list though.

MAYOR BARRETT: Colonel, I believe Mr. Winn is inferring you didn't try to notify the people. These people were notified, Mr. Winn, agencies were notified. People just didn't come - but I believe this is a pretty good representation, a good turn out. The only way you are going to get all to come is to get them by their neck and bring them in. I sorta resent your inferring that they failed to let people know this meeting was going to be held.

STATEMENT: I'm just disappointed in the fact that there was no public notice in the newspaper.

MAYOR BARRETT: There was a public notice, it was in the newspaper.

STATEMENT: Well would you show me. I would like to see it because I have been looking for it. Other than a general announcement, several days ago, that there would be a meeting on this date but I don't believe it even gave the time. As you pointed out, very few people might not come but in a case as important as this, we should take every precaution that the public be fully informed of such a meeting. I'm not saying who is responsible it just hasn't been done. I think the attendance is great but I think there might be other people who would like to have attended.

COLONEL WILSON: Let me put it this way. I'm concerned about getting the word out to all the people because that is the reason we came on up here. We are always looking into better ways of getting the word. We give notice to television stations and it is optional whether they put it out or not. If you sense there are a lot of people that may be directly affected and

somehow didn't get the word, I'll be glad to come back and discuss the project with those people, no question. If you all think of some other points, be sure to drop us a line or give us a call.

STEVE MORRISON: I would like to clarify one thing that I don't think was clarified in two of the groups I was attending. One is that there has already been an environmental assessment made, a cursory environmental assessment by myself. I have made a comparison of the environmental effects of each plan; made a list of such things as change in channel dimensions, the amount of cover that would be effected, disturbance to bottom, whether or not the cover would be allowed to reestablish; the effects on the water table; all of these things are formulated in a chart. These have been considered now, and before the report is made into a form to be sent to our next higher authority in Atlanta, then Washington, this assessment will be improved upon and added to. I am waiting now on reports from the State of North Carolina pertaining to benthic organisms, fish and things of this sort. So, it is not, as I think might have been misunderstood, that we will just mention a general description of all impacts together. Each plan will be given separate consideration from an environmental standpoint.

COLONEL WILSON: Any other questions?

QUESTION: Will any of these other people here tonight receive a copy of the environmental assessment when it comes out - is there anybody on that mailing list that would want to review it and say if they felt it was adequate and say the project requires an EIS - to comment in such a way?

COLONEL WILSON: You can send in if you wish to get a copy - anybody can.

QUESTION: How will we know it is available to ask for it?



STEVE MORRISON: We have to make a decision on whether or not we are going to issue an environmental impact statement. You may know about environmental impact statements; there is a mailing list and they are available to the public. We make our decision based on whether or not, after we make an assessment, we consider the project has sufficient impact to require an environmental impact statement. That is one reason why you might have an environmental impact statement issued. The other is public concern. Even though we may not think the project requires an impact statement, if public concern is great enough, we will issue an environmental impact statement for that reason. We decide. If we do not issue an environmental impact statement, we will issue something called a negative declaration. This will be sent to people on the mailing list. It will have an environmental assessment and why we think a full impact statement is not required. Responses can be made to this. After responses are received we review our assessment and our decision. Then an impact statement may be made if sufficient concern warrants one.

COLONEL WILSON: These mailing lists include all appropriate state agencies, city agencies and county agencies, as the case may be. Also, we send notices to any organizations, environmental or other type organizations that we know are interested in this type of project. Also individuals have written in and asked that we put them on our mailing list. So, if you don't think you are on the mailing list, drop us a short note and ask to be put on the mailing list. We'll be glad to.

Any other questions?

QUESTION: Are the people on the mailing list kept informed of the progress of the project?

COLONEL WILSON: Our sponsor is the city and we generally keep the city up to date on it. It would be nice to keep each interested individual informed but it is an administrative problem. We have maybe a half dozen, dozen projects like this. Five, six, flood insurance type projects. We have three or four major multi-million dollar projects - so it gets to be an administrative problem. All the information is public information and is available to you - just write us a letter or call.

QUESTION: Colonel would that environmental assessment be sent to the city? (The Colonel answered that it would.) Then it will be made available to anyone who wants to see it if they would come up to City Hall. That might be the easiest way.

QUESTION: Will you announce when you receive it? (Mayor Barrett stated he would be in contact with the person and would let him know when it was received.)

COLONEL WILSON: Fine, anything else? One more point on processing this report. If it is decided to make an EIS it will delay the final approval because the project will not get approved until that EIS is on file in final version.

QUESTION: Concerning the EIS, how would the public go about showing its concerns?

COLONEL WILSON: Just write us a letter. However do not just say "we think you need an EIS" - state why you think an EIS is warranted. It does not help us at all just to get an "I don't agree" type comment. We need to know what your reasons are.

STEVE MORRISON: I would like to state there are at least two chances to get your opinions recorded. One is tonight. If you didn't state your

thoughts you should write us and give us your opinion. If, in our opinion, there hasn't been enough local concern to merit an environmental impact statement, and we personally don't feel the impact is great enough, after we have finished all our assessments, then we will issue a negative declaration. This will be circulated to everyone on the mailing list and made public. You can look at this, look at our reasoning - why we don't think an environmental impact statement was necessary - and respond to that. If we get enough responses to that, then - [unclear] - if there is a concern, public concern - we will issue an EIS.

COLONEL WILSON: Assuming, most agree on the environmental assessment and on the negative declaration, we would hope to forward a proposed final version of the project to our next headquarters in Atlanta in about two to three months. There it will be examined engineering wise, environmental wise, and otherwise and if they approve it then it then goes to the board for final approval. This action would authorize the project. As to the question of money, we would just have to keep you posted on what is the budget for this type of project. As I said, it is when the Chief of Engineers authorizes the project, we will know better at that point as to what the money situation is. I won't attempt to give you a date.

QUESTION: What point will one of the five alternatives be selected? Do you select the alternative and send it on to Atlanta or Atlanta makes the decision of the five - who will make that decision?

COLONEL WILSON: Well, we will look at the environmental assessment and we will look at the engineering and the cost and the other things and send it to our next level in Atlanta.

DAVID HARRIS: We will recommend that a final decision be made by the

tonight; based on engineering feasibility; based on environmental considerations; the environmental assessment. All these factors will be considered and we will make a recommendation that one of these alternatives be the recommended plan. This will be recommended to Atlanta, they will have a chance to either concur or not concur with this recommendation.

COLONEL WILSON: Somebody has to make a decision and that decision is based on the public interest. That's the reason we are here tonight to get public input. I know we didn't get a unanimous vote on any one alternative tonight but at the same time we obtained indicators.

QUESTION: I have a question regarding how the City of Laurinburg plans to pay their share and I really think that should be cleared where that money is to come from.

COLONEL WILSON: I will let the Mayor answer that one.

MAYOR BARRETT: The money will come from various sources. It is up to the elected officials if the project is approved to obtain the money as they will. It could come from tax money, it could come from revenue shares, things like that.

COLONEL WILSON: Any other questions (No response)

Let me compliment you. I really appreciate your interest in coming out tonight. You were a very enthusiastic group. You brought up some good questions which will help us. I hope we can get a reasonable and effective project for the City of Laurinburg that we'll see underway in the near future. Thank you very much.

(Meeting adjourned at 2140 hours)

LIST OF SLIDES

SLIDE NUMBER	DESCRIPTION
1	Leith Creek Public Workshop
2	Aerial photo of flood plain
3	Flood conditions on Leith Creek
4	Flood conditions on Leith Creek
5	Flood conditions on Leith Creek
6	W. Kerr Scott Dam and Reservoir
7	Channel improvements on Buck Creek
8	Channel improvements on Buck Creek

Exhibit 1

JESSE HELMS  
NORTH CAROLINA

United States Senate

WASHINGTON, D.C. 20510

November 10, 1975

Colonel Harry S. Wilson, Jr.  
District Manager-Corps of Engineers  
Department of the Army  
Post Office Box 919  
Charleston, South Carolina 29402

Dear Colonel Wilson:

Senator Helms asked that I acknowledge receipt of your recent letter advising him of the workshop to be held on Thursday, November 20th.

He certainly wishes he could be with you, but due to the fact that Senate will be in session it will be impossible for him to leave Washington.

The Senator sends his regards and best wishes.

Sincerely,

*Vicki Davis*

(Mrs.) Vicki F. Davis  
Appointment Secretary



STATE OF NORTH CAROLINA  
GOVERNOR'S OFFICE  
RALEIGH 27611

JAMES E. HOLSHOUSER, JR.  
GOVERNOR

November 12, 1975

Col. Harry S. Wilson, Jr.  
Corps of Engineers, District Engineer  
Post Office Box 919  
Charleston, South Carolina 29402

Dear Colonel Wilson:

Thank you very much for your invitation for Governor Holshouser to attend a public workshop concerning possible flood control alternatives for Leith Creek, Scotland County on November 20.

Unfortunately, the Governor has a previous commitment which will prevent him from attending. He regrets this very much, but I am sure you can understand the many demands on his time.

The Governor appreciates your thoughtfulness in inviting him and sends his best wishes for a successful event.

Sincerely,

A handwritten signature in cursive script that reads "Phillip J. Kirk, Jr.".

Phillip J. Kirk, Jr.  
Administrative Assistant  
to the Governor

PJKjr/jh

November 21, 1975

Roland C. Bowyer, Sr.  
211 Bowyer Drive  
Laurinburg, N. C. 28352

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

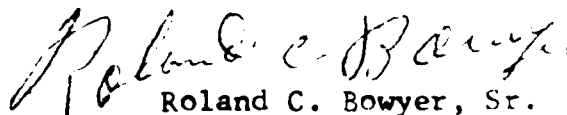
Dear Sirs:

I would like you to consider deepening and widening Leith Creek approximately 300 yards north of Gill Street bridge. There are ten homes involved in this area. Their signatures are on the attached sheet.

Also, there is a place that drag lines and trucks can get to the run approximately 300 yards from Gill Street. I own the land in this area and we (the people in this area) have trouble with drainage and septic tanks in wet weather.

I would like to talk to one of your engineers about this and show him this area.

Thank you,

  
Roland C. Bowyer, Sr.



Roland C. Bowyer  
211 Bowyer Drive  
Laurinburg, N.C.

Roland C. Bowyer

Harry Pfeiffer  
213 Bowyer Drive  
Laurinburg, N.C.

Harry M. Pfeiffer

Linwood Roberts  
715 N. Gill Street  
Laurinburg, N.C.

Linwood Roberts

Diane & Sandra Beane  
717 N. Gill Street  
Laurinburg, N.C.

Diane Beane  
Sandra Beane

Melinda Williford  
727 N. Gill Street  
Laurinburg, N.C.

Melinda Williford

Marvin Walters  
729 N. Gill Street  
Laurinburg, N.C.

Marvin J. Walters

George Carter  
731 N. Gill St.  
Laurinburg, N.C.

George Carter

Carolyn Nixon  
733 N. Gill Street  
Laurinburg, N.C.

Carolyn Nixon

Charles McQuage  
730 N. Gill Street  
Laurinburg, N.C.

Charles McQuage

LaVerne Caulder  
Aberdeen Rd./N. Gill Street  
Laurinburg, N.C.

LaVerne Caulder

November 21, 1975

SANGP-F

4 December 1975

Mr. Roland C. Bowyer, Sr.  
211 Bowyer Drive  
Laurinburg, North Carolina 28352

Dear Mr. Bowyer:

Reference is made to your letter of 21 November 1975 and to the subsequent telephone conversation with Mr. David C. Harris of my staff on 26 November concerning past experience with drainage and septic tank problems immediately upstream of Gill Street on Leith Creek.

Your statements concerning this problem and your recommendation to extend the Leith Creek project limits approximately 300 yards above Gill Street will be given full consideration when formulating the project.

Thank you for your interest in this matter and should you have any further comments or questions please contact me.

Sincerely,

HARRY S. WILSON, JR.  
Colonel, Corps of Engineers  
District Engineer

Appendix  
B-43



STATE OF NORTH CAROLINA  
Department of Cultural Resources  
Raleigh 27611

James E. Holshouser, Jr.  
Governor

November 24, 1975

Grace J. Rohrer  
Secretary

Division of Archives and History  
Larry E. Tise, Director  
State Historic Preservation Officer

Colonel Harry S. Wilson, Jr.  
Corps of Engineers  
Post Office Box 919  
Charleston, South Carolina 29402

Dear Colonel Wilson:

I have forwarded your letter of November 6, 1975 concerning the public workshop on possible flood control alternatives for Leith Creek, Scotland County, North Carolina to personnel of the Archaeology Section staff. The Chief of the Archaeology Section has informed me that although the section is interested in this project, it will not be possible to send a staff member to cover the workshop. Archaeology Section personnel have therefore prepared the following comments that are pertinent to this project that should be read into the record at this meeting.

A number of federal statutes indicate that cultural resources must be taken into account in projects that involve federal funding or permits (see Public Law 93-291 for one example). Numerous archaeological sites are known in Scotland County, but the Leith Creek section of the county has not been the subject of a professional archaeological survey. An archaeological survey of the portion of Leith Creek to be impacted by this project should be undertaken during early stage planning. A determination of the eligibility for nomination to the National Register should be made in the case of each archaeological site found in the proposed adverse impact area. All survey work and determinations of eligibility should be completed well in advance of the construction of the proposed project to insure adequate time for any needed mitigation of adverse impact. All of the needed archaeological work should be completed by a competent professional archaeologist, and needed mitigation work should be done well in advance of any project related ground disturbing activity.

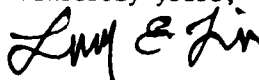
The foregoing comments are rendered as a free service of the State Historic Preservation Officer and the staff of the Division of Archives and History, Department of Cultural Resources to assist applicants, governmental agencies, and other institutions in complying with the requirements of one or more of the following laws, orders, or statutes: P.L. 59-209, 74-292, 85-31, 89-665, 91-190, 93-291, 93-383; Executive Order 11593; 36 CFR 800, G. S. 70, 113-229, 113A, 121-4, 121-8, 121-12, 121-22, 136-42.1. Further information on the review process and legal requirements regarding historical and archaeological resources may be found in "Environmental Assessments of Historical Archaeological Resources: Policies and Procedures of the North Carolina State Historic Preservation Officer and the Department of Cultural Resources," a copy of which will be sent to interested citizens upon written request.

Appendix 2  
B-44

Colonel Harry S. Wilson, Jr.  
November 24, 1975  
Page 2

If you have any questions or need additional information, please  
contact L. E. Babits of the Archaeology Section at (919) 829-7342.

Sincerely yours,



Larry E. Tise

Appendix 2  
B-45

November 25, 1975

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

Dear Friends:

On behalf of the Scotland County chapter of E660S, I am writing to request information regarding the proposed Leith Creek project in Laurinburg, North Carolina.

What is the expected rate of siltation below the area of this plan? How can you reassure the public that there will not be an increased problem downstream?

What are the maximum and minimum flow rates for each plan?

What is the annual cost of maintenance for each plan, separated from the total cost per year?

Would you please itemize the public property damage taking place now? What is the justification of the \$23,500 total? What is the people cost? What is the business cost?

What is the expected change in the water table for each plan? Could increases cause the run-off of more pesticides from the area above the project?

What effect, if any, will there be on the Hall Street treatment plant?

What is the planned pattern of spoil placement? Our concern is that the spoils will have the effect of a levy preventing adequate drainage. Also, we are concerned that this placement of spoils might destroy vegetation that keeps the water temperature stable.

We suggest that precautions be taken to expand the general notification process. The Laurinburg newspaper carried a story about the project only on October 29, quite a number of days before the Nov. 20 meeting. The time of day was not given. The report said that the hearing was "to hear comments by property owners who might be affected by improvements to the creek and the surrounding area." This does not constitute proper public notice.

Sincerely,

*William White*

Appendix 2  
B-46

P.S. Do you foresee the possibility that the creek might dry out during a prolonged summer drought period?

SANGP-F

5 December 1975

Mr. William Winn  
Route 1, Box 200  
Laurinburg, North Carolina 28352

Dear Mr. Winn:

In response to your inquiry of 25 November 1975 concerning Leith Creek, I am pleased to furnish the following information:

- a) The rate of siltation for the area below the recommended plan is not expected to have any significant increase. Areas which would be disrupted during the course of construction would be seeded as rapidly as possible to prevent any significant siltation increase.
- b) The maximum flow rates for each plan are generally in the range of 700 to 1000 cfs dependent upon the specific plan and the location. In general, the designed plans will carry the 10 year flow in bank; wider channels will carry somewhat less frequent flow in bank.
- c) Estimated annual maintenance cost per year is \$800 per mile of project length.
- d) As described in the brochure distributed at the public workshop; annual damages of \$23,500 consist of \$12,200 residential, \$9,900 commercial, and \$1,400 public properties. All damages computed are estimated flood damages based on an individual analysis of each structure within the flood plain. Public property damages were computed for schools and playgrounds within the flood plain. The term people cost is not understood.
- e) Plans 1 and 2 as presented at the public workshop require deepening the existing channel and as a result may have a slight effect on the water table in the immediate vicinity of the channel. Other plans presented do not require deepening and are not anticipated to have any significant effect on the water table. No increase in the amount of pesticides from the area above the project is anticipated as a result of project construction.

Appendix 2  
B-47

SANGP-F  
Mr. William Winn

5 December 1975

f) Construction of a project on Leith Creek is not expected to affect the sewage treatment facilities.

g) Excavated materials resulting from channel construction would be deposited adjacent to the channel on one bank only. All possible efforts will be made to minimize disruption of vegetation. Adequate drainage would be provided to prevent ponding behind disposal areas. Decisions as to which bank would be used for disposal would be made after careful consideration of environmental impacts and availability of easements. Disposal areas would be shaped and seeded as rapidly as possible to prevent siltation and to enhance environmental and aesthetic qualities.

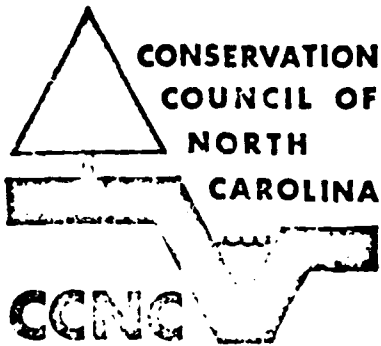
h) The possibility that the creek might dry out during prolonged summer drought periods is extremely slim in consideration of the meteorological conditions of the area and the size of the drainage basin.

Your suggestions recommending precautions to be taken to expand the general notification process are noted and will be given consideration in the future.

Thank you for your interest in this project.

Sincerely,

HARRY S. WILSON, JR.  
Colonel, Corps of Engineers  
District Engineer



January 13, 1976

Department of the Army  
Corps of Engineers  
Charleston District  
P.O. Box 919  
Charleston, South Carolina 29402

Dear People:

It is our understanding that your office sponsored a public meeting in Laurinburg, North Carolina on November 20, 1975 to discuss possible dredging work on a section of Leith Creek in Laurinburg. We are interested in learning more about the project which is being contemplated for the creek, and would appreciate your providing us with the following:

1. A copy of the public notice which was prepared to publicize the November 20 meeting and a list of the newspapers which printed the notice.
2. A list of the people who attended the November 20 meeting.
3. A brief discussion of the project, including a history of the planning which preceded the November 20 meeting.
4. The estimated dates of publication of any environmental assessments, impact statements, or other documents dealing with the environmental, social, and economic impacts of the proposed project and the alternatives to the project.

Thank you very much for your assistance.

Sincerely,

Drew S. Dichi  
Executive Coordinator



20 January 1976

Mr. Drew S. Diehl, Executive Coordinator  
Conservation Council of North Carolina  
Suite 410, Professional Building  
Raleigh, North Carolina 27601

Dear Mr. Diehl:

In response to your letter of 12 January 1976 requesting information concerning the Leith Creek Flood Control Study in Laurinburg, North Carolina, I am pleased to furnish the following:

a. A copy of the public notice announcing the Leith Creek public workshop along with a mailing list of all who received the notice. A list of newspapers and other news media receiving the notice are listed under the subheading of communications.

b. A list of persons attending the 20 November workshop.

c. An information brochure distributed at the public workshop. The brochure briefly describes the planning effort which preceded the workshop. Plan 1, as generally described in the brochure, will be the recommended plan. This plan was selected after careful analysis of public response at the workshop and subsequent environmental, economic and engineering studies.

It is anticipated that a Detailed Project Report, describing environmental, social and economic impacts of the proposed project and alternatives will be published during February or March of this year. The report will be accompanied by a Negative Declaration of Significant Environmental Effects. The Detailed Project Report, when published, will be available for public review at this office and at city hall in Laurinburg. The Negative Declaration will be mailed to all persons who have expressed interest in this project and a copy will be mailed to your office.

SANGP-F  
Mr. Drew S. Diehl

20 January 1976

Thank you for your interest in this project and if I can be of any further service, please let me know.

Sincerely,

4 Incl  
As stated

HARRY S. WILSON, JR.  
Colonel, Corps of Engineers  
District Engineer

Appendix  
B-51

LEITH CREEK  
SCOTLAND COUNTY, NORTH CAROLINA

Technical Report

SECTION A

REFERENCE LIST FOR  
SECTION 404 EVALUATION

A

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3

PREPARED BY THE  
CHARLESTON DISTRICT, CORPS OF ENGINEERS  
DEPARTMENT OF THE ARMY

**SECTION A**

REFERENCE LIST FOR SECTION 404 EVALUATION

EVALUATION OF FACTORS INVOLVED IN THE DISCHARGE  
OF DREDGED OR FILL MATERIALS IN NAVIGABLE WATERS.  
CRITERIA FROM 40 CFR 230

<u>Paragraph</u>	<u>Criteria</u>	<u>Relation to Selected Plan</u>
230.4-1(a)	PHYSICAL EFFECTS	
230.4-1(a)(1)	Wetlands	Excavated material from the creek bottom would be placed in a series of narrow mounds along a 2,500-foot portion of the low area adjacent to Leith Creek, just below the sewage treatment plant (see Plate 2). The area affected is intermittently flooded wetlands, the dominant aquatic species being arrow-aram and broad leaved arrow-head, which would be completely and permanently covered. The area is poor to marginal for fish and wildlife because of its closeness to residential and commercial development, trash deposited in the creek from these areas, and pollutant discharges into the water. The area does not qualify as "highly productive" in that it does not provide the important functions specified in paragraph 230.4-1(a)(1). Breaks in the mounds would be provided such that drainage in adjacent areas would not be impaired.
230.4-1(a)(2)	Water Column	Material would be placed to a height of four feet to minimize the area required for disposal. No water column would remain in the disposal area which is now intermittently inundated. The placement of material adjacent to the creek would result in an increase in turbidity following construction until vegetation is reestablished. The existing channel bottom is sand and silt along most of the project area, and the resultant heavy siltation does not now appear to impair the vigor of vegetation in the broad, slow-moving area below the project where most of the sediment would continue to fall out. No major impacts are anticipated in areas far downstream.
230.4-1(a)(3)	Benthos	Benthic organisms in the disposal area which are unable to move to adjacent, unaffected areas would be destroyed. The low value of this area has been described in 230.4-1(a)(1).
230.4-1(b)	CHEMICAL-BIOLOGICAL INTERACTIVE EFFECTS	
230.4-1(b)(1)	Exclusion Criteria	Material will be placed on land adjacent to the creek, which is very similar to the source of the excavated material. The material is not sufficiently removed from sources of pollution to qualify under the exclusion criteria.
230.4-1(b)(2)	Water Column Effects	No water column in resultant filled area. Elutriate tests are not applicable. Because the material would be elevated above the normal water level, the potential for any pollutants entering the adjacent waters by leaching would be less than for the existing situation where these pollutants remain available in bottom sediments.
230.4-1(b)(3)	Effect on Benthos	Chemical effects on benthos in adjacent areas, like water quality effects, would be about the same or less than with existing conditions. Trash would be cleaned from the creek bottom.
230.4-1(c)	Comparison of Sites	The disposal site is adjacent to the area from which material is to be excavated. The disposal area after use will support upland vegetation. A detailed comparison of the sites in this case would not be useful.
230.4-2	Water Quality	Water quality in the project area is generally poor in this Class C - swamp stream. No violation of water quality standards established in 40 CFR 230 or "Rules, Regulations, Classifications, and Water Quality Standards Applicable to the Surface Waters of North Carolina" can be predicted as a result of the project. Turbidity will increase during construction until vegetation is reestablished.

EVALUATION OF FACTORS INVOLVED IN THE DISCHARGE  
OF DREDGED OR FILL MATERIALS IN NAVIGABLE WATERS.  
CRITERIA FROM 40 CFR 230  
(continued)

<u>Paragraph</u>	<u>Criteria</u>	<u>Relation to Selected Plan</u>
230.5	SELECTION OF DISPOSAL SITES	
230.5(a)	Need for the Proposed Activity	Structural modifications are required if flood control benefits in excess of costs are to be realized.
230.5(a)	Alternative Disposal Sites and Methods of Disposal	Trucking material to upland sites would require more fill due to the access required than the proposed action. Pumping of the excavated material is possible; however, special equipment would be required, and the increased costs can not be justified to protect a poor to marginal area.
230.5(b)	Degradation of Water Uses at Proposed Disposal Sites	
230.5(b)(1)	Municipal Water Supply	No intakes are located near the proposed disposal sites.
230.5(b)(2)	Shellfish	None.
230.5(b)(3)	Fisheries	No significant fishery in the project area.
230.5(b)(4)	Wildlife	Impact not significant because of the poor to marginal habitat for limited types of wildlife.
230.5(b)(5)	Recreation	Recreation improved by greenway, trail, tables, and benches.
230.5(b)(6)	Threatened or Endangered Species	No threatened or endangered species are known to occur in the project area.
230.5(b)(7)	Benthic Life	See paragraphs 230.4-1(a)(3) and 230.4-1(b)(3). Loss to benthos not significant.
230.5(b)(8)	Wetlands	See paragraphs 230.4-1(a)(1). The proposed action is directly related to water, and will not cause a permanent unacceptable disruption to water quality uses.
230.5(b)(9)	Submerged Vegetation	Disposal is not in an area where submerged vegetation is important to overall biological productivity.
230.5(b)(10)	Size of Disposal Site	Size held to minimum which would not result in failure of slopes or severe erosion.
230.5(c)	Other Factors Considered to Minimize Adverse Impacts	Appropriate scientific literature was consulted and various methods of disposal were considered.
230.5(d)	Contaminated Fill Material Restrictions	Polluted material placed in upland mounds would result in less release to adjacent waters than from the existing pollutants in bottom sediments.
230.5(e)	Mixing Zone	Mixing zone not applicable to disposal site which will be filled above water level.

**END**

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**3-85**

**DTIC**